



**ST. MARY'S UNIVERSITY COLLEGE**  
**SCHOOL OF GRADUATE STUDIES**

**PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE**  
**MANAGEMENT**  
**ON**  
**ETHIOPIAN PRIVATE GRADE ONE ROAD CONSTRUCTION**  
**COMPANIES**

**BY**  
**ALENE T/MARIAM WOLDU**  
**ID NO SGS/0064/03**

**APRIL 2013**  
**ADDIS ABABA (ETHIOPIA)**

**PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMENT**

**ON**

**ETHIOPIAN PRIVATE GRADE ONE ROAD CONSTRUCTION  
COMPANIES**

**BY**

**ALENE T/MARIAM WOLDU**

A THESIS SUBMITTED TO ST.MARY'S UNIVERSITY COLLEGE, SCHOOL OF  
GRADUATE STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE  
DEGREE OF MASTER OF BUSINESS ADMINISTRATION (GENERAL BUSINESS  
CONCENTRATION)

APRIL, 2013

ADDIS ABABA (ETHIOPIA)

**ST. MARY'S UNIVERSITY COLLEGE  
SCHOOL OF GRADUATE STUDIES  
FACULTY OF BUSINESS**

**PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMENT IN  
ETHIOPIAN PRIVATE GRADE ONE ROAD CONSTRUCTION COMPANIES  
(EPGORCC)**

**Prepared by: - Alene T/Mariam Woldu  
ID No: - SGS/0064/03**

**APPROVED BY BOARD OF EXAMINERS**

-----  
Dean, Graduate Studies

-----  
Signature

-----  
Advisor

-----  
Signature

-----  
External Examiner

-----  
Signature

-----  
Internal Examiner

-----  
Signature

<b>Table of Contents</b>	<b>Page</b>
1. INTRODUCTION	
1.1 BACKGROUND OF THE STUDY .....	1
1.2 STATEMENT OF THE PROBLEM .....	4
1.3 RESEARCH QUESTIONS .....	6
1.4 OBJECTIVE OF THE STUDY.....	6
1.4.1 GENERAL OBJECTIVES .....	6
1.4.2 SPECIFIC OBJECTIVES .....	6
1.5 SIGNIFICANCE OF THE STUDY.....	7
1.6 SCOPE OF THE STUDY .....	7
1.7 OPERATIONAL DEFINITION.....	7
1.8 LIMITATION OF THE STUDY.....	8
1.9 ORGANIZATION OF THE STUDY .....	8
2. LITERATURE TO REVIEW...	
2.1 THE CONSTRUCTION INDUSTRY.....	9
2.1.1 DEFINITION OF FIXED ASSETS.....	10
2.1.2 PHYSICAL RESOURCE MANAGEMENT.....	11
2.2 FUNCTION OF FIXED ASSET MANAGEMENT.....	15
2.3 MAINTENANCE POLICY:.....	15
2.4 EQUIPMENT OPERATION PLANNING.....	16
2.5 SELECTION OF EQUIPMENT & MACHINERIES.....	17
2.6 MAINTENANCE MANAGEMENT:.....	20

2.7 OBJECTIVES OF MAINTENANCE:.....	.21
2.8 TYPES OF MAINTENANCE:.....	22
2.9 PREVENTIVE MAINTENANCE:.....	23
2.10 FUNCTIONS OF PREVENTIVE MAINTENANCE:.....	24
2.11 SPARE PARTS MANAGEMENT:.....	25
2.12 SUPPORTIVE ORGANIZATIONAL CONDITIONS FOR BETTER MAINTENANCE MANAGEMENT:.....	25
2.13 TOTAL PRODUCTIVE MAINTENANCE (TPM):.....	27
2.14 RECORD FOR DECISION TO ACQUIRE .....	27
3. RESEARCH DESIGN AND METHODOLOGY <u>...</u>	
3.1 RESEARCH DESIGN.....	29
3.2 RESEARCH METHOD .....	29
3.3 POPULATION AND SAMPLING TECHNIQUES.....	29
3.3.1 SAMPLING TECHNIQUE .....	29
3.3.2 POPULATION & SAMPLING SIZE.....	30
3.4 TYPES OF DATA AND INSTRUMENTS OF DATA COLLECTION.....	30
3.4.1 PRIMARY DATA COLLECTION.....	30
3.4.2 SECONDARY DATA COLLECTION.....	31
3.5 PROCEDURES OF DATA COLLECTION.....	31
3.6 VALIDITY & RELIABILITY OF QUESTIONNAIRE .....	31
3.7 METHODS OF DATA ANALYSIS.....	32
4. DISCUSSION & RESULT.....	33
5. SUMMARY, CONCLUSION & RECOMANDATION	
5.1 SUMMARY OF MAJOR FINDINGS .....	48
5.2 CONCLUSION.....	50

---

## **PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMENT IN EPGORCC**

---

5.2.1 LACK OF FORMULATING PRM POLICY & PROCEDURES.....	50
5.2.2 LACK TO DEVELOPED SOUND ORGANIZATIONAL STRUCTURES.....	51
5.2.3 WEEK EQUIPMENT MANAGEMENT SYSTEM.....	51
5.2.4 INADEQUATE PHYSICAL RESOURCE UTILIZATION RECORD SYSTEM.....	51
5.2.5 POOR PREVENTIVE MAINTENANCE PROCEDURES .....	51
5.2.6 CHALLENGES NOT YET ADDRESSED .....	52
5.3 RECOMANDATIONS.....	53
5.3.1 POLICY AND PROCEDURE RELATED TO PHYSICAL RESOUCCE MANAGEMENT ...	53
5.3.2 ORGANIZATIONAL RESPONSIBILITY FOR PHYSICAL RESOURCE MANAGEMENT .....	55
5.3.3 PROPERTY CONTROL PROCEDURE.....	56
5.3.4 EQUIPMENTS MANAGEMENT & MAINTENANCE SYSTEM .....	58
5.3.5 COMPUTER BASED MANAGEMENT INFORMATION SYSTEM TO FACILITATE PHISICAL RESOURCE MANAGEMENT .....	61
5.3.6 RECOMMENDATION FOR THE CHALLENGES .....	61

ACKNOWLEDGEMENTS

It is my pleasure to give thanks to my advisor Dr. Matiows Ensermu for the constructive guidance and professional assistance exerted on study.

I would like also to thank my brother Kifly T-Mariam who has made direct and indirect contribution to accomplish my study, especially in providing me literature & books from abroad.

I also deeply express special thanks to W/o Kalkidan Getachew who provide me an enormous secretarial assistance to my thesis.

Once again, thank you all!!

LIST OF ABRIVATIONS

- EGOCA – ETHIOPIAN Grade One Contractors Association  
EPGORCC – Ethiopian Private Grade One Road Construction Companies  
ERA – Ethiopian Road Authority  
MOFED – Ministry of Finance & Economic Development  
OCA - Occupational Competency Assessment and Certification  
OID – Operation, Idle and Down Time  
PM - Preventive Maintenance  
RSDP – Road Sector Development Program

LIST OF TABLES

Table 1 - Policy Issue

Table 2 – Planning

Table 3 – Training

Table 4 - Inspection & Calibration

Table 5 – Equipment life cycle history record

Table 6 - Information Communication technology

Table 7 – Supplies management System

Table 8 – Maintenance System

Table 9 – Physical resource maintenance time

Table 10 – Focus on maintenance type

Table 11 – Qualification of personnel staff in the area of physical resource functions

Table 12 – Assessment on the existing system of physical resource management practice

Table 13 – Efficiency of resource utilization

Table 14 – Owning Issue (Selection of PR)

Table 15 – Decision to avail physical resource to projects

Table 16 – Basic knowledge level required to manage physical resource

Table 17 - Percentage of investment cost for major overhaul

Table 18 - Recording on utilization of physical resource

Table 19 - HRM factors affecting physical resource management

**ABSTRACT**

The situation in Ethiopian construction industry is the massive program of capital investment to road sector development projects (RSDP). This very extensive road program requires great capacity of domestic road construction companies to deliver quality works on time and within budget. Thus to carry out this huge responsibility improved and high rise level of physical resource management has to be heavily considered.

Today one of the key challenges of domestic contractors is, due to inefficient physical resource management system contractors failed to avail reliable physical resource on continual basis and deliver projects on-time, at required quality thresholds. As a result over and over again harsh financial penalties and liquidity damage are imposed by clients. A research in this area viewed to provide a basis for analyzing the Existing practices and challenges of Physical resource Management in Ethiopian private road construction companies. To achieve these research objectives questionnaire and interview were used to collect relevant data and documents were reviewed. The study involves learning from the related fields of management. A descriptive study, random sampling technique was used to select 14 companies out of the existing 29 companies, representing 48%. Then purposive sampling technique was used to select 42 respondents. The analysis table showed that physical resource management system is lightly addressed. The implications of the findings towards physical resource management system were stated & recommendations are hereby made.

## 1. INTRODUCTION

### 1.1 BACKGROUND OF THE STUDY

Road construction works always contain capital investment to carry out major new road construction, rehabilitation or upgrading works. The Ethiopian road sector is characterized by a massive ongoing and upcoming road construction program.

The road sector plans and commitments under the national road development program include a large number of high value projects. The implementation of this broad road construction program requires an increasing portion of local road construction companies to be engaged with greater capacity.

The movement of this great responsibility to Ethiopian road construction companies is not to be expected in the short term to ease the situation because local contractors to be involved & carry out the road development program within the scheduled period at a required quality the capacity to acquire, manage and control physical resource is considerably mandatory. It needs to establish & implement high rise level of physical resource management system.

According to road sector development program capacity building service project final inception report;

ROAD SECTOR DEVELOPMENT PROGRAM (RSDP) III WHICH STARTED IN OCTOBER 2007, THE GOVERNMENT IS REFORMING PROCEDURES FOR GOVERNMENT FOUNDED WORKS, TO FACILITATE THE INVOLVEMENT OF LOCAL CONTRACTORS AND TO CARRY OUT THE PROGRAM WITHIN THE SCHEDULED PERIOD. IT IS THE INTENTION FOR MAJOR ROAD PROJECTS TO BE PACKAGED INTO MANAGEABLE LOTS. REGIONAL ROAD REHABILITATION AND THE CONSTRUCTION PROJECTS WILL ALSO BE PACKAGED IN TO LOTS TO ENCOURAGE THE PARTICIPATION OF LOCAL CONTRACTORS, (EUROPE AID/121745/D/SER/ET/19)

These provide us an idea that there is ample opportunity for local road contractors to work on huge road projects as long as they obtain adequate construction materials, equipment and machineries. Acquiring physical resource by itself does not prove the competence of contractors to carry out the road project, but efficient and effective Physical resource management system should be established with the aim to support construction & maintenance activities with equipment, material and supplies on a timely basis to ensure the road construction projects are completed on schedule and within budget.

To ensure achievement on construction commitments companies has to be increasingly spinning physical resource management as an optimization strategy. To improve performance and reduce waste needs capable system with the necessary management tools. The current situation within Ethiopian private grade one road construction companies (EPGORCC) attest that there is deficiency in the existence of sound & clear physical resource management system.

Physical resources in its many forms are a critical resource for grade one construction companies, and it requires appropriate use and control to confirm maximum utilization & conservation.

The deployment of physical resource management in construction companies results not only the construction work to be high quality, and at the initial contract price, but deliveries must be on time. Poor physical resource management system unfavorably affects the availability of construction materials, equipments and machineries on a continual base, consequently poor performance and delay on projects results. when a contractor fails to deliver on-time or at required quality thresholds over and over again harsh financial penalties and liquidity damage are imposed by clients, in due course the negative financial impact unexpectedly hindering the overall performance of the company by affecting the pre planed budget and working capital of other projects.

In the absence of proper Physical resource management system it will be difficult to avail uninterrupted flow of required construction materials, machineries, and equipments.

To boost ability, to schedule future maintenance activities and reduce risk high rise level of physical resource management has to be heavily considered.

SHARMA (1997) THE COST OF EQUIPMENT IN A PROJECT VARIES FROM 10 TO 30% OF THE TOTAL COST OF THE PROJECT, DEPENDING UPON THE EXTENT OF MECHANIZATION. IN MODERN FULLY MECHANIZED PROJECTS THE COST OF EQUIPMENT GOES UP TO 30%. PROPER PLANNING, SELECTION, PROCUREMENT, INSTALLATION, OPERATION, MAINTENANCE AND EQUIPMENT REPLACEMENT POLICY PLAYS AN IMPORTANT ROLE IN EQUIPMENT MANAGEMENT FOR THE SUCCESSFUL COMPLETION OF THE PROJECT. EQUIPMENT MANAGER'S MAIN TASK IS TO REDUCE DOWNTIME, ACHIEVE OPTIMUM EQUIPMENT UTILIZATION AND INCREASE PRODUCTION AT MINIMUM COST.

Physical resource management system is decisive to provide materials and parts timely to construction operations and equipment maintenance in order to safely increase the total quality construction output at a minimum cost.

Contractors must realize effective management system for acquisition, distribution, utilization, maintenance and eventual retirements to enhance their performance and reduce waste to meet their assigned construction responsibilities but the present physical resource management system cannot support this objective Past experience in the field witnessed that the construction operation and physical resource management personnel are constantly faced with decision-making based on limited information. In the field of information system, physical resource management system permits managers & decision makers to have accurate real time information which is critical to identify physical resources that are underutilized, operational, and idle and down time data.

Thus to carry out this huge national and company level responsibility improved and high rise level of physical resource management has to be heavily considered, because inefficient utilization of physical resource coupled with poor performance of road construction.

In any event, it is important that available physical resources be used as efficiently as possible. Giving attention to development of improved physical resource management system will be significant in achieving construction responsibilities.

The primary objective of physical resource management within construction companies is to support construction and maintenance activities with materials and equipments on a timely basis to ensure that construction projects are completed on schedule and within budget. However, the

Practical situation is noticeable that the physical resource management system within the construction companies is far from adequate or satisfactory to support construction operation.

To alleviate the challenges there must be a shift from traditional to scientific physical resource management system, including establishing effective system with internal working procedures compatible with modern practices to support construction activities with material and equipment.

To achieve the shift research in the area of physical resource management system should be conducted, with the aim to assess the current implementation of physical resource management system.

Therefore a research in this area is viewed to provide a basis for analyzing the Existing Situation of Physical resource management system, and its challenges within EPGORCC. It investigates whether the existing Physical Resource Management system supports the overall objectives of EPGORCC or not. The study also focused on the drawbacks and based on the findings Recommend the best possible approaches.

### **1.2 STATEMENT OF THE PROBLEM**

What is remarkable about the present situation in Ethiopia construction industry is the massive capital investment to road sector development program (RSDP). This very extensive road program will in the future require great capacity of domestic road construction companies to deliver quality works on time and within budget.

Physical resources in its many forms are critical for EPGORCC therefore, proper use and control system is highly important.

The deployment of physical resource management in construction companies results not only the construction work is of high quality, and at the initial contract price, but deliveries must be on time. Due to poor physical resource management system the availability of construction materials, equipments & machineries will be out of operation, consequently poor performance and delay on projects results. Physical resources are huge investment of a company, if this huge investment cannot be managed properly; deliveries delayed, quality & time will be in question.

When a contractor fails to deliver on-time or at required quality thresholds, over and over again harsh financial penalties and liquidity damage are imposed by clients, ultimately the negative financial impact unexpectedly hindering the overall performance of the company.

Physical resource management system within EPGORCC should aim to support construction & maintenance activities with equipment, material and supplies on a timely basis to ensure the road construction projects are completed on schedule and within budget.

Construction companies are always under pressure from all sides to reduce costs and deliver excellent performance, while improving availability, reliability, safety and sustainability of their complex physical resource management was neglected.

Today one of the key challenges of domestic road construction companies is the lack of managing physical resource which is the spinal cord of the company. To effect improvements in the performance of road construction works effective support should be provided by effective & efficient physical resource management system.

Therefore a realistic approach has to be developed to avail reliable physical resource on continual base.

The justification of the researcher for selecting such research problem was, based on the researcher experience. The researcher served for more than 3 decades in both government and private construction companies in technical and administrative supervision work.

So as a member of the system the researcher understand and observed the practical problems of the industry.

The other justification is to manage physical resource efficiently in construction industry is not only about effective utilization of resource or to gain more return on investment, but it is also delivering quality road & infrastructure development.

Therefore it is important and right time to conduct a research & get clear insight on the existing physical resource management system & its challenges in Ethiopian private grade one road construction companies.

### 1.3 RESEARCH QUESTIONS

To address the problem the study was guided by the following research questions.

- 1.3.1 To what extent physical resource management policies & procedures are designed & implemented?
- 1.3.2 How effectively & efficiently plan, allocate & schedule physical resources?
- 1.3.3 To what extent equipment management and maintenance systems is implemented to enhance availability & reliability of physical resources?
- 1.3.4 How material management methods & techniques put into practice to support construction activities?
- 1.3.5 What are the challenges to establish and realize effective physical resource management system?

### 1.4 OBJECTIVE OF THE STUDY

#### 1.4.1 GENERAL OBJECTIVES

The primary objectives of this research is to assess & examine the existing practice and challenges of physical resource management in Ethiopian private grade one road construction companies and recommend the best practices required to effectively manage physical resource.

#### 1.4.2 SPECIFIC OBJECTIVES

The specific objectives are:-

- A) To examine the implementation of physical resource management policy and procedures.
- B) To review the current practice of physical resource management functions performed in domestic private grade one road construction companies.
- C) To assess equipment management & maintenance system.
- D) To examine the existing material management methods & techniques.
- E) To identify factors that adversely affects effective physical resource management.
- F) To recommend best practices for the implementation of effective physical resource management system.

### 1.5 SIGNIFICANCE OF THE STUDY

The result of this study is expected to be useful and contribute in the following ways.

- 1.5.1 To Show policy makers the status of Ethiopian grade one road construction companies in the implementation of physical resource management system.
- 1.5.2 Getting insight about ways and means to conservation and maximization of available physical resource.
- 1.5.3 To show owners & managers the extent of effective physical resource management system in reducing risk and enhance construction performance which leads to be competitive in the current complex and dynamic business settings.
- 1.5.4 Clarify the role of effective and efficient equipment management and maintenance system to avail reliable physical resource on continual bases.
- 1.5.5 The fact that the use of Modern physical resource management system in Ethiopian construction companies is a very recent phenomenon, it is believed that the study will add knowledge to company owners and managers.
- 1.5.6 To wake up company owners and managers for making necessary decisions.
- 1.5.7 To Serves as a spring board for interested researcher in the area of physical resource management system.

### 1.6 SCOPE OF THE STUDY

The scope of the study encompasses Ethiopian private sector road construction companies only, not included the government grade one road construction companies.

According to the information from Ethiopian grade one contractors association, Currently in Ethiopia there are 41 private grade one construction companies (Appendix D), among them 29 are engaged in road construction works, but the study will covered only 14 companies which is (48%) of the total population.

