Chapter-3

Depreciation

Introduction and Definitions

- Asset: property that is acquired and exploited for monetary gain such as machines, vehicles, office building, planes, ships, boats, computers, etc.

- First Cost of an Asset: total expenditure required to place an asset in operating condition.

E.g. If an asset is purchased, it includes the purchase price related and all incidental expenses such as transportation, tax, telephone, assembly, expert advice, etc.

- Salvage Value or Residual Value: the price at which a fixed asset is expected to be sold at the end of its useful life.

Con’t

- **Book Value**: the value of an asset displayed on the documents of the firm.

E.g. if the first cost of an asset is $20,000 and the depreciation charges to date total $14,000 the current book value is $6,000

- As time elapses, every asset undergoes a progressive loss of value resulting from:

1) Physical factors: wear and tear, exposure to elements

2) Functional factors: technological change

Con’t

- In contrast to other business expenses, depreciations does not manifest itself in the form of cash transactions during the life of the asset, and consequently it is necessary to make an entry in the books of the firm at the close of each accounting period, for two reasons:

1) to record the depreciation that occurred during that period, and there by permit a true determination of the earnings for that period.

2) to display the current value of the asset.

- This entry is known as a depreciation charge, and the process of entering depreciation charges is known as writing-off the asset.

Depreciation Allocation Methods

The notational system for depreciation is as follows

- Bo = first cost of asset
- Br = book value of asset at the end of rth year
- L = estimated salvage value
- Dr = depreciation charge for rth year
- n = estimated life span of asset, years

Depreciation computation methods

- It is the simplest method of depreciation.
- It is almost rough estimate.
- It has the disadvantage of yielding a slow write-off of the asset.
- It assumes as the total depreciation cost to be assigned uniformly over the life of the asset. $Dr = \frac{Bo - L}{n}$

Bn = Bo- nD, book value end of each year.

Con’t

Example 1: A machine costing \$15,000 has an estimated life span of 8 years and an estimated salvage value of \$3000. Compute the annual depreciation charge and the book value of the machine at the end of each year under the straight line depreciation method.

Solution:

Given:

Bo = \$15,000

L = \$3000

n = 8 years

then, $Dr = \frac{Bo - L}{n} =$. $Dr = \frac{15,000 - 3000}{8} =$ 1500, annual depreciation charge.

Con’t

Hence, the Book Values for each year:

$B1 = Bo – 1*D = 15,000 – 1,500 = \$13,500$

$B2 = B0 –2*D = 15,000 – 2*1500 = 12000$

In general,

$Bn = Bo - nD$, book vale “end of each year

$B3 = 15,000 – 3 x 1,500 = \$10,500$

$B4 = 15,000 – 4 x 1,500 = \$9,000$

$B5 = 15,000 – 5 x 1,500 = \$7,500$

$B6 = 15,000 – 6 x 1,500 = \$6,000$

$B7 = 15,000 – 7 x 1,500 = \$4,500$

$B8 = 15,000 – 8 x 1,500 = \$3,000$ (what does this number implies?)

2. Sum-of-Years' Digits Method

- It avoids the problem of straight-line depreciation method (that is, it accelerates the write-off of the asset).
- By this method, the depreciation charges form a descending arithmetic progression in which the first term is n times the last term. It follows that,

$$Dr = (n - r + 1)Dn$$

- The depreciation charge for the final year is the total depreciation divided by the sum of the integers from 1 to n, inclusive. Since this sum is n(n+1)/2, we have

$$Dn = \frac{2(Bo - L)}{n(n+1)}$$

Con’t

- The Book value of the asset at the end of the rth year is:

$$B_r = B_0 - \frac{\left[2nr - r(r-1)\right](B_0 - L)}{n(n+1)}$$

Example: A machine costing $10,000 is estimated to have a service life of 8 years at the end of which time it will have a salvage value of $1000. Calculate the depreciation charges, applying the sum-of-digits method?

Solution: using this formula, the depreciation at the end of8th year is

$$Dn = \frac{2(Bo-L)}{n(n+1)} = \quad Dn = \frac{2(10000-1000)}{8(8+1)} = 250$$

D1=8(8-1+1)Dn=8*250, D2=7*250=1750

D3=6*250= 1500, D4= 5*250=1250

D5= 4*250= 1000, D6=3*250=750

D7=2*250=500, D8=1*250=250

Con’t

Summing up these depreciations charges

$$\sum_{r=1}^{8} D = 9000$$

Therfore, the machine will have a salvage value of;

1000 at the end of 8 years.

3. Declining-Balance Method:

This method postulates that the depreciation of an asset for a given year is directly proportional to its book value at the beginning of that year . i.e.

$Dr \propto B_{r-1}$

Let h denote the constant of proportionality, then

$$Dr = h\, B_{r-1}$$

h is expressed as k/n, where k is assigned the value 1.25, 1.5, and 2, depending on the nature of the asset.

$$\text{Then, } Dr = \frac{K}{n} B_{r-1}$$

Since book value diminishes as the asset ages, the depreciation charges form a decreasing series, and the declining-balance also yields an accelerated write-off.

Con't

Assume the salvage value of the asset as zero, and let

- D1s denotes the depreciation charge for the first year calculated by straight-line method.
- D1d denotes the depreciation charge for the first year calculated by the declining-balance method.

$$B_{1s} = \frac{Bo - L}{n} = \frac{Bo - 0}{n} = \frac{Bo}{n}$$

$$D1d = \frac{K}{n} B_{r-1}, \text{ where } r = 1$$

$$\Rightarrow D1d = \frac{K}{n} B_0 = k\frac{B_o}{n}$$

$$D1d = \frac{K}{n} B_0, \text{ but } \frac{B_o}{n} = D1s$$

$$\text{Thus, } D1d = k\, D1s$$

For this reason, the declining-balance method is called the "double declining-balance method" when k = 2.

