Tikrit University

The College of Petroleum Processes Engineering

Petroleum and Gas Refining Engineering Department

Management and economics of petroleum projects

Fourth Class

Lecture (5)

By

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Depreciation Models

Depreciation – Definition

- Depreciation is the reduction of an asset's value over time.
- by:
  - Wear, Use, Deterioration, Obsolescence
- Why depreciation?

  Taxes = (income - expenses - depreciation) (tax rate)

Why depreciation?

- The capital investments of a corporation in tangible assets; equipment, computers, vehicles, buildings, and machinery are commonly recovered on the books of the corporation through depreciation.

Depreciable?

- Property is depreciable if it must:
  - be used in business
  - have a determinable useful life which is longer than one year
  - wear out, get used up, or become obsolete
  - not be inventory, stock in trade, or investment property
  - Land is not depreciable because it has an infinite life.

Problem

- Variable Cost per Unit = 1 SR
- Unit Price = 3 SR
- Machine First Cost = 50,000 SR
- Quantity Sold = 1 unit/year
- **Profit = ?????????????**

Solution

- Profit = Total Revenue – Total Cost
- Profit = [1*3] – [1*1] = + 2 ?
- Profit = [1*3] – [(1*1) + 50,000] = - 49,998 ?
- Profit = [1*3] – [(1*1) + 8,000] = - 7,998 ?

Depreciation

Types of Depreciation

- Book Depreciation
  - Used for internal managerial decision making.
  - Management is free to use any method they so choose to compute book depreciation amounts
- Tax Depreciation
  - Used by a firm for income tax reporting
  - Follows strict rules and regulations.

Depreciation Methods

- Depreciation Methods

  1. Straight-Line Method (SL),
  2. Activity Method,
  3. Sum-of-the-Years Digits Method (SYD).

Straight-Line Method

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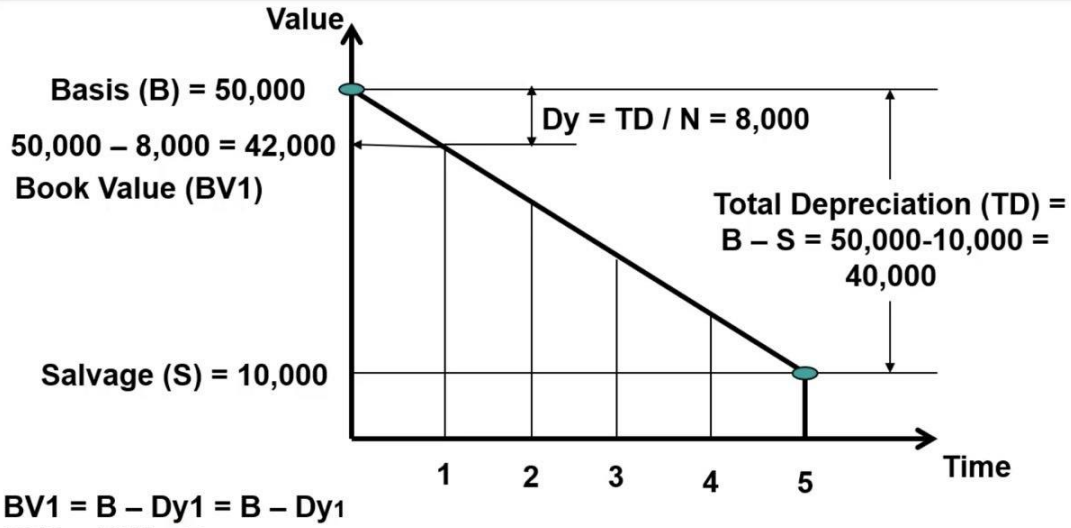
Example 1

- Given:
  - First cost or Basis (B) is $50,000
  - Machine life (Recovery Period) is 5 years
  - Estimated salvage (S) of $10,000.
- Required:
  - Depreciation rate (Dy)
  - The Book Value (BV) at the end of each year

Solution



$BV1 = B - Dy1 = B - Dy_1$

$BV2 = BV1 - Dy_2$

$BV3 = BV2 - Dy_3$

.

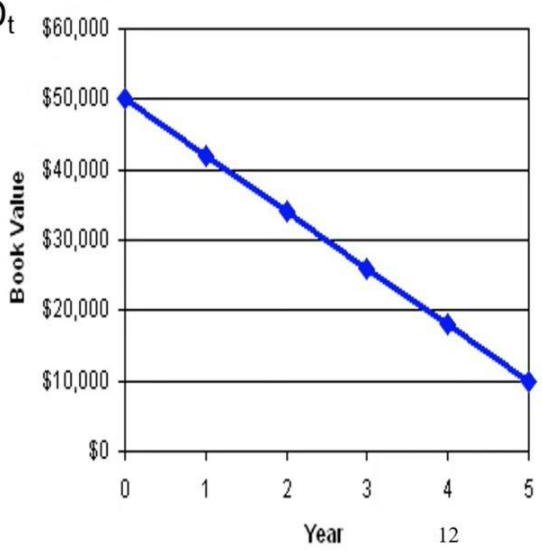
BV_N = Salvage value

Solution (Cont.)

