



## **Optimum method for determine the percent of depreciation in the productivity machines & equipment: Applied study**

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### **Keywords**

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### **Abstract**

This search aimed to try make comparative between various methods of depreciation percent computing by literature review to these methods and then practical applied to it , and consequently . compare the results of these methods to know which method it's better to depend for compute the depreciation percent in highly accurate as well as the research show other variables like concept of depreciation , the differences between the terminologies : depreciation , depletion , and amortization , also Categories of Depreciable Property , and Factors Affecting the Amount of Depreciation

## **1. Introduction**

The wearing down of plant assets is referred to as depreciation; the wearing down (consumption) of natural resources (coal, oil, timber) is referred to as depletion. We shall discuss depreciation first .

Depreciation, as defined by the accounting profession, is the allocation of an asset's cost to expense in a systematic and rational manner, over the periods expected to benefit from the use of the asset .

expenses should be matched to and recognized in the same period as their related revenues. Therefore, plant assets-which produce revenue over several periods-must have their expense (depreciation) gradually recognized and allocated over those periods as well .

Depreciation is an attempt at cost allocation rather than asset valuation. Even in those situations where an asset's fair market value has increased, depreciation recognition is still necessary .

Assets depreciate because of physical factors and economic factors. Physical factors consist of the physical wear and tear and deterioration of the asset as the

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asset is used over time. Economic factors consist primarily of market conditions that cause an asset to become obsolete. The asset may be in perfect physical shape, but if other assets are produced in the marketplace that are faster and more efficient, it becomes economically impractical to continue using this asset, and early disposal becomes a necessity .

Most plant assets do not depreciate completely-they can be sold as scrap at the end of their useful lives .

The ending value is referred to as scrap value, salvage value, or residual value .

Thus, the amount an asset will depreciate is its original cost less its salvage value, and this is referred to as the depreciable base.

## **2. Aim & Objectives**

The aim of this research is to comparative between the methods of depreciation measurement and evaluation these methods to know which one is better for adopting by organization in order to compute the percent of the depreciation in production machines, equipment, and facilities. to achieve this aim, the following objectives are be considered:

- To identify the importance of compute the percent of depreciation in productive facilities in accurate & better way.
- To present theoretical framework for the depreciation in term of concept, factors, & causes of depreciation. Consequently, understand the subject correctly.

## **3. Statement of Problem**

The issue of depreciation is very important in organizations since to its critical role in expose net profits and non- gave mislead profits . and since there are several methods that are used to measure the percent of depreciation to production machines , and equipment , and that all these methods not give results in the same accurate . So , it should finding the best method which is compute the percent of depreciation in high accurate .

## **4. Literature review**

### **4.1. The Meaning of Depreciation**

What is the literal and terminology meaning of the word "depreciation"?

The literal meaning of depreciation word is value reduction for tangible assets.

Depreciate/to lose value, especially as a result of use or age. (Oxford dictionary, 1999, 204).

### **4.2. Concept of depreciation**

Depreciation is the process of allocating in a systematic and rational manner this total expense to each period benefited by the asset. Land is not depreciated because it generally does not have a limited life and its residual value usually is higher than its cost. Thus, there is no expense to be recognized over the life of the

asset and, therefore, no periodic cost allocation (Nikolai et.al.,2007,505). Terms used to describe this allocation process depend on the type of asset :

- **Depreciation** is the allocation of the cost of tangible assets, such as property, plant, and equipment.
- **Depletion** is the allocation of the cost of natural resource assets, such as oil, gas, minerals, and timber.
- **Amortization** is the allocation of the cost of intangible assets, such as patents and copyrights. It may be used as a general term to describe the periodic allocation of costs; in that case, it is synonymous with depreciation and depletion.

#### **Depletion of natural resources :**

There are three types of costs incurred in acquiring and preparing various natural resources (coal, oil, timber, etc.) for use (England,2007,p254) :

- Purchase price-amounts paid to the seller for the natural resource .
- Exploration costs-amounts paid to find the natural resource (usually associated with oil) .
- Development costs-amounts paid to prepare the resource site for mining. These include drilling costs, extraction costs, and the construction of tunnels, shafts, and wells.

**Depreciation** is defined as the accounting process of allocating the cost of tangible assets to expense in a systematic and rational manner to those periods expected to benefit from the use of the asset.

When long-lived assets are written off, **the term depreciation** is most often used to

indicate that tangible plant assets have declined in value. Where natural resources, such as timber, gravel, oil, and coal, are involved, **the term depletion** is employed. The expiration of intangible assets, such as patents or goodwill, **is called amortization** (Ibarra, 2013, 481).

Three different terms are used to describe the process of allocating the cost of long-lived assets to periodic expense. The allocation of tangible property costs is referred **to as depreciation**. For minerals and other natural resources, the cost allocation process is called **depletion**. For intangible assets, such as patents and copyrights, the process is referred to **as amortization**. Sometimes amortization is used generically to encompass all three terms (Stice, Stice, Skousen 2008, 616).

In order to correct measuring of depreciation it is essential to know the conceptual meaning of depreciation, depletion and amortization. (Ibarra & Kantianism, 2015,317).

Depreciation: **Depreciation** is treated as a revenue loss which is recorded when expired utility fixed assets such as plant and machinery, building and equipment etc.

**Depletion:** The term depletion refers to measure the rate of exhaustion of the natural resources or assets such as mines, iron ore, oil wells, quarries etc. While comparing with depreciation, depletion is generally applied in the case of natural resources to ascertain the rate of physical shrinkage but in the case of depreciation is used to measure the fall in the value or utility of fixed assets such as plant and machinery and other general assets.

**Amortization:** The term Amortization is applied in the case of intangible assets such as patents, copyrights, goodwill, trademarks etc., Amortization is used to measure the reduction in value of intangible assets.

the concept of depreciation is related to the fixed assets. Fixed assets like building, machines and equipment etc. acquired for their long time used in business operations and they are subjected to deterioration due to wear and tear, due to their use, because of climatic conditions, passage of time etc. the efficiency of these fixed assets also goes on reducing and at one time it becomes uneconomical to be used further and needs to be replaced by another unit.

Instead, **depreciation** is the systematic allocation of the cost of an asset over the different periods benefited by the use of the asset (Stice, Stice, Skousen 2008, 617).

So, we can define the depreciation as following (M.Sc. Mahakam, 2008,220):

- The reduction in the value and efficiency of the plant, equipment or any fixed asset because of wear and tear, due to passage of time , use climatic conditions is known as " **depreciation** " .
- **Depreciation** may also be defined as a method for spreading the cost of a fixed asset over the life, or expected years of uses of the asset.
- From the accounting point of view, depreciation is an annual charge reflecting the decline in value of an asset due to such causes as wear and tear, action of elements, obsolescence and inadequacy.
- From the operating stand point, depreciation can be thought as the rent paid for use of equipment during a period of time.
- The most scientific definition of depreciation can be given as: "**Depreciation** is the process of allocating the acquisition cost of the tangible asset less salvage value, if any, in a systematic and a rational manner over the estimated life of the asset".

