

ADDIS ABABA UNIVERSITY

**AAiT- SCHOOL OF CIVIL AND ENVIRONMENTAL
ENGINEERING**

CENG5213: CONSTRUCTION EQUIPMENT

CHAPTER-3

CONSTRUCTION EQUIPMENT MANAGEMENT

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EQUIPMENT MANAGEMENT

1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.1 GENERAL

- ❑ 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.

EQUIPMENT MANAGEMENT

1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.1 GENERAL

- Equipment engineer should coordinate with various wings of the organization in discharging his job of:
 - Equipment planning,
 - Balancing,
 - Selection of equipment and its utilization,
 - Personnel selection and training,
 - Financial planning,
 - Preventive maintenance and
 - General supervision.
- Thus **equipment management** integrates and continuously interacts with human, technical, financial and production system in order to achieve top efficiency and cost effectiveness.

EQUIPMENT MANAGEMENT

1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.2 EQUIPMENT PLANNING

- ❑ Modern construction projects are complex in nature and success of a project depends greatly on proper and scientific planning.
- ❑ Before starting every project its planning is done with great care, as the efficiency of the whole project largely depends upon its planning.
- ❑ While planning a project we must very carefully decide about the extent of use of construction equipments.

1.3 EXTENT OF MECHANIZATION

- ❑ Extent to which mechanization in a project should be planned depends upon the following main factors:
 1. **Manpower:** Type of manpower required by the project for its execution, is first decided and whether this type of manual labour is cheaply and sufficiently available round the year.

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1.3 EXTENT OF MECHANIZATION

2. ***Completion period***: Completion period plays a deciding role about the extent of mechanization, since less the completion period more the mechanization.
3. ***Nature of work***: Nature of work includes adverse weather, climatic conditions, topography, toughness, handling of large quantities of construction material for long distance.
4. ***Availability of money***: Since cost of equipment is too high and to be spent initially, it needs heavy investment in the beginning. Therefore availability of money is a main factor in deciding the extent of mechanization.
5. ***Availability of Indigenous Equipment***: After sales service, repair facilities are also considered where equipments manufactured in our own country are not available.

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1.3 EXTENT OF MECHANIZATION

6. ***Social objects of the project***: Sometimes projects are sanctioned with the object of providing employment opportunities, to improve the economic condition of the masses in addition to the development in the area.
7. ***Labour Relations***: In certain areas, past experience indicates labour unrests, strikes, absenteeism, uncertainty, unavailability of labour or seasonal fluctuations. In such circumstances machines are preferred being more reliable to complete the project in time.
8. ***Overseas Projects***: It is difficult and expensive to send large number of man-power required in adopting the manual means in these projects, therefore only alternative left is to execute the project using construction equipments only.

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1.3 EXTENT OF MECHANIZATION

9. ***Quality and Performance***: The work carried out by means of construction equipments is of high standard of quality and performance. The quality is consistent, execution is fast and work is more durable.
10. ***Development of Industries***: In countries like Ethiopia where industries are in developing stage, it is the need of time to use construction equipments for the development of manufacturing industry and faster industrialization of the country.

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1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.4 USE OF MACHINES V/S USE OF MANUAL LABOUR

- ❑ The advantages and disadvantages of using machines and manual labour in construction projects are briefly described hereunder:

Points in favor of Machines	Points in favor of Manual labour
1. It can handle tough works which cannot be performed by manual labour.	1. Initial heavy investments are not required to be made.
2. It is cheaper when quantum of work is more and material is required to be transported for long distances.	2. Valuable foreign exchange is saved by employing exchange is saved by employing manual labour instead of using machines which are to be imported.
3. Machines when used in the project, it delivers better quality of work.	3. Small and short duration projects are sometimes found to be economical with manual labour.
4. It is possible to adhere to schedules.	4. Direct advantage to considerably large number of people by way of employment which help in social and economic betterment.
5. It is easy to predict the behavior of a machine as compared to that of man, hence planning is easy.	5. No problem due to delay in procurement of spares for the repair of machines. The delay (lead time) is substantially high in case of imported equipments.

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1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.4 USE OF MACHINES V/S USE OF MANUAL LABOUR

Points in favor of Machines	Points in favor of Manual labour
<p>6. Being lesser number of persons, (operators only), it is easy to supervise and control.</p>	<p>6. Project can be started immediately, which is not possible in case machines are used. Since importation, shipment, transportation installation and commissioning of equipments require a substantial time.</p>
<p>7. It helps in development of technical knowhow, skill and industrial development of the country.</p>	<p>7. Disposal of equipment and its balance spare parts poses a problem after the project is completed.</p>
<p>8. Availability of Manpower and seasonal fluctuations will not affect the project's progress.</p>	
<p>9. Effect of climate and topographic conditions is less when machines are used as compared to that when manual labour is used.</p>	
<p>10. No problem for housing and transportation of persons and also for the arrangement for supply of food, water, light and medicines etc.</p>	

EQUIPMENT MANAGEMENT

1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.5 FORECASTING EQUIPMENT REQUIREMENT

- Following are the main points planner has to decide in equipment planning.
 1. **Working Shifts**: By increasing the number of shifts we can reduce the number of equipment required, as the same equipment can be used in second and third shift.
 2. **Number and Size of Equipments**: For deciding the number and size of the equipments following factors should be considered.
 - Quantum of work,
 - Working days available for completion of project.
 - Number of shifts planned.
 3. **Matching Units**: The number and size of the matching equipments should be planned for each activity, keeping in view that complete matching set must be utilized at the maximum and combination must be optimum.

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1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.5 FORECASTING EQUIPMENT REQUIREMENT

4. ***Procurement Scheduling***: Procurement scheduling is done considering procurement time required and time when equipment is required.
5. ***Workshop and Stores Planning***: While planning for the purchase of equipments, it is necessary to plan for the workshop and stores for carrying out the repair and maintenance.
6. ***Man power planning***: Planning for manpower in order to operate the equipment and to carry out the repair and maintenance is also necessarily be done sufficiently in advance.
7. ***Site Conditions***: The type of equipment selected mainly depends upon soil available, and valley conditions, surface and strata where work is to be carried out.

