

# Engineering Economy

## Chapter 11

### Depreciation

#### 1. Depreciation

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- \*Please note that depreciation is *not* a cash flow.

#### 2. Depreciation is caused by:

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#### 3. From an Accountant's Perspective, Depreciation is:

- The systematic allocation of an asset's cost over its \_\_\_\_\_.

#### 4. Depreciation and Expenses

- Business costs are generally either \_\_\_\_\_ or \_\_\_\_\_.
- Expensed items (such as labor, utilities, materials, insurance, etc.) are part of regular business operations and are "consumed" over short periods of time. For tax purposes, they are subtracted from business revenues when they occur. Thus, expensed items reduce income taxes because businesses are able to "\_\_\_\_\_ " their full amount when they occur.
- Business costs due to \_\_\_\_\_ are not fully "written off" when they occur. A depreciated asset loses value *gradually* and must be written off over an extended period.

#### 5. Depreciable Life or Recovery Period

- This is the \_\_\_\_\_ over which an asset is depreciated.
- Depreciable life is determined by the \_\_\_\_\_ used to spread out the cost.
- Depreciable life often differs from the asset's useful or most economic life.

6. In Order to be Depreciated, an Asset Must Meet the Following General Requirements:

- The property must be used for \_\_\_\_\_ to produce income.
- The property must have a useful life that can be determined, and this life must be longer than one year.
- The property must be an asset that decays, gets used up, wears out, becomes obsolete, or loses value to the owner from natural causes.

7. What About Land?

- Land is NOT depreciable because it does not wear out, lose value, or have a determinable useful life. (See the 2nd and 3rd bullets in note #6.)

8. Because Depreciation is Tax Deductible for Businesses:

- It is advantageous to profitable businesses to depreciate more earlier in the asset's life than later in its life. This is because they want to delay taxes as much as possible. That is, the time value of money once again comes into play. Thus certain methods might be preferred to others (if applicable).

9. We will look at the following types of depreciation:

- Straight Line Depreciation
- Sum-of-Years Digits (SOYD) Depreciation
- Declining Balance Depreciation (150% and 200%--a.k.a., Double Declining Balance(DDB))
- Declining Balance Converted to Straight Line
- Modified Accelerated Cost Recovery System (MACRS)

#### 10. Variables Used in Depreciation

- $P =$  \_\_\_\_\_ Made Ready for Use
- $N =$  Number of Years in \_\_\_\_\_
- $S =$  Estimated Salvage Value After \_\_\_\_\_ Life
- $D_t =$  Depreciation in Year  $t$
- $B_t =$  Book Value in Year  $t$

#### 11. Book Value

- $B_t = P -$  accumulated depreciation through year  $t$

$$B_t = P - \sum_{i=1}^t D_i$$

- $B_t = B_{t-1} - D_t$

## 12. Straight Line Depreciation

- This is the simplest method.
- It does not always provide the largest tax benefit.
- It is often used for intangible property (see p. 379).

### Straight Line Formula

### Straight Line Example

- Cost of Asset = \_\_\_\_\_
- Depreciable Life = \_\_\_\_ years
- Estimated Salvage After Depreciable Life = \_\_\_\_\_

EOY t	0	1	2	3	4
$D_t$					
$B_t$					

### **13. Sum-of-Years Digits (SOYD) Depreciation**

- When compared to Straight Line, this method results in larger depreciation amounts during the early years and smaller depreciation amounts as the asset nears the end of its depreciable life.

#### **SOYD Formulas**

#### **SOYD Example**

- Cost of Asset = \_\_\_\_\_
- Depreciable Life = \_\_\_ years
- Estimated Salvage After Depreciable Life = \_\_\_\_\_

<b>EOY t</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>D<sub>t</sub></b>		\$18,000	\$13,500	\$9,000	\$4,500
<b>B<sub>t</sub></b>	\$50,000	\$32,000	\$18,500	\$9,500	\$5,000

#### **14. Declining Balance Depreciation**

- Like SOYD, this is an accelerated method.
- It applies a constant depreciation rate to the declining book value.
- Two rates commonly used: 150% and 200%.
- Since 200% is twice the straight-line rate, it called Double Declining Balance (DDB).

#### **150% Declining Balance Formula**

#### **200% Declining Balance Formula**

#### **Remember**

$B_t = \text{cost} - \text{total depreciation amounts to date}$

### **Double Declining Balance Example**

- Cost of Asset = \_\_\_\_\_
- Depreciable Life = \_\_\_\_ years
- Estimated Salvage After Depreciable Life = \_\_\_\_\_



- \*Notice that our book value in year 4 dropped below our estimated salvage. In cases like this, we need to modify the depreciation value. The modification stops depreciation once the book value becomes equal to the salvage value---this prevents taking too much depreciation.

<b>EOY t</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>D<sub>t</sub></b>					
<b>B<sub>t</sub></b>					

#### **Another Potential DB Modification**

- In the previous example, our book value dropped below the salvage value in year 4 (based on the original calculation). Because of this, we modified the depreciation amount in year 4.
- Another potential modification would entail switching from Declining Balance Depreciation to Straight Line Depreciation.
- This ensures taking enough depreciation.