According to the Institute of Chartered Accountants of India, Depreciation is a measure of the wearing out, consumption or other loss of value of a depreciable asset arising from use, effluxion (passage) of time or obsolescence through technology and market changes. Depreciation is allocated so as to charge a fair proportion of the depreciable amount in each accounting period during the expected useful life of the asset (liapis & Kantianism, 2015, 318; Mert & Dil, 2016, 312):

- Depreciation is the process of allocating, in a systematic and rational manner, the total cost of an asset held for more than one year as an expense to each period benefited by the asset. The total expense or depreciation

base (depreciable cost) involved is the difference between the purchase price and the estimated residual value. Depreciation is not an attempt to reflect the market value of an asset. Land, which generally has an unlimited life and a future selling price higher than its cost, is not depreciated.

- The term depreciation describes the allocation of the cost of tangible assets, such as property, plant, and equipment. The term depletion describes the allocation of the cost of natural resource assets, such as oil, gas, minerals, and timber. The term amortization describes the allocation of the cost of intangible assets, such as patents and copyrights. "Amortization" is also sometimes used as a synonym for "depreciation" and "depletion."

### 4.3. Categories of Depreciable Property

Property may be divided into a number of different categories.

For physical property (tangible), categories include (Richard K. Gordon, 1998, 4):

- buildings other than industrial plant,
- industrial plant and equipment,
- depletable property (e.g., minerals),
- land, and
- inventory<sup>3</sup>.

For nonphysical property (intangible), they include:

- term-limited rights (e.g., leases, copyrights), and
- property without specific time limits on use, such as goodwill .

And another author said This Standard deals with depreciation accounting and applies to all depreciable assets, except the following items to which special considerations apply (Goni & Budiarmo, 2018, 13):

- forests, plantations and similar regenerative natural resources;
- wasting assets including expenditure on the exploration for and extraction of minerals, oils, natural gas and similar non-regenerative resources;
- expenditure on research and development;
- goodwill and other intangible assets;
  
- livestock;<sup>4</sup> animals that are kept on a farm , e.g. cows , sheep , etc.

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<sup>3</sup>.Inventory depreciation refers to the decrease in the value of a company's inventory over time due to factors such as obsolescence, damage, spoilage, or changes in market demand. This decrease in value is recorded as an expense on the company's income statement and is reflected in the company's balance sheet as a reduction in the value of the inventory.

<sup>4</sup> Depreciation is not charged on livestock. However, at the time animal died or become permanently useless for such purposes, the actual cost to the assessee of the animals can be reduced from and the amount realized in respect of the carcasses or animals.

#### **4.4. Factors Affecting the Amount of Depreciation**

The following factors are to be considered while charging the amount of depreciation or The amount of the periodic depreciation is depended on following factors (M.Sc. Mahakam, 2008, 222; Kieso, et.al., 2013 , 540):

- The original cost of the asset.
- The useful life of the asset.
- Estimated scrap or residual value of the asset at the end of its life.
- Selecting an appropriate method of depreciation.

##### **4.4.1. Acquisition cost**

Refers to the purchase price of an asset . In case of machine and equipment , the expenses incurred on their installation , maintenance are also included in the acquisition costs .

##### **4.4.2. Estimated life**

The service life of an asset is the total units of service expected to be derived from the asset during its useful existence. The units of service are popularly measured in the following ways:

- Time units, such as years, months, days etc.
- Output units, such as physical units, machine hours, kilometers, etc. for example, the service life of a motor car can be expressed as 5 years or 1.00.000 kilometers.

##### **4.4.3. Estimated salvage value**

The scrap value of an asset is the estimated amount that will be received at the time of the disposal of the asset less the cost of its removal or disposal. The salvage value is also called as remainder value. It is estimated in the ordinary way by what a purchaser would pay for it as it stood.

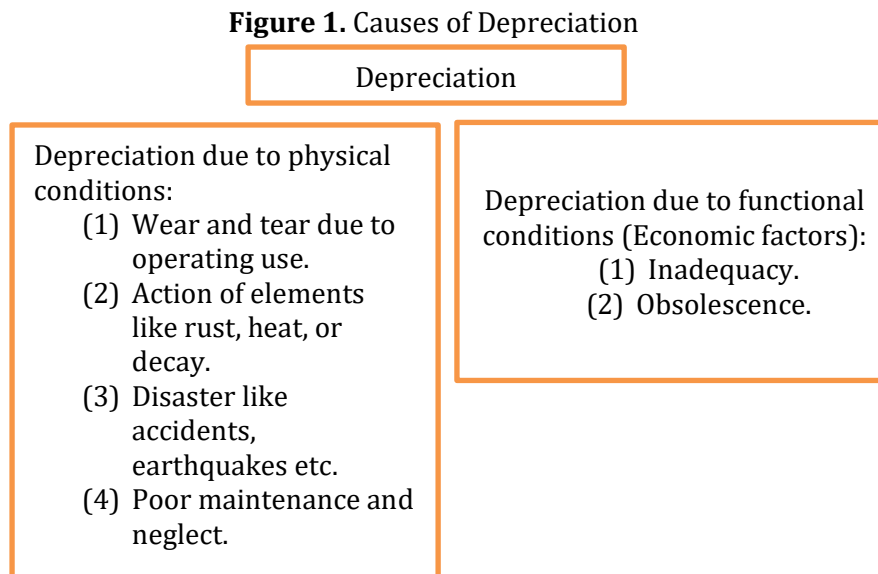
It may be pointed out that the salvage value may be zero or even negative, depending upon the removal cost. For instance, the case of chimney or building which costs more to remove than its material worth, and yet it has to be removed owing to its site being required or its being a public danger.

##### **4.4.4. Selection of the depreciation method**

The depreciable value of an asset is allocated over its estimated service life on some systematic and rational manner. The allocation is made on the basis of various depreciation methods. The selection of the depreciation method has a direct bearing on the amount of depreciation which is provided during a particular accounting period e.g., in case of straight line method the amount of yearly depreciation is same throughout the estimated life of an asset . while , under reducing balance method or sum of the years digit method , the amount of depreciation will be higher in the initial period and will be lower in the later period of its useful life .

#### 4.5. The Causes of depreciation

The depreciation classified into two groups according to causes as shown in the figure:



**Source** : M.S. Mahakam , (2008 ) , industrial engineering and production management , DHANPAT RAI & CO.(P)LTD . P 222.

The physical deterioration of an asset can be reduced by following a sound maintenance policy, which enhances the service life and efficiency of an asset. Sometimes, even if the asset is in sound physical condition, it is not economical to use it. The estimation of the deterioration caused by economic factors is relatively difficult. The following factors deteriorate the service life of an asset (M.S. Mahajan, 2008: 222; Kiss, et.al., 2013, 540; Sigidov et.al., 2016, 89):

**Depreciated due to wear & tear:** whenever any fixed asset like processing plant, machine etc. is subjected to regular use, wearing of certain parts of assets takes place due to the presence of friction between sliding or rotating parts. The friction thus present cannot be eliminated but it can be reduced to a minimum by proper and efficient lubrication of the moving parts. The reduction in the efficiency and value of the plant because of wearing of its parts due to friction is known as depreciation due to wear and tear.