### 1.7 OPERATIONAL DEFINITION

For the purpose of this study the researcher defines physical resource as tangible resources that are manmade to be available to road construction operation and significant in their investment, such as construction materials, supplies, equipments and machineries.

### 1.8 LIMITATION OF THE STUDY

- 1.8.1 Respondents were reluctant to fill out and return the questionnaire on time
- 1.8.2 Unavailability of relevant data on equipment and machineries operational, idle and down time (OID) report to have better collection & analysis of the wide range of data required for effective physical resource management.
- 1.8.3 Due to time constraints it was not possible to collect data for every reason which affects physical resource management in each company.
- 1.8.4 Majority Respondents were missed to replay the financial data.
- 1.8.5 Lack of sufficient materials in the study area and absence of research documents done on Ethiopian construction industry physical resource management system, the study much depend on few resources.

However, through rigorous efforts and preservation, necessary data were collected.

### 1.9 ORGANIZATION OF THE STUDY REPORT

The study report was organized in five chapters. Chapter one contained the introduction part, chapter two reviews related literature, Chapter three presents research design and methodology, Chapter four contains data interpretation, discussion and results, Chapter five covers conclusion and recommendations.

## 2. LITERATURE REVIEW

### 2.1 THE CONSTRUCTION INDUSTRY

The responsibility to deliver road at a specified time and cost requires accepting legal, financial, and managerial obligations. Construction consumes more equipment and construction materials than any other industry. Under the stimulus of increasing demand for its services, the construction industry has expanded and is expanding in geographical scope and technological dimension.

The construction sector in Ethiopia is growing and taking on an increasingly significant role in development of the Ethiopian economy. This is manifested by the construction of roads and development projects that are undertaken all over the country. Current construction sector activities include the many road construction projects in urban and rural areas being undertaken by Ethiopian private grade one road construction companies. This testifies that there is a big construction boom all over the country.

PEURIFOY (1970) EXPLAIN CONSTRUCTION IS ESSENTIALLY A SERVICE INDUSTRY, WHOSE RESPONSIBILITY IS TO CONVERT THE PLANS AND SPECIFICATIONS PREPARED BY AN ENGINEER OR AN ARCHITECT INTO A FINISHED PROJECT. THE CONSTRUCTION OF PROJECTS INVOLVES THOUSANDS OF DETAILS AND COMPLEX INTERRELATIONSHIPS AMONG OWNERS, ARCHITECTS, ENGINEERS, GENERAL CONTRACTORS, SPECIALTY CONTRACTORS, MANUFACTURERS, MATERIAL DEALERS, EQUIPMENT DISTRIBUTORS, GOVERNMENTAL BODIES AND AGENCIES, LABOR, AND OTHERS. AN INEFFICIENT & INEFFECTIVE CONSTRUCTION SECTOR INDUSTRY WILL ADVERSELY AFFECT THE OTHER SECTORS OF THE ECONOMY.

In Ethiopia the construction of road is not the responsibility of the construction company only, but numerous stakeholders are concerned for the delivery of quality construction works on time and within budget.

Therefore Ethiopian Road construction companies in order to complete their contractual obligations and meet their responsibilities they need to effectively plan and manage physical resources.

### 2.1.1 DEFINITION OF FIXED ASSETS

DEADMAN (2010) DEFINES THE TERM PLANT ASSET; PLANT AND EQUIPMENT; PROPERTY OR FIXED ASSET OFTEN IS USED TO DESCRIBE THE TANGIBLE ASSET USED BY BUSINESS ENTERPRISE IN ITS OPERATION. FIXED ASSET IS AN ASSET THAT IS HELD WITH THE INTENTION OF BEING USED FOR THE PURPOSE OF PRODUCING OR PROVIDING GOODS OR SERVICES AND ARE NOT HELD FOR SALE IN THE NORMAL COURSE OF BUSINESS.

In construction companies fixed assets includes property acquired for use in operation, such as machinery, equipments, tools & construction materials.

Studies from different literature describes the concept of physical resources are resources that are available to business organizations in the form of buildings and other machineries needed for the day to day running of the organization.

Construction companies should acquire the necessary Physical resource which is productive like equipment, inventory, and plant that is man-made and is used to generate income & accomplish the construction works, but ensuring the availability of physical resource by itself is not enough, it needs to be managed and monitored.

The Council of Ministers Financial Regulations No. (17/1997) provides two important definitions as follows:

FIXED ASSETS – MEANS TANGIBLE ASSET COSTING BIRR 200 OR MORE THAT IS IN OPERATIONAL USE AND THAT HAS A USEFUL ECONOMIC LIFE OF MORE THAN ONE YEAR, SUCH AS FURNITURE, COMPUTERS, HEAVY EQUIPMENT, VEHICLES, SHIPS AND AIRCRAFTS, BUILDINGS, ROADS, SEWERS, BRIDGES, IRRIGATION SYSTEMS, DAM.

### 2.1.2 PHYSICAL RESOURCE MANAGEMENT

DEKKER (2002) IN HIS STUDY ABOUT RESOURCE MANAGEMENT FOR THE CONSTRUCTION INDUSTRY MAKE CLEAR THAT, THE MANAGEMENT OF RESOURCES IS AN ESSENTIAL TASK IN EACH CONSTRUCTION COMPANY. TODAY, ERP SYSTEMS AND E-BUSINESS SYSTEMS ARE AVAILABLE TO ASSIST CONSTRUCTION COMPANIES TO EFFICIENTLY ORGANIZE THE ALLOCATION OF THEIR PERSONNEL AND EQUIPMENT WITHIN THE COMPANY, BUT THEY CANNOT PROVIDE THE COMPANY WITH THE IDLE RESOURCES FOR EVERY SINGLE TASK THAT HAS TO BE PERFORMED DURING A CONSTRUCTION PROJECT. THEREFORE, COMPANIES SHOULD HAVE AN ALTERNATIVE SOLUTION TO BETTER EXPLOIT EXPENSIVE RESOURCES AND COMPENSATE THEIR FIXED COSTS, BUT ALSO HAVE THEM AVAILABLE AT THE RIGHT TIME FOR THEIR OWN BUSINESS ACTIVITIES. RESOURCE MANAGEMENT DESCRIBES REQUIREMENTS FOR THE MANAGEMENT OF CONSTRUCTION RESOURCES, ITS CORE FEATURES, AND THE INTEGRATION APPROACH.

In Ethiopian construction industry contractors are obliged to own all resources which are required for the level contract, but there are special equipments, like asphalt distributor that are manufactured for the use of specific task only or special type of operation. Such equipment cannot use it throughout the project life time; its idle time is very high. Especially if the special equipments are used under different conditions time & location E-sharing of resources among different projects is less expensive and effective. Ethiopian road construction companies should not be forced to own such equipments to perform construction works as long as they can work it with rent or someone else equipments. Machineries pool system can be a good alternative to share resources and efficient utilization of physical resources.

SHARMA(1997) MAKE CLEAR GIVEN AN ORGANIZATIONAL OBJECTIVE, PHYSICAL RESOURCE MANAGEMENT MEAN THE SET OF ACTIVITIES ASSOCIATED WITH, IDENTIFYING WHAT ASSETS ARE NEEDED, AND IDENTIFYING FUNDING REQUIREMENTS, ACQUIRING ASSETS, PROVIDING LOGISTIC AND MAINTENANCE SUPPORT SYSTEMS FOR ASSETS, DISPOSING OR RENEWING ASSETS.

Management of physical resource in construction companies have to include equipment planning, Forecasting equipment requirement, extent of mechanization, output and capacity of equipment, utilization and time period, operation planning, Selection of equipment, Workshop installation, Spare-parts management, Maintenance management, Down-time and availability, Operation and utilization, Equipment replacement.

ANTONY AND HASTINGS (2009) CLARIFY THAT SYSTEMATIC AND COORDINATED ACTIVITIES AND PRACTICES THROUGH WHICH AN ORGANIZATION OPTIMALLY AND SUSTAINABLY MANAGES ITS ASSETS AND ASSET SYSTEMS, THEIR ASSOCIATED PERFORMANCE, RISKS AND EXPECTATIONS OVER THEIR LIFE CYCLE FOR THE PURPOSE OF ACHIEVING ITS ORGANIZATIONAL STRATEGIC PLAN.

Physical resource management in construction companies has to be the process of using company's resources in the most efficient way possible. The resources include tangible resources such as construction materials, equipment, and inventory. Making sure one has enough physical resources for completion of project.

Resource management is the efficient and effective deployment and allocation of company's resources when and where they are needed.

WILSON (2009) IN HIS BOOK A GUIDE TO DEVELOPING STRATEGY AND IMPROVING PERFORMANCE REVIEWS THE EIGHT MAJOR POLICY SECTORS, ACTIVITIES DEVELOPMENT, PEOPLE DEVELOPMENT, PLANNING, CONTRACTING, CONTROL, COMPUTER SYSTEM SOLUTIONS, ASSET MANAGEMENT TOOLS, AND AUDITING ARE MAJOR POLICIES FOR DEVELOPING ASSET MAINTENANCE MANAGEMENT STRATEGIES TO MEET DEFINED TARGETS AND COMMITMENTS.

In his study describes proven best practices based on actual experience. Also provides options for how asset maintenance managers can implement their strategies and obtain the involvement and support of other key players in their organizations.

GREEN (1974) GIVE DETAIL THAT ASSET MANAGEMENT IS THE MANAGEMENT OF FIXED OR NON-CURRENT ASSETS SUCH AS EQUIPMENT AND PLANT. PHYSICAL ASSET MANAGEMENT PRESENTS A SYSTEMATIC APPROACH TO THE MANAGEMENT OF THESE ASSETS FROM CONCEPT TO DISPOSAL. THE GENERAL PRINCIPLES OF PHYSICAL ASSET MANAGEMENT ARE DISCUSSED IN A MANNER WHICH MAKES THEM ACCESSIBLE TO A WIDE AUDIENCE, AND COVERS ALL STAGES OF THE ASSET MANAGEMENT PROCESS, INCLUDING: INITIAL BUSINESS APPRAISAL; IDENTIFICATION OF FIXED ASSET NEEDS; FINANCIAL EVALUATION; LOGISTIC SUPPORT ANALYSIS; LIFE CYCLE COSTING; MAINTENANCE STRATEGY; OUTSOURCING; COST-BENEFIT ANALYSIS; DISPOSAL; AND RENEWAL. PHYSICAL ASSET MANAGEMENT ADDRESSES THE NEEDS OF EXISTING AND POTENTIAL ASSET MANAGERS, AND PROVIDES AN INTRODUCTION TO ASSET MANAGEMENT FOR PROFESSIONALS IN RELATED DISCIPLINES, SUCH AS FINANCE.

Physical Resource management includes planning, allocating and scheduling of resources to tasks, which typically include construction materials, machines, and equipments.

Many organizations use professional services automation software tools to make resource management tasks more efficient and effective. In order to be sustainable, resources must be maximally utilized on time and activities. Effective resource management will optimize organization efficiency, minimize bench time and improve the bottom line.

AMMER (1973) EXPLICATE FIXED ASSET MANAGEMENT IS MAINLY CONCERNED ABOUT THE DUTIES OF CARE, CONTROL AND EFFECTIVE USE OF THE FIXED ASSETS. EFFECTIVENESS OF ANY ORGANIZATION LARGELY DEPENDS ON ITS ABILITY TO CONTROL AND MANAGE THE FIXED ASSET IN SOME UNIFORM FASHION. THE BOOK ADDRESSES MANY ISSUES ON MAXIMIZATION & CONSERVATION OF PHYSICAL RESOURCE THROUGH THE PROCESS OF PROPER PHYSICAL RESOURCE MANAGEMENT SYSTEM.

Although there have been patterns and trends that have emerged around the world in physical resource management, the root principles are the same however, many of the tools, technologies, and thought processes have evolved and matured to allow a rethinking of the deeper physical resource management system processes.

Effective, proactive resource management delivers the utmost level of optimization and efficiency by enabling proactive allocation of resources based on the work schedule. At this level, implementation of business-policy oriented resource provisioning ensures that resources are provisioned in advance of business needs and in alignment with overall business priorities and objectives. This drives the highest possible resource utilization rates, while simultaneously maximizing construction performance and minimizing available risk.

CHITKARA (1998) SHED LIGHT ON FIXED ASSET MANAGEMENT IS AN ACCOUNTING PROCESS THAT SEEKS TO TRACK FIXED ASSETS FOR THE PURPOSES OF FINANCIAL ACCOUNTING, PREVENTIVE MAINTENANCE, AND THEFT DETERRENCE. MANY ORGANIZATIONS FACE A SIGNIFICANT CHALLENGE TO TRACK THE LOCATION, QUALITY, CONDITION, AND MAINTENANCE AND DEPRECIATION STATUS OF THEIR FIXED ASSETS.

Since physical resources are fixed assets and properties that are expected to have a useful life of longer than one year that constitute a significant proportion of the total asset on the balance sheet of the company and are long-term assets held for business use and not expected to be converted to cash in the current or upcoming fiscal year, the ability to control should be highly related to the quality of physical resource management system. It needs detailed information with respect to the performance, user, location and status. Also it is important to keep minimum stock on hand, reducing both excess inventories and shortages.

So the learning is physical resource management is the process of management, which coordinates, supervises and executes the task associated with the flow of construction materials, equipments & machineries in an integrated manner. It is possible to maximize benefit from established and implemented sound & clear physical resource management system. The above concept manifested to maximize benefits from physical resource investment, Ethiopian road construction companies have to design and implement proper physical resource management system.

## 2.2 FUNCTION OF FIXED ASSET MANAGEMENT

ANTONY AND HASTING (2009) MAKE CLEAR THAT MANAGEMENT PLANS AND OPERATES THROUGH WORKERS APPLYING THEIR SKILLS OVER MATERIAL AND SYSTEM. THE PROCESS STAFFING AND DIRECTING ARE THE TWO ELEMENTS ENCOMPASSED BY THE MANAGEMENT CONTROL SYSTEM. ONCE MATERIAL MANAGEMENT IS RESPONSIBLE FOR PLANNING ACQUISITION, STORAGE, MOVEMENT AND CONTROL OF FIXED ASSET SO AS TO OPTIMIZE PHYSICAL FACILITIES, IT SHOULD BE IN PERFECT HARMONY WITH THE ORGANIZATION GOAL. HE EXTENDS HIS EXPLANATION THAT, EFFICIENT FIXED ASSET MANAGEMENT FUNCTION MUST BE VIEWED AS AN IMPORTANT MANAGEMENT TOOLS FOR THE FURTHERANCE OF THE OBJECTIVE OF THE ORGANIZATION AS A WHOLE.

In road construction companies efforts has to be made to develop the function of physical resource management with the objectives to effectively support construction and maintenance operations with materials and repair parts on a timely basis to ensure that construction projects are completed on schedule and within budget.

Establishing organizational structure & functional staff with sufficient personnel and defined responsibilities to plan acquire utilize and dispose is mandatory.

## 2.3 MAINTENANCE POLICY

CHARY (2010) EXPLAINED ABOUT MAINTENANCE POLICY THAT, IT IS CLEAR THAT THERE IS NOTHING LIKE A PURELY PREVENTIVE MAINTENANCE; RATHER THERE IS ALWAYS AN APPROPRIATE MIX OF THE PREVENTIVE AND BREAKDOWN MAINTENANCE. MOREOVER, SUCH A POLICY MAY BE USEFUL ONLY IF THE COSTS OF PREVENTIVE ACTION ARE SIGNIFICANTLY LOWER THAN THOSE OF THE BREAKDOWN MAINTENANCE REPLACEMENT, WHICH MEANS, THAT THE ITEM SHOULD PREFERABLY BE A 'SIMPLE REPLACEABLE' ITEM AND NOT A COMPLEX ONE FOR REPLACEMENT ACTION. OF COURSE, PREVENTIVE REPLACEMENT IS NOT RULED OUT FOR A COMPLEX PART; THE 'COST-CUM-SAFETY' FACTORS HAVE TO BE TAKEN INTO ACCOUNT WHILE DECIDING ON A POLICY.

Construction companies have to establish preventive (scheduled) maintenance policy and program. Assigned drivers and equipment operators follow systematic procedure for performing operator maintenance. The periodic servicing of machineries and equipments is reflected on schedule program.

## 2.4 EQUIPMENT OPERATION PLANNING

WILSON (2009) MAKE CLEAR THAT PRACTICAL EXPERIENCE SHOWED THAT MANAGERS OF CONSTRUCTION COMPANIES EXPRESS CONCERN ABOUT THE LACK OF EQUIPMENT; HOWEVER, NO SYSTEM EXISTS FOR SCHEDULING THE ASSIGNMENT AND UTILIZATION OF AVAILABLE EQUIPMENT TO A PROJECT IN ORDER TO MAXIMIZE UTILIZATION. ADDITIONALLY THE REPAIR PARTS SUPPLY SYSTEM IS NOT RESPONSIVE TO EMERGENCY REPAIR REQUIREMENTS, RESULTING IN EXCESSIVE DOWNTIME FOR AVAILABLE EQUIPMENT. THE ABSENCE OF UTILIZATION REPORTS AS A TOOL OF MANAGEMENT, COMBINED WITH POOR MAINTENANCE RESPONSE FOR EMERGENCY REPAIRS, RESULTS IN AN EXTREMELY LOW LEVEL OF EQUIPMENT UTILIZATION. THIS REFLECTS HIGHER PROJECT COSTS WITHIN CONSTRUCTION COMPANIES AND ALSO RESULTS IN POOR UTILIZATION OF RESOURCES.

The above theory gives us message an aggressive program should be implemented to schedule the assignment and utilization of all physical resource. The equipment operation planning requires the accumulation of accurate data which can be utilized in equipment scheduling and which can generate cost data for planning and budgeting purpose. The best use of equipment during its useful life must be divided between productive work and time allotted for preventive maintenance, repair and lost time. Parts, supplies and people are needed to use or maintain equipment. The best management of equipment results in maximized productive work optimal preventive maintenance, and minimize repair and lost time.

SHARMA (1997) POINT UP THE SUCCESS OF A MECHANIZED CONSTRUCTION SHALL BE JUDGED BY ITS LOW COST, TIMELY AND SAFE COMPLETION. WHILE PLANNING EQUIPMENT OPERATION:

EQUIPMENTS MUST WORK IN COORDINATION, ESPECIALLY WHEN THEY ARE REQUIRED TO WORK IN A TEAM, FOR EXAMPLE, THE WORKING OF BIG SIZE CRUSHER WHERE STONES ARE FED BY THE DUMPERS, WHICH ARE LOADED AT THE QUERY BY THE WHEEL LOADERS. IN THIS CASE WHEEL LOADER, DUMPERS AND CRUSHERS ARE REQUIRED TO WORK IN A TEAM AND THEREFORE THEIR OPERATION WOULD BE PLANNED IN SUCH A WAY THAT THERE IS NO WAITING AT ANY PLACE. THE CAPACITIES OF ALL THE CONNECTED EQUIPMENTS SHOULD BE PROPERLY BALANCED.

