CONSTRUCTION EQUIPMENT COSTS

Courtesy of Dr. Emad Elbeltagy

AGENDA

Construction Equipment Costs

Depreciation

CONSTRUCTION EQUIPMENT COSTS

- Estimating equipment cost involves identifying the **ownership and operating costs**
- **Ownership costs** include:
  - Initial cost,
  - Financing (investment) costs,
  - Depreciation costs
  - Taxes and insurance costs
- **The operating costs** include:
  - Maintenance and repair costs,
  - Storage costs
  - Fuel and lubrication costs

INITIAL COST

- The initial cost is the total cost required to purchase a piece of equipment
- This initial cost is the basis for determining other costs related to ownership as well as operating costs
- Generally, initial cost is made up of:
  - Price at the factory or used equipment price,
  - Extra options and accessories,
  - Sales tax,
  - Freight
  - Assembly or setup charges
- The initial cost is very straight forward and calculated through the depreciation cost

INVESTMENT COST (COST OF FINANCE)

- The purchase of construction equipment requires a significant investment of money.
- This money either be borrowed from a lender, or it will be taken from reserve fund of the contractor
- In order to calculate the cost of finance, both the purchase price, P, and the salvage value, F, should be

$$Annual\ cos\,t\ \ of\ \ finance = \left[P\left(\frac{i(1+i)^n}{(1+i)^n-1}\right)-\frac{P}{n}\right]-\left[F\left(\frac{i}{(1+i)^n-1}\right)-\frac{F}{n}\right]$$

INVESTMENT COST (COST OF FINANCE)

- Example: An excavator purchase price is LE460,000 and its salvage value is LE40,000 after 10 years of useful life. Find the annual cost of finance of this excavator if the annual interest rate is 15%
- P = 460,000; F = 40,000; n = 10; i = 15%

$$Annual cost\ of\ finance = \left[460000\left(\frac{0.15(1.15)^{10}}{(1.15)^{10}-1}\right)-\frac{460000}{10}\right]-\left[40000\left(\frac{0.15}{(1.15)^{10}-1}\right)-\frac{40000}{10}\right]$$

- ***Annual cost of finance = LE47,684/year***

OPERATION COSTS

- Operating cost accrue only when the equipment is used, whereas ownership costs accrue whether or not the equipment is used
- Operating costs include maintenance and repairs, fuel, oil and lubricants
- The cost for maintenance and repairs include the expenditures for parts and labor required to keep the equipment in good condition
- The annual cost of maintenance and repairs is often expressed as a percentage of purchase prices or as a percentage of the straight-line depreciation costs

OPERATION COSTS

- Fuel consumption:
  - A gasoline engine consume approximately 0.06 gallon of fuel for each horsepower-hour.
  - A diesel engine consume approximately 0.04 gallon of fuel for each horsepower-hour
- Lubricating oil consumption: The quantity of lubricating oil consumed by an engine varies with the engine size , the capacity, the equipment condition and number of hours between oil change
- Cost of rubber tires: tires life usually not be the same as the equipment on which they are used
- Thus, the cost of depreciation and repairs for tires should be estimated separately from the equipment

EXAMPLE

Calculate the hourly rate of equipment based on the following data:

- Purchase price (P) = LE460,000
- Salvage value (F) = LE40,000
- Useful life (N) = 10 years
- Working hours per year = 2000 Hours
- Annual maintenance costs = 10% of purchase price
- Annual operating costs = LE47,000
- Interest rate (i) = 15%

EXAMPLE

- **Depreciation (assume straight-line)**

  = (460000 – 40000) / 10 = LE42000/year

- **Investment annual cost is calculated as follows:**

$$\left[460000\left(\frac{0.15(1.15)^{10}}{(1.15)^{10}-1}\right)-\frac{460000}{10}\right]-\left[40000\left(\frac{0.15}{(1.15)^{10}-1}\right)-\frac{40000}{10}\right]$$

- ✓ **Annual investment = LE47684/year**

EXAMPLE

- Maintenance and repair cost = 0.1 × 460000

  = LE46000/year
- Operating costs = LE47000/year
- Then, the total annual costs

  = 42000 + 47684 + 46000 + 47000 = LE182684/year
- Accordingly, the hourly cost = 182684/ 2000

  = LE91.34/hr

DEPRECIATION

DEPRECIATION

- **The depreciation: is defined as "the decrease in market value of an asset over time" through wear, deterioration or obsolescence**
- **A machine may depreciate (decline in value) because it is wearing out and no longer performing its function**
- **Another aspect of depreciation is that caused by obsolescence**
- **A machine is described as obsolete when the function it performs can be done in some better manner**

