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# EQUIPMENT COST

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# EQUIPMENT COST

- Costs associated with owning and operating equipment

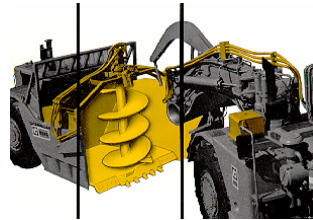


*“How to determine what kind and size of equipment seem to be the most suitable for a given project”*



# EQUIPMENT PROCUREMENT

## ■ Objective



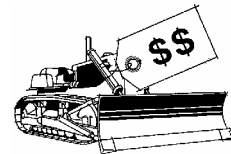
– Provide the right equipment at the right time and place so the work can be accomplished at the lowest cost.



# EQUIPMENT PROCUREMENT

## ■ Specific Objectives

- Minimize ownership and operating (O&O) cost.
- Increase availability.
- Increase utilization.





# EQUIPMENT CLASSIFICATION

- Equipment may be classified according to the following:
  - The **type of work** it performs.
  - As **standard** - equipment which is commonly manufactured and available to prospective purchasers with readily accessible spare parts.
  - As **special** - equipment which has to be manufactured for a specific project or which does not have readily accessible spare parts.



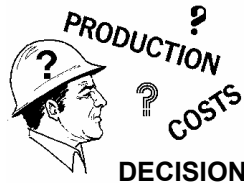
# WORK AT THE LOWEST COST

- Not the same as machine at lowest cost.
- Machine utilization
- Utilization drives purchase or rent/lease decision.



# LIFE CYCLE COST

- Predicting costs of Ownership and Usage.

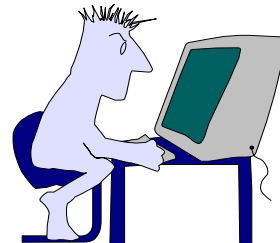


- Using that information in decision making.



# INFORMATION SYSTEM

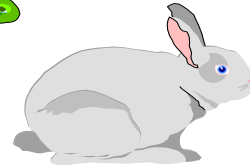
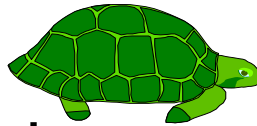
- Machine identification
- Utilization data
- Purchase cost
- Repair cost
- Operating charges
- FOG (fuel, oil, grease)





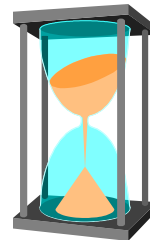
# UTILIZATION DATA

- ✓ Load
- ✓ Speed
- ✓ Environment



# UTILIZATION

**Utilization is  
working time  
duration**



**not calendar  
duration.**





# UTILIZATION DATA

## Basis of costing



**Hourly**



**Daily**



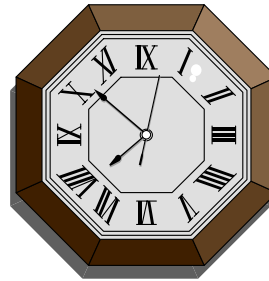
**Weekly**



**Miles**



**Fuel consumption**



# EQUIPMENT COST

- Equipment costs rank second to labor cost in terms of uncertainty.
- Equipment costs rank second to labor cost on the outcome of the anticipated profit of a particular project.
- Accurate estimation of equipment cost is of primary importance to the successful constructor.



## TOTAL EQUIPMENT COST

<b>\$ Depreciation</b>	<b>25%</b>
<b>\$ Operating</b>	<b>23%</b>
<b>\$ Repair</b>	<b>37%</b>
<b>\$ Overhead</b>	<b>15%</b>



## EQUIPMENT COST

**Question No. 1**  
What is the largest single equipment cost?



# EQUIPMENT COST

- Two questions in the mind of a contractor or equipment owner:



- How much does it cost to operate the machine on a project?
- What is the optimum economic life and the optimum manor to secure a machine?



# EQUIPMENT COST

- The first question is critical to bidding and operation planning.
  - Identify the expense associated with productive machine
    - Ownership and Operating (O&O) Cost



O&O is usually stated in hourly basis (e.g., \$90/hr for a dozer)  
If a dozer can push 300 cy yd (cubic yard) per hour, and it has \$90/hr O&O cost, then production cost (PC) will be

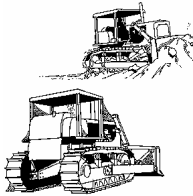
$$PC = \frac{\$90 / \text{hr}}{300 \text{ cy yd} / \text{hr}} = \frac{\$0.30}{\text{cy yd}}$$





# EQUIPMENT COST

- The second question is important to machine replacement
  - Identify the optimum point in time to replace a machine and the optimum way to secure a machine.



- This is important in that it will reduce O&O cost and thereby lower production expense.