In order to ensure proper operating of equipment and to eliminate delays it is necessary to plan equipment and materials required for the work & ensure scheduled maintenance.

Safety on the work is a must. In order to ensure proper safety, equipment must be kept in good condition, operate them properly, working area should be well-lighted and observe proper traffic control.

Good workmen should be given proper incentives. This will help in increasing the production.

One of the key elements for proper equipment operation planning is maintaining Proper records for equipment operations, maintenance, breakdown, consumption of stores and spare parts, repaired etc. It will help future estimation, reviewing the plan in addition to the cost accounting of the equipment and evaluating the progress of work.

Planning and Scheduling equipment operation identifies available resources, creates an effective system to manage work orders, maximizes the productive time of your technicians & generates the opportunity for identifying improvement opportunities.

## 2.5 SELECTION OF EQUIPMENT & MACHINERIES

PEURIFOY (1970) EXPLAIN A PROBLEM WHICH FREQUENTLY CONFRONTS A CONTRACTOR AS HE PLANS TO CONSTRUCT A PROJECT IS THE SELECTION OF THE MOST SUITABLE EQUIPMENT. HE SHOULD CONSIDER THE MONEY SPENT FOR EQUIPMENT AS AN INVESTMENT WHICH HE CAN EXPECT TO RECOVER, WITH A PROFIT, DURING THE USEFUL LIFE OF THE EQUIPMENT. A CONTRACTOR DOES NOT PAY FOR CONSTRUCTION EQUIPMENT; THE EQUIPMENT MUST PAY FOR ITSELF BY EARNING FOR THE CONTRACTOR MORE MONEY THAN IT COST. UNLESS IT CAN BE ESTABLISHED IN ADVANCE THAT A UNIT OF

EQUIPMENT WILL EARN MORE THAN THE COST, IT SHOULD NOT BE PURCHASED. A CONTRACTOR CAN NEVER AFFORD TO OWN ALL TYPES OR SIZE OF EQUIPMENT THAT MIGHT BE USED FOR THE KIND OF WORK HE DOES.

Contractors should confine their purchases to standard equipment unless a project definitely justifies the purchase of special equipment. Delivery of standard equipment may be obtained more quickly. Standard equipment can be used economically on more than one project. Repair parts for standard equipment may be obtained more quickly and economically than for special equipment. If contractor no longer needs a unit of standard equipment, he can usually dispose of it more easily and at a more favorable price.

The selection of equipments is highly related with planning of work & principle of synergy. The selection of construction equipments and machineries should be done carefully with coordinated team, and for the right type the consultation of professional specification analyst is vital. Especially for special purpose machineries & equipments which are not utilized fully throughout their economic life time pooling or E-sharing system could have advantage. They must be capable of performing more than one company on different time.

As to the importance of repair parts availability, while selecting a particular type or make of equipment, it should be ensured that the spare parts will be available at reasonable price throughout the working life of the equipment. It should also be ensured that the downtime of the equipment for want of spare parts may not be more. This is all the more necessary when construction companies want to import equipment & machineries.

CHARRY (1995) GIVE DETAIL ABOUT ACQUISITION, PROPER SELECTION OF EQUIPMENT FOR A CONSTRUCTION PROJECT IS OF VITAL IMPORTANCE FOR ITS SPEEDY AND ECONOMICAL COMPLETION. PROBLEM OF EQUIPMENT SELECTION HAS BECOME MORE COMPLICATED, BECAUSE LARGE VARIETY OF EQUIPMENTS IS BEING MANUFACTURED NOW-A-DAYS. FOR PROPER SELECTION OF EQUIPMENT, A CONSIDERABLE EXPERIENCE IN THE OPERATION AND MAINTENANCE IN THE FIELD IS ESSENTIAL.

Once the selection of the equipment is done the purchase order for the selected model and type is issued considering lead time for the supply of equipment, time required for its installation and commissioning. The process of selection of equipment is generally a part of procurement, followed by equipment planning and helps in purchase of equipment. The complete procurement action is divided in various activities like calling enquiries, its technical and financial evaluation, ordering, contract-making, transporting, assembling and installation and commissioning, and should be followed vigorously, as any delay in any of these activities will result in delay in completion of the project. Therefore these activities are monitored at top most priority.

To substantiate proper planning on selection of equipment construction companies should adopt and implement policy and procedural guidance for all purchasing activities and exercise technical supervision over these activities. The question of standardizing the make and model of equipment and vehicles should be heavily considered as a very vital aspect on the process of selection of equipment. It is better to have same type and size of equipments in the project. It means lesser spare parts reserve, more interchangeability of parts if required, easy for the operators to understand it, mechanics will be able to maintain and repair better as they become expert by handling one type of equipment. The question of Availability of know-how is another key factor on selection decision; this means the equipment selected should be satisfactorily handled by available operators and mechanics. Sophisticated equipment may give excellent performance but it may be difficult to handle and maintain it through available know-how.

SHARMA, (1997) POINT UP VERSATILITY OF THE EQUIPMENT SHOULD BE GIVEN DUE PRIORITY. THIS MEANS A MACHINE WHICH CAN BE USED FOR MANY JOBS, THE VERSATILITY PROMISES EXTRA PROFIT FROM TWO DIRECTIONS;

- (I) ALLOWS ONE MACHINE TO DO THE JOB OF SEVERAL MACHINES AND THUS CUTTING INTO OWNERSHIP AND OPERATING COSTS ASSOCIATED WITH ADDITIONAL PLANT AND LABOR.
- (II) IT INCREASES UTILIZATION, WHICH MEANS A MACHINE EARNS MONEY WHEN IT MIGHT OTHERWISE BE IDLE.

Particularly the special purpose machineries & equipments which are not utilized fully throughout their economic life time, such as asphalt mixing plant cannot be engaged throughout the project duration, thus pooling or E-sharing system could have advantage. They must be able

To be engaged in more than one company on different time. Especially for special purpose machineries & equipments which are not utilized fully throughout their economic life time pooling or E-sharing system could have advantage. For the reason that special purpose machines Are not utilized full lives in one the project they must be capable of performing more than one company on different time.

From the above and other reviewed materials for successful selection of equipment & machineries, suitability for Job conditions, size of the equipment, standardization, availability of Equipment in the market, availability of Spare Parts, availability of know-how, the Economical aspects & Service Support should be considered.

PEURIFOY, (1970) EXPRESS ABOUT SELECTION OF EQUIPMENTS, HE STATED THAT “PROPER SELECTION OF EQUIPMENT RECORDS KEPT FOR OPERATION, MAINTENANCE IN THE FIELD IS ESSENTIAL. RECORDS KEPT FOR OPERATION, MAINTENANCE AND ACTUAL OUTPUT OBTAINED UNDER COMPARABLE CONDITIONS OF PREVIOUS PROJECTS WILL GREATLY HELP IN TAKING DECISION FOR EQUIPMENT SELECTION.

## 2.6 MAINTENANCE MANAGEMENT

WILSON (2009) IN HIS STUDY MARK EVERY MACHINE IS THOROUGHLY TESTED AND INSPECTED BY THE MANUFACTURERS BEFORE SELLING. WHEN USED IT IS SUBJECTED TO WEAR AND TEAR, HENCE PROPER ATTENTION SHOULD BE GIVEN TO PROTECT THE MACHINE AND ITS COMPONENTS FROM UNDUE WEAR AND THUS PROTECT THEM FROM FAILURES. A PROPER ATTENTION MEANS LUBRICATION, CLEANING, TIMELY INSPECTION AND SYSTEMATIC MAINTENANCE. MAINTENANCE OF MACHINE MEANS EFFORTS DIRECTED TOWARDS THE UP KEEP AND THE REPAIR OF THAT MACHINE. REPAIR MUST BE DONE AT A TIME WHEN IT MAY HAVE LEAST DISRUPTIONS I.E. MACHINE MAY BE REPAIRED WHEN IT IS NOT BEING USED OR ITS USE MAY BE POSTPONED WITHOUT

AFFECTING THE PRODUCTION MUCH. THUS, MAINTENANCE IS RESPONSIBLE FOR THE SMOOTH AND EFFICIENT WORKING OF AN INDUSTRY AND HELPS IN IMPROVING THE PRODUCTIVITY. IT ALSO HELPS IN KEEPING THE MACHINE IN A STATE OF MAXIMUM EFFICIENCY AND ECONOMY.

Every equipment & machine will require repairs even if it is best make and model, hence the repair must be done at such a time when it may have least disruption. To increase reliability, Productivity and reduce down time of resources maintenance policy & detail procedures are obligatory functions to maintenance managers.

Maintenance management is one of the key functions of management in construction companies. The absence of defined maintenance programs has resulted in major repair jobs being undertaken at the expense of completing minor repair jobs which would put more equipment into construction operation. Maintenance management is a basic function to keep the resources available and reliable for construction projects, hence to provide adequate maintenance facilities, shops equipment and tools with adequate staff to perform maintenance is the key function of maintenance management. Creating conducive environment to effective maintenance operation, with adequate physical facilities helps to benefit from maintenance.

## 2.7 OBJECTIVES OF MAINTENANCE

SHARMA (2007) CLARIFY THE MAIN OBJECTIVES OF MAINTENANCE ARE:-

- (A) TO MAXIMIZE THE AVAILABILITY OF PLANT AND EQUIPMENT FOR PRODUCTIVE UTILIZATION.
- (B) TO EXTEND THE LIFE-SPAN OF PLANT, AND EQUIPMENT BY MINIMIZING THEIR WEAR AND TEAR, AND DETERIORATION.
- (C) TO REDUCE THE COST OF LOST PRODUCTION DUE TO BREAK-DOWN.
- (D) TO ENSURE SAFETY OF PERSONNEL.
- (E) TO PROVIDE INFORMATION ON HT COST AND EFFECTIVENESS OF MAINTENANCE.

The Primary objective of Maintenance Management within construction companies should be geared to facilitate the best possible use of construction equipment & machineries through

actions such as replacement, repair, service and modification of the components so that these will continue to operate at a specified availability for as long as it is beneficial to do so. In construction companies Maintenance means keeping the availability of the entire construction operation system.

In this way, we say that maintenance management is responsible for the smooth and efficient working of equipment and helps in improving its productivity. It also helps in keeping the machine in a state of maximum efficiency with economy.

Success of any organization largely depends on proper selection of persons engaged for the operation work. Production in the concern depends largely on the maintenance of plant and equipments. Hence, the organization of the maintenance wing should be such that a proper maintenance and overhauls etc. can be done economically and effectively. Maintenance wing is generally given an important position in the project.

## 2.8 TYPES OF MAINTENANCE

PEURIFOY, (1970) GIVE EXPLANATION GENERALLY MAINTENANCE CAN BE DONE IN THE FOLLOWING TWO WAYS:-

BREAKDOWN MAINTENANCE, PREVENTIVE MAINTENANCE, IN THE FIRST CASE OF MAINTENANCE, REPAIR IS DONE AFTER THE BREAKDOWN OCCURS, WHILE IN THE SECOND CASE MAINTENANCE IS DONE ON THE BASIS OF PREDICTION OR ON THE BASIS OF PERIODICAL CHECKING. BREAKDOWN OF A MACHINE CAN OCCUR DUE TO THE FOLLOWING TWO REASONS:-

DUE TO UNPREDICTABLE FAILURE OF COMPONENTS WHICH CANNOT BE PREVENTED; DUE TO GRADUAL WEAR AND TEAR OF THE PARTS, WHICH CAN BE ELIMINATED TO A LARGE EXTENT BY REGULAR INSPECTION, KNOWN AS PREVENTIVE MAINTENANCE. FROM EXPERIENCE IT CAN BE DECIDED THAT, WHEN A PART SHOULD BE REPLACED, SO THAT BREAKDOWN CAN BE AVOIDED.

IN BREAKDOWN MAINTENANCE, DEFECTS ARE RECTIFIED ONLY WHEN THE MACHINE CANNOT PERFORM ITS FUNCTION ANY LONGER. IN THIS TYPE OF MAINTENANCE, REPAIR SHALL HAVE TO BE DONE ON FAILURE, THUS IT MAY DISRUPT THE WHOLE PRODUCTION, IF IT IS PERFORMING AN IMPORTANT WORK. THIS METHOD IS MUCH

EXPENSIVE ALSO DUE TO INCREASE OF DEPRECIATION COST, PAYMENT TO IDLE OPERATORS, OVERTIME TO THE MAINTENANCE

**STAFF FOR DOING THE EMERGENCY REPAIRS, AND IDLING OF MATCHING EQUIPMENT.**

Proper attention should be given to protect the construction equipments & machineries from undue wear and thus protect them from failures.

Road construction companies have to establish maintenance program being to operate in a manner conducive to sound maintenance practices.

There should be defined scope of each maintenance type because the absence of defined maintenance program has resulted in major repair jobs and much expensive. To set up, the proportion of preventive maintenance and breakdown maintenance is the key function of maintenance manager. So, efforts directed towards systematic maintenance accelerate smooth and efficient construction works.

From the topic discussed, what to benefit in keeping the machine in a state of maximization is not discussed or no model to analytically calculate its economy.

## 2.9 PREVENTIVE MAINTENANCE

SHARMA (1997) EXPLAIN PREVENTIVE MAINTENANCE IS SOMETIMES TERMED AS “PLANNED MAINTENANCE” OR “SCHEDULED MAINTENANCE” OR “SYSTEMATIC PLANT MAINTENANCE’ ETC. IT IS AN EXTREMELY IMPORTANT FUNCTION FOR THE REDUCTION OF MAINTENANCE COST AND TO KEEP THE GOOD OPERATIONAL CONDITION OF EQUIPMENT AND HENCE INCREASES THE RELIABILITY. PREVENTIVE MAINTENANCE AIMS TO LOCATE THE SOURCES OF TROUBLE AND TO REMOVE THEM BEFORE THE BREAKDOWN OCCURS. THUS IT IS BASED ON THE IDEA “PREVENTION IS BETTER THAN CURE”. SCHEDULED MAINTENANCE IS ALWAYS ECONOMICAL THAN UNSCHEDULED MAINTENANCE, BEST SAFEGUARD AGAINST COSTLY BREAKDOWNS IS TO INSPECT, LUBRICATE AND CHECK UP THE EQUIPMENT AS FREQUENTLY AS POSSIBLE. TO TAKE FULL USE OF EQUIPMENT AND TO MAINTAIN IT IN RELIABLE CONDITION, NECESSARY MEASURES SHOULD BE TAKEN TO PREVENT OVERLOADING, DAMPNES, NEGLIGENCE AND MISUSE OF MACHINES. FREQUENCY OF INSPECTION SHOULD BE DECIDED ON THE BASIS OF THE IMPORTANCE OF THE MACHINE; WEAR AND TEAR OF THE MACHINE AND ITS DELICACY.

THIS PERIODIC INSPECTION OR CHECKING HELPS TO FIND OUT THE REASONS LEADING TO BREAKDOWN AND TO RECTIFY THEM WHEN THEY ARE AT MINOR STAGES.

Construction machine & equipments needs periodic inspection or checking at the pre planned time, because it helps to find out the reasons leading to breakdown and to maintain them when they are in minor stage.

Construction companies need to have preventive maintenance instructions for operators. This instructions would indicate the daily & weekly services that operators should be made.

If preventive maintenance program is not operating in road construction company assigned operators and drivers can not follow systematic procedure to prevent their machine from breakage.

Although every construction machine has a repair manual and standard service time by the manufacturer the periodic servicing of machine differ from company to company due to the nature & condition of the work area.

The study lack to discuss & reflect what type of servicing, at what time or mileage or odometer reading & the place to be performed.

## 2.10 FUNCTIONS OF PREVENTIVE MAINTENANCE

WILSON (2009) POINT UP THE FOLLOWING ARE SOME OF THE IMPORTANT FUNCTIONS OF THE PREVENTIVE MAINTENANCE PROGRAM;

INSPECTION OR CHECKUPS AT CAREFULLY DECIDED FREQUENCIES. LUBRICATION, MECHANICAL COMPONENTS LIKE GEARS, BEARINGS, BUSHES AND OTHER FRICTION SURFACES GIVE GOOD PERFORMANCE FOR LONG PERIODS, WHEN THEY ARE SYSTEMATICALLY LUBRICATED I.E. APPLICATION OF RIGHT TYPE OF LUBRICANT AT THE RIGHT TIME, AT THE RIGHT PLACE AND IN RIGHT QUANTITY.

The discussion on function of preventive maintenance was focused on what to accomplish, but to have systematic and economical maintenance system or program it need to establish convenient maintenance shops with adequate facilities, shop equipment and tools and be adequately staffed to perform scheduled preventive maintenance.

Construction companies should preplan every preventive maintenance work. To plan it is essential to keep good record and Storage of maintenance spares. For company's dependant on Heavy equipment, Preventive Maintenance has paramount importance, such as. Less operation downtime, less repair costs less stand-by equipments needed.

## 2.11 SPARE PARTS MANAGEMENT

GREEN (1974) MAKES CLEAR THAT, IMPROVEMENT IN THE CAPACITY UTILIZATION AND COST REDUCTION CAN BE ACHIEVED BY BETTER SPARE PARTS MANAGEMENT. THE OBJECTIVE OF SPARE PARTS MANAGEMENT IS TO PROVIDE RIGHT PARTS IN RIGHT QUANTITY, IN RIGHT PLACE, AT RIGHT TIME AND AT RIGHT COST. THE PARTS MUST BE PROPERLY CODIFIED AND CLASSIFIED. VARIOUS COST REDUCTION TECHNIQUES FOR SPARS HELP THE MANAGER TO CONTROL LARGE NUMBER OF SPARE PARTS SELECTIVELY AND EFFECTIVELY, WHICH HELP TO UTILIZE HIS ENERGY TO PROBLEM AREAS RESULTING IN OPTIMAL USE OF HIS EFFORTS. THESE METHODS DEMAND MORE CONCENTRATION IN AREAS OF MORE IMPORTANCE, WHILE AREAS OF LEAST IMPORTANCE CAN BE LEFT TO SUPERVISORY LEVEL.

Adequate repair parts supply procedure and control system should be set forth in preventive maintenance program & be seriously implemented.

If construction company lack to establish & implement systematic method of storage and stock control on spare parts results expensive repairing the stock level for spare parts can be excessively large quantity or inadequate or totally missing the required parts. Effective parts management system requires each maintenance shop to have parts & maintenance manual for all types of physical resource.

For effective maintenance the need of paying more attention on the management of spare parts is vital. Construction companies should to have adequate repair parts supply procedures and control.

