

ROAD CONSTRUCTION PLANT POOLS AS AN ALTERNATIVE TO INDIVIDUAL EQUIPMENT OWNERSHIP IN GHANA


by

KNUST
Kobena Brentuo, BSc. Civil (Hons.)

A thesis submitted to the Civil Engineering Department,
Kwame Nkrumah University of Science and Technology, in
partial fulfilment of the requirement for the degree

Of

MASTER OF SCIENCE

The logo of Kwame Nkrumah University of Science and Technology (KNUST) is centered in the background. It features a shield with a red flame at the top, a yellow eagle with spread wings in the middle, and a green base. Below the shield is a yellow banner with the text 'NYANSAP' on the left and 'ADWENNA' on the right. The entire logo is rendered in a light, semi-transparent style.

Faculty of Civil and Geomatic Engineering
College of Engineering

September 2009

DECLARATION

I declare that this report submitted towards the Master of Science degree is my own work. To the best of my knowledge it has not been previously published in part or whole by any person neither has it been accepted for the award of any other degree of the University, except where due acknowledgement have been made in the text and references.

Kobena Brentuo

(Student)



(Signature)

13/05/2010

(Date)

Prof. S.I.K. Ampadu

(Supervisor)



(Signature)

16/05/2010

(Date)

Prof. S.I.K. Ampadu

(Head of Department)



(Signature)

16/05/2010

(Date)

ACKNOWLEDGEMENT

My most gratitude goes to God Almighty for his favour and sustenance throughout the period of study.

I am also indebted to the following people for the various roles they played in putting this report together.

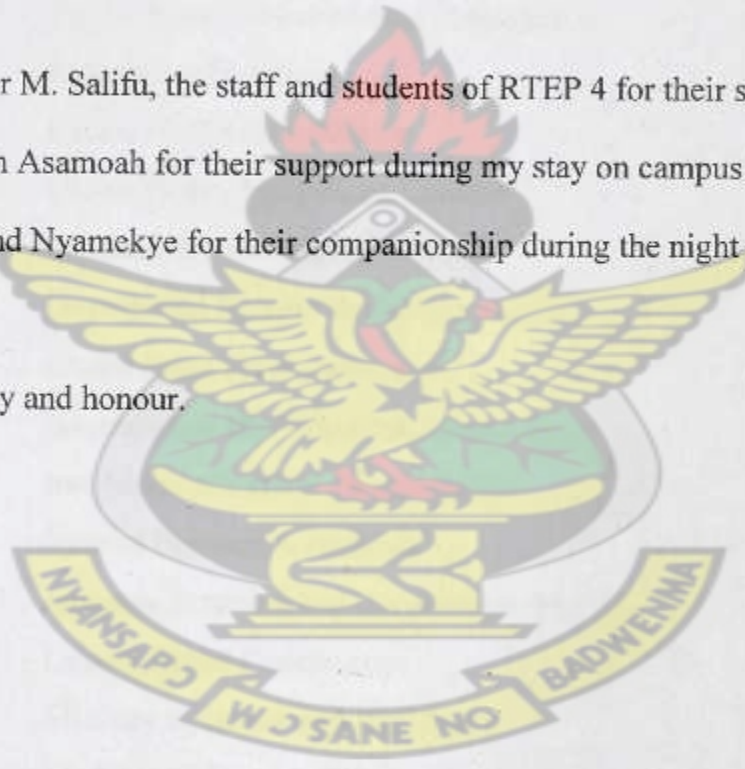
Associate Professor S. I. K. Ampadu for his resources and time spent in the supervision of this work.

Associate Professor M. Salifu, the staff and students of RTEP 4 for their support.

Dr. and Mrs. Adom Asamoah for their support during my stay on campus for this course.

Lastly Theodora and Nyamekye for their companionship during the night vigils.

To God be the glory and honour.



LIST OF ABBREVIATIONS

ACEL	Associated Construction Equipment Lessors
ADB	Agricultural Development Bank
BHC	Bank for Housing and Construction
DANIDA	Danish International Development Agency
DFID	Department for International Development
DFR	Department of Feeder Roads
DUR	Department of Urban Roads
EPC	Equipment Pool Company
EU	European Union
FRIP	Feeder Roads Improvement Programme
FSU	Former Soviet Union
GHA	Ghana Highway Authority
GHEL	Ghana Heavy Equipment Limited
GoG	Government of Ghana
GPRS	Growth and Poverty Reduction Strategy
GRFS	Ghana Road Fund Secretariat
IDA	International Development Association
ILO	International Labour Organization
IPC	Interim Payment Certificate
JICA	Japanese International Corporation Agency
LBC	Labour Based Constructor
MRH	Ministry of Roads and Highways
MoT	Ministry of Transportation
MWRWH	Ministry of Water Resources Works and Housing
NIB	National Investment Bank
PC	Payment Certificate
PPL	Plant Pool Limited
RLP	Rural Livelihood Project
RSDP	Road Sector Development Programme
SEP	Supply Equipment Programme

SNNIT

Social Security and National Insurance Trust

USAID

United States Agency for International Development

KNUST



ABSTRACT

The non performance of road contractors in Ghana have been largely attributed to the non availability of road construction equipment that they require to do the work. The Road Sector Development Programme (RSDP) which was initiated to support the achievement of the goals of the Growth and Poverty Reduction Strategy (GPRS), aimed at achieving an overall condition mix of 59% good, 22% fair and 14% poor for the road network in Ghana. Only 45% good, 28% fair and 27 % poor was achieved. One of the reasons cited for the non achievement of the set targets was lack of capacity in terms of equipment on the part of contractors.

This research sought to determine whether road construction equipment pools can be an alternative to owning road construction equipment individually by contractors.

The research identified that, equipments own by contractors are over 50% of the time idle due to insufficient work load. Also over 80% of contractors do not keep records on their equipments, over 50% do not have their own depot facilities whilst over 70% do not possess workshops facilities nor competent workshop personnel, an indication of poor equipment management. It therefore concludes that factors like inadequate work load, low levels of turnover and equipment mismanagement do not favour the ownership of road construction equipment in the nation. The way forward, as far as road construction equipment availability is concerned, is the establishment of road construction equipment pools. This has been successfully practised both in developed and developing countries like the United Kingdom Armenia and the Philippines. It also suggests a further study into the modality for the establishment of these pools.

TABLE OF CONTENT

1.0	INTRODUCTION	1
1.1	Background of study	1
1.2	Research objectives	4
1.3	Justification	4
1.4	Scope of research	5
2.0	LITERATURE REVIEW	7
2.1	The Road Construction Sector in Ghana	7
2.1.1	Size of the construction sector in Ghana	7
2.1.2	Road administration in Ghana	7
2.1.3	Road maintenance activities in Ghana	9
2.1.3.1	Routine Maintenance	10
2.1.3.2	Periodic Maintenance	11
2.1.4	Classification of Contractors in Ghana	12
2.2	Equipment management	15
2.2.1	Considerations for equipment selection	15
2.2.2	Economic comparison of equipment alternatives	15
2.2.3	Equipment acquisition methods in Ghana	17
2.2.3.1	Cash or outright purchase	18
2.2.3.2	Credit sale	18
2.2.3.3	Hire purchase	18
2.2.3.4	Leasing	19
2.2.3.5	Sale and lease-back	20

2.2.3.6 Auctioning	20
2.2.3.7 Hiring	21
2.2.4 Calculation of construction equipment hire rate	23
2.2.4.1 Ownership cost	23
2.2.4.2 Operating cost	24
2.2.5 Maintenance of equipment	25
2.2.5.1 Types of maintenance	26
2.2.5.2 Monitoring of maintenance	27
2.3 Road construction equipment financing in Ghana	27
2.3.1 Equipment financing through Dealers	28
2.3.2 Equipment financing through Financial Institutions	28
2.3.2.1 The Supply Equipment Programm (SEP)	29
2.3.3 Equipment financing through Client	30
2.4 Some successful stories of Plant Pooling	33
2.4.1 The story of ACEL	33
2.4.2 The story of Armenia	34
2.4.3 Equipment Pool Companies (EPC)	35
2.5 Plant Pool in Ghana	36
2.5.1 Plant Pool Limited	36
2.5.2 J. A. Plant Pool (Ghana) Limited	38
3.0 METHODOLOGY	39
3.1 Desk Study	39
3.2 Field study	39

3.2.1	Identification of stakeholders	39
3.2.2	Interview with Contractors	40
3.2.3	Interview with Client's representatives	40
3.2.4	Interview equipment companies	41
3.2.4.1	Equipment suppliers	41
3.2.4.2	Plant Hire Companies	41
3.2.5	Interview with the National Investment Bank	41
4.0	DISCUSSIONS AND ANALYSIS	42
4.1	Return of questionnaire	42
4.1.1	Response from contractors	42
4.1.2	Response from clients' representatives	43
4.1.3	Response from National Investment Bank	44
4.2	Equipment ownership and usage by contractors	44
4.3	Equipment management	47
4.4	Equipment availability and patronage at plant pools	48
4.5	Preference for Equipment acquisition method	49
4.6	Annual turnover of contractors and cost of equipment	53
4.7	The Supply Equipment programme (SEP)	56
4.7.1	Challenges associated with the SEP	56
4.7.2	Performance of SEP	57
4.7.3	Annual turnover and The Supply Equipment programme (SEP)	58
4.7.4	Growth of contractor numbers in Ghana	59

5.0	CONCLUSSIONS AND RECCOMENDATIONS	60
5.1	Conclusions	60
5.1.1	Equipment ownership and management	60
5.1.2	Loan repayment	60
5.1.3	Plant pool concept	61
5.2	Recommendations	61
	REFERENCES	63
	APPENDICES	66
No.	Title	Page
1	Samples of survey questionnaire	66
2	Equipment and annual turn over requirements for contractor classification	75
3	Contractors' equipment ownership	78
4	Contractors' equipment usage	83
5	Turn over of contractors	84
6	Supply Equipment Programme	88
7	Results from Plant Pools	89

LIST OF TABLES

Table No.	Title	Page
2-1	Routine Maintenance activities with required equipment	11
2-2	Periodic Maintenance activities with required equipment	12
2-3	Technical Categories and type of work	13
2-4	Minimum equipment requirement for classification into Category A	14
2-5	Equipment acquisition methods in Ghana	22
2-6	Equipment financing through Dealers	28
2-7	Equipment financing through Financial Institutions	28
2-8	Client sponsored equipment acquisition programmes in Ghana	31
4-1	Responses from contractors	42
4-2	Responses from client's representatives	43
4-3	Contractors with all the required equipment in their class	44
4-4	Contractors' equipment ownership	45
4-5	Contractors' equipment usage	46
4-6	Contractors' equipment usage compared with their economic life	47
4-7	Contractors' equipment management	48
4-8	Contractors preference of equipment acquisition method	49
4-9	Annual turn over of contractors	53
4-10	Exchange rate for US Dollar from Year 2000 to	54
4-11	Coefficients for Baxter's formula	55
4-12	Portion of annual turn over for equipment	56
4-13	Performance of the Supply Equipment Programme	58

4-14	Average turn over and SEP loan debt	59
4-15	Growth of contractor numbers in Ghana	59

LIST OF FIGURES

Figure No.	Title	Page
2-1	Structure of Ministry of Roads and Highways	9
4-1	Turn over of contractors	54



Chapter One

INTRODUCTION

1.1 Background of study

The economy of every nation largely depends on its transportation system for the movement of goods, services and people. Even though the relationships between transportation and the economy are very complex and poorly understood, transportation is a massive enterprise with substantial direct and indirect effects on economic productivity and economic growth. A good performance of the construction industry is therefore essential for growth and development of several other sectors of the economy (Ofori, 2007).

In Ghana about 95% of freight and 97% of passenger movement are by road transport (Ambo 2005). This implies that the economy of Ghana largely depends on its road transport system. There is therefore the need to expand and maintain the road network to an appreciable level to ensure free movement of freight and passengers, reduce vehicle operating cost, road accidents and improve comfort. When rural communities lack roads or their roads are poorly maintained, they become isolated, the results of which is the creation of poverty, poor health and illiteracy within them (Burningham and Stankevich, 2005).

Ghana, like most Sub-Sahara African countries, was encouraged by the World Bank through the Road Maintenance Initiative to shift from the use of force account in road maintenance to contracting using private local firms in order to enhance efficiency.

Ghana has since shifted completely except for the Ghana Highway Authority (GHA) which maintains a Mobile Maintenance Unit (MMU) for some emergency works. The

development and maintenance of the road network therefore depends on the performance of the contractors. The non performance of contractors in this nation has been largely attributed to non availability of the road construction equipment that they require to undertake the works amongst other factors like poor capacity of technical staff, poor management skills, lack of continuity in performance, inadequate production of materials and delayed payments from clients (Ofori, 2007).

The government of Ghana with support from her development partners and through the Ministry of Transportation from 2002 to 2007 implemented the **Road Sector Development Programme (RSDP)**. This was to support the achievement of the goals of the **Growth and Poverty Reduction Strategy (GPRS)**. The RSDP targeted for the nation's road network, an overall condition mix of **59% good, 22% fair and 14% poor** by June 2008. However the programme could achieve only **45% good, 28% fair and 27% poor** by the end of 2006. One of the reasons cited by the evaluators of RSDP for the non achievement of the targets was lack of capacity in terms of equipment on the part of contractors (MoT 2007).

Progress reports of road maintenance contracts supervised by agencies of the Road and Highways Ministry is replete with recommendations for termination of contracts because of non performance partly due to lack of equipment. Various attempts have been made by the Ministry of Transportation in collaboration with some financial institutions with support from some of Ghana's development partners to solve the problem of non availability of road construction equipments. These have mainly been in the form of equipment loans to individual contractors to purchase some of the equipment. Some contractors also in the past, made their own arrangements with some

financial institutions and equipment dealers/suppliers to acquire their needed pieces of equipment.

These financial institutions and equipment suppliers have different arrangements for the acquisition of these facilities. The arrangement offered by the National Investment Bank has been evaluated to be the most suitable for contractors to purchase equipment in terms of interest rate and repayment duration (Diabene, 2008).

Like similar schemes in Zambia, Kenya and Zimbabwe the literature is replete with under achievement of many of these programmes thereby challenging their sustainability. For example in Zimbabwe a local bank was selected to supply equipment to contractors after the Department of Roads and contractors have given the specifications. A sponsored guaranteed fund was set aside to compensate the bank in case of default by any contractor. Also in Zambia, contractors made regular payments for equipment after which ownership was transferred to them. In some countries like Kenya, Contractor Support Agencies (CSA) were established (eg The National Construction Corporation) to take care of the needs of contractors including training and equipment (Eyiah and Cook, 2003).

The problem with road construction equipment availability seems not to have been improved with all these programmes to equip contractors individually. The use of plant pools appears to be an alternative option to equipment ownership that has not been given the needed attention it deserves even though it was one of the recommendations made by the evaluators of the RSDP programme.

1.2 Research objectives

This research seeks to determine whether road construction plant pools can be an alternative to individual equipment ownership in the road construction sector in Ghana.

The specific objectives are:

1. To review programmes that have been used to equip contractors in Ghana.
2. To determine the level of road construction equipment ownership and whether the equipments owned are being effectively used to recoup the investments made in them.
3. To determine the performance of road construction equipment loans in terms of beneficiaries and recovery using the 'Supply Equipment' programme as a case study.
4. To determine the characteristics of plant pools in Ghana in terms of equipment availability and patronage
5. To assess the road construction stakeholders' preferences for plant pool schemes

1.3 Justification

The construction industry in Ghana, like most developing countries, is faced with problems like poor capacity of technical staff, poor managerial skills on the part of contractors, import dependency, lack of continuity in performance, low degree of local participation in contracting, inadequate production of materials, delayed payments from clients and lack of working capital, equipment and tools (Ofori, 2007).