**Depreciated due to physical decay:** fixed assets like factory building overheads tanks, steel structures, vehicles etc. whether in use or not are subjected to climatic and atmospheric effects which slowly reduce their strength, serviceability due to oxidation, rotting of wood, etc. therefore, after some period it becomes necessary to replace them.

**Depreciated due to accident:** some accident may occur in the industry due to fire hazard, faulty operations etc. This may cause damage to the machines, plant, building, vehicles or such other fixed assets. In such circumstances, the asset may require either replacement or heavy investment on repairs.

The loss in the value of the asset mainly due to undesirable, uncontrollable and unforeseen accidents is therefore, known as depreciation due to accidents.



**Deferred maintenance: Manufacturers** usually provide instruction manuals along with the machines, equipment, processing unit etc. supplied by them. these manuals contain important instructions replacement of use lubricant after a definite period etc. if these instructions are not followed in time due to negligence or any other reason, the efficiency of the plant or machine gradually decreases. the loss in the efficiency of the machine due to poor maintenance and neglect is known as depreciation due to deferred maintenance.

**Inadequacy: Sometimes** due to the growth of business, the scales of operations are changed, in such cases the existing equipment is not capable of manufacturing the product in large quantities and it becomes inadequate. For example, an existing pit furnace may be melting gray cast iron till present, in foundry, but huge orders make it inadequate and necessitates its replacement by a cupola.

**Obsolescence:** whenever new equipment comes in the market, which is capable of producing more products of goods quality with less labor and has more efficiency, the existing machine becomes obsolete and needs to be replaced to withstand the market competition, although it is functioning well.

Obsolescence means a reduction of usefulness of assets due to technological changes, improved production methods, change in market demand for the product or service output of the asset or legal or other restrictions.

#### **4.6. Methods of calculation depreciation**

##### **Purpose of Charging Depreciation**

The following are the purpose of charging depreciation of fixed assets (Tsamis , & Liapis, 2014, 124):

- To ascertain " ensure " in the true profit of the business.
- To show the true presentation of financial position.
- To provide fund for replacement of assets.
- To show the assets at its reasonable value in the balance sheet.

The following are the various methods applied for measuring allocation of depreciation cost (M.S. Mahajan, 2008,222; Tsamis & Liapis, 2014, 124; Goni & Budiarmo, 2018,13; Mert & Dil, 2016,312):

- Straight Line Method
- Written Down Value Method
- Annuity Method
- Sinking Fund Method
- Revaluation or Appraisal Method
- Insurance Policy Method
- Production Units Method
- Sum of the Digits Method



- Machine Hour Rate Method
- Retirement Method

the following are the explain for each method:

**Straight line method** (fixed installment method): in this method every year a fixed amount is put aside as a depreciation charges during the economical of the equipment & machinery. the amount of depreciation, (initial cost of machine including erection & installation charges – scrap value), is distributed over the useful life of the machine in equal periodic installments.

Let, C = initial cost of the machine.

S = scrap value (salvage value) .

N = estimated life of the machine in years.

Then, annual depreciation rate =  $C - S / N$  ... (1)

**Written down value method** (Diminishing balance method): the machine or equipment depreciates rapidly in the early years and later on slowly. Therefore, according to this method the depreciation fund is more during the early years, when repairs and renewals are not costly.

The book value of the machine goes on decreasing as its existence continues. Hence in this method a certain percentage of the current book value is taken as depreciation.

Let, X = fixed percentage for calculating yearly depreciation.

C = initial cost.

S = scrap value.

N = estimated life.

Then, yearly depreciation factor  $X = 1 - ( S / C )^{1/N}$  ... (2)

**Sinking fund method**: in this method a depreciation fund equal to the actual loss in the value of the asset is estimated for each year. this amount is invested elsewhere other than in the business itself, and the interest will be earned on the fund. therefore, the sinking fund investment will grow year – by – year with the amount of annual depreciation plus the interest earned on the past investment.

Let, D = rate of depreciation per year.

R = rate of interest on invested fund (in fraction number).

S = scrape value.

N = number of years of the life of the asset.

Then ,  $D = R(C - S) / ( 1 + R )^N - 1$  ... (3)

**The sum of the years digit method**: this method also termed as SYD method. The Sum of years Digits Method is designed on the basis of Written –Down Value Method. under this method the amount of depreciation to be charged to the profit

and loss account goes on decreasing every year throughout the life of the asset. The formula for calculating the amount of depreciation is as follows:

$$\text{Rate of depreciation} = \frac{\text{(remaining life of the asset)}}{\text{(sum of all the digits of the life)}} \times \text{original cost of the asset} \quad \dots (4)$$

**The insurance policy method:** is somewhat alike the depreciation or sinking fund method. The only difference is that the annual depreciation instead of investing in government papers or gilt-edged securities<sup>5</sup> is paid as premium to an insurance company, who issues an insurance policy equivalent to cost of asset. At the end of the life of asset, insurance company pays money covered by the policy and a new asset is purchased with it. this method covers the risk if the machine becomes unserviceable before its estimated life. in this method, the machine or equipment is insured with insurance company and the premiums are paid on the insurance policy; when the policy mature the company provide sufficient sum to replace the unit by a new one. The following are the merits and demerits of this method (Tsamis & Liapis, 2014, 124) :

The merits are as follows:

- There is a certainty that the guaranteed amount will be received from the insurance company, there is no such risk due to fluctuation in the market price policy.
- There is no need to judge the merit of different securities for investment, fund is made by paying the premium on insurance policy.

The demerits are as follows:

- As the insurance company takes the risk and it also makes some profit naturally the interest on insurance policy is less than the rate of interest prevailing in the market. so depreciation charge in this method becomes more expensive.
- If new asset is acquired during the life of the old asset this method cannot be used effectively because the contract with the insurance cannot be changed.

**Machine hour basis method:** In this method the rate of depreciation is calculated by a fixed rate per hour of production. The depreciation rate per hour is calculated by dividing the value of the asset by the estimated number of working hours of its life.

$$\text{Rate of depreciation} = \frac{\text{valeur of asset}}{\text{number of production hours}} \quad \dots (5)$$

**Production units method:** In this method, the life of a machine is expressed in term of the number of units that a machine is expected to produce over its estimated life. Therefore,

$$\text{Depreciation cost per unit} = \frac{\text{( cost of machine - salvage value )}}{\text{No. of units its expect to produce.}} \quad \dots (6)$$

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<sup>5</sup> Gilt-edged securities are high-grade bonds issued by certain national governments and private organizations.

**Annuity method:** In this method, the interest is charged on the cost of machine every year on the book value, but the rate of depreciation remains constant for each year. the formula used for calculating rate of depreciation is:

$$D = [C (1 + R)^N - S] [1 - (1 + R)] / [1 - (1 + R)^N] \quad \dots (7)$$

Where, R = rate of depreciation.

This method assumes that the purchase of a fixed asset is an investment on which interest is earned. Therefore, the investment for the purpose of the method is written down value plus interest earned to date.

The sinking fund method and annuity method are similar in nature and operation except with one basic difference, in sinking fund method, the amount of depreciation is invested in some outside securities, while under the annuity method, the amount of the depreciation is retained in the business and used for business operations.