2.12 SUPPORTIVE ORGANIZATIONAL CONDITIONS FOR BETTER MAINTENANCE MANAGEMENT

CHARY, (2010) GIVE EXPLANATION, IN ORDER PREVENTIVE MAINTENANCE AND MAINTENANCE IN GENERAL, SHOULD SUCCEED, THE FOLLOWING

SUPPORTING CONDITIONS ARE NECESSARY. MANY OF THESE ARE THE ORGANIZATIONAL ASPECTS. GOOD COOPERATION AND COORDINATION BETWEEN THE PRODUCTION AND MAINTENANCE FUNCTIONS, IN GENERAL, IS ESSENTIAL. ANNUAL PLANNING FOR MAINTENANCE SHOULD BE DONE ALONG WITH THE ANNUAL PRODUCTION PLAN. MONTHLY, WEEKLY AND DAILY MAINTENANCE SCHEDULES SHOULD BE DRAWN, PREFERABLE IN CONSULTATION WITH THE PRODUCTION PEOPLE. THESE MUST BE PROPERLY COMMUNICATED TO THE PRODUCTION PEOPLE. IF THERE ARE ANY CHANGES IN THE CAPACITY-UTILIZATION, PROCESS-CHANGES AND METHOD-CHANGES, ETC., THE MAINTENANCE DEPARTMENT SHOULD BE AWARE OR MADE AWARE OF THE SAME.

To be successful in the field of reliability the preventive maintenance work should be plan in cooperation with construction departments. If the maintenance schedule is not properly communicated with the concerned departments availability of machineries will fall in short which will be the reason to be out of work schedule and slippage on project progress.

CHARY, (2010) EXPLAIN PROPER EQUIPMENT RECORDS SHOULD BE KEPT GIVING DETAILS SUCH AS BREAKDOWN-STATISTICS, MAINTENANCE CARRIED OUT, THE CAUSES OF BREAKDOWN, TIME TAKEN FOR MAINTENANCE, THE COMPONENTS AND PARTS OF THE MACHINERY, THE SUPPLIERS, DATES ON WHICH PREVENTIVE MAINTENANCE WAS CARRIED OUT, THE TYPE OF PREVENTIVE ACTION CARRIED OUT, ETC. SUCH INFORMATION HELPS IN POLICY-PLANNING, SCHEDULING, AND ALLOCATION OF MAINTENANCE RESOURCE. FOR INSTANCE, IT CAN HELP IN DECIDING ABOUT THE NATURE, TIME, TECHNIQUE AND MANPOWER OF PREVENTIVE MAINTENANCE ACTION. SPARE-PARTS INVENTORY SHOULD BE CONTROLLED PROPERLY, SO THAT ADEQUATE NUMBERS ARE AVAILABLE FOR MAINTENANCE PURPOSES. TO ENSURE GOOD CONTROL, THE MAINTENANCE WORK (PREVENTIVE AND BREAKDOWN) SHOULD BE STANDARDIZED AS MUCH AS POSSIBLE.

Ethiopian private road construction companies have to establish and maintain records on the numbering system of physical resource. Establish and maintain card files on physical resource in which identifying characteristics, cost, date of acquisition, assigned location, and replacement of major components are recorded. Develop a system of periodic reports on utilization and downtime of equipments and machineries. Parts authorized to be stocked should be limited only to those required performing the authorized level of maintenance. Minimum and maximum stock level should be established based on usage data and that replenishment requisitions be practiced.

### 2.13 TOTAL PRODUCTIVE MAINTENANCE (TPM)

CHARY, (2010) POINT UP THE CONCEPTS OF MAINTENANCE MANAGEMENT PRESENTED THAT FAILURE OF BREAKDOWNS IS INEVITABLE. HENCE, THE TRADE-OFF OR COMPROMISE BETWEEN THE PREVENTIVE MAINTENANCE AND THE BREAKDOWN MAINTENANCE OR, THE COMPUTATIONS FOR OPTIMAL STOCK OF SPARE PARTS. ONCE THERE IS A COMPROMISING ATTITUDE, IT LEADS TO COMPROMISES IN OTHER AREAS. FOR INSTANCE, IF THE MACHINES DO BREAK DOWN, THEN THE QUALITY ALSO MAY BREAK DOWN AND THE DELIVERIES MAY GET UPSET.

To be productive in the whole works construction company's maintenance management wing should develop proportional ratio between preventive maintenance and breakage maintenance. Although the optimal proportion is not described in the above literature, it is believed that less the breakdown of machinery, the less would be the proportion of defective quality.

### 2.14 RECORD FOR DECISION TO ACQUIRE

PEURIFOY, (1970) GIVE EXPLANATION THAT, CAREFULLY KEPT RECORDS FOR EQUIPMENT PREVIOUSLY USED SHOULD GIVE INFORMATION WHICH MAY BE USED AS A GUIDE FOR PREVIOUSLY USED SHOULD GIVEN INFORMATION WHICH MAY BE USED AS A GUIDE FOR THE PARTICULAR EQUIPMENT. BUT THERE IS NO ASSURANCE THAT SIMILAR EQUIPMENT WILL INVOLVE SIMILAR COSTS, ESPECIALLY IF THE EQUIPMENT IS USED UNDER DIFFERENT CONDITIONS.

Responsible person for equipment management should establish and maintains records on the history of equipment to identify uneconomical for performance, serviceability and reparability. To wind up the literature reviewed so far, it is important to remind what was discussed. To own physical resource costs money, regardless of the extent to which it is used. The cost of physical resource is investment costs, include interest on the money Invested, taxes of all types which are assessed against the equipment, insurance, and storage.

The reference materials used in the study briefly discussed about physical resource management system, covers all stages of the management process, including: initial business appraisal, Identification of fixed asset needs; financial evaluation; logistic support analysis; life cycle costing; maintenance strategy; outsourcing; cost-benefit analysis; disposal; and renewal also it Point out the importance of effective equipment management and maintenance system. Explain the dynamic influences and optimization of spares management.

Show the necessity of a methodology for developing maintenance management strategies to meet defined targets and commitments.

Hence, Ethiopian Road construction companies required the life cycle resource management system to achieve the stated output of the company effectively and efficiently, this are basically to:-

- a) Establish policy and procedure to manage physical resource effectively. It is the life cycle management of physical resource.
- b) Structure the organization & staffing.
- c) Develop and administer the physical resource program.
- d) Plan the use of physical resource.
- e) Acquire physical resources.
- f) Ensure availability of physical resources when ever required for construction works.
- g) Monitor the use of physical resources.
- h) Ensure conservation and reliability.
- i) Ensure the availability of supplies.
- j) Maintain appropriate records.
- k) To monitor the use of physical resources.
- l) Practice to dispose unserviceable physical resource.

### 3. RESEARCH DESIGN AND METHODOLOGY

In this chapter the researcher discusses the research locale, research design, and method, population & sampling techniques, sample size, respondents of the study, research instrument, and the statistical treatment of data.

Research Locale is Addis Ababa-Ethiopia, because the head office of Ethiopian grade one contractors is located in Addis Ababa.

The target populations are the owners, managers and resource management related professionals such as employees in equipment Administration, equipment maintenance & supplies management.

#### 3.1 RESEARCH DESIGN

The general approach of the research is mixed strategy, both quantitative & qualitative.

#### 3.2 RESEARCH METHOD

The researcher employed descriptive survey method, because, it helps in describing existing phenomena with the aim of producing data that justify about the current practice and it tries to make the necessary recommendations for adjustment.

#### 3.3 POPULATION AND SAMPLING TECHNIQUES

##### 3.3.1 SAMPLING TECHNIQUE

The sampling techniques used were mixed, simple random sampling & Purposive sampling technique. To EPGORCC the required capacity of physical resource, especially Equipment & machineries are almost the same to all companies (Appendix-G).Therefore; the researcher used simple random sampling techniques to select the sample from the total EPGORCC and

Purposive sampling technique to determine the number of respondent from the selected companies.

The researcher used Purposive sampling technique because, the selected sample were aimed at respondents who are information rich on the subject & to get best meet to the purpose of the study.

### 3.3.2 POPULATION & SAMPLE SIZE

According to Ethiopian Grade one contractors association record the total numbers of EPGORCC are 29. (Appendix-E)

The researcher conducted 14 companies (48%) sample from all 29 EPGORCC. (Appendix- F)

The total population was determined to be three from each company, thus the total respondents are 42. The respondents are owners, managers and resource management related professionals.

Interview was conducted with nine managers.

### 3.4 TYPES OF DATA AND INSTRUMENTS OF DATA COLLECTION

The types of Research instrument were questionnaires & interview. Both primary & secondary source were used.

Data collection & collation were based on questionnaires & interview. The questionnaires were used to collect relevant data on existing practices and challenges of physical resource management system variables. Using interview guide unstructured face to face with the interviewee was conducted.

#### 3.4.1 PRIMARY DATA COLLECTION

Questionnaire and interview were selected to collect the primary data, through structured Questionnaire and unstructured interview. The primary data instruments were evolved from the actual current practice, and the researcher experience. The questionnaire had two basic parts, the general Bio data section which contains the overall information of the respondents; such as the respondent's educational background, years of experience, current occupation, job position while, questionnaire B covers the essential information section which is about the detail physical resource management policies, procedures and practices. (Appendix-B)

Interview was conducted for the total population of 9. (Appendix-C)

### 3.4.2 SECONDARY DATA COLLECTION

The selected construction companies working manuals, work procedures, process flow charts periodic reports, Supply management vouchers, Property registration Books, internet web-sites, academic books and the likes have been the source of secondary data.

### 3.5 PROCEDURES OF DATA COLLECTION

Structured questioner was designed to collect primary data from professionals who took part in physical resource management functions, company's owners & managers.

Questionnaires were prepared in English language. The types of questions are open ended & closed items, five points liker's scale and interval form.

Questionnaire were developed and distributed to the respective data sources after pre-test was implemented and then collected.

100% the questionnaire were returned, but 95% of the respondents miss to answer 4 questions which are financial related questions. After questionnaires were collected, using interview guide face to face Interview with nine managers was conducted to obtain relevant information to triangulate the response gained from the questionnaires. Working manuals, procedures, work flow process, supply management vouchers, property registration books were assessed and analyzed.

### 3.6 VALIDITY & RELIABILITY OF QUESTIONNAIRE

After designing the questionnaires the researcher gave it to Ethiopian grade one construction association executive board members & manager of the association to test the questionnaires are valid and questionable.

The physical resource management questionnaire was per-tested by discussing with the members of Ethiopian grade one contractor's association executive board members & manager. After the necessary modification was made, the tools were administered to the respondents. Hence, the researcher believed that the instrument is valid.

### 3.7 METHODS OF DATA ANALYSIS

The Method of data Analysis was both qualitative & quantitative.

Quantitative data which were collected through closed ended questions were analyzed quantitatively by stating the frequency, percentage & cumulative percentage of each item through using SPSS (Statistical Package for the Social Sciences) to perform the necessary analyses & Qualitative data collected through interview & Documents were analyzed qualitatively using narrative form to strengthen the results of the quantitative data through triangulation.

#### 4. DISCUSSION & RESULT

This chapter summarized the results of analyzed data collected and interview conducted about current effective physical resource management system.

To achieve the study data & information were collected from both primary and secondary sources that help to assess, analyze and interpret the current PRMS & its challenges with in EPGORCC.

Questioners were distributed to 42 respondents. Nine managers and owners were interviewed for the in-depth understanding of physical resource management policy, procedures process & their challenges.

100% the questioners distributed were returned. Among the returned questionnaires most of the respondents miss to respond the same 4 questions which are financial related. Those questions are, question number 19, 35, 36 & 37.

The researcher considered that since 95% of the questions are replied the missed few questions cannot affect the purpose of the study. The data information collected is presented, discussed & analyzed in the following tables.

Table 1- Policy Issue

No	Variable	Yes		No		Total	
		Frequency	In %	Frequency	In %	In Number	In %
1	Do the company have systematic ways procedure to implement physical resource management policy	6	14	36	86	42	100
2	Is there a policy for inventory management?	15	36	27	64	42	100
3	Do you have a policy for disposition of old property?	18	43	24	57	42	100
4	Do you have a policy reduce risk?			42	100	42	100
5	Do you have sound maintenance policy	3	7	39	93	42	100
Cumulative Average			20		80		

---

## PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMENT IN EPGORCC

---

The percentage of respondents for each issue of policy shown in table – 1.

The cumulative average indicates that 80% of the respondent replied that there is no clear & sound policy with regard to physical resource.

MENZEL, WAGNER, KELLER, ANTONIADIS (2004) IN THEIR STUDY ABOUT RESOURCE MANAGEMENT FOR THE CONSTRUCTION INDUSTRY CLARIFY THAT, THE MANAGEMENT OF RESOURCES IS AN ESSENTIAL TASK IN EACH CONSTRUCTION COMPANY. THEREFORE TO MANAGE THIS CRITICAL RESOURCE CLEAR, SOUND AND APPLICABLE POLICY HAS TO BE ESTABLISHED. AMONG THE IMPORTANT TASK IN PHYSICAL RESOURCE LIFE CYCLE UTILIZATION MAINTENANCE ACTIVITY HAS A LION SHARE WHICH NEED SOUND POLICY.

Thus, the above concept confirms that their wills no success without establishing clear & Sound policy. Policies, directives, procedures, detail working manuals are the basic tools to success effective & efficient physical resource management.

Table 2- Planning Issue

No	Variable	Yes		No		Total	
		Frequency	In %	Frequency	In %	In Number	In %
1	Is there physical resource planning and management within the company	35	83	7	17	42	100

Planning physical resource issues in table 2, 35(83%) of respondents are replied that there is designed planning for the allocation and utilization of physical resource, and 7(17%) of the respondents replied that there is no coordinated task on planning.

SHARMA (1997) IN HIS STUDY ABOUT CONSTRUCTION EQUIPMENT & ITS MANAGEMENT EMPHASIZE THE ESSENTIALITY OF WELL PLANNED PHYSICAL RESOURCE OPERATION. THE SUCCESS OF A MECHANIZED CONSTRUCTION SHALL BE JUDGED BY ITS LOW COST, TIMELY AND SAFE COMPLETION, ALSO STRESSED ON THE MAIN POINTS WHICH SHOULD BE CONSIDERED WHILE PLANNING FOR EQUIPMENT OPERATION.

---

**PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMENT IN EPGORCC**

---

So, systematic plan of physical resource is extremely important function in the process of physical resource management. Systematic planned function of physical resource has a positive impact to the performance of construction works.

Table 3- Training issues

No	Variable	Yes		No		Total	
		Frequency	In %	Frequency	In %	In Number	In %
3.1	Are your operators and drivers having certificate of competence			42	100	42	100
3.2	Is there a training policy for operator sand drivers	3	7	39	93	42	100

Table 3, item No. 3.1 Shows that all of the respondents replied that drivers & operators are not examined & trained to be certified & competent.

Table 3 Item No. 3.2 describes 39 (93%) of the respondent replayed there is no committeemen to trained manpower only which is 3 (7%) respondents respond that they have a training program to operators & mechanics.

SHARMA IN HIS STUDY, CONSTRUCTION EQUIPMENT & MANAGEMENT ABOUT TRAINING EQUIPMENT OPERATORS EVEN THE BEST EQUIPMENT OF THE WORLD IS VALUELESS WITHOUT THE COMPETENT OPERATOR. A LITTLE THOUGHT IS GIVEN AS TO WHO WILL RUN THIS EQUIPMENT AND HOW THEY WILL BE TRAINED TO MAKE MAXIMUM USE OF THEIR CAPABILITIES. MOST OPERATORS HAVE ACQUIRED THEIR SKILLS BY SELF-INSTRUCTION OR FROM OTHER OPERATORS MOSTLY BY TRIAL AND ERROR. CONTRACTORS HAVE NOW BEGUN TO REALIZE THAT SUCH A HAPHAZARD APPROACH IS WASTEFUL AND CAN BE DANGEROUS. WITH EQUIPMENT BECOMING MORE SOPHISTICATED EACH DAY, IT IS NOT DESIRABLE TO HAVE JUST ANY ONE LEARN HOW TO OPERATORS MACHINE ON A TRIAL AND ERROR BASIS. SUCH OPERATORS HAVE LITTLE KNOWLEDGE OF THE SPECIAL FEATURES BUILT INTO THE EQUIPMENT THEY DRIVE.

---

**PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMENT IN EPGORCC**

---

In Ethiopia there is an institution under Ethiopian road Authority (ERA) for occupational competency Assessment and certification (OCA).

The vital aspect on the process of physical resource management is availability of the operation system and optimal utilization. The key element to play the above role is the human element so, to run the system reliably & optimize failure of equipments minimizing ignorance is important and this should be achieved through training and continuous assessment of operator's competency.

Table 4- Inspection & Calibration

No	Variable	Yes		No		Total	
		Frequency	In %	Frequency	In %	In Number	In %
4.1	Do you inspect & calibrate machineries & equipments	12	29	30	71	42	100

Table 4 describes that 30 (71%) of the respondents reply there is no inspection & calibration process only 12(29%) respondents reply that there is inspection & calibration.

Proper inspection and calibration of equipments and instruments, especially special equipments, laboratory & surveying equipments needs calibration.

The data in table 4 item no. 4.1 shows that there is a danger of high down time and consequence reduction in productive time.

**DIXEY AND GALLIMORE (2003) IN THEIR ARTICLE ABOUT THE RELIABILITY OF PROTECTIVE SYSTEMS EXAMINE HOW THE SYSTEMS CAN FAIL TO PROTECT, THE CAUSES AND PREVENTION OF SUCH FAILURES, AND WAYS IN WHICH THEIR RELIABILITY CAN BE OPTIMIZED.**

**DIXEY AND GALLIMORE (2003) EXPLAIN AMONG THE BENEFITS FROM INSPECTION AND CALIBRATIONS ARE:-**

- **REDUCTION OF THE TOTAL DOWN-TIME AND CONSEQUENT REDUCTION IN PRODUCTION LOSSES.**
- **REDUCTION IN THE NUMBER OF MAJOR REPAIRS, AND CONSEQUENTLY**
- **REDUCED MAINTENANCE EXPENSES.**
- **REDUCTION IN THE NUMBER OF REJECTS AND AN IMPROVEMENT IN PRODUCT QUALITY.**
- **REDUCTION IN THE INVENTORY OF SPARE PARTS.**

---

## PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMTN IN EPGORCC

---

If construction work is performed without accurate & timely calibrated instruments there will be a danger in increasing the number of rejects on quality which results rework and cries management. For the above reason to preserve the causes of failures due to inaccuracy of equipments, timely calibration and inspection should be made.

Table 5- Equipment life cycle history record

No	Variable	Yes		No		Total	
		Frequency	In %	Frequency	In %	In Number	In %
5.1	Use of vehicles and equipments maintenance history card	12	29	30	71	42	100
5.2	Use of equipment performance report	7	17	35	83	42	100
5.3	Use spare parts control card	15	36	27	64	42	100
Cumulative Average			27%		73%		

Table 5 describes that the use of history card & performance report are not designed & implemented. The cumulative average shows that 73% of the respondents theirs is no use of recording system and 27% use the recording system. The result is equipment life cycle history record and information system is insufficient, such that concurrent measurement of both technical and financial risk is undeveloped.

