Depreciation Determination of a D9 Earth Moving Mechanical Plant

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Abstract

In this study, various methods used in equipment depreciation were used to determine the depreciation of a D9 earth moving mechanical plant to determine the best method possible to achieve an effective result. For the study, total depreciation, annual depreciation, weekly, daily and hourly depreciation were considered and the best method recommended.
These methods were used to compute the various depreciation of the plant and the results compared, analyzed in order to select the best method for determining depreciation. From the study, the capital outlay method was chosen to be the best method.

Keywords
Depreciation, mechanical plant, capital outlay method, straight line method

1. Introduction

Any device or machinery that can be used for doing work can be termed a plant. Plant are used on the field of engineering and constructional works. According to M. Subash and K. Damian, [1] the highest allocations to production and construction process are in the area of plant and equipment. A lot of a company's capital are spent in this area and need to be looked into.
Plant may be used to increase production, reduce overall construction cost, increase productivity by eliminating heavy manual work and therefore reducing fatigue, undertaking activities which cannot be done by the manual methods in the context of economics, maintains high standards requirement in the area of structured engineering works and also replaces labour in the area where there is shortage of personnel with the required crafts [2].
In acquiring a plant there is the need to look at the ease with which it can be maintained, the ability of the plant to be user friendly and also the economic factors [3]. The method of plant acquisition can be in the form of cash or outright purchase, leasing, hiring and hire purchase. According to Harris et al [4], economic consideration should be based upon when taking the decision to purchase an item of plant. Unless it is otherwise proven that the investment will lead to a satisfactory rate of return, there should be no purchase at all.
There is the need to understand all the important factors involved in deciding to purchase a plant or equipment. There are a lot of manufacturers of plants and equipment with its attendant specifications. These can be available when needed but there is the intangible aspect too which involves such points as after sales service, maintenance, delivery and payment arrangement that also need to be looked at when making decision in the purchase of plant [4]. There is therefore the need to find a holistic approach towards making decision to purchase a plant and this involves a compromise of technical factors, economic factors, scientific, human and social factors to choose an alternative from amongst others [5, 6]
According to Prasertrungruang and Hadikusumo [7,8] the last stage of a machine life cycle is the disposal stage. At this stage decision is taken including depreciation cost in order to make the right disposal decision.

2. The Bulldozer Plant

Plant may consist of a wide range of machinery, installation, equipment and tools used in doing work. [2] classifies plants as excavators, hoists, cranes, transport vehicles, rubble chutes and skips, concreting plants etc. depreciation takes place in plants with age and usage. Depreciation can be defined as the decrease in value of an asset over time

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due to use, wear and tear or obsolescence. Owners of plant normally recover this loss by factoring in a sum of money equal to the depreciation cost in doing work or hiring out plants.
According to [9, 4], the methods of depreciation are: the straight line method, the sinking fund method, the declining balance method, the sum of digits method, the capital outlay method. Others are the discounted cash flow methods, the effect of inflation method and the marginal method.
Bulldozers are plant made up of a track or wheel mounted power unit with a hydraulic ram. They have the ability to move their mould blade about a central swivel point. Rear attachments can be fitted on some bulldozers such as rollers and scarifies. [9]. Functions of bulldozers may range from: shallow excavations up to 300 mm deep either on side hill cutting or on level ground, clearing of shrubs and small trees, used as a towing tractor, acting as a pusher to scraper machine, using the mould blade as a pusher arm in clearing trees [2].
The aim of this study is to determine the depreciation of a mechanical plant (D9 Bulldozer), the objectives of which are to: determine the total, the annual, the weekly, daily and hourly depreciation of the plant and to suggest the best method for determining depreciation.

3. Methodology

Primary and secondary data sources were employed here through the use of informal interviews from suppliers of plants and equipment, financiers, textbooks and journals. These data were analysed using the various methods of calculating depreciation thus: straight line method, declining balance method, sinking fund method, sum of digits method and finally capital outlay method.
Data

$$Cost\ price = \$530{,}000$$
$$life\ span = 5\ years$$
$$Annual\ working\ life = 1{,}000\ hours$$
$$Resale\ value = \$85{,}000$$
$$Number\ of\ working\ days\ in\ the\ week = 5$$
$$Working\ hours\ in\ a\ day = 8\ hours$$
$$interest\ rate = 8\%\ p.a$$

A. Using the Straight Line Method

(i) $$Total\ depreciation = Purchase\ Price - Resale\ Value$$
$$Total\ depreciation = \$530{,}000 - \$85{,}000$$
$$Total\ depreciation = \$445{,}000$$

(ii) $$Annual\ Depreciation = \frac{Total\ Depreciation}{Annual\ working\ life} = \frac{\$\,445{,}000}{5\ years} = \$89{,}000\ per\ annum$$

