AN ANALYSIS OF FACTORS CAUSING TIME OVERRUNS IN ROUTINE MAINTENANCE PROJECTS IN KARONGA DISTRICT - A CASE OF ROADS AUTHORITY FUNDED PROJECTS

Master of Science in Sustainable Engineering Management (MSc. Eng. Mgt.)

Thesis

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(BSc Civil Engineering)

A thesis submitted in partial fulfilment of the requirements for a Master of Science in Sustainable Engineering Management (MSc. Eng. Mgt.)

University of Malawi

Polytechnic

September, 2016

DECLARATION

I declare that this research entitled "An analysis of factors causing time overruns in routine maintenance projects in Karonga District -a case of Roads Authority funded projects" is my own work. It is submitted in partial fulfilment of the requirements for the Master of Science in Sustainable Engineering Management at the Polytechnic, University of Malawi. It has not been submitted for any other degree to any University.

SIGNATURE :

DATE :

CERTIFICATE OF APPROVAL

The undersigned certify that they have read and approve for acceptance by the University of Malawi, Polytechnic this thesis entitled "An analysis of factors causing time overruns in routine maintenance projects in Karonga District -a case of Roads Authority funded projects".

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Date **:**

DEDICATION

This thesis is dedicated to my beloved wife, Tusayile, my sweat mother, Frances, my adorable sons, Mbawuwo, Amstrong, Jerome, and my late daughter, Lerato. And to my late father Michael: you always expected and demanded the best, encouraged me to face challenges and taught me to believe and have faith in Almighty **GOD**.

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Lastly, I whole heartily thank my wife, Tusayile, and our beloved child, Jerome. I recognize your role, perseverance and encouragement.

May **GOD** bless you All.

ABSTRACT

This thesis had one main objective to address, i.e., analyse factors influencing time overruns in road maintenance projects funded by Roads Fund Administration through Fuel Levy and undertaken by the Roads Authority in Karonga District. Specifically, the study (a) reviewed factors influencing time overruns in road maintenance projects, (b) identified prime factors influencing time overruns in road maintenance projects in Karonga District, (c) ranked the identified time overruns factors, and (d) determined whether factors influencing time overruns were significantly different among different maintenance programmes.

Roads Authority is currently implementing twelve main maintenance programmes in Karonga District as follows: pothole patching, bridge construction, sectional rehabilitation of paved roads, re-decking of timber bridges, grass cutting, grading, reshaping, road marking, replacement of road signs, spot repairs, emergency works and accident spot improvement. This study focused on three programmes namely; pothole patching, bridge construction and sectional rehabilitation of paved roads. The key element in the study was the people who were involved in the maintenance projects. A total of 130 copies of a questionnaire were distributed out of which 92 were dully completed and returned representing 71% response rate.

Data analysis process employed the following tools; firstly the Analytical Hierarchy Process (AHP) method was adopted to identify critical time overruns factors for projects, secondly, the Relative Importance Index (RII) method was used to rank factors influencing time overruns. Lastly, a paired t-test was used to determine whether factors influencing time overruns were significantly different among different maintenance programmes.

The results demonstrate that the factors that significantly contribute to time overruns in road maintenance projects in Karonga District include: insufficient contractor cash flow, delays in producing variation orders, slow payment procedures adopted by client in making payments and delay in site mobilization. However, the paired t-test results show that there is significant difference of factors influencing time overruns among the three maintenance programmes.

Therefore, to counteract to time overruns problem, each programme must be treated independent of the other.

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ABBREVIATIONS AND ACRONYMS

AAA	American Arbitration Association
ACC	Association of Construction Contractors
ADB	African Development Bank
AHP	Analytical Hierarchy Process
BCIS	Building Cost Information Service
BR	Bridge Construction
ESSP	Education Sector Support Programme
GDP	Gross Domestic Product
GoM	Government of Malawi
MGDS	Malawi Growth and Development Strategy
MPA	Mobility Pilot Activity
MPWH	Ministry of Public Works and Housing
MRA	Malawi Rural Accessibility
MRTTP	Malawi Rural Transport and Travel Program
NAO	National Audit Office
NEDs	Non-excusable delays
NSO	National Statistical Office
NTP	National Transport Policy
PCFA	Principal Component and Factor Analysis

PP	Pothole Patching,
PS	Public West Bank Sector
RA	Roads Authority
RAAR	Roads Authority Annual Report
RAM	Roads Authority Management
RFA	Roads Fund Administration
RII	Relative Importance Index
ROMAC I	Road Maintenance and Construction
SR	Sectional Rehabilitation
UK	United Kingdom
WB	West Bank

Chapter 1

Introduction

1.1 Preamble

The study analyses factors influencing time overruns in road maintenance projects funded by Roads Fund Administration through Fuel Levy and undertaken by the Roads Authority in Karonga District. Specifically, the study (a) identifies factors contributing to time overruns, (b) analyses questionnaire data to rank factors that cause time overruns according to their frequency, severity and significance, (c) establishes the statistical relationship between contract type and time overruns and (d) identifies contract types mostly associated with time escalation. The study focuses on three programmes namely; pothole patching, bridge construction and sectional rehabilitation of paved roads, out of the twelve programmes the Road Authority is currently implementing in the District. The twelve programmes are pothole patching, bridge construction, sectional rehabilitation of paved roads, re-decking of timber bridges, grass cutting, grading, reshaping, road marking, replacement of road signs, spot repairs, emergency works and accident spot improvement. The key element in the study is the people who have been involved in the maintenance projects so that their experiences form the basis for data that is required in the study.

The study was conducted in Karonga District in the Northern Region of Malawi. Questionnaires and interviews were used to understand the level and experiences of participants, as well as to collect information relating to the study.

This chapter discusses the background and significance of this research. The chapter also outlines the research objectives and the organization of the thesis.

1.2 Research Background

One of the major achievements in construction industry is to complete projects within budgeted time because each day of time extension has a direct bearing on the final cost of project. Therefore, in order to properly manage and control construction processes, various management tools are being developed. However, literature shows that in spite of adopting various management practices, construction projects in many countries are still facing problem of time

overruns (Aibinu & Jagboro, 2002; Assaf & Al-Hejji, 2006; Mansfield, Ugwu, & Doran, 1994; Odeh & Battaineh, 2002; Tumi, Omran, & Pakir, 2009). Malawi construction industry is also facing the same problem of time overruns. This must be avoided. The first and most important step is to identify and understand attributes to time overruns (Memon, 2014).

The growth in construction industry means expansion in construction projects in both size and complexity. This means time overruns still remain project managers' concern. Identifying the main causes of delays in construction projects is very difficult and often initiates disputes with respect to those responsible for the delays, since many stakeholders are involved in the management of the projects. It may be argued that delays can lead to some negative effects such as lawsuits between project parties, increased costs, loss of productivity and revenue, public inconvenience and in some cases contract termination.

The problem of delays in the construction industry is a global phenomenon (Kaliba, Muya, & Mumba, 2009: Sambasivan & Soon, 2007). Even with today's advanced technology and professional management systems, construction projects continue to suffer delays. The question raised is - how can construction industry prevent the project overruns? In 2000s, the number of claims submitted to the American Arbitration Association (AAA) reached almost 25% of the 1.7 million claims submitted over the past 74 years (Kassab, Tarek, & Keith, 2006). In the United Kingdom (UK) 70% of the projects undertaken by government departments and agencies were delivered late (National Audit Office United Kingdom, 2003). In addition, a recent research by Building Cost Information Service (BCIS) found that nearly 40% of all studied projects had time overruns (Lowsley & Linnett, 2006). In India, about 646 central sector projects costing about $50 trillion were approximately 40% behind the project schedule (Iyer & Jha, 2006). A study by Chirwa, Samwinga, & Shakatu (2011) established that out of 184 contracts administered between 2003 and 2008 in Malawi, 111 contracts completed beyond initial contract period, representing 60.3% failure rate of completing within scheduled time. The first phase of the Road Maintenance and Construction (ROMAC I) Projects in Malawi (between 1984 and 1988) had time overruns of almost 12 months and the second phase (between 1991 and 1998) had time overruns of 30 months.

There are many reasons why delays occur. For example, repeating of some of the construction works, poor organization, material shortage, equipment failure, change of orders and to some extent act of God. The severity of delays vary from project to project, for example, in the study of public water and sewage projects (Al-Khalil & Al-Ghafly,1999) concluded that delay occurred frequently in medium and large size projects, and considered severe in small projects. The study suggested that special attention to factors will help industry practitioners in minimizing contract disputes. Delays have a strong relationship with failure and ineffective performance of contractors.

The time delay factors are categorized into eight major groups namely: client-related factors, contractor-related factors, consultant-related factors, material-related factors, labour and equipment- related factors, contract- related factors, contract relationship-related factors, external factors. However, some causes and effects of delays in construction projects can be specific to the region or country.

The Malawi Roads Authority was established by an act of parliament to ensure that public roads are constructed, maintained or rehabilitated at all times. The Roads Authority is responsible for all public road networks of 15,451 km together with 9,478 km of undesignated road network that serves rural communities. Out of the 15,451 km public road network, 28% is paved and the rest is unpaved (Roads Authority Annual Report, 2012). The maintenance department aims at carrying out maintenance of all designated public roads in Malawi. This is achieved through implementation of several programmes which include; pothole patching, bridge construction, sectional rehabilitation of paved roads, re-decking of timber bridges, grass cutting, grading, reshaping, road marking, replacement of road signs, spot Interventions, emergency works, and accident spot improvement. At operational level, the maintenance department has established three operational regions namely South, Centre and North which are further divided into five zones: Blantyre, Zomba, Lilongwe, Kasungu and Mzuzu.

For some years now, it has been observed that road maintenance projects from various programmes have been exceeding their initial time by huge margins, in some cases double the contract period and this is a big inconvenience to road users and costly to the organization.

Information extracted from various progress reports from different consultants from 5 administrative zones reveal that, out of 1240 contracts under Roads Authority executed between 2010 and 2015, 523 contracts experienced time overruns representing 42.2%. At Regional level, the North executed 314 contracts of which 145 experienced time overrun, representing 46.2% and registered the highest percentage of time overruns, 218 (42%) of the total (519) contracts executed in the Central Region experienced time overruns, whereas in the Southern Region 160 (39.3%) out of 407 contracts experienced time overruns. Furthermore, progress reports highlight that Chitipa District recorded the highest percentage of contracts (26 out 44 – representing 59.1%) which were finished beyond contract period. In Karonga District, 36 out of 66 – representing 57.1% contracts that were executed in the past five years were completed beyond the contract period. This underscores that untimely completion of contracts has remained a big problem within the Roads Authority in the last 5 years and that Karonga District is one of the districts which have registered the highest percentage of contracts which were completed beyond contract period.

The literature review demonstrated that pothole patching, bridge construction and sectional rehabilitation of paved roads were the most affected programmes with respect to time overruns. Though Chitipa District registered highest percentage of contracts which were completed beyond contract period and would have been the possible candidate, programmes like pothole patching and sectional rehabilitation of paved roads have not taken place for the past 5years in the Chitipa District, as such Karonga District was chosen as a study district.

The studies on the causes of time overrun have been conducted by many, for example in Malawi a study by Kamanga & Steyn (2013) identified 72 causes of delay, in India Shanmugapriya & Subramannan (2013) identified 76 factors and Memon (2014) identified 30 factors that contributed to time overruns in Malaysia. However, the top ranked significant factors from the studies vary widely and have been ranked differently by different researchers. Furthermore, the findings highlighted by most authors are a result of review of literature and the study focus was general and mostly in large project. The progress reports from the consultants in the five operational zones in the past five years have only highlighted time delay and have not gone

further to establish the different causes of the time delay in Roads Authority maintenance contracts.

Stakeholders also recognised the importance of dealing with time overruns in the road maintenance projects. Many road maintenance projects in various programmes are still facing time overruns which has been linked to the ineffective analysis of factors contributing to time overruns. The Roads Authority Annual Report (2012) also cited time overruns as a contributing factor, amongst its challenges for not fully achieving its performance targets for planned works. Therefore, timely completion of maintenance work is the major goal of the public transportation agency for the preservation of the existing infrastructures, convenience of road users and cost control. It is important to achieve timely completion of projects within stipulated budget and required quality as each day of time overrun in the completion of any project has direct impact on the cost of project (Memon, 2014). As such, the need to analyse factors contributing to time overruns for road projects in Malawi, Karonga District in particular, need not be overemphasized.

1.3 Significance of the Research

Accessibility to socio-economic facilities has been identified as a key indicator of development (Peterson, 1997b). The importance of good road infrastructure in providing sustainable development can therefore not be over emphasized. However, while continued investment in transport sector by Government of Malawi and cooperating agencies is viewed as an instrument in development in Malawi, there has been limited studies to analyse the factors that contribute to delays in timely completion of road maintenance works.

The Roads Authority builds on achieving the objectives of the National Transport Policy (NTP) as well as the Malawi Growth and Development Strategy I (MGDS I) whose main objective is to create wealth through sustainable economic growth and infrastructure development as a means of achieving poverty reduction. This objective is expected to transform the country from being a predominantly importing and consuming economy to a predominantly manufacturing and exporting economy. The Roads Authority's vision is to be the best agency and authority in the management of the public road network, whereas, its "mission" is to develop and maintain the designated public road network infrastructure investment in a cost effective manner with a view

to provide an accessible, reliable, efficient, safe, sustainable and most economic transport system in Malawi. However, this cannot be achieved if the projects are subjected to time overruns (Roads Authority Annual Report, 2012). Information extracted from various progress reports from different consultants from 5 administrative zones reveal that, out of 1240 contracts under Roads Authority executed between 2010 and 2015, 523 contracts experienced time overruns representing 42.2%. The high failure rate to complete the projects in time had significant negative impact on the organization budget. The Roads Authority Annual Report (2012) also cited time overruns as a contributing factor, amongst its challenges for not fully achieving its performance targets for planned works. Therefore, timely completion of maintenance on work is the major goal of the Roads Authority for the preservation of the existing infrastructures, convenience of road users and cost control. It is important to achieve timely completion of projects within stipulated budget and required quality as each day of time overruns in the completion of any project has direct impact on the cost of project (Memon, 2014). As such, the need to analyse factors contributing to time overruns for road projects in Malawi, Karonga District in particular, need not be overemphasized.

There has been little focused research to support development policies and strategies with a view of enhancing the maintenance of the designated public road network infrastructure investment in a timely and cost effective manner, thereby promoting development of the targeted communities and living conditions of the people. For Roads Authority to be successful in its policies and strategies its operations must be based on reliable information and detailed analysis and understanding of time overruns. Therefore, this research will augment and enrich existing knowledge on time overruns problems. Based on the knowledge from this research, Roads Authority Management will ably develop management systems to minimize delays in road maintenance projects.

1.4 Research Objectives

1.4.1 Main Objective

This study analysed factors influencing time overruns in road maintenance projects funded by Roads Fund Administration through Fuel Levy and undertaken by the Roads Authority in Karonga District.

1.4.2 Specific Objectives

The specific objectives of the study were as follows:

1. To identify factors that influence time overruns
2. To rank factors of time overruns according to their frequency, severity and significance
3. To establish whether factors contributing to time overruns differ based on the type of the contract.

1.5 Organization of the Thesis

This thesis is presented in 5 chapters as follows:

The introduction, background, significance and objectives of this research are presented in Chapter 1. Chapter 2 reviews literature and provides the underlying concept of this research. Chapter 3 highlights the process of how location, programmes and participants from existing data sources were determined and the details of how primary data collection was conducted. Data analysis and results are presented in Chapter 4 and finally, Chapter 5 outlines the conclusions that were drawn from the research and makes recommendations on how the research results can be used as a guide to policy and strategy formulation on issues of time overruns in Malawi.

Chapter 2

Literature Review

2.1 Introduction

Several studies have been conducted to investigate causal and effect relationships between time overruns and the project environment. Different methodologies and methods have been employed to understand the most critical attributes that influence time overruns and the intensity of effect that the attributes have on the project environment. One of the methods commonly used in the determination of critical factors influencing time overruns are the Relative Importance Index (RII) that ranks factors based on importance and the t-Test that determines significance of the influencing factor. This chapter reviews studies on time overruns in different projects to determine the prevalent causative factors for delays on construction projects. Literature review will inform the analytical framework for analysis of factors causing time overruns on routine maintenance projects in Karonga District.

2.2 Case Studies

Kamanga & Steyn (2013) conducted a study to identify the significant factors influencing time overrun in road construction projects in Malawi. A questionnaire that sought respondents to rank severity of individual factors of delay was constructed based on seventy-two (72) attributes of time overrun that were extracted from literature. Field visits on Malawian construction projects were also conducted to identify causes of delay that might have been particular to visited projects or indeed common among different projects. Kamanga & Steyn (2013) also sought to determine whether there existed a relationship between the perceptions of consultants, contractors and clients on the severity of factors causing time overruns. Among ten (10) factors that Kamanga & Steyn (2013) identified from an RII analyses, two depict an economic upheaval that prevailed in Malawi during the time of the study. The two factors include Shortage of fuel and shortage of foreign currency for importation of materials and equipment. During the aforementioned period fixed dollar prices on the market that resulted in depletion of legal foreign currency reserves thus making it very difficult for fuel trading entities to sustain a steady importation of fuel. It may therefore be argued that some of the causes that were identified by the study were to some extent both country and period specific and may vary over time and place. Four other factors of interest

from the study by Kamanga & Steyn (2013) that are generally common to poor economies like Malawi include insufficient contractor cash-flow, slow payment procedures adopted by the clients (be it public or private) in settling end of milestone payments, insufficient state of the art equipment and deficiency of trained technical personnel. The study by Kamanga & Steyn (2013) falls short of clarifying the imperativeness of correlation factors between different respondent groups and how relational analysis contributes to knowledge and policy.

Shanmugapriya & Subramannan (2013) investigated significant factors influencing time and cost overruns in Indian construction projects. The study was justified on the notion that time and cost overruns are becoming prevalent in India despite the threat that such overruns have on the economy of the country. One noteworthy aspect of the study by Shanmugapriya & Subramannan (2013) is the examination of time and cost overruns independent of each other. The approach may be justified by Love, Tse, & Edwards (2005) who, despite acknowledging the relationship between time and cost overruns, indicate that the cost of the project may not be the best predictor of time requirement for a particular project. Reasonably cost overruns may not always consequentially influence time overruns and vice versa because of the nexus among project constrains (i.e. time, cost, quality and scope). Shanmugapriya & Subramannan (2013) identified 76 factors influencing time overruns from literature. The RII analysis was employed to rank the factors on a hierarchal scale. The results from the study indicated that material market rate, contract modifications, high level of quality requirement, project location, dependence on the new recruits to bear responsibility, rework for bad quality performance, switching subcontractors, lack of technical skill, lack of experience in similar projects and shortage of generally experienced personnel influenced time overruns more than other factors.

Memon, Rahman, Muhammad, & Nornshima (2014) investigated the time overruns factors in construction industry of Peninsular of Malaysia. Malaysia identifies construction Industry as a major contributor to the country's economic and social development. However, this sector is also considered to be one of the riskiest, dynamic and challenging sectors. It was observed that many projects would not complete in time. Therefore, it became necessary to examine the causal attributes to the continuous and severe problem of excessive time overruns. Memon et al. (2014) identified thirty (30) factors influencing time overruns from literature. A questionnaire that

sought respondents to rank individual causes of delay was constructed based on thirty (30) attributes of time overruns that were extracted from literature. The RII analysis was employed to rank the factors on a hierarchal scale. The results from the study indicated that cash flow and financial difficulties faced by contractors, contractor poor site management and supervision, contractor incompetent subcontractors, contractor shortage of site workers, resource difficulties of owner, owner frequent design changes, consultant shortages of materials, resource delay in progress payment by owner, owner unforeseen ground condition and other delay preparation, and approval of drawings were the top ranked factors. Memon et al. (2014) study further shows that among the ranked top ten causes of delay, three are contractor related, two are related to resource shortages, two are consultant related, two are client related and one is related to external factors. Memon et al. (2014) categorisation of attributes and questionnaire respondents is very similar to those by Mahamid (2011), Salunker & Patil (2014) and Shanmugapriya & Subramannan (2013), in that all studies categorised attributes and sought data from project clients, project consultants and contractors. However, it is seemingly apparent that attributes influencing time overruns are somewhat specific to the environment and period within which particular projects are undertaken. Lack of technical expertise and experience seem to be top common among the abovementioned studies, regardless the specificity to the environment and time of attributes causing time overruns.