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1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.6 SCIENTIFIC PLANNING

- ❑ Modern construction projects are complex in nature and success of a project depends greatly on proper and scientific planning.
- ❑ This means that the data or basis taken should be based on past experiences gained in various projects and on work studies carried out in various conditions at various places.
- ❑ While planning a project we must very carefully decide about the extent of use of construction equipments.

1.6.1 Quantum of work

- ❑ The first stage of planning is to calculate the total quantity of work involved in each operation.
- ❑ For correct planning it is very much essential to ascertain quantity of work as accurate as possible.

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1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.6.1 Quantum of work

- While calculating the quantity of work involved it is necessary to take a note of various constraints, for example,
 - A. limitation of working space, which may affect the efficiency of the machine, so as to assess the output rate of equipment to be used,
 - B. location of quarries and amount of material available in each of them.

1.6.2 Output and Capacity of Equipment

- Next phase of planning is to decide the equipment on the basis of its output and capability.
- The equipment must be capable to handle the work efficiently on which it is to be engaged.

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1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.6.2 Output and Capacity of Equipment

- Output of the equipment varies with various conditions. Following are some of them:
 - Different type of soil needs different amount of effort.
 - Reduction of horse power of engine due to altitude.
 - Time spent on servicing and inspection varies with the working conditions.
 - Output of the equipment also depends upon the operator's efficiency.
 - Output of dumper etc. depends on the condition of haul road.
 - Time spent on the unproductive works.
 - Changing weather conditions are responsible for variation in output.
 - Capacities of the matching machineries working in the same group.

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1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.6.3 Utilization and Time-period

- ❑ It is always a good practice to utilize equipment to the limit of its useful life on one particular project.
- ❑ For a project of nearly 4 years or more duration, it is possible to use the equipment to its full economic life.
- ❑ Experience has shown that a yearly utilization for as equipment under average working condition in most case is as follows:
 - Single shift operation – 1500 hrs.
 - Double shift operation – 2500 hrs.
 - Triple shift operation – 3200 hrs.
- ❑ Two shift operation of equipment is economical and should be employed whenever possible.
- ❑ Three shift working results in frequent breakdowns and low availability, which means more standbys and increase in cost.

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1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.6.4 Equipment Operation Planning

- Following are the main points which should be considered while planning for equipment operation:
 - Equipments must work in coordination, especially when they are required to work in a team.
 - Proper working and the maintenance of auxiliary equipments should also be ensured.
 - Poor maintenance of service roads may result in more cycle time of trucks, dumpers etc. besides causing more downtime.
 - In order to ensure proper operating of equipment and to eliminate delays it is necessary to ensure scheduled maintenance in addition to watch the working by the operator.
 - Safety on the work is a must.
 - Good workmen should be given proper incentives.

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1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.6.5 Manpower Planning

- ❑ To achieve maximum production at lower cost and at desired quality, **right man at right place at right job and at right time** must be put.
- ❑ This is what is called scientific assessment of manpower planning.
- ❑ Following are the essential requirements for a sound manpower planning:
 - It should be done sufficiently in advance.
 - It should be reviewed periodically, so that modifications or alternations if any can be incorporated.
 - The planning should have top management support.
 - It should be need based.
 - It should be economic in nature.
 - It should incorporate the elements of flexibility and elasticity.
 - It should provide a suitable policy

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1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.6.5 Manpower Planning

- ❑ To achieve maximum production at lower cost and at desired quality, right man at right place at right job and at right time must be put.
- ❑ For an effective and efficient manpower planning following main factors should be considered:
 - **Working Hours:** Manpower requirement is directly related to the total hours worked per day by the employee in a project.
 - **Number of shifts:** It has been experienced that production falls in the night shifts as compared with day shifts.
 - **Nature of work:** Nature of work decides the output and capabilities hence plays an important role in deciding manpower requirement.
 - **Operators Efficiency:** Normally following standard is considered as guidelines for measuring workers efficiency:
 - Operators having one year of job experience = 85%
 - Newly appointed operators after training = 60%

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1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.7 SELECTION OF EQUIPMENT

- ❑ Proper selection of equipment for a construction project is of vital importance for its speedy and economical completion.
- ❑ For proper selection of equipment, a considerable experience in the operation and maintenance in the field is essential.
- ❑ Following are the main points which should be considered in the process of equipment selection.
 - A. ***Suitability for Job Conditions***: The equipment must meet the requirement of the work, climate and working conditions.
 - B. ***Size of the Equipment***: Size of equipment should be such that it must be able to be used with other matching units.
 - C. ***Standardization***: It is better to have same type and size of equipments in the project.

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1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.7 SELECTION OF EQUIPMENT

- D. *Availability of Equipment in the market:*** The equipment which is easily available in the market should be purchased.
- E. *Availability of Spare Parts:*** 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.
- F. *Multipurpose Equipments (Versatility):*** There are certain types of equipments which are not utilized fully.
- G. *Availability of Know-how:*** The equipment selected should be satisfactorily handled by available operators and mechanics.
- H. *Use in Future projects:*** When equipment completes only a part of their useful life in a project, it should be kept in view that the equipment can be used in future projects and may not become obsolete.

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1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.7 SELECTION OF EQUIPMENT

- I. *The Economical Aspects*:** While selecting the equipment, it should be considered that the cost of unit production should be minimum.
- J. *Reliability of the Equipment*:** Equipment selected for the project must be reliable one.
- K. *Service Support*:** Service support should be available in the area of project where the equipment shall be used. Service after sales is a major criteria for selection of equipment.
- L. *Operating Requirements*:** The equipment selected should be easy to operate and maintain, acceptable to the operator and should have lesser fuel consumption.
- M. *Past performance*:** If the equipment being purchased is of new make and model, it is desirable to enquire about its performance from other users, who are using this make and model.