CHARY, (2010) PROPER EQUIPMENT RECORDS SHOULD BE KEPT GIVING DETAILS SUCH AS BREAKDOWN-STATISTICS, MAINTENANCE CARRIED OUT, THE CAUSES OF BREAKDOWN, TIME TAKEN FOR MAINTENANCE, THE COMPONENTS AND PARTS OF THE MACHINERY, THE SUPPLIERS, DATES ON WHICH PREVENTIVE MAINTENANCE WAS CARRIED OUT, THE TYPE OF PREVENTIVE ACTION CARRIED OUT, ETC. SUCH INFORMATION HELPS IN POLICY-PLANNING, SCHEDULING, AND ALLOCATION OF MAINTENANCE RESOURCE. PEURIFOY, (1970) IT COSTS MONEY TO OWN EQUIPMENTS, REGARDLESS OF THE EXTENT TO WHICH IT IS USED. THESE COSTS, WHICH ARE FREQUENTLY CLASSIFIED AS INVESTMENT COSTS, INCLUDE INTEREST ON THE MONEY INVESTED, TAXES OF ALL TYPES WHICH ARE ASSESSED AGAINST THE EQUIPMENT, INSURANCE, AND STORAGE. THE RATES FOR THESE ITEMS WILL VARY SOMEWHAT AMONG DIFFERENT OWNERS, WITH LOCATION, AND FOR OTHER REASONS.

To ensure schedule construction works and to avail equipments to construction projects when they are required the use of equipment history card & their performance is vital importance. The use of spare part record as it is shown in table 5 is 36% only. But, improvement in the capacity utilization and cost reduction can be achieved if the companies have better spare parts control record system. The purpose of spare parts recording system is to provide right parts in right quantity, in right place, at right time and at right cost. The above idea is supported by, CHARY, (2010) make clear that “Spare-parts inventory should be controlled properly, so that adequate numbers are available for maintenance purposes”

Table 6- Information Communication technology”

No	Variable	Yes		No		Total	
		Frequency	In %	Frequency	In %	In Number	In %
6.1	Do you implementation formation and communication technology	8	19	34	91	42	100
6.2	Do you have seamless data integration?	3	7	39	93	42	100

SHARMA(1997) COMPUTERS ARE USED EFFECTIVELY FOR VARIOUS ASPECTS RELATED TO THE EQUIPMENT MANAGEMENT LIKE, AVAILABILITY OF EQUIPMENT, OPTIMIZATION OF EQUIPMENT, FOR MATCHING THE SIZE OF THE EQUIPMENT WITH THAT OF OTHER EQUIPMENTS USED TOGETHER FOR ONE OR RELATED ACTIVITIES, RESOURCE LEVELING, MAINTENANCE OF HISTORY CARDS AND THEN USING THEM FOR PLANNING THE OVERHAULING OF ASSEMBLIES/EQUIPMENT AS A WHOLE. THE COMPUTER CAN ALSO BE USED FOR DETERMINING THE ECONOMIC ORDERING SIZE OF SPARES CONSIDERING THE PAST CONSUMPTION DATA, AND TO CARRY OUT VARIOUS ANALYSIS SUCH AS ABC; FSN (FAST, SLOW AND NONE MOVING) ETC. AS THESE HELP IN INVENTORY CONTROL, REDUCTION IN DOWN-TIME AND BETTER FINANCIAL CONTROL.

In related to the issue of using computerized information communication shown in the table 6, 34 respondents (91%), replied that there is no usage of computer information system and 8(19%) of the respondent replied there is a system of computerized information communication.

The result indicates the huge portion of percentage shows that there is deficiency of understanding the importance of computer information technology, which is vital to collect, flow, store, analyze data for managerial decisions making. The result indicates the application of computer technology for information and decision are falling short, which in all cases, the proper use of computer technology could provide management information more completely and more rapidly, even it is cost effective than manual work to have seamless integrated data & information.

Table 7- Supplies management System

No	Variable	Yes		No		Total	
		Frequency	In %	Frequency	In %	In Number	In %
7.1	Does the company have a written procedure for supply management	10	24	32	76	42	100
7.2	Does the company have a stock control procedure and record of inventory	10	24	32	76	42	100
7.3	Is their inventory management control system	3	7	29	93	42	100
7.4	Does the company has physical resources registration system	6	14	36	96	42	100
Cumulative Average			17		83		

In table 7 item no. 7.1 – 7.4 shows the effectiveness level of existing supplies management system. The assessment focused on the existence of:-

- Written procedures for the management of supply & construction materials.
- Stock control procedure and record of inventory.
- Inventory control management system
- Physical resource registration system

As shown in the above table the existing supplies management system, is not efficient. More than 83% of the cumulative average respondents replied the existing supply management system within the companies cannot support the construction performance with construction materials on timely basis to ensure the construction projects are completed on schedule and within budget.

---

**PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMENT IN EPGORCC**

---

The remaining respondent (17%) replied that supplies management, inventory control, scheduling, controlling and physical resource registration systems are applied.

The result point out that the majority of the selected companies do not have improved management and operation of the supply system, but the established sound and effective implemented procedure & process of supply & stock control procedure deals with material cost, utilization & handling. So, to increase productivity supplies management system should be effective & efficient.

SHARMA (1997) GIVE DETAILS ABOUT MATERIALS MANAGEMENT & INVENTORY CONTROL, MATERIALS MANAGEMENT FUNCTION INCLUDES SEVERAL IMPORTANT ASPECTS CONNECTED WITH MATERIALS, SUCH AS PURCHASING, STORAGE, INVENTORY CONTROL, MATERIALS HANDLING, AND STANDARDIZATION.

Table 8- Maintenance System

No	Variable	Yes		No		Total	
		Frequency	In %	Frequency	In %	In Number	In %
8.1	Do you have a system to prioritize maintenance	2	5	40	95	42	100
8.2	Is maintenance optimization planned ahead	2	5	40	95	42	100

Table 8 item no. 8.1 & 8.2 in the above demonstrate the existing maintenance system of the companies the result of the respondents shows that 40 (95%) of the respondents replied that their company have no system to prioritize and optimize maintenance plan ahead, while 2 (5%) respondents replied that they do have the system. The interpretation of the above data implies that construction companies to meet their assigned construction responsibilities effective maintenance system was not realized. About the importance of optimization planning on maintenance;

WIREMAN (2005) MAINTENANCE OF PHYSICAL RESOURCES CONTRIBUTES SIGNIFICANT ROLE TO SMOOTH & EFFICIENT UTILIZATION, PROPER ATTENTION SHOULD BE GIVEN TO PROTECT THE MACHINE AND ITS COMPONENTS FROM UNDUE WEAR AND THUS PROTECT THEM FROM FAILURES.

Table 9- Physical resource maintenance time

No	Variable	Yes		No		Total	
		Frequency	In %	Frequency	In %	In Number	In %
9.1	Is there frequent total assessments for equipment and machineries	1	2	41	98	42	100

Concerning to the frequency of total assessment made 41(98%) the respondent replied total assessment for machineries & equipments are not carried out the remaining 1(2%) of the respondent answer, there is the practice for the total assessment of equipment of machineries this showed that there is less or no consideration to frequently assess the health of physical resource which is vital function to keep & follow the productive operation of equipments throughout the life cycle of the resource.

Table 10- Focus on maintenance type

		Frequency	Percentage
Valid	Preventive maintenance	1	2
	Breakage maintenance	41	98
	Total	42	100

The data in table 10 about maintenance type shows that the maintenance and repair procedure based on down equipments are 41 (98%) of the respondent & 1 which is 2% of the respondent reply the focus is on preventive maintenance. The data shows that there is remote opportunity to develop and excuse a preventive (predictive) maintenance program.

Chary, (2010) explained “maintenance policy that, it is clear that there is nothing like a purely preventive maintenance; rather there is always an appropriate mix of the preventive and breakdown maintenance.”

As to the data shown in the above table the importance of inspection or checkups at carefully decided frequency before the resource be out of use or down is missed within the companies.

## **PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMENT IN EPGORCC**

---

The very vital aspect of preventive maintenance for good performance of long period is missed, so companies lose the advantage of less production down time, less repair cost are increased life time of the resource. As the result there is a direct impact on the availability of required physical resources at a required time.

The availability and productivity of machineries & equipments has a positive correlation with the performance of construction work.

Table 11- Qualification of personnel staff in the area of physical resource functions

No	Variable	Yes		No		Total	
		Frequency	In %	Frequency	In %	In Number	In %
11.1	Are the personnel assigned in warehouse operations has relevant training & experience	6	14	36	86	42	100

Table 11 about the existence of qualified personnel staff in the area of physical resource functions, 6(14%) respond that they consist qualified personnel's, the rest 36(86%) of the respondents reply that there is no qualified personnel, which is the vital aspect of companies human dimension. The need to committed and trained personnel towards to the effective and smooth function of physical resource management is vital to provide sufficient support for construction operation.

Table 12- Assessment on the existing system of physical resource management practice

No	Variable	Yes		No		Total	
		Frequency	In %	Frequency	In %	In no.	In %
Organizational Structure							
12.1	Do you manage physical asset in a separate or independent department	5	12	37	88	42	100

From the data & information collected the result of the existing organizational structure for physical resource management in table 12 shows that there is a limitation. 5 (12%) of the respondents replied that they manage their physical resource in a separate responsible department

but 37 (88%) of the respondents replied there is no sound organizational structure to manage physical resource.

Table 13- Efficiency of resource utilization

No	Variable	Yes		No		I don't know		Total	
		Frequen cy	In %	Frequen cy	In %	Frequen cy	In %	In no	In %
13.1	Is your internal physical resource management system support your company to be efficient in construction performance	1	2	36	86	5	12	42	100

Table 13, shows the result of the respondents that currently employed physical management practices within the companies. As it is shown 36 (86%), 5(12%) and 1(2%) replied as No, Yes and I don't know respectively.

The result in table 13, shows that 36 (86%) of the respondents replied that the existing efficiency on resource utilization cannot support to meet the companies assigned construction responsibilities. Effective physical resource management system is not realized.

Owning Issue (Selection of physical resource)

From the data collected & interview conducted all (100%) respondents reply that the owners of the company decide on what physical resource to own.

SHARMA (1997) IN HIS BOOK ABOUT CONSTRUCTION EQUIPMENT & ITS MANAGEMENT STRESSED ABOUT SELECTION OF PHYSICAL RESOURCE. THE COMPLETE PROCUREMENT ACTION IS DIVIDED IN VARIOUS ACTIVITIES LIKE CALLING ENQUIRIES, ITS TECHNICAL AND FINANCIAL EVALUATION, ORDERING, CONTRACT-MAKING, TRANSPORTING, ASSEMBLING AND INSTALLATION AND COMMISSIONING, AND SHOULD BE FOLLOWED VIGOROUSLY, AS ANY DELAY IN ANY OF THESE ACTIVITIES WILL RESULT IN DELAY IN COMPLETION OF THE PROJECT. THEREFORE THESE ACTIVITIES ARE MONITORED AT TOP MOST PRIORITY.

The process of selection of equipments and machineries to own is generally a parts of physical resource management. The selection process is vital and highly related with planned work. The

---

**PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMTN IN EPGORCC**

---

technical & functional evaluation before selection should be worked out by professional specification analyst to ensure appropriate owning of physical resource.

The Proper selection of physical resource for road construction project is vital importance for its effective performance. Problem of physical resource selection has become more complicated, because large variety of equipments is being manufactured now-a-days

Table 14- Decision to avail physical resource to projects

	Frequency	Percentage
Valid owner	6	14
general manager	33	79
project manager	3	7
Total	42	100.0

Table 14- shows the decision responsibility to avail physical resource required for works majorly fall under the jurisdiction of the general manager. In few companies decision is made by owners. The data shows that 33 (74%) of respondents replied that decision is made by general manager and 6, (14%) decision is made by owner and 3, 7% decision is made by project manager. The participation of resource manager is less. Thus the data described that there is no combined systematic and performance based processes to availed physical resource to project.

Table 15 - Basic knowledge level required to manage physical resource

	Frequency	Percentage
Valid diploma	3	7
first-degree	39	93
Total	42	100.0

On the basis of data obtained about the required education level to manage physical resource of construction companies, 39(93%) of the respondents agreed on first degree holders, 3(7%) respondents classify diploma level is enough. The data explain that professionally qualified

## **PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMTN IN EPGORCC**

---

employees to manage physical resource are vital. Companies even they establish sound policy and directives the implementation is highly depend on the existence of qualified personals.

Table 16- Percentage of investment cost for major overhaul

		Frequency	Percentage
Valid	5-10%	2	5
	10-15%	4	10
	15-20%	6	14
	morethan20%	30	71
Total		42	

As stated in the above table the cost of major overhaul (rehabilitation) cost from the total investment is 30(71%) replied it is greater than 20% of the total investment, 6(14%) replied the cost is between 15 – 20% of the total investment, 4(10%) replied the cost of major maintenance cost is between 10 – 15% of the total investment. The remaining respondent 2(5%) replied 5 – 10% of the total investment is the cost of major rehabilitation of physical resource.

The result shows that the majority of companies have high cost for maintenance work. Although there is no one agreed and approved figure the relatively huge amount of money is set out for Maintenance. So efforts have to be exerted to reduce the cost of major maintenance to the practically acceptable average 5 – 10% of the total investment of physical resource.

Table 17- Recording on utilization of physical resource

No	Variable	Applicable		Partially applicable		Not Applicable		Total	
		Frequency	In %	Frequency	In %	Frequency	In %	In No.	In %
17.1	Operational idle & down time of resource report system	2	5	7	16	33	79	42	100
17.2	Actual performance against capacity specification					45	100	42	100

## **PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMTN IN EPGORCC**

---

The above 17 tables describe the practice of recording the utilization of physical resource. As it is shown in the table 17 item no. 1.1 the operation (productive) time, idle and down time calculation for decision making is applicable by 2(5%) of the respondents, while the 7(16%) & 33(79%) of respondents respectively replied that operation, idle & down time of the deployed resource recording and reporting is partially applicable & not applicable.

Table 17 item no. 17.2 the follow up and recording of the deployed physical resource actual performance against capacity specification is 100% not applicable.

One of the implementation tools to develop and use effective management practice of physical resource is to record and calculate, the productive and non productive utilization of the deployed resource; but the data shows the practice is insufficient. This implies the control practice is poor. Unless genuine reports are generated for operational, idle & down (OID) time, appropriate decision making in allocation & effective utilization is in danger and it is a challenge to managers to properly manage the resource.

Table 18- HRM factors affecting physical resource management

No	HRM factors affecting physical resource management	Highly influence		Moderate influence		Low influence		Total	
		Frequency	In %	Frequency	In %	Frequency	In %	In Number	In %
18.1	Is Physical resource management affected by human resource management factors such as operator negligence, Operators capacity, Employee motivation problem, Salary Scale, Employee supervisor relationship, Recruitment and selection Procedure?	30	72	9	21	3	7	42	100

The result in the above table 18 shows that 72% of the respondents replied that physical resource management is adversely affected by operators negligence, operators capacity, maintenance problems, spare parts managements problems, employee motivation salary scale, employee supervisor relationship, recruitment & selection procedure, while the other respondents replied 21% and 7% moderately influenced and low influenced respectively. The above analysis shows that the companies have to improve the practice of the above mentioned factors.

## 5. SUMMARY, CONCLUSION & RECOMANDATION

### 5.1 SUMMARY OF MAJOR FINDINGS

As per the analysis and interpretation of data findings was presented as follows;

Findings on policy issue,

- 81 % of the respondent replied that is there no clear, sound & applicable policy to effectively manage the physical resource.

Findings on planning and scheduling,

- 80 % of the respondent replied there is a designed planning & Scheduling for the allocation of physical resource.

Findings on training program,

- 93% of the respondent agreed no training program to create competent operators, drivers & supply personnel.

Findings on inspection & calibration,

- 67% of the respondent replied no inspection & calibration for equipments to reduce down time, cost & rejection of quality work.
- 67% of the respondent agreed that there is no equipment lifecycle recording system.

Findings on computerized information system,

- 82% of the respondent replied that the use of integrated computerized information system for data sharing & decision making is not applied.

Findings on Materials management & inventory control system,

- 73% of the respondent disagreed that there is well designed materials management & inventory control system.

Findings on maintenance plan,

- 88% of the respondent replied system to prioritize and optimize maintenance plan is not applicable.

Findings on assigning qualified personnel in physical resource management functions

- 84% of the respondent agreed that qualified personnel are not assigned in the area of physical resource management functions.

Findings on Periodical assessment of physical resource,

- 98% of the respondent replied there is no total assessment of physical resource often carried out.

Findings on organizing & staffing,

- 100% of the respondent agreed there is an urgent need to change in organizing & staffing physical resource management functions.

Findings on Support of physical resource functions to construction performance

- 80% of the respondent agreed that the present physical resource management system cannot support the construction performance to be efficient.

Findings on focusing preventive maintenance,

- 98% of the respondent replied that maintenance is not focused on preventive maintenance principles.

Findings on procurement activity,

- 100% of the respondent replied that selection to acquire physical resource was not carried out in co-ordination or in a team.

Findings on Effect of human resource management system,

- 51% of the respondent replied that physical resource management activities are adversely affected by human resource administration system.

Findings on management commitment to heavily address physical resource management system,

- 80% of the respondents agreed that there is less consideration of physical resource management system.

From the discussion, analysis and interpretation the following challenges were noted;

- i. Lack of Formulating PRM policy & procedures
- ii. Lack to developed sound organizational structures.
- iii. Weak equipment management system
- iv. Absence of quality utilization record system.
- v. Lack of workshop and maintenance procedures

- vi. Lack of periodic assessment of equipments and machineries
- vii. Poor preventive maintenance procedure.
- viii. Need for formulating plans to improve physical resource performance,
- ix. Absence of inspection and calibration for construction equipments
- x. Lack of visible procurement activity
- xi. Inadequate property and inventory control system.
- xii. Insufficient integrated computerized information system.
- xiii. Deficiency on developing a consistent knowledge base education and training

## 5.2 CONCLUSION

Physical resources management is an emerging inter-disciplinary field that combines the technical issues of physical resource acquisition, reliability, safety, performance, utilization, maintenance and disposition with management skills. It is about achieving sustainable business outcomes and competitive advantage by applying systemic and risk based processes to decisions concerning a company's physical resources.

Today effective physical resource management system is the core competency requirements. EPGORCC in order to be competitive, and successfully complete their contractual obligation they would need to invest on a high rise physical resource management system.

Based on the above summary of major findings the following conclusions were drawn;

### 5.2.1 LACK OF FORMULATING PHYSICAL RESOURCE MANAGEMENT POLICY & PROCEDURES

EPGORCC needs a sound physical resource management policy to carry out their responsibility and achieve the established goals and objectives. Company management should establish & provide policy and procedural guidance for all physical resource management activities and exercise technical supervision over these activities. However as the study revealed with the existence of physical resource management policy & procedures, most of the companies were not established and implemented sound and clear policy and procedures for significant improvement in physical resource management.

### 5.2.2 LACK TO DEVELOPED SOUND ORGANIZATIONAL STRUCTURES

The study and analysis of the organization indicate that the need for immediate change to develop sound and efficient management organization to achieve the goal of effective physical resource management.