Salunker & Patil (2014) investigated effect of construction delays on project time overruns in India. India also identifies construction industry as a major contributor to social-economic development of the country. While at the same time the country also appreciates that construction industry is full of unpredicted problems. The industry is severely affected by numerous factors both external and internal that influence the construction process. India construction industry in 2012 registered 57% of time overruns. This was a major setback to the sector that contributes a lot to the social-economic development of the country. Therefore, identifying causative attributes was necessary. Salunker & Patil (2014) reviewed literature and extracted eleven (11) factors: 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 & order problem, delay in supply of equipment, slow progress of civil work and escalation in cost as the most recurring factor in time overrun. Salunker & Patil (2014) based their study on the influence of the three (3) key participants (e.g. owner, contractor and consultant) to project

performance and established that participants like owner, contractor and consultant were very influential on project performance aspects. Among top ten (10) factors that Salunker & Patil (2014) identified from analysis, categorised them as follows; three were client or owner related, four were contractor related and three were consultant related. This is in Salunker & Patil (2014) a big contrast with findings in the study conducted by Kamanga & Steyn (2013) in Malawi. Kamanga & Steyn (2013) findings were resources related and few factors were contractor and consultant related. Salunker &Patil (2014) findings are in agreement with those found the study by Memon et.al. (2014) in Malayia. Shanmugapriya & Subramannan (2013) in India and Mahamid (2011) in Palestine. The differences in findings by Kamanga & Steyn (2013) and the three other studies augment the fact that environment and time period plays a major role in determining factors that influence time overruns in project processes. It may also be argued that one of the major determinants of factors influencing on a project is the performance of the economy of a country in which studies are undertaken. For example, the economies of India and Malaysia are better than Malawi much that one would expect more commonality of attributes causing delay between India and Malaysia than between India and Malawi

Mahamid (2011) investigated risk matrix for factors affecting time delay in road construction projects. The aim was to understudy Palestine road construction projects with the view of identifying the risk matrix for factors influencing time overrun in the West Bank from owners' viewpoint. In total, 43 factors that were thought to influence time overrun in road construction projects were listed through literature review. A questionnaire was developed based on forty three (43) attributes of time overrun that were extracted from literature and was distributed to respondents to rank individual causes of delay. The RII analysis was employed to rank the factors on a hierarchal scale. The results from the study indicated that payment delays by the owner, the political situation, the segmentation of the West Bank, the financial status of the contractor, Poor communication between the construction parties, lack of equipment efficiency and high competition in bids. In this study by Mahamid (2011) like Kamanga & Steyn (2013) identified two factor namely the political situation and the segmentation of the West Bank which are specific in the Palestinian Territories. Two factors depict political difficulties that prevailed in Palestinian Territories during the time of the study. It may therefore be argued that some of the causes that were identified by the study were to some extent both country and period specific and

may vary over time and place. Furthermore, Mahamid (2011) study unlike Kamanga & Steyn (2013, has identified only one factor that is resource related probably a sign that the country's economy is better than Malawi. Apparently, the problem of equipment efficiency are common among developing economies like India while for poor economies like Malawi the problem is an absolute lack of modern technology.

Sweis & Ghaleb (2013) investigated factors affecting time overruns in Public Construction Projects inJordan. The aim was to understudy road construction projects in Jordon in order to identify factors influencing time overruns. In total, 37 delay factors were extracted from literature review. A questionnaire based on the compiled list of thirty seven (37) factors was formulated and distributed to intended respondents. The study was designed to be purposive, targeting specific type of respondent and therefore, 30 engineers of different levels of work experience at the Ministry of Public Works and Housing and the Association of Construction Contractors were identified and given the questionnaire to respond. The Principal Component and Factor Analysis (PCFA) method was employed to calculate the weighted indexes for importance and frequency of overrun variables. The time overrun variables were ranked according to their Severity Index (the product of Importance Index and Frequency Index). Sweis & Ghaleb (2013) in the study identified that too many change orders from owner, poor planning and scheduling of the project by the contractor, ambiguities and mistakes in specifications and drawings, slow decision making from owner, poor qualification of consultants, engineers and staff assigned to the project, Improper technical study by the contractor during the bidding stage, delay in progress payments by the owner, severe weather conditions on the job site, presence of unskilled labours and shortage of technical professionals in the contractor's organization as the most significant time overruns factors ranked within the top ten. Sweis & Ghaleb (2013) findings on factors fluencing time overruns are baised towards client or owner related and resourse related other than other categories. These findings are similar to what Kamanga & Steyn (2013) found in their study. This could probably be a result of poor economy in the two countries.

As illustrated in the case studies, several studies have identified many different factors that influence time overruns in construction projects. Time overruns in construction industry are one of the most recurring problems and have a major influence on project performance and success in

many aspects (e.g. in terms of time, cost, quality and safety).The behaviour is more severe in developing countries, sometimes time overruns can exceed 100% of the anticipated project period (Abd El-Razek, Bassionni, & Mobarak, 2008; Le-Hoai, Lee, & Lee, 2008). Furthermore, these have shown that these factors vary widely from country to country, project and time specific possibly due to environmental, topographical and technological constraints among other factors. And each researcher has found a different list of top significant factors and in a different order of ranking in the top ranking significant factors after an analysis on factors. Kamanga & Steyn (2013) ranked shortage of fuel and shortage of foreign currency for importation of materials and equipment on the list of the top ten significant factors. These factors are not found on the list of other researchers. This was as a result of poor economic environment in Malawi at that time and hence adversely affected projects in Malawi. He also found shortage of construction materials such as bitumen, cement and steel, delay in paying compensations to land owners and delay in relocating utilities. These factors were also found in the top ten significant ranking in the study done by Kamanga & Steyn (2013) because are attributes of poor economy. Likewise, Mahamid (2011) has the political situation and the segmentation of the West Bank as significant factors appearing in the list of top seven factors. Again this situation was applicable in Palestine, it is political and location specific situation. Shanmugapriya & Subramannan (2013) listed Project location among the top ten significant factors, Sweis & Ghaleb (2013)listed Severe weather conditions on the job site and Memon et al. (2014) listed owner unforeseen ground condition. The specificity of factors influencing time overruns on construction projects can be further observed from Kamanga & Steyn (2013) and Shanmugapriya & Subramannan (2013). For example, only one factor – "lack of technical skill/personnel" – is common among lists of time overrun influencing factors of the two aforementioned studies.

However, despite the variation in the factors found, there are also commonalities in their research findings. For example; Kamanga & Steyn (2013) in the study identified five factors namely; insufficient contractor cash-flow/difficulties in financing projects, slow payment procedures adopted by the client in making progress payments, insufficient equipment, shortage of construction materials such as bitumen, cement and steel and shortage of technical personnel are also appearing in the top ranking findings of other researchers work (e.g. Mahamid, 2011: Memon, 2014: Salunker & Patil, 2014). Mahamid (2011) mentioned that 'payment delays by the

owner, the financial status of a contractor and lack of resources are some of significant risk factors to time overruns which need to be controlled and reduced'. Shanmugapriya & Subramannan (2013) also found financial problems by contractor payment delays by the owner and lack of equipment are same of significant risk factors to time overruns and should be given a serious attention. Memon et.al (2014) and Salunker & Patil (2014) they too found the three above-mentioned factors being among the top factors in their studies.

The studies have also categorised factors into eight major groups: client-related factors, contractor-related factors, consultant-related factors, material-related factors, labour and equipment-related factors, contract-related factors, contract relationship-related factors and external- related factors. Kamanga & Steyn (2013) found that five were related to resource shortages, two were contractor related, and two were related to external factors and one was client related. It was also observed that there were no contract and contract relationship related or consultant-related delay factors among the top ten factors of delay. Kamanga & Steyn (2013) findings show that most of the factors causing construction time overruns are resource related factors and less of other factors related categories. Their findings are true reflections of situations in developing countries were economies are married with a lot of problems e.g. political, environmental and governance among others. Therefore since the World is anticipating effect of globalization and the technological difference between developing and developed countries, it is necessary to identify the actual reasons of delay in order to reduce the impact of delay in any construction project (Shebob, Dawood, Shah, & Xu, 2012). The literature review has also shown that the Relative Importance Index (RII) method was the most commonly used method by many researchers in ranking factors of time overruns. This method appears to be the favourite with many other researchers, e.g., Memon (2014), Memon et al. (2014), Salunker & Patil (2012), Shanmugapriya & Subramannan (2013), and Sweis & Ghaleb (2013).

From the literature, it is clear that several studies have identified many different factors that influence time overruns in construction projects. This research, therefore proposes to focus on factors causing time overruns in routine maintenance projects in Karonga District in the Northern Malawi under Roads Authority. Therefore, to form the basis for the study, various factors found from other research works and field visits conducted in this study, were put together and sorted

out to compile one list for this particular study. From the sorted list, an Analytical Hierarchy Process (AHP) was carried out to identify factors that are most relevant to Karonga District in particular. Thereafter, a questionnaire was designed to facilitate ranking of factors by respondents. The developed list of factors from various research works is presented as appendix F.

2.3 Chapter Summary

It is important to state that from the literature review there is justification as to why time overruns needs to be pursued. While some challenges towards implementation have been mentioned it remains this writer's intention to explore further and agree or disagree with some of the findings. The literature has outlined the basis for research in field of study; time overruns are one of the most recurring problems in the construction industry and it has major influence on project performance and success in terms of time, cost, quality and safety irrespective of project size, location, etc. The causal and effects of delay factors in construction industry vary from country to country possibly due to environmental, topographical and technological constraints among other factors. Further, the findings highlighted by most authors are a result of review of literature other than field visits. This research work did not dwell on review of literature alone but conducted site visits where discussions with the people involved in construction was carried out and interviews with all stakeholders was also conducted.

Chapter 3

Methodology

3.1 Introduction

This chapter presents the process of how the units (district, programmes and stakeholders) were determined and the details of how primary data collection was conducted. It shows how the sample of contracts and participants were chosen, how questionnaires and interviews were administered and how data was analysed and interpreted. The chapter also discusses the instruments used and how correction measures were undertaken to overcome bias during data collection. Moreover, the chapter shows how contemporary issues in research especially ethical issues were considered. Finally, it outlines the challenges encountered during the data collection process.

3.2 Scope of the Study Area

3.2.1 Malawi Profile

Malawi is a landlocked country in southeast Africa. It is bordered by Zambia, Tanzania and Mozambique. Malawi has three regions, three main cities and 29 administrative districts as shown in Figure 2. Malawi is over 118,000 km2 with an estimated population of 17 million of which 51.4% are females and 85% live in rural areas. Additionally, Malawi has illiteracy rate of 36% and poverty rate of 52.4%. Furthermore, Malawi has a youthful population with more than half of the population under the age of 35. According to the labour force survey report released in 2014 for the country; formal unemployment rate in Malawi at 21 percent. The economy of Malawi is predominantly agricultural, with about 90% of the population living in rural areas. The landlocked country in south central Africa ranks among the world's least developed countries. Agriculture accounts for 29% of GDP and 85% of export revenues (National Statistics Office (NSO), 2010).

Figure 1: Main Cities and Districts in Malawi

3.2.2 Karonga District Profile

Karonga is a district in the Northern Region of Malawi located about 200 km north of Mzuzu, the administrative city of the Region. It is bordered by Lake Malawi on the East, Songwe River (border with Tanzania) on the North and the Nyika Plateau and highlands on the West and South. The district covers an area of 3,355 km² and has a population of 194,572. It is mainly occupied by the Nkhonde tribe. Other tribes include Henga (mainly occupying the southern part) and Nyakyusa (migrants from Tanzania). Karonga is hot and dry from September to December, rainy from January to May, and cool and dry from June to August. The terrain is flat and fertile along the lake, and increasingly hilly towards the west. There are several rivers, fed from the Nyika highlands to the west, and the northern sector is dominated by the floodplain of the Songwe River. Poverty in Karonga is caused by many factors, including constraints on the economic productivity of land, labour, capital, and technology. It is estimated that 66% of the population has a monthly household income at approx. USD 4, which is too low for a sustainable life. However, over the last few years, there has been much development in the region due to the discovery of uranium at the Kayelekera mine, which officially opened in 2009, and many of the previously graveled roads have been laid with tarmac (Simkonda, 2008).

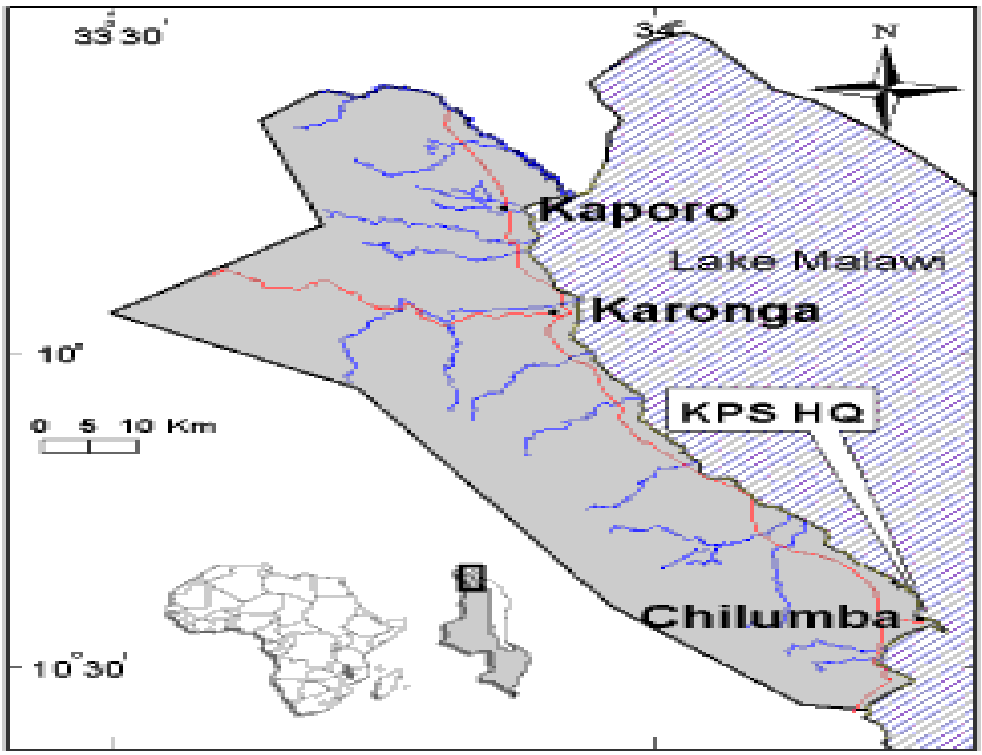

Figure 2: Topographic features of Karonga District

3.3 Determining Location, Programmes and Stakeholders from Existing Data Sources

To arrive at the units (location, programmes and stakeholders) used in this study, the following stages were considered; (a) the location of the study:- this was identified through review of progress reports from consultants who in the past five years supervised routine maintenance contracts in the region; the Malawi and Karonga profiles are locating were Karonga is as area of study,(b) through review of reports from Roads Authority and Supervising Engineers, the most affected programmes with respect to delays, organizations directly involved in implementation of the programmes and their key personnel were identified.

The key elements in the sample design were the people who were involved in the maintenance projects. The samples were drawn from the stakeholders involved in the implementation of maintenance projects. This study focused on all contractors, consultants and the Roads Authority (client organization) who participated in the execution of contracts in Karonga District. The participants chosen were from different levels in an organization as follows: Directors, Site Agents and Foremen were chosen from the Contractor, from the Consultant: Team Leaders, Highway Engineers and Road Inspectors were targeted and from Roads Authority: Directors,

Regional Managers, Engineers and Road Inspectors were chosen as participants. This was done to ensure that experiences at all levels were captured, considering that people at different levels in an organization perform different roles in a project.

This method of sampling is called purposive sampling. The three category groups were purposely targeted to provide the information relevant to this study. In applying this sampling method, the study was guided by Berg (2001) concept and I quote: "When developing a purposive sample, researchers use their special knowledge or expertise to select subjects who represent this population". The key element remains unbiased sampling that will enable the researcher to answer the research questions.

3.4 Sample Size

Karonga District was identified as the location of the study since it was among the two districts in the Northern Region which registered highest number of contracts in the past five years which were not completed within the contract period. The district is also within the zone the author is administering as such, it provided a conducive environment for data collection.

Out of the twelve programmes the Roads Authority has been implementing in the district, three programmes namely: pothole patching, bridge construction and sectional rehabilitation of paved roads were identified as candidates representing 25% of the total number of programmes which are being implemented. These were the most affected programmes and they were implemented almost every year during the past five years.

The targeted respondents to this study were key personnel from organizations directly involved in implementation of the programmes (Roads Authority, Contractors and Consultants). Through review of reports the key personnel involved in implementation of projects were identified. A total number of 44 projects in pothole patching, bridge construction and sectional rehabilitation of paved roads were implemented from 2010 to 2015 in Karonga District (Roads Authority Annual report, 2015). As such, a total of 130 participants were targeted and 92 participants responded representing 71% response rate.

The robustness and choice of a sample size to get a significant level of representation of the whole population have been widely studied (Atkins, 2005; Maas & Hox, 2005). In order to get adequate statistical power with respect to estimates of all model parameters and their standard errors, Maas & Hox (2004) and Huang & Lu (2007) suggested sample sizes of at least 30. In addition, some researchers have argued that estimates of sample errors and variance components tend to be underestimated when the number of units is less than 30. Therefore, considering that (i) many studies cited above demonstrated that convergence rates of parameters at 95% confidence intervals improved considerably with sample size of 30, (ii) the study population was fairly sampled, (iii) this study adopted purposive sampling technique and (iv) the sample population represented the whole population of the contracts implemented in the past five years in the district; the response rate of 71% was adequate since beyond a minimum size required to make statistically significant statements, differences in sample size would not significantly affect the outcomes of the study (Babbie, 1998).

3.5 Development of Questionnaire

The questionnaire was developed in line with the study objective. Considerations for the use of questionnaires are well documented. Past studies acknowledged the influence of a specific study on questionnaire development (McColl, Jacoby, Thomas, & Soutter, 2002).A study can use standardized questionnaires or questionnaires specific to a particular research. Other standardized questionnaires were considered for this study (e.g. Gondwe, 2015; Kamanga & Steyn, 2013; NSO, 2010). This study adopted some questions from these standardized questionnaires and added some specific to this study. An attempt was made to keep the questions as clear and simple as possible to avoid ambiguity (McColl et al., 2002). Both the questionnaire and the group discussions were designed to seek information through all key stakeholders who are well informed members from the construction industry.

The questionnaire was divided into four parts. The first part had four questions. The first section sought general information on respondents for example organization/company type, position in the company/organization, number of years of experience in road construction industry and number construction projects the informant was involved in during the past five years. The second section sought information on time overruns; typical factors that caused time overruns in

the past five years. The third section looked at the extent of the impact of factors. The respondents were asked whether impact was significant or not significant. The respondents weighted using 1-5 scale; where '1' is less significant and '5' is extremely significant. The fourth section asked questions on how management of time overruns can be improved. The questionnaire and interview guide are presented as Appendices A1 and A2 respectively.

3.6 Administration of Questionnaires

The administration of questionnaires and interview guides firstly involved liaison with directors of the construction companies and consultants firms to allow their key personnel to be interviewed or to respond to the questionnaire. A total of 50 construction companies and consultant firms were contacted and a no objection was granted from all firms. Each organization provided one key person responsible to coordinate the survey. These acted as enumerators. As part of the process, the key persons from each and every organization sampled were oriented to the questionnaire. This was to ensure that the concepts and questions were well understood. It was also noted that most respondents had already been involved in the previous surveys (Gondwe, 2015; Kamanga & Steyn, 2013; NSO, 2010). In addition, a sample of five key persons from five companies went through training before conducting a 2hours pilot study. The Pilot Survey was conducted in order to (i) check the reliability and consistency of various information obtained, (ii) determine the capability of the questionnaire in providing inputs for the study and (iii) accustom the key persons with survey and share their previous experiences in such exercises. The exercise also sought to recommend improvements in survey methodology and the questionnaire. The training was conducted by the researcher. The overall aims and objectives of the study were explained to the respondents in great detail, stressing the point that the study was for research purposes and that all the respondents were to participate voluntarily. All questions and options were explained to the enumerators and clarifications were made where applicable. The process was very time consuming but extremely important. The enumerators were further coached in other general points of the interviewing process such as: (i) introducing the study and building rapport, (ii) how to deal with interruptions and other similarly difficult situations, (iii) how to probe for more information without introducing bias, (iv) how to record the responses, (v) when to skip questions, (v) what to do with the participants to end the interview and (vi) what to do with the questionnaire.