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1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.7 SELECTION OF EQUIPMENT

- I. *Reputation of the manufacturer.*
- J. *Warranty or guarantee offered by the manufacturer.*
- K. *Use of standard components in the equipment.*
- L. *Adequacy of drive mechanism or power of the prime-mover.*
- M. *Versatility of the equipment should be given due priority:* This means a machine which can be used for many jobs.

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1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.8 FORWARD PLANNING

- ❑ The planning of a project should be made at least 6 to 9 months in advance of commencement of work.
- ❑ This time lead is essential for the following main tasks to be performed before the commencement of project:
 - A. *Purchase of Equipment*:** This includes the formalities for calling enquiries from manufacturers, selecting an equipment; time taken by the supplier for supply of the equipment and transporting it to the project site, installation and commissioning it.
 - B. *Workshop Installation*:** A well equipped workshop should be installed in the project, so as to fulfill the requirement of repair of equipment.
 - C. *Spare Parts Stock*:** Initial lot of spares should be purchased along with the equipment.
 - D. *Posting of Personnel*:** Selection of the right operator.

EQUIPMENT MANAGEMENT

1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.9 PURCHASE OF EQUIPMENT

- ❑ 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, and the time when equipment should be available for use.
- ❑ 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.

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1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.9 PURCHASE OF EQUIPMENT

1.9.1 Purchasing v/s Hiring

- ❑ Contractors and other users of construction equipment are required to take a decision as to whether to purchase an equipment or to acquire it on hire.
- ❑ Following are the points which are *in favor of purchasing* an equipment:
 - When the equipment used for the most of the construction period and likely to complete almost its full life, while working in the project.
 - It remains available for use whenever it is needed.
 - Purchased equipment means an own equipment, is generally kept in better mechanical condition and is more reliable. This means matching equipments will not be affected adversely due to frequent breakdowns.

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1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.9 PURCHASE OF EQUIPMENT

1.9.1 Purchasing v/s Hiring

- Following are the points which are *against owning* the equipment:
 - When the equipment cannot be used for its full life, then the owning may be more expensive than hiring.
 - The purchaser is required to do huge investment initially, which otherwise he may need for other purposes.
 - Contractor may have to face the danger of obsolescence of the equipment.

1.9.2 Hiring with an option to purchase

- In this system user hire the equipment at the prevailing rate with a provision that he may purchase it at a later date if he wishes to do so.

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1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.10 WORKSHOP INSTALLATION

- A workshop should be installed in the project so as to enable to carry out necessary repair and maintenance of the equipment. Workshop should cater for the following facilities:
 - Servicing, which includes cleaning, cooling, lubrication, and check-ups.
 - Field repairs.
 - To carry out inspection at regular specified intervals to detect faults which can be rectified in time to avoid breakdowns. It detects the defects in operation, change in adjustments, wear and tear, cracks or any other indication for likely breakdown in near future.
 - Tire repair.

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1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.11 SPARE PARTS MANAGEMENT

- ❑ Machines worth millions of Birr are idle for want of spares, on other hand huge stock of spares are lying which perhaps may not be used.
- ❑ This emphasizes the need of paying more attention on the management of spares.
- ❑ 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.

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1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.12 MAINTENANCE MANAGEMENT

- ❑ 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 means efforts directed towards the up keep and the repair of that machine.

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1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.12 MAINTENANCE MANAGEMENT

- Following are the types of maintenances:
 - A. *Repair Maintenance*** can be followed for non-critical equipments, and where failures are unpredicted.
 - B. *Corrective Maintenance*** should be adopted for frequently falling components.
 - C. *Preventive Maintenance (planned or scheduled or systematic maintenance)***. Periodic inspection or checking at the pre-decided frequency helps to find out the reasons leading to breakdown and to rectify them when they are in minor (or initial) stages.

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1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.12 MAINTENANCE MANAGEMENT

1.12.1 Functions of Preventive Maintenance

- Following are some of the *important functions* of the preventive maintenance programme:
 - A. Inspection or checkups at carefully decided frequencies.
 - B. Lubrication. Mechanical components like gears, bearings, bushes and other friction surfaces give good performance for long periods
 - C. Every preventive maintenance work should be preplanned.
 - D. Good record keeping is essential for good preventive maintenance.
 - E. Training of maintenance personnel.
 - F. Storage of maintenance spares.

EQUIPMENT MANAGEMENT

1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.12 MAINTENANCE MANAGEMENT

1.12.1 Functions of Preventive Maintenance

□ *Advantages* of Preventive Maintenance

- A. Less overtime work required as it is pre-planned.
- B. Less repair costs
- C. Less Production downtime.
- D. Less stand-by equipments needed.
- E. Increased life expectancy.
- F. Better spare parts control leading to reduced inventory.
- G. More reliability.

EQUIPMENT MANAGEMENT

1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.12 MAINTENANCE MANAGEMENT

1.12.2 Tyre Maintenance

- ❑ Correct tyre selection and proper tyre maintenance are therefore very essential for ensuring economic operation.
- ❑ For proper maintenance of tyres following factors should be considered:
 - Proper inflation.
 - Proper Loading.
 - Proper Speed.
 - Keeping the tyre up to desired temperature.
 - Proper driving habit.
 - Avoiding vehicles' mechanical irregularities.
 - Storing of tyres properly.
 - Tyre rotation and Retreading at right time.

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1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.13 DOWN-TIME AND AVAILABILITY

- ❑ The **downtime** is the duration from the time when equipment goes under breakdown to the time when it is restored to service.
- ❑ Down time can be reduced by following ways:
 - **Speedy Fault Detection**. Fault should be detected before it becomes serious enough to affect performance.
 - **Speedy Fault Diagnosis**. The time spent in fault diagnosis can be reduced by following a logical method of fault diagnosis.
 - **Speedy repairs**. Time for repairs include time required for fault detection and diagnosis, removal of assembly, stripping, adjustments, assembly and then final trial test.
 - **Reduction in Waiting Time**. Waiting time for repair is considerably higher than actual time taken for repairs due to the irregular (random) arrival of repair jobs.