Even though the need to maintain roads is widely recognised by many countries, it is still not adequately done. Many countries spend only about 20 – 50 % of what they are supposed to spend on road maintenance (Burningham and Stankevich, 2005).

The RSDP targeted for the nation's road network, an overall condition mix of **59% good, 22% fair and 14% poor** by June 2008. However the programme could achieve only **45% good, 28% fair and 27% poor** by the end of 2006. One of the reasons cited by the evaluators of the RSDP for the non achievement of the targets was lack of capacity in terms of equipment on the part of contractors (MoT 2006).

Progress reports of road maintenance contracts supervised by agencies of the Road and Highways ministry is replete with **recommendations** for termination of contracts because of non performance most of which is due to lack of equipment.

Attempts by Government and Development Partners to finance equipment availability have focused on ownership by individual contractors. This approach has been associated with some difficulties which include the inability of the contractors to pay back loans, equipment mismanagement and equipment idling. There is the need to explore alternative sources of making equipment available to contractors in this nation. This study therefore seeks to determine whether plant pools could be an alternative.

1.4 Scope of research

The study covered both desk study and field study. The desk study was in the form of literature review from various publications. The field study was in the form of questionnaires and personal interviews covering the stakeholders in the road construction sector as much as possible. These included the Ministry of Roads and

Highways (MRH) and its agencies, (Department of Urban Roads - DUR, Department of Feeder Roads - DFR, Ghana Highway Authority - GHA and the Ghana Road Fund Secretariat - GRFS), Contractors duly registered with the MRH and Contractors who benefited from the "Supply Equipment Programme", National Investment Bank (NIB), Equipment suppliers and Equipment hire companies.

KNUST



LIBRARY
KWAME NKRUMAH UNIVERSITY OF
SCIENCE AND TECHNOLOGY
KUMASI-GHANA

Chapter two

LITERATURE REVIEW

2.1 THE ROAD CONSTRUCTION SECTOR IN GHANA

2.1.1 *Size of the construction sector in Ghana*

The construction sector comprises civil engineering works, infrastructure services and buildings. The construction sector has experienced consistent growth within the last few years. Its contribution to the GDP rose from 8.1% in 2004 to 9.0% in 2007 and it was projected to rise to 9.4% in 2008. This is attributable to the increased road construction and other infrastructural development throughout the country (Ghana Budget, 2007).

The 2009 budget for the Roads Sector alone was 386.4 million Ghana cedis representing about 4.0% of government's total income (Ghana Budget, 2009). Government is the largest client and the most regular buyer in the construction industry.

2.1.2 *Road administration in Ghana*

The Public Works Department (PWD) was set up in the pre-independence era to be responsible for all public works including roads, buildings, water and electricity. As growth in population and its associated increased demand for infrastructural services became significant, the functions of PWD were redefined to make it more efficient. The result of this was the establishment of the Ghana Water and Sewerage Corporation (GWSC) and Electricity Corporation of Ghana (ECG) to be responsible for the provision of water and sanitation and the distribution and management of electricity respectively. In 1974 the Ghana Highway Authority (GHA) was formed under the Ministry of Works and Housing by Decree 298 (1974), as a result of a study commissioned to propose ways to improve the construction and maintenance of roads. The GHA was charged with the

responsibility of the administration, development, and maintenance of all public highways and related facilities in Ghana. Whilst trunk roads and rural feeder roads were placed under the Ghana Highway Authority, the rest of the roads were managed by the Cocoa Board, Volta Authority, and timber companies. Roads in urban areas were managed by city and municipal councils under the Ministry of Local Government. Further institutional changes took place in 1981 and all feeder roads were placed under the Department of Feeder Roads (DFR) within the Ministry of Works and Housing. In 1982, a new Ministry of Roads and Highways (MRH) was formed from the previous Public Works Department with responsibility of formulating policies for the road transport sector, establishing the regulatory framework for road transport operations, investments and the development of an integrated road transport system which is modally complementary. GHA and DFR were moved and placed under the authority of the new ministry. In 1988, the responsibility for the administration and maintenance of roads in urban areas was also taken from the local authorities to the newly created Department of Urban Roads (DUR) in the Ministry of Roads and Highways. The current structure of the ministry with its organs is indicated in Figure 2.1 below. The organs can be broadly categorised into three; Road Infrastructure, Training Institutions and Transport Services & Safety.

The future of road infrastructure administration in Ghana will look different from the current organization. With the full implementation of Ghana's decentralization programme, feeder and urban roads administration will move to the District, Municipal and Metropolitan Assemblies of the Ministry of Local Government whilst trunk roads will be under National and Local Road Authorities to be established under MRH.

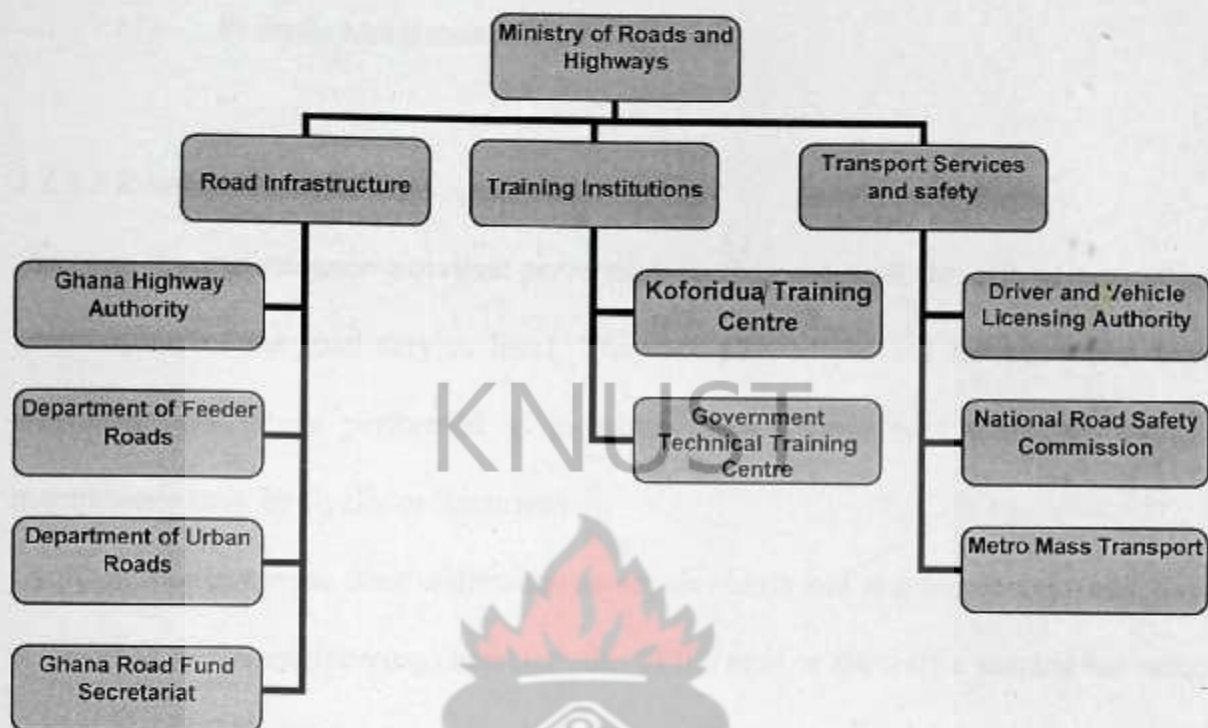


Figure 2.1: Structure of Ministry of Roads and Highways

2.1.3 Road Maintenance activities in Ghana

Road pavement surfaces in Ghana can be grouped into two broad categories. These are paved and unpaved. Paved surfaces have either bituminous or Portland cement concrete surfaces otherwise known as flexible or rigid pavements respectively. The bituminous or flexible pavements have asphalt concrete or surface dressing as wearing course. All these surfaces are underlain by crushed rock base or natural gravel base on top a natural gravel sub base.

A maintenance activity may be defined as any piece of work or intervention carried on the road to correct or prevent a defect.

Maintenance activities can be grouped into various categories. The two main categories used in Ghana by the Ministry of Roads and Highways and its agencies are:

- (1) Routine Maintenance and
- (2) Periodic Maintenance

2.1.3.1 Routine Maintenance

They are the maintenance activities performed on the road with the aim of preventing deterioration of the road service level. They are also to prevent the pavement from weakening and hence performed as to when needed throughout the year. Routine maintenance may be Cyclic or Recurrent.

Cyclic activities are the ones undertaken on regular basis and at a frequency which does not depend on the engineering characteristics of the road or the traffic volume but rather on the climatic conditions. An example is grass cutting.

Recurrent activities are undertaken at a frequency dependent on the engineering and traffic characteristics of the road. Examples are pothole patching and edge repair.

Examples of routine maintenance activities are indicated in Table 2-1 below for both paved and unpaved roads, with the equipment required to undertake them.

Table 2-1 **Routine Maintenance activities with required equipment**

Maintenance Activity	Required Equipment
Pothole patching (paved roads)	Bitumen Dispenser, roller, tipper truck
Pothole patching & gully repairs (gravel roads)	Water bowser, roller, tipper truck
Depressions, ruts, shoving and corrugation	Bitumen Dispenser, roller, tipper truck
Repair of edge failure	Bitumen Dispenser, roller, tipper truck
Crack sealing	Bitumen Dispenser, roller, tipper truck
Breakup spots	Grader, Roller, Water bowser
Grading of gravel and high shoulders	Grader, Roller, Water bowser
Patching gravel shoulder drop-offs	Grader, Roller, Water bowser
Ditch cleaning /Re-excavation of ditches	Grader
Sectional patching	Grader, Roller, Water bowser, tipper truck

2.1.3.2 Periodic Maintenance

Periodic Maintenance activities are required over longer time intervals. Their intervals are prolonged by routine maintenance activities. They are required to preserve the structural integrity of the pavement when routine maintenance becomes ineffective. They may include activities to re-align or widen the geometry of the road.

Examples of periodic maintenance activities are indicated in Table 2-2 below for both paved and unpaved roads, with the equipment required to undertake them.

Table 2-2 Periodic Maintenance activities with required equipment

Maintenance Activity	Required Equipment
Upgrading	Dozer, Grader, Roller, Water bowser, tipper truck, Bitumen distributor, Pneumatic tyre roller, Pay loader
Rehabilitation (paved road)	Dozer, Grader, Roller, Water bowser, tipper truck, Bitumen distributor, Pneumatic tyre roller, Pay loader
Rehabilitation(unpaved road)	Dozer, Grader, Roller, Water bowser, tipper truck, Pay loader
Resealing	Tipper truck, Bitumen distributor, Pneumatic tyre roller, Pay loader
Gravelling	Dozer, Grader, Roller, Water bowser, tipper truck, Pay loader
Asphalt overlay	Tipper truck, Bitumen distributor, Pay loader, Pneumatic tyre roller, Asphalt paver

(Source: GHA, 2001)

2.1.4 Classification of Contractors in Ghana

The contractor classification exercise aims at properly grading contractors into respective categories and financial classes so as to facilitate easy access to contractors by government departments and corporate organizations requiring their services. An organization seeking to operate in Ghana as a contractor must first obtain a certificate of incorporation and then a certificate to commence business from the Registrar General's Department.

The Ministry of Roads and Highways is responsible for the registration and classification of contractors who work in the road sector whilst the Ministry for Water

Resources Works and Housing is responsible for contractors who work in the building sector and other civil engineering works including dams.

Requirements for classification as a contractor in the road sector are based on the applicant's equipment, technical and administrative personnel as well as financial standing together with the fulfillment of tax, labour and social security obligations. Even though registration with the MRH is not compulsory, only contractors so registered will be permitted to participate in public road and bridge contracts.

Road contractors are classified into six (6) technical categories (A, B, C, S, M and L) and four (4) financial classes (1, 2, 3, 4). The technical categories group contractors according to the type of work they can do based on their years of experience, equipment holding and human resource capability whereas the financial classes group them into their financial capabilities. Table 2-3 below explains the technical categories.

Table 2-3: Technical categories and type of work

Technical Category	Type of work
A	Roads, Airports and related structures
B	Bridges, culverts and other related structures.
C	Labour based road works and mainly for road maintenance and spot improvement
S	Construct, rehabilitate and maintain steel bridges and structures
M	Maintenance of bituminous or asphaltic pavements
L	Construct and maintain road furniture and appurtenances

As indicated on Table 2-3, road construction and maintenance are undertaken by Category A contractors. The minimum equipment requirement for entry into technical category A, as specified by MoT, is indicated in Table 2-4 below.

Table 2-4: Minimum equipment requirement for classification into **Category A**

ITEM	EQUIPMENT	NUMBER FOR EACH FINANCIAL CLASS			
		1	2	3	4
1	Bulldozer 150 KW & 105KW(D7 &	3	2	*1	
2	Grader 105	2	1		
3	Grader 90 KW	2	1	1	1
4	Traxcavator (1.9m ³ & 1.1m ³)	4	1	*1	
5	Wheeled Loader 1.1 m ³	1	1		
6	Static Roller -(10 Tonne & 6 Tonne)	4	1	1	1
7	Vibratory Roller -8 Tonne	2	1		
8	Pneumatic Roller	1	1		
9	Plate/Pedestrian Roller	2	1		
10	Water Tanker Truck -Min. 5000 L	3	2	1	
11	Low Loader Truck	2	1		
12	Flatbed truck	2	1		
13	Tipper Truck -5m ³	15	8	4	2
14	Dump Truck -15m ³	2			
15	Chippings Distributor (Attachment)	3	1	1	
16	Bitumen Distributor	1	1		

(Source: MOT, 2008. * implies either of)

The financial classes with limits on work loads and tenders are shown as Appendix 3.

2.2 EQUIPMENT MANAGEMENT

2.2.1 Consideration for equipment selection

The main financial assets within any construction group consist of plant and equipment. It should therefore be noted that the correct selection of plant and equipment affects both the profitability of the particular project and the long term success of the company (Blake, 1989).

In order to make an effective selection of construction equipment for use on any construction project, three key considerations, listed below, will have to be analyzed.

1. Technical efficiency

Every project requires that the activities or tasks involved would be completed to the required technical specifications within the project timetable and cost. In this analysis therefore the equipment with the capability to perform the required job are identified.

2. Commercial and Financial viability

For the tasks to be completed within the project cost, the cost of any equipment selected must be within the project estimates.

3. Availability:

The availability and source of supply for the pieces of required equipment considered under 1 and 2 must be ensured. This can be from a number of sources. i.e. existing internal holdings, the hire market or by additional purchase.

(Blake, 1989).

2.2.2 Economic comparison of equipment alternatives

Like any other economic venture, the cost for the acquisition of any equipment must be gathered and compared to all alternative proposals available in order to ascertain which of them is more economical. To be able to compare the costs of the different proposals or alternatives, their **present worth/value** or their **equivalent annual cost** must be calculated. The present worth/ value method is the commonly used.

Calculations of the costs require an interest rate. The interest rate used represents the value of money to the investor. That is, it represents the interest which the investor could receive if his capital was invested elsewhere. In situations where the investment scheme would last for a short period, say less than a year, the calculation can be done without considering an interest rate.

The present worth converts the running costs of the different proposals to today's value, before they are compared. The Equivalent Annual Cost method is an alternative to the present worth method of comparing economic proposals. Whereas the present worth method converts all future running costs to a present value, the equivalent annual costs method convert the capital investment to annual costs.