Research Ethics were also emphasized while collecting data through interviews. All participants were informed of their freedom to give out answers or not and that they could stop and leave the interview should they fill not comfortable. The identities of participants remained concealed and could only be revealed upon their authorization. All participants were given a transcribed copy of the interview should they wish and participation was on a voluntary basis and good relationship with the people were to be maintained in the most possible realistic way so as to get as much information as possible. FHI 360 (2009) highlighted these points as important guidelines for identifying best practices for a survey. After the Pilot Survey, improvements in survey methodology and the questionnaire were made e.g. minimizing time for introduction and building rapport, proper recording of the responses and improvement of some questions which were not properly answered due to misunderstanding by the interviewer and respondent.

The first step in the management of questionnaire was for the enumerator to book an appointment with respondent and then orient him/her on how to go about responding to the questionnaire. The involvement of the key person from the organization helped to reduce time in seeking further permission from the company before dealing with other lower ranked personnel e.g. Site Foreman. This arrangement intended to maximize the response rate.

This process was followed up with some group discussion where applicable; the purpose of the group discussion was to enrich the data collected through the questionnaire form. Where group discussions were conducted the proceedings were tape recorded and then transcribed and analysed later. Plate 1 shows a group discussion session.

Plate 1: A session of group discussions

Questionnaires from enumerators were collected and reviewed after every 3 days. Any questionnaire that was found incorrectly completed was not considered. Fortunately, only one of 93 questionnaires received was incorrectly completed. Using IBM SPSS version 20.0 (IBM SPSS, 2011), a database was created. Data was entered manually from the completed questionnaires into IBM SPSS file. Each questionnaire was given a code which was also coded in the IBM SPSS file. After all the questionnaires were entered, 50 questionnaires were randomly selected and compared with the information from the database to determine if the information from the respondent had been accurately recorded. Generally very minor inaccuracies were observed. This may be because the data entry was done by the researcher who made sure that the data entry was entered correctly throughout the process. All the inaccuracies were reviewed and corrected by referring back to the original questionnaire of the respondent.

3.7 Survey Challenges

The challenges in the research study were issues affecting the administration of survey questionnaires and interviews and were ranging from logistical to finances; for example (a) directors of some companies did not live up to their promise of assigning one key person to coordinate the survey in their company. This resulted in the researcher making persistent reminders to such directors and in some cases travelling to their offices several times to make sure that the data collection exercise was achieved and this was costly. (b) Some key participants in the research were no longer working for the companies; they left to join other companies and could not be traced for recording of the information while others were reported as having died. In such cases, where possible the participant was replaced and if no replacement was available, his/her involvement was nullified, (c) the study was not funded, the author had to use his own resources to finance the activities and (d) the author had to balance time between study time and the work at work place.

3.8 Data Analysis

The analysis of data was carried out as follows; (a) identification of critical factors contributing to time overruns was done by using the Analytical Hierarchy Process (AHP) method, (b) the Relative Importance Index (RII) method was employed to analyze questionnaire data to rank causes of time overruns according to their frequency, severity and significance including identification of contract types mostly associated with time escalation and (c) a paired t-test was used to establish the statistical relationship between contract type and time overruns. The reliability of data was also carried out using Cronbach's Alpha equation. The purpose was to make sure that data used in the study was reliable.

3.8.1 Analysis of Data Using Analytical Hierarchy Process (AHP)

The Analytical Hierarchy Process (AHP) method has been adopted in this study to identify critical time overruns factors for projects. The Analytical Hierarchy Process (AHP) is a decision-aiding method developed by Saaty (1980). It aims at quantifying relative priorities for a given set of alternatives, based on the judgment of the decision maker, and stresses the importance of the intuitive judgments of a decision-maker as well as the consistency of the comparison of the alternatives in the decision-making process. Decision-makers base judgments on knowledge and

experience, and then make decisions accordingly. The AHP approach agrees well with the behavior of a decision-maker. In the present work, AHP was used to quantify the critical time overruns factors from the data obtained through field survey and secondary sources like journals, books and related literature available on the research topic.

3.8.2 Determining Reliability of the Results Using Cronbarch's Alpa

Determination of the reliability of data was done using Cronbach's Alpha equation. Reliability testing provides the most detailed form of reliable data because the conditions under which the data are collected can be carefully controlled and monitored. Furthermore, reliability tests can be designed to uncover particular suspected failure modes and other problems. The type of reliability testing a product undergoes will change along different points of its life cycle, but the overriding goal is to insure that data from all or most of the tests were generated under similar enough conditions so that an "apples to apples" comparison can be made of the product's reliability characteristics at different points in the product's life. Cronbach's alpha is a measure of internal consistency, that is, how closely related a set of items are as a group. It is considered to be a measure of scale reliability. It is a coefficient of reliability (or consistency). Cronbach's alpha is defined as:

$$a = \frac{k}{k=1}\left(\frac{\sum_{i\neq j}^{k} cov(x_i x_{j,})}{var(x_o)}\right) = \frac{k}{k-1}\left(\frac{\sum_{j=1}^{k} var(x_j)}{var(x_o)}\right) \quad \text{..... (3.1)}$$

Cronbach's alpha provides a useful lower bound on reliability. Cronbach's alpha will generally increase when the correlations between the items increase. For this reason the coefficient measures the internal consistency of the test. Its maximum value is 1, and usually its minimum is 0, although it can be negative. A commonly-accepted rule of thumb is that an alpha of 0.7 indicates acceptable reliability and 0.8 or higher indicates good reliability. Very high reliability (0.95 or higher) is not necessarily desirable, as this indicates that the items may be entirely redundant. The goal in designing a reliable instrument is for scores on similar items to be related (internally consistent), but for each to contribute some unique information as well (Yang & Wei, 2010). Therefore, prior to data analysis of factors causing delays, reliability test was carried out

to ensure that data collected are valid and reliable for further analysis (Memon et al., 2014)**.** Reliability test was carried out by evaluating Cronbach's alpha using IBM SPSS.

3.8.3 Ranking of Factors Using Relative Importance Index (RII) Method

The Relative Importance Index (RII) method was used to rank causes of time overrun; this method has been the favorite method by many researchers (Assaf & Al-Hejji, 2006; Kamanga & Steyn, 2013; Memon et.al., 2014; Shanmugapriya & Subramannan, 2013; Sweis & Ghaleb, 2013). It was used to rank different causes of delays from the perspective of clients, consultants, contractors and other stakeholders. The indices for the causes were ranked for each group. The cause with the highest index was the most important, while that with smallest number was the least important.

The data received from the survey was analyzed using the following formula:

$$\text{Relative Importance Index(RII)} = \frac{\sum W}{A * N} (0 \leq RII \leq 1) \qquad (3.2)$$

where W = weights given to each factor by the respondents and ranged from 1 to 5 where '1' is less significant and '5' is extremely significant. A = highest weight (i.e. 5 in this case), and N = total number of respondents.

3.8.4 The Statistical Relationship between Contract Type and Time Overruns

To establish the statistical relationship between contract type and time overruns, a paired t-test was used. A paired t-test was used to compare two population means where you have two samples in which observations in one sample can be paired with observations in the other sample. According to Shier (2004), some assumptions are made as this paired t-test is done; (1) only the matched pairs can be used to perform the test, (2) normal distributions are assumed, (3) the variance of two samples is equal and (4) cases must be independent of each other. For this study, a paired t-test was carried out using IBM SPSS.

3.9 Summary

This chapter has presented (i) the process of how the location, programmes and stakeholders from existing data sources were determined and (ii) the details of how primary data collection was conducted. In addition the chapter demonstrated how the sample was chosen, how the interviews were conducted and how data was analyzed and interpreted.

Chapter 4

Results and Discussions

4.1 Introduction

This chapter analyses primary and secondary data. The analysis of data was carried out through the following tools: (a) Analytical Hierarchy Process (AHP) method; this tool was used to identify critical factors contributing to time overruns. (b) The Relative Importance Index (RII) method: This was employed to rank causes of time overruns according to their frequency and severity. In determining the rankings, the data analysis firstly considered demographic data to establish the proportional representation of the organization type, respondent's category groups and experience. Secondly, the analysis looked at the actual primary data by calculating frequency of occurrence of factors, Relative Importance Index (RII) and finally the actual ranking. (c) A paired t-test was used to establish the statistical relationship between contract type and time overruns. In order to establish the reliability of the data obtained from the survey, the reliability test was conducted before any analysis was carried out. The reliability was carried out using Cronbach's Alpha equation.

4.2 Identification of Prime Factors

The Analytical Hierarchy Process (AHP) method was used in this study to identify critical factors that contribute to time overruns for projects. The Analytical Hierarchy Process (AHP) is a decision-aiding method developed by Saaty (1980). Fifteen factors were identified through literature review. This was a very important step because there are a lot of factors that cause time overruns. For example; Memon et al. (2014) identified 30 factors, Kamanga & Steyn (2013) identified 72 factors, Shanmugapriya & Subramannan (2013) identified 76 factors and Mahamid (2011) identified 72 factors. Therefore, it was necessary to select only factors that were critical and relevant to the study. The factors were then coded before further analysis was carried out for easy identification. The list of prime factors and their code numbers are as shown in table 1.

Table 1: Prime Factors and Code Numbers

Item No	Factors causing time overruns	Code Number
1	Omissions in Bill of Quantities	F.1
2	Delays in producing variation orders	F.2
3	Slow payment procedures adopted by client in making progress payments	F.3
4	No or small time extensions associated with change orders initiated by client	F.4
5	Inefficient pre-qualification procedures by client, which result in the selection of incompetent contractors	F.5
6	Delays in work approval	F.6
7	Insufficient contractor cash flow/difficulties in financing projects	F.7
8	Poor qualifications and inadequate experience of contractor's key personnel	F.8
9	Delay in site mobilization	F.9
10	Conflict between/with contractor and other parties (consultant and client)	F.10
11	Unrealistic schedule programme submitted by Contractor's	F.11
12	Shortage of construction materials (bitumen, cement)	F.12
13	Shortage of fuel	F.13
14	Shortage of foreign currency for importation of materials	F.14
15	Theft of contractor's resources	F.15

4.3 Determining Reliability of Data by Using Cronbach's Alpha Equation

The questionnaire forms received were evaluated in order to determine the important factors that cause time overruns. In order to ascertain the reliability of the data source, the data analysis started by looking at the level of reliability of data collected from the respondents by conducting reliability test before analyzing the actual primary data. The reliability test data are presented as Appendices B1, B2, B3 and B4 respectively. Reliability test was carried out by evaluating Cronbach's Alpha values. Reliability test was firstly done on data from each individual maintenance programme and on all programmes combined. The results of the analysis are shown in Table 2.

Table 2: Reliability test results

Programme Category	**Cronbach'sAlpha**
Pothole Patching	0.839
Bridge Construction	0.839
Sectional Rehabilitation	0.804
All Programmes combined	0.889

From the table 2 above, it can be seen that the values are in the range of 0.804 to 0.889. The results demonstrate that the data from the respondents is reliable since the values are higher than the threshold value of 0.7 as highlighted by Yang & Wei (2010). The goal in having reliable data is for scores on similar items to be related and for each to contribute some unique information as well. Furthermore, reliability tests can uncover particular suspected failure patterns in the data and other problems. The overriding goal is to insure that data from all or most of the tests were generated under similar enough conditions so that an "apples to apples" comparison can be made.

4.4 Demography of Respondents

The demography of the respondents was assessed to understand their technical knowledge, experience and representation of respondents involved in the data collection.

4.4.1 Representation of Respondents in Designated Organizations

The representation of respondents in the three organization category groups was examined. The purpose was to check if all the category groups were represented so that there is a fairy contribution to the outcome of the results. The results are presented in the figure 3 below:

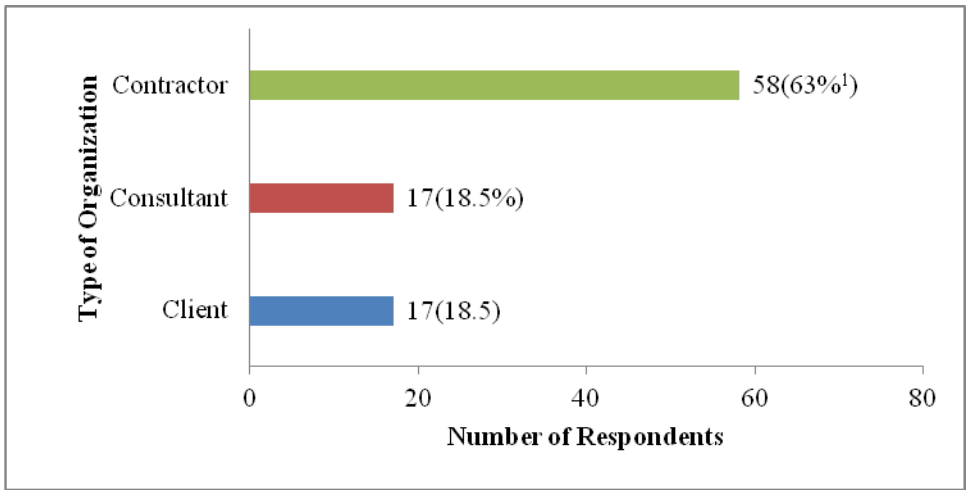

Figure 3: Percentages of Respondents per Organisation

[1]percentage is calculated based on 92 respondents

Figure 3 shows respondents from different organizations which were considered in this study. Out of 92 respondents, 58 were from the contractor representing 63%. 17 were from consultant representing 18.5% and another 17 were from the client representing 18.5%. 75(81.5%) respondents represented the private sector (i.e., contractors and consultants) while the road maintenance management agency (Roads Authority) had 17 respondents. The high response rate from the contractor is attributed to the following (a) many contractors are engaged in various maintenance activities every financial year, (b) the contractor is a hand on executor of works on the ground and (c) usually contractors encounter many problems in the process of execution.

Table 3: No of respondents by designation

Organization	Designation	No of respondents
Client (Roads Authority)	Manager	5(30%)[2]
	Engineer	5(30%)
	Road Inspector	7(40%)
Consultant	Team Leader	-*
	Highway Engineer	8(47.1%)
	Site Inspector	9(52.9%)
Contractor	Director	8(13.8%)[3]
	Site Agent	35(60.3%)
	Site Foreman	15(25.9%)

* represents zero percent response rate

[2]percentage is calculated based on 17 respondents

[3]percentage is calculated based on 58 respondents

Table 3 demonstrates that out of 17 respondents from the client; 5(30%) were Managers, 5(30%) were Engineers and 7(40%) were Road inspectors. In addition, from the consultants, there was no response from the Team Leader, 8(47.1%) were Highway Engineers and 9(52.9%) were Site Inspectors. Moreover, out of 58 respondents from the contractor, 8(13.8%) were Managing Directors, 35(60.3%) were Site Agents and 15(25.9%) were Site Foremen.

In general, the representation was fair. It covered all levels of respondent groups except for the Team Leader. However, this did not affect our sample representation since the Team Leader is at management level whereas the works are usually executed by the Highway Engineer and the Site Agent.

4.4.2 Experience of respondents

The questionnaire also examined the level of experience of the respodents in all the three programmes. This was in both general and particular experience. In general experience, the researcher wanted to know if the respondent has participated in similar type of programmes. The general experience was to assist the participant to know and understand when a problem has occurred. And particular experience in this case was experience in contracts executed in Karonga

District. This was to assist the participant to differetiate problems experienced during execution of contracts elsewhere and in Karonga District.

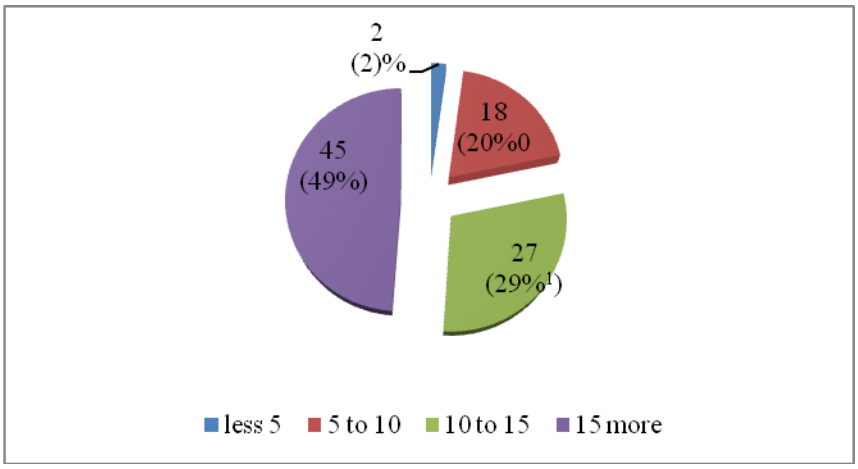

Figure 4: General Experience of Respondents

[1]percentage is calculated based on 92 respondents

Figure 4 shows that many participants had a lot of the general experience in construction industry; the category of 15 and more contracts had the highest number of respondents (45) representing 49%. The category of 10 – 15 contracts had 27 informants representing 29%. In total, it can be seen that 90 respondents representing 98% had general experience in 5 or more number of contracts.

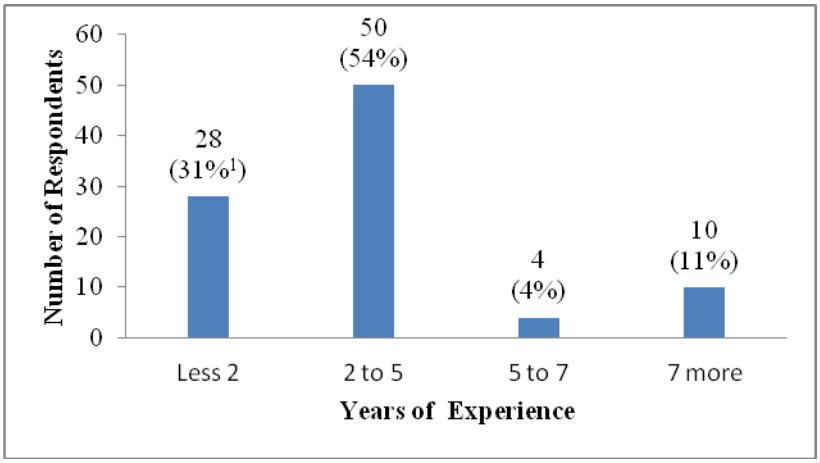

Figure 5: Particular Experience of Respondents

[1]percentage is calculated based on 92 respondents

Figure 5 shows that many participants had been involved in construction works in Karonga District. The category of 2 to 5 years of experience had the highest number of respondents (54%) followed by category of less than 2 years of experience (31%). In general, the figure above shows 69% of the respondents had been involved in more than 2 maintenance contracts in Karonga District.

Table 4: Experience distribution of Respondents

Programmes	No of participants
Pothole patching	24(26%)
Bridge Construction	42(45.7%)
Sectional Rehabilitation	26(28.3)

Percentage is calculated based on 92 respondents

Table 4 demonstrates that out of 92 respondents; 22(26%) had experience in Pothole patching, 41(45.7%) in bridge construction and 25(28.3%) in Sectional rehabilitation. The distribution of level of experience is fair enough to provide representative results.

4.5 Determination of Number of Contracts that Incurred Time Overrun

From the consultant progress reports, the number of contracts that incurred time overrun was established. The contracts executed in Karonga between 2010 and 2015 are presented in Appendix C1, C2 to C5 under Karonga column. Figure 6 demonstrates number of contracts executed between 2010 and 2015 in Karonga District.