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1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.14 OPERATION AND UTILISATION

- ❑ Since this is the task directly responsible for production, maximum managerial care should be given to the ‘operation’.
- ❑ Following are the main *factors which effect the operation*:
 - i. Availability of Trained Personnel.
 - ii. Adequate repair and maintenance facilities in the projects.
 - iii. Availability of spares required for repair and maintenance.
 - iv. Working Conditions.
 - v. Haul roads should be well maintained
 - vi. Information Monitoring System
 - vii. Feedback should be extended to the manufacturers
 - viii. The output of each equipment should be compared with that of pre-determined norms.
 - ix. Encourage operators and maintenance personnel for giving long life of the equipment.

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1.15 MANAGEMENT TECHNIQUES

- A. *Network Techniques.*** Network techniques can be used to prepare equipment schedules, organizing and executing the work of assembling, installation and commissioning of plants, to organize and execute major repair job of equipment.
- B. *Work Study.*** Work study is performed to determine:
- i. A best way of doing a work so as to get maximum output without affecting the equipment adversely.
 - ii. How much time a unit of work should take to perform or how much work per hour should be performed by the equipment?
- C. *Operation Research Techniques.*** Operation research is a method of analysis by which management receives aid for their decision. It offers alternative plans for a problem for decision by adopting analytical methods.

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1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.15 MANAGEMENT TECHNIQUES

C. Operation Research Techniques.

- The methods of operation research which can be applied to equipment management are:
 - i. Waiting line models,
 - ii. equipment replacement models,
 - iii. simulation and
 - iv. transportation model.

D. Communication. Communication means transmission of ideas, information, directions etc. The communication is a continuous process and must move freely in both directions and can be either oral or written, and flows either in upward or downward or horizontal directions.

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1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.15 MANAGEMENT TECHNIQUES

E. Computerization in Equipment management. Computers are used effectively for various aspects related to the equipment management like, availability of equipment, resource leveling, maintenance of history cards and then using them for planning the over hauling of assemblies/equipment as a whole.

F. Value Engineering. Value engineering is a tool of management to determine the approaches for saving the cost from the point of 'value.'

- The job of value engineers is to make a study of the design, specifications, materials and methods of construction of the project at a lesser cost without reducing the equality and usefulness of project.

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1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.16 REDUCTION OF CONSTRUCTION COST

□ A cost reduction in construction can be achieved by adopting following ways:

- i. ***Proper planning***
- ii. ***Timely supply*** of funds, equipment, materials, and personnel.
- iii. ***Proper equipment planning*** and selection.
- iv. ***Proper equipment operation***, maintenance and utilization.
- v. Adopting ***proper inventory*** control.
- vi. Engaging ***experienced operators***
- vii. ***Monitoring progress*** and adopting scientific methods.
- viii. Ensuring ***continuous supervision***.
- ix. Adopting ***innovations*** and ***latest techniques*** suitable for the job
- x. ***Eliminate unnecessary construction*** requirements.
- xi. Use ***local materials*** when they are satisfactory.
- xii. By applying ***value Engineering***.

EQUIPMENT MANAGEMENT

1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.17 DECISION-MAKING

- ❑ Decision-making is the most important task in equipment management and we can say that good decision making ability is the key to success.
- ❑ Efficiency, loss or profit, and working atmosphere of a construction firm are affected by these decisions.
- ❑ Management without decisions is like a man without backbone.
- ❑ The days of hit and mis methods in management are over and have been replaced by new concepts and scientific techniques.
- ❑ In general, decisions are the output of the following inputs:
 - i. *Knowledge and information,*
 - ii. *Ability and skill:* Communications, analytical, or conceptual.
 - iii. *Value system:* Opinions, attitudes, habits, or belief

EQUIPMENT MANAGEMENT

1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.17 DECISION-MAKING

- The job of equipment management involves a large number of decisions e.g.
 - a) Which equipment should be used?
 - b) What work is to be done by equipment?
 - c) Whether to use equipment or to do it manually?
 - d) What make and model of the equipment is to be purchased?
 - e) Which of the matching equipment and of what size and in what number to be deployed?
 - f) Which of the accessories to be purchased with the equipment?
 - g) Whether to purchase the equipment or take on hire.
 - h) When to purchase from own capital or take loan.
 - i) Whether to purchase a particular spare for store or purchase when needed.

EQUIPMENT MANAGEMENT

1. EQUIPMENT MANAGEMENT IN CONSTRUCTION PROJECTS

1.17 DECISION-MAKING

Characteristics of a Good Decision:

- a) It is the choice of the best course among various alternatives.
- b) It is the end process preceded by the deliberations and reasoning
- c) It is associated with commitment.
- d) It is rational.
- e) Evaluation process exists in every course of decision making.

Procedure for Decision-Making:

- a) Recognizing and analyzing the problems.
- b) Finding relevant facts.
- c) Determining possible alternatives.
- d) Evaluating the impact of alternatives.
- e) Selecting the best solution.
- f) Implementation of the decision.

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

GENERAL

- ❑ Principles and techniques of engineering economics are utilized while making equipment selection and planning of finances for the purchase of construction equipments.
- ❑ Economics of construction equipment deals with the study of working of the equipment and to compute the unit costs of production.
- ❑ Unit cost of production is calculated after estimating the best of production by calculating hourly ownership and operating cost of the equipment and knowing hourly production of that equipment.

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.1 OWNING COSTS

2.1.1 Investment Costs

- This is a kind of fixed cost and continues to be incurred whether the equipment is used or not. Investment costs comprises of the following:
 - **Interest** on the money invested in the procurement of the equipment.
 - Various **taxes** on the equipment.
 - **Insurance** expenses.
 - **Storage** costs.
- If the money spent on the purchase of the equipment, was invested in the bank or similar other agencies, it would have earned an interest. Now this amount, equivalent to the interest, should be recovered from this equipment.

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.1 OWNING COSTS

2.1.1 Investment Costs

- Generally these investment costs are taken as about 10 to 15% of the total cost of the equipment. This total cost comprises of the following:
 - a) Price of the equipment with all attachments and accessories.
 - b) Insurance and freight charges.
 - c) Expenses on un-loading, clearance and custom duty.
 - d) Cost of transportation to the job site including loading and unloading.
 - e) Erection and commissioning charges.