Economic comparison of equipment alternatives must be done with a consideration for the effect of inflation. Inflation can simply be explained as more money being paid for the same amount of goods over a period of time. The rate of inflation differs from item to item and the basket of goods concept is used to create indicators of inflation or price movement. The most commonly known 'basket of goods' is that used to calculate the retail price index. Other indices of inflation used in the construction industry are the 'cost of new construction index', the 'tender price index' or the NEDO indices used in

the calculation of price adjustments in construction contracts. These indices are used for different types of goods or 'basket of goods'. They are therefore indications of the variability in the nature of inflation (Harris and McCaffer, 1991).

2.2.3 Equipment acquisition methods

A construction company's equipment holding develops as a result of previous construction activities. In Ghana the starting point may be the requirements for registration as a contractor or construction company. Equipment are gradually acquired to service contracts and eventually grow to the size where the fleet will need to be organized into a separate unit.

In situations where equipment is available for hiring in a country, ownership need not be a requirement for contractor registration. Some contractors may own some of the equipment they require for the purposes of prestige and convenience. A company acquiring equipment therefore need to consider the following points before a decision is taken on the mode of acquisition.

- 1 The equipment must be able to generate sufficient turnover to provide sufficient rate of return on the capital to be employed in the acquisition of the equipment.
- 2 The mode of acquisition whether hiring or owning must be absolutely necessary and appropriate for the business.

The various modes by which equipment can be acquired are explained in the paragraphs below.

LIBRARY
KWAME N. RUMAH UNIVERSITY II
SCIENCE AND TECHNOLOGY
KUMASI-GHANA

2.2.3.1 Cash or outright purchase

In this method of equipment acquisition, the purchase price of the equipment is fully paid for by the acquiring company. The source of financing could either be from the companies own resources, investors or shareholders (equity financing) or a bank loan. Also some contracts include monies for contractors to be able to purchase some needed equipment at the beginning of the contract especially in technically specialized contracts.

In outright purchase, title of the equipment is placed with the acquiring company immediately after purchase (Harris and McCaffer, 2001).

2.2.3.2 Credit sale

In credit sale the purchase price is paid in installments which include the purchase price and any financing charges the supplier makes. Like outright purchase credit purchases attract capital allowances immediately and can be used in the same way as outright purchase. The title of the equipment also goes to the acquiring company.

2.2.3.3 Hire purchase

In a hire purchase agreement, the purchaser pays specified rental amounts during the period of contract to the supplier. At the end of this period the purchaser may pay a previously agreed sum to the supplier after which ownership is transferred to the purchaser. Hire purchased equipment also have the advantage of attracting capital allowances as in outright or credit purchase. It also does not require large capital sums and repayments on borrowed funds can be spread progressively.

2.2.3.4 Leasing

The leasing method of equipment acquisition is the type in which the user of the equipment (lessee) pays specified rentals for the use of the equipment but ownership of the equipment remains with the supplier (lessor). The fundamental difference between leasing and outright or hire purchase is that the lessee never becomes the owner of the equipment.

There are several forms of leasing of which the finance lease and operating lease are the forms appropriate for equipment acquisition.

Finance lease

The lessor in a financial lease arrangement is normally a financial institution. The rental charges paid by the lessee cover the capital cost of the equipment less the salvage value. Other costs to be covered by the rental are service charge to meet the overheads of the lessor, interest charges, cost of servicing and the lessor's profit margin. Usually the lease is set in two parts. The primary period would normally last between three (3) and five (5) years during which rental levels are set to recover all costs. The secondary (or continuation) period could be fixed time intervals and it is extended to meet the lessee's needs. Only nominal rental may be required during this period. The equipment may or may not be sold at the end of the lease but not directly to the lessee. Since the lessor often has no direct interest in the equipment, it is not likely the contract would be cancelled until the lessor realizes his full investment. The lessee would then have the

advantage of the full use of the equipment but takes the risk for obsolescence, cost of maintenance and insurance.

Operating lease

Unlike a finance lease the lessor in an operating lease is likely to be the manufacturer or the supplier of the equipment whose purpose is to help in its marketing. Again the primary period is likely to be non-cancelable but because the lessor has an interest in the equipment, the duration of the primary period and the rentals are likely to be different. For example the lessor may have use for the equipment itself or a well developed secondhand leasing market. This condition will make an operating lease cheaper than a finance lease. As with finance leasing, the capital allowances would go to the leasing company.

2.2.3.5 Sale and lease-back

A company who owns equipment in order to obtain working capital can sell the equipment to a leasing company (lessor). They then enter into a finance lease agreement so that the original owner, now the lessee, can have the equipment to work with.

2.2.3.6 Auctioning

One other mode through which contractors acquire or own their equipment is auctioning. In this mode contractors acquire broken down or non-serviceable equipment from corporate organisations. These equipment are then refurbished for use. This mode

is normally cheaper and highly affordable to contractors however subsequent cost of operations may be high.

2.2.3.7 Hiring

Hiring is an agreement or a contract in which the acquiring company pays an agreed upon sums of money to the owner of an equipment for the use of the equipment over a period of time. Hiring is similar to leasing except that it is for shorter periods whilst leasing is for longer periods.

When the economic situation of a nation is such that many construction companies do not have enough workload to justify purchasing all the equipment wanted, the best solution to the equipment needs of contractors is hiring. In the United Kingdom for instance hiring or rental of construction equipment has introduced a new dimension into contracting. A range of equipment for hire is now available for choosing thereby freeing many contractors from the burden of having to stock and maintain uneconomical equipment.

Hired plant was in great demand in the United Kingdom during the reconstruction period that followed the World War II due to economic recession. The market has continued to grow and today it is estimated that sixty percent (60%) of all plant and equipment used is hired (Harris F. and R. McCaffer, 1991).

The need for a hired facility as opposed to ownership will be influenced by the following reasons:

- 1 Less pride by construction companies in displaying the firm's name and leverage on equipments used on contracts.

- 2 When laws protecting firms hiring out equipment offer greater safeguards.
- 3 Relatively slow economic growths.
- 4 Large proportions of small to medium firms included in the construction industry.
- 5 When government policies allow full and immediate depreciation of the cost of equipment thus encouraging purchasers to off set tax payments on profit. This will induce firms to buy plant and look for work to maintain profitable levels of utilization, an arrangement which would favorer the development of a hiring system. Table 2-5 indicates the equipment acquisition methods used or practiced in Ghana.

Table 2-5 Equipment acquisition methods in Ghana.

Method	Practiced in Ghana?	Comment
Cash or Outright purchase	Yes	Financing is normally through bank loans
Credit sale	Yes	Arrangement is normally between contractors and equipment suppliers.
Hire purchase	No	Not yet practiced in Ghana
Leasing	No	Practiced on a very small scale by certain banks e.g. SG-SSB
Sale and lease-back	No	Not yet practiced in Ghana
Auctioning	Yes	Largely practiced in Ghana
Hiring	Yes	Arrangement is normally between plant pools and contractors or among contractors.

2.2.4 Calculation of construction equipment hire rate

A construction company may keep equipment either for hiring or rental to the public or operated for internal use by the company. In any case the plant or equipment must be operated to recover the owning and operating costs as well as achieving additional profit. Ownership costs are fixed costs and arise indirectly such as company overheads. They are incurred throughout the ownership of the equipment. They include (1) capital cost; (2) depreciation on equipment; (3) insurances and licenses; (4) corporation tax and capital allowances and (5) establishment charges.

Operating costs are direct costs of material, labour and expenses which vary according to the usage of the equipment. They include (1) servicing cost - e.g. oil, grease and other consumables; (2) maintenance costs, (3) transport charges; (4) fuel and (5) operators wages.

2.2.4.1 Ownership cost

Cost of capital

Capital to purchase the equipment may be obtained either from borrowing or retained profits. In any case the interest payments on the borrowing or a reasonable rate of return should be incorporated into the hire rate.

Depreciation

Almost all equipment deteriorates with usage and or become obsolete with time. Equipment must therefore be able to generate sufficient revenue by the end of its economic life to pay for the loan that was used to purchase it or replace the equipment if it was purchased with internal funds.

The economic or useful life of the equipment can be estimated based on experience of operating similar equipment. A machine can be said to have exhausted its economic life for a company when levels of utilization show a downward trend coupled with increase in maintenance costs and loss of profit.

Methods of calculating depreciation include the Straight line method, the Declining Balance method, the Sinking Fund method and the Sum of digits method.

Licenses and insurances cost

The cost of licenses and insurance for construction equipment depend upon whether it will be traveling on a public road. In general the premium depends on the degree of risk to third parties.

Establishment charges

The cost of the company's overheads must be recovered in the hire rate. Overheads relate to the central organization and include costs for the offices and workshops and the associated administrative facilities.

2.2.4.2 Operating cost

Maintenance

Facilities are required to undertake both planned and breakdown maintenance of construction equipment so that they can be kept in a good working order. The budgeted costs for these maintenance activities must be included in the hire rate of the equipment as a direct cost per unit of hire.

Consumables

Consumables which include oil, grease, tyres and fuel are direct costs which vary according to the conditions of the equipment. Manufacturers provide guidelines on their consumption but the best form of guideline must be from the operation of a similar equipment because manufacturer's guidelines may be ideal for only new equipment working in ideal conditions. The inclusion of fuel in the hire rate will depend on the conditions of the hire contract.

Operators' wages

The inclusion of the operator's wages in the hire rate would depend on whether the equipment is hired with or without an operator. The operator's wages would include his hourly rate, allowances for overtime, bonus, insurance premiums, holiday pay, sick pay and pension.

Even though there are several acceptable methods of calculating the hire rate the most favoured one is the simple calculation to allow for ownership and operating costs, with an addition for profit. However for investments extending over a few years, the discounted cash flow (DCF) method which takes into account the timing of cash flows is more satisfactory.

Example on the calculation of the economic hire rate is given in appendix 9

2.2.5 Maintenance of equipment

Construction equipment like any other machine can break down any time during its working life. This may be due to normal wear and tear or a sudden failure of a component part. The purpose of maintenance is to reduce the incidence of failure and

“down – time” so that economical levels of utilization can be achieved. Even though the purpose of maintenance is to keep the equipment in service, safety must not be compromised. A plant item will therefore require complete replacement at some stage. Equipment maintenance requires facilities like depots, workshop experienced staff ect.

2.2.5.1 Types of maintenance

Planned Preventive maintenance

Planned regular procedures aimed at ensuring the efficient use of equipment by preventing breakdowns are implemented. Activities include:

- Daily servicing and superficial inspection for about 30 minutes before and after days work.
- Regular full maintenance and inspection including periodic overhaul.
- Replacement of component parts within a specified working period or working conditions

Planned preventive maintenance is very comprehensive and can be implemented by firms who have available workshop facilities and can substitute for the machine whilst it is being maintained to avoid ‘down-time’.

Planned Corrective maintenance

Adequate maintenance is provided to enable the machine to operate when on site. A major overhaul should be undertaken when it completes its duties. This type of maintenance is not systematic and does not ensure the upholding of highest safety standards.

Unplanned maintenance

This type of maintenance is adopted when the cost for regular maintenance are likely to exceed the cost of complete replacement. This is appropriate for equipment which is not essential to the production process and whose failure will neither cause much disruption nor constitute a safety hazard.

2.2.5.2 Monitoring of maintenance

To be able to execute the maintenance policy efficiently it is important to keep:

- An assets register
- A maintenance schedule
- A job card and
- History record card

2.3 ROAD CONSTRUCTION EQUIPMENT FINANCING IN GHANA

According to Diabene 2008, road construction equipment financing in Ghana can broadly be categorised into there (3)

- 1/ Financing through equipment dealers
- 2/ Financing through Financial Institutions
- 3/ Financing through clients

Tables 2-6, 2-7 and 2-8 below give summaries of these methods.

2.3.1 Equipment financing through Dealers.

Tables 2-6 Equipment financing through dealers

Company	Interest rate	Conditions
Mantrac Ghana Ltd.	24% for Gh¢ 12% for US\$	50% down payment and 50% spread over 6 – 12 months
Multi-Tech Services Ltd.	24% for Gh¢ 7.5% in US\$	15% down payment and 85% spread over 36 months
Ghana Heavy Equipment Ltd.	10% for Gh¢	50% down payment and 50% spread over 12 months

The results of the three equipment dealers investigated by Diabene (2008) are summarized in Table 2-6. It can be seen that the lowest interest rate of 10% in Gh¢ was offered by GHEL while Multi-Tech offered the lowest interest rate of 7.5% in US\$ and the lowest initial down payment of 15% with remaining spread over a longer period of 36 months.

2.3.2 Equipment financing through Financial Institutions.

A comparison between the two financial institutions interview by Diabene (2008) are summarized in table 2-7 below.

Tables 2-7 Equipment financing through Financial Institutions

Company	Products	Interest rate
Amalgamated Bank	Discounting of PCs and IPCs	N/A
	Commercial loans	N/A
	Equipment Financing loans (Gh¢)	29.5%
National Investment Bank	Equipment Financing loans	N/A
	Commercial loans	N/A
	Supply Equipment loan (US\$)	7.5 %

2.3.2.1 The supply Equipment Programme

The Ministry of Transportation (MoT), in its usual attempt to solve the problem of non availability of road construction equipment to contractors, initiated the Supply Equipment Programme (SEP) in the year 2006. It was a joint effort involving the Client, a Financial Institution and an Equipment Dealer.

Under the SEP, the Ministry guaranteed loans from NIB in the form of road construction equipment supplied by Multi- Tech Limited. The brand of equipment was Volvo and the main equipments dealt in were motor graders, rollers, tipper trucks and excavators. Even though arrangements for the facility started earlier, the actual disbursement of the loan (distribution of the equipment) was effected between June and October 2006. The supply was in two batches. Forty-three (43) contractors benefited from the first batch and the second batch is yet to be distributed.

Conditions for the loan

1. Since no collateral was demanded, the ownership of the equipment was to remain in the name of NIB. Transfer was to be effected when a contractor completes with the repayment of the loan.
2. Multi- Tech Limited trained the contractors' operators since they were not familiar with the Volvo equipments.
3. The equipment were comprehensively insured and charged against the loan.
4. All payment certificates raised by beneficiary contractors were to be honoured only through NIB so that payments for the loan could be

deducted. All beneficiary contractors were required to open accounts with the bank.

5. The repayment period was thirty-six (36) months with an interest rate of 7.5% per annum.

Challenges associated with the programme are discussed in Chapter 4.

2.3.3. Equipment Financing through Client

The Client (Government of the republic of Ghana) sponsored equipment financing programs for contractors in Ghana since 1985 have been summarized in Table 2-8 below.

2.3.3.1 The Feeder Road Improvement Project (FRIP)

The FRIP was funded by EU. Arrangement under FRIP to equip contractors was similar to that of the Rural Livelihood Project (RLP) except that the amount given was 30% of the cost of the equipment. Even though the programme benefited only two (2) contractors and the pieces of equipments involved in the program were few, it was successful in that contractors could pay for and own the equipment.

2.3.3.2 The Rural Livelihood Project (RLP)

The DFID sponsored the RLP as part of the RSDP to eliminate rural poverty. During this program, contractors who were awarded contracts, apart from the advance mobilisation loan, were given another 15 - 20 % of the contract sum to purchase needed

equipment. The payments were made direct to Suppliers of the equipment. The contractor paid the rest of the cost with deductions from PC's.

Table 2-8 Client sponsored equipment acquisition programmes in Ghana.