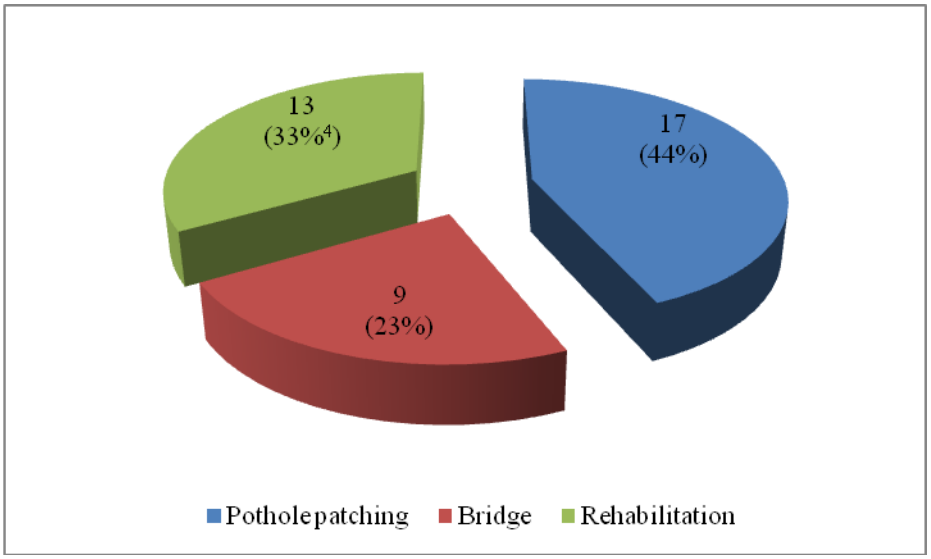

Figure 6: No of Contracts Executed per Programme (2010-2015)

[4]percentage is calculated based on 39 respondents

Out of 39 contracts executed in Karonga between 2010 and 2015, 17 were from sectional rehabilitation programme representing 44%. 13 were from bridge construction programme representing 33% and 9 were from pothole patching programme representing 23%. Of the 39 contracts, only 5 contracts were completed within the contract period as highlighted in Figure 7.

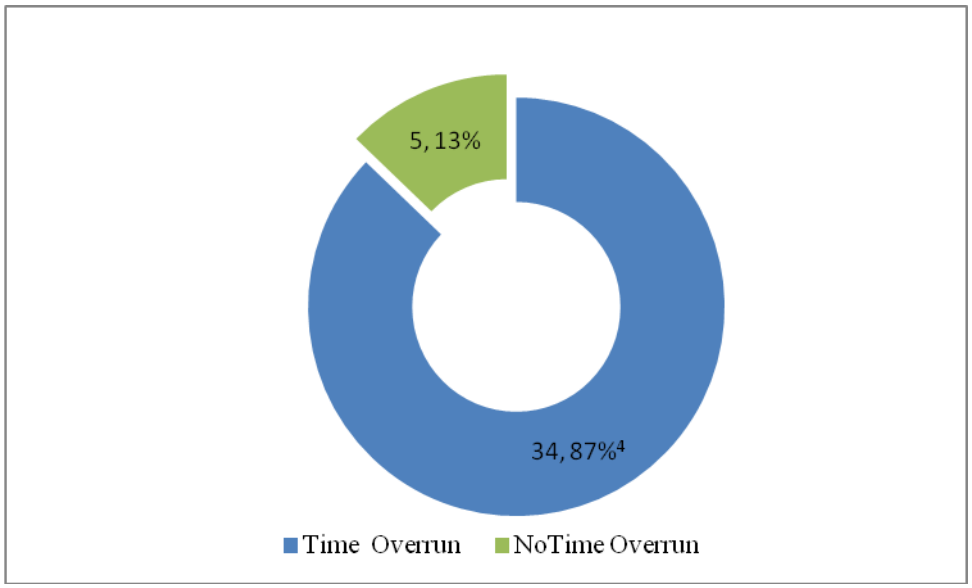

Figure 7: Contracts that experienced time overruns (2010-2015)

[4]percentage is calculated based on 39 respondents

Figure 7 demonstrates how high failure rate (87%) justifies why it was necessary to conduct this Study in Karonga District.

4.6 Determination of Distribution of Occurrence of Factors

The questionnaires received were analysed to determine the trend of occurance in terms of frequency. The trend of occurrance was examinedin all the three programmes; firstlyit was the individual programmesand secondly was the general trend whereall the frequency totals of each factor for the three programmes were put together. The trend of occurrence data is presented as Appendix D1, D2, D3 and D4 respectively.

4.6.1 Determination of Distribution of Occurrence in Pothole Patching

The pothole patching programme had 35 out of 92 questionnaires recieved representing 38%. The results were plotted on the bar graph as shown in the figure 8.

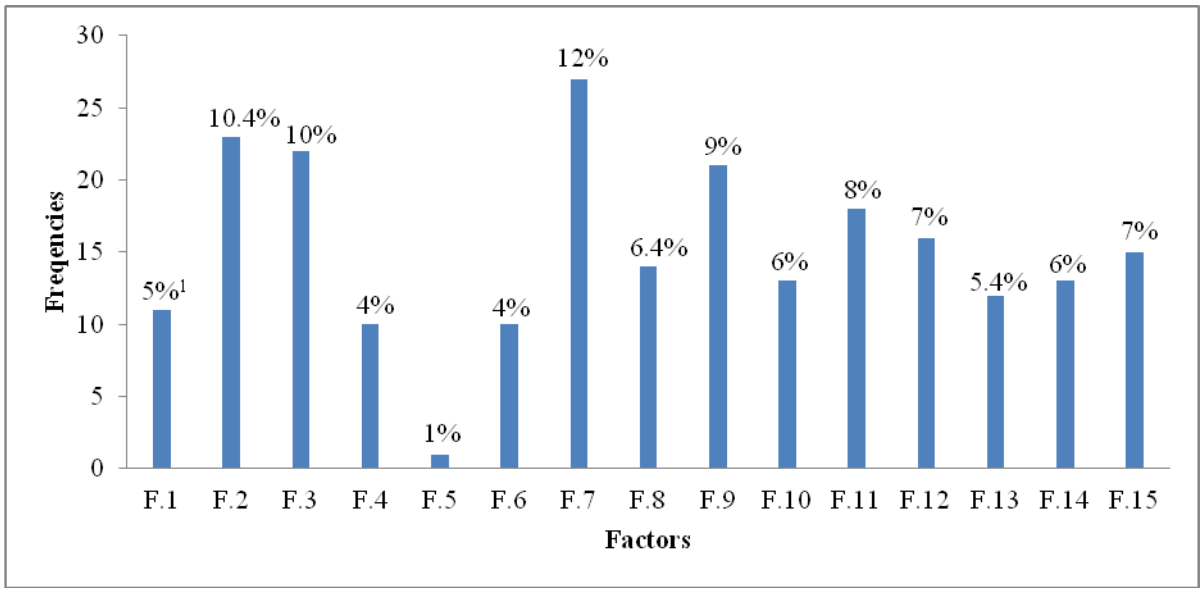

Figure 8: Distribution of Factors in Pothole Patching

[1]percentage is calculated based on 92 respondents

From Figure 8, it is observed that F.7 (insufficient contractor cash flow/difficulties in financing projects) was the most frequent factor causing time overrun in pothole patching contracts;

followed by F.2 (delays in producing variation orders). The least factor was inefficient pre-qualification procedures by client (F.5).

4.6.2 Determination of Distribution of Occurrence in Bridge Construction

The bridge construction programme had 52 out of 92 questionnaires received representing 56.5%. The results on frequency of occurrence of factors contributing to time overruns are shown in Figure 9.

From Figure 9, it is demonstrated that insufficient contractor cash flow/difficulties in financing projects (F.7), was also the most frequent factor causing time overrun in bridge construction contracts, followed by slow payment procedures adopted by client in making progress payments (F.3). Inefficient pre-qualification procedures by client (F.5) which resulted in the selection of incompetent contractors was the least highlighted factor.

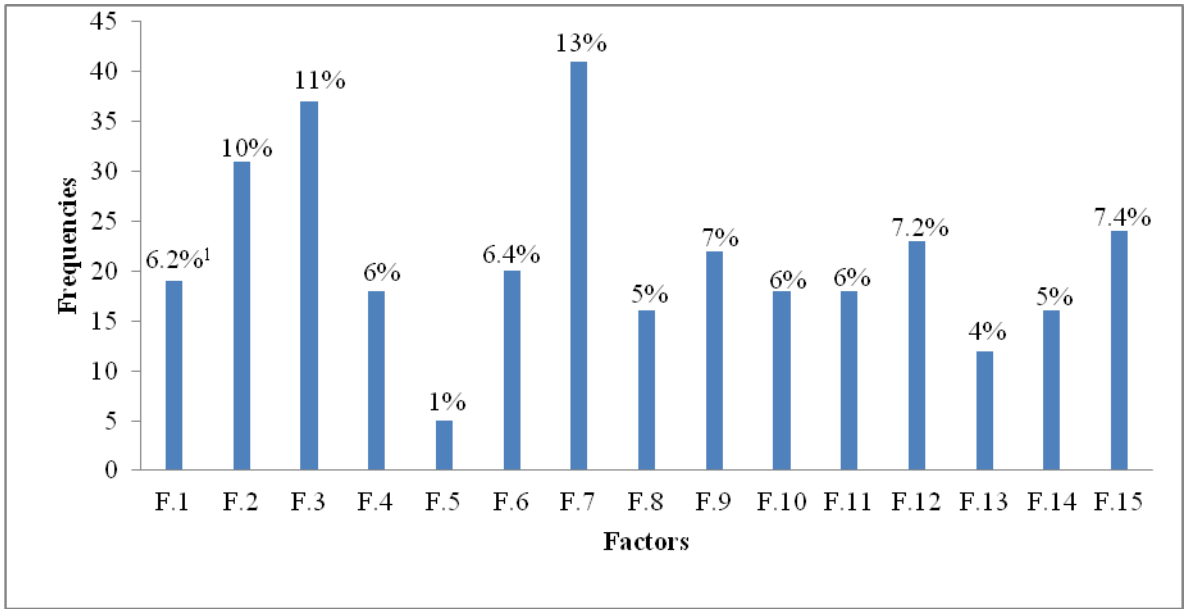

Figure 9: Distribution of Factors in Bridge Construction

[1]percentage is calculated based on 92 respondents

4.6.3 Determination of Distribution of Occurrence in Sectional Rehabilitation

The sectional rehabilitation programme had 47 out of 92 questionnaires recieived representing 51.1%. The results on frequency of occurrence of factors contributing to time overruns in this category are shown in Figure 10.

From Figure 10, it is shown that insufficient contractor cash flow/difficulties in financing projects (F.7), was also the most frequent factor causing time overrun in sectional rehabilitation contracts, followed by slow payment procedures adopted by client in making progress payments (F.3). Inefficient pre-qualification procedures by client (F.3) which resulted in the selection of incompetent contractors was also the least highlighted factor (F.5).

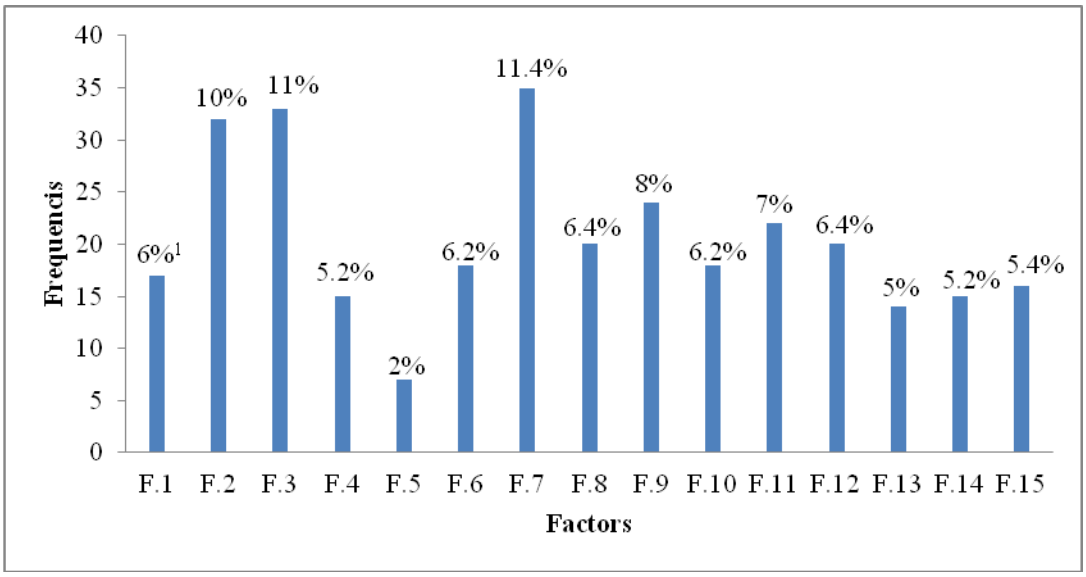

Figure 10: Distribution of factors in Sectional Rehabilitation

[1]percentage is calculated based on 92 respondents

4.6.4 Determination of Distribution of Occurrence in All Programmes

The resuts in Figure 11 demonstrate how the frequency of occurrence were rated considering all the three programmes.

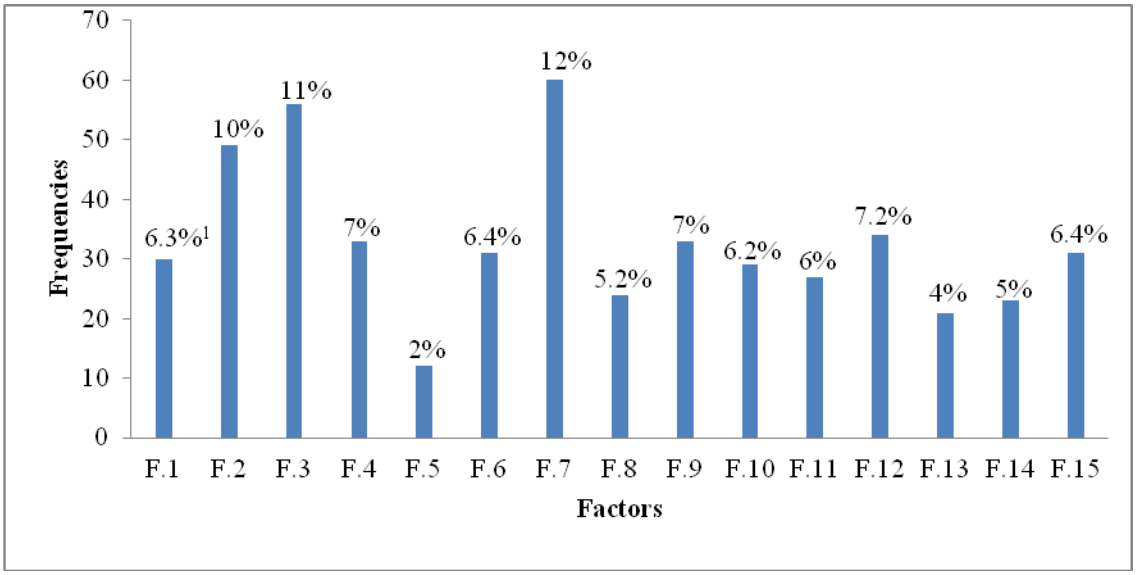

Figure 11: Distribution of Factors in all Programmes

[1]percentage is calculated based on 92 respondents

As it was with assessment of individual programmes, Figure 11 shows that insufficient contractor cash flow/difficulties in financing projects (F.7) was the most frequent factor causing time overruns when all programmes were combined followed by slow payment procedures adopted by client in making progress payments (F.3); whereas inefficient pre-qualification procedures by client (F.5), which resulted in the selection of incompetent contractors was the least cited factor.

The frequency distribution figures also demonstrate that the following factors were also frequently rated: delays in producing variation orders (F.2), delay in site mobilization (F.9) and, unrealistic schedule programme submitted by Contractor's (F.11). In addition, the following factors were also cited as factors contributing to time overruns in bridge construction contracts; theft of contractor's resources (F.15) and shortage of construction materials (bitumen, cement, etc.) (F.12).

4.7 Ranking of Factors

After determination of frequency of occurrence of the prime factors causing time overrun, the factors were weighted and ranked to determine the most influential factors in causing time

overruns. The weighting of the factors was carried out using a 5-likert scale and ranking was done by employing a Relative Importance Index (RII) method.

4.7.1 Ranking of Factors Using Relative Importance Index (RII) Method

The Relative Importance Index (RII) method was used for ranking causes of time overrun. The scores assigned to each factor by the respondents were entered in an excel sheet and calculated using Relative Importance Index (RII) formula scores submitted by the respondents are presented as Appendix E1, E2, E3 and E4 respectively. Consequently, the responses from the 92 questionnaires were subjected to statistical analysis for further insight. The contribution of each of the factors to overall delays was examined and the ranking of the attributes in terms of their criticality as perceived by the respondents was done and the results of the analysis are presented in Table 5 to Table 8. The factors were ranked based on category of the programmes i.e. pothole patching, bridge construction, sectional rehabilitation and then combination of all the three programmes.

Table 5: Ranking of factors in Pothole Patching

Item No	Factor Coding	Factors causing time overruns	Pothole Patching	
			RII	Rank
1	F.7	Insufficient contractor cash flow/difficulties in financing projects	0.237	1
2	F.2	Delays in producing variation orders	0.185	2
3	F.9	Delay in site mobilization	0.165	3
4	F.3	Slow payment procedures adopted by client in making progress payments	0.152	4
5	F.11	Unrealistic schedule programme submitted by Contractor's	0.147	5
6	F.15	Theft of contractor's resources	0.141	6
7	F.8	Poor qualifications and inadequate experience of contractor's key personnel	0.126	7
8	F.12	Shortage of construction materials (bitumen, cement etc.)	0.104	8

9	F.14	Shortage of foreign currency for importation of materials	0.092	9
10	F.1	Omissions in Bill of Quantities	0.091	10
11	F.13	Shortage of fuel	0.087	11
12	F.6	Delays in work approval	0.082	12
13	F.10	Conflict between/with contractor and other parties (consultant and client)	0.74	13
14	F.4	No or small time extensions associated with change orders initiated by client	0.065	14
15	F.5	Inefficient pre-qualification procedures by client, which result in the selection of incompetent contractors	0.003	15

As shown in Table 5, the top five significant factors that contributed to time overrun in Pothole Patching contracts were as follows: insufficient contractor cash flow/difficulties in financing projects (RII=0.237), delays in producing variation orders (RII=0.185), delay in site mobilization (RII=0.165), slow payment procedures adopted by client in making progress payments (RII=0.152), and unrealistic schedule submitted by Contractors (RII=0.147). From these cited factors, three factors (insufficient contractor cash flow/difficulties in financing projects, delay in site mobilization and unrealistic schedule submitted by Contractors) relate to contractors' responsibility, one (delays in producing variation orders) relate to consultant and the other (slow payment procedures adopted by client in making progress payments) relate to the client's responsibility. Therefore, it can be highlighted that most of the significant factors contributing to time overrun in pothole patching contracts are related to contractor's responsibility.

Table 6: Ranking of factors in Bridge Construction

Item No	Factor Coding	Factors causing time overruns	Bridge Construction	
			RII	Rank
1	F.7	Insufficient contractor cash flow/difficulties in financing projects	0.367	1
2	F.3	Slow payment procedures adopted by client in making progress payments	0.285	2
3	F.2	Delays in producing variation orders	0.263	3
4	F.15	Theft of contractor's resources	0.178	4
5	F.9	Delay in site mobilization	0.167	5
6	F.6	Delays in work approval	0.159	6
7	F.12	Shortage of construction materials (bitumen, cement etc.)	0.157	7
8	F.8	Poor qualifications and inadequate experience of contractor's key personnel	0.143	8
9	F.1	Omissions in Bill of Quantities	0.141	9
10	F.4	No or small time extensions associated with change orders initiated by client	0.141	9
11	F.10	Conflict between/with contractor and other parties (consultant and client)	0.141	9
12	F.11	Unrealistic schedule programme submitted by Contractor's	0.126	10
13	F.14	Shortage of foreign currency for importation of materials	0.126	10
14	F.13	Shortage of fuel	0.100	11
15	F.5	Inefficient pre-qualification procedures by client, which result in the selection of incompetent contractors	0.050	12

As demonstrated in Table 6, the top five significant factors that contributed to time overrun in Bridge Construction contracts were as follows: insufficient contractor cash flow/difficulties in

financing projects (RII=0.367), slow payment procedures adopted by client in making progress payments (RII=0.285), delays in producing variation orders (RII=0.263), theft of contractor's resources (RII=0.178), and delay in site mobilization (RII=0.167). Again from these cited factors, three factors (insufficient contractor cash flow/difficulties in financing projects, delay in site mobilization and theft of contractor's resources) relate to contractors' responsibility, one (delays in producing variation orders) relate to consultant and the other (slow payment procedures adopted by client in making progress payments) relate to the client's responsibility. Therefore, it can also be highlighted that most of the significant factors contributing to time overrun in bridge construction contracts are attributed to contractor's responsibility.