DEPRECIATION

- As asset always has different values: initial value (P), book value (BV), salvage value (F) and market value (MV)
- **The initial value**: represents the purchase price of an asset
- **Salvage value**: represents the expected price for selling the asset at the end of its useful life
- **The book value**: represents the current value in the accounting systems. It equals the initial value of the asset minus all the depreciation costs till given time. The book value is always calculated at the end of each year
- **The market value:** represents the value of the asset if it is sold in the free market. It is not necessary that the book value equals the market value

DEPRECIATION

- **There are three common methods for calculating depreciation:**
  - Straight-line,
  - Sum-of-years digits
  - Sinking fund method.
- **Each method involves the spreading of the amount to be depreciated over the recovery life of an asset in a systematic manner**

DEPRECIATION

- **The straight-line method** assumes linear depreciation or the depreciation cost is allocated equally over the asset useful life
- **The sum-of-years digits** assumes high rate of depreciation at the early age of an asset and decreasing rate at its aged life
- **The sinking fund** method assumes lower rate at the early ages and faster rate at the late age

1.THE STRAIGHT LINE METHOD

- In this method a constant depreciation charge is made
- The total amount to be depreciated (initial value, P – salvage value, F) is divided by the useful life, N years
- (Annual depreciation charge) $D_n = (P – F) / N$
- The book value at any time, n, could be calculated as follows
- $BV(n) = P – nD_n$

1.THE STRAIGHT LINE METHOD

- **Example:** **If an asset has a initial value of LE50,000 with LE10,000 salvage value after five years. Calculate the annual depreciation and calculate the book value of the asset after each year**

1.THE STRAIGHT LINE METHOD

- **Annual depreciation:**
  - $D_n = (P - F) / N = 50{,}000 - 10{,}000 / 5 = LE8{,}000$ per year
- **Book value of the asset after each year:**
  - $BV(n) = P - nD_n$ (n = 1, 2, 3, 4, 5)
  - BV(1) = 50,000 – (1) 8,000 = LE42,000
  - BV(2) = 50,000 – (2) 8,000 = LE34,000
  - BV(3) = 50,000 – (3) 8,000 = LE26,000
  - BV(4) = 50,000 – (4) 8,000 = LE18,000
  - BV(5) = 50,000 – (5) 8,000 = LE10,000 = F

2.SUM-OF-YEARS DIGITS METHOD

- This method results in faster depreciation at the early life of an asset and smaller charges as the asset nears the end of its estimated life
- Each year, the depreciation charge is computed as the remaining useful life at the beginning of the year divided by the sum of the years digits for the total useful life, with this ratio multiplied by the total amount of depreciation (P – F)
- Thus means that the depreciation is calculated as the percentage of the remaining life to the original life

2.SUM-OF-YEARS DIGITS METHOD

- D_n = (Remaining useful life at beginning of a year / Sum of years digits) × (P – F)
- Sum of years digits = N (N + 1) / 2

$$D_n = \left[\frac{N - n + 1}{N(N+1)/2} \right] \times (P - F)$$

2.SUM-OF-YEARS DIGITS METHOD

- **Example:** **If the purchase price of an equipment is LE60,000 and its salvage value after 8 years is LE6,000, calculate the annual depreciation and the book value of the equipment each year.**
- **P = 60,000; F = 6,000; N = 8**
- **Sum-of-years digits = 8 (8 + 1) / 2 = 36 years**

2.SUM-OF-YEARS DIGITS METHOD

Year	Remaining life / sum-of-years	Annual depreciation	Book value
0	0	0	60,000
1	8/36	12,000	48,000
2	7/36	10,500	37,500
3	6/36	9,000	28,500
4	5/36	7,500	21,000
5	4/36	6,000	15,000
6	3/36	4,500	10,500
7	2/36	3,000	7,500
8	1/36	1,500	6,000

3.SINKING FUND METHOD

- This method assumes that a uniform series of payments are deposited into an imaginary fund at a given interest rate i
- The amount of the annual deposit is calculated so that the accumulated sum at the end of the asset life will equal the value of the asset depreciated (P – F)
- The amount of yearly depreciation is invested in a compound manner for the remaining period

3.SINKING FUND METHOD

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

- **Then the depreciation value, D_n, at any year n is calculated**
- **$D_n = A \times (1 + i)^{n-1}$; n = 1, 2, 3, …….. ……., N**

3.SINKING FUND METHOD

- **Example:** **If the purchase price of an equipment is LE60,000 and its salvage value after 8 years is LE6,000, calculate the annual depreciation and the book value of the equipment each year.**