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.1 OWNING COSTS

2.1.2 Depreciation

- ❑ Due to use and obsolescence every equipment loses its value. This loss is accounted for by depreciating the equipment every year.
- ❑ **Depreciation**. Whenever any machine or equipment performs useful work its wear and tear is bound to occur. This can be minimized up to some extent by proper care and maintenance but can't be totally prevented.
- ❑ **Obsolescence**. is the depreciation of existing machinery or asset due to new and better invention, design of equipment of processes etc.

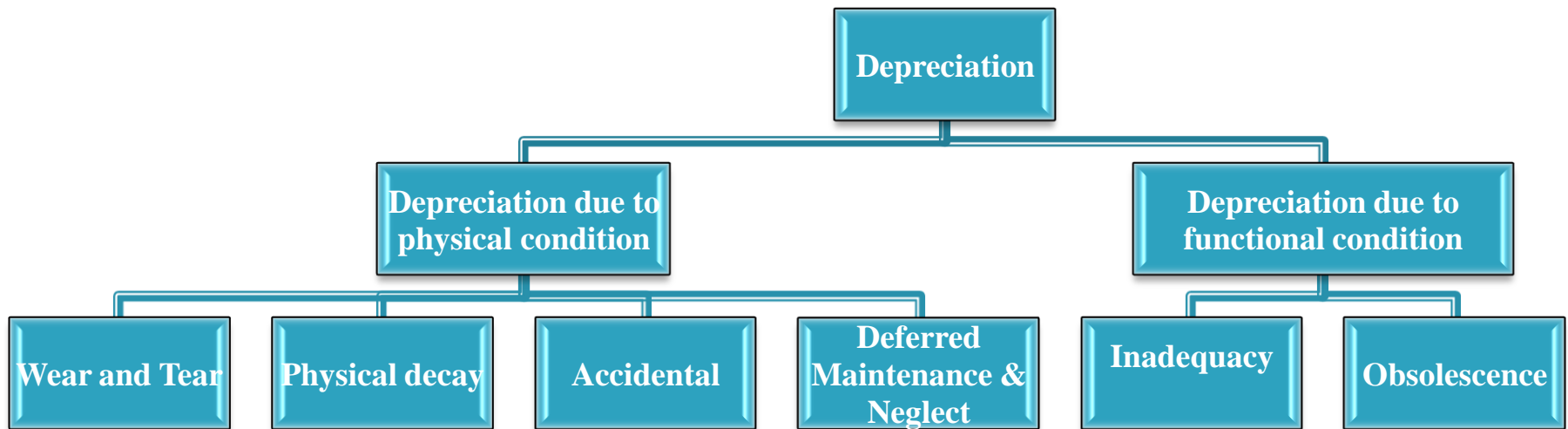
EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.1 OWNING COSTS

2.1.2 Depreciation

- depreciation can be classified as under:



EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.1 OWNING COSTS

2.1.2 Depreciation

- **Methods of Calculation:** The following are the methods for calculating depreciation.
 - i. Straight line Methods***
 - ii. Diminishing Balance Method***
 - iii. Sinking fund Method**
 - iv. Annuity Charging method**
 - v. The Insurance policy method**
 - vi. The Revaluation or Regular Valuation method**
 - vii. Machine Hour Basis method**
 - viii. The sum of the year's Digits method**

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.1 OWNING COSTS

2.1.2 Depreciation

Straight Line Method

- This method assumes that the loss of value of machine is directly proportional to its age. It means one should deduct the scrap value from the original value and divide the remaining value by the number of years of useful life.

Let C be the Initial cost of a machine.

S be the scrap value.

N be the Number of years of life of machine. and

D be the depreciation amount per year.

$$\text{Then, } D = \frac{C - S}{N} \text{ Birr}$$

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.1 OWNING COSTS

2.1.2 Depreciation

Straight Line Method

Example-1

(a) A machine was purchased for Birr 450,000 on 1st January, 1991, the erection and installation work costs Birr 70,000. This was replaced by a new one on 31st Dec, 2010. If the Scrap Value was estimated as Birr 150,000 what should be the rate of depreciation and depreciation fund on 15th June, 2000?

(b) If after 12 years of running, some assemblies are replaced and the replacement cost is Birr 150,000 what will be the new rate of depreciation?

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.1 OWNING COSTS

2.1.2 Depreciation

Straight Line Method

Solution

(a) Total cost = Machine Cost + Erection and installation charges

$$C = 450,000 + 70,000 = 520,000 \text{ Birr}$$

$$\text{Scrap value } S = 150,000 \text{ Birr}$$

Life of machine = From 1st January, 1991 to 31st Dec, 2010

= 20 years.

$$\begin{aligned} \therefore \text{Rate of depreciation; } D &= \frac{C - S}{N} \\ &= \frac{520,000 - 150,000}{20} \\ &= \frac{370,000}{20} = \text{Birr } 18,500.00 \end{aligned}$$

\therefore Depreciation per year = + **Birr 18,500 only.**

Ans.

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.1 OWNING COSTS

2.1.2 Depreciation

Straight Line Method

Solution

Now, depreciation fund on 15th June, 2000 i.e., 9 Installments (from 1st January, 1991 to 15th June, 2000) could be accumulated.

∴ Depreciation fund collected up to 15 June, 2000.

$$= 9 \times 18,500 = 166,500.00 \text{ Birr only}$$

Ans.

b) As after 12 year assemblies have been replaced and cost of replacement is Birr 150,000.

Now, book value in 12 years will be Birr 520,000-12 x 18,500

$$= \text{Birr } 298,000$$

And replacement cost = Birr 150,000

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.1 OWNING COSTS

2.1.2 Depreciation

Straight Line Method

Solution

Hence, new book value = 298,000 + 150,000.

$$= 448,000 \text{ Birr}$$

As scrap value is same i.e. Birr 150,000 hence the depreciation for the rest 8 years will be (Birr 448,000 – 150,000)

$$= \text{Birr } 298,000$$

$$\therefore \text{New rate of depreciation} = \text{Birr } \frac{298,000}{8}$$

$$= 37,250$$

\therefore New rate of depreciation per year = **Birr 37,250**

Ans.

