CV-302 Economics for Civil Engineers
Lecture Week #13 (10-15 May, 2021)

Depreciation & Depletion

Asset: Anything owned from business point of view is asset.

Type of assets:

Tangible Asset:

Asset having physical existence with some value e.g. machinery, pipe networks, and building.

Intangible asset:

No physical existence but some value e.g. trademark, formula, knowledge, goodwill, skill, research

Natural Asset:

Land, water, air, minerals, mines.

Depreciation: Depreciation is the decrease in the worth of property or asset with passage of time due to:

1) Wear & tear
2) Deterioration
3) Obsolete

Depletion:

Decrease in worth of natural asset, reduction of water in dam.

Purpose of determination of depletion value

1) To provide recovery of capital that has been invested
2) To work out real cost of assets

Physical Depreciation:

Lessening in the physical ability of the property to provide desired result. (Main cause of normal depreciation is wear and tear). It is related to time and asset maintenance.

Functional Depreciation:

Lessening in the demand of the asset because of advancement in technology e.g. Pentium 2 to Pentium 4 or Pentium 5.

Book Value (BV):

Refers to the difference between its original cost and total amount of depreciation that has been changed to date and shown in books. It is current worth of assets.

The BV depreciation is charged once a year and BV is computed at the end of the year.

Book Value is the worth of an asset as shown on the records of a firm. It means that original cost of the property less all amounts that have been charged as depreciation expenses.

Market Value (MV) of an asset refers to the amount of money that could be obtained for the asset if it were sold in the free market. In some cases the market value bears very little relationship to the BV e.g. plot of land or commercial building In this case market value does not depreciate with passage of time but appreciate while BV decrease due to depreciation charges.

Salvage Value (SV) refers to net residual value. A price that can be obtained from sale of property (asset) after it has been used.

Methods to calculate Depreciation

There various methods for calculating depreciation as mentioned below:

1) Straight Line Depreciation (SLD)
2) Declining Balance (DB)
3) Sum of the Year Digit (SYD)

Straight Line Depreciation (SLD)

In SLD it is assumed that constant amount depreciates each year over life of asset.
Or
BV reduces linearly

Formula

$$D = \frac{P - SV}{N} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where

D = Annual Depreciation
P = Initial Cost of asset
SV = Salvage Value
n = Life of asset
m = BV after "m" years

$$BV_m = P - {}_mD \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Problem

An asset has initial cost of $ 50,000. SV $ 10,000 after 5 years.

Calculate

a) Annual Depreciation
b) Book Value (BV) at the of Year 1, Year 2, Year 3.

Solution

Depreciation per year can be found by using equation No. 1.

$$D = \frac{P - SV}{n} = \frac{50{,}000 - 10{,}000}{5}$$

$$= 8000 \text{ / year}$$

BV of asset can be found after each year by Equation (2)

$BVm = P = mD$; $m = 1, 2, 3, 4, 5$

BV1 = 50,000 – 1 x 8000 = $ 42,000
BV2 = 50,000 – 2 x 8000 = $ 34,000
BV5 = 50,000 – 5 x 8000 = $ 10,000

Sum of Year Digit (SYD) Method

1) SYD is rapid write –off method for asset.
2) Through SYD most of the value of asset is written off in 1st 1/3rd life of asset.
3) SYD method provides large depreciation during early years than in later years.

$$Dm = \frac{\text{Depreciable years Remaining}}{\text{Sum of the year-Digits}} (\text{First Cost} - SV)$$

$$Dm = \frac{n - m + 1}{SYD} (P - SV) \quad \ldots\ldots (1)$$

Where

Dm = Depreciable charge for any given year "m"
SYD = Sum of year digits 1 – n

$$SYD = \sum^{n} J = \frac{n (n + 1)}{2} \quad \ldots\ldots (2)$$

$$BVm = P - \left[\frac{m (n - m/2 + 0.5)}{SYD} \right] (P - SV) \quad \ldots\ldots (3)$$

Problem 1.

