

Equipment Economics

How much to charge per hour for an equipment you bought as an investment?

Owing, salvage, cost of finance, operating, maintenance, depreciating

Depreciation

- **Depreciation** or Capital Recovery is the reduction in value of assets owned by the corporation. Depreciation methods are based upon legally approved rules which do not necessarily reflect actual usage patterns of assets during ownership.
- **Depreciation** is the decrease in value of an asset resulting from deterioration, wear, tear, obsolescence, etc. arising from improvements in the design and construction of new equipment or the depletion of resources.

- **Book value:** The remaining undepreciated investment on corporate Books after the total amount of annual depreciation charges to date has been subtracted from the initial value. The book value is usually determined at the end of each year, which is consistent with the end-of-year convention.
- **Market value:** The actual amount that could be realized if an asset were sold on the open market.

- The book value and market value may have substantially different numerical values.

3 broad groups of methods for depreciation

1. Similar value for every year
2. Greater asset's value in the early years
3. Smaller amount in the early years

Example

- If an asset has a first cost of 8,000 LE with a 2,000 LE salvage value after 6 years.
 1. Calculate the annual depreciation
 2. Compute the book value of the asset after each year
 3. Plot the book value of the asset after each year.

Assume an interest rate = 10%

1. Straight Line Depreciation

- This method of depreciation is sometimes known as the fixed instalment method. The basis of the method is that the difference between the initial cost of the asset and the estimated salvage value at the end of its life is divided by the estimated life in years, to give the uniform instalment of depreciation which is written off each year. The depreciation of the asset is assumed to be directly proportional to its age.

1. Straight Line Depreciation

Initial cost = 8,000 LE, SV = 2,000 LE, Life 6 years

Year (t)	0	1	2	3	4	5	6
D	-	1,000	1,000	1,000	1,000	1,000	1,000
Book value	8,000	7,000	6,000	5,000	4,000	3,000	2,000

$$D_t = \frac{(B-SV)}{n} = \frac{(8,000-2,000)}{6} = 1,000$$

**Straight line depreciation =
(Initial cost - estimated SV)/estimated life**

2. Declining Balance (DB)

- A method from the second group. In the declining balance, a fixed percentage of the book value of an asset is written annually. The ratio of the depreciation for any year to the book value of the asset at the beginning of that year is therefore constant for all years of the assets' life.

2. Declining Balance (DB)

- B = first cost
- SV = Salvage value
- D_t = Depreciation for year t
- d = rate of depreciation (uniform rate)

- $BV_t = B(1 - d)^t$
- $SV = BV_n = B(1 - d)^n$
- $d = 1 - \sqrt[n]{\frac{SV}{B}}$, for $SV > 0$

$$d = 1 - \sqrt[6]{\frac{2,000}{8,000}} = 0.2063$$

2. Declining Balance (DB)

Year (t)	0	1	2	3	4	5	6
Dt	-	1,650	1,310	1,040	825	625	520
Book value	8,000	6,350	5,040	4,000	3,175	2,520	2,000

3. Sum of Integers Depreciation

- A method from the second group. Each year's depreciation is calculated as a fraction of the total cost, where there is no salvage value, or initial - salvage value.

Year (t)	0	1	2	3	4	5	6
%		6/21	5/21	4/21	3/21	2/21	1/21
D	-	6,000(6/21) 1,714	6,000(5/21) 1,429	6,000(4/21) 1,143	6,000(3/21) 857	6,000(2/21) 571	6,000(1/21) 286
Book value	8,000	6,286	4,857	3,714	2,857	2,286	2,000

- Sum of year digits = $1+2+3+4+5+6 = 21$
- Amount to be depreciated = $8,000-2,000=6,000$

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

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

$$\text{Annual Cost of Finance} = \left[\underbrace{P \left(\frac{i(1+i)^n}{(1+i)^n - 1} \right)}_{\text{Initial Cost}} - \frac{P}{n} \right] - \left[\underbrace{F \left(\frac{i}{(1+i)^n - 1} \right)}_{\text{Salvage}} - \frac{F}{n} \right]$$

Example

- A Loader purchase price is LE550,000 and its salvage value is LE50,000 after 10 years of useful life. The loader works 2000 hours per year. The annual maintenance costs is 15% of purchase price, the annual operating costs is LE47,000, and the annual interest rate is 10%.
- **It is required to** Calculate the hourly rate (cost per hour) of the Loader

Solution

- Depreciation (assume straight-line) =
 $(550,000 - 50,000) / 10 = \text{LE}50,000/\text{year}$

- Investment annual cost =

$$\left[550,000 \left(\frac{0.10(1.10)^{10}}{(1.10)^{10} - 1} \right) - \frac{550,000}{10} \right] - \left[50,000 \left(\frac{0.10}{(1.10)^{10} - 1} \right) - \frac{50,000}{10} \right]$$

- Annual investment = $\text{LE}36,372.69/\text{year}$
- Maintenance and repair cost = $0.15 \times 550,000 = \text{LE}82,500/\text{year}$
- Operating costs = $\text{LE}47,000/\text{year}$
- The total annual costs = $50,000 + 36,372.7 + 82,500 + 47,000 = 215,872.7/\text{year}$
- The hourly cost = $215,872.7 / 2000 = \text{LE}107.9/\text{hr}$