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.1 OWNING COSTS

2.1.2 Depreciation

Straight Line Method

Example-2

Consider an excavator purchased for 3.1 million birr having a useful life of 5 yrs. Determine the depreciation and book value for each of the 5 years using Straight Line method. Assume a salvage value of S = 860,000 birr.

Solution

$$\text{Depreciation Rate} = \frac{1}{N} = \frac{1}{5} = 0.2$$

$$D_n = \frac{3,100,000 - 860,000}{5}$$
$$= 448,000 \text{ birr}$$

or

$$(3,100,000 - 860,000) * 0.2$$

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.1 OWNING COSTS

2.1.2 Depreciation

Straight Line Method

Solution

Year	BV_{n-1}	D_n	BV_n
0	0	0	3100
1	3100	448	2652
2	2652	448	2204
3	2204	448	1756
4	1756	448	1308
5	1308	448	860

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.1 OWNING COSTS

2.1.2 Depreciation

Diminishing Balance Method

- ❑ This is also called “Reducing Balance” Method. The diminishing value of machine is greater in the early years. It depreciates rapidly in the early and later-on slowly.
- ❑ So under this method, the book value of the machine goes on decreasing as its existence continues.
- ❑ In this, let x be the fixed percentage taken to calculate the yearly depreciation on the book value.

$$\text{Then } x = 1 - \left(\frac{S}{C} \right)^{\frac{1}{N}}$$

Where, C = initial cost, S = Scrap Value, N=No. of the years of life.

- ❑ It will be more clear by the following solved example.

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.1 OWNING COSTS

2.1.2 Depreciation

Diminishing Balance Method

Example - 3

A lathe is purchased for Birr 800,000 and the assumed life is 10 years and scrap value Birr 200,000. If the depreciation is charged by diminishing Balance method, calculate the percentage by which value of the lathe is reduced every year and depreciation fund after 2 years.

Solution

Here $C = 800,000$

$S = 200,000$

$N = 10$

We know that $x = 1 - \left(\frac{S}{C}\right)^{\frac{1}{N}}$

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.1 OWNING COSTS

2.1.2 Depreciation

Diminishing Balance Method

Solution

Substituting the given values in the above formula

$$X = 1 - \left(\frac{200,000}{800,000} \right)^{\frac{1}{10}}$$

$$= 1 - (0.25)^{1/10}$$

Solving $(0.25)^{1/10}$ we get

$$(0.25)^{1/10} = 0.8706$$

$$\therefore x = (1 - 0.8706) = 0.1294 = 12.94\%$$

$$\therefore \text{Required \%} = 12.94$$

Ans.

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.1 OWNING COSTS

2.1.2 Depreciation

Diminishing Balance Method

Solution

∴ Value of lathe after 1 year

$$= 800,000 \times (1 - 0.1294) = 800,000 \times 0.8706$$

$$= \text{Birr } 696,480$$

∴ Depreciation fund after 1 year

$$= 800,000 - 696,480 = 103,520$$

Now value of lathe after 2 years

$$= 696,480 \times (0.8706) = \text{Birr } 606,355$$

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.1 OWNING COSTS

2.1.2 Depreciation

Diminishing Balance Method

Solution

∴ Depreciation of 2nd year

$$= 696,480 - 606,355 = \text{Birr } 90,125$$

∴ Depreciation fund after 2 years

$$= 103,520 + 90,125 = \text{Birr } 193,645$$

Ans.

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.1 OWNING COSTS

2.1.3 Major Repair Cost

- ❑ While minor or field repairs are carried out during the day to day working of the equipment the major repairs are carried out after the substantial use of the equipment.
- ❑ Major repairs and over hauls are the replacement of major parts of the equipment because of the excessive wear through a long period of use.
- ❑ Since these repairs require a heavy amount of expenditure, they are met from the major repair fund.
- ❑ Usual practice is to consider this major repair cost as a percentage of straight line depreciation cost and is generally taken as 80 to 200% of the cost of depreciation depending on the type of equipments.

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.2 OPERATING COSTS

2.2.1 Cost of Fuel

- The actual consumption of fuel or electricity in these construction equipments depends upon:
 - i. Engine B.H.P
 - ii. The load factor, which means the extent to which the engine will operate at full power. Load factor generally vary from 30% to 70%.
 - iii. The conditions of the engine
- Optimum fuel consumption in liters per hour may be calculated using following formula:

$$\text{Fuel consumption} = 0.27 \times \text{load factor.}$$

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.2 OPERATING COSTS

2.2.1 Cost of Fuel

- Recommended value of load factor

S.No.	Type of Equipment	Excellent	Average	Severe
1	Wheel type equipment (highway)	0.25	0.30	0.40
2	Wheel type equipment (off highway)	0.50	0.55	0.60
3	Truck type tractors	0.50	0.63	0.75
4	Excavators	0.50	0.55	0.60

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.2 OPERATING COSTS

2.2.2 Cost of Lubricants

- Lubricants include the following:
 - Engine oil
 - Air filter oil
 - Transmission oil
 - Hydraulic oil
 - Greases etc.

- The quantity of lubricating oil depends upon various factors. Some of these factors are:
 - Capacity of the crank case
 - Condition of piston rings
 - Number of hours between oil changes.

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.2 OPERATING COSTS

2.2.2 Cost of Lubricants

Lubricating Oil Consumed

- Requirement of lubricants including engine oil, air cleaner oil, transmission oil, greases, and hydraulic oil, can be assessed on the basis of information supplied by the equipment manufacturer.
- Following formula is used for estimating the quantity of oil required per hour:

$$Q = \frac{HP \times f \times 0.006 \times 4.5}{7.4} + \frac{C}{t} \text{ lit / hr}$$

Where, Q = Quantity of oil consumed in lit/hr

HP= Rated horse power of the engine

F = operating factor

C = Capacity of crankcase, in lit.