Name of programme	Financing agency	Collaborating Bank	Number of beneficiaries	Period
Supply Equipment Programme	GoG	NIB	43	2006 - Date
Feeder Roads Improvement Programme	EU	N/A	2	2007 - Date
Rural Livelihood Project	DFID	N/A	5	2002 - 2007
National Feeder Roads programme	WORLD BANK	A D B	21	1997 - 1999
	GOG		5	1991
	DANIDA		16	1994
	USAID		12	1994
Second Highway Project	WORLD BANK	B H C	21	1985 - 1992
Third Highway Project			19	
Fourth Highway Project			26	
TOTAL			170	

(Adapted from Diabene, 2008)

2.3.3.3 The National Feeder Roads Program

The NFRP took place between 1987 and 1996 .During this program, a revolving fund managed by ADB was used as an equipment loan scheme for Labour Based Contractors who had been trained by DFR in road maintenance techniques. Each beneficiary contractor had a set of equipment worth US\$ 150,000 renewable every four year. Each was also guaranteed a minimum of US\$ 200, 000 worth of contract annually for four (4) years in order to be able to service the loan. The contractors were selected by DFR and were assessed by ADB. The loans were scheduled for repayment within four years. A contractor was rescheduled for another four years if they were unable to pay within the first four years.

The program could not be sustained after 2006 because donor funds ceased to flow.

According to Eyiah and Cook (2003), other factors that led to the non sustainability of the programm were:

1. Contractors deliberately commercialised the equipment
2. Non availability of after sales servicing and maintenance leading to equipment breakdown.
3. Lack of commitment to repay on the part of some contractors leading to cash flow problems.
4. Excessive delays on the part of the client in honouring claims.

2.3.3.4 The Highway Projects

The second, third and fourth highway projects took place between the mid-eighties and the early nineties and was managed by the GHA. During these programs, the Ministry of

Roads and Highways collaborated with the BHC to equip contractors who were working on the various maintenance contracts. Loan from the World Bank was used to purchase equipment by BHC and supplied to contractors on hire-purchase bases to enable them complete the maintenance projects under the program. Some of the equipments supplied were tipper trucks, graders and water bowsers. The program sponsors acknowledged the need for contractors to compete in order to grow. Contracts were therefore awarded on competitive basis. Some of the contractors took this as an opportunity to engage in more lucrative jobs whilst others who lacked technical competence to bid competitively could not service their loans. Other factors that led to the non success of the program were the lack of parts to maintain the equipment and the falling value of the Ghanaian cedi to the US dollar. The loans were contracted in US dollars but proceeds from contracts to pay back were in Ghanaian cedis. This led to the seizure of the equipment from defaulting contractors (Eyiah and Cook, 2003).

2.4 SOME SUCCESSFUL STORIES OF PLANT POOLING

2.4.1 The ACEL of Philippines

The construction industry in the Philippines saw an upscale of activities in the mid-sixties. There were massive infrastructural development in all sectors of the economy such as transport, power, irrigation, commercial housing and real estate development. A major challenge of the time was availability of construction equipments to meet the increasing demand. The cost of purchasing equipment was prohibitive and there were no sources of financing. The only possible way of overcoming the challenge was to pool

resources together and share. This brought together eight (8) contractors to form the Associated Construction Equipment Lessors (ACEL) in May 1966.

ACEL first introduced the practice of equipment leasing and rental which is considered today to be the best alternative to owning and maintaining equipment in the Philippines. The group agreed and standardized equipment rental rates that applied to all members owning and operating the same type of equipment. They also formulated and Standardized an Equipment Rental Requisition Form that was used as the basis for rental contracts. They have also published a guidebook which includes equipment specification, profile and performance. The guidebook is useful in equipment sourcing and identification even for those who are not very knowledgeable with equipments.

(<http://www.acel.com>).

2.4.2 The Plant Pool project in Armenia

Armenia is a breakaway republic from the former Soviet Union. Together with Azerbaijan and Georgia, they form the Southern Caucasus.

Like most of the Former Soviet Union (FSU) countries they inherited outmoded and worn out equipment from the previous era. Most of the equipment in these countries were manufactured in the Soviet Union and acquired before 1990. Road construction and maintenance companies were few and small in size and with very low equipment holding. The equipment were also poorly managed.

Armenia received a World Bank loan of about US\$ 2.6 million and used it to purchase western road construction and maintenance equipment with another US\$ 0.4 million for an asphalt emulsion plant. The equipment is currently administered by a special

company, the Plant Pool, under the subordination of the Ministry of Transport of the republic.

The only challenge encountered in this programme was the insufficient use of the equipment due to high rental rates. (World Bank 2000).

2.4.3 Equipment Pool Companies (EPC)

According to Lantran (1992), a more optimum use of road maintenance equipment can be achieved in developing countries by setting up equipment rental schemes within Road or Highway agencies. These schemes can serve both force account maintenance units and contractors who lack the capital and equipment for maintenance works contracted to them.

Under the Road Maintenance Initiative (RMI) which encouraged sub-Sahara African countries to enhance the efficiency of road maintenance operations, many highway agencies were encouraged to open the road maintenance market to private domestic contractors. The domestic contractors often lacked the equipment and capital and many had to rent equipment to perform the works contracted to them. A successful way of meeting the equipment needs of these contractors and the agency's maintenance units was to establish commercial firms (Equipment Pool Companies or EPCs) to manage the agencies' fleet and rent it out to both the agencies' maintenance units and the private contractors. It was a first step towards full privatization of equipment provision in a competitive environment (Lantran 1992)

Under the World Bank / IDA Transport Sector Projects, some EPCs were established.

The government of Burkina Faso and Central Africa Republic established EPCs under a

management contract with private operators. In Guinea a parastatal firm was incorporated to operate both as an EPC and a maintenance contractor and was later privatised. An existing EPC in Cameroon was rehabilitated and a private sector EPC was established in Tanzania to service private contractors (Lantran 1992).

2.5 PLANT POOLS IN GHANA

2.5.1 Plant Pool Limited (PPL)

Plant Pool Limited was established in Ghana by a German firm as a plant hire company. It was later jointly owned by the Bank for Housing and Construction (BHC), the Social Security and National Insurance Trust (SSNIT) and the Government of Ghana (GoG) in 1975 to provide plant and equipment hire services to the construction, mining and timber industries. BHC owned 60% shares, SSNIT owned 20% shares whilst the remaining 20% was owned by GoG. BHC was one of the banks owned by government and created as a Development Finance Institution to provide support for some targeted activities in the country including construction (Eyiah and Cook, 2003).

PPL, between 1987 and 1993, faced a lot of financial difficulties which were attributed to mismanagement. Its foreign exchange debt had grown very large due to the depreciation of the cedi which was as a result of the relaxation of foreign exchange controls in the country. Almost all their equipment had broken down. They could not purchase spare parts to service them because there were no mechanisms and procedures to check and stop proceeds from hiring of the equipment from getting into private individual pockets. Operators either ganged up with contractors to cheat in the payment

of rent or with mechanics to remove and sell machine parts whilst they replaced them with older or malfunctioning ones.

In 1992 BHC benefited from the World Bank's Financial Institutions Restructuring Programme under which they were advised to liquidate Plant Pool limited. The world Bank however gave BHC a second chance and assisted them to put Plant Pool Limited under a new management in 1993. Before the take over by the new management Plant Pool Limited were indebted to the tune of Gh¢ 650,000 in equipment loan and bank overdrafts. Their equipment fleet stood at only:

2 No. Old Motor graders

2 No. Old Still drum rollers

1 No. Old Low Loader

1 No. Old Bulldozer and

3 No. Broken down articulator trucks (Non tipping)

With an approval from the board of directors the new management decided to enter into road construction as the way out.

By the year 2002 there was a tremendous recovery at PPL. They had reduced their indebtedness to only Gh¢ 45,000 with \$600,000 credit in their account. They also expected Gh¢140,000 from their certified works done. They were also able to increase their equipment fleet by:

1 No. New Motor grader

1 No. Old Low Loader

1 No. New Pay Loader

1 No. Water Bowser

5 No. Fairly New Pay Loaders

10 No. Reconditioned Tipper trucks

12 No. Concrete mixers

- | | |
|---|-------------------------------|
| 3 No. Reconditioned Articulator trucks (Tipper) | 1 No. Bitumen distributor and |
| | 1 No. Truck mounted crane |
| 4 No. New Tipper trucks | |

Even though PPL was progressively doing well, they went liquidated in 2003 because their parent company BHC went liquidated.

(Private conversation from Ray Markings, 2009)

KNUST

2.5.2 J. A. Plant Pool (Ghana) Limited

Following the demise of PPL a new company, J. A. Plant Pool (Gh) Limited, took over their assets and operations. The new company was registered in 2007 and became fully operational in March 2008. It has offices and depots in all the regional capitals in Ghana. It has over a 100 equipment population comprising tipper trucks, water tankers, motor graders, bulldozers excavators, loaders, farm tractors, luxurious buses and sanitation equipments. J. A. Plant Pool (Gh) Limited have also set up a training school to train Mechanical Technician Engineers from the Polytechnics free of charge.

With the help of modern technology, J. A. Plant Pool (Gh) Limited have put in place measures to manage their operations to curtail the experiences of Plant Pool Limited. For example they have a GPS system that helps them to identify the location of their machines at any point in time. They can also determine whether the machine is idle or working.

METHODOLOGY

3.1 DESK STUDY

Available literature on the subject matter was reviewed to obtain information and also secondary data for the research. Materials were in the form of publications, journals, reports, manuals, working papers and text books obtained from libraries and the internet. The materials covered Equipment management (i.e. selection, acquisition and maintenance), the construction sector in Ghana and, classification of contractors in Ghana.

3.2 FIELD STUDY

3.2.1 Identification of stakeholders

Stake holders in the road construction sector were first identified. These were Contractors, representatives of the Client who are officials of the Road and Highways Ministry and its road agencies, Consulting Engineers, Financial Institutions, Equipment suppliers and plant hire companies. Questionnaire were designed to collect primary data needed to achieve the objectives of the research. The questionnaires were made up of both open and close ended questions seeking factual information, opinions and suggestions from the respondents. Separate sets of questionnaire were designed for the various stakeholders. This method of sampling known as the purposive sampling was used since it is only these stakeholders who can provide the data needed for the research. Samples of the questionnaire used can be found in appendix 1

3.2.2 Interview with Contractors

Questionnaires administered to contractors were in five sections. The **Background Data** section sought information on the contractors name, technical category and financial class as well as contact telephone numbers. The **equipment ownership** section sought information on the contractors' equipment holding, mode of acquisition, usage and management. It also sought their opinion on their preferred source of equipment, either through a bank loan or a plant pool. The financial commitment section requested information on their commitment to the bank in terms of equipment loan and the loan management section was on how they intended to pay back their loans. The work load and annual turnover section requested information on their work load and annual turnover.

Questionnaires were administered to twenty-three (23) of the forty-three (43) contractors who benefited from the 'Supply Equipment' Programme and a hundred and two (102) other contractors. These contractors were targeted at the offices of the road agencies where they do business since most of them could not be located at their offices.

3.2.3 Interview with Client's representatives

Questionnaires administered to the client's representatives sought information on the 'Supply Equipment, Program and their opinions on equipment acquisition by bank loan and through plant hire. The client's representatives comprised officials of the Ministry of Roads and Highways (MRH), Ghana Highway Authority (GHA), Department of Feeder Roads (DFR), Department of Urban Roads (DUR), Ghana Road Fund Secretariat (GRFS) as well as Consulting Engineers involved in road maintenance activities.

3.2.4 Interview with equipment companies

3.2.4.1 Equipment suppliers

Questionnaire was administered to Multi-Tech Services Limited, suppliers of the Volvo equipment that were distributed to contractors in the 'Supply Equipment program'. The questionnaire sought to find out the pieces of equipment available for supply and the challenges encountered or successes achieved in the 'Supply Equipment programme'. Mantrac Ghana Limited was also interviewed.

3.2.4.2 Plant Hire Companies

Questionnaires were administered to two organised plant pools in Ghana, J.A. Plant Pool Limited in Accra and Naachaa Plant Pool Limited in Kumasi. The questionnaire sought to find out the equipment availability, the terms of payment and the levels of patronage to these equipment for hire.

3.2.5 Interview with the National Investment Bank

Questionnaires sent to the NIB sought information on the performance of the beneficiaries of the "Supply Equipment Program" and the challenges encountered. It included the Bank's opinion on financing equipment loans like the "Supply Equipment Program" or financing the establishment of plant pools.

Ten questionnaires were sent to the bank (one to each region) so that different opinions could be sought on financing plant pools and individual ownership.

Chapter four

DISCUSSIONS AND ANALYSIS

4.1 RETURN OF QUESTIONNAIRE

4.1.1 Responses from contractors

Table 4-1 below indicate the distribution of questionnaire sent out to contractors and the responses received. These contractors were in both technical category A and B. Fifty-nine responses were received out of one hundred and twenty-five sent out giving a response rate of 47.2 %.

The road construction industry was experiencing a recess because contractors had not been paid for work done for over a year. They were therefore not interested in anything that will not bring them money directly. This might have influenced the response rate.

Table 4-1 Response from Contractors

Financial Class of contractor	No. sent out	No received	Response rate
1	4	3	75.0 %
2	16	10	62.5 %
3	75	39	52.0 %
4	25	7	28.0 %
Total	125	59	47.2 %

4.1.2 Responses from client's representatives

Table 4-2 below indicate the distribution of questionnaire sent out to the client's representatives and the responses received. Seventy-one responses were received out of one hundred sent out giving a response rate of 71.0 %. Respondents belonged to the top management, i.e. Directors, Chief and Principal Engineers, Regional Directors and Managers as well as Metro Engineers.

There were a lot of disorganization within the Ministry of Transportation and its agencies due to mass transfer of personnel as a result of the change in government. This might have influenced the response rate.

Table 4-2 Response from Client's representatives

Organization	Number sent out	No received	Response rate
MRH	10	5	50.0 %
GHA	20	11	55.0 %
DFR	40	36	90.0 %
DUR	20	14	70.0 %
GRFS	5	2	40.0 %
CONSULTING ENGINEERS	5	3	60.0 %
TOTAL	100	71	71.0 %

4.1.3 Responses from National Investment Bank

The National Investment Bank did not respond to the questionnaire sent to them. They were reluctant to provide any information because the bank was being investigated at the time of the research by the Bureau of National Investigations (BNI) on certain activities of theirs.

4.2 CONTRACTORS' EQUIPMENT OWNERSHIP AND USAGE.

Contractors are expected to own a certain minimum set of equipment before they are classified into a category and class. Table 4-3 indicates the percentage of respondents who claimed to have the full complement of equipment required in their category and class. The responses suggest that on the average 33.9% of respondents have all the required equipment to be in their classes. However the situation is better with Class A1 contractors (66.6%).

Table 4-3 Contractors with all the required equipment in their category

Class of contractor	No of contractors responding	No. of contractors having all required equipment	% of contractors having all required equipment
1	3	2	67
2	10	2	20
3	36	14	39
4	7	1	14
Total	56	19	34

Analysis of the responses in terms of the different pieces of equipment was also made. The summary of the analysis is presented in Table 4-4 whilst details of it can be found in Appendix 2.

It can be noticed from Table 4-4 that only A3 contractors own 31% and 6% more graders and rollers respectively than the Ministry's requirement. A1 contractors also own 33% more wheel loaders than specified. On the average contractors own less than the specified number of all pieces of equipments apart from wheel loaders.

Table 4-4 Contractors' equipment ownership.

EQUIPMENT	% COMPLIANCE				
	A1	A2	A3	A4	AVERAGE
Motor Grader	66.8	85	131	86	92
Excavator	66.8	50	8	-	42
Tipper Truck	36	45	60.5	64.5	52
Bulldozer	41.2	55	47	-	48
Road Roller	33.3	55	106	29	56
Low Loader	66.5	70	-	-	68
Bitumen distributor	67	50	-	-	59
Chipping distributor	11	50	11	-	24
Water bowser	0	20	42	-	21
Wheel Loader	133	80	-	-	107

Table 4-5 indicates the average number of hours per year that respondents use their equipment. This was obtained by dividing the number of hours the equipment had worked since acquired by the number of years it has been kept. It must be noted that the nine respondents who provided such information are all beneficiaries of the Supply Equipment Programme. This is because they are compelled by the suppliers of the equipment to keep such records. The most used equipment is the tipper truck (78%) followed by the motor grader and wheel loader (51%) and the least used is the road roller (17%). The average usage compared to standards indicate a high rate of equipment idling.