# EQUIPMENT COST

The money a company spends for equipment is an investment which must be recovered as the machine is utilized on projects.



## COST OF CAPITAL

- Many discussion of equipment economics include interest as a cost of capital.

- Definition:



#%



“The interest rate at issue in economical literature is defined as the cost of capital.”



## MEANS OF EQUIPMENT EMPLOYMENT

- **Means by which a piece of equipment may be employed on the project:**
  - **Purchase**
    - Lowest hourly use charge
    - Challenge to keep equipment fleet busy
  - **Lease**
    - Higher use charge than owning a piece of equipment
    - Lower risk involved than in owning
  - **Rent**
    - Highest use charge for relatively short periods of time.



# FEW TIPS

- There are many different possibilities available to perform any given task.
- There is no best or standard piece of equipment for any particular job.
- No constructor can afford to own all types and sizes of equipment that might be used for the kind of work he performs.



# FEW TIPS

## ■ Different Types of Equipment



Grader  
Roller  
Water truck





# COST OF OPTIONS



- The constructor will generally try to use his own equipment first, whether or not it is the "optimum" piece.
- Purchasing will be considered along with other options if:
  - The constructor does not have the equipment,
  - The equipment is unavailable due to its being committed elsewhere



# COST OF OPTIONS

- Purchase normally will not be selected if:
  - The project is small,
  - The equipment cannot be easily sold upon completion of the work,
  - The future needs for the equipment are deemed remote.





# COST OF OPTIONS



- Costs associated with leasing and renting equipment are readily available from firms in the business of providing these services.
- Regardless of the type of equipment, estimated costs of owning and operating equipment are calculated in the same manner.



# THE COST OF CONSTRUCTION EQUIPMENT

- The cost of construction equipment consists of two general type of cost:
  - **Ownership Cost**
  - **Operating Cost**



$$\text{Equipment Cost} = \text{Ownership Cost} + \text{Operating Cost}$$





# THE COST OF CONSTRUCTION EQUIPMENT

## ■ General Notes

1. Costs associated with major overhauls, modifications, and additions to the equipment are sometimes considered to be ownership costs; other times they are considered to be operating costs.
2. Historical records of ownership costs are of limited value
3. Conditions of equipment use, equipment technology, interest rates, and the like, change, thus diminishing the value of historical records.



# THE COST OF CONSTRUCTION EQUIPMENT

## ■ Objectives

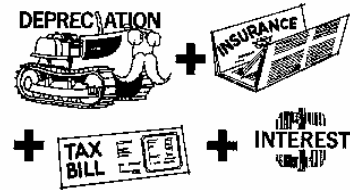
- Equipment owners and contractors must carefully calculate machine cost.
  - Ability to calculate ownership cost.
  - Ability to calculate operating cost.
  - Understanding of the advantages and disadvantages associated with direct ownership, renting, and leasing machine.





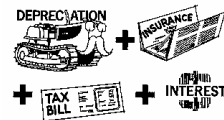
# EQUIPMENT OWNERSHIP COST

- ✓ Depreciation (Purchase expense)
- ✓ Insurance
- ✓ Taxes
- ✓ Salvage value
- ✓ Shop expenses



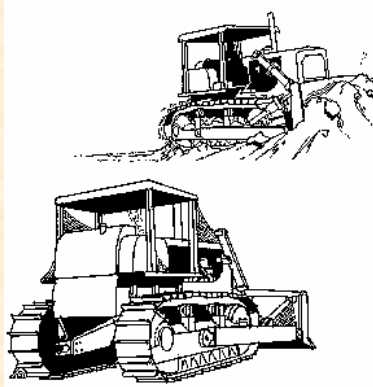
# EQUIPMENT OWNERSHIP COST

- The most significant cash flows affecting ownership cost are
  1. Purchase expense.
  2. Salvage value.
  3. Tax saving from depreciation.
  4. Major repairs and overhauls.
  5. Property taxes.
  6. Insurance.
  7. Storage and miscellaneous.





## OWNERSHIP COST



### Question No. 2

Ownership costs are accumulated whether or not the equipment is actually being used.