T = Number of hours between oil changes.

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.2 OPERATING COSTS

2.2.3 Servicing and Maintenance Cost

- Regular servicing and maintenance of each equipment is very essential in order to have the equipment in reliable and perfect condition of working. This cost includes:
 - Change of lubricants
 - Checking and servicing of fuel and lubricating systems, including change of filter elements.
 - Care of tyres and tubes
 - Care of Battery and electrical system
 - Cleaning of the equipment and other similar works.

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.2 OPERATING COSTS

2.2.4 Labour Cost

- ❑ Labour cost is an important element of operating cost and contributing a major part of it.
- ❑ Labour cost element includes the salaries of operators, and helpers engage on the equipment.
- ❑ Provision for leave reserve (may vary from 10 to 12%) is also made under the bead of labour cost.
- ❑ A percentage of the wages of supervisory staff, depending upon the attention required on that particular equipment, is also to be added.

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.2 OPERATING COSTS

2.2.5 Cost of Field Repairs

- ❑ This is the cost incurred on minor repairs which are carried out on the site or in field workshops.
- ❑ These repairs include replacement of minor parts, such as fan belts, filters, bearings, wire ropes etc. and other adjustments required to be carried out during normal working of the equipment.

2.2.6 Overheads

- ❑ These are the charges which are incurred on complete fleet of the equipment.
- ❑ These charges includes the pay on watchman, light and water charges in the storage yards, uniform to the operating and maintenance staff etc.

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

Determination of Owning and Operation Costs

- To determine the cost of owning and operating following procedure is adopted.

I. Ownership Charges

i) Depreciation

A. Total cost of equipment less cost of tyres Birr _____

B. Deduct salvage value (generally 10% of A) Birr _____

C. Total investment to be depreciated (A-B) Birr _____

D. Economic life in hours Birr _____

E. Depreciation per hour (C/D) Birr _____

ii) Interest, Insurance, Taxes and Storage

F. Annual expenditure on these items Birr _____

G. Interest, Ins, Taxes and Storage charges/hr

$$\frac{F}{\text{Annual ...use...in...hrs.}}$$
 Birr _____

Total Owning Costs = E + G Birr _____

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

Determination of Owning and Operation Costs

II. Operating charges

iii) Fuel Charges

H. Consumption in lit per hour Birr _____

I. Cost of fuel per lit Birr _____

J. Fuel charges/hr (H x I) Birr _____

iv) Lubricants and Filters Charges

K. Engine oil (consumption/hr x rate) Birr _____

L. Transmission oil ('do') Birr _____

M. Final drive oil ('do') Birr _____

N. Hydraulic oil ('do') Birr _____

O. Grease ('do') Birr _____

P. Filters ('do') Birr _____

Q. Total lub. And filter charges (total of k to p) Birr _____

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

Determination of Owning and Operation Costs

v) Cost of Tyres

R. price of 1 set of tyre Birr _____

S. Estimated tyre life Hrs _____

T. Cost of Tyres $\left(\frac{R}{S}\right)$ is per hr Birr _____

vi) Repair Charges

U. Repair Factor x Depreciation per hr Birr _____

vii) Operator's and Helper's Hourly Wages

V. Operator's and Helper's Hourly Wages Birr _____

viii) Special Items

W. Special Items (like cutting edge Rippers, drill rods, bits etc.) Birr _____

Total Operating Costs = J + Q + T + U + V+W = Birr _____

Total Hourly Owning and Operating Costs = Birr _____

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.3 EQUIPMENT RENTAL RATES ACCORDING TO ETHIOPIAN ROADS AUTHORITY (ERA)

READING ASSIGNMENT

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.4 STANDARD COSTING

Standard Cost

- ❑ Standard cost is an estimated cost of a job or project prepared in advance of execution.
- ❑ This is prepared considering normal cost of normal production with in normal capacity and under normal conditions and efficiency.

Standard Costing V/S Budgetary Control

A. Common principles

- Establishing predetermined standards, target or yardstick of performance.
- Measuring actual performance as compared to yardstick.
- Locating variances between actual and standard performances
- Disclosing reasons for such variances.

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.4 STANDARD COSTING

Standard Costing V/S Budgetary Control

B. Differences

No.	Standard costing	Budgetary Control
i	Applicable only to production, operation and project costs	Applicable to all functional areas of an enterprise.
ii	More intensive in nature	More extensive in nature
iii	It projects cost accounts.	It projects financial accounts
iv	More improved system	Elementary system.

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.4 STANDARD COSTING

Essential Requirements for Standard Costing

- Standard cost of a work requires following:
 - Technical specifications of quality, type and quantity of direct material for each item.
 - Estimated prices of all materials required, based on current prices and anticipated changes during the period.
 - Estimates of direct labour time for each category of labour
 - Standard hourly rates of each category of direct labour.
 - Estimate overhead recovery rate
- *Uses of Standard Costs*
 - Assisting the management in better planning, coordination and control.
 - Facilitates in comparing with actual costs.
 - Provides basis for measuring the productivity improvement.
 - Provides basis for measuring the productivity improvement.

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.5 COST CONTROL AND COST REDUCTION

- ❑ **Cost control** is a method of comparing actual costs with predetermined standards or targets.
- ❑ Whereas the **cost-reduction** is meant to take drastic actions, sometimes by changing rigid boundaries laid down by the standards or targets.

Steps for Cost Control and Cost Reduction

- ❑ Following essential steps are required to be taken for effective cost control and cost-reduction.
 - i. Inculcating an all-round cost consciousness in the organization.
 - ii. While setting standards and norms, scope of cost reduction is to be explored.
 - iii. Decide priorities for attack to achieve quick results.
 - iv. Control on consumption as well as on block-up of capital is to be exercised.
 - v. Provide right climate to encourage creativity.
 - vi. Reporting and monitoring system should be strengthened.