Table 4-5 Contractors' equipment usage.

Equipment	No. of Hours/year				% Usage
	Minimum	Maximum	Average	Standard (Multi-Tech)	
Wheel Loader	629	1966	1270	2500	51
Excavator	2800	1357	1029	2500	41
Tipper Truck	238	4118	1952	2500	78
Motor Grader	746	2000	1272	2500	51
Road Roller	200	600	429	2500	17
Bulldozer	312	1500	1011	2500	40
Average					46

(Source of standard usage: Multi-Tech Limited)

Table 4-6 compares contractors usage of equipment with their economic life. As indicated, it will take between 10 and 12 years to recover any investments made in the equipment at that rate of use. This does not make it economical.

Table 4-6 Contractors' equipment usage compared with their economic life.

Equipment	Ave.No. of Hours/year	Ave. Economic life (Hours)	No. of years to recover investment
Excavator	1029	10000	10
Tipper Truck	1952	20000	10
Motor Grader	1272	15000	12
Bulldozer	1011	10000	10

(Source : Caterpillar handbook)

4.3 EQUIPMENT MANAGEMENT

It is required that contractors who own equipment must manage them well. They must keep records on the equipment, have depot and workshop facilities as well as competent technical personal to man them. The questionnaire sought to find out how contractors manage their equipment. Table 4-7 indicates their responses. The results show that only 16% of respondents do record keeping, 47% have depot facilities, 25% have workshop facilities and 25% have competent workshop personnel. These values are rather on the lower side. It may be assumed that the 56% who do not own workshop facilities use other private workshops.

Table 4-7 Contractors' equipment management.

	Record keeping on equipment	Possession of own depot facilities	Possession of own workshop facilities	Competent workshop personnel
Yes	16%	47%	25%	25%
No	61%	32%	56%	53%
Not responding	23%	21%	19%	12%

4.4 EQUIPMENT AVAILABILITY AND PATRONAGE AT PLANT POOLS

Appendix 7 contains equipment commonly stocked at plant pools and their hiring rates. The survey indicated that equipment stocked at plant pools are mainly earth moving equipment that are used both by road contractors and mineral mining companies. Plant Pools do not stock equipment or plant that are used solely for road construction and maintenance like Bitumen distributors, chipping spreaders, asphalt pavers concrete batchers/mixers and road markers. Patronage of the equipment by Road contractors is low (2 on a scale of 1 to 5). Their major clients are the mineral mining companies since they pay higher and their payments are also regular. Plant pools require advance payment before giving their equipment out to contractors. However they are prepared to negotiate or arrange payment terms with the MRH on behalf of contractors. Their major problem with MRH as an employer is not how long her payments are delayed but its irregular nature. The charges are per hour and in US dollars or its equivalent.

4.5 PREFERENCE FOR EQUIPMENT ACQUISITION METHOD

4.5.1 Contractors' view

Table 4-8 Contractors' preference of equipment acquisition method

Class	Total no. responding	No. preferring Plant pool	No. preferring Equip. Loan	No. not decisive	% preferring Plant pool
1	3	0	3	0	0
2	10	7	1	2	70
3	36	33	1	2	92
4	7	5	1	1	71
Total	56	45	6	5	80

From Table 4-8, forty-five (45) of respondents forming 80% indicated that they would prefer plant pools as their source of needed equipment. Six respondents representing 11% preferred equipment loans whereas five (5) representing 9% were not decisive. Those who preferred the equipment loans were mainly the Class one contractors. The reasons given are as follows:

In favour of plant pool:

1. It is more economical and convenient to use equipment from plant pools. Whilst a contractor would spend time and resources to repair his broken down equipment, hired equipment will immediately be replaced when it breaks down.
2. The problem of pilfering and misuse of equipment will also be eliminated with plant pools.
3. Payment terms can be arranged with plant pools.

4. There would not be commitment to any financial institution.
5. It is difficult to obtain capital loans from banks. They also come with high interest rates.
6. Contractors would have enough free working capital.
7. Hired equipment would not idle as compared to owned equipment.
8. The way payment certificates are delayed before they are honoured does not help in the repayment of loans.

In favour of equipment loan

1. Contractors rush to complete works when equipment is hired. This may lead to shoddy work being done.
2. Hiring of equipment comes with discomfort.
3. Some just wanted to own the equipment for prestige.

4.5.2 Client's representatives' view

Seventy-one (71) out the hundred (100) questionnaires administered to the client's representatives were returned.

Fifty-three percent (53%) of respondents believed that client sponsored or facilitated equipment loans have helped to solve the problem of equipment to a medium extent whilst (29.5% felt that it is to only a low extent. 12.7% felt it has been solved to a high extent.

Ninety-two percent (92 %) of respondents felt that plant pools can help solve the problems of equipment better than equipment loans whilst seven percent (7%) felt otherwise. The following were reasons given:

In favour of plant pool:

1. Contractors will have easier access to equipment through plant pools than equipment loans.
2. It is uneconomical for contractors to own equipment since the equipment are idle most of the time. Those from a plant pool will not idle since they would be hired only for the duration needed.
3. Since equipment loans lock up the working capital of contractors, they are compelled to work with whatever equipment they have resulting sometimes in using inappropriate equipment for particular activities.
4. Hiring from a plant pool will free the contractor's working capital.
5. Small and Medium scale contractors who form the bulk of road contractors in Ghana do not have the financial capacity to own equipment.
6. The terms of payment could be negotiated with plant pools.
7. The burden of plant management will be off the shoulders of the contractors so that they can concentrate on their core business. This will also ensure better management of the equipment in terms of maintenance and operation since it is the core business of the plant pool.
8. Contractors would be compelled to plan and program well for the works before bringing in hired equipment. With the planning, and programming, the overall progress of the project will be improved.
9. ~~There would not be the need to use plant ownership as criteria for contractor~~ classification.

10. Contractors will have the opportunity to choose from a range of equipment the ones that are appropriate for their operations.

Against plant pool

1. Payments to contractors by the Client are not regular enough to make them capable for paying their rentals.
2. Planning may become difficult for contractors because they will have to depend on plant pools.

The reason that payment to contractors are not regular enough to make them able to pay for the rentals is not tangible enough because if that is true, then they can't as well pay for loans.

It may be noted that DFR have had and continue to have bridges programmes in which some of Ghana's development partners supply the department with steel bridge components which are installed by local Ghanaians contractors under the supervision of the Department and private Civil Engineering Consultants. Example of these programmes is the JICA small and medium Bridges I & II, the D F I D bridges, the Spanish Bridges and the American Bridges.

In each of these programs, contractors who undertook the installation of the bridges successfully shared common sets of equipment and tools even though the projects were scattered in all regions in the country. The equipment and tools were in the form of trucks, cranes, lashing nose, lashing pad, winches and hand tools. This suggests that sharing common equipment is a viable option.

4.6 ANNUAL TURN OVER OF CONTRACTORS

Table 4-9 shows the average nominal turnover of Contractors by class. The values have been converted to US dollars using the average annual exchange rates for the respective years shown in Table 4-10. The trend has also been plotted in Figure 4-1. The results were obtained from 3 contractors for Class 1, 5 contractors for Class 2, 22 contractors for Class 3 and 6 contractors for Class 4, though not all contractors provided information for all the years. The turnover generally shows an increasing trend for all classes. Class 1 appears to have made the largest improvement from less than US\$ 500,000 in the year 2000 to over US\$ 4.7million in the year 2008.

Table 4-9 Average Annual turn over of contractors in US\$

CLASS	2000	2001	2002	2003	2004	2005	2006	2007	2008
1	465,861	867,286	1,667,922	1,396,483	1,680,553	1,985,747	3,055,237	3,162,575	4,745,927
2	422,372	635,818	889,228	409,360	467,086	883,203	856,642	1,608,512	1,512,351
3	342,130	520,713	288,600	273,760	271,927	372,156	617,003	895,730	486,233
4	58,233	69,793	76,220	300,241	467,028	458,759	358,653	410,916	319,130

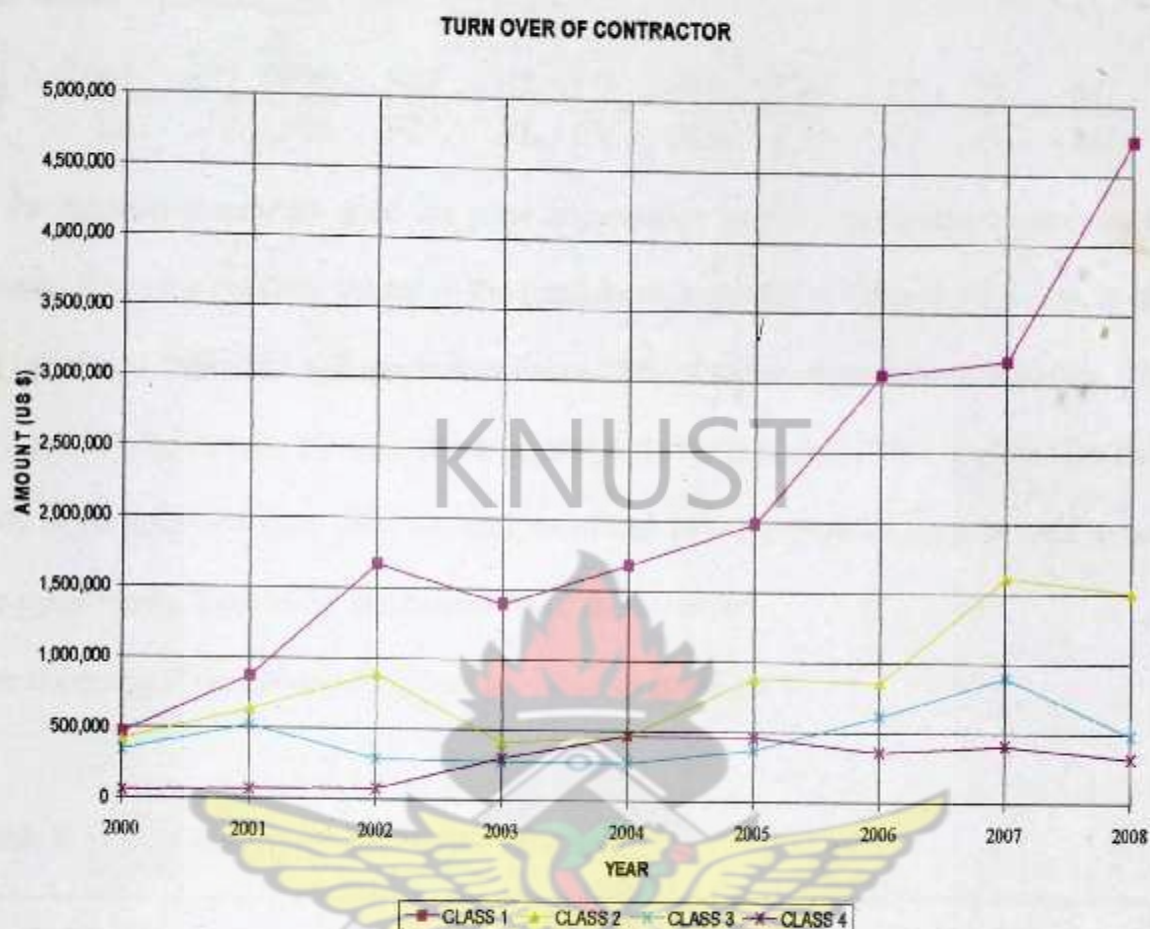


Figure 4-1 Annual turn over of contractors

Table 4-10 Exchange rate for US dollar from Year 2000 to 2008

Year	US\$ exchange rate in Gh¢	Year	US\$ exchange rate in Gh¢
2000	0.6869	2005	0.9050
2001	0.7164	2006	0.9111
2002	0.7872	2007	0.9242
2003	0.8670	2008	1.1902
2004	0.8982		

(Source : Bank of Ghana)

The Baxter's formula,

$$P_n = x + a \frac{LL}{LL_0} + b \frac{PL \times FE}{PL_0 \times FE_0} + c \frac{FU}{FU_0} + d \frac{BI}{BI_0} + e \frac{CE}{CE_0} + f \frac{RS}{RS_0} + g \frac{CH}{CH_0} + h \frac{TI}{TI_0} + i \frac{PC}{PC_0} + j \frac{MI}{MI_0}$$

is the formula commonly used for price adjustments in road construction contracts in Ghana. From the coefficients use in the formula as indicated in Table 4-12 below, it can be calculated that plant and equipment forms 28% of the contract sum or turnover. The rest are 5% for labour, 10% for mark-up and 41% for materials. This implies that only 38% of the turn over (i. e. 28% for equipment and 10% for mark-up) can be used to pay for equipments. Table 4-12 indicates 38% of the turnovers.

The meaning of the abbreviations are provided as appendix 8

Table 4-11 Coefficients for Baxter's formula

Construction activity	Partial Coefficient											TOTAL
	x	a	b	c	d	e	f	g	h	i	j	
Site Clearance	0.10	0.03	0.65	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.11	1.00
Gravelling/ Earthworks	0.10	0.02	0.63	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.12	1.00
Concrete Works	0.10	0.04	0.05	0.01	0.35	0.00	0.34	0.00	0.00	0.00	0.11	1.00
Formwork	0.10	0.15	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.25	1.00
Reinforcing Steel	0.10	0.04	0.06	0.02	0.00	0.65	0.00	0.00	0.00	0.00	0.13	1.00
Precast Concrete Pipes	0.10	0.02	0.17	0.05	0.00	0.01	0.00	0.00	0.00	0.52	0.13	1.00
Surfacing	0.10	0.03	0.18	0.09	0.13	0.00	0.00	0.00	0.33	0.00	0.14	1.00
Haulage of Aggregates	0.10	0.02	0.58	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.12	1.00
General Items	0.10	0.08	0.22	0.04	0.00	0.05	0.02	0.02	0.08	0.00	0.39	1.00
Average	0.10	0.05	0.28	0.07	0.05	0.08	0.04	0.06	0.05	0.06	0.17	1.00

Table 4-12 Portion of annual turn over of contractors for plant and equipment in US\$

CLASS	2000	2001	2002	2003	2004	2005	2006	2007	2008
1	177,027	329,569	633,810	530,664	638,610	754,584	1,160,990	1,201,778	1,803,452
2	160,501	241,611	337,907	155,557	177,493	335,617	325,524	611,234	574,693
3	130,009	197,871	109,668	104,029	103,332	141,419	234,461	340,377	184,768
4	22,128	26,521	28,963	114,092	17,747,062	174,329	136,288	156,148	121,269

4.7 THE SUPPLY EQUIPMENT PROGRAMME (SEP)

4.7.1 Challenges associated with the SEP

- a/ The procedure used for the selection of beneficiaries is neither documented anywhere nor known to officials of MRH and NIB. There was therefore lack of transparency in the selection process.
- b/ Selection of the brand of equipment did not involve the contractors, neither did they have a choice as to which type of equipment they would like.
- c/ Interest on the loan is US dollar rated. It therefore becomes high as the Ghanaian cedi falls in value against the US dollar.
- d/ Beneficiary contractors complain that NIB takes about 75% of their payment to service the loan leaving them virtually nothing to work with. From table 4-11 the maximum should have been 38%.
- e/ Beneficiaries cannot secure enough jobs to be able to pay back the loan because they would have to compete for these jobs. Unlike some previous similar programmes, where beneficiaries were guaranteed jobs to be able to pay back,

the procurement act does not permit these contractors to be favoured in the procurement of any public works.