Table 7: Ranking of factors in Sectional Rehabilitation

Item No	Factor Coding	Factors causing time overruns	Sectional Rehabilitation	
			RII	Rank
1	F.7	Insufficient contractor cash flow/difficulties in financing projects	0.333	1
2	F.2	Delays in producing variation orders	0.267	2
3	F.3	Slow payment procedures adopted by client in making progress payments	0.259	3
4	F.9	Delay in site mobilization	0.196	4
5	F.11	Unrealistic schedule programme submitted by Contractor's	0.190	5
6	F.8	Poor qualifications and inadequate experience of contractor's key personnel	0.183	6
7	F.12	Shortage of construction materials (bitumen, cement etc.)	0.146	7
8	F.10	Conflict between/with contractor and other parties (consultant and client)	0.144	8
9	F.1	Omissions in Bill of Quantities	0.139	9
10	F.15	Theft of contractor's resources	0.137	10
11	F.6	Delays in work approval	0.135	11
12	F.4	No or small time extensions associated with change orders initiated by client	0.130	12
13	F.14	Shortage of foreign currency for importation of materials	0.098	13
14	F.13	Shortage of fuel	0.091	14
15	F.5	Inefficient pre-qualification procedures by client, which result in the selection of incompetent contractors	0.048	15

As shown in Table 7, the top five significant factors that contributed to time overrun in sectional rehabilitation contracts were as follows: insufficient contractor cash flow/difficulties in financing projects (RII=0.333), delays in producing variation orders (RII=0.267), slow payment procedures adopted by client in making progress payments (RII=0.259), delay in site mobilization (RII=0.196) unrealistic schedule submitted by Contractors (RII=0.19). Again from these cited

factors, three factors (insufficient contractor cash flow/difficulties in financing projects, delay in site mobilization and unrealistic schedule submitted by Contractors) relate to contractors' responsibility, one (delays in producing variation orders) relate to consultant and the other (slow payment procedures adopted by client in making progress payments) relate to the client's responsibility. As such, it can also be highlighted that most of the significant factors contributing to time overrun in sectional rehabilitation contracts are attributed to contractor's responsibility.

Table 8: Ranking of factors in all programmes

Item No	Factor Coding	Factors causing time	All three Programmes	
			RII	Rank
1	F.7	Insufficient contractor cash flow/difficulties in financing projects	0.513	1
2	F.3	Slow payment procedures adopted by client in making progress payments	0.443	2
3	F.2	Delays in producing variation orders	0.413	3
4	F.9	Delay in site mobilization	0.261	4
5	F.6	Delays in work approval	0.252	5
6	F.15	Theft of contractor's resources	0.246	6
7	F.4	No or small time extensions associated with change orders initiated by client	0.237	7
8	F.12	Shortage of construction materials (bitumen, cement etc.)	0.237	7
9	F.8	Poor qualifications and inadequate experience of contractor's key personnel	0.213	8
10	F.11	Unrealistic schedule programme submitted by Contractor's	0.193	9
11	F.10	Conflict between/with contractor and other parties (consultant and client)	0.180	10
12	F.1	Omissions in Bill of Quantities	0.174	11
13	F.14	Shortage of foreign currency for importation of materials	0.165	12
14	F.13	Shortage of fuel	0.161	13
15	F.5	Inefficient pre-qualification procedures by client, which result in the selection of incompetent contractors	0.107	14

Table 8 demonstrates ranking of factors when all three programmes are combined. It is highlighted that the top five significant factors that contributed to time overrun were: insufficient

contractor cash flow/difficulties in financing projects (RII=0.513), slow payment procedures adopted by client in making progress payments (RII=0.443), delays in producing variation orders (RII=0.413), delay in site mobilization (RII=0.261) and delays in work approval (RII=0.252). From these cited factors, two factors (insufficient contractor cash flow/difficulties in financing projects and delay in site mobilization) relate to contractors' responsibility, two (delays in producing variation orders and delays in work approval) relate to consultant and the other (slow payment procedures adopted by client in making progress payments) relate to the client's responsibility. As such, it can be highlighted that most of the significant factors contributing to time overrun in all contracts may be attributed to contractor's and consultant's responsibilities.

Analysis of all the three programmes demonstrated that insufficient contractor cash flow/difficulties in financing projects was the most cited factor contributing to time overruns. This result agrees with findings by Memon et al. (2014) who highlighted that problems in payment at the higher end of the hierarchy will lead to a serious knock-on cash flow problem down the chain of contracts which affects the construction progress. This factor is related to slow payment procedures adopted by client in making progress payments. In essence, the financial bottleneck by either contractor or client is a major factor in causing construction time overruns. This is because most of the contractors in Malawi use interim payments to finance their projects. As such, when the payment is delayed by client or finances are mismanaged by the contractor, the project schedule may be affected. Other researchers (Alaghbari, Kadir, Salim, & Emawati, 2007; Kamanga & Steyn, 2013; Mahamid, 2011; Memon et al., 2014) also highlighted that the financial status of a contractor is one of risk factors to time overruns which need to be controlled and reduced. Likewise, delays in producing variation orders may affect the schedule of the project. Changes in scope of the project much after the project approval and commencement would usually warrant changes in the project variables such as time and cost and is one of the important factors to consider. It reflects on poor decision-making especially when such revisions are supplied late to the contractor. As underscored by Morris (1990), delays in decision-making owing to a genuine problem that cropped up affected the Rihand Stage I of NTPC project.

The analysis has further revealed that Bridge construction programme had higher waiting values than the other two programmes. This means that the programme was the most affected by time

overruns. The lowest affected programme was pothole patching. The findings have also shown that all the 15 factors identified in the Analytical Hierarchy Process (AHP) were relevant in the case of Karonga District projects under Roads Authority and contribute significantly to time overruns in construction process despite some having low waiting values e.g. shortage of foreign currency for importation of materials, shortage of fuel and inefficient pre-qualification procedures by client, which result in the selection of incompetent contractors. Furthermore, the study has uncovered those factors like insufficient contractor cash flow/difficulties in financing projects, slow payment procedures adopted by client in making progress payments, delays in producing variation orders, delay in site mobilization and Unrealistic schedule programme submitted by Contractor's and delays in work approval are among the top ranking in all the three programmes. From these cited factors, three factors (insufficient contractor cash flow/difficulties in financing projects, Unrealistic schedule programme submitted by Contractor's and delay in site mobilization) are related to contractors' responsibility, two (delays in producing variation orders and delays in work approval) are related to consultant and one (slow payment procedures adopted by client in making progress payments) is related to the client's responsibility. Therefore, the study is showing that time overruns problems the organization is encountering are mostly originated from factors related to consultants and contractors categories. In this scenario, Roads Authority as an Organization responsible for road maintenance, must ensure that contractors are paid in time while at the sometime enrich the contract conditions by introducing contract clauses that would eliminate time delays in the construction processes.

4.8 Statistical Relationship between Contract Type and Time Overruns

To determine the statistical relationship between contract type and time overruns, a paired t-test was used. A paired t-test was carried out in SPSS and the results are presented in the table 9.The t-test analysed all the 15 prime factors derived from Analytical Hierarchy Process (AHP) method.

Table 9: Paired T- test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	PP - BR	0.01867	0.67987	0.03511	-0.05037	0.0877	0.532	374	0.595
Pair 2	PP - SR	-0.048	0.6882	0.03554	-0.11788	0.02188	-1.351	374	0.178
Pair 3	BR - SR	-0.06667	0.73734	0.03808	-0.14154	0.0082	-1.751	374	0.081

Case A: Pair1 (PP-BR)

H_0: Factors influencing time overruns in Pothole Patching Programme were the same as those in Bridge Construction Programme (null hypothesis).

H_f: Factors influencing time overruns in Pothole Patching Programme were different to those in Bridge Construction Programme (alternative hypothesis).

From Table 9, the paired t-test results ($t = 0.532,\ p$-value $= 0.595 > 0.05$) indicates that there is a significant difference between factors influencing time overruns in Pothole Patching and Bridge Construction Programme. This implies the rejection of the null hypothesis.

Case B: Pair 2 (PP-SR)

H_0: Factors influencing time overruns in Pothole Patching Programme are the same as those in Sectional Rehabilitation Programme (null hypothesis).

H_f: Factors influencing time overruns in Pothole Patching Programme are different to those in Sectional Rehabilitation Programme (alternative hypothesis).

From Table 9, the paired t-test results ($t = -1.351,\ p\text{-value} = 0.178 > 0.05$) indicates that there is a significant difference between the Pothole Patching Programme and Sectional Rehabilitation Programme factors. This implies that the null hypothesis is rejected

Case C: Pair 3 (BR-SR)

H_0: Factors influencing time overruns in Bridge Construction Programme are the same as those in Sectional Rehabilitation Programme (null hypothesis)

H_f: Factors influencing time overruns in Bridge Construction Programme are different to those in Sectional Rehabilitation Programme (alternative hypothesis)

From Table 9, the paired t-test results ($t = -1.751, \text{with } p\text{-value} = 0.081 > 0.05$) indicates that there is a significant difference between the Bridge Construction and Sectional Rehabilitation Programme factors. Again, this implies that the null hypothesis is rejected.

The paired t-test results analysis have demonstrated that there is significant difference among factors influencing time overruns in the three different maintenance programmes. This means that to prevent or reduce time overruns in the three programmes mentioned above, each programme should be treated independent of the other. The programmes have different attributes of time overruns despite having similarities in the top ranked factors. The findings depict that factors influencing time overruns in pothole patching projects are very different from factors in Bridge construction programme while factors in Bridge construction are not very different from those of sectional rehabilitation programme.

4.9 Chapter Summary

This chapter has presented results after analysis of data. It has been demonstrated that insufficient contractor cash flow/difficulties in financing projects was the most cited factor influencing time overruns. The other factors include: slow payment procedures adopted by client in making progress payments, delays in producing variation orders, delay in site mobilization and delays in work approval. The paired t-test results also demonstrated that there is significant difference among factors influencing time overruns in the three different programmes.

Chapter 5

Conclusion and Recommendations

5.1 Introduction

The overall aim of the thesis was to analyse factors influencing time overruns in road maintenance projects, in particular projects funded by Roads Fund Administration through Fuel Levy and managed by the Roads Authority. The study focused on pothole patching, bridge construction and sectional rehabilitation contracts.

This Chapter outlines the findings, limitations of this research, the contribution of the thesis, areas for future research, conclusion and recommendations.

5.2 Research Findings

The study conducted has established as follows: (a) In pothole patching programme the most significant factors influencing time overruns were insufficient contractor cash flow/difficulties in financing projects, delays in producing variation orders, slow payment procedures adopted by client in making progress payments, delay in site mobilization and unrealistic schedule programme submitted by Contractor's, (b) In bridge construction were insufficient contractor cash flow/difficulties in financing projects, slow payment procedures adopted by client in making progress payments, delays in producing variation orders, theft of contractor's resources and delay in site mobilization and (c) In sectional rehabilitation were insufficient contractor cash flow/difficulties in financing projects, delays in producing variation orders, slow payment procedures adopted by client in making progress payments, delay in site mobilization and unrealistic schedule programme submitted by Contractor's.

However, the paired t-test results analysis have demonstrated that there is significant difference among factors influencing time overruns in the three different maintenance programmes. This means that to prevent or reduce time overruns in the three programmes mentioned above, each programme should be treated independent of the other. The programmes have different attributes of time overruns despite having similarities in the top ranked factors.

5.3 Research Limitations

The following were the limitations of this research:

1) Directors of some companies did not live to their promise of assigning one key person to coordinate the survey in their company. This resulted in the author making persistent reminders to such directors and in some cases travelling to their offices several times to make sure that the data collection exercise was achieved and this to some extent was costly;
2) Some companies did not participate at all, thinking the results of the research might be used against them since the author works for the Roads Authority (Client);
3) Some anticipated key informants in the research were no longer working for the companies; they left to join other companies and could not be traced to record the information; while others were reported as being dead;
4) The research study was not funded as such the author had to use his own resources to finance the study for example administration of the questionnaires and interviews.
5) Time management to some extent was difficult as the author had to balance time between study and work.

5.4 Research Contributions

This study has identified critical factors influencing time overruns in road maintenance projects in Karonga District. There had not been any study on factors that influence time overruns in construction projects in the Northern Region of Malawi. The findings from this research will contribute to road maintenance reforms as it is among the strategies for achieving the aims and objectives of road maintenance initiatives in Malawi.

5.5 Reflections for Further Research

There is need to carryout similar research in other districts to establish the trend in those districts. Furthermore, the research only sampled three programmes out of twelve programmes, as such the importance of carrying out a similar research in all other remaining programmes in the district need not be overemphasized. If the research is carried out in all programmes and districts where the Roads Authority is implementing the programmes, a more accurate generalization of trend of

factors would be established which could subsequently assist in improving the specifications and policy formulation.

5.6 Concluding Remarks

This study looked at factors that influence time overruns in three road maintenance programmes (Pothole patching, Bridge Construction and Sectional rehabilitation of paved roads) funded by Roads Fund Administration through Fuel Levy and undertaken by the Roads Authority in Karonga District. Specifically, the study (a) reviewed factors influencing time overruns in road maintenance projects, (b) identified prime factors influencing time overruns in road maintenance projects in Karonga District, (c) ranked the identified time overruns factors, and (d) determined whether factors influencing time overruns were significantly different among different maintenance programmes.

The data analysis established that insufficient contractor cash flow/difficulties in financing projects, delays in producing variation orders, slow payment procedures adopted by client in making progress payments, delay in site mobilization and unrealistic work schedules submitted by Contractors and delays in work approval as the main factors that influence time overruns. These were highlighted in the three road maintenance programmes. The analysis has further revealed that Bridge construction programme had higher waiting values than the other two programmes. This means that the programme was the most affected by time overruns. The lowest affected programme was pothole patching. The findings have also shown that all the 15 factors identified in the Analytical Hierarchy Process (AHP) were relevant in this study of time overruns in Karonga District projects under Roads Authority. All the 15 factors contributed significantly to time overruns in the construction process despite some were given low waiting values e.g. shortage of foreign currency for importation of materials, shortage of fuel and inefficient pre-qualification procedures by client, which result in the selection of incompetent contractors. And from the abovementioned factors, three factors (insufficient contractor cash flow/difficulties in financing projects, unrealistic schedule programme submitted by Contractor's and delay in site mobilization) are related to contractors' responsibility, two (delays in producing variation orders and delays in work approval) are related to consultant and one (slow payment procedures adopted by client in making progress payments) is related to the client's responsibility. Therefore, the

study has demonstrated that time overruns problems the organization is encountering are mostly originated from factors related to consultants and contractors categories. Therefore, Roads Authority as an Client Organization responsible for road maintenance, must ensure that contractors are paid in time while at the sometime enrich the contract conditions by introducing contract clauses that would eliminate time delays in the construction processes.

However, the paired t-test results analysis have demonstrated that there is significant difference among factors influencing time overruns in the three different maintenance programmes. This means that to prevent or reduce time overruns in the three programmes mentioned above, each programme should be treated independent of the other. The programmes have different attributes of time overruns despite having similarities in the top ranked factors.

5.7 Recommendations

On the basis of these findings, the recommendations will draw from the five prime factors identified in this study as follows:

1. **Insufficient Contractor Cash Flow/Difficulties in Financing Projects**

The Roads Authority must introduce a clause or clauses in the contract conditions that would make monthly submission of interim payment certificates by contractors is mandatory to boost their cash flow and also must ensure that the contractors adhere to the clause. Insufficient contractor cash-flow/difficulties in financing projects develop either as a lack of liquidity on the part of the contractor and/or client delays in making progress payments. Assaf & Al-Hejji (2006) and Kamanga & Steyn (2013) recommend that contractors should manage their financial resources and plan cash-flow by utilizing interim payments.

2. **Slow Payment Procedures Adopted by Client in Making Progress Payments**

The Roads Authority must introduce a payment guarantee clause in the contract conditions to allow the contractor that if a duly issued payment certificate is not paid within the stipulated period, the contractor may demand his payment from the guarantor. In this case a reputable Bank/ Insurance Company should be able to enter into agreement with the Roads Authority and provide a guarantee to a payment certificate. A duly endorsed payment certificate by the Roads Authority

should be used by the contractor to access the equivalent money from the guarantor at any point in time during the guarantee period which will also be the contract period.

3. Delays in Producing Variation Orders

The Roads Authority must ensure that the consultant issues variation orders in time. Appropriate clause should be introduced or amended to punish the consultant who does not adhere to this clause. The Roads Authority Bidding Document for the Procurement of Normal Maintenance Works July 2014 Version; Clause 39 of the general conditions of the contract does not stipulate delay as a compensation event should a consultant or a client delay in issuing a variation order.

4. Delay in Site Mobilization

The Roads Authority must introduce a sub–clause to clause SCC 21.1of the special conditions of contract. This clause must clearly stipulate penalties such as cancellation or termination of contract should a contractor fail to mobilize in time. The Roads Authority Bidding Document for the Procurement of Normal Maintenance Works July 2014 Version stipulates the time frame within which a contractor should mobilize. The Contractor is required to mobilize men, material and machinery within 14 days after the date of possession of site or issue of the Work Order.

5. Unrealistic Programme of Works Submitted by Contractors

The Roads Authority must ensure that the submitted works programmes are thoroughly scrutinized before approval is granted and also ensure that penalties stipulated in violation must be evoked. Clause GCC 27.1 states that the Contractor shall submit a revised Programme for the Works within 14days of Signing of Contract and the period between programme updates is 28 days. Furthermore, clause SCC 27.3 stipulates **t**he amount of money to be withheld for late submission of an updated Programme as 5% of Current Interim Payment Certificate amount. Many contractors submit works programme in order to fulfill to the requirements of the clauses above while the works programmes do not reflect reality of progress on the ground.

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Appendices

Appendix A1: Questionnaire

SECTION A

General Information on Respondent

1. State your organization/company type? (Tick in applicable box)			
☐	Client	☐	Others, specify below
☐	Consultant		
☐	Contractor		

2. What position do you hold in the company/organization? (Tick in applicable box)			
☐	Manager/Director (Client)	☐	Site Inspectors (Consultant)
☐	Engineer (Client)	☐	Site Agent/Engineer (Contractor)
☐	Road Inspector (Client)	☐	Site Foreman (Contractor)
☐	Team Leader (Consultant)	☐	Others, specify below
☐	Highway Engineer (Consultant)		

3. Cite the number of years of experience in road construction industry? *(Tick in applicable box)*			
☐	Less than 5 years	☐	10 – 15 years
☐	5 - 10 years	☐	More than 15 years

4. How many construction projects in the categories below, have you been involved in for the past five years in Karonga District? *(Tick in applicable box)*				
Project Type / Years	Less than 2	2 – 5	5 – 7	More than 7
Pothole patching				
Bridge construction				
Sectional rehabilitation				

SECTION B

Did you experience time overruns in management of the construction projects mentioned in question No. 4 in Section A? YES/NO

If yes, what were the typical factors that caused time overruns in road maintenance projects in Karonga Districts?

(Please tick in the box you have selected)

No	Factors causing time overruns in road maintenance projects in Karonga District	Occurrence				
		YES or NO		Pothole patching	Bridge construction	Sectional rehabilitation
1	Omissions in Bill of Quantities					
2	Delays in producing variation orders					
3	Slow payment procedures adopted by client in making progress payments					
4	No or small time extensions associated with change orders initiated by client					
5	Inefficient pre-qualification procedures by client, which result in the selection of incompetent contractors					

6	Delays in work approval					
7	Insufficient contractor cash flow/difficulties in financing projects					
8	Poor qualifications and inadequate experience of contractor's key personnel					
9	Delay in site mobilization					
10	Conflict between/with contractor and other parties (consultant and client)					
11	Unrealistic schedule programme submitted by Contractor's					
12	Shortage of construction materials (bitumen, cement					
13	Shortage of fuel					
14	Shortage of foreign currency (importation of material					
15	Theft of contractor's resources					
	Others: Specify:					

SECTION C

To what extent was the impact of factors on road maintenance projects in Karonga District?

