INDE 301
Engineering Economy

Depreciation Methods

Dr. N. Nehme

1. Understand basic terms of asset depreciation
2. Apply straight line method of depreciation
3. Apply DB and DDB methods of depreciation; switch between DDB and SL methods
4. Explain depletion and apply cost depletion & percentage depletion methods

Depreciation Terminology

Definition: ***Book (noncash) method*** to represent **decrease in value** of a tangible asset over time

Two types: book depreciation and tax depreciation

Book depreciation: used for *internal accounting* to track value of assets

Tax depreciation: used to determine *taxes due* based on tax laws

Common Depreciation Terms

First cost *P* or unadjusted basis *B*: Total installed cost of asset

Book value BV_t: Remaining undepreciated capital investment in year t

Recovery period *n*: Depreciable life of asset in years

Market value *MV*: Amount realizable if asset were sold on open market

Salvage value *S*: Estimated trade-in or MV at end of asset's useful life

Depreciation rate d_t: Fraction of first cost or basis removed each year t

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Personal property: Possessions of company used to conduct business

Real property: Real estate and all improvements **(land is not depreciable)**

Half-year convention: Assumes assets are placed in service in midyear

Straight Line Depreciation

➡ **Book value decreases *linearly with time***

$$D_t = \frac{B - S}{n}$$

Where: D_t = annual depreciation charge
t = year
B = first cost or unadjusted basis
S = salvage value
n = recovery period

$$BV_t = B - tD_t$$

Where: BV_t = book value after t years

SL depreciation rate is **constant** for each year: $d = d_t = 1/n$

Example: SL Depreciation

An argon gas processor has a first cost of $20,000 with a $5,000 salvage value after 5 years. Find (a) D_3 and (b) BV_3 for year three. (c) Plot book value vs. time.

Solution: (a) $D_3 = (B - S)/n$

$= (20,000 - 5,000)/5$

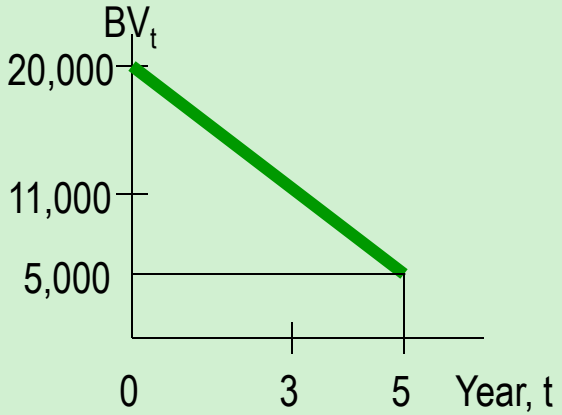
$= \$3,000$

(b) $BV_3 = B - tD_t$

$= 20,000 - 3(3,000)$

$= \$11,000$

(c) Plot BV vs. time



Declining Balance (DB) and Double Declining Balance (DDB) Depreciation

➡ **Determined by multiplying BV at beginning of year *by fixed percentage d***

- **Max rate for d is twice straight line rate, i.e., $d \leq 2/n$**
- **Cannot depreciate below salvage value**

Depreciation for year t is obtained by either relation:

$$D_t = dB(1 - d)^{t-1} = dBV_{t-1}$$

Where: D_t = depreciation for year t

d = uniform depreciation rate (2/n for DDB)

B = first cost or unadjusted basis

BV_{t-1} = book value at end of previous year

Book value for year t is given by:

$$BV_t = B(1 - d)^t$$

Example: Double Declining Balance

A depreciable construction truck has a first cost of $20,000 with a $4,000 salvage value after 5 years. Find the (a) depreciation, and (b) book value after 3 years using DDB depreciation.

Solution:

(a) $d = 2/n = 2/5 = 0.4$

$$D_3 = dB(1 - d)^{t-1}$$

$$= 0.4(20{,}000)(1 - 0.40)^{3-1}$$

$$= \$2880$$

(b) $BV_3 = B(1 - d)^t$

$$= 20{,}000(1 - 0.4)^3$$

$$= \$4320$$

Spreadsheet Functions for Depreciation

Straight line function: SLN(B,S,n)

Declining balance function: DB(B,S,n,t)

Double declining balance function: DDB(B,S,n,t,d)

Note: It is better to use the DDB function for DB and DDB depreciation. DDB function checks for BV < S and is more accurate than the DB function.

Depletion Methods

Depletion*: book (noncash) method to represent decreasing value of *natural resources

Two methods: *cost* depletion (CD) and *percentage* depletion (PD)

Cost depletion: Based on level of activity to remove a natural resource

- Calculation: Multiply factor CD_t by amount of resource removed

  Where: **CD_t = first cost / resource capacity**

- Total depletion can not exceed first cost of the resource

Percentage depletion: Based on gross income (GI) from resource

- Calculation: Multiply GI by standardized rate (%) from table
- Annual depletion can not exceed 50% of company's taxable income (TI)

Example: Cost and Percentage Depletion

A mine purchased for $3.5 million has a total expected yield of one million ounces of silver. Determine the depletion charge in year 4 when 300,000 ounces are mined and sold for $30 per ounce using (a) cost depletion, and (b) percentage depletion. (c) Which is larger for year 4?

Solution: Let depletion amounts equal CDA_4 and PDA_4

(a) Factor, CD_4 = 3,500,000/ 1,000,000 = $3.50 per ounce

$$CDA_4 = 3.50(300{,}000) = \$1{,}050{,}000$$

(b) Percentage depletion rate for silver mines is 0.15

$$PDA_4 = (0.15)(300{,}000)(30) = \$1{,}350{,}000$$

(c) Claim **percentage depletion** amount, provided it is ≤ 50% of TI