Calculate Depreciation Value for first 3 years and BV of the initial cost of asset is $ 25,000, SV of $ 4,000, life of 8 years. Use SYD method.

Solution

Apply Equation 1 and 2

$$Dm = \frac{n - m + 1}{SYD}(P - SV) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \ (1)$$

$$BVm = P - \left[\frac{m\,(n - m/2 + 0.5)}{SYD}\right](P - SV) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

$$SYD = \frac{n\,(n+1)}{2} = \frac{8(9)}{2} = 36$$

Depreciation for 3 years

$$D_1 = \frac{8 - 1 + 1}{36}(25000 - 4{,}000)$$
$$= \frac{8 - 1 + 1}{36}(21000)$$

$$= \frac{8}{36}(21000)$$
$$= 2/9\ (21000)$$
$$= 4687$$

$$D_2 = \frac{7}{36}(21{,}000) = \$\ 4{,}083$$

$$D_3 = \frac{6}{36}(21{,}000) = \$\ 3{,}500$$

Note that $D_1 > D_2 > D_3$. Thus depreciation takes place at a decreasing rate.

BV for 3 years

$$BV_m = 25{,}000 - \left[\frac{3\,(8 - 3/2 + 0.5)}{36}\right](25{,}000 - 4{,}000)$$
$$= 25{,}000 - \left[\frac{3\,(7)}{36}\right](21{,}000)$$
$$= \$\ 12{,}750$$

Declining Balance Method (DBM)

1. DBM is also known as uniform or fixed percentage depreciation
2. DBM is rapid write off –technique.
3. Equations of DBM:

$d = 2\ (1/n) \times 100\% = \frac{200\%}{n}$ ..... (1)

$D_m = dP\ (1 - d)^{m-1}$ ..... (2)

$D_1 = dP(1 - 1)^{1-1}$

$D_1 = dP$ .....(3)

$d = DDB = 2/n$ ..... (4)

$DDB = 2/n\ P\ (1 - d)^{m-1}$ ..... (5)

Or $BV_n = P\ (1 - d)^n$ ..... (6)

Where
P = 1st cost of asset (initial cost of asset)
d = Depreciation
D_m = DBM or Depreciation for any given year "m".
n = Time or period or life of asset
DDB = Double Declining Balance
BV_n = Book Value after "n" year

Problem
An asset has a initial cost of $ 25,000 and SV of $ 4,000 after 12 years.

Calculate:
a) Depreciation after 1st year
b) Depreciation after 4th years
c) BV after 4 years

Follow DBM method

Solution

Substituting value in equation ..... (1)

$d = \frac{200\%}{n}$

$d = \frac{200\%}{12} = 16.67\%$ or $\frac{16.67}{100}$

d = 0.1667

Substituting value of d in equation No. 3.

$D_1 = dP$ …… (3)

$= (0.1667)25{,}000$

$= \$ 4{,}167$

Depreciation after 4 years by DDM

Substituting Value in equation No. 2.

$$D_4 = \frac{2}{n} P(1 - d)^{m-1}$$

$$D_4 = \frac{2}{12} \times 25{,}000\ (1 - 0.1667)^{4-1}$$

$$= \frac{1}{6} \times 25{,}000\ (0.83)^3$$

$$= \frac{1}{6} \times 25{,}000\ (0.57)$$

$= 4167\ (0.57)$

$= \$ 2{,}375$

$BV_4 = 25000\ (1 - 0.1667)^4 = 25000\ (0.83333)^4 = 25000\ (0.482) = 12050$

BV after 12 years by substituting value in Equation 6.

$BV_n = (1 - d)^n$

Substitute in equation (5)

$BV_{12} = 25{,}000\ (1 - 0.1667)^{12}$

$BV_{12} = \$ 2{,}802.57$