**Revaluation method:** In this method the depreciation is evaluated by an expert every year. the depreciation, in this method is equal to the difference between the values assigned to the asset at the beginning and end of each year. this method is particularly suited to those assets which constantly change and the life of which is uncertain *e.g.* livestock or motor vehicle etc. this appears to be the most practical and satisfactory method particularly where the books of the enterprise are closed at stated periods, say annually or half yearly and final accounts are prepared. The formula for computing depreciation expense under revaluation method is given below:

$$\text{Depreciation expense} = \text{Value of asset at the start of the year} + \text{Additions during the year} - \text{Deductions during the year} - \text{Value of asset at the end of the Year} \quad \dots (8)$$

For instance, if the value of an equipment on 1<sup>st</sup> April 2019 is 15.000 \$ and on 31<sup>st</sup> March 2021 it is evaluated as 13.500 \$ , then the depreciation for this period is 15.000 – 13.500 = 1.500 \$ .

This method as already stated is commonly used for those items which constantly change and the life of which is uncertain for example, loose tools<sup>6</sup>, laboratory glassware, patterns, farmers livestock, plant used on contract work etc.

Advantages and disadvantages of revaluation method of depreciation

The major advantages and disadvantages of revaluation method of depreciation are given below:

Advantages:

- The method is very simple and straightforward to understand.
- This method could be applied to a variety of assets upon which assessment of inflow of financial benefits individually could not be estimated easily.
- Where a business has many small assets, this method could be applied to all the assets collectively assuming all the smaller assets as one big asset.

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<sup>6</sup> are assets that are used in various steps of the production process and therefore are vital for the conversion of raw materials into finished goods.

Disadvantages:

- It may be the case that the asset could not be revalued every year or the cost of asset may not decline. In such a case no depreciation could be charged on the asset.
- The sum of depreciation that is charged to the assets does not show a steady pattern.
- The implementation of this method could become costly as revaluation exercise requires assistance from experts and so sometimes result in costs exceeding its benefits.
- The revaluation is a judgmental area and the amount of depreciation to be charged depends upon it. So, if the revaluation is not carried accordingly the amount of depreciation charged could be miscalculated.

**The retirement method:** According to this, the whole original cost of asset is charged to depreciation expenses in the year in which it is being retired from service. Thus, the depreciation is not charged on regular annual basis, but it is charged only in the year of its end of useful life.

The effect of this method is that, in the year of retirement the burden of depreciation would be heavy and would deflate the revenue income substantially, while in other years the position would be reverse, i.e. as depreciation is not charged, the revenue income will get inflated to that extent.

This method is applicable to only such asset whose service life is very short, say one or two years *e.g.* small machinery items in a small concern.

## 5. Methodology

This research depend on approach of case study . where collecting the data that are need for the production machines from the searched field through visit the plant and gathering the data from concern departments , then . applied the methods of depreciation on these data to find which one is better and more effective to compute the percent of depreciation in desirable & suitable way.

## 6. Analyzing the data & Interpreting the findings:

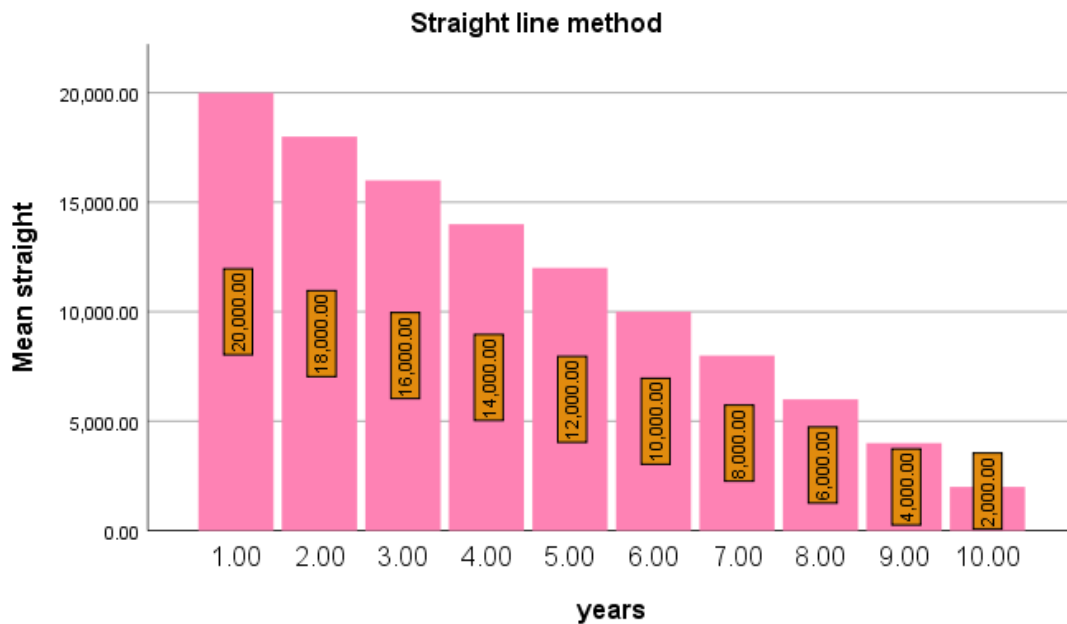
The following the practical applying for each method of depreciation computing methods supported by illustrations:

**Illustration 1:** A machine costing 24.000 \$ was purchased. the installation and erection charges were 1.000 \$ and its useful life is expected to be 10 years. The scrap value of the machine at the end of the useful life is 5.000 \$. calculate the yearly depreciation by **straight line method**.

**Solution:** Annual depreciation charge =  $(C-S) / N = 24.000 + 1000 - 5.000 / 10$   
 $= 2.000 \$$

Thus, the amount of depreciation would be 2.000 for every year .

**Figure 2.** Straight – line method



According to this method there are annually fixed amount allocated to the periods of useful life of production facilities. So, this method its very simple & easy way to compute the rate of depreciation.

**Illustration 2:** Written- down Method

An engine lathe was purchased for 20.000\$ . its useful life was estimated as ten years and the salvage value as 5.000\$ . Using the diminishing balance method, calculate the depreciation ratio (%). Also estimate the depreciation fund at the end of two years.

Solution:  $X = 1 - (S / C)^{1/N} = 1 - (5000 / 20.000)^{1/10} = 0.1294$  OR 12.94%