(Please tick in the box you have selected)

No	Extent of Impact onroad maintenance projects in Karonga District	**Extent**				
		No Significance	**Minor Significance**	**Average Significance**	**High Significance**	**Extreme Significance**
1	Omissions in Bill of Quantities	**1**	**2**	**3**	**4**	**5**
2	Delays in producing variation orders	**1**	**2**	**3**	**4**	**5**

3	Slow payment procedures adopted by client in making progress payments	**1**	**2**	**3**	**4**	**5**
4	No or small time extensions associated with change orders initiated by client	**1**	**2**	**3**	**4**	**5**
5	Inefficient pre-qualification procedures by client, which result in the selection of incompetent contractors	**1**	**2**	**3**	**4**	**5**
6	Delays in work approval	**1**	**2**	**3**	**4**	**5**
7	Insufficient contractor cash flow/difficulties in financing projects	**1**	**2**	**3**	**4**	**5**
8	Poor qualifications and inadequate experience of contractor's key personnel	**1**	**2**	**3**	**4**	**5**
9	Delay in site mobilization	**1**	**2**	**3**	**4**	**5**
10	Conflict between/with contractor and other parties (consultant and client)	**1**	**2**	**3**	**4**	**5**
11	Unrealistic schedule programme submitted by Contractor's	**1**	**2**	**3**	**4**	**5**
12	Shortage of construction materials (bitumen, cement	**1**	**2**	**3**	**4**	**5**
13	Shortage of fuel	**1**	**2**	**3**	**4**	**5**
14	Shortage of foreign currency (importation of material	**1**	**2**	**3**	**4**	**5**
15	Theft of contractor's resources	**1**	**2**	**3**	**4**	**5**
	Others: Specify:					

SECTION D

Please state ways that you think would assist in improving the management of time overruns in road construction projects in Karonga District?

1)……..……
……

2)……
……

3)……
……

Appendix A2: Interview Guide

SECTION A

General Information on Respondent

1. State your organization/company type?
2. What position do you hold in the company/organization?
3. How many years of experience in road construction industry?
4. How many construction projects in the categories below, have you been involved in for the past five years in Karonga District?
    a) Pothole patching
    b) Bridge construction
    c) Sectional rehabilitation

SECTION B

Did you experience time overruns in management of the construction projects mentioned in question No. 4 in Section A? YES/NO

If yes, what were the typical factors that caused time overruns in road maintenance projects in Karonga Districts?

No	Factors causing time overruns in road maintenance projects in Karonga District	Occurrence				
		YES or NO		Pothole patching	Bridge construction	Sectional rehabilitation
1	Omissions in Bill of Quantities					
2	Delays in producing variation orders					

3	Slow payment procedures adopted by client in making progress payments					
4	No or small time extensions associated with change orders initiated by client					
5	Inefficient pre-qualification procedures by client, which result in the selection of incompetent contractors					
6	Delays in work approval					
7	Insufficient contractor cash flow/difficulties in financing projects					
8	Poor qualifications and inadequate experience of contractor's key personnel					
9	Delay in site mobilization					
10	Conflict between/with contractor and other parties (consultant and client)					
11	Unrealistic schedule programme submitted by Contractor's					
12	Shortage of construction materials (bitumen, cement					
13	Shortage of fuel					
14	Shortage of foreign currency (importation of material					
15	Theft of contractor's resources					
	Others: Specify:					

SECTION C

To what extent was the impact of factors on road maintenance projects in Karonga District?

		Extent

No	Extent of Impact onroad maintenance projects in Karonga District	No Significance	Minor Significance	Average Significance	High Significance	Extreme Significance
		1	2	3	4	5
1	Omissions in Bill of Quantities					
2	Delays in producing variation orders					
3	Slow payment procedures adopted by client in making progress payments					
4	No or small time extensions associated with change orders initiated by client					
5	Inefficient pre-qualification procedures by client, which result in the selection of incompetent contractors					
6	Delays in work approval					
7	Insufficient contractor cash flow/difficulties in financing projects					
8	Poor qualifications and inadequate experience of contractor's key personnel					
9	Delay in site mobilization					
10	Conflict between/with contractor and other parties (consultant and client)					
11	Unrealistic schedule programme submitted by Contractor's					
12	Shortage of construction materials (bitumen, cement					
13	Shortage of fuel					
14	Shortage of foreign currency (importation of material					
15	Theft of contractor's resources					
	Others: Specify:					

SECTION D

Please state ways that you think would assist in improving the management of time overruns in road construction projects in Karonga District?

1)……..……
……
2)……
……
3)……
……

Appendix B1: Cronbach's Alpha Table (Pothole Patching)

Item No.	Q/F	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	
1	**Q6**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4	31
2	**Q9**	0	0	3	0	0	4	5	0	3	0	0	3	0	0	0	18
3	**Q10**	0	4	5	0	0	3	5	0	3	0	0	0	0	0	0	20
4	**Q13**	5	4	3	0	0	0	4	0	4	5	0	0	0	0	0	25
5	**Q19**	2	2	2	2	1	2	2	2	2	1	2	2	2	2	2	28
6	**Q26**	0	0	0	0	0	0	0	0	0	0	0	1	0	4	0	5
7	**Q27**	0	1	0	0	0	0	0	0	0	0	0	0	0	4	0	5
8	**Q28**	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
9	**Q30**	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0	6
10	**Q31**	0	0	0	0	0	0	5	0	0	0	3	0	0	0	0	8
11	**Q32**	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4
12	**Q34**	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3
13	**Q35**	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	5
14	**Q37**	3	4	2	2	0	3	5	5	4	3	4	4	3	3	0	45
15	**Q38**	0	4	4	3	0	3	4	4	5	3	3	4	4	4	0	45
16	**Q39**	0	4	4	2	0	3	4	5	4	3	4	3	3	4	0	43
17	**Q40**	0	4	4	2	0	3	4	5	4	3	4	3	3	4	0	43
18	**Q41**	0	0	0	0	0	0	4	0	0	0	0	4	4	0	0	12
19	**Q43**	0	0	0	0	0	4	0	0	0	4	0	5	0	1	0	14
20	**Q53**	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	4
21	**Q55**	0	4	0	0	0	0	4	5	3	3	4	4	3	3	0	33
22	**Q56**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4	31
23	**Q57**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4	31
24	**Q58**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4	31
25	**Q69**	0	0	2	0	0	0	0	0	0	0	0	0	3	0	0	5
26	**Q71**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4	31
27	**Q72**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4	31
28	**Q73**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4	31
29	**Q74**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4	31
30	**Q76**	0	5	4	0	0	4	5	0	3	4	0	4	0	0	4	33
31	**Q77**	0	5	4	0	0	1	3	0	0	0	0	3	0	0	0	16
32	**Q89**	0	3	3	2	0	0	3	0	3	1	2	2	1	1	3	24
33	**Q90**	0	3	3	2	0	0	3	0	3	1	2	2	1	1	3	24
34	**Q91**	0	3	3	2	0	0	3	0	3	1	2	2	1	1	3	24
35	**Q92**	0	0	0	0	0	0	2	0	0	2	0	2	0	0	2	8
	Total Freq	**42**	**85**	**70**	**24**	**1**	**30**	**109**	**58**	**76**	**34**	**54**	**48**	**32**	**34**	**52**	**749**
		9.13	**18.48**	**15.22**	**6.52**	**0.27**	**8.15**	**23.70**	**12.61**	**16.52**	**7.39**	**14.67**	**10.43**	**8.70**	**9.24**	**14.13**	
	Var	**3.30**	**3.56**	**2.69**	**1.30**	**0.03**	**2.07**	**3.87**	**4.34**	**3.40**	**2.20**	**2.48**	**2.75**	**2.02**	**2.20**	**3.16**	**181.38**
	ΣVar																**39.36**
	α																**0.8389194**
	Key																
	Q= Questionnaire																
	F = Factor																

Appendix B2: Cronbach's Alpha's Table (Bridge Construction

Item No.	Q/F	F.1	F.2	F.3	F.4	F.5	F.6	F.7	F.8	F.9	F.10	F.11	F.12	F.13	F.14	F.15	
1	**Q1**	0	0	4	0	0	0	5	0	3	0	0	0	0	0	0	12
2	**Q3**	0	2	3	4	0	0	3	0	0	3	0	3	0	3	0	21
3	**Q4**	0	2	3	4	0	0	3	0	0	3	0	3	0	3	0	21
4	**Q5**	0	0	3	4	4	0	2	0	0	2	0	3	4	4	3	29
5	**Q6**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4	31
6	**Q8**	0	0	0	0	0	0	3	0	2	0	3	3	0	0	0	11
7	**Q9**	0	0	3	0	0	4	5	0	0	0	0	3	0	0	0	15
8	**Q10**	4	4	5	0	5	3	5	0	3	0	0	0	0	0	0	29
9	**Q11**	0	2	0	0	3	0	3	2	2	3	4	2	0	0	0	21
10	**Q16**	0	0	3	0	0	0	5	0	0	0	0	0	0	0	3	11
11	**Q17**	0	0	3	0	0	0	5	4	3	0	0	0	0	0	3	18
12	**Q20**	3	4	5	3	3	4	5	4	4	3	3	5	5	5	3	59
13	**Q22**	0	0	5	0	0	0	5	0	0	0	0	5	5	5	4	29
14	**Q24**	0	3	5	4	0	5	5	0	5	4	5	5	4	5	5	55
15	**Q26**	0	0	0	0	0	0	0	0	0	0	0	1	0	4	0	5
16	**Q27**	1	1	0	0	0	0	0	0	0	0	0	0	0	4	0	6
17	**Q30**	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3
18	**Q31**	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	5
19	**Q32**	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4
20	**Q34**	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3
21	**Q35**	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	5
22	**Q36**	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
23	**Q37**	0	0	2	2	4	3	5	5	4	3	4	4	3	3	3	45
24	**Q38**	3	4	4	3	0	3	4	4	5	3	3	4	4	4	1	49
25	**Q39**	2	4	4	2	0	3	4	5	4	3	4	3	3	4	3	48
26	**Q40**	2	4	4	2	0	3	4	5	4	3	4	3	3	4	3	48
27	**Q41**	0	0	0	0	0	0	4	0	0	0	0	4	4	0	0	12
28	**Q43**	0	0	0	0	0	4	0	0	0	4	0	5	0	1	0	14
29	**Q44**	1	2	3	3	0	2	3	0	0	3	0	2	0	0	2	21
30	**Q45**	0	0	3	4	4	0	2	0	0	2	0	3	4	4	3	29
31	**Q52**	1	2	3	3	0	0	3	0	0	3	0	2	0	0	2	19
32	**Q55**	3	4	0	0	0	3	4	5	3	3	4	4	3	3	3	42
33	**Q56**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4	31
34	**Q57**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4	31
35	**Q58**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4	31
36	**Q66**	0	0	3	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	3
37	**Q67**	0	3	0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	3
38	**Q71**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4	31
39	**Q72**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4	31
40	**Q73**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4	31
41	**Q74**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4	31
42	**Q76**	0	5	4	0	0	4	5	0	3	4	0	0	0	0	4	29
43	**Q77**	0	5	4	0	0	1	3	0	0	0	0	3	0	0	0	16
44	**Q79**	0	5	4	0	0	4	0	0	0	1	0	0	0	0	0	14
45	**Q80**	0	5	3	3	0	4	4	0	0	0	0	0	0	0	0	19
46	**Q81**	0	5	4	3	0	5	4	0	0	0	0	0	0	0	0	21
47	**Q82**	0	5	4	4	0	5	4	0	0	0	0	0	0	0	0	22
48	**Q83**	0	5	4	4	0	5	4	0	0	0	0	0	0	0	0	22
49	**Q86**	0	5	4	0	0	4	4	0	0	0	0	0	0	0	0	17
50	**Q87**	0	5	5	0	0	4	4	0	0	0	0	0	0	0	0	18
51	**Q92**	0	0	0	0	0	0	2	0	0	2	0	2	0	0	2	8
	Total Freq	**52**	**121**	**131**	**52**	**23**	**73**	**169**	**66**	**77**	**52**	**58**	**72**	**46**	**58**	**82**	**1132**
		14.1	**26.3**	**28.5**	**14.1**	**5.0**	**15.9**	**36.7**	**14.3**	**16.7**	**14.1**	**12.6**	**15.7**	**10.0**	**12.6**	**17.8**	
	Var	**2.579607843**	**4.198431373**	**2.970196078**	**2.499607843**	**1.61254902**	**3.650196078**	**3.499607843**	**3.891764706**	**3.574901961**	**2.139607843**	**2.760784314**	**3.207058824**	**2.810196078**	**3.240784314**	**3.123137255**	**210.8407843**
	ΣVar																**45.75843137**
	α																**0.838898177**

Key
Q= Questionnaire
F = Factor

Appendix B3: Cronbach's Alpha Table (Sectional Rehabilitation)

Item No.	Q/F	F.1	F.2	F.3	F.4	F.5	F.6	F.7	F.8	F.9	F.10	F.11	F.12	F.13	F.14	F.15	
1	**Q2**	0	0	0	0	5	0	5	5	4	0	0	0	0	0	0	19
2	**Q6**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4	31
3	**Q9**	0	0	3	0	0	4	5	3	0	0	3	3	0	0	0	21
4	**Q10**	4	4	5	5	0	0	5	0	3	0	0	0	0	0	0	26
5	**Q11**	0	0	4	0	3	3	3	2	2	3	4	0	0	0	0	24
6	**Q12**	0	0	0	0	5	0	5	5	4	0	3	0	0	0	4	26
7	**Q18**	1	4	0	4	0	0	0	0	0	0	0	0	0	0	0	9
8	**Q21**	3	3	4	4	3	3	4	4	4	4	3	4	3	4	5	55
9	**Q23**	0	0	5	0	0	0	5	0	0	0	0	5	5	5	4	29
10	**Q25**	0	3	5	0	0	4	5	5	5	5	5	5	5	4	0	51
11	**Q26**	0	0	1	0	0	0	0	0	0	0	0	1	0	4	0	6
12	**Q27**	0	1	0	0	0	0	0	0	0	0	0	0	0	4	0	5
13	**Q30**	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3
14	**Q31**	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	5
15	**Q32**	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4
16	**Q33**	0	4	4	0	0	4	0	0	0	4	0	0	0	0	0	16
17	**Q34**	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3
18	**Q35**	2	3	3	4	3	2	4	4	4	2	3	3	2	2	3	44
19	**Q37**	0	0	2	2	0	3	5	5	4	3	4	4	3	3	0	38
20	**Q38**	0	4	4	3	0	3	4	4	5	3	3	4	4	4	0	45
21	**Q39**	0	4	4	2	0	3	4	5	4	3	4	3	3	4	0	43
22	**Q40**	0	4	4	2	0	3	4	5	4	3	4	3	3	4	0	43
23	**Q41**	4	0	0	0	0	0	0	0	0	0	0	0	4	0	0	8
24	**Q42**	5	5	0	0	0	5	0	0	0	3	0	3	0	0	0	21
25	**Q43**	0	2	0	0	0	4	0	0	0	4	0	5	0	1	0	16
26	**Q51**	0	4	5	0	0	0	0	0	0	4	0	1	0	0	0	14
27	**Q55**	0	4	2	0	3	0	4	5	3	3	4	4	3	3	0	38
28	**Q56**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4	31
29	**Q57**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4	31
30	**Q58**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4	31
31	**Q66**	0	0	3	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	3
32	**Q67**	0	0	0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
33	**Q71**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4	31
34	**Q72**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4	31
35	**Q73**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4	31
36	**Q74**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4	31
37	**Q75**	0	0	0	0	0	0	4	0	0	0	0	4	0	0	0	8
38	**Q76**	0	5	4	0	0	4	5	0	3	4	0	4	0	0	4	33
39	**Q77**	0	5	4	0	0	1	3	0	0	0	0	3	0	0	0	16
40	**Q78**	0	5	5	4	0	4	5	0	0	0	0	0	0	0	0	23
41	**Q84**	0	5	5	4	0	4	5	0	0	0	0	0	0	0	0	23
42	**Q85**	0	5	5	4	0	4	5	0	0	0	0	0	0	0	0	23
43	**Q88**	0	5	5	4	0	4	5	0	0	0	0	0	0	0	0	23
44	**Q89**	0	3	3	2	0	0	3	0	3	1	2	2	1	1	3	24
45	**Q90**	0	3	3	2	0	0	3	0	3	1	2	2	1	1	3	24
46	**Q91**	0	3	3	2	0	0	3	0	3	1	2	2	1	1	3	24
47	**Q92**	0	0	0	0	0	0	2	0	0	2	0	2	0	0	2	8
	Total Freq	**51**	**123**	**119**	**48**	**22**	**62**	**153**	**84**	**90**	**53**	**70**	**67**	**42**	**45**	**63**	**1092**
		13.9	**26.7**	**25.9**	**13.0**	**4.8**	**13.5**	**33.3**	**18.3**	**19.6**	**14.4**	**19.0**	**14.6**	**9.1**	**9.8**	**13.7**	
	Var	**3.123034228**	**3.85013876**	**3.515263645**	**2.629972248**	**1.645698427**	**3.17853839**	**4.281221092**	**4.649398705**	**3.818686401**	**2.592044403**	**2.82053654**	**3.206290472**	**2.444958372**	**2.606845513**	**3.40333025**	**191.3135985**
	ΣVar																**47.76595745**
	α																**0.803921128**
	Key																
	Q= Questionnaire																
	F = Factor																

Appendix B4: Cronbach's Alpha Table (All Programmes)

Item No.	Q/F	TO	F.1	F.2	F.3	F.4	F.5	F.6	F.7	F.8	F.9	F.10	F.11	F.12	F.13	F.14	F.15
1	Q1	1	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0
2	Q2	1	0	0	0	0	1	0	1	1	1	0	0	0	0	0	0
3	Q3	1	0	1	1	1	0	0	1	0	0	1	0	1	0	1	0
4	Q4	1	0	1	1	1	0	0	1	0	0	1	0	1	0	1	0
5	Q5	1	0	0	1	1	1	0	1	0	0	1	0	1	1	1	1
6	Q6	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
7	Q7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	Q8	1	0	0	0	0	0	0	1	0	1	0	1	1	0	0	0
9	Q9	1	0	0	1	0	0	1	1	1	1	0	1	1	0	0	0
10	Q10	1	1	1	1	1	0	1	1	0	1	0	0	0	0	0	0
11	Q11	1	0	1	1	0	1	1	1	1	1	1	1	1	0	0	0
12	Q12	1	0	0	0	0	1	0	1	1	1	0	1	0	0	0	1
13	Q13	1	1	1	1	0	0	0	1	0	1	1	0	0	0	0	0
14	Q14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	Q15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	Q16	1	0	0	1	0	0	0	1	0	1	0	0	0	0	0	1
17	Q17	1	0	0	1	0	0	0	1	1	1	0	0	0	0	0	1
18	Q18	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0
19	Q19	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
20	Q20	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
21	Q21	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
22	Q22	1	0	0	1	0	0	0	1	0	0	0	0	1	1	1	1
23	Q23	1	0	0	1	0	0	0	1	0	0	0	0	1	1	1	1
24	Q24	1	0	1	1	1	0	1	1	0	1	1	1	1	1	1	1
25	Q25	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0
26	Q26	1	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0
27	Q27	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0
28	Q28	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
29	Q29	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
30	Q30	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
31	Q31	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0
32	Q32	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
33	Q33	1	0	1	1	0	0	1	0	0	0	1	0	0	0	0	0
34	Q34	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
35	Q35	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
36	Q36	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
37	Q37	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
38	Q38	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1
39	Q39	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1
40	Q40	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1
41	Q41	1	1	0	0	0	0	0	1	0	0	0	0	1	1	0	0
42	Q42	1	1	1	0	0	0	1	1	0	0	1	0	1	0	0	0
43	Q43	1	1	1	0	0	0	1	0	0	0	1	0	1	0	1	0
44	Q44	1	1	1	1	1	0	1	1	0	0	1	0	1	0	0	0
45	Q45	1	0	0	1	1	1	0	1	0	0	1	0	1	1	1	1
46	Q46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	Q47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	Q48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	Q49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	Q50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	Q51	1	1	1	1	0	0	0	0	0	0	1	0	1	0	0	0
52	Q52	1	1	1	1	1	0	0	1	0	0	1	0	1	0	0	1
53	Q53	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
54	Q54	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
55	Q55	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1
56	Q56	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
57	Q57	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
58	Q58	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
59	Q59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	Q60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	Q61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	Q62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	Q63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	Q64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	Q65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	Q66	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
67	Q67	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	Q68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	Q69	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
70	Q70	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71	Q71	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
72	Q72	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
73	Q73	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
74	Q74	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
75	Q75	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
76	Q76	1	0	1	1	0	0	1	1	0	1	1	0	1	0	0	1
77	Q77	1	0	1	1	0	0	1	1	0	0	0	0	1	0	0	0
78	Q78	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
79	Q79	1	0	1	1	0	0	1	0	0	0	1	0	0	0	0	0
80	Q80	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
81	Q81	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
82	Q82	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
83	Q83	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
84	Q84	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
85	Q85	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
86	Q86	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
87	Q87	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
88	Q88	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
89	Q89	1	0	1	1	1	0	0	1	0	1	1	1	1	1	1	1
90	Q90	1	0	1	1	1	0	0	1	0	1	1	1	1	1	1	1
91	Q91	1	0	1	1	1	0	0	1	0	1	1	1	1	1	1	1
92	Q92	1	0	0	0	0	0	0	1	0	0	1	0	1	0	0	1
			30	49	56	33	12	31	60	24	33	29	27	34	21	23	31