Currently organizational structures are delineated along traditional disciplines often fail to provide an asset-centric focus. This exacerbates and amplifies divergent views on what should constitute physical resource management in an organizational setting.

### 5.2.3 WEEK EQUIPMENT MANAGEMENT SYSTEM

Currently the management system related to the utilization, maintenance & disposition of equipments have not been efficient. There is no centralized equipment & maintenance control program. No or less effective system exists for scheduling the assignment and utilization of available equipments. So it could be possible to conclude that the existing equipment management system is not sound & effective to meet the assigned construction responsibilities.

### 5.2.4 INADEQUATE PHYSICAL RESOURCE UTILIZATION RECORD SYSTEM

The best use of equipment during its useful life have to be divided between productive work and time allotted for preventive maintenance, repair, and lost time. The study and analysis in this area exposed that, operation, idle and down (OID) time of physical resources recording system are insufficiently integrated within the companies, such that concurrent measurement of both technical and financial risk is undeveloped.

### 5.2.5 POOR PREVENTIVE MAINTENANCE PROCEDURES

The best management of equipment results in maximized productive work, optimal preventive maintenance and minimized repair and lost time, but from the study result currently no effort has been made to Plan and schedule preventive maintenance work to optimize resources availability and reliability of physical resources which are required for construction project. Therefore it is concluded that preventive maintenance procedures were not developed knowledgably to be benefited from its concept.

### 5.2.6 CHALLENGES NOT YET ADDRESSED

From the summary and findings the following challenges was not yet addressed;

- i. Lack of workshop and maintenance procedures.
- ii. Absence of inspection and calibration for construction equipments construction equipments, particularly laboratory & surveying equipments needs frequent inspection and calibration to keep away construction works from error in measurement and poor quality. The study discovered that there is no timely inspection and calibration of equipments and instruments.
- iii. Lack of visible procurement activity. The present procurement activities are carried out with little or no policy or procedural guidance. No supply system can afford to stock to meet every possible need.\no efforts made to purchase common supplies in bulk quantities. No evidence is available to indicate that efforts are made to standardize types and models of vehicles and equipments. Hence it is concluded that the procurement system is inefficient and the procedure is not clearly outlined.
- iv. Lack of effective property and inventory control system. The study revealed that the existing property and inventory control system is not capable to support construction and maintenance activities with equipments, machineries, tools, repair parts and materials on a timely basis to ensure that road construction projects are completed on schedule and within budget.
- v. Insufficient integrated computerized information system. Developments of computerized technology improved information systems and decision making which are factors that can contribute to improvements in physical resource management. So far the current information system has only evolved as to data collection & still geared to fulfilling a traditional maintenance cost control philosophy rather than full physical resource value management functions. Data and information systems are generally not well integrated across different organizational levels and do not yet provide the same level of reliability for decision making. Thus from the study it could be concluded that the importance of computerized physical resource management system to effective utilization of physical resource is neglected.

vi. Deficiency on developing a consistent knowledge base education and training

The most pressing challenge facing is the weak commitment to develop a consistent knowledge base, on the physical resource, plus commitment to re-aligning education and training towards effective human resource development. Thus, the human element has not been handled competently, both in terms of training and in terms of managing processes.

Finally it is possible to conclude the true nature of the important relationship between physical resource management and associated value to the effectiveness of construction performance rarely well represented and understood.

### 5.3 RECOMANDATIONS

In light of the findings of this study and conclusions made, the following major recommendations are forwarded in order to improve the current practice of physical resource management system.

#### 5.3.1 POLICY AND PROCEDURE RELATED TO PHYSICAL RESOUCCE MANAGEMENT

##### 5.3.1.1 ESTABLISH SOUND POLICY

The Ethiopian Grade one road Construction companies should have formal written policies about how to manage all the physical resource complete with legal requirements reduce waste and obtain better value of money.

The present policy, system, reviews & analysis describes most of the companies do not develop Physical resource management policy. They think that policy of physical asset is set forth and defined by ministry of fiancé & economic development.

However the structure for the management of fixed asset, acquisition, registration process utilization maintenance, reporting ... etc system is not well developed. Road construction companies from the practical experience be supposed to capacity building to develop sound and effective policy & procedures to ensure maximum utilization of resource so that to increase their performance and maintain the synergy principle.

Although physical resource management system is broad area the road construction companies at list have to establish their policy & procedures on physical resource question, utilization,

Maintenance, physical facility registration, maintenance managements, inventory /supply/ management, and property disposal.

Giving attention to establish sound policy will be significant factor in achieving the construction works within the time budget and required quality.

#### 5.3.1.2 DEVELOPMENT OF IMPROVED PROCEDURE

Among the deficiencies observed from the study is the lack of sound and effective Physical resource management procedures & guidelines.

Giving attention to establish and develop improved procedures and management system with the necessary management tools will be significant factor in achieving the construction works within the time budget and required quality. The procedures that work well and make the management of resource efficient & effective to follow & keep all the physical resources in good order so, that the construction works runs smoothly quite well and increase the performance to meet the company's responsibility & obligations.

Detail procedure for Physical resource management, planning mechanism, reporting system that are both systematized and standardized should be developed. One of the significant aspects for successful operation of road construction is that physical resource management shall be structurally organized with the managerial techniques and tools to achieve best the major objective. The development of plan of action and guidelines for implementation of Physical resource management should aim at improved system for acquisition, utilization, maintain and disposition efficiently. Inefficient guideline or method is to plan for failure. If there is not sound and effective procedure and method of scheduling company physical resource, the company will never move beyond reactive (firefighting) actions to proactive physical resource management.

In order to effect improvements in management and operation of physical resource effective support should be provided in planning equipment maintenance and related operation.

Hence, it is recommended that to develop sound & effective procedures. In the establishment of sound and effective physical resource management procedure the management evaluation tools are vitally important.

### 5.3.1.3 DEVELOPE PLANNING & SCHEDULING SYSTEM

To have no plan means no success if construction companies do not plan and schedule their physical resource against to the construction work program it is a failure they will never move beyond reactive (firefighting) actions. So to make transition from reactive to proactive actions the following practices are recommended.

- i. Plan and prepare responsible personnel, project manager and project focused instead of overworked firefighters.
- ii. Make effort to Planning and scheduling be a lifeline implement the planned.
- iii. Calculate operational, idle and down hours of machineries and equipments.
- iv. Develop a weekly plan and a daily schedule
- v. Keep scheduling
- vi. Creates the opportunity to develop and execute a preventive/predictive maintenance program.

### 5.3.2 ORGANIZATIONAL RESPONSIBILITY FOR PHYSICAL RESOURCE MANAGEMENT

#### 5.3.2.1 DEVELOP SOUND ORGANIZATIONAL STRUCTURE

Different literature on physical resource management commonly enclosed and accepted that the general principles and objective of physical resource management with in construction companies is to support construction and maintenance activities with materials, machineries and equipments and repair parts on a timely basis to ensure that construction projects are completed on schedule and within budget.

From the data & information collected and analyzed, the present organizational structure for resources management within road construction companies cannot support this objective and is not in keeping with sound organizational principles.

Foremost among the practical deficiencies is the lack of a functional staff and organization with sufficient personnel and defined responsibilities to operate an effective physical resource management system. In order to effect improvements in the management and operation of the physical resource, so that effective support can be provided to construction, equipment

Maintenance, and related operations, a significant change in organizational structure and staffing is required.

It is recommended that a resource management be established as a department which is accountable to the general manager of a company. This department is supposed to have responsibility for development of physical resource management policies and procedures including stock control, requirements forecasting, equipment and plant administration and maintenance and unserviceable property disposal.

It is also the responsibility of the organization to develop monitoring & evaluation system for physical resource, acquisition, Utilization & Disposition.

With regard to monitoring and evaluation of physical resource management system is observed deficiencies, so to alleviate the deficiencies it is recommended to have a complete physical resource management control system including the detailed application of estimating, scheduling, and cost control should be developed.

### 5.3.3 PROPERTY CONTROL PROCEDURE

In the establishment and operation of a sound and effective physical resource management system, property control procedures are vitally important. Property control procedures which are presently used within company are far from adequate or satisfactory to support the performance of construction. The analysis of data collected from companies indicates that in most of the companies the property control records system are not well designed & are not serving the purposes. The property control record in road construction companies should serve the purpose for which they exist, namely, providing a record of the physical asset with its reason codes and, the complete asset registration book or module which recorded the specification, type, model make .price, expected life, depreciation remaining value, location, the asset due in on purchases requests, and the asset issued when it is requested for project work. Additionally, no effort has been made to establish log book for the movement and their supplies (fuel lubricant, tyre...etc) utilization. Hence to plan & schedule physical resource allocation & utilization the traditional way of recording should be replaced by modern scientific system, such as enterprise resource planning, micro soft record system.

#### 5.3.3.1 STOCK CONTROL PROCEDURE

The analysis of data collected from companies indicates that in most of the companies there is no stock control procedure for construction materials and supplies. Minimum stockage objectives, such as reorder points based on the amount of time needed for a purchase order to be processed and the items received, or a minimum or safety level which will trigger an emergency purchase request.

The poor stock control system results the important and required construction materials to be stock out. This practice adversely affects the construction performance to complete as per the schedule & finally resulted to face liquidity damage.

It is recommended that Effort has to be made to establish a list of stock items which are frequently required in construction operations. To alleviate problems and deficiencies on stock control procedure, it is recommended that:-

- i. A standard stock record card be established and implementing its use be mandatory. A stock age objective, reorder point, and safety level be established for each item normally stocked within the system and posted on the stock card.
- ii. To establish a standard stock age list for construction items normally used in construction operations and each project stock a limited quantity of these items and central stores are a master resupply point with a large stock age.
- iii. All supply requirements from project warehouses be screened and approved by the resource management prior to issue.
- iv. The stock age of repair parts at main stores is based on the manufacturer's recommendations. Stock age of repair parts at project and maintenance shops should be limited to those parts which are used to provide the scope of maintenance outlined by the policy of the company.

#### 5.3.3.2 WAREHOUSE OPERATIONS

Data collected about warehouse operation indicate that warehousing of supplies and material is performed by personnel who have not been trained in proper materials handling and storage techniques. It is recommended to recruit and train personnel for specific positions.

### 5.3.3.3 PROCUREMENT MANAGEMENT

Since procurement of goods and equipments is one of the vital management function of the company, for effective acquisition of physical resource sound and effective procurement management system is mandatory.

It is recommended that well designed procedures for the procurement and control of supplies can contribute significantly to the efficiency of Road construction operation.

The review and analysis of these functions have indicated improvements to be effected in these services.

Thus from what was observed in the study the following is recommended:-

- i. Construction companies should develop and implement procedures for all purchasing activities. Adopt a procedure to reduce the frequency of single item purchases and utilize bulk purchasing more effectively.
- ii. All purchase requests be acted upon.
- iii. Specific limitations should place on project purchasing.
- iv. Standardize to the extent possible, the make and model of equipment and vehicles purchased.

### 5.3.4 EQUIPMENTS MANAGEMENT & MAINTENANCE SYSTEM

#### 5.3.4.1 EQUIPMENT MANAGEMENT

Conservation and maximum utilization of equipment is achieved with a well developed and administered system of equipment maintenance and management. The study report and accompanying data on this subject indicates that to set forth recommendations relating to policy and procedures for significant improvement in equipment management is compulsory. From the study observed to alleviate deficiencies on the issue of equipment management system the following are recommended:-

- i. Road construction companies have to develop sound and effective equipment management policies, practices, equipment utilization procedures.

- ii. Establish an Equipment management Division within the proposed physical resource management department to develop equipment management practices, equipment utilization policies, and procedures.
- iii. Develop and implement equipment registration numbering system.
- iv. Develop equipment control system and develop equipment Management Manual.
- v. Analyze equipment inventory reports to determine if the item is repairable or salvage; initiate appropriate repair, disposal, and/or cannibalization procedures.
- vi. Analyze the age of the fleet and initiate a disposal and replacement policy based on an annual age or condition analysis.
- vii. Adopt and implement equipment control and utilization reports.

#### 5.3.4.2 EQUIPMENT & MACHINERIES MAINTENANCE MANAGEMENT

From the study observed the insufficient policy ,procedure, process flow of construction companies with regard to maintenance management, to alleviate deficiencies on the issue of equipment maintenance management system the following are recommended:-

- i. Maintenance shops should be provided adequate facilities, tools, equipment, and qualified personnel to perform the scope of maintenance authorized. Project maintenance shops operate mobile maintenance teams to perform scheduled maintenance and minor repair on vehicles and equipment located at project sites.
- ii. Establish a maintenance facility at each major construction site to perform the scope of maintenance authorized for such facilities.
- iii. Establish mobile maintenance teams within each project to perform scheduled maintenance and minor repair to equipment permanently located at well sites. All vehicles and equipment requiring repair beyond the scope of maintenance authorized for project facilities be returned to the head quarter Maintenance Facility for needed repair.
- iv. Adopt and implement the preventive maintenance concepts and procedures.

#### 5.3.4.3 TYPE OF MAINTENANCE TO DOMINATE

The analysis of collected data and information describes that the Ethiopian road companies focused on corrective maintenance, which is very expensive and creates shortage and unavailability of the required equipments and machineries for the construction work and has negative effect on the performance of the work to be completed on time & at budget. The adverse effect of not focusing on preventive maintenance is to short the required machineries for construction work to perform as per to the schedule, then sleep age of schedule costs projects. They should focus and implement preventive maintenance system and reduce the frequency of corrective maintenance type to alleviate the deficiency caused due to down time of machineries. Although it impossible to totally eliminate breakage maintenance, to have appropriate mix of preventive and breakdown maintenance is advisable.

#### 5.3.4.4 SHOP MANAGEMENT

The study findings indicate that there is a problem in shop management practice of the companies.

Hence, the recommendations for the utilization of effective shop management are as follows:-

- i. All maintenance activities are organized for scheduled maintenance services and functional repair areas.
- ii. Each shop is provided with equipment required to perform maintenance.
- iii. Each maintenance facility be provided skilled personnel, adequate in number.
- iv. Train all shop foremen and maintenance facility managers in shop management procedures.
- v. Provide all maintenance shop with parts and maintenance manuals for all vehicles serviced by the facility.

#### 5.3.4.5 MAINTENANCE OF CONSTRUCTION INSTRUMENTS

The findings indicates servicing and repair of office machines and equipment be performed by commercial vendors. This practice is acceptable & recommended. Especially surveying & laboratory equipments maintenance should be out sourced.

### 5.3.5 COMPUTER BASED MANAGEMENT INFORMATION SYSTEM TO FACILITATE PHYSICAL RESOURCE MANAGEMENT

Information is vital to the proper functioning of any company physical resource, management system. Computer based information travels through the company, helping users contribute their efforts to the achievement of the company's objectives. Physical resource managers usually have greatest need for information because the scope of their work is the greatest. All members of the physical resource management should use computerized information system. The resource management contributes updated information to the overall management system, especially to the equipment management application.

Without establishing computerized based information system companies cannot maintain proper and timely utilization records for resource utilization and health information derived from data embedded to predict problems before they can escalate.

Therefore, it is recommended that to develop & implement integrated computerized information system.

In general Consideration computer technology for a management information system is deferred. Finally, Under the stimulus of increasing demand for the construction services, the construction companies has expanded and is expanding in geographical scope and technological dimension.

### 5.3.6 RECOMMENDATION FOR THE CHALLENGES

Challenges are constraints on the development of effective physical resource management system as observed in the study results. However most of the problems are internal and implementation challenges which are directly related to the construction companies. Seeing as there is a strong desire to benefit from effective physical resource management system, there is a room to address each type of deficiencies in the area of technical and managerial skill. These challenges can be tackled and improved by commitment and skills of the owners and managers joint effort. Therefore it is recommended that to take radical measures to tackle and improve the constraints in order to ensure and promote physical resource management system of the company achieve its supportive purpose.

The main objective of effective physical resource management is to design, plan, develop and evaluate a system to provide the necessarily required physical resource to construction projects. Ethiopian Road contractors in order to fill complete in their contractual obligations they need to have a complete physical resource management control system including the detailed application of estimating, planning, scheduling and cost control.

Effective physical resource management system has a vital role to accelerate the efficiency of construction performance. The responsibility of the contractor for the delivery of the completed facility at a specified time and cost is dependent on effective physical resource management system. In doing effective physical resource management system the contractor accepts legal, financial, and managerial obligations.