The reduction in the value of the lathe after one year = C . X

Therefore , the book value of the lathe at the end of one year

$C_1 = C - CX = C (1-X) = 20.000 (1 - 0.1294) = 17.412 \$$

Therefore , the depreciation fund at the end of one year of

$20.000 - 17.412 = 2.588\$$

The book value of the lathe at the end of second year

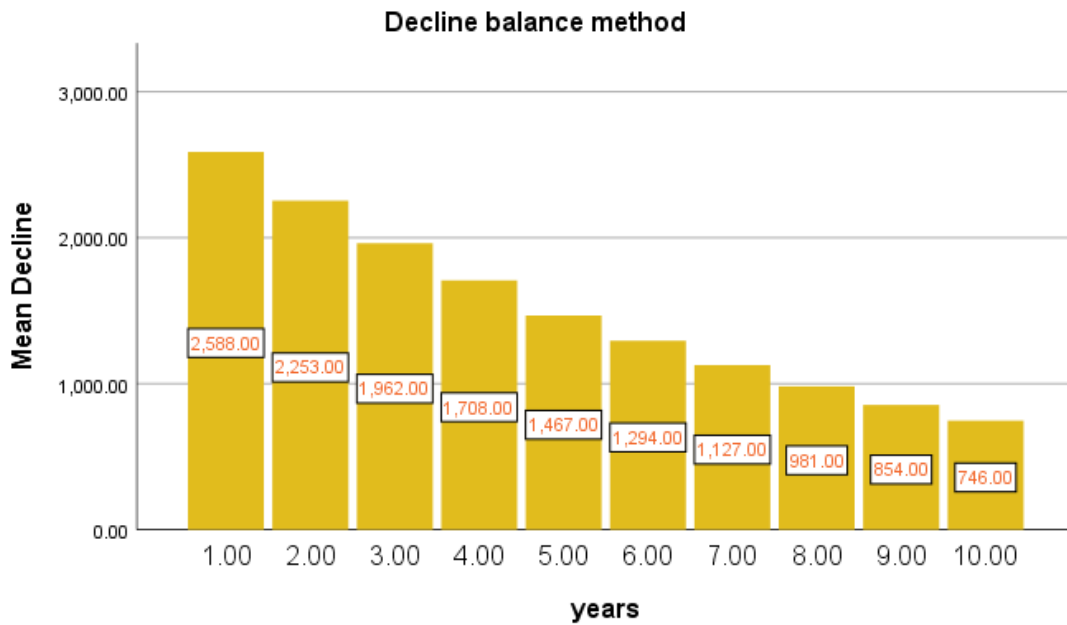
$$C_2 = C_1 (1-X) = 17.412 (1-0.1294) = 15.158.89 \$$$

$$= 17.412 - 15.158.89 = 2.253.11\$$$

And the depreciation fund at the end of second year

$$20.000 \$ - 15.158.89 \$ = 4.841.11 \$$$

**Figure 3.** Decline balance method



According to this method, annually percent from the book value of asset discount as a depreciation. usually the rate of depreciation has been high in the early periods and then decreasing at the last periods.

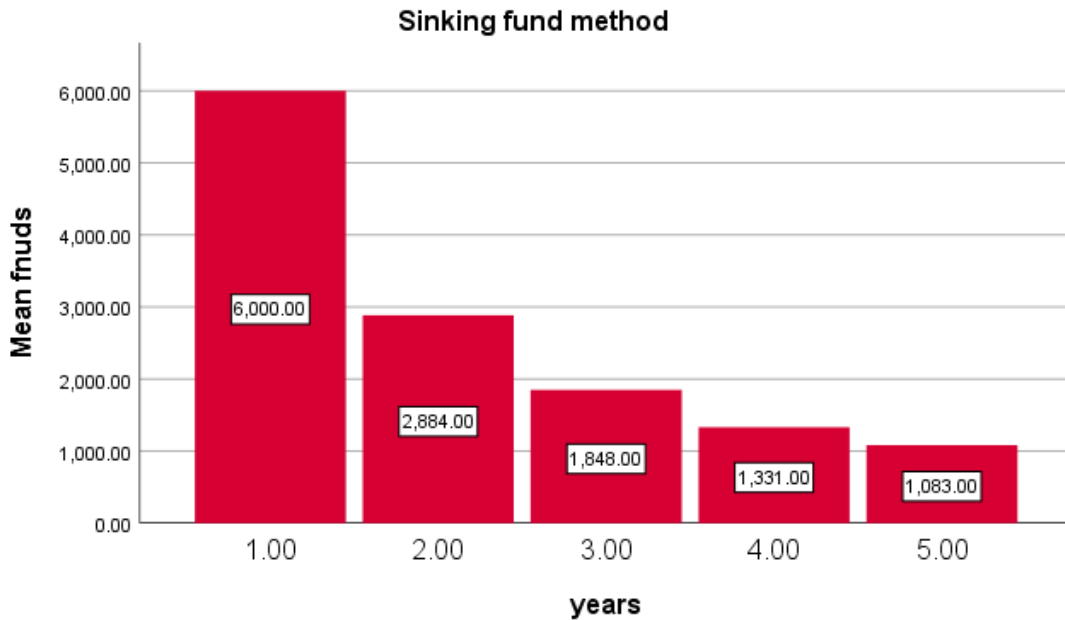
**Illustration 3:** Sinking Fund Method

Estimate the rate of depreciation from the following data, using the sinking fund method: cost of machine 10.000\$ , scrap value 4.000 \$ interest at the rate of 8% compound, useful life of the machine 5 years .

Solution: Rate of depreciation per year  $D = R(C - S) / (1 - R)^N - 1$

$$= 0.08 (10.000 - 4000) / (1 + 0.08)^5 - 1 = 1.023.0179 \$$$

**Figure 4.** sinking fund method



According to this method, percent of depreciation is compute yearly and the amount of depreciation invested at anywhere other than itself business. So, the depreciation fund will grow yearly due to the amount of depreciation that are invested plus the interest on the invested money.

**Illustration 4:** Sum of the Years Digit Method

Find the yearly depreciation by The sum of the years digit method if available the following information for one machine in the plant . the costs (\$25000) , and the estimated useful life is (8 years ) , and the salvage value is (\$0)