Key
Q= Questionnaire
F = Factor

Appendix C1: Number of Projects Subjected to Time Overrun- Mzuzu Zone (2014/2015 Financial Year)

MZUZU ZONE

Northern Region Analysis

Pamodzi Consulting Engineers (2014/15)

Chitipa		Karonga		Rumphi		Mzimba		Nkhata Bay/Likoma	
Executed Contracts	Time Overrun Contracts	Executed Contracts	Time Overrun Contracts	Executed Contracts	Time Overrun Contracts	Executed Contracts	Time Overrun Contracts	Executed Contracts	Time Overrun Contracts
1	**1**	**1**	**1**	**1**	**0**	**1**	**1**	**1**	**0**
1	1	1	0	1	0	1	1	1	0
1	1	1	0	1	0	1	0	1	1
1	0	1	1	1	1	1	0	1	0
1	0	1	1	1	1	1	0	1	0
1	0	1	1	1	1	1	0	1	0
1	1	1	1	1	1	1	0	1	1
1	0	1	0	1	1	1	1	1	0
1	0	1	0	1	0	1	0	1	0
9	**4**	1	0	**1**	**0**	1	0	**1**	**1**
44		**10**	**5**	1	0	1	1	1	0
		50		1	0	1	0	**11**	**3**
				1	0	1	1	**27**	
				13	**5**	1	1		
				38		1	1		
						1	0		
						1	0		
						1	0		
						1	0		
						1	0		
						1	0		
						1	0		
						22	**7**		
						31.8			
Total Numbr of Contracts Executed						**65**			
Total Number of Contracts Experienced Time Overrun						**24**			
Percentage of Time overrun						**36.9**			

Key

1=Time Overrun

0=No Time Overrun

Appendix C2: Number of Projects Subjected to Time Overrun – Mzuzu Zone (2013/2014 Financial Year)

MZUZU ZONE									
Northern Region Analysis									
Bua Consulting Engineers (2013/14)									
Chitipa		Karonga		Rumphi		Mzimba		Nkhata Bay/Likoma	
Executed Contracts	Time Overrun Contracts	Executed Contracts	Time Overrun Contracts	Executed Contracts	Time Overrun Contracts	Executed Contracts	Time Overrun Contracts	Executed Contracts	Time Overrun Contracts
1	1	1	0	1	1	1	0	1	0
1	0	1	0	1	0	1	1	1	0
1	0	1	0	1	0	1	1	1	1
1	0	1	1	1	1	1	0	1	1
1	0	1	1	1	1	1	0	1	1
1	1	1	0	1	0	1	1	1	0
1	1	1	0	1	0	1	0	1	0
1	0	1	1	1	1	1	0	1	0
8	**3**	1	1	1	0	1	0	1	0
37.5		1	1	**9**	**4**	1	1	**9**	**3**
		1	0	**44.4**		1	1	**33.3**	
		1	0			1	1		
		1	1			1	0		
		13	**6**			1	0		
		46.2				1	0		
						1	0		
						1	1		
						1	0		
						18	**7**		
						38.9			
Total Numbr of Contracts Executed						**57**			
Total Number of Contracts Experienced Time Overrun						**23**			
Percentage of Time overrun						**40.4**			

Key
1=Time Overrun
0=No Time Overrun

Appendix C3: Number of Projects Subjected to Time Overrun – Mzuzu Zone (2012-2013 Financial Year)

MZUZU ZONE

Northern Region Analysis

Mphizi Consulting Engineers (2012/13)

Chitipa		Karonga		Rumphi		Mzimba		Nkhata Bay/Likoma	
Executed Contracts	Time Overrun Contracts	Executed Contracts	Time Overrun Contracts	Executed Contracts	Time Overrun Contracts	Executed Contracts	Time Overrun Contracts	Executed Contracts	Time Overrun Contracts
1	1	1	0	1	1	1	0	1	1
1	1	1	1	1	1	1	0	1	0
1	1	1	0	1	1	1	1	1	1
1	1	1	1	1	1	1	0	1	1
1	0	1	1	1	1	1	1	1	0
1	0	1	0	1	1	1	1	1	0
1	0	1	1	1	0	1	1	1	0
1	0	1	1	1	0	1	0	1	1
1	0	1	1	1	0	1	0	1	0
1	0	1	0	1	0	1	0	1	0
1	0	1	0	1	0	1	1	1	0
11	4	1	0	1	0	1	1	1	0
36		1	0	12	**6**	1	0	1	0
		1	**0**	**50**		1	0	**13**	**4**
		14.0	**6.0**			1	0	**31**	
		42.9				1	0		
						1	0		
						1	0		
						1	0		
						1	0		
						1	0		
						1	0		
						1	0		
						1	0		
						1	0		
						1	0		
						1	0		
						1	0		
						1	0		
						27	**6**		
						22			

Total Numbr of Contracts Executed	**77.0**
Total Number of Contracts Experienced Time Overrun	**26.0**
Percentage of Time overrun	**33.8**

Key

1=Time Overrun

0=No Time Overrun

Appendix C4: Number of projects subjected to time overrun - Mzuzu Zone (2011/12 Financial year)

MZUZU ZONE									
Northern Region Analysis									
Bua Consulting Engineers (2011/12)									
Chitipa		Karonga		Rumphi		Mzimba		Nkhata Bay/Likoma	
Executed Contracts	Time Overrun Contracts	Executed Contracts	Time Overrun Contracts	Executed Contracts	Time Overrun Contracts	Executed Contracts	Time Overrun Contracts	Executed Contracts	Time Overrun Contracts
1	1	1	1	1	1	1	1	1	1
1	1	1	0	1	1	1	0	1	1
1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	0	1	1
1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	0	1	1	1	1
1	1	1	1	1	1	1	1	1	1
8	**8**	1	0	1	0	1	0	1	0
100		1	0	**9**	**7**	1	0	1	0
		1	1	**77.8**		1	0	1	0
		1	1			1	0	**11**	**8**
		1	1			1	0	**72.7**	
		13	**10**			1	0		
		76.9				1	0		
						1	0		
						1	0		
						1	0		
						18	**6**		
						33.3			
Total Numbr of Contracts Executed						**59**			
Total Number of Contracts Experienced Time Overrun						**39**			
Percentage of Time overrun						**66.1**			
Key									
1=Time Overrun									
0=No Time Overrun									

Appendix C5: Number of Projects Subjected to Time Overrun – Mzuzu Zone (2010/2011 Financial Year)

MZUZU ZONE									
Northern Region Analysis									
Bua Consulting Engineers (2010/11)									
Chitipa		Karonga		Rumphi		Mzimba		Nkhata Bay/Likoma	
Executed Contracts	Time Overrun Contracts	Executed Contracts	Time Overrun Contracts	Executed Contracts	Time Overrun Contracts	Executed Contracts	Time Overrun Contracts	Executed Contracts	Time Overrun Contracts
1	0	1	0	1	1	1	1	1	0
1	1	1	0	1	1	1	1	1	1
1	1	1	1	1	1	1	0	1	1
1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	0	1	1
1	1	1	1	1	0	1	0	1	0
1	1	1	1	6	5	1	1	1	0
1	1	1	1	83		1	1	1	0
8	**7**	1	0			1	0	1	0
87.5		1	0			1	0	1	0
		1	1			1	1	1	0
		1	1			1	1	**11**	**4**
		1	1			1	0	**36.4**	
		13	**9**			1	0		
		69.2				1	0		
						1	1		
						1	0		
						1	0		
						18	**8**		
						44.4			
Total Numbr of Contracts Executed						**56**			
Total Number of Contracts Experienced Time Overrun						**33**			
Percentage of Time overrun						**58.9**			

Key
1=Time Overrun
0=No Time Overrun

Appendix D1: Factors Frequency Table (Pothole Patching)

Item No.	Q/F	TO	F.1	F.2	F.3	F.4	F.5	F.6	F.7	F.8	F.9	F.10	F.11	F.12	F.13	F.14	F.15
1	Q6	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
2	Q9	1	0	0	1	0	0	1	1	0	1	0	0	1	0	0	0
3	Q10	1	0	1	1	0	0	1	1	0	1	0	0	0	0	0	0
4	Q13	1	1	1	1	0	0	0	1	0	1	1	0	0	0	0	0
5	Q19	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6	Q26	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
7	Q27	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
8	Q28	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
9	Q30	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
10	Q31	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0
11	Q32	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
12	Q34	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
13	Q35	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
14	Q37	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0
15	Q38	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	0
16	Q39	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	0
17	Q40	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	0
18	Q41	1	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0
19	Q43	1	0	0	0	0	0	1	0	0	0	1	0	1	0	1	0
20	Q53	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
21	Q55	1	0	1	0	0	0	0	1	1	1	1	1	1	1	1	0
22	Q56	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
23	Q57	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
24	Q58	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
25	Q69	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
26	Q71	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
27	Q72	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
28	Q73	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
29	Q74	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
30	Q76	1	0	1	1	0	0	1	1	0	1	1	0	1	0	0	1
31	Q77	1	0	1	1	0	0	1	1	0	0	0	0	1	0	0	0
32	Q89	1	0	1	1	1	0	0	1	0	1	1	1	1	1	1	1
33	Q90	1	0	1	1	1	0	0	1	0	1	1	1	1	1	1	1
34	Q91	1	0	1	1	1	0	0	1	0	1	1	1	1	1	1	1
35	Q92	1	0	0	0	0	0	0	1	0	0	1	0	1	0	0	1
		35	**11**	**23**	**22**	**10**	**1**	**10**	**27**	**14**	**21**	**13**	**18**	**16**	**12**	**13**	**15**
	Key																
	Q= Questionnaire																
	F = Factor																

Appendix D2: Factors Frequency Table (Bridge Construction)

Item No.	Q/F	TO	F.1	F.2	F.3	F.4	F.5	F.6	F.7	F.8	F.9	F.10	F.11	F.12	F.13	F.14	F.15
1	Q1	1	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0
2	Q3	1	0	1	1	1	0	0	1	0	0	1	0	1	0	1	0
3	Q4	1	0	1	1	1	0	0	1	0	0	1	0	1	0	1	0
4	Q5	1	0	0	1	1	1	0	1	0	0	1	0	1	1	1	1
5	Q6	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
6	Q8	1	0	0	0	0	0	0	1	0	1	0	1	1	0	0	0
7	Q9	1	0	0	1	0	0	1	1	0	0	0	0	1	0	0	0
8	Q10	1	1	1	1	1	0	1	1	0	1	0	0	0	0	0	0
9	Q11	1	0	1	0	0	1	0	1	1	1	1	1	1	0	0	0
10	Q16	1	0	0	1	0	0	0	1	0	1	0	0	0	0	0	1
11	Q17	1	0	0	1	0	0	0	1	1	1	0	0	0	0	0	1
12	Q20	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
13	Q22	1	0	0	1	0	0	0	1	0	0	0	0	1	1	1	1
14	Q24	1	0	1	1	B	0	1	1	0	1	1	1	1	1	1	1
15	Q26	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
16	Q27	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0
17	Q30	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
18	Q31	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
19	Q32	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
20	Q33	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	Q34	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
22	Q35	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
23	Q36	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
24	Q37	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
25	Q38	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1
26	Q39	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1
27	Q40	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1
28	Q41	1	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0
29	Q43	1	0	0	0	0	0	1	0	0	0	1	0	1	0	1	0
30	Q44	1	1	1	1	1	0	1	1	0	0	1	0	1	0	0	0
31	Q45	1	0	0	1	1	1	0	1	0	0	1	0	1	1	1	1
32	Q52	1	1	1	1	1	0	0	1	0	0	1	0	1	0	0	1
33	Q55	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1
34	Q56	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
35	Q57	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
36	Q58	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
37	Q66	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
38	Q67	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	Q71	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
40	Q72	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
41	Q73	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
42	Q74	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
43	Q76	1	0	1	1	0	0	1	1	0	1	1	0	1	0	0	1
44	Q77	1	0	1	1	0	0	1	1	0	0	0	1	1	0	0	0
45	Q79	1	0	1	1	0	0	1	0	0	0	1	0	0	0	0	0
46	Q80	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
47	Q81	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
48	Q82	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
49	Q83	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
50	Q86	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
51	Q87	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
	Q92	1	0	0	0	0	0	0	1	0	0	1	0	1	0	0	1
			19	**31**	**37**	**18**	**5**	**20**	**41**	**16**	**22**	**18**	**18**	**23**	**12**	**16**	**24**

Key
Q= Questionnaire
F = Factor

Appendix D3: Factors Frequency Table (Sectional Rehabilitation)

Item No.	Q/F	TO	F.1	F.2	F.3	F.4	F.5	F.6	F.7	F.8	F.9	F.10	F.11	F.12	F.13	F.14	F.15
1	Q2	1	0	0	0	0	1	0	1	1	1	0	0	0	0	0	0
2	Q6	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
3	Q9	1	0	0	1	0	0	1	1	1	0	0	1	1	0	0	0
4	Q10	1	1	1	1	1	0	0	1	0	1	0	0	0	0	0	0
5	Q11	1	0	0	1	0	1	1	1	1	1	1	1	0	0	0	0
6	Q12	1	0	0	0	0	1	0	1	1	1	0	1	0	0	0	1
7	Q18	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0
8	Q21	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
9	Q23	1	0	0	1	0	0	0	1	0	0	0	0	1	1	1	1
10	Q25	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0
11	Q26	1	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0
12	Q27	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
13	Q30	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
14	Q31	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
15	Q32	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
16	Q33	1	0	1	1	0	0	1	0	0	0	1	0	0	0	0	0
17	Q34	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
18	Q35	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Y
19	Q37	1	0	0	1	1	0	1	1	1	1	1	1	1	1	1	0
20	Q38	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	0
21	Q39	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	0
22	Q40	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	0
23	Q41	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
24	Q42	1	1	1	0	0	0	1	0	0	0	1	0	S	0	0	0
25	Q43	1	1	1	0	0	0	1	0	0	0	1	0	1	0	1	0
26	Q51	1	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0
27	Q55	1	0	1	1	0	1	0	1	1	1	1	1	1	1	1	0
28	Q56	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
29	Q57	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
30	Q58	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
31	Q66	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
32	Q67	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	Q71	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
34	Q72	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
35	Q73	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
36	Q74	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
37	Q75	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
38	Q76	1	0	1	1	0	0	1	1	0	1	1	0	1	0	0	1
39	Q77	1	0	1	1	0	0	1	1	0	0	0	0	1	0	0	0
40	Q78	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
41	Q84	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
42	Q85	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
43	Q88	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
44	Q89	1	0	1	1	1	0	0	1	0	1	1	1	1	1	1	1
45	Q90	1	0	1	1	1	0	0	1	0	1	1	1	1	1	1	1
46	Q91	1	0	1	1	1	0	0	1	0	1	1	1	1	1	1	1
47	Q92	1	0	0	0	0	0	0	1	0	0	1	0	1	0	0	1
			17	**32**	**33**	**15**	**7**	**18**	**35**	**20**	**24**	**18**	**22**	**20**	**14**	**15**	**16**

Key
Q= Questionnaire
F = Factor

Appendix D4: Factors Frequency Table (All Programmes)

Item No.	Q/F	TO	F.1	F.2	F.3	F.4	F.5	F.6	F.7	F.8	F.9	F.10	F.11	F.12	F.13	F.14	F.15
1	Q1	1	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0
2	Q2	1	0	0	0	0	1	0	1	1	1	0	0	0	0	0	0
3	Q3	1	0	1	1	1	0	0	1	0	0	1	0	1	0	1	0
4	Q4	1	0	1	1	1	0	0	1	0	0	1	0	1	0	1	0
5	Q5	1	0	0	1	1	1	0	1	0	0	1	0	1	1	1	1
6	Q6	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
7	Q7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	Q8	1	0	0	0	0	0	0	1	0	1	0	1	1	0	0	0
9	Q9	1	0	0	1	0	0	1	1	1	1	0	1	1	0	0	0
10	Q10	1	1	1	1	1	0	1	1	0	1	0	0	0	0	0	0
11	Q11	1	0	1	1	0	1	1	1	1	1	1	1	1	0	0	0
12	Q12	1	0	0	0	0	1	0	1	1	1	0	1	0	0	0	1
13	Q13	1	1	1	1	0	0	0	1	0	1	1	0	0	0	0	0
14	Q14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	Q15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	Q16	1	0	0	1	0	0	0	1	0	1	0	0	0	0	0	1
17	Q17	1	0	0	1	0	0	0	1	1	1	0	0	0	0	0	1
18	Q18	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0
19	Q19	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
20	Q20	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
21	Q21	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
22	Q22	1	0	0	1	0	0	0	1	0	0	0	0	1	1	1	1
23	Q23	1	0	0	1	0	0	0	1	0	0	0	0	1	1	1	1
24	Q24	1	0	1	1	1	0	1	1	0	1	1	1	1	1	1	1
25	Q25	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0
26	Q26	1	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0
27	Q27	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0
28	Q28	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
29	Q29	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
30	Q30	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
31	Q31	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0
32	Q32	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
33	Q33	1	0	1	1	0	0	1	0	0	0	1	0	0	0	0	0
34	Q34	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
35	Q35	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
36	Q36	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
37	Q37	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
38	Q38	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1
39	Q39	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1
40	Q40	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1
41	Q41	1	1	0	0	0	0	0	1	0	0	0	0	1	1	0	0
42	Q42	1	1	1	0	0	0	1	1	0	0	1	0	1	0	0	0
43	Q43	1	1	1	0	0	0	1	0	0	0	1	0	1	0	1	0
44	Q44	1	1	1	1	1	0	1	1	0	0	1	0	1	0	0	0
45	Q45	1	0	0	1	1	1	0	1	0	0	1	0	1	1	1	1
46	Q46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	Q47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	Q48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	Q49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	Q50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	Q51	1	1	1	1	0	0	0	0	0	0	1	0	1	0	0	0
52	Q52	1	1	1	1	1	0	0	1	0	0	1	0	1	0	0	1
53	Q53	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
54	Q54	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
55	Q55	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1
56	Q56	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
57	Q57	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
58	Q58	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
59	Q59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	Q60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	Q61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	Q62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	Q63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	Q64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	Q65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	Q66	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
67	Q67	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	Q68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	Q69	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
70	Q70	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71	Q71	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
72	Q72	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
73	Q73	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
74	Q74	1	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1
75	Q75	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
76	Q76	1	0	1	1	0	0	1	1	0	1	1	0	1	0	0	1
77	Q77	1	0	1	1	0	0	1	1	0	0	0	0	1	0	0	0
78	Q78	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
79	Q79	1	0	1	1	0	0	1	0	0	0	1	0	0	0	0	0
80	Q80	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
81	Q81	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
82	Q82	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
83	Q83	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
84	Q84	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
85	Q85	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
86	Q86	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
87	Q87	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
88	Q88	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0
89	Q89	1	0	1	1	1	0	0	1	0	1	1	1	1	1	1	1
90	Q90	1	0	1	1	1	0	0	1	0	1	1	1	1	1	1	1
91	Q91	1	0	1	1	1	0	0	1	0	1	1	1	1	1	1	1
92	Q92	1	0	0	0	0	0	0	1	0	0	1	0	1	0	0	1
			30	49	56	33	12	31	60	24	33	29	27	34	21	23	31

Key
Q= Questionnaire
F = Factor

Appendix E1: Weighting Factor Table (Pothole Patching)