SL depreciation: $D_t = (50{,}000-10{,}000)/5 = \$8{,}000$

SL book value: $BV_t = BV_{t-1} - D_t$

Year, t	D_t	BV_t
0	0	$50,000
1	8,000	42,000
2	8,000	34,000
3	8,000	26,000
4	8,000	18,000
5	8,000	10,000



Depreciation Terms

- First Cost or Basis (B) of an asset is:
  - Purchasing cost plus, Delivery costs plus, Installation costs and any other costs associated with preparing the asset for use.
- Salvage Value (SV) is the estimated market value at the end of the asset's useful life
  - Expressed as an estimated amount or as a percentage of the first cost

Salvage Value

- Book Value of an Asset (BVt)
  - The remaining, undepreciated capital investment on the firm's books after the accumulated amounts of depreciation have been subtracted from the original cost basis.
- Recovery Period is Number of years over which basis of property is recovered through accounting process.

Straight-Line: The Standard (SL)

- Notations
  - B = The Basis or , first cost
  - N = The Recovery Period,
  - S = Estimated Salvage Value at t = n,
  - TD = The total depreciation = B - S
  - Dy = Annual depreciation charge = TD / N

Activity Method

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Activity Measures

Asset	Activity measure
Vehicles	Kilometers
Printer	Number of printed papers
Crane	Number of working hours

Example 2 (Activity Method)

Cost of crane	$500,000
Estimated useful life	5 years
Estimated salvage value	$ 50,000
Productive life in hours	30,000 hours

If the company used the crane for 4,000 hours in the first year, calculate:

1. The depreciation charge for the first year
2. The book value at the end of the first year

Solution

- B = 500,000 $
- S = 50,000 $
  - ➢TD = B – S = 500,000 – 50,000 = 450,000 $
- Life = 5 years or 30,000 hrs
  - ➢Dh = TD / Lh = 450,000 / 30,000 = 15 $/hr
- Dy = Dh * Working hours/year
  - ➢Dy1 = 15 * 4,000 = 60,000
  - ➢BV1 = B – Dy1 = 500,000 – 60,000 = 440,000 $

Sum-of-the-Years' Digits Method

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Sum-of-the-Years'-Digits Method

- *Sum-of-the-Years'-Digits.* Each fraction uses the sum of the years as a denominator (5 + 4 + 3 + 2 + 1 = 15). The numerator is the number of years of estimated life remaining as of the beginning of the year.

- Alternate sum-of-the-years' calculation = n (n+1) / 2

Example 3 (SYD Method)

Cost of crane	$500,000
Estimated useful life	5 years
Estimated salvage value	$ 50,000
Productive life in hours	30,000 hours

Sum-of-the-Years'-Digits. Each fraction uses the sum of the years as a **denominator** (5 + 4 + 3 + 2 + 1 = 15). The **numerator** is the number of years of estimated life remaining as of the beginning of the year.

Alternate sum-of-the-years' calculation = n (n+1) / 2

SYD Method

Year	Dep. Fraction	Dep. Expenses	End of Year Book Value
1	5/15	450,000 * (5/15) = 150,000	500,000 - 150,000 = 350,000
2	4/15	450,000 * (4/15) = 120,000	350,000 - 120,000 = 230,000
3	3/15	450,000 * (3/15) = 90,000	230,000 – 90,000 = 140,000
4	2/15	450,000 * (2/15) = 60,000	140,000 – 60,000 = 80,000
5	1/15	450,000 * (1/15) = 30,000	80,000 – 30,000 = 50,000
Sum = 15	**15/15=1**	**450,000**	

Problem (1): The first cost of a machine is 15,000 SR with a life of 4 years or 1000 working hours and estimated salvage of 5,000 SR. if the company used this machine as shown in the following table:

year	1	2	3	4
Working hours	100	200	300	400

Calculate the book value at the end of the fourth year using:

a) Straight line method

$B = 15000\ SR$ $S = 5000\ SR$ $N = 4$

$$TD = B - S = 1500 - 5000 = 10000\ SR$$

$$Dy = \frac{TD}{N} = \frac{10000}{4} = 2500\ SR/\text{YEAR}$$

$$Bv_1 = B - Dy_1 = 15000 - 2500 = 12500\ SR$$

$$Bv_1 = B - Dy_1 = 15000 - 2500 = 12500\ SR$$

$$Bv_2 = Bv_1 - Dy_2 = 12500 - 2500 = 10000\ SR$$

$$Bv_3 = Bv_2 - Dy_3 = 10000 - 2500 = 7500\ SR$$

$$Bv_4 = Bv_3 - Dy_4 = 7500 - 2500 = 5000\ SR$$

b) Activity method

$B = 15000\ SR \qquad S = 5000\ SR \qquad life = 1000\ hours$

$$TD = B - S = 1500 - 5000 = 10000\ SR$$

$$Dh = \frac{tD}{life} = \frac{10000}{1000} = 10\ SR/hr$$

$$Dy = Dh * working\ \ hours/\text{year}$$

$$Dy = Dh * working\ \ hours/\text{year}$$

$$Dy_1 = 10 * 10 = 1000\ \ SR$$
$$Bv_1 = B - Dy_1 = 15000 - 1000 = 14000\ \text{SR}$$