- **P = 60,000;** **F = 6,000;** **N = 8;** **i =10%**

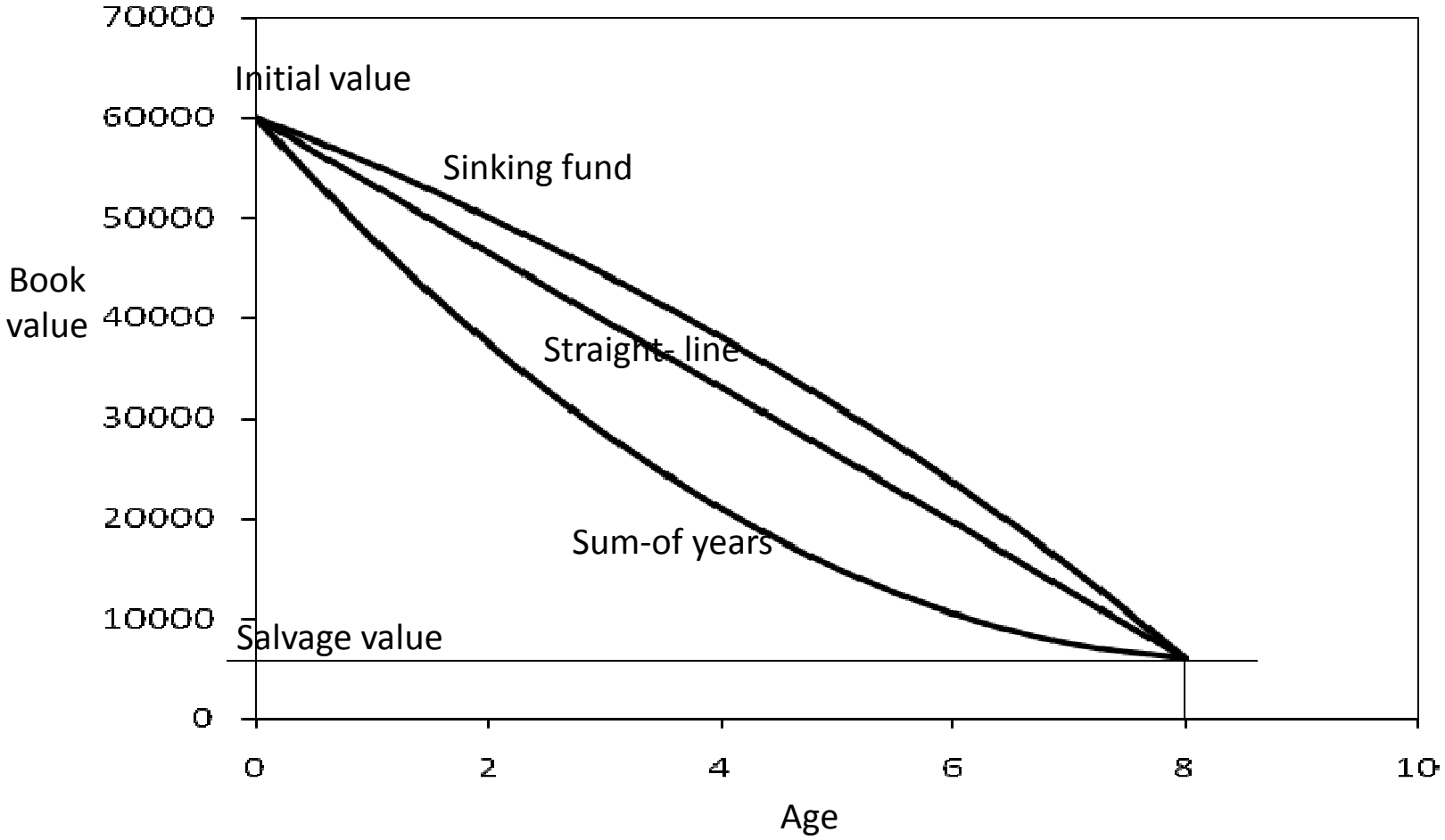
3.SINKING FUND METHOD

- $A = (60000 - 6000) \times [(0.1) / (1.1^8 - 1)] = LE4,722$
- Accordingly, the annual depreciation could be calculated as :
- At the first year: $D_1 = \quad = LE4,722$
- At the second year: $D_2 = 4722 \times (1.1) = LE5,194$
- At the third year: $D_3 = 4722 \times (1.1)^2 = LE5,714$
- ……..
- At the eighth year: $D_8 = 4722 \times (1.1)^7 = LE9,202$

3.SINKING FUND METHOD

Year	Annual depreciation	Book value
0	0	60,000
1	4,722	55,278
2	5,194	50,084
3	5,714	44,370
4	6,285	38,085
5	6,913	31,172
6	7,605	23,567
7	8,365	15,202
8	9,202	6,000

DEPRECIATION



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QUESTIONS