Item No.	Q/F	F.1	F.2	F.3	F.4	F.5	F.6	F.7	F.8	F.9	F.10	F.11	F.12	F.13	F.14	F.15
1	**Q6**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
2	**Q9**	0	0	3	0	0	4	5	0	3	0	0	3	0	0	0
3	**Q10**	0	4	5	0	0	3	5	0	3	0	0	0	0	0	0
4	**Q13**	5	4	3	0	0	0	4	0	4	5	0	0	0	0	0
5	**Q19**	2	2	2	2	1	2	2	2	2	1	2	2	2	2	2
6	**Q26**	0	0	0	0	0	0	0	0	0	0	0	1	0	4	0
7	**Q27**	0	1	0	0	0	0	0	0	0	0	0	0	0	4	0
8	**Q28**	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
9	**Q30**	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0
10	**Q31**	0	0	0	0	0	0	5	0	0	0	3	0	0	0	0
11	**Q32**	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0
12	**Q34**	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
13	**Q35**	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3
14	**Q37**	3	4	2	2	0	3	5	5	4	3	4	4	3	3	0
15	**Q38**	0	4	4	3	0	3	4	4	5	3	3	4	4	4	0
16	**Q39**	0	4	4	2	0	3	4	5	4	3	4	3	3	4	0
17	**Q40**	0	4	4	2	0	3	4	5	4	3	4	3	3	4	0
18	**Q41**	0	0	0	0	0	0	4	0	0	0	0	4	4	0	0
19	**Q43**	0	0	0	0	0	4	0	0	0	4	0	5	0	1	0
20	**Q53**	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0
21	**Q55**	0	4	0	0	0	0	4	5	3	3	4	4	3	3	0
22	**Q56**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
23	**Q57**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
24	**Q58**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
25	**Q69**	0	0	2	0	0	0	0	0	0	0	0	0	3	0	0
26	**Q71**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
27	**Q72**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
28	**Q73**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
29	**Q74**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
30	**Q76**	0	5	4	0	0	4	5	0	3	4	0	4	0	0	4
31	**Q77**	0	5	4	0	0	1	3	0	0	0	0	3	0	0	0
32	**Q89**	0	3	3	2	0	0	3	0	3	1	2	2	1	1	3
33	**Q90**	0	3	3	2	0	0	3	0	3	1	2	2	1	1	3
34	**Q91**	0	3	3	2	0	0	3	0	3	1	2	2	1	1	3
35	**Q92**	0	0	0	0	0	0	2	0	0	2	0	2	0	0	2
	Total Freq	**42**	**85**	**70**	**24**	**1**	**30**	**109**	**58**	**76**	**34**	**54**	**48**	**32**	**34**	**52**
		0.09	**0.185**	**0.152**	**0.065**	**0.003**	**0.082**	**0.237**	**0.126**	**0.165**	**0.074**	**0.147**	**0.104**	**0.087**	**0.092**	**0.141**
	Key															
	Q= Questionnaire															
	F = Factor															

Appendix E2: Weighting Factor Table (Bridge Construction)

Item No.	Q/F	F.1	F.2	F.3	F.4	F.5	F.6	F.7	F.8	F.9	F.10	F.11	F.12	F.13	F.14	F.15
1	**Q1**	0	0	4	0	0	0	5	0	3	0	0	0	0	0	0
2	**Q3**	0	2	3	4	0	0	3	0	0	3	0	3	0	3	0
3	**Q4**	0	2	3	4	0	0	3	0	0	3	0	3	0	3	0
4	**Q5**	0	0	3	4	4	0	2	0	0	2	0	3	4	4	3
5	**Q6**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
6	**Q8**	0	0	0	0	0	0	3	0	2	0	3	3	0	0	0
7	**Q9**	0	0	3	0	0	4	5	0	0	0	0	3	0	0	0
8	**Q10**	4	4	5	0	5	3	5	0	3	0	0	0	0	0	0
9	**Q11**	0	2	0	0	3	0	3	2	2	3	4	2	0	0	0
10	**Q16**	0	0	3	0	0	0	5	0	0	0	0	0	0	0	3
11	**Q17**	0	0	3	0	0	0	5	4	3	0	0	0	0	0	3
12	**Q20**	3	4	5	3	3	4	5	4	4	3	3	5	5	5	3
13	**Q22**	0	0	5	0	0	0	5	0	0	0	0	5	5	5	4
14	**Q24**	0	3	5	4	0	5	5	0	5	4	5	5	4	5	5
15	**Q26**	0	0	0	0	0	0	0	0	0	0	0	1	0	4	0
16	**Q27**	1	1	0	0	0	0	0	0	0	0	0	0	0	4	0
17	**Q30**	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
18	**Q31**	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0
19	**Q32**	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0
20	**Q34**	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
21	**Q35**	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3
22	**Q36**	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
23	**Q37**	0	0	2	2	4	3	5	5	4	3	4	4	3	3	3
24	**Q38**	3	4	4	3	0	3	4	4	5	3	3	4	4	4	1
25	**Q39**	2	4	4	2	0	3	4	5	4	3	4	3	3	4	3
26	**Q40**	2	4	4	2	0	3	4	5	4	3	4	3	3	4	3
27	**Q41**	0	0	0	0	0	0	4	0	0	0	0	4	4	0	0
28	**Q43**	0	0	0	0	0	4	0	0	0	4	0	5	0	1	0
29	**Q44**	1	2	3	3	0	2	3	0	0	3	0	2	0	0	2
30	**Q45**	0	0	3	4	4	0	2	0	0	2	0	3	4	4	3
31	**Q52**	1	2	3	3	0	0	3	0	0	3	0	2	0	0	2
32	**Q55**	3	4	0	0	0	3	4	5	3	3	4	4	3	3	3
33	**Q56**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
34	**Q57**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
35	**Q58**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
36	**Q66**	0	0	3	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
37	**Q67**	0	3	0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
38	**Q71**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
39	**Q72**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
40	**Q73**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
41	**Q74**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
42	**Q76**	0	5	4	0	0	4	5	0	3	4	0	0	0	0	4
43	**Q77**	0	5	4	0	0	1	3	0	0	0	0	3	0	0	0
44	**Q79**	0	5	4	0	0	4	0	0	0	1	0	0	0	0	0
45	**Q80**	0	5	3	3	0	4	4	0	0	0	0	0	0	0	0
46	**Q81**	0	5	4	3	0	5	4	0	0	0	0	0	0	0	0
47	**Q82**	0	5	4	4	0	5	4	0	0	0	0	0	0	0	0
48	**Q83**	0	5	4	4	0	5	4	0	0	0	0	0	0	0	0
49	**Q86**	0	5	4	0	0	4	4	0	0	0	0	0	0	0	0
50	**Q87**	0	5	5	0	0	4	4	0	0	0	0	0	0	0	0
51	**Q92**	0	0	0	0	0	0	2	0	0	2	0	2	0	0	2
	Total Freq	**52**	**121**	**131**	**52**	**23**	**73**	**169**	**66**	**77**	**52**	**58**	**72**	**46**	**58**	**82**
		14.1	**0.263**	**0.285**	**0.141**	**0.050**	**0.159**	**0.367**	**0.143**	**0.167**	**0.141**	**0.126**	**0.157**	**0.100**	**0.126**	**0.178**
	Key															
	Q= Questionnaire															
	F = Factor															

Appendix E3: Weighting Factor Table (Sectional Rehabilitation)

Item No.	Q/F	F.1	F.2	F.3	F.4	F.5	F.6	F.7	F.8	F.9	F.10	F.11	F.12	F.13	F.14	F.15
1	**Q2**	0	0	0	0	5	0	5	5	4	0	0	0	0	0	0
2	**Q6**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
3	**Q9**	0	0	3	0	0	4	5	3	0	0	3	3	0	0	0
4	**Q10**	4	4	5	5	0	0	5	0	3	0	0	0	0	0	0
5	**Q11**	0	0	4	0	3	3	3	2	2	3	4	0	0	0	0
6	**Q12**	0	0	0	0	5	0	5	5	4	0	3	0	0	0	4
7	**Q18**	1	4	0	4	0	0	0	0	0	0	0	0	0	0	0
8	**Q21**	3	3	4	4	3	3	4	4	4	4	3	4	3	4	5
9	**Q23**	0	0	5	0	0	0	5	0	0	0	0	5	5	5	4
10	**Q25**	0	3	5	0	0	4	5	5	5	5	5	5	5	4	0
11	**Q26**	0	0	1	0	0	0	0	0	0	0	0	1	0	4	0
12	**Q27**	0	1	0	0	0	0	0	0	0	0	0	0	0	4	0
13	**Q30**	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
14	**Q31**	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0
15	**Q32**	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0
16	**Q33**	0	4	4	0	0	4	0	0	0	4	0	0	0	0	0
17	**Q34**	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
18	**Q35**	2	3	3	4	3	2	4	4	4	2	3	3	2	2	3
19	**Q37**	0	0	2	2	0	3	5	5	4	3	4	4	3	3	0
20	**Q38**	0	4	4	3	0	3	4	4	5	3	3	4	4	4	0
21	**Q39**	0	4	4	2	0	3	4	5	4	3	4	3	3	4	0
22	**Q40**	0	4	4	2	0	3	4	5	4	3	4	3	3	4	0
23	**Q41**	4	0	0	0	0	0	0	0	0	0	0	0	4	0	0
24	**Q42**	5	5	0	0	0	5	0	0	0	3	0	3	0	0	0
25	**Q43**	0	2	0	0	0	4	0	0	0	4	0	5	0	1	0
26	**Q51**	0	4	5	0	0	0	0	0	0	4	0	1	0	0	0
27	**Q55**	0	4	2	0	3	0	4	5	3	3	4	4	3	3	0
28	**Q56**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
29	**Q57**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
30	**Q58**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
31	**Q66**	0	0	3	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
32	**Q67**	0	0	0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
33	**Q71**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
34	**Q72**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
35	**Q73**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
36	**Q74**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
37	**Q75**	0	0	0	0	0	0	4	0	0	0	0	4	0	0	0
38	**Q76**	0	5	4	0	0	4	5	0	3	4	0	4	0	0	4
39	**Q77**	0	5	4	0	0	1	3	0	0	0	0	3	0	0	0
40	**Q78**	0	5	5	4	0	4	5	0	0	0	0	0	0	0	0
41	**Q84**	0	5	5	4	0	4	5	0	0	0	0	0	0	0	0
42	**Q85**	0	5	5	4	0	4	5	0	0	0	0	0	0	0	0
43	**Q88**	0	5	5	4	0	4	5	0	0	0	0	0	0	0	0
44	**Q89**	0	3	3	2	0	0	3	0	3	1	2	2	1	1	3
45	**Q90**	0	3	3	2	0	0	3	0	3	1	2	2	1	1	3
46	**Q91**	0	3	3	2	0	0	3	0	3	1	2	2	1	1	3
47	**Q92**	0	0	0	0	0	0	2	0	0	2	0	2	0	0	2
	Total Freq	**51**	**123**	**119**	**48**	**22**	**62**	**153**	**84**	**90**	**53**	**70**	**67**	**42**	**45**	**63**
		13.9	**0.267**	**0.259**	**0.130**	**0.048**	**0.135**	**0.333**	**0.183**	**0.196**	**0.144**	**0.190**	**0.146**	**0.091**	**0.098**	**0.137**

Key
Q= Questionnaire
F = Factor

Appendix E4: Weighting Factor Table (All Programmes)

Item No.	Q/F	F.1	F.2	F.3	F.4	F.5	F.6	F.7	F.8	F.9	F.10	F.11	F.12	F.13	F.14	F.15
1	**Q1**	0	0	4	0	0	0	5	0	3	0	0	0	0	0	0
2	**Q2**	0	0	0	0	5	0	5	5	4	0	0	0	0	0	0
3	**Q3**	1	2	3	4	1	2	3	1	1	3	1	3	1	3	1
4	**Q4**	1	2	3	4	1	2	3	1	1	3	1	3	1	3	1
5	**Q5**	1	2	3	4	4	2	2	2	2	2	1	3	4	4	3
6	**Q6**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
7	**Q7**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	**Q8**	0	0	0	0	0	0	3	0	2	0	3	3	0	0	0
9	**Q9**	0	0	3	0	0	4	5	3	3	0	3	3	0	0	0
10	**Q10**	4	4	5	5	5	3	5	0	3	0	0	0	0	0	0
11	**Q11**	0	2	4	0	3	3	3	2	2	3	4	2	0	0	0
12	**Q12**	0	0	0	0	5	0	5	5	4	0	3	0	0	0	4
13	**Q13**	5	4	3	0	0	0	4	0	4	5	0	0	0	0	0
14	**Q14**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	**Q15**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	**Q16**	0	0	3	0	0	0	5	0	0	0	0	0	0	0	3
17	**Q17**	0	0	3	0	0	0	5	4	3	0	0	0	0	0	3
18	**Q18**	1	4	0	4	0	0	0	0	0	0	0	0	0	0	0
19	**Q19**	2	2	2	2	1	2	2	2	2	1	2	2	2	2	2
20	**Q20**	3	4	5	3	3	4	5	4	4	3	3	5	5	5	3
21	**Q21**	3	3	4	4	3	3	4	4	4	4	3	4	3	4	5
22	**Q22**	0	0	5	0	0	0	5	0	0	0	0	5	5	5	4
23	**Q23**	0	0	5	0	0	0	5	0	0	0	0	5	5	5	4
24	**Q24**	0	3	5	4	0	5	5	0	5	4	5	5	4	5	5
25	**Q25**	0	3	5	5	0	4	5	5	5	5	5	5	5	4	5
26	**Q26**	0	0	1	0	0	0	0	0	0	0	0	1	0	4	0
27	**Q27**	1	1	0	0	0	0	0	0	0	0	0	0	0	4	0
28	**Q28**	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
29	**Q29**	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0
30	**Q30**	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0
31	**Q31**	0	0	0	0	0	0	5	0	0	0	3	0	0	0	0
32	**Q32**	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0
33	**Q33**	0	4	4	0	0	4	0	0	0	4	0	0	0	0	0
34	**Q34**	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
35	**Q35**	2	3	3	4	3	2	4	4	4	2	3	3	2	2	3
36	**Q36**	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
37	**Q37**	3	4	2	2	4	3	5	5	4	3	4	4	3	3	3
38	**Q38**	3	4	4	3	0	3	4	4	5	3	3	4	4	4	1
39	**Q39**	2	4	4	2	0	3	4	5	4	3	4	3	3	4	3
40	**Q40**	2	4	4	2	0	3	4	5	4	3	4	3	3	4	3
41	**Q41**	4	0	0	0	0	0	4	0	0	0	0	4	4	0	0
42	**Q42**	5	5	0	0	0	5	0	0	0	3	0	3	0	0	0
43	**Q43**	0	2	4	0	0	4	0	0	0	4	0	5	0	1	0
44	**Q44**	1	2	3	3	0	0	3	0	0	3	0	2	0	0	2
45	**Q45**	0	0	3	4	4	0	2	0	0	2	0	3	4	4	3
46	**Q46**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
47	**Q47**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
48	**Q48**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
49	**Q49**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
50	**Q50**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
51	**Q51**	0	4	5	0	0	0	0	0	0	4	0	1	0	0	0
52	**Q52**	1	2	3	3	0	0	3	0	0	3	0	2	0	0	2
53	**Q53**	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0
54	**Q54**	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0
55	**Q55**	3	4	2	0	3	3	4	5	3	3	4	4	3	3	3
56	**Q56**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
57	**Q57**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
58	**Q58**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
59	**Q59**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
60	**Q60**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
61	**Q61**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
62	**Q62**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
63	**Q63**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
64	**Q64**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
65	**Q65**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
66	**Q66**	0	0	3	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
67	**Q67**	0	3	0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
68	**Q68**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
69	**Q69**	0	0	2	0	0	0	0	0	0	0	0	0	3	0	0
70	**Q70**	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0
71	**Q71**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
72	**Q72**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
73	**Q73**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
74	**Q74**	4	4	3	0	0	0	5	4	4	0	3	0	0	0	4
75	**Q75**	0	0	0	0	0	0	4	0	0	0	0	4	0	0	0
76	**Q76**	0	5	4	0	0	4	5	0	3	4	0	4	0	0	4
77	**Q77**	0	5	4	0	0	1	3	0	0	0	0	3	0	0	0
78	**Q78**	0	5	5	4	0	4	5	0	0	0	0	0	0	0	0
79	**Q79**	0	5	4	0	0	4	0	0	0	1	0	0	0	0	0
80	**Q80**	0	5	3	3	0	4	4	0	0	0	0	0	0	0	0
81	**Q81**	0	5	4	3	0	5	4	0	0	0	0	0	0	0	0
82	**Q82**	0	5	4	4	0	5	4	0	0	0	0	0	0	0	0
83	**Q83**	0	5	4	4	0	5	4	0	0	0	0	0	0	0	0
84	**Q84**	0	5	5	4	0	4	5	0	0	0	0	0	0	0	0
85	**Q85**	0	5	5	4	0	4	5	0	0	0	0	0	0	0	0
86	**Q86**	0	5	4	0	0	4	4	0	0	0	0	0	0	0	0
87	**Q87**	0	5	5	0	0	4	4	0	0	0	0	0	0	0	0
88	**Q88**	0	5	5	4	0	4	5	0	0	0	0	0	0	0	0
89	**Q89**	0	3	3	2	0	0	3	0	3	1	2	2	1	1	3
90	**Q90**	0	3	3	2	0	0	3	0	3	1	2	2	1	1	3
91	**Q91**	0	3	3	2	0	0	3	0	3	1	2	2	1	1	3
92	**Q92**	0	0	0	0	0	0	2	0	0	2	0	2	0	0	2
	Total Freq	**80**	**190**	**204**	**109**	**49**	**116**	**237**	**98**	**120**	**83**	**89**	**109**	**74**	**76**	**113**
		0.2	**0.413**	**0.443**	**0.237**	**0.107**	**0.252**	**0.515**	**0.213**	**0.261**	**0.180**	**0.193**	**0.237**	**0.161**	**0.165**	**0.246**
	Key															
	Q= Questionnaire															
	F = Factor															

Appendix F: Factors Causing Time Overruns

Item No	Factors causing time overruns
1	Delay factors
2	Incomplete drawings/specifications
3	Design errors and omissions
4	Excessive extra works
5	Inadequate design team experience
6	Delays in producing design documents
7	Excessive variations in quantities
8	Rework due to wrong drawings
9	Insufficient data collection and survey before design
10	Slow response
11	Slow decision-making
12	Long period for approval of tests and inspections
13	Unfamiliarity with or lack of knowledge by the consultant's supervision staff regarding new construction methods, materials and techniques
14	Lack of application of construction management tools and techniques by consultant's project and site staff
15	Conflicts between drawings and specifications
16	Frequent design changes requested by client during construction
17	Inaccurate initial project scope estimate

18	Slow payment procedures adopted by client in making progress payments
19	Unrealistic time estimation
20	Executive bureaucracy at client's offices
21	Slow decision-making process by client's departments
22	Inefficient flow of information from client's departments
23	No or small time extensions associated with change orders initiated by client
24	Inefficient pre-qualification procedures by client, which result in the selection of incompetent contractors
25	Understaffed client's project and site personnel
26	Poor communication and coordination by client and other parties
27	Delays in work approval
28	Client-initiated variations
29	Insufficient contractor cash flow/difficulties in financing projects
30	Poor qualifications and inadequate experience of contractor's supervisors
31	Ineffective planning and scheduling of project
32	Equipment allocation problems
33	Materials management problems
34	Misinterpretation of drawings and specifications
35	Rework due to errors during construction
36	Poor communication and coordination with other

	parties
37	Poor contractor's site management and supervision
38	Delay in site mobilisation Conflict between/with contractor and other parties (consultant and client)
39	Improper construction methods implemented by contractor
40	Late delivery of materials and equipment
42	Poor procurement programming of materials
43	Type of project bidding and award (lowest bidder)
44	Ineffective delay penalties
45	Inadequate definition of substantial completion
46	Legal disputes between/with various parties
47	Unrealistic project construction duration
48	No financial incentives for contractors to finish ahead of time
49	No application of construction management procedures
50	Late detection of construction problems
51	Unrealistic schedule programme submitted by contractor
52	Contractor's staff are not properly trained in professional techniques
53	Poor judgment and inexperience in estimating procedures
54	Shortage of construction materials (bitumen, cement and steel)

55	Shortage of technical personnel
56	Insufficient equipment
57	Shortage of fuel
58	Shortage of labour
59	Price escalation
60	Low level of equipment operators' skills
61	Low productivity and efficiency of equipment
62	Lack of high-technology mechanical equipment
63	Unqualified workforce
64	Low productivity of labour
65	Shortage of foreign currency for importation of materials
66	Delays attributed to third-party testing of materials
67	Differing or unexpected geotechnical conditions
68	Effect of rain on construction activities
69	Effect of hot weather on construction activities
70	Theft of contractor's resources
71	Vandalism of works (in progress or finished)
72	Delay in paying compensations (land-owners)
73	Delay in relocating utilities
74	Industrial action (strike/sit-in)
75	High competition in bids
76	Severe weather conditions on the job site
77	The political situation
78	The segmentation of the West Bank

79	Project location