- f/ Some of the beneficiaries are not sincere to the bank. They manage to receive their payment transfers through other banks, especially those that do not come from MRH, thereby denying the bank of the loan repayments.
- g/ Contractors do not maintain the operators that were trained by Multi-Tech Limited to operate the equipment

(Source: Private interview with contractors, bank official, Multi-tech Limited official and MRH official)

4.7.2 Performance of SEP

In the survey of Contractors' financial commitment to the Bank, **nine (9)** out of forty-three (43) beneficiaries of the SEP responded. Table 4-13 indicate the performance of these eleven beneficiaries in the repayment of their loans.

Almost at the end of the 36 months repayment period, about 56% of respondents have paid less than half of what they are supposed to pay. The performance of contractors in terms of loan repayment does not follow any trend in contractors' class. Factors that have affected the repayment have been explored in the previous section (under challenges associated with The Supply Equipment Programme).

Table 4-13 Performance of the supply Equipment programme

NO.	CLASS	PRINCIPAL (P) BORROWED IN 2006 (US\$)	PRINCIPAL WITH COMPOUND INTEREST AS AT 2009 (P + I) (US\$)	AMOUNT PAID (US\$)	AMOUNT DUE (US\$)	% PAID
1	A3	130000	162628	32628	130000	20
2	A3	1265940	1583670	421253	1162418	27
3	A3	1145543	1433056	500118	932938	35
4	A2	1646362	2059572	852241	1207332	41
5	A3	570000	713061	343061	370000	48
6	A2	2743936	3432621	2115531	1317089	62
7	A3	561958	703001	474705	228295	68
8	A2	658545	823829	659193	164636	80
9	A2	1200000	1501181	1361781	139400	91
SUM		9922282	12412619	6760510	5652108	54

4.7.3 Annual turnover of contractors and the Supply Equipment Programme (SEP)

The averages of the debt of Class 2 and Class 3 contractors (ie P + I) are calculated from Table 4-13 for a year. Their respective annual turn over are also calculated from Table 4-12 for years 2006, 2007 and 2008 which were the loan years. These are presented in Table 4-1. A comparison of the figures indicate that the turn over are lower than the loan and hence cannot pay for them.

Table 4-14 Average turn over and SEP loan debt

	Class 2	Class 3
Ave. Annual turnover (US\$)	1 325 835	666 322
Portion(38%) of Average annual turnover for equipment (US\$)	503 817	253 202
Average loan debt per year (US\$)	651 433	306 361
38% of Ave. Annual turnover as a percentage of average loan debt per year (%)	77	82

4.7.4 Growth of contractor numbers in Ghana

As indicated in Table 4-15, the numbers of **category A** contractors in Ghana have grown from a size of one hundred and ninety-three (193) in the year 2002 to one thousand five hundred and three (1,503) in 2009. This represents an increase of a thousand three hundred and ten (1,310) and an average growth rate of 40.8% per annum. Within the same period, fifty (50) contractors, representing 3.8%, benefited from the client's (MRH) facilitated programmes to equip contractors. This clearly indicates that individual equipment ownership programs benefited only a small fraction of contractors.

Table 4-15 Growth of contractor numbers in Ghana

Year	No. of contractor in each class				Total
	1	2	3	4	
2002	17	22	80	74	193
2008	24	67	546	866	1503

Chapter five

CONCLUSIONS AND RECOMENDATIONS

5.1 CONCLUSIONS

Using information obtained from the literature review and interview and the discussion and analysis made in the foregoing chapters, the following conclusions can be made:

5.1.1 *Equipment ownership and management*

1. Sixty-six percent (66%) of contractors do not have the basic equipment that qualifies them to be in their class. This is an indication of a low level of equipment ownership.
2. Equipment owned by contractors are over 50% of the time idle due to insufficient work. It is therefore impossible for enough returns to be generated to offset any investments made in them.
3. Contractors do not have the capacity to manage well the equipment they own.
 - (a) Over 80% of contractors do not keep records on their equipment.
 - (b) Over 75% of contractors do not have workshops nor qualified personnel to look after their equipment.

5.1.2 *Equipment loan repayment*

1. Contractors cannot effectively pay back any equipment loan they take with their turn over as it is now. The portion of average annual turn over of class 2 and 3 contractors that can be dedicated to loan repayment can cater for only 71% and 82% respectively of their loan debt.

2. Equipment loans given to contractors in the country have not performed well in terms of the number of beneficiaries and repayment. At the end of the repayment period, only 54% of the loans had been repaid.

5.1.3 Plant pool concept

1. The major cause that led to the collapse of earlier plant pools in Ghana was mismanagement.
2. There is a competition between the road construction industry and the mining industry for equipment. Mining has an advantage over road construction since they pay higher and promptly.
3. Financing of plant pools appears to be the preferred option by the clients representatives
4. Class A2, A3 and A4 contractors prefer plant pool as a source of equipment acquisition compared to individual equipment loans.

5.2 RECOMMENDATIONS

1. Efforts made by government and her development partners to equip road constructors must be channelled through establishment of plant pools instead of individual equipment ownership.
2. Studies must be conducted to determine how plant pools (either private or public/private partnership) can be established for road construction in the country.

3. Payments to contractors from the client (Government of Ghana) must be regular so that players of the industry can project their cash flows.
4. Contractors through their associations must form cooperatives so that they can pool their resources together for effective use.
5. Contractors should be encouraged to form joint partnerships / ventures when bidding for contracts. This means they will put their resources in the form of equipment together.



REFERENCES

African Transport Technical Notes, 1997. Road sector reform: A tale of two countries (Part1) Ghana; Serendipity or Foresight, Note No. 6, March 1997

Ambo A, 2005. Ghana – Review of Bank assistance to the transport sector. African Development Bank Operations Evaluations Department

Anvuur A and S Kumaraswamy, "Taking Forward Public Procurement Reform in Ghana", Department of Civil Engineering, University of Leeds, United Kingdom

Birmingham S. and N. Stannaries, 2005. "Why road maintenance is important and how to get it done", World Bank Transport Notes: TRN-5

Blake L S, 1989. Civil Engineers Reference Book. Oxford: Reed Educational and Professional Publishing Limited, Page 36/3-36 /13

Committee on National statistics, 2002. Summary of a workshop on Transport Indicators of Economic Growth.

Diabene B O, 2008, Financing Road construction Equipment for small and medium scale contractors in Ghana.

Eyiah K and P Cook, 2003. "Financing small and medium scale contractors in developing countries: a Ghana case study", Construction Management and economics: 21,357 -367, 2003

GHA, 2001. Road maintenance Activities, Road Maintenance Operations Manual

Harris F and R McCaffer, 1991. Management of Construction Equipment. London: MacMillan Education Limited, Pages 3-46. 80-85

Harris F. and R. McCaffer, 2001. Modern Construction Management. Oxford: Blackwell Publishers, Pages 279 – 299

Lantran J. M. 1992, "Equipment Pools for Road Maintenance" World Bank Infrastructure Notes: Transport No. RD-10, 1992

Ministry of Finance and Economic Planning, Ghana Budget 2007.
<http://www.mofep.gov.gh/budget> 2007.

Ministry of Finance and Economic Planning, Ghana Budget 2009.
<http://www.mofep.gov.gh/budget> 2009.

Ministry of Finance, Procurement Reform Proposals, A component of the Public Financial Management and Reform Programme (PURFMARP) Accra, Ghana.
Ministry of Roads and Highways, 2009. "List of contractors in good standing".

Ministry of Transportation, 2004 "Guidelines for classification of contractors for Road and Bridge works"

Ministry of Transportation, 2008, "Road Sector Development Programme 2007 Review Report"

Ofori G, 2007. "Construction in Developing Countries" Contract Management and Economics, Volume 25 Issue 1: Pages 1-6

Policies and measures for small contractor development in the construction industry
United Nations Centre for Human settlement

Stock E A, 1999. "Developing Successful Labour-Based Contractor Programs: Lessons from Ghana", World Bank Infrastructure Notes: Transport No. RD-21

The story of ACEL. <http://www.acel.com>

LIBRARY
KWAME N. RUMAH UNIVERSITY OF
SCIENCE AND TECHNOLOGY
KUMASI-GHANA

Transport Research Board, 2002. "Financial Aspects of Equipment Acquisition",
Transport Research Circular: Number E-CO47: Pages 2-4

World Bank. "Armenia and Azerbaijan Post Conflict Transport Study", Draft Final
Report. www.inweb90.worldbank.org/eca/eca.nfs

KNUST



QUESTIONNAIRE TO CONTRACTORS

BACKGROUND DATA

Name of

Contractor (Company name, address, telephone, fax, e-mail, website, etc.)

Telephone numbers where in case classification is

required

Financial & Technical class (Please tick the boxes that describe your M&T classification)

☐

A1

☐

A2

☐

A3

☐☐☐

B1

☐

B2

☐

B3

☐☐

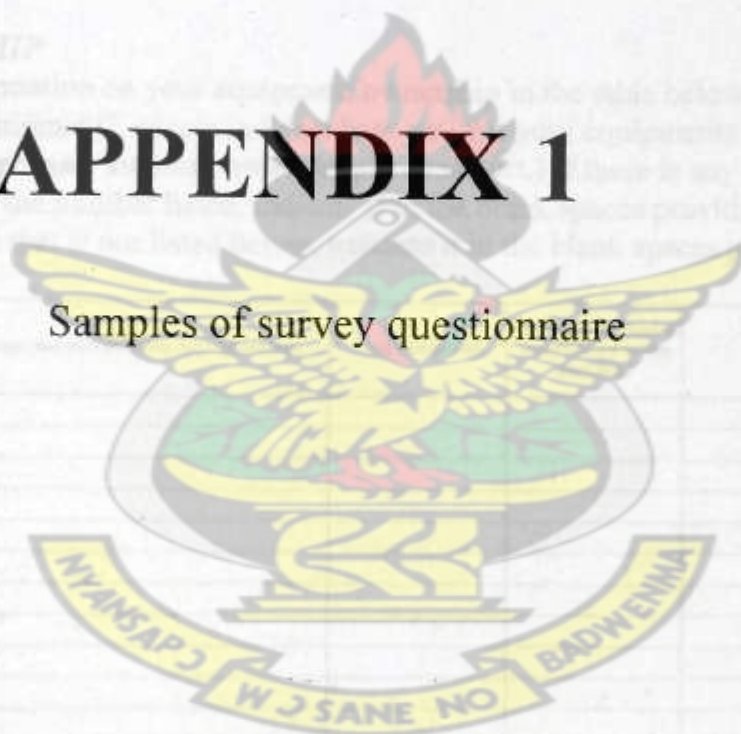
KNUST

EQUIPMENT OWNERSHIP

Please provide information on your equipment ownership in the table below. Under "How you acquired the equipment" please indicate whether you purchased the equipment, leased it, or acquired it through a loan. If you have more than one piece of equipment, please provide details for each piece. If you also have any equipment that is not listed in the table, please provide details in the space provided.

APPENDIX 1

Samples of survey questionnaire



A. QUESTIONNAIRE TO CONTRACTORS

BACKGROUND DATA

1. Name of contractor:.....
2. Telephone numbers to call in case clarification is required:.....
3. Financial & Technical class. (Please tick the boxes that describe your MoT classification.

<input type="checkbox"/>	A1	<input type="checkbox"/>	A2	<input type="checkbox"/>	A3	<input type="checkbox"/>	A4	<input type="checkbox"/>	C
<input type="checkbox"/>	B1	<input type="checkbox"/>	B2	<input type="checkbox"/>	B3	<input type="checkbox"/>	B4		

EQUIPMENT OWNERSHIP

4. Please provide information on your equipment ownership in the table below. Under "How you acquired the equipment", please indicate how you got your equipments (ie through bank loan, hire purchase, auction, outright purchase ect.) If there is any equipment that you have more than the number listed, indicate it in the blank spaces provided. If you also have any equipment that is not listed below, indicate it in the blank spaces provided.

Equipment	How did you acquire the equipment	Year acquired	Average number of hours used since acquired	Comments
Wheel Loader				
Wheel Loader				
Motor Grader				
Motor Grader				
Motor Grader				
Excavator				
Excavator				
Tipper Truck				
Tipper Truck				
Tipper Truck				
Tipper Truck				
Bulldozer				
Bulldozer				
Bulldozer				
Road Roller				
Road Roller				
Low Loader				
Road Marker				
Bitumen Sprayer				

5. If you acquired any of your equipment through an equipment loan, indicate the financial institutions from which you acquired your loan.(Please list all)

.....

6. How did you calculate the average number of hours your machines have worked in question four (4) above
- ☐ From their log books ☐ From the works done ☐ From a guess
7. Do you have a depot where you keep your equipments?
- ☐ Yes ☐ No
8. Do you have your own workshop where you services/maintain your equipments?
- ☐ Yes ☐ No
9. If your answer to question seven (8) above is yes, do you have enough qualified technical personnel to man your workshop?
- ☐ Yes ☐ No
10. If your answer to question seven (8) above is no, where do you service/maintain your equipments.
-
11. Which of the following would you prefer as a source for the equipment that you do not own but require to undertake your works (Please tick).
- ☐ Purchase with another bank loan.
- ☐ Hire from a good and reliable plant pool (with an arranged payment plan) if available in your region of work.
12. Give reasons for your answer to question eleven (11) above. (Write at the back of this sheet if you need more space)

FINANCIAL COMMITMENT

13. How much equipment loan (all put together) did you take from the financial institution (bank)?.....
14. How much do you owe the bank now (including interest)?.....

WORKLOAD AND ANNUAL TURNOVER

15. Please provide information on your annual-turnover.

YEAR	NO. OF CONTRACTS EXECUTED	TOTAL TURN-OVER (Gh¢)	TOTAL EXPENDITURE ON CONTRACTS (Gh¢)
2000			
2001			
2002			
2003			
2004			
2005			
2006			
2007			
2008			

6. Are the contracts you get adequate for you to pay back your equipment loan(s) regularly?

(please tick)

☐

Yes

☐

No

LOAN MANAGEMENT

17. If your answer in question sixteen (16) is no, how do you intend to pay back your equipment loan.

☐

Rent out the equipment(s)

☐

Sell out the equipment(s)

☐

Pay from other business proceeds

☐

Other, (Please. explain)

18. Are you doing, any of the above already?

☐

Yes

☐

No

B. QUESTIONNAIRE TO CLIENT AND REPRESENTATIVES

1. Name of Road Agency:
2. Name/Position of respondent
3. Telephone numbers to call in case clarification is required.....
4. Your Ministry (Ministry of Road and Transport) have had various programs with the National Investment Bank to equip contractors. Please list the constraints encountered in these programmes. Use back of this sheet if more space is required.
5. On a scale of 1 to 5 indicate the extent to which the problem of equipment has been improved in the road construction industry by these programmes. (1 being to no extent and 5 being to a high extent)(Please tick)

<input type="checkbox"/> 1	No extent
<input type="checkbox"/> 2	Low extent
<input type="checkbox"/> 3	Medium extent
<input type="checkbox"/> 4	High extent
<input type="checkbox"/> 5	Very high extent
6. Do you think plant pools can help solve the problem of equipment better? (Please tick).

<input type="checkbox"/>	Yes
<input type="checkbox"/>	No
7. What are your reasons for your answer in question six (6). Use the back of this sheet if more space is required
8. In your opinion which other ways can equipment be made available to road contractors to solve the problem of non availability of equipments.