**15. Declining Balance Converted to Straight Line Depreciation (i.e., DB converted to SL)**

- Because the formulas for the Declining Balance depreciation methods do not consider the estimated salvage value, the book value may drop below or stop at a value greater than the estimated salvage.
- When the book value stops at a value larger than the salvage value, it is beneficial to convert to straight-line depreciation.

**DDB Converted to Straight Line Example**

- Cost of Asset = \_\_\_\_\_
- Depreciable Life = \_\_\_ years
- Estimated Salvage After Depreciable Life = \_\_\_\_\_

Based on our original DDB calculations and the new salvage value

EOY t	0	1	2	3	4
D <sub>t</sub>					
B <sub>t</sub>					

Notice that the book value stays higher than the new estimated salvage value of \_\_\_\_\_. This means we can convert to straight-line depreciation.

- In order to decide when to convert to Straight Line, we must ***re-calculate*** the straight-line depreciation value each year.
- Once the straight-line value exceeds that of the declining balance value, the remaining years will be depreciated using the calculated straight-line value.

**Formula to Re-calculate Straight Line Depreciation**

**Our Example**

<b>EOY t</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>DDB <math>D_t</math></b>					
<b>SL <math>D_t</math></b>					
<b>Selected <math>D_t</math></b>					
<b><math>B_t</math></b>					

## **16. Modified Accelerated Cost Recovery System (MACRS)**

- This method is the newest and most widely used.
- It was introduced by the Tax Reform Act of 1986 and continued with the Taxpayers Relief Act of 1997. (See p. 383.)
- Use of MACRS focuses on the general depreciation system, which is based on \_\_\_\_\_.
- The alternative depreciation system (ADS) provides for a longer period of recovery and uses straight-line depreciation (thus it is much less attractive). See page 383 for examples of things that must use the ADS system.
- We will assume the use of the general depreciation system unless otherwise noted.

### **Applying MACRS**

- Determine property class from the first of the following that works: a) property class given in problem; b) asset is named in table 11-2, p. 385; c) IRS tables or table 11-1, p. 384; d) class life; e) seven year property for “all other property not assigned to another class.” (See p. 384)
- Multiply the appropriate annual percentages and the cost of the asset. The %'s are found in table 11-3, p. 386.
- \*Note: The first and last years of depreciation use a \_\_\_\_\_. For an example of how the percentages are calculated, see pp. 387-388.

### **Advantages of MACRS**

- Property class lives are often less than actual usage lives.
- Salvage values are assumed to be zero.
- Tables of annual percentages simplify calculations.

### MACRS Example

- BullyDawg, Inc. recently purchased special handling devices for food and beverage manufacturing. The equipment cost \_\_\_\_\_ and is to be depreciated with the MACRS. Calculate the depreciation schedule.
- From table 11-2, p. 385, we see that this equipment fits into the \_\_\_\_\_ property class.
- From table 11-3, p. 386, we see the appropriate %'s are \_\_\_\_\_.

EOY t	0	1	2	3	4
$D_t$					
$B_t$					

### 17. Unit-of-Production Depreciation

- You may omit Unit-of-Production Depreciation

### 18. A Reminder About Depreciation

- “Depreciation deductions benefit a firm after taxes because they reduce taxable income and taxes. The time value of money ensures that it is better to take these deductions as soon as possible.” (See p. 390)
- “In general, MACRS, which allocates larger deduction earlier in the depreciation life, provides more economic benefits than historical methods.” (See p. 390)
- For an example, see table 11-5 (p. 390) and figure 11-5 (p. 391).



## 21. Percentage Depletion

- This is based on the property's gross income.
- Because percentage depletion is based on *income* rather than cost, the total depletion could exceed the cost of the property. Therefore, in computing the *allowable percentage depletion* on a property in a given year, the percentage depletion cannot exceed 50% of the property's taxable income computed with the depletion deduction.
- Step 1: Find categorized percentage depletion allowance from table 11-6, p. 396.
- Step 2: Calculate depletion for the year

$$D_t =$$

- Step 3: Compare the depletion calculated in step 2 to 50% of taxable income (i.e., T.I.).  
*Remember,  $D_t$  cannot exceed  $0.5(T.I.)$ .*
- Step 4: Choose the minimum of  $D_t$  and  $0.5(T.I.)$ .

## 22. Depletion Example

- Hi Ho Silver, Inc. recently purchased the rights to remove silver from a mine. The negotiated price was \_\_\_\_\_. The mine was estimated to contain \_\_\_\_\_ of silver.
- During the first and second years of operation, the company extracted \_\_\_\_\_ ounces of silver, respectively. Gross income was \_\_\_\_\_ in year 1 and \_\_\_\_\_ in year 2. Expenses amounted to \_\_\_\_\_ in year 1 and \_\_\_\_\_ in year 2.
- Compute the depletion that should be taken in year 2.

### Cost Method

- Step 1: Calculate the depletion rate

- Step 2: Calculate the Depletion for the year

### **Percentage Method**

- Step 1: Categorized % from table 11-6, p. 396.
- Step 2: Calculate  $D_t$  for the year
- Step 3: Compare  $D_t$  to  $0.5(T.I.)$ , choose the minimum

### **Compare Cost Method to Percentage Method**