Con't

Example: Applying the double-declining-balance method, calculate the depreciation charges for an asset having a first cost of \$20,000, a life span of 8 years and an estimated salvage value of

a) \$4000 b) \$500

Solution: a) given Bo =\$20,000

L= \$4,000

k = 2, n = 8

Required: Depreciation charges

We shall first establish the depreciation charges & final book value that result if the declining-balance method is applied throughout the life of the asset

$h = k/n = 2/8 = 0.25$

$D_r = h B_{r-1}$

Con’t

$D1 = hBo$	$B1 = Bo - D1$ $B1 = Bo - hBo = Bo\,(1-h)$	
$= 0.25\,(20{,}000)$	$= 20{,}000 - 5{,}000$	
$= \$5{,}000$	$= \$15{,}000$	
$D2 = hB1$	$B2 = B1 - D2$	$B2 = Bo\,(1-h) - hBo\,(1-h)$
$= 0.25\,(15{,}000)$	$= 15{,}000 - 3750$	$= Bo\,(1-h)\,(1-h)$
$= \$3750$	$= \$11{,}250$	$= Bo\,(1-h)^2$
$D3 = hB2$	$B3 = B2 - D3$	$B3 = Bo(1-h)^2 - hBo\,(1-h)^2$
$= 0.25\,(11{,}250)$	$= 11{,}250 - 2813$	$= Bo\,(1-h)2\,(1-h)$
$= \$2813$	$= \$8{,}437$	$= Bo\,(1-h)^3$

In general, $\mathbf{Bn = Bo\,(1-h)^n}$

Con’t

Consistently using the above equations, the depreciation charge and final book values can be summarized as below:

Year	Book value at beginning, $	Depreciation change, $	Book value at end, $
1	20,000	5,000	15,000
2	15,000	3,750	11,250
3	11,250	2,813	8,437
4	8,437	2,109	6,328
5	6,328	1,582	4,746
6	4,746	1,187	3,559
7	3,559	890	2,669
8	2,669	667	2,002

Con’t

- Since the book value can never fall below the salvage value, the declining-balance method must be abandoned at the end of the 5th year .
- Depreciation is charged for the sixth year but not for the 7th & 8th years.

Then

D1 = $ 5000 D3= $ 2813 D5= $ 1582

D2= $ 3750 D4= $ 2109 D6= 4746 – 4000 = $ 746

D7= D8= 0

b) The declining-balance method yields a final book value of $2002, but the salvage value is only $500. One possibility is to apply the declining balance method for the first 7 years and then set the depreciation for the 8th year equal to 2669-500 = $2169.

Con't

- However, if the objective is to write-off the asset rapidly, it is more advantageous to transfer to the straight-line method at the point where this method yields a higher depreciation charge than does the declining balance method.

- Assume that the transfer from declining-balance to straight-line method occurs at the beginning of the r^{th} year . The remaining depreciation must be allocated uniformly among the remaining years of the life of the asset. Therefore, the depreciation charge for the r^{th} year (and all subsequent years) is, $Dr = \dfrac{B_{r-1} - L}{n - r + 1}$

Con’t

Year	Depreciation if transfer is made at beginning of year, $	Depreciation if transfer is differed, $
2	(15,00-500)/7 = 2071	3750
3	(11,250-500)/6 = 1792	2813
4	(8437-500)/5 = 1587	2109
5	(6328-500)/4 = 1457	1582
6	(4746-500)/3 = 1415	1187
7	(3559-500)/2 = 1530	890

Con’t

- Referring to the table above, which is constructed by applying the values obtained in the first table. The depreciation charge for the rth year as given by equation above is recorded in column 2, and the depreciation charge as obtained by a continuation of the declining-balance method is recorded in column 3.
- A comparison of the values in the two columns discloses that a reversal occurs at the beginning of the 6th year & therefore the transfer from declining balance method to straight-line method should be made at that date. Then

D_1 = \$5000 D_3= \$2813 D_5= \$1582

D_2= \$3750 D_4= \$2109 D_6= D_7= D_8= \$1415

4. Units of Production Method

- If deterioration of an asset is primarily of exploitation rather than obsolescence, we have to use production volume as the base of depreciation charge.

- Moreover, if the asset is a machine that is used to produce a standard commodity, the magnitude of its use can be measured by the number of units it produces.

The depreciation charge/unit of production = Bo–L/Units produced by the asset

- Depreciation charges for consecutive years are allocated by multiplying the volume of production by this unit charge.

- N .B Depreciation can be allocated on the basis of profitability rather than production alone.

- Assume that the net profit per unit of production declines as the asset ages. Each unit can be assigned a weight proportional to its net profit, and the depreciation charges are then calculated on the basis of these weighted units, which are termed depreciation units.

Con’t

Example: A machine costing $42000 will have a life of 5 years and salvage value of $3000. It is estimated that 10,000 units will be produced with this machine, distributed in this manner: first year, 2000; second year, 2400; third year, 2100; fourth year, 1800; fifth year, 1700. If depreciation is allocated on the basis of production, calculate the depreciation charges:

Solution: The depreciation charge per unit of production is: $D = \frac{42000-3000}{10000}$=3.9

Multiplying the volume of production by this unit charge, we obtain the following results:

D1= 2000*3.9=7800

D2=9360 D3=8190 D4 =7020 D5= 6630

THANK YOU!