C. QUESTIONNAIRE TO BANK

1. Branch of Bank:
2. Name/Position of respondent
3. Telephone numbers to call in case clarification is required.....
4. Provide the various programs you have had with the Ministry of (Roads and) Transport to equip contractors.

Programme	Year		No. of Beneficiaries
	Start	End	

5. Please list the constraints encountered in these programmes. Continue at the back of the sheet if more space is required.
6. Please provide information on beneficiaries of these programme. (Since you may not want to disclose names of beneficiaries, please use coding. Let beneficiaries appear for each program they have benefited). Continue at the back of this sheet if more space is required.

Name of Beneficiary	Class	Equipments Benefited	Year acquired	Cost of Equipment	Accrued Interest	Total Cumulative Debt	Payment Made	Outstanding Debt

7. To what extent have the problem of equipment been solved with these equipment financing programmes. (Please tick)

☐

No extent

☐

Low extent

☐

Medium extent

☐

High extent

☐

Verv high extent

KNUST

8. Which of the following do you think can help solve the problem of equipments better in terms of the number of contractors who benefit and also the recovery rate of the banks investment?

(Please tick).

☐

Loan schemes for individual contractors to purchase their needed road construction equipments

☐

Loan schemes for the establishment of construction plant pools.

9. Provide suggestions as to how your choice in question eight (8) above can be improved. (Continue at the back of this sheet if more space is required).

D. QUESTIONNAIRE TO EQUIPMENT DEALERS

BACK GROUND DATA

1. Name of Organization
2. Name/Position of respondent
3. Telephone numbers to call in case clarification is required.....

EQUIPMENTS AVAILABLE

4. Please provide information on road construction equipments available for supply. Continue at the back of this page if required

Equipment	Model	Capacity	Cost (US\$)	Working hrs. per year	Life of equipment (Yrs)

AFTER SALES SERVICES

5. List the type of payment arrangements you have with your clients who buy road construction equipments from you.
6. List the type of services you give to your clients after sales.

E. QUESTIONNAIRE TO PLANT POOLS

1. Name of Organization.....
2. Type of business ☐ Limited Liability ☐ Sole Proprietorship
3. Name/Position of respondent
4. Telephone numbers to call in case clarification is required.....
5. Please provide information on road construction equipments available for rental. List all equipments. Eg if you have ten (10) graders, list all of them (Please use back of sheet if required)

Equipment	Model	Capacity	Rental rate per day (Gh¢)	Working hrs. per day	Ave. no. of hrs. used per year

6. On a scale of 1 to 5 (1 being very bad and 5 being very good) what would you say is the level of patronage of your hiring equipments by road contractors. (Please tick)

☐ 1
 ☐ 2
 ☐ 3
 ☐ 4
 ☐ 5

7. How do you charge for the equipments rented.

- ☐ According to number of hours machine works
☐ According to volume of work done
☐ Other (Please explain)

8. What type of payment arrangements do you have with your clients who rent road construction equipments (Please tick).

L. K. K. K.
 KWAME N. RUMAH UNIVERSITY
 SCIENCE AND TECHNOLOGY
 KUMASI-GHANA

Road construction plant pools as an alternative to individual equipment ownership

☐

Advance Payment

☐

Payment after use

☐

Credit payment

☐

Other (Please explain)

9. Would you agree to credit payments if employers of your clients (Ministry of Transport) would guarantee direct payment from their payment certificates to you?

☐

Yes

☐

No

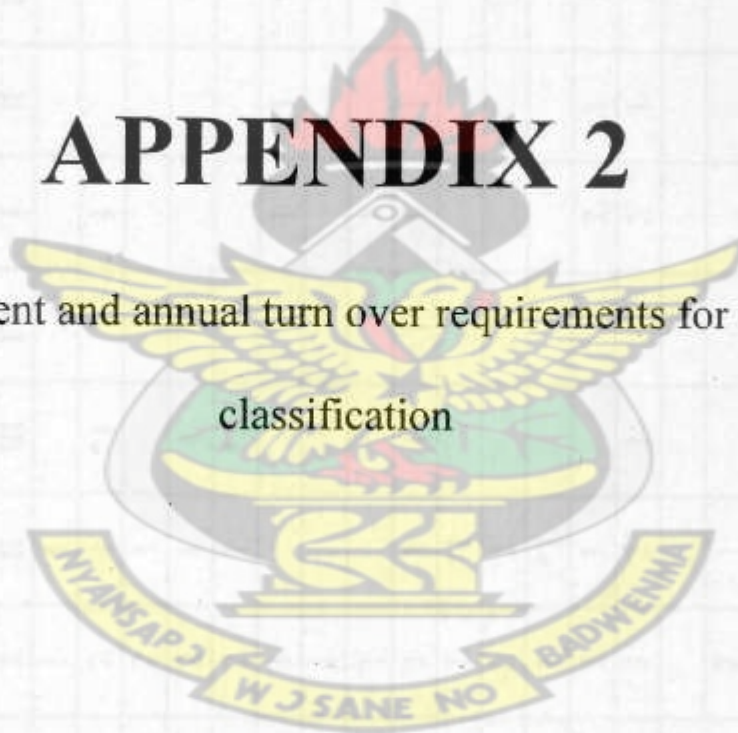
10. What in your opinion led to the collapse of some earlier plant pools in Ghana? (Please use the back of this sheet if extra space is required)



KNUST

APPENDIX 2

Equipment and annual turn over requirements for contractor
classification



CONTRACTORS MINIMUM EQUIPMENT REQUIREMENT FOR CLASSIFICATION

ITEM	EQUIPMENT	A ROADS, AIRPORTS AND RELATED TRANSPORT INFRASTRUCTURE				B BRIDGES CULVERTS AND OTHER STRUCTURES				C LABOUR INTENSIVE ROAD CONSTRUCTION & MAINTENANCE
		I	II	III	IV	I	II	III	IV	
1	Dozer 150 KW (D7)	1	1							
2	Dozer 105 KW (D6)	2	1	*1		1				
3	Grader 105	2	1							
4	Grader 90 KW	2	1	1	1					
5	Traxcavator 1.9m3	2	1	*1						
6	Traxcavator 1.1 m3	1				1	1			
7	Wheeled Loader 1.1 m3	1	1							
8	Excavator 1 m3	1				1				
9	Static Roller -10 Tonne	3	1	1	1	1	1			
10	Static Roller -6 Tonne	1	*1							
11	Vibratory Roller -8	2	1							
12	Pneumatic Roller	1	*1							
13	Plate/Pedestrian Roller	2	1			2	1	1		2
14	Water Tanker Truck -	3	2	1		2	1			
15	Towed Water Tanker -									1
16	Low Loader Truck	2	1							
17	Flatbed truck	2	1			1				
18	Tipper Truck -5m'	15	8	4	2	3	2	1		1
19	Dump Truck -15m3	2								

CONTRACTORS MINIMUM EQUIPMENT REQUIREMENT FOR CLASSIFICATION (CONTINUED)

ITEM	EQUIPMENT	A ROADS, AIRPORTS AND RELATED TRANSPORT INFRASTRUCTURE				B BRIDGES CULVERTS AND OTHER STRUCTURES				C LABOUR INTENSIVE ROAD CONSTRUCTION & MAINTENANCE	
		6	3			3	1			1	
20	Pickup Truck	6	3			3	1			1	
21	Bitumen Distributor	1	1								
22	Farm Tractor									3	
23	Concrete Mixer 0.5m ³	2	1				2	1			
24	Concrete Mixer 0.25m ³						2	1	1		
25	Concrete Vibrator	2	1			3	2	1	1		
26	Air Compressor 0.3m ³ /s	1				1					
27	Air Track 65mm diameter	1				1					
28	Water Pump – 90,000	1				2	1				
29	Water Pump – 45,000	1	1			1	1	1		1	
30	Chippings Distributor	3	1	1							
31	Crane					1					
32	Dragline Boom & Bucket					1					
33	Piling Hammer – 1 Tonne					1					
34	Pile Driving Leads					1					
35	Bar Bender & Cutter	1				2	1				
36	Theodolite	2	1			1					
37	Engineer's Level	2	1	1		1	1				

* Either of them

Source: MRT

CONTRACTOR'S ANNUAL TURNOVER LIMITS FOR CLASSIFICATION

CONTRACTOR'S ANNUAL TURNOVER (Gh Cedis x 1,000)				
FINANCIAL CLASSIFICATION	CATEGORY A ROADS AIRPORTS AND RELATED MINOR STRUC- TURES	CATEGORY B BRIDGES, CULVERTS & OTHER STRUC- TURES	CATEGORY C LABOUR BASED ROADWORKS	CATEGORY S STEEL BRIDGES AND STRUCTURES: CONSTRUCTION, REHABILITATION AND MAINTENANCE
1	over 60	over 30	up to 20	50
2	from 40-60	from 20-30		40
3	from 20-40	from 10-20		30
4	up to 20	up to 10		

Source: MRT

KNUST

APPENDIX 3

Contractor' equipment ownership



LIBRARY
KWAME N NAMAH UNIVERSITY OF
SCIENCE AND TECHNOLOGY
KUMASI-GHANA

Contractors' equipment ownership.

Equipment	A1		A2		A3		A4		Total	
	No. of responses	No. Own	No. of responses	No. Own	No. of responses	No. Own	No. of responses	No. Own	No. of responses	No. Own
Motor Grader	3	8	10	17	36	47	7	6	56	78
Excavator	3	8	10	5	36	3	7	0	56	16
Tipper Truck	3	21	10	36	36	87	7	9	56	153
Bulldozer	3	5	10	11	36	17	7	0	56	33
Road Roller	3	9	10	22	36	38	7	2	56	71
Low Loader	3	4	10	7	36	0	7	0	56	11
Bitumen distributor	3	2	10	5	36	1	7	0	56	9
Chipping distributor	3	1	10	5	36	4	7	0	56	10
Water bowser	3	0	10	4	36	15	7	0	56	19
Wheel Loader	3	4	10	8	36	0	7	0	56	12

Table 4-4 Class 1 Contractors' equipment ownership.

Equipment	No. of responses	Total No. Own	Ave. Ownership	MoT Minimum Requirement	% Compliance
Motor Grader	3	8	2.67	4	66.8
Excavator	3	8	2.67	4	66.8
Tipper Truck	3	21	7.0	17	36
Bulldozer	3	5	1.67	3	41.2
Road Roller	3	9	3.0	9	33.3
Low Loader	3	4	1.33	2	66.5
Bitumen distributor	3	2	0.67	1	67
Chipping distributor	3	1	0.33	3	11
Water bowser	3	0	0.0	3	0
Wheel Loader	3	4	1.33	1	133

Table 4-5 Class 2 Contractors' equipment ownership.

Equipment	No. of responses	Total No. Own	Ave. Ownership	MoT Minimum Requirement	% Compliance
Motor Grader	10	17	1.7	2	85.0
Excavator	10	5	0.5	1	50.0
Tipper Truck	10	36	3.6	8	45.0
Bulldozer	10	11	1.1	2	55.0
Road Roller	10	22	2.2	4	55.0
Low Loader	10	7	0.7	1	~70.0
Bitumen distributor	10	5	0.5	1	50.0
Chipping distributor	10	5	0.5	1	50.0
Water bowser	10	4	0.4	2	20.0
Wheel Loader	10	8	0.8	1	80.0

Table 4-6 Class 3 Contractors' equipment ownership.

Equipment	No. of responses	Total No. Own	Ave. Ownership	Minimum Requirement	% Compliance
Motor Grader	36	47	1.31	1	131.0
Excavator	36	3	0.08	1	8.0
Tipper Truck	36	87	2.42	4	60.5
Bulldozer	36	17	0.47	1	47.0
Road Roller	36	38	1.06	1	106.0
Low Loader	36	0	0.0	0	-
Bitumen distributor	36	1	0.03	0	-
Chipping distributor	36	4	0.11	1	11.0
Water bowser	36	15	0.42	1	42.0
Wheel Loader	36	0	0.0	0	-

Table 4-7 Class 4 Contractors' equipment ownership.

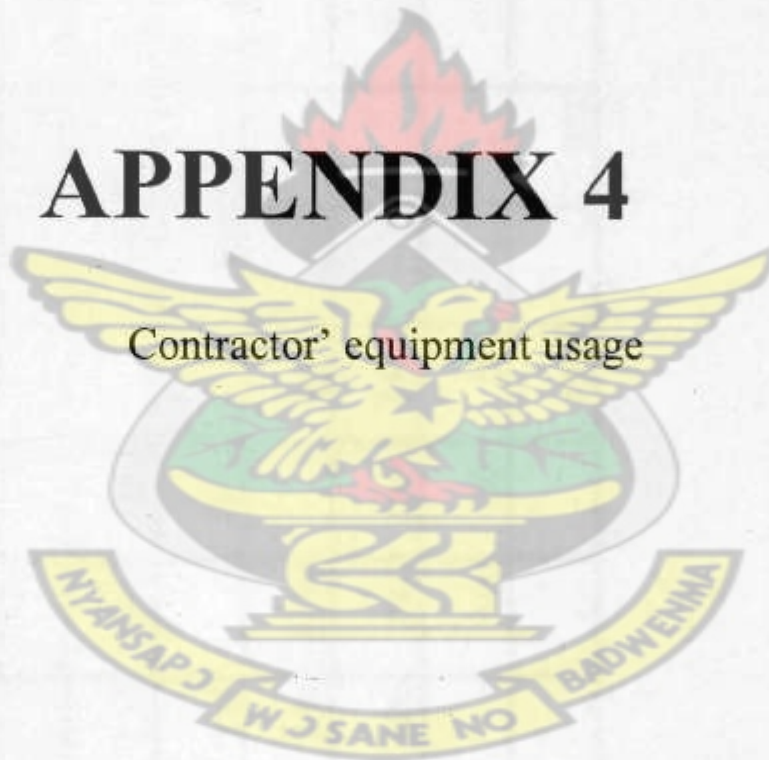
Equipment	No. of responses	Total No. Own	Ave. Ownership	MoT Minimum Requirement	% Compliance
Motor Grader	7	6	0.86	1	86.0
Excavator	7	0	0.0	0	-
Tipper Truck	7	9	1.29	2	64.5
Bulldozer	7	0	0.0	0	-
Road Roller	7	2	0.29	1	29.0
Low Loader	7	0	0.0	0	-
Bitumen distributor	7	0	0.0	0	-
Chipping distributor	7	0	0.0	0	-
Water bowser	7	0	0.0	0	-
Wheel Loader	7	0	0.0	0	-

1

KNUST

APPENDIX 4

Contractor' equipment usage



Contractors' equipment usage.