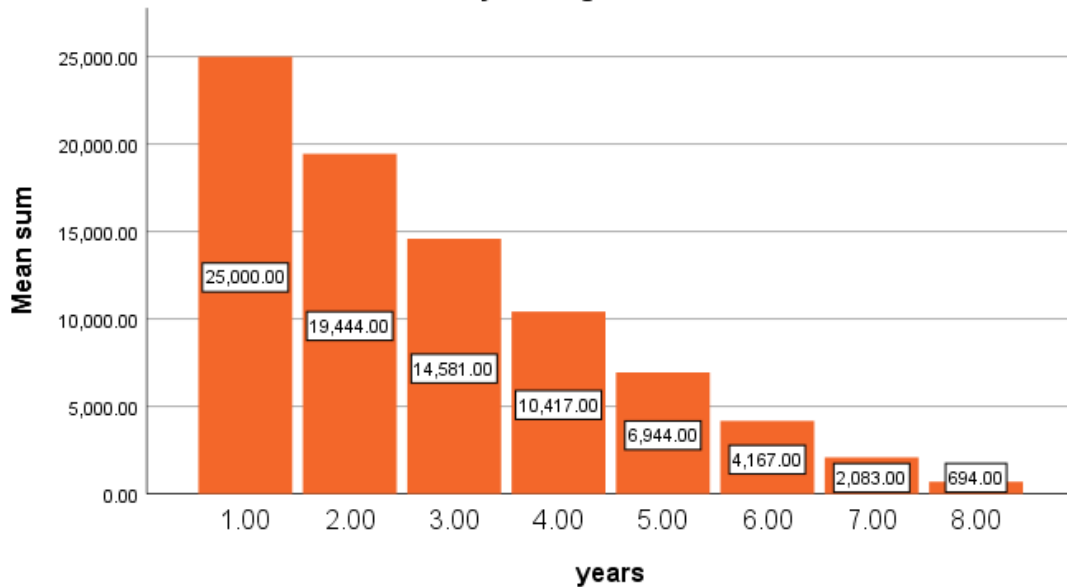
**Table 1.** Amount of depreciation

| Year | Remaining life (RL) | RL/SYD        | Amount of depreciation (\$) = (RL/SYD) * machine cost |
|------|---------------------|---------------|---|
| 1    | 8                   | 8/36 = 0.2222 | 0.2222*25000 = 5556                                   |
| 2    | 7                   | 7/36 = 0.1945 | 0.1944*25000 = 4861                                   |
| 3    | 6                   | 6/36 = 0.1667 | 0.1667*25000 = 4167                                   |
| 4    | 5                   | 5/36 = 0.1389 | 0.1389*25000 = 3472                                   |
| 5    | 4                   | 4/36 = 0.1112 | 0.1112*25000 = 2778                                   |
| 6    | 3                   | 3/36 = 0.0834 | 0.0834*25000 = 2085                                   |
| 7    | 2                   | 2/36 = 0.0555 | 0.0555*25000 = 1389                                   |
| 8    | 1                   | 1/36 = 0.0278 | 0.0778*25000 = 694                                    |

The advantage of this method is that it provides greatest depreciation during the earlier years of assets life, when there is a large profit from the asset.



**Figure 5. Sum of the years digit method  
the sum of years digits method**

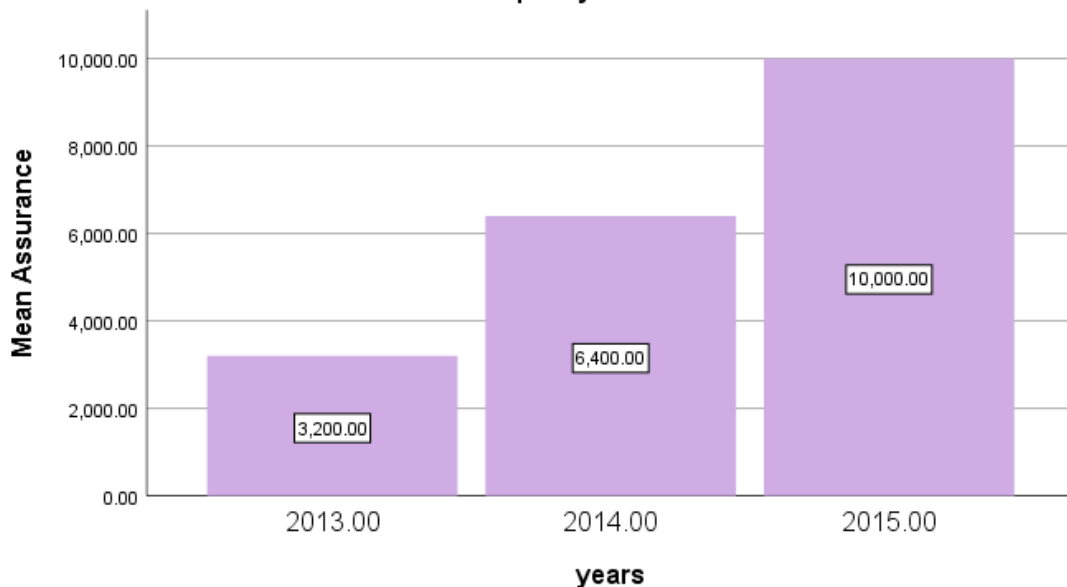


At this method , the rate of depreciation has been high in the beginning and then lowest gradually whenever closed to last of useful life .

**Illustration 5: The insurance policy method**

On 1st January 2013 plant purchased a three years truck for \$10,000 and it was decided provision for replacement of the truck by means of an insurance policy purchased for an annual premium of \$3,200.

**Figure 6. Assurance policy method  
Assurance policy method**



is somewhat alike the depreciation or sinking fund method. The only difference is that the annual depreciation instead of investing in government papers or gilt-

edged securities is paid as premium to an insurance company, who issues an insurance policy equivalent to cost of asset. At the end of the life of asset, insurance company pays money covered by the policy and a new asset is purchased with it .

**Illustration 6: Machine Hors Method**

calculate the depreciation charges by machine hour basis method from the following information:

Cost of machine = 11.000 \$ , scrap value = 1.000 \$ , life of machine = 10 years .

- 31/03/2019 – 2100
- 31/03/2020 – 1950
- 31/03/2021 – 2200
- 31/03/2022 – 2500
- 31/03/2023 – 2350

Calculation of amount of depreciation under Machine Hour Rate Method of Depreciation

Solution : depreciation charges per hour =

$$C - S / \text{total machine hours over useful life of machine}$$

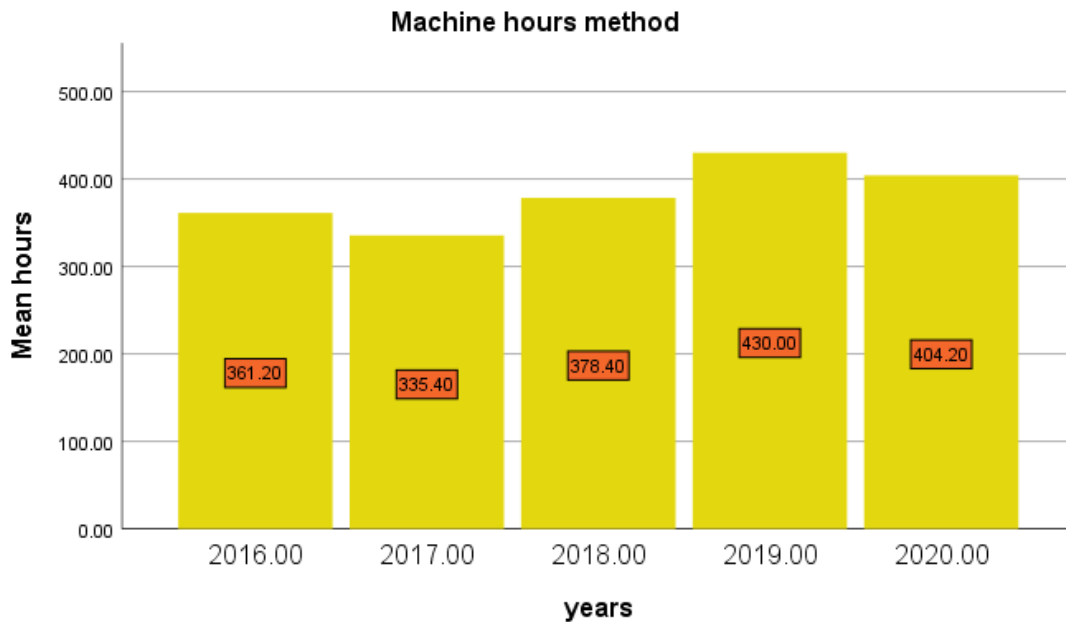
$$= 11000 - 1000 / ( 10 * 16 * 365 ) = 0.172 \$ \text{ per hour}$$

So now, the following table shows the calculation of an amount of depreciation year by year :

**Table 2.** The calculation of an amount of depreciation year by year

| <b>Year</b> | <b>Total working hour (per year )</b> | <b>Rate of depreciation (per hour )</b> | <b>Amount of depreciation for year</b> |
|-------------|---------------------------------------|---|--|
| 2018-19     | 2100                                  | 0.172                                   | 361.2                                  |
| 2019-20     | 1950                                  | 0.172                                   | 335.4                                  |
| 2020-21     | 2200                                  | 0.172                                   | 378.4                                  |
| 2021-22     | 2500                                  | 0.172                                   | 430                                    |
| 2022-23     | 2350                                  | 0.172                                   | 404.2                                  |

**Figure 7. Machine hours Method**



Based on this method the rate of depreciation computed depend on operating hours through the life of facility. So, whenever the life of facility longer that made the cost of depreciation lesser. Therefore, the cost of depreciation depend on the useful life of facility.