$$Dy_2 = 10 * 200 = 2000\ SR$$
$$Bv_2 = Bv_1 - Dy_2 = 14000 - 2000 = 12000\ \text{SR}$$

$$Dy_3 = 10 * 300 = 3000\ SR$$

$$Dy_3 = 10 * 300 = 3000\ SR$$

$$Bv_3 = Bv_2 - Dy_3 = 12000 - 3000 = 9000\ \text{SR}$$

$$Dy_4 = 10 * 400 = 4000\ \text{SR}$$
$$Bv_4 = Bv_3 - Dy_4 = 9000 - 4000 = 5000\ \text{SR}$$

c) sum-of-the-digits method

Year	Dep. Fraction	Dep. Exposes	End of year Book value
1	4/10	10000*4/10 = 4000	15000 – 4000 = 11000
2	3/10	10000*3/10 = 3000	11000 – 3000 = 8000
3	2/10	10000*2/10 = 2000	8000 – 2000 = 6000
4	1/10	10000*1/10 = 1000	6000 – 1000 = 5000
Sum = 10	10/10	1000	

problem (2): The first cost of a machine is 40,000 SR with a life of 5 years or 2,000 working hours and the estimated salvage of 10,000 SR. If the company used this machine as shown in the following table:

year	1	2	3	4	5
Working hours	500	300	400	300	500

Calculate the Book Value at the end of the five years using:

a) Activity method

$B = 40000\ SR \qquad S = 10000\ SR \qquad life = 2000\ Hours$

$$TD = B - S = 40000 - 10000 = 30000\ \text{SR}$$

$$Dh = \frac{TD}{life} = \frac{30000}{2000} = 15\ SR/hr$$

$$Dy = Dh * working\ \ Hours/year$$

$$Dy_1 = 15 * 500 = 7500\ SR$$
$$Bv_1 = B - Dy_1 = 40000 - 7500 = 32500\ \text{SR}$$

$$Dy_2 = 15 * 300 = 4500\ \text{SR}$$
$$Bv_2 = Bv_1 - Dy_2 = 32500 - 4500 = 28000\ \text{SR}$$

$$Dy_3 = 15 * 400 = 6000\ \text{SR}$$
$$Bv_3 = Bv_2 - Dy_3 = 28000 - 6000 = 22000\ \text{SR}$$

$$Dy_4 = 15 * 300 = 4500\ SR$$

$$Bv_4 = Bv_3 - Dy_4 = 22000 - 4500 = 17500\ \text{SR}$$

$$Dy_5 = 15 * 500 = 7500\ SR$$

$$Bv_5 = Bv_4 - Dy_5 = 17500 - 7500 = 10000\ \text{SR}$$

$$Dy_5 = 15 * 500 = 7500\ SR$$

$$Bv_5 = Bv_4 - Dy_5 = 17500 - 7500 = 10000\ \text{SR}$$

b) Straight-Line Method

$$B = 40000\ SR \qquad S = 10000\ SR \qquad N = 5$$

$$TD = B - S = 40000 - 10000 = 30000\ SR$$

$$Dy = \frac{TD}{N} = \frac{30000}{5} = 6000\ \text{SR/year}$$

$$Bv_1 = B - Dy_1 = 40000 - 6000 = 34000\ \text{SR}$$

$$Bv_1 = B - Dy_1 = 40000 - 6000 = 34000\ \text{SR}$$

$$Bv_2 = Bv_1 - Dy_2 = 34000 - 600 = 28000\ \text{SR}$$

$$Bv_3 = Bv_2 - Dy_3 = 28000 - 6000 = 22000\ \text{SR}$$

$$Bv_4 = Bv_3 - Dy_4 = 22000 - 6000 = 16000\ \text{SR}$$

$$Bv_5 = Bv_4 - Dy_5 = 16000 - 6000 = 10000\ \text{SR}$$

3- Sum of digit method:

Year	Dep. Fraction	Dep. Exposes	End of year Book value
1	5/15	30000*5/15 = 10000	40000 – 10000 = 30000
2	4/15	30000*4/15 = 8000	30000 – 8000 = 22000
3	3/15	30000*3/15 = 6000	22000 – 6000 = 16000
4	2/15	30000*2/15 = 4000	16000 – 4000 = 12000
5	1/15	30000*1/15 = 2000	12000 – 2000 = 10000
Sum = 15	15/15	30000	