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.5 COST CONTROL AND COST REDUCTION

Cost saving Areas

A. Reduction in Material Cost

- Ensure purchase of right quantities of right quality at right time from right source and at right price.
- Avoid overstocking or inventory build-up
- Planning material procurement in advance, scientifically and from practical consideration.
- Decision regarding whether to purchase aggregate etc. or to manufacture.
- Minimum handling of material be ensured.
- Utilize scrap and waste material.
- Avoid wastage of material.

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.5 COST CONTROL AND COST REDUCTION

Cost saving Areas

B. Reduction in Labour Cost

- Judicious and rational distribution of workmen
- Labour rate should be decided considering actual norms of output.
- Suitable inspection and supervision methods be introduced.
- Decision for single shift, double shift, triple shift, or extended shift (one shift of 10 to 12 hrs) be taken, considering overall economy.
- Operators should be trained from time to time to make them well conversant with the latest technology to enable to achieve maximum productivity.

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.5 COST CONTROL AND COST REDUCTION

Cost saving Areas

c. Reduction in Overheads

- Overhead expenditure should be maintained in a proper record and compared with estimates or standards from time to time.
- To keep control on indirect labour.
- To have versatile machines with different accessories to have optimum utilization.
- Reduction in avoidable unproductive expenditure to the maximum.
- Construction of colonies, office etc. be made by utilizing the local material for economy and location be decided after careful considerations.

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.6 Cost-Accounting

- In the current days of competition, it is necessary that the concern should have utmost efficiency and minimum possible wastage and losses.

Financial or Accounting Ratio Analysis

- Financial or accounting ratio may be defined as relating one accounting figure to another to provide better comparison. Different financial ratio are:

A) Activity Ratio

$$\text{i) Inventory Turnover} = \frac{\text{cost of material consumed}}{\text{Average inventory}}$$

$$\text{ii) Average inventory period (months)} = \frac{\text{Average inventory}}{\text{consumption per month.}}$$

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.6 Cost-Accounting

Financial or Accounting Ratio Analysis

B) Cost Ratio (per cent)

- i) Employee expenses as percentage of production
- ii) Fixed costs as percentage of production
- iii) Variable costs as percentage of production.

C) Profitability Ratios (percentage)

- i) Gross Operating Margin =

$$\frac{\text{Gross operating profit before depreciation interest and tax}}{\text{Turnover}} \times 100$$

- ii) Return on Equity

$$= \frac{\text{Net profit after tax and preference dividend}}{\text{equity paid up and free reserves}} \times 100$$

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.6 Cost- Accounting

Financial or Accounting Ratio Analysis

D) Return on investment (R.O. I)

$$\begin{aligned} \text{R.O.L} &= \frac{\text{Net profit}}{\text{Capital employed}} \\ &= \frac{\text{Net profit}}{\text{turnover}} \times \frac{\text{Turnover}}{\text{Capital employed}} \\ &= \text{Net profit ratio X capital turnover ratio} \end{aligned}$$

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.6 Cost- Accounting

Uses of Financial Ratio Analysis

- ❑ Financial ratios provide useful indications to appraise financial health of a concern and overall efficiency of the project.
- ❑ Computation of ratios often leads to a further enquiry into various aspects of project, and which enables to bring out some important facts, which ultimately helps in:
 - a) Planning: short, medium, and long range.
 - b) Diagnosis of financial ills or industrial sickness.
 - c) Decision marking of all types
 - d) Keeping a continuous watch on the financial trends and taking corrective actions well in advance

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.6 Cost-Accounting

Bidding by the Construction Agencies

- The value of the profit is decided after considering several factors, some of them are:
 - Competition in the market
 - Size of the project.
 - Facilities available like, mobilization advances, interval at which payments will be made to the contractor.
 - price escalation
 - Risk involved
 - Chances for utilizing the equipment after completion of the project.
 - Availability of raw material from open market or on control and its lead time.
 - Maintenance period after completion of the project.

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.7 REPLACEMENT OF EQUIPMENTS

- The main reasons for the replacement of the equipment are:
 - A. ***Deterioration***. It becomes necessary to replace the machine when it wears out and does not function properly.
 - B. ***Obsolescence***. Whenever new equipment comes in the market, which is capable of producing more products of good quality with less labour and has more efficiency, the existing machine is to be replaced with this machine although it was functioning well.
 - C. ***Inadequacy***. With the change of product design to meet the customers demand or quantity to be manufactured, old machinery becomes inadequate and, therefore, calls for different manufacturing equipment.

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.7 REPLACEMENT OF EQUIPMENTS

Equipment Replacement Policy

- Equipment replacement decision plays an important role in the economic running of any concern. A firm has to face three types of replacement decisions.
 - i. The replacement of capital equipment, as it wears out.
 - ii. The capital equipment required for expansion.
 - iii. The replacement of old technology by the new (replacement of obsolete equipment)

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.7 REPLACEMENT OF EQUIPMENTS

Equipment Replacement Policy

- Large numbers of factors are responsible to replace the equipment before the expiry of the estimated life, namely:
 - To reduce production cost.
 - To reduce fatigue.
 - To raise quality
 - To increase output
 - To secure greater convenience, safety and reliability.

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.7 REPLACEMENT OF EQUIPMENTS

Guidelines in Replacement Analysis

- There are certain rules which may be used as guidelines for replacement analysis.

A. For equipment in use

Do consider:

- Operating cost
- Repairs and maintenance cost.
- Down time cost.
- Salvage value
- Rebuilding cost

Do not consider:

- Original cost.
- Money already spent on repairs and maintenance
- Unrealistic book value

EQUIPMENT MANAGEMENT

2. ECONOMICS OF CONSTRUCTION EQUIPMENT

2.7 REPLACEMENT OF EQUIPMENTS

Guidelines in Replacement Analysis

B. For new equipment

Do consider:

- Initial cost
- Interest on capital investment.
- Salvage value at the end of useful life
- Cost advantage of improved product
- Labour savings.

Do not consider:

- Any savings not clearly assessable.
- Overhead charges

THANK YOU!