**Illustration 7: Production Units Method**

The plant purchased machinery for \$200000 on 1<sup>st</sup> January. It has an estimated useful life of 10 years and an estimated residual value of \$20000. The firm sells the asset at the residual value at the end of the 10<sup>th</sup> year. The machine has an expected production of 15000 units during its useful life. Now the production pattern is as follows:

**Table 3. Amount of production for ten years**

| Year | Production          |
|------|---------------------|
| 1-3  | 2000 units per year |
| 4-7  | 1500 units per year |
| 8-10 | 1000 units per year |

Calculate the amount of depreciation using the units of production method .

**Solution:**

Formula:

$$\text{Depreciable Value} = \text{Original cost} - \text{Scrap value} \dots (1)$$

$$\text{Depreciable Value} = 20000 - 2000 = 18000$$

$$\text{Annual Depreciation} = \text{Depreciable Value} \times \frac{\text{Units produced during the year}}{\text{Estimated total production}} \dots (2)$$

**Table 4.** Annual Depreciation

| Year | Annual Depreciation              |
|------|----------------------------------|
| 1-3  | $18000 * 2000 / 15000 = 2400 \$$ |
| 4-7  | $18000 * 1500 / 15000 = 1800 \$$ |
| 8-10 | $18000 * 1000 / 15000 = 1200 \$$ |

The figure show the annual depreciation for the method of production units:

**Figure 8.** Production Units Method



According to this method , determined the rate of depreciation in production facilities for every produced unit based on number of units produced through the life of facility. So, the rate of depreciation would be lower at the initial periods and become high at the last period because the facilities become deteriorate at the last years and produce lesser than the initial years .

**Illustration 8: Annuity Method**

A firm purchases a machine lather for 5 years for \$40,000. it decides to write off depreciation on the annuity method charging, the rate of interest at 5% annual. The annuity table shows that annual amount necessary to write off \$1 for 5 years at 5% is (0.230975) .

Solution:

$$\text{Depreciation} = \$40,000 \times 0.230975 = \$9,239$$

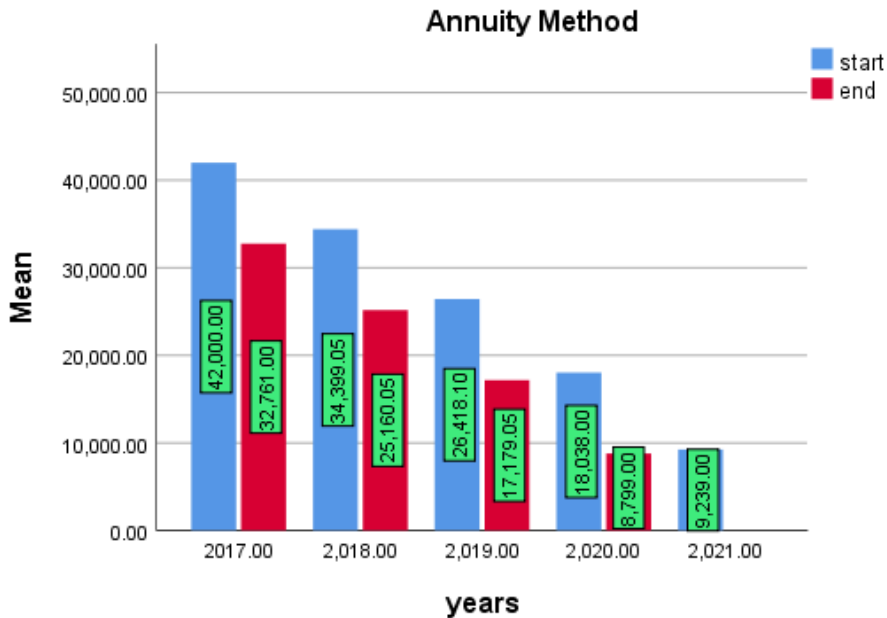
$$\text{Amount of interest} = 40,000 \times 5\% = \$2000$$

$$\text{Total amount} = 40,000 + 2000 = \$42,000$$

**Table 5.** Amount of production

| Years | Year start | Year end  |
|-------|------------|-----------|
| 2017  | 42,000     | 32,761    |
| 2018  | 34,399.05  | 25,160.05 |
| 2019  | 26,418.1   | 17,179.05 |
| 2020  | 18,038     | 8,799     |
| 2021  | 9,239      | 0         |

**Figure 9.** Annuity method



This method assumes that the purchase of a fixed asset is an investment on which interest is earned. Therefore, the investment for the purpose of the method is written down value plus interest earned to date.

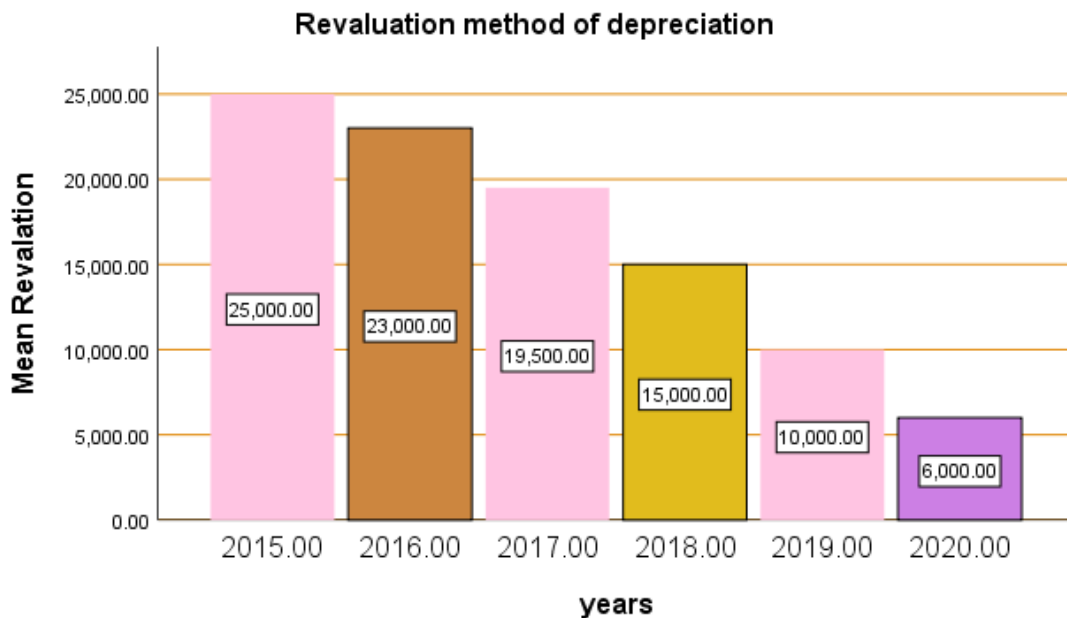
**Illustration 9:** Revaluation method

A plant has certain equipment in use worth \$25,000. At the end of the year, the recoverable amount of asset decreases to \$23,000. The amount of the depreciation to be charged will be the difference between the two values.