Respondent Equipment	R1	R2	R3	R4	R5	R6	R7	R8	R9	Average usage (hrs/year)
Wheel Loader	771	629	1563		1966			1464	1226	1270
Excavator	998		1000		1089			2800	1357	1448
Tipper Truck	238	4118		1650	2292				2833	2099
Motor Grader	800	746	2000	1500			1316			1060
Road Roller		516	400	200				600		429
Bulldozer				1500		312		1220		1010

KNUST



APPENDIX 5

Turn over of contractors

TURNOVER OF A1 RESPONDENTS

YEAR RESPONDENT	2000	2001	2002	2003	2004	2005	2006	2007	2008
1				746,450	863,802	788,156	2,188,432	1,901,839	
2		1,211,121	2,903,933	2,935,503	3,643,454	4,461,903	5,308,968	5,681,535	5,122,840
3	465,861	523,451	431,911	507,497	534,402	707,182	1,668,313	1,904,350	4,369,014
AVERAGE TURN OVER	465,861	867,286	1,667,922	1,396,483	1,680,553	1,985,747	3,055,237	3,162,575	4,745,927
MINIMUM TURN OVER	465,861	523,451	431,911	507,497	534,402	707,182	1,668,313	1,901,839	4,369,014
MAXIMUM TURN OVER	465,861	1,211,121	2,903,933	2,935,503	3,643,454	788,156	5,308,968	1,904,350	5,122,840

TURNOVER OF A2 RESPONDENTS

YEAR RESPONDENT	2000	2001	2002	2003	2004	2005	2006	2007	2008
1	60,255	41,000	90,000	220,000	170,000	1,350,000	1,011,000	1,300,000	1,800,000
2				262,435	471,063	642,862	874,854	1,149,708	
3				815,505	803,209	542,377	386,579	1,214,825	
4				187,634	248,410	750,254	150,000	538,400	
5	820,000	1,170,000	1,310,000	289,000	405,000	711,000	1,480,000	3,230,000	
AVERAGE TURN OVER	440,128	605,500	700,000	354,915	419,536	799,299	780,487	1,486,587	1,800,000
MINIMUM TURN OVER	60,255	41,000	90,000	187,634	170,000	542,377	150,000	538,400	1,800,000
MAXIMUM TURN OVER	820,000	1,170,000	1,310,000	815,505	803,209	1,350,000	1,480,000	1,300,000	1,800,000

TURNOVER OF A3 RESPONDENTS

YEAR RESPONDENT	2000	2001	2002	2003	2004	2005	2006	2007	2008
1	301,210	328,100	339,282	270,198	480,195	491,200	548,700	679,100	680,598
2			112,000	211,000	101,000	305,000	419,000	325,000	421,000
3				30,000	50,000	20,000	40,000	50,000	80,000
4								32,100	21,259
5							200,000	411,000	517,000
6			285,928	376,000	358,971	420,000	581,920	6,012,577	862,164
7							150,000	45,000	48,000
8	103,817	430,696	442,481	501,985	512,788	596,811	774,575	548,960	744,602
9			386,000	200,000	116,000	208,000	179,000	260,000	150,000
10	300,000	1,069,000	205,000	200,000	207,100	121,500	1,134,724	260,000	280,000
11						1,099,371	1,123,113	992,352	821,522
12				278,336	287,901	227,364			

TURNOVER OF A3 RESPONDENTS (CONTINUED)

RESPONDENT	YEAR	2000	2001	2002	2003	2004	2005	2006	2007	2008
13			270,000		430,664	200,000	126,600	235,000	159,609	
14				206,000	189,000		100,000	270,000	156,000	
15					387,425	158,779	102,032	1,796,853	569,472	
16										288,000
17			125,290	145,927	165,342	167,469				
18					50,963	144,084	248,222	369,464		
19					261,064	395,392	528,303	648,083	783,984	
20				124,216	220,325	397,366	663,808	1,138,831	1,960,185	
21					9,939	25,202	41,880	61,146		
22			15,145	25,025	252,701	305,671	425,535	548,156		
AVERAGE TURN OVER		235,009	373,039	227,186	237,350	244,245	336,802	567,698	827,834	409,512
MINIMUM TURN OVER		103,817	15,145	25,025	9,939	25,202	20,000	40,000	32,100	21,259
MAXIMUM TURN OVER		301,210	1,069,000	442,481	501,985	512,788	1,099,371	1,796,853	1,960,185	821,522

TURN OVER OF A4 RESPONDENTS

RESPONDENT	YEAR	2000	2001	2002	2003	2004	2005	2006	2007	2008
1					228,097	167,007	697,235	338,700	222,795	
2						278,334	220,994	214,027		
3						846,137	664,088	778,180	658,329	562,642
4		58,233	69,793	76,220	80,738			54,879	97,382	75,618
5					591,889	576,633	578,882	601,496	664,907	
6							132,597	164,636	411,166	
AVERAGE TURN OVER		58,233	69,793	76,220	300,241	467,028	458,759	358,653	410,916	319,130
MINIMUM TURN OVER		58,232.64	69,793	76,220	80,738	167,007	132,597	54,879	97,382	75,618
MAXIMUM TURN OVER		58,232.64	69,793	76,220	591,889	846,137	697,235	778,180	664,907	562,642

KNUST

APPENDIX 6

Supply Equipment Programme



Supply Equipment programme

RESPONDENT	CLASS	PRINCIPAL (P) BORROWED IN 2006 (Gh ₵)	AMOUNT DUE (Gh ₵)
1	A3	560,000.00	840,000.00
2	A2	942,000.00	1,200,000.00
3	A3	182,000.00	182,000.00
4	A3	1,772,315.45	1,627,384.56
5	A3	1,043,703.93	850,000.00
6	A2	1,500,000.00	1,100,000.00
7	A3	798,000.00	518,000.00
8	A2	2,500,000.00	1,200,000.00
9	A3	512,000.00	208,000.00
10	A2	600,000.00	150,000.00
11	A2	1,680,000.00	195,160.00

KNUST

APPENDIX 7

Results from Plant Pools



ITEM	Description	Qty	Unit
1	Roller for road works	100	per roller
2	Tipper truck	100	per truck
3	Motor grader	100	per grader
4	Excavator	100	per excavator
5	Grader	100	per grader
6	Roller	100	per roller
7	Motor grader	100	per grader
8	Excavator	100	per excavator
9	Grader	100	per grader
10	Roller	100	per roller
11	Motor grader	100	per grader
12	Excavator	100	per excavator
13	Grader	100	per grader
14	Roller	100	per roller
15	Motor grader	100	per grader
16	Excavator	100	per excavator
17	Grader	100	per grader
18	Roller	100	per roller
19	Motor grader	100	per grader
20	Excavator	100	per excavator
21	Grader	100	per grader
22	Roller	100	per roller
23	Motor grader	100	per grader
24	Excavator	100	per excavator
25	Grader	100	per grader
26	Roller	100	per roller
27	Motor grader	100	per grader
28	Excavator	100	per excavator
29	Grader	100	per grader
30	Roller	100	per roller
31	Motor grader	100	per grader
32	Excavator	100	per excavator
33	Grader	100	per grader
34	Roller	100	per roller
35	Motor grader	100	per grader
36	Excavator	100	per excavator
37	Grader	100	per grader
38	Roller	100	per roller
39	Motor grader	100	per grader
40	Excavator	100	per excavator
41	Grader	100	per grader
42	Roller	100	per roller
43	Motor grader	100	per grader
44	Excavator	100	per excavator
45	Grader	100	per grader
46	Roller	100	per roller
47	Motor grader	100	per grader
48	Excavator	100	per excavator
49	Grader	100	per grader
50	Roller	100	per roller
51	Motor grader	100	per grader
52	Excavator	100	per excavator
53	Grader	100	per grader
54	Roller	100	per roller
55	Motor grader	100	per grader
56	Excavator	100	per excavator
57	Grader	100	per grader
58	Roller	100	per roller
59	Motor grader	100	per grader
60	Excavator	100	per excavator
61	Grader	100	per grader
62	Roller	100	per roller
63	Motor grader	100	per grader
64	Excavator	100	per excavator
65	Grader	100	per grader
66	Roller	100	per roller
67	Motor grader	100	per grader
68	Excavator	100	per excavator
69	Grader	100	per grader
70	Roller	100	per roller
71	Motor grader	100	per grader
72	Excavator	100	per excavator
73	Grader	100	per grader
74	Roller	100	per roller
75	Motor grader	100	per grader
76	Excavator	100	per excavator
77	Grader	100	per grader
78	Roller	100	per roller
79	Motor grader	100	per grader
80	Excavator	100	per excavator
81	Grader	100	per grader
82	Roller	100	per roller
83	Motor grader	100	per grader
84	Excavator	100	per excavator
85	Grader	100	per grader
86	Roller	100	per roller
87	Motor grader	100	per grader
88	Excavator	100	per excavator
89	Grader	100	per grader
90	Roller	100	per roller
91	Motor grader	100	per grader
92	Excavator	100	per excavator
93	Grader	100	per grader
94	Roller	100	per roller
95	Motor grader	100	per grader
96	Excavator	100	per excavator
97	Grader	100	per grader
98	Roller	100	per roller
99	Motor grader	100	per grader
100	Excavator	100	per excavator

Results from Plant Pools

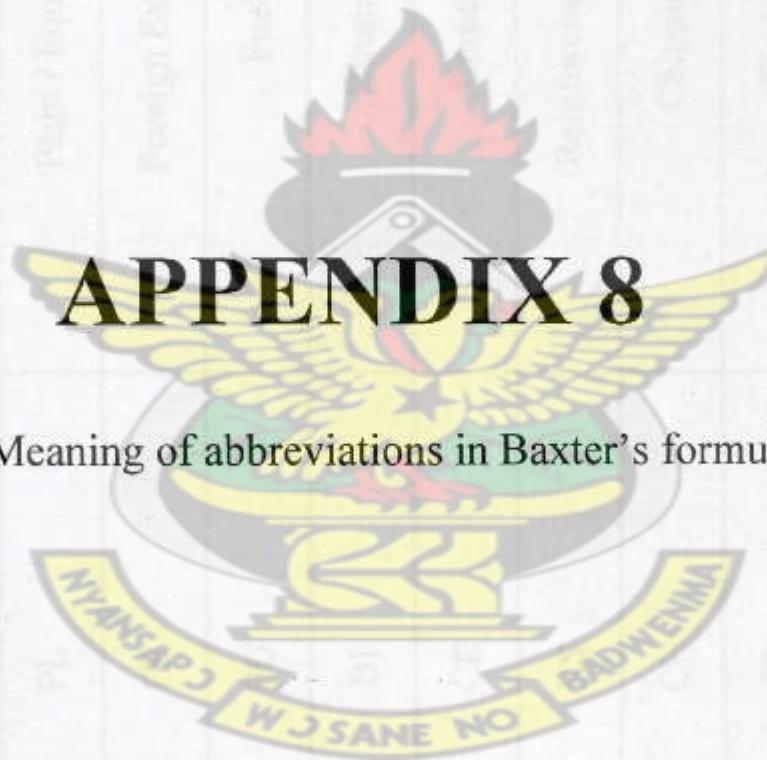
ITEM	Description	R1	R2
1	Rental rates for equipments	(\$)	(\$)
	Tipper truck	200	300
	Motor grader	400	680
	Bulldozer	500	760
	Excavator	550	720
	Payloader	500	640
	Water bowzer	200	300
	Roller	200	440
	Low loader	500	700
2	Patronage of equipments by road contractors	Scale 2	Scale 2
3	Charging for rented equipment	per hour	per hour
4	Mode of payment	Down payment	Down payment
5	Arrangement for credit payments with MHR	Acceptable	Acceptable

1

KNUST

APPENDIX 8

Meaning of abbreviations in Baxter's formular



KUMASI
KWAME NKRUMAH UNIVERSITY OF
SCIENCE AND TECHNOLOGY
KUMASI-GHANA

Baxter,s formular

Abbreviation	Meaning
LL	Labour
PL	Plant / Equipment
FE	Foreign Exchange
FU	Fuel
BI	Bitumen
CE	Cement
RS	Reinforcing Steel
CH	Chippings
TI	Timber
PC	Concrete Pipes
MI	Miscellaneous

Calculation of the Economic Hire Rate

Even though the cost of road construction equipment has declined over the years, the cost of owning and maintaining it has increased. This is due to the increasing cost of fuel, oil, and other consumables. The cost of hiring equipment is also increasing. This is due to the increasing cost of fuel, oil, and other consumables. The cost of hiring equipment is also increasing.

Example 1

A piece of equipment with a capacity of 1000 per year is purchased at a cost of GH¢125,000. The life of the equipment is expected to be 10 years after which GH¢50,000 would be realized. This would be:

Conventional method

Capacity

Cost of unit

Anticipated life

Residual value

Road tax and license

Maintenance

Overhead of employer

Expected rate of return on business

Projected operating cost

Transport charge

KNUST

APPENDIX 9

Sample calculation of Economic hire rate

Item

Depreciation (straight line)

Residual value (GH¢50,000)

Cost of unit (GH¢125,000)

Life (10 years)

(125,000 - 50,000) / 10 = 7,500

Overhead of employer (8% x 7,500)

Road tax and license

Maintenance

Operating cost (Fuel)

Transport charge

Expected rate of return on business

Maintenance

Operating Cost

Total cost

Sample calculation of Economic hire rate



Operating cost = 30,575,000 - GH¢ 25.87 per hour or GH¢ 253.98 per day

Please note that this method does not include transport and profit.

Calculation of the economic hire rate.

Even though there are several acceptable methods of calculating the hire rate the most favoured one is the simple calculation to allow for ownership and operating costs, with an addition for profit. However for investments extending over a few years, the discounted cash flow (DCF) method which takes into account the timing of cash flows is more satisfactory.

Example 7

A piece of equipment with an average working hours of 2000 per year is purchased at a cost of and Gh¢ 125000. The life of the equipment is expected to be 10 years after which only Gh¢5000 would be realized from resale.

Conventional method

Capital cost	=	Gh¢ 125 000
Resale value	=	Gh¢ 5 000
Anticipated Life	=	10 years
Insurance Premium	=	Gh¢ 600
Road tax and licenses	=	Gh¢ 300
Maintenance	=	10% of capital cost
Consumables	=	Gh¢ 1200
Overheads of business	=	Gh¢ 6 per hour
Required Rate of return on business	=	15%
Budgeted operating time	=	2000 hours per year
Transport charges	=	Gh¢ 300 say

Item	Gh¢ per year
Depreciation (straight line) = $120000/10$	12 000
Interest on finance (calculated using a capital recovery factor from interest tables (CRF= 0.199 at 15% p.a. for 10 years): $[(125000 \times 0.199 \times 10) - 125000]/10$	12 375
Fixed overheads = 6×2000	12 000
Road tax and licenses	300
Insurance premium	600
Ownership Cost (Fixed)	<u>37 275</u>
Consumables	1 200
Maintenance = 10% of 125 000	12 500
Operating Cost (Variable)	<u>13 700</u>
Total cost	<u>50 975</u>

Hire charge = $50\,975/2000 = \text{Gh¢ } 25.49 \text{ per hour or Gh¢ } 203.90 \text{ per day}$

Please note that this exclude the cost of transport and profit.

Discounted cash flow (DCF) method

The DCF method takes into account the timing of cash flows. Income and outgoings are balanced to yield a satisfactory return.

Table 2.1.5 – 4

Year	Capital (Gh ₵)	Salvage value (Gh ₵)	Operating cost (Gh ₵)	Ownership costs (Gh ₵)	Cash out (Gh ₵)	Cash in (Gh ₵)	Total (Gh ₵)
1	-120000	-	0	-25275	-145275	0	-145275
2	-	-	-13700	-25275	-38975	x	x - 38975
3	-	-	-13700	-25275	-38975	x	x - 38975
4	-	-	-13700	-25275	-38975	x	x - 38975
5	-	-	-13700	-25275	-38975	x	x - 38975
6	-	-	-13700	-25275	-38975	x	x - 38975
7	-	-	-13700	-25275	-38975	x	x - 38975
8	-	-	-13700	-25275	-38975	x	x - 38975
9	-	-	-13700	-25275	-38975	x	x - 38975
10	-	5000	-13700	0	-8700	x	x - 8700

To have 15% return on the investment over 10 years, the total cash flow reduced to net present worth at time zero must equate to:

$$0 = -145275 + (x - 38975) * 4.7715 + (x - 8700) * 0.24718$$

$$0.24718x + 4.7715x = 145275 + (38975 * 4.7715) + (8700 * 0.24718)$$

$$5.01868x = 145275 + 185969.21 + 2150.47$$

$$x = 333394.68 / 5.01868$$

$$x = 66430.75$$

Hire charge = 66430.75/2000 = Gh₵ 33.22 per hour or Gh₵ 265.72 per day

Please note that this exclude the cost of transport and profit.