**REFERENCE**

1. Alan Wilson (2009). Asset maintenance management: A Guide to developing strategy and improving performance. Boston, mass. , USA: Harvarol Business School Publishing.
2. Chary S.N. (1995).Theory & problems in production & operation management. NewDelhi: Tata McGraw.
3. Chary S.N (2010).Production and operation management. NewDelhi: McGraw-Hill offices Private Limited.
4. Chftkara K.K (1998).Construction Project Management. Newdelhi: McGraw-Hill Publishing Company limited.
5. Clive Dead man (2010).Strategic Asset Management. Vermont, USA: Oliver Weight Publication.
6. Dekker (2002).Asset management Excellence: Optimizing Equipment life- cycle Decision. USA: Reston Publishing Co.
7. Eqisbceom. (2008, July) Road Sector Development program capacity Building Service Project. Final inception report presented to Europe AID. ADDIS ABABA.
8. Green J.H. (1974). Production & Inventory Control.USA: Prentice-Hall
9. Hmmer D.S. (1973) Materials Management. Illinois: Hoomwood.
10. Ministry of finance & economic development (1997, December) government owned fixed assets management. Financial Regulations No 17/1997, Addis Ababa-Ethiopia.
11. Nicholas Anthony and John Hastings (2009). Physical Asset Management.
12. Peurifoy R.L. (1970). Construction Planning, Equipment, and Methods. Tokyo: Kogadusha Company, Ltd.
13. Prasanna Chandra (2004).Maintenance and Reliability best Practices. NewDelhi: McGraw-Hill offices Private Limited.
14. SHARMA S.C. (1997).Construction Equipment and its management. Delhi: KHANNA PUBLISHERS
15. SHARMA S.C. (2007). Plant lay out and Material handling. Delhi :KHANNA PUBLISHERS
16. Terry Wireman (2005). Developing performance indicators for managing maintenance. New\_York: McGraw-Hill

THE FUNDAMENTAL ISSUES ON PHYSICAL RESOURCE MANAGEMENT

APPENDIX A

Table 1- Policy Issue

No	Variable	Yes		No		Total	
		Frequenc y	In %	Frequenc y	In %	In Number	In %
1	Do the company have systematic ways procedure to implement physical resource management policy	6	14	36	86	42	100
2	Is there a policy for inventory management?	15	33	27	64	42	100
3	Do you have a policy for disposition of old property?	18	43	24	57	42	100
4	Do you have a policy reduce risk?			42	100	42	100
5	Do you have sound maintenance policy	3	7	39	93	42	100
Cumulative Average			20		80		

Table 2- Planning Issue

No	Variable	Yes		No		Total	
		Frequenc y	In %	Frequenc y	In %	In Number	In %
1	Is there physical resource planning and management within the company	35	83	7	17	42	100

Table 3- Training issues

No	Variable	Yes		No		Total	
		Frequenc y	In %	Frequenc y	In %	In Number	In %
3.1	Are your operators and drivers having certificate of competence			42	100	42	100
3.2	Is there a training policy for operator sand drivers	3	7	39	93	42	100

## **PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMENT IN EPGORCC**

Table 4- Inspection & Calibration

No	Variable	Yes		No		Total	
		Frequency	In %	Frequency	In %	In Number	In %
4.1	Do you inspect & calibrate machineries & equipments	12	29	30	71	42	100

Table 5- Equipment life cycle history record

No	Variable	Yes		No		Total	
		Frequency	In %	Frequency	In %	In Number	In %
5.1	Use of vehicles and equipments maintenance history card	12	29	30	71	42	100
5.2	Use of equipment performance report	7	17	35	83	42	100
5.3	Use spare parts control card	15	36	27	64	42	100
Cumulative Average			27%		73%		

Table 6- Information Communication technology

No	Variable	Yes		No		Total	
		Frequency	In %	Frequency	In %	In Number	In %
6.1	Do you implementation formation and communication technology	8	19	34	91	42	100
6.2	Do you have seamless data integration?	3	7	39	93	42	100

Table 7- Supplies management System

No	Variable	Yes		No		Total	
		Frequency	In %	Frequency	In %	In Number	In %
7.1	Does the company have a written procedure for supply management	10	24	32	76	42	100
7.2	Does the company have a stock control procedure and record of inventory	10	24	32	76	42	100
7.3	Is their inventory management control system	3	7	29	93	42	100
7.4	Does the company has physical resources registration system	6	14	36	96	42	100
Cumulative Average			17		83		

## **PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMTN IN EPGORCC**

---

Table 8- Maintenance System

No	Variable	Yes		No		Total	
		Frequency	In %	Frequency	In %	In Number	In %
8.1	Do you have a system to prioritize maintenance	2	5	40	95	42	100
8.2	Is maintenance optimization planned ahead	2	5	40	95	42	100

Table 9- Physical resource maintenance time

No	Variable	Yes		No		Total	
		Frequency	In %	Frequency	In %	In Number	In %
9.1	Is there frequent total assessments for equipment and machineries	1	2	41	98	42	100

Table 10- Focus on maintenance type

		Frequency	Percentage
Valid	Preventive maintenance	1	2
	Breakage maintenance	41	98
	Total	42	100

Table 11- Qualification of personnel staff in the area of physical resource functions

No	Variable	Yes		No		Total	
		Frequency	In %	Frequency	In %	In Number	In %
11.1	Are the personnel assigned in warehouse operations has relevant training & experience	6	14	36	86	42	100

## **PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMENT IN EPGORCC**

---

Table 12- Assessment on the existing system of physical resource management practice

No	Variable	Yes		No		Total	
		Frequency	In %	Frequency	In %	In no.	In %
<b>Organizational Structure</b>							
12.1	Do you manage physical asset in a separate or independent department	5	12	37	88	42	100

Table 13- Efficiency of resource utilization

No	Variable	Yes		No		I don't know		Total	
		Frequency	In %	Frequency	In %	Frequency	In %	In no.	In %
13.1	Is your internal physical resource management system support your company to be efficient in construction performance	1	2	36	86	5	12	42	100

Table 14- Decision to avail physical resource to projects

		Frequency	Percentage
Valid	owner	6	14
	general manager	33	79
	project manager	3	7
	Total	42	100.0

Table 15 - Basic knowledge level required to manage physical resource

		Frequency	Percentage
Valid	diploma	3	7
	first-degree	39	93
	Total	42	100.0

## **PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMTN IN EPGORCC**

---

Table 16- Percentage of investment cost for major overhaul

		Frequency	Percentage
Valid	5-10%	2	5
	10-15%	4	10
	15-20%	6	14
	morethan20%	30	71
Total		42	

Table 17- Recording on utilization of physical resource

No	Variable	Applicable		Partially applicable		Not Applicable		Total	
		Frequency	In %	Frequency	In %	Frequency	In %	In No.	In %
17.1	Operational idle & down time of resource report system	2	5	7	16	33	79	42	100
17.2	Actual performance against capacity specification					45	100	42	100

Table 18- HRM factors affecting physical resource management

No	HRM factors affecting physical resource management	Highly influence		Moderate influence		Low influence		Total	
		Frequency	In %	Frequency	In %	Frequency	In %	In Number	In %
18.1	Is Physical resource management affected by human resource management factors such as operator negligence, Operators capacity, Employee motivation problem, Salary Scale, Employee supervisor relationship, Recruitment and selection Procedure	30	72	9	21	3	7	42	100

**QUESTIONNAIRES**

**APPENDIX – B**

The questionnaire:-

Questionnaire to be filled by Owners, managers & professionals;-

The Purpose of this study is to assess the overall process of physical resource management undertaken by Ethiopian road grade one contractors. The questionnaire is meant to secure relevant data to the study & has no any intention except is solely for academic purpose and its confidentiality is maintained.

Therefore; your valuable support in responding to the question raised is of paramount importance to the success of the study.

Hence, I sincerely request you to fill the questionnaire so carefully. The quality and quantity of information you provide determines the ultimate of the study.

Thank you in advance for your every cooperation.

**N.B:**

- There is no need to write your name.
- For open-ended questions, a space is provided, if the space is not sufficient please use the back of the paper or separate paper which ever suits you.
- Close ended questions are answered by placing check (√) mark of the blank space.

**(Questioner A)-- General Bio-Data**

1. Education

<input type="checkbox"/>	Less than 12 <sup>th</sup> grade	<input type="checkbox"/>	12 <sup>th</sup> grade Complete	<input type="checkbox"/>	Certificate
<input type="checkbox"/>	Diploma	<input type="checkbox"/>	First Degree	<input type="checkbox"/>	2 <sup>nd</sup> Degree
<input type="checkbox"/>	PHD	<input type="checkbox"/>	Other -----		

2. Service Year in the Company

<input type="checkbox"/>	Less than 1 Year	<input type="checkbox"/>	between 2-3 Years	<input type="checkbox"/>	above 3 Years
--------------------------	------------------	--------------------------	-------------------	--------------------------	---------------

---

**PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMTN IN EPGORCC**

---

3. Related Service Year in Resource Management

Less than 1 Year       between 2-3 years       above 3 Years

4. Organizational Responsibility

Owner       Manager Level

(Questioner B) -- Questions on fundamental matters;-

1. Do your company has a policy & procedures for the development, acquisition, operation & monitoring the use of physical resource?

Yes       No

What is the policy to define capital equipment with regard to cost of useful life?

-----  
-----

2. What is the policy for Maintenance?

Focuses on preventive maintenance  
 Fescue on breakage maintenance  
 Whenever it is down  
 Other -----

3. Is there a policy for inventory management?

Yes       No

4. Do you have a policy for disposition of book value 0 property?

Yes       No

5. Do you have a policy to reduce risk to health & safety

Yes       No

6. Is the company management comfortable with the existing physical resource management system?

Yes       No

7. Does your company like to improve the existing physical resource management system?

Yes       No

8. Is there Physical resource planning & Management system within the company?

Yes       No

---

**PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMTN IN EPGORCC**

---

9. Who decide what to own?

- Owner of the company
- General manger
- Management as a team
- Resource management /manager/
- Others -----

10. Who decide the physical resource, when you need it & what do you need to do with it?

- Owner of the company
- General manger
- Management as a team
- Project Manager
- Resource management /manager/
- Other -----

11. What type of management system do your companies have for physical resource management?

- Enterprise Asset management
- Work force management
- Physical resource owing & renting management
- Operations management
- Others Management system -----

12. How much % of the total physical resource investment cost is the cost for major over haul or rehabilitation cost?

- <5%       5-10 %       10-15%       >20%

13. Does your company plan for the allocation of physical resource?

- Yes                       No

**PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMTN IN EPGORCC**

14. Please tick (√) on the systems which are in use to handle the physical resource management in your company.

The rating is organized in five measure of weighting you ordered them as follows;

5 = for strongly Agree

4 = for partially agree

3 = for partially disagree

2 = for neither agree or disagree

1 = for strongly disagree

No	Activities	1	2	3	4	5
1	The management of physical resources is an essential task in each construction company?					
2	Do you agree that your company physical resource management be considered as essential task for your performance?					
3	It is essential to structure the physical Resource at management position level so, that the development, acquisition & operation of the physical resources are carried out effectively.					
4	It is important that the management of physical resource clearly represented in your company structure equivalent to operation, finance & human resource management.					
5	Pre-Designed system to monitor the effectiveness & Efficiency of physical resource usage is mandatory requirement for the success of the company objective.					
6	Besides to particular department who is responsible for the use of resource management project managers & managers have a role & responsibility towards resource planning & Management.					

15. If there is a clear organizational structure for managing physical resource the basic knowledge level required for the responsible personnel is?

High school Complete     Diploma     B.A level     BSC

16. Please tick (√) your company ways & methods to find out the effectiveness of the resource utilization performance. If you have some other ways please write it (them) on the space provided.

**PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMTN IN EPGORCC**

---

Activities	Applicable	Partially applicable	Not Applicable
Operational, idle, Down (OID) Report.			
Actual performance Vs capacity specification			
Actual performance hourly base			
Combination of the above			
Other ways -----			

17. Who are the key stake holders in your company resource Management? -----  
-----

18. What is the total investment of physical resource in birr?

< 50 million      50 – 80 million  
 80 – 100 million      > 100 million

19. What is the total preventive maintenance cost & total maintenance cost of equipments and machineries in birr for the following years?

Maintenance		
Year	Total Cost	Total Preventive Maintenance Cost
1 <sup>st</sup>		
2 <sup>nd</sup>		
3 <sup>rd</sup>		
4 <sup>th</sup>		
5 <sup>th</sup>		
6 <sup>th</sup>		
7 <sup>th</sup> – 10 <sup>th</sup>		
Over 10 <sup>th</sup>		

20. How much % of the total physical resource investment cost is the cost for major over haul or rehabilitation cost?

5%      5-10%      10-15%      15-20%      >20%

**PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMENT IN EPGORCC**

---

21. Please tick on the factors adversely affects the successes of physical resource management & the degree of magnitude.

VARIABLES	Highly Influence	Moderate Influence	Low Influence
Operator negligence			
Operators Capacity			
Maintenance Problem			
Spare Parts Management Problem			
Employee Motivation problem (Employee dissatisfaction)			
Salary Scale			
Employee, supervisor relation ship			
Recruitment & Selection Policy			
Wrong application of machineries & Equipment			
Poor Working area			
Standardization problem			
Management problem			

22. Is there a training policy for operators & Drivers?

- Yes                       No

23. Are your operators & Drivers having certificate of competence (COC)?

- Yes                       No

If Yes how often?

- < One Year  
 Once in a year  
 Once in 2 years  
 > One year

24. Do you calibrate Construction Instruments? (Surveying, Libratory etc.)

- Yes                       No

If Yes how often?

- Once a year  
 Once in 2 years  
 More than 2 years

**PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMENT IN EPGORCC**

---

25. In respect of the maintenance information system do you use the following forms?

- Vehicle and equipment history card  Yes  No
- Performance report -----  Yes  No
- Spare part records -----  Yes  No

If the answer for the above question is yes, kindly provide the forms.

26. Any additional comment on the physical resource management of the company.

- Strength -----  
-----  
-----
- Weakness -----  
-----  
-----

27. What factors shall be suggested to improve existing physical resource management. -----

-----  
-----  
-----

28. What would be your suggestion about the policies & procedures that should be placed to ensure effective physical resource management.

-----  
-----  
-----

## **PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMTN IN EPGORCC**

---

29. Please tick (√) on the system which are in use to manage the physical resource of the company.

No	VARIABLES	Yes	No	I Don't Know
29.1	Do you have physical asset management policies, directives and standards separate from other current asset management?			
29.2	Do you manage physical asset in a separate or independent department?			
29.3	Do you have an entity responsible for preparing a physical asset management plan?			
29.4	Is there a preliminary physical asset management plan administrative actions?			
29.5	Is there a method of preparation of work plans and schedule process?			
29.6	Are there actions to be taken after physical asset management plan completion?			
29.7	Do you have an implementation procedure (monitoring, plan revision or amendment, standards and guides)?			
29.8	Do you implement information and communication technology?			
29.9	Do you monitor the conditions of assets using?			
29.10	Do you have a system process of maintaining, operating and upgrading assets?			
29.11	Do you have seamless data integration?			
29.12	Do you have a standardization framework?			
29.13	Do you have life cycle analysis?			
29.14	Do you outsource some or all of your maintenance work?			
29.15	Do you have a system to prioritize maintenance?			
29.16	Does the company have a written procedure for the management of supply and construction materials?			
29.17	Does the company have a Stock control procedures and record of inventory?			
29.18	Are the personnel assigned in Warehouse Operations has training in proper materials handling, distribution and storage techniques?			
29.19	Is their inventory management control system including the detailed application of estimating, scheduling, and cost control?			
29.20	Dose the company has physical resources registration system?			
29.21	Is maintenance optimization planned ahead?			

**PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMENT IN EPGORCC**

30- Physical resource management activities and the magnitude of its applicability.

Please tick (√) the actual reality used to handle the physical resource management activities and in what amount of magnitude.

The evaluation is structured in five measures of weightings; their orders of rating are as follows;

5 = for strongly Agree

4= for partially agree

3 = for partially disagree

2 = for neither agree or disagree

1= for strongly disagree

No	Activities	1	2	3	4	5
30.1	Physical resource management activities the primary objective of physical Resource management with in construction companies is to support construction and maintenance activities to ensure that construction projects are completed on schedule and within budget.					
30.2	The present organization for supply management within the company support the objective and with sound organizational principles.					
30.3	In order to effect improvements in the management and operation of the supply system significant change in organization and staffing is required.					
30.4	In the establishment and operation of a sound and effective supply system, stock control procedures are vitally important.					
30.5	The company establishes a list of stock items which are frequently required in construction operations.					
30.6	Within the company there is screening or approval process for the issuing of requested supplies which are in stock in order to ensure that available quantities are not issued solely to one project.					
30.7	Stock control procedures which are presently used within company are adequate or satisfactory.					
30.8	Expensive mechanical equipment items are handled in such a manner as to cause no damage.					
30.9	There is applicable efficient and effective Policy and procedural guidance for projects procurement activities.					
30.10	There is Effort to purchase common supplies in bulk quantities					
30.11	There is a physical resources management control system including the detailed application of estimating, scheduling, and cost control is developed.					

**PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMTN IN EPGORCC**

---

30.12	Well designed procedures for the procurement and control of physical resource can contribute significantly to the efficiency of Road construction operation.					
30.13	Work performance is dependent upon proper equipment and adequate maintenance garages and equipment.					
30.14	Work performance is dependent upon proper equipment and adequate maintenance garages and equipment.					
30.15	Within the company there is a systematic inventory of existing equipment and facility resources					
30.16	A calculation of additional needs of physical resources including preparation of preliminary plans for new facilities or renovations of existing facilities would provide to your company necessary information for capital budget.					
30.17	Conservation and maximum utilization of physical resources is achieved within the company					
30.18	To utilize open storage areas more effectively is important to manage the handling of huge physical resources					
30.19	There is activity to identify and dispose of scrap and unserviceable physical resource.					
30.20	There is a physical resources registration numbering system.					
30.21	Adopt and implement the preventive maintenance concepts and procedures set forth in the preventive maintenance program.					
30.22	There is computer technology for a management information system.					
30.23	Designed system of Physical resource management increases the performance of construction works & significantly contributes to meet the scheduled contract obligations at the required quality, contract price & time.					
30.24	Physical resource management is a well identified activity by itself.					
30.25	Senior managers often have priorities and short term imperatives which result in the paying of insufficient attention to physical asset decisions which run to longer planning.					
30.26	Information technologies are used for data management and communication systems.					
30.27	Is physical resource performance, risk and cost are determined, or pre-determined?					
30.28	Sound and effective supply system, stock control procedures are vitally important for effective performance of the construction works & success of company.					

---

**PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMTN IN EPGORCC**

---

31. How often total assessments made for Equipment & Machineries.

Very often

Rarely

Often

Never

Sometimes

32. Which type of maintenance has high frequency?

Preventive Maintenance

Breakage Maintenance

No record

33. When do preventive Maintenance Carried out.

Every day

2-3 times a week

2-6 times a week

Once a week

Once a month

Never

34. How often the competency of machine operators & Drivers Assessed.

Very often

Often

Sometimes

Rarely

Never

---

**PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMTN IN EPGORCC**

---

35. What is the annual average cost of maintenance for the last 3 years?

<b>Types of Maintenance</b>	<b>Year 2010</b>	<b>Year 2011</b>	<b>Year 2012</b>
- Preventive Maintenance			
- Breakage Maintenance			
<b>Total</b>			

36. What is the Average Availability of physical Resource (Equipments, Machineries & Trucks) for the last 3 years?

<b>Types of Physical Resource</b>	<b>Year 2010</b>	<b>Year 2011</b>	<b>year 2012</b>
Equipment & Machineries			
Trucks & Vehicles			
<b>Total</b>			

37. How much construction materials consumed during the last 3 years.

<b>Year</b>	<b>Cost in Birr</b>
2010	
2011	
2012	

## INTERVIEW QUESTIONS

### APPENDIX – C

This interview questions are prepared for in-depth understanding of present practices on physical resource management system and to validate what to recommend and suggest for implementation.

- Do you have applicable efficient and effective Policy and procedural guidance for physical resource management?
- The primary objective of physical Resource management with in construction companies is to support construction and maintenance activities to ensure that construction projects are completed on schedule and within budget. Does the present organization for physical resources management within the company adequate or satisfactory to support the objectives?
- Do You believe To effect improvements in the management and operation of the physical resource significant change in organization and staffing is required
- Is there is screening or approval process for the receipt, storage, and issuing of requested physical resource?
- Construction Work performance is dependent upon proper equipment and adequate maintenance garages and tools. Does the company exercise equipment management system?
- Is there is a systematic inventory and registration of existing physical resource of the company?
- When there is an additional need of physical resources do you prepare preliminary plans?  
If the answer is yes, who prepare it?
- Do you agree that Conservation and maximum utilization of physical resources is achieved within the company? If the answer is disagreed why?
- Is there an activity to identify and dispose of scrap and unserviceable physical resource?
- Is there computer technology for a management information system?

# PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMENT IN EPGORCC

## MEMBERS OF ETHIOPIAN GRADE ONE CONTRACTORS ASSOCIATION

### APPENDIX—D

SOURCE: - ETHIOPIAN GRADE ONE CONTRACTORS ASSOCIATION

No	Member Company Name	Grade	Owner of the Company	Address					Registration No.
				Kefele Ketema	Kebelle	Office Tel.	Mobile No.	FAX	
1	Yencomad Construction PVT.LTD.CO.	GC-1	Ato Yemeru Nega	Kirkose	20/21	0115-51-40-87		0115/51-94-60	EOOCA 001
2	Sur Construction	GC-1	Ato Tadese Yemane	Kirkose	03	0114-66-86-50/59 0114-66-83-44		0114/66-83-50	EOOCA 025
3	Alemayhu Ketema Construction	GC-1	Ato Alemayhu Ketema	Yeka	04	0116-51-20-42 0116-47-78-06		0116/47-78-24	EOOCA 004
4	Yergaaleme Construction	GC-1	Ato Zelaleme W/Amanuyle	Hawasa	Tabor	0462-20-16-02		0462/20-18-34	EOOCA 027
5	Varniro Construction	GC-1	Mir Adelefo Varniro	Kirkose	21	0115-51-45-11		0115-51-14-96	EOOCA 006
6	Federal Construction Engineering	GC-1				0114-34-18-79 0114-34-27-52		0114/34-18-73	EOOCA 029
7	Sun Shine Construction PVT.LTD.CO.	GC-1	Ato Samuel Tafese	Kirkose	03	0115-51-32-89		0115/51-24-44	EOOCA 007
8	Pyramid Construction	GC-1	Ato Dejene Eremeno	Arada	01/02	0115-52-49-17		0115/50-91-76	EOOCA 030
9	Akir Construction	GC-1	Ato Awetahegne Kirose	Nefase Selke Lafeto	56	0114-42-04-01		0114/42-46-69	EOOCA 008
10	Aleme Tefera General	GC-1	Ato Alem Tefera	Kirkose	08/09	0114-66-15-37		0114/66-15-35 0114/66-46-54	EOOCA 031
11	Tibebe Construction	GC-1	Ato Tesefaye Yeferu	Bole	14	0116-51-05-32 011651-05-34		0116/63-00-51	EOOCA 011
12	Genete Construction PVT.LTD.CO.	GC-1	Ato Mulugeta Zeleke	Bole	12/13	0116-47-82-26		0116/47-82-25	EOOCA 034
13	DMC Construction PVT.LTD.CO.	GC-1	Ato Daniel Mamo	Yeka	04	0114-19-81-83/198477/78		0114/19-81-87	EOOCA 012
14	Afero Tseyon Construction PVT.LTD.CO.	GC-1	Ato Sisay Desta G/Yesuse	Bole	13/14	0118-50-37-71		0116/45-17-74	EOOCA 037

## PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMTN IN EPGORCC

15	Yo-teke Construction	GC-1	Ato Yohanese Tekelaye	Kirkose	10	0113-72-71-12 0113-20-08-26		0113/72-71-24 0113/71-77-66	EOOCA 017
16	Asere Construction PVT.LTD.CO.	GC-1	Ato Yemane T/Selase	Bole	03/05	0116-62-03-57		-	EOOCA 038
17	Sate cone Construction	GC-1	Ato Samuel Tekelay	Lafeto	05	0113-72-78-22 0113-72-54-09		0113/71-33-80	EOOCA 018
18	Tekeleberehan Ambaye Construction	BC-1	Ato Tekeleberehan Ambaye	Kerekose	04	0114/42-61-44 0114/42-30-42		0114/42-61-46	EOOCA 002
19	Berehe Hagose General Construction	GC-1	W/ro Fantaneshe W/Mherete	Bole	08	0116-61-04-17 0116-62-81-80		0116/61-50-95	EOOCA 020
20	Gad Construction	BC-1	Ato Gezahegne Adeghe	Nefase Selke Lafeto	11	0114/42-22-55		0114/42-22-23 0114/42-38-96	EOOCA 003
21	Ethio Canadian Business Group Construction	GC-1	Ato Yosefe Aserate	Akaki/Ka liti	10	0114-39-34-39 0114-41-42-43		0114/39-34-45	EOOCA 021
22	Gerese Engineering PVT.LTD.CO.	BC-1	Ato Gebremikael Markose	Bole	12	0116/29-41-90		0116/29-48-67	EOOCA 005
23	Eny Construction	RC-1	Ato Endale Yerga	Kolefe	04	0113-48-21-44 0113-48-20-62		0113/48-20-00	EOOCA 022
24	Nasew Construction PVT.LTD.CO.	BC-1	Ato Shete Lulsegedede	Lafeto	10	0114/42-54-90		0114/42-44-20	EOOCA 009
25	Gemshu Beyene Construction	RC-1	Ato Gemshu Beyene	Bole	04	0116-47-76-40		0116/47-76-72	EOOCA 023
26	Santamaria Construction PVT.LTD.CO.	BC-1	Ato Abele S/Mariam	Bole	03	0116/63-77-63		0116/63-77-57	EOOCA 010
27	Rama construction	GC-1	Ato Ferewe Tedela	Gulele	15	0116-46-32-90		0116/46-58-62	EOOCA 024
28	NKH Construction PVT.LTD.CO.	BC-1	Ato Ngeru Keberet	Arada	15	0114/67-30- 02/06/04		0114/16-79-59	EOOCA 013
29	Tera Construction	RC-1	Ato Yonige Bosasiayan	Nefase Selke Lafeto	10	0114-42-59-00		0114/42-52-51 0114/42-52-31	EOOCA 026
30	Emenete Endeshawe Building Construction	BC-1	Ato Emenete Endeshawe	Kolefe	05	0116/61-68-59		0116/61-68-63	EOOCA 014
31	Pan Africa Construction Engineering	BC-1	Ato Mekedeme Abera	Lafeto	59	0114/65-48-60 0114/66-52-87		0114/66-52-86	EOOCA 015
32	Taye Asefaw Construction	BC-1	W/ro Fantansh Mesefen	Yeka	22	0116/63-60-76 63-60-77/78		0116/61-34-84	EOOCA 016
33	Redsee Construction	BC-1	Ato Asemelash Menaye	Kirkose	45	0114/16-01-55		0114/65-49-22	EOOCA 018
34	Berket Endeshawe	BC-1	Ato Berket	Bole	08/09	0114/65-43-74		0114/66-07-90	EOOCA 028

## **PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMTN IN EPGORCC**

---

	Construction		Endeshawe						
35	Homa Construction	BC-1	Ato Adugna Ejegu	Bole	06	0116/62-72-00		0116/61-52-22	EOOCA 028
36	Asemelash & Children's Construction PVT.LTD.CO.	BC-1	Ato Tadele Asemelash	Nefas Silke	03	0113/71-27-93 0113/71-65-96		0113/71-30-88	EOOCA 033
37	Raycon Construction & Machinery Rental	BC-1	Aresema Abebe Kasay	Ledeta	08	0115/54-96-58		0115/15-34-35	EOOCA 033
38	Kerafts Construction PVT.LTD.CO.	BC-1	Ato Yemanhe Tsfay W/Abzgi	Bole	14/15	0116/47-80-97/98		0116/47-80-99	EOOCA 036
39	Melkone Construction	BC-1	Ato Melekam Kumelachew	Bole	04/06	0118/96-12-54		0116/18-52-17	EOOCA 039
40	Ele General Business PVT.LTD.CO.	BC-1	Ato Daniel Wendwesen Benti	Bole	-	0116/63-78-50/51		0116/63-85-53	EOOCA 040
41	Zamera Construction PVT.LTD.CO.	BC-1	Ato Sabagads Abay	Bole	20	0116/18-17-58		0116/18-17-54	EOOCA 041

# PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMENT IN EPGORCC

## LIST OF ETHIOPIAN GRADE ONE ROAD CONSTRUCTION COMPANIES

### APPENDIX E

SOURCE: - ETHIOPIAN GRADE ONE CONSTRUCTION ASSOCIATION

No	Member Company Name	Grade	Owner of the Company	Address					Registration No.
				Kefele Ketema	Kebel e	Office Tel.	Mobile No.	FAX	
1	Yencomad Construction PVT.LTD.CO.	GC-1	Ato Yemeru Nega	Kirkose	20/21	0115-51-40-87		0115/51-94-60	EOOCA 001
2	Sur Construction	GC-1	Ato Tadese Yemane	Kirkose	03	0114-66-86-50/59 0114-66-83-44		0114/66-83-50	EOOCA 025
3	Alemayhu Ketema Construction	GC-1	Ato Alemayhu Ketema	Yeka	04	0116-51-20-42 0116-47-78-06		0116/47-78-24	EOOCA 004
4	Yergaaleme Construction	GC-1	Ato Zelaleme W/Amanuyele	Hawasa	Tabor	0462-20-16-02		0462/20-18-34	EOOCA 027
5	Varniro Construction	GC-1	Mir Adelefo Varniro	Kirkose	21	0115-51-45-11		0115-51-14-96	EOOCA 006
6	Federal Construction Engineering	GC-1				0114-34-18-79 0114-34-27-52		0114/34-18-73	EOOCA 029
7	Sun Shine Construction PVT.LTD.CO.	GC-1	Ato Samuel Tafese	Kirkose	03	0115-51-32-89		0115/51-24-44	EOOCA 007
8	Pyramid Construction	GC-1	Ato Dejene Eremeno	Arada	01/02	0115-52-49-17		0115/50-91-76	EOOCA 030
9	Akir Construction	GC-1	Ato Awetahegne Kirose	Nefase Selke Lafeto	56	0114-42-04-01		0114/42-46-69	EOOCA 008
10	Aleme Tefera General	GC-1	Ato Alem Tefera	Kirkose	08/09	0114-66-15-37		0114/66-15-35 0114/66-46-54	EOOCA 031
11	Tibebe Construction	GC-1	Ato Tesefaye Yeferu	Bole	14	0116-51-05-32 011651-05-34		0116/63-00-51	EOOCA 011
12	Genete Construction PVT.LTD.CO.	GC-1	Ato Mulugeta Zeleke	Bole	12/13	0116-47-82-26		0116/47-82-25	EOOCA 034
13	DMC Construction PVT.LTD.CO.	GC-1	Ato Daniel Mamo	Yeka	04	0114-19-81-83/198477/78		0114/19-81-87	EOOCA 012
14	Afero Tseyon	GC-1	Ato Sisay Desta	Bole	13/14	0118-50-37-71		0116/45-17-74	EOOCA 037

## **PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMTN IN EPGORCC**

	Construction PVT.LTD.CO.		G/Yesuse						
15	Yo-teke Construction	GC-1	Ato Yohanese Tekelaye	Kirkose	10	0113-72-71-12 0113-20-08-26		0113/72-71-24 0113/71-77-66	EOOCA 017
16	Asere Construction PVT.LTD.CO.	GC-1	Ato Yemane T/Selase	Bole	03/05	0116-62-03-57		-	EOOCA 038
17	Sate cone Construction	GC-1	Ato Samuel Tekelay	Lafeto	05	0113-72-78-22 0113-72-54-09		0113/71-33-80	EOOCA 018
18	Tekeleberehan Ambaye Construction	BC-1	Ato Tekeleberehan Ambaye	Kerekos e	04	0114/42-61-44 0114/42-30-42		0114/42-61-46	EOOCA 002
19	Berehe Hagose General Construction	GC-1	W/ro Fantaneshe W/Mherete	Bole	08	0116-61-04-17 0116-62-81-80		0116/61-50-95	EOOCA 020
20	Gad Construction	BC-1	Ato Gezahegne Adeghe	Nefase Selke Lafeto	11	0114/42-22-55		0114/42-22-23 0114/42-38-96	EOOCA 003
21	Ethio Canadian Business Group Construction	GC-1	Ato Yosefe Aserate	Akaki/Ka liti	10	0114-39-34-39 0114-41-42-43		0114/39-34-45	EOOCA 021
22	Gerese Engineering PVT.LTD.CO.	BC-1	Ato Gebremikael Markose	Bole	12	0116/29-41-90		0116/29-48-67	EOOCA 005
23	Eny Construction	RC-1	Ato Endale Yerga	Kolefe	04	0113-48-21-44 0113-48-20-62		0113/48-20-00	EOOCA 022
24	Nasew Construction PVT.LTD.CO.	BC-1	Ato Shete Lulsegedede	Lafeto	10	0114/42-54-90		0114/42-44-20	EOOCA 009
25	Gemshu Beyene Construction	RC-1	Ato Gemshu Beyene	Bole	04	0116-47-76-40		0116/47-76-72	EOOCA 023
26	Santamaria Construction PVT.LTD.CO.	BC-1	Ato Abele S/Mariam	Bole	03	0116/63-77-63		0116/63-77-57	EOOCA 010
27	Rama construction	GC-1	Ato Ferewe Tedela	Gulele	15	0116-46-32-90		0116/46-58-62	EOOCA 024
28	NKH Construction PVT.LTD.CO.	BC-1	Ato Ngeru Keberet	Arada	15	0114/67-30- 02/06/04		0114/16-79-59	EOOCA 013
29	Tera Construction	RC-1	Ato Yonige Bosasiayan	Nefase Selke Lafeto	10	0114-42-59-00		0114/42-52-51 0114/42-52-31	EOOCA 026

## PRACTICES AND CHALLENGES OF PHYSICAL RESOURCE MANAGEMTN IN EPGORCC

### LIST OF SELECTED GRADE ONE ROAD CONSTRUCTION COMPANIES

#### APPENDIX – F

No	Member Company Name	Grade	Owner of the Company	Address					Registration No.
				Kebele Ketema	Kebele	Office Tel.	Mobile No.	FAX	
1	Yencomad Construction PVT.LTD.CO.	GC-1	Ato Yemeru Nega	Kirkose	20/21	0115-51-40-87		0115/51-94-60	EOOCA 001
2	Alemayhu Ketema Construction	GC-1	Ato Alemayhu Ketema	Yeka	04	0116-51-20-42 0116-47-78-06		0116/47-78-24	EOOCA 004
3	Varniro Construction	GC-1	Mir Adelefo Varniro	Kirkose	21	0115-51-45-11		0115-51-14-96	EOOCA 006
4	Sun Shine Construction PVT.LTD.CO.	GC-1	Ato Samuel Tafese	Kirkose	03	0115-51-32-89		0115/51-24-44	EOOCA 007
5	Akir Construction	GC-1	Ato Awetahegne Kirose	Nefase Selke Lafeto	56	0114-42-04-01		0114/42-46-69	EOOCA 008
6	Tibebe Construction	GC-1	Ato Tesefaye Yeferu	Bole	14	0116-51-05-32 011651-05-34		0116/63-00-51	EOOCA 011
7	DMC Construction PVT.LTD.CO.	GC-1	Ato Daniel Mamo	Yeka	04	0114-19-81-83/198477/78		0114/19-81-87	EOOCA 012
8	Yo-teke Construction	GC-1	Ato Yohanese Tekelaye	Kirkose	10	0113-72-71-12 0113-20-08-26		0113/72-71-24 0113/71-77-66	EOOCA 017
9	Sate cone Construction	GC-1	Ato Samuel Tekelay	Lafeto	05	0113-72-78-22 0113-72-54-09		0113/71-33-80	EOOCA 018
10	Berehe Hagose General Construction	GC-1	W/ro Fantaneshe W/Mherete	Bole	08	0116-61-04-17 0116-62-81-80		0116/61-50-95	EOOCA 020
11	Ethio Canadian Business Group Construction	GC-1	Ato Yosefe Aserate	Akaki/Kaliti	10	0114-39-34-39 0114-41-42-43		0114/39-34-45	EOOCA 021
12	Eny Construction	RC-1	Ato Endale Yerga	Kolefe	04	0113-48-21-44 0113-48-20-62		0113/48-20-00	EOOCA 022
13	Gemshu Beyene Construction	RC-1	Ato Gemshu Beyene	Bole	04	0116-47-76-40		0116/47-76-72	EOOCA 023
14	Rama construction	GC-1	Ato Ferewe Tedela	Gulele	15	0116-46-32-90		0116/46-58-62	EOOCA 024

LIST OF CONSTRUCTION EQUIPMENTS AND MACHINERIES

APPENDIX G

Source: - (S.C.SHARMA, Construction Equipment and its Management)

**Category and sub category of Construction Equipment**

**1. Heavy Earthmoving equipment**

- Bull Dozers
- Scrapers
- Loaders
- Excavators

**2. Shovels and Cranes**

- Shovels
- Cranes

**3. Compaction Equipment**

- Smooth Roller
- Seep foot compactor

**4. Grading Equipment**

- Motor graders

**5. Aggregate Production Screening and Mixing**

- Crushers
- Washing barrels
- Aggregate Mixing Plant

**6. Asphalt Making**

- Asphalt batch hot mix plant
- Drum-mix asphalt plants

**7. Asphalt Laying Equipments**

- Paver finishers,
- Road Marking machine
- Motor blower
- Chip spreader
- Bitumen boiler
- Equipment for heating and mixing of bitumen mastic

- Curb and gutter pavers

**8. Hauling Equipment**

- Dump trucks-on-highway dump trucks
- Off-highway dump trucks
- Rear dump trucks
- Bottom dump trucks
- Side dump trucks
- Articulated dump trucks

**9. Concreting Equipment**

- Concrete batching and mixing plants
- Concrete mixers
- Concreting
- Weigh batchers
- Truck-mixers transit truck mixers
- Truck agitators
- Concrete dumpers
- Concrete pumps
- Concrete vibrators
- Cement concrete pavements
- Concrete paver finishers

**10. Material handling devices**

- Lifting and lowering devices
- Block and tackle
- Winch
- Power hoist
- Elevators
- Pillar crane
- Overhead crane

**11. Pneumatic Equipment**

- Air Compressors
- Air operated tools and equipment concrete breakers
- Rock breakers
- Pneumatic Chisel
- Back fill Pneumatic tampers

- Pneumatic auger drills
- Pneumatic grinders
- Pneumatic sump pumps

**12. Bridge Construction Equipment**

- Piles
- Pile driving hammers
- Diesel hammer
- Hydraulic Hammers
- Vibrating hammers
- Pile extractors
- Pile driving rigs
- Grunting

**13. Drilling and blasting Equipment**

- Rock drills-sinkers
- Construction of jack hammers
- Crawler drills
- Drill bits and steels
- Button bits

**14. Tunneling Equipment**

- Drill and blast
- Loading and firing
- Tunnel boring machine

**15. Pumping and dewatering equipment**

- Centrifugal pumps
- Submersible pump
- Rotary pump-gear pump
- Screw pump
- Vane pump
- Air lift pump
- Cooling water
- Jet pump
- Dewatering system

DECLARATION

I, the undersigned, declare that this thesis is my original work, prepared under the guidance of Dr. Matiwos Ensermu. All sources of materials used for the thesis have been duly acknowledged. I further confirm that the thesis has not been submitted either in part or in full to any other higher learning institution for the purpose of earning any degree.

-----

Name

Signature

St. Mary's University College, Addis Ababa

February, 2013

ENDORSEMENT

This thesis has been submitted to St. Mary's University College, School of Graduate Studies for examination with my approval as a university advisor.

-----  
Name

-----  
Signature

St. Mary's University College, Addis Ababa

February, 2013