True

False



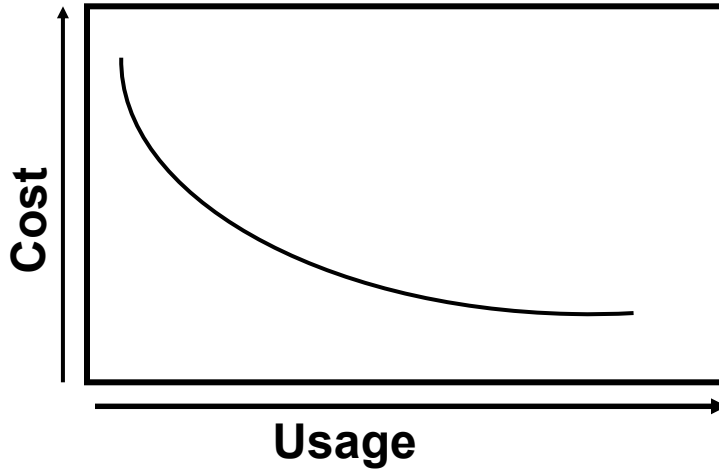
## OWNERSHIP COST

$$\begin{aligned} & \text{Purchase price} \\ & \quad - \text{Salvage} \\ & \quad + \text{Overhead} \\ & = \text{Ownership expense} \end{aligned}$$





# OWNERSHIP COST



# AVERAGE HOURS TO REPLACEMENT

- Rollers 9,500
- Wheel loaders 12,300
- Crawler dozers 12,500
- Hydraulic excavators 12,500
- Graders 14,300
- Scrapers 16,100
- Off-highway trucks 18,300



## OWNERSHIP COST

- ⊕ Include the cost of all attachments and delivery charges in initial machine cost (delivered price).
- ⊕ Deduct tire cost for wheel-type machines.



## OWNERSHIP COST

**Question No. 3** Machine owning cost includes which of the expenses listed?

- \$ Insurance
- \$ Fuel
- \$ Taxes
- \$ Repairs

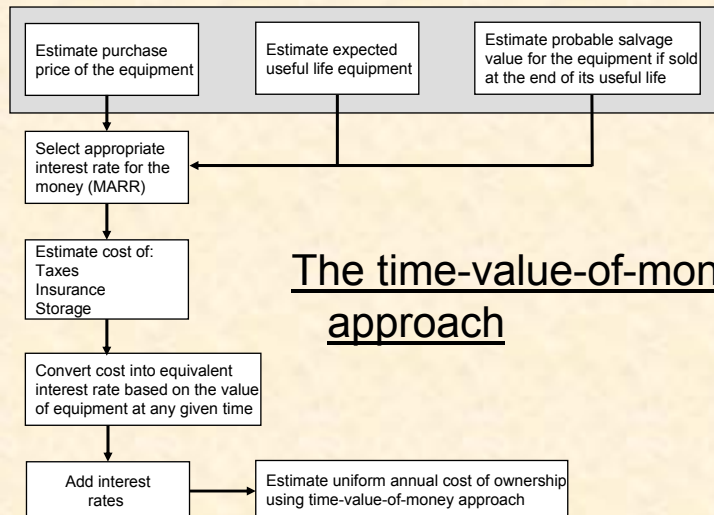


# OWNERSHIP COST

- Methods for Estimating Ownership Cost
  1. Time Value Method
  2. Average Annual Investment Method



# Estimating Ownership Cost of Equipment





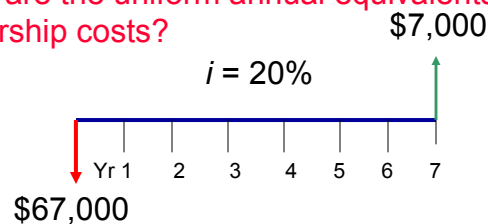
## Example 1

A piece of equipment is estimated to cost \$67,000 new and to have a useful life of 7 years with a salvage value of \$7,000. The company believes that a realistic MARR would be 12%. Taxes, insurance, and storage should amount to an additional 8%, which results in an overall cost of money of 12 + 8, or 20%.



## Example 2 (cont'd)

What are the uniform annual equivalents of estimated ownership costs?



$$A = -\$67,000 \left( \frac{A}{P}, 20, 7 \right) + \$7,000 \left( \frac{A}{F}, 20, 7 \right) = -\$18,045$$

$$A = P \left[ \frac{i(1+i)^n}{(1+i)^n - 1} \right] + F \left[ \frac{i}{(1+i)^n - 1} \right]$$

$$A = -\$67,000 \left[ \frac{0.2(1+0.2)^7}{(1+0.2)^7 - 1} \right] + \$7,000 \left[ \frac{0.2}{(1+0.2)^7 - 1} \right] = -\$18,045$$



# CHARGING OWNERSHIP COSTS

To recover ownership costs, an appropriate amount must be charged for equipment usage.

Charge per hour of use, based on an expected use rate per year.

Example: If the expected use rate is around 1,400 hours per year, then the ownership charge per hour will be

$$\mathbf{\$18,045/1,400 = \$12.89 \text{ per hour of use}}$$

Daily, weekly, or monthly rate that it is available on the job, whether or not used.

Example: If historical records indicate that this type of equipment is assigned to projects around 260 days per year, then the ownership charge per day of availability will be

$$\mathbf{\$18,045/260 = \$69.40 \text{ per day of availability}}$$