**Table 6.** The amount of the depreciation

| Years | Asset value<br>At start of year | Market value<br>End of year | Depreciation |
|-------|---------------------------------|-----------------------------|--------------|
| 2015  | 25000\$                         | 23000\$                     | 2000 \$      |
| 2016  | 23000\$                         | 19500\$                     | 3500\$       |
| 2017  | 19500\$                         | 15000\$                     | 4500\$       |
| 2018  | 15000\$                         | 10000\$                     | 5000\$       |
| 2019  | 10000\$                         | 6000\$                      | 4000\$       |
| 2020  | 6000\$                          | 4000\$                      | 2000\$       |

**Figure 10.** Revaluation method of depreciation



Revaluation depreciation method is usually used to calculate depreciation of assets where, there are numerous small identifiable assets of low value but nevertheless of lasting value such as loose tools or livestock.

Under revaluation depreciation method, the asset is valued at the end of each financial period and this revalued amount is compared with the value in the beginning of the period. The reduction in the value is recorded as depreciation for that year.

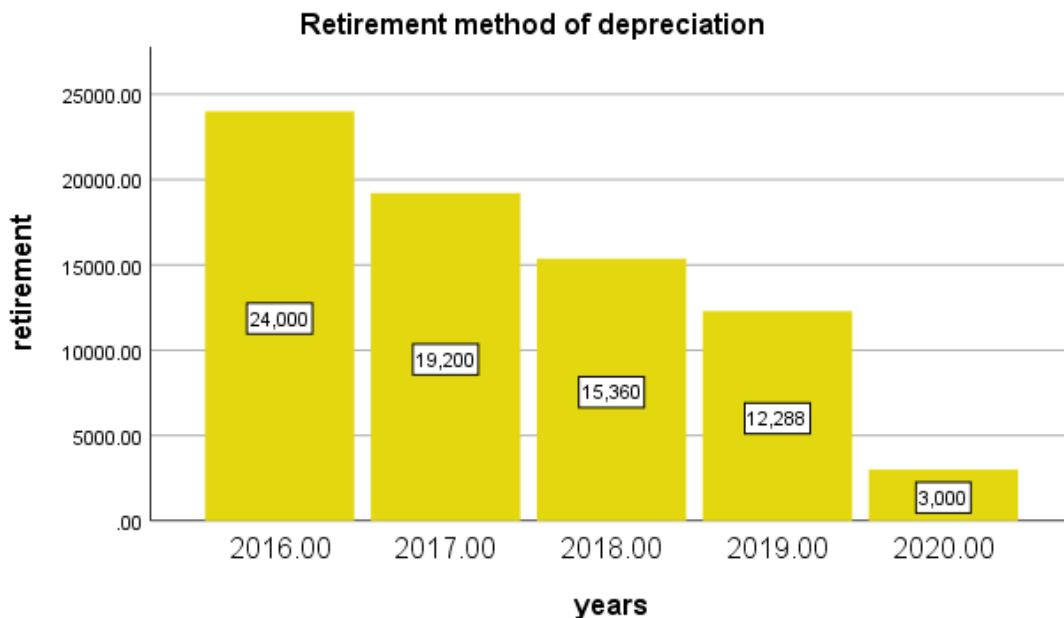
**Illustration 10:** The retirement method

The plant purchases lathe machine for \$30,000. Salvage value at last year is \$3,000. the cost of the machine (\$30,000) minus its salvage value (\$3,000) gives you a depreciable base of \$27,000 . The expected useful life is 5 years. So depreciation . Book value at the end of year 5 is the salvage value of \$3,000.

**Table 7.** Depreciation. Book value at the end of year 5

| Years | Net book value | Depreciation Expense | Accumulate Depreciation | Ending Net Book Value |
|-------|----------------|----------------------|-------------------------|-----------------------|
| 2016  | \$ 30.000      | 6000                 | 6.000                   | 24.000                |
| 2017  | 24.000         | 4.800                | 10800                   | 19200                 |
| 2018  | 19200          | 3.840                | 14640                   | 15360                 |
| 2019  | 15360          | 3.072                | 17712                   | 12288                 |
| 2020  | 12.288         | 9.288                | 27000                   | \$ 3000               |

**Figure 11.** Retirement method of depreciation



Retirement method of depreciation used by public utilities & railroad companies which own many similar units of small value ( i.e., poles , conductor , telephones ) .

Its charge the cost of retired assets (less salvage ) to depreciation expense .

## 7. Conclusions

The **conclusions** in this study are:

- For straight – line method, its allocated fixed amount for every year of the useful life of facility, and in the end life of equipment these amounts represent the depreciation expense of facility.
- For decline balance method, the amount that is allocated as a depreciation expense is different from year to year, where its high amount at beginning of life machine and then gradually lowered till become less amount at the end life of facility.
- For the sinking fund method, every year of useful life of devise, its allocated certain percent from original cost of asset as a depreciation expense and this percent vary from year to other, and the a mount of depreciation invested at anywhere other than this plant. so, the fund of depreciation will grow yearly due to the amount that invested plus the interest on the invested many.
- For the sum of years digits method, its allocation greatest depreciation during the earlier years of asset life, while allocated lowest amount during the latest years of asset life.
- For the assurance policy method, its payment annual premium to the insurance company, then at the end of machine life insurance company pays money covered by a new asset.



- For production hours method, its allocated the depreciation expense based on the operating hours for the machine through the year. So, we noticed through the analyzing the amount of depreciation different from year to year due to variance of a hour share of depreciation.
- For units of production method, its depend on number of units produced, as we see in the analyzing the depreciation expense based on units produced at every year. So, whenever the number of units more the depreciation cost is more.
- For annuity method, it's based on the present value for annual cash flow that are represent the amount of depreciation. So, the value of depreciation expense being in worth value that are gain after certain number of years.
- For revaluation method, at this method its depend on value of asset that is compute be different between beginning and end the year. In another word, the a mount of depreciation representation the different between book value and market value.
- For retirement method of deprecation, as we noticed through analyzing of this method, the amount of depreciation represent the different between the value of asset at the beginning and ending the life of asset. so, in this method usually its compute the depreciation at the end life of asset.

#### **8. The study suggested the following**

- The plant should select the method which is more suitable to it facilities. Consequently, lead to making extremely utilizing from it.
- Every method have merits & demerits. so, the plant should study all both sides to select the method which is more economical useful.
- The trade-off between all these methods based on which one is more accurate and easy to compute the amount of depreciation for the facilities of plant.
- Nature of activity that is practiced by plant also important play role in choice the suitable method for compute the depreciation expense. so, sometime the other.
- Finally, the research suggest to select and use the production units method as a best method for compute the depreciation expense because the assets did not become wear & tear without usage with the passage of time.

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