(iii) $$Hourly\ Depreciation = \frac{Annual\ Depreciation}{working\ life\ per\ annum} = \frac{\$\,89{,}000}{1000\ hours}$$
$$Hourly\ Depreciation = \$\,89.00\ per\ annum$$

(iv) $$Daily\ Depreciation = Hourly\ Depreciation \times 8\ hours$$

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$$= \$89.00/_{hour} \times 8\ hours$$

$$Daily\ Depreciation = \$712.00$$

(v) $$Weekly\ Depreciation = \ Daily\ Depreciation \times 5\ days = \$712 \times 5$$

$$Weekly\ Depreciation = \$3{,}560$$

B. **Using the Declining Balance Depreciation**.

$$d = \left(1 - \sqrt[n]{\frac{L}{p}}\right) \times 100\,\%$$

Where

$L = Salvage\ value, P = Purchase\ Price, n = life\ of\ asset\ and$

$d = percentage\ depreciation$

$$d = \left(1 - \sqrt[5]{\frac{85{,}000}{530{,}000}}\right) \times 100\,\%$$

$$d = (1 - 0.693471) \times 100\,\%$$

$$d = 30.65\%$$

Calculating using tables

Table 1: Depreciation using Declining balance method

End of year	Depreciation (%)	Depreciation for year ($)	Book value ($)
0	30.65	0	530,000
1	30.65	162,445.00	367,555.00
2	30.65	112,655.61	254,899.39
3	30.65	78,126.66	176,772.73
4	30.65	54,180.84	122,591.89
5	30.65	37,574.41	85,017.48
	TOTAL	444,982.52	

$$Total\ Depreciation\ = \$530{,}000 - \$85{,}000 = \$445{,}000$$

Annual Depreciation for subsequent years will vary (see Table 1)

$$Depreciation\ for\ year\ 1\ = \$162{,}445.00$$

$$Depreciation\ for\ year\ 2\ = \$112{,}655.61$$

$$Depreciation\ for\ year\ 3\ = \$78{,}126.66$$

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$$Hourly\ Depreciation\ for\ year\ 1 = \frac{Annual\ Depreciation}{Annual\ working\ life}$$

$$Hourly\ Depreciation\ for\ year\ 1 = \frac{\$162{,}445.00}{1000\ hours} = \$162.45\ per\ hour$$

$$Hourly\ Depreciation\ for\ year\ 2 = \frac{Annual\ Depreciation}{Annual\ working\ life}$$

$$Hourly\ Depreciation\ for\ year\ 2 = \frac{\$112{,}655.61}{1000\ hours} = \$112.66\ per\ hour$$

Hourly depreciation for the year varies

$$Daily\ Depreciation\ for\ year\ 1 = Hourly\ Depreciation \times 8\ hours$$

$$Daily\ Depreciation\ for\ year\ 1 = \$162.45 \times 8\ hours = \$1{,}299.60$$

$$Daily\ Depreciation\ for\ year\ 2 = Hourly\ Depreciation \times 8\ hours$$

$$Daily\ Depreciation\ for\ year\ 2 = \$112.66 \times 8\ hours = \$901.28$$

$$Weekly\ Depreciation\ for\ year\ 1 = Daily\ Depreciation \times 5\ days$$

$$Weekly\ Depreciation\ for\ year\ 1 = \$1{,}299.60 \times 5$$

$$= \$6{,}498.00$$

C. Using the Sinking Fund Method

$$Sinking\ fund\ factor\ over\ 5\ years = \frac{i}{[(1+i)^n - 1]} = \frac{0.08}{[(1.08)^5 - 1]}$$

$$where\ i = interest\ rate$$

$$n = life\ span$$

$$S.F.F. = 0.1705$$

$$Annual\ Payment = Sinking\ Fund\ Factor \times Total\ Dpreciation$$

$$Annual\ Payment = 0.1705 \times [\$530{,}000 - \$85{,}000]$$

$$Annual\ Payment = 0.1705 \times \$445{,}000$$

$$Annual\ Payment = \$75{,}872.50$$

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Table 2: Depreciation using Sinking Fund method

Year	Payment ($)	Interest ($)	Depreciation ($)	Book value ($)
1	75,872.50	0	75,872.50	454,127.50
2	75,872.50	6,069.80	81,942.30	372,185.20
3	75,872.50	12,625.18	88,497.68	283,687.52
4	75,872.50	19,705.00	95,577.50	188,110.02
5	75,872.50	27,35120	103,223.70	84,886.32
Total			445,113.68	

$$Total\ Depreciation = Cost\ Price - Resale\ value$$

$$Total\ Depreciation = \$530{,}000 - \$85{,}000$$

$$Total\ Depreciation = \$445{,}000$$

Annual Depreciation varies for the subsequent Years

$$Annual\ Depreciation\ for\ year\ 1\ = \$75{,}872.50\ using\ Table\ 2$$

$$Annual\ Depreciation\ for\ year\ 2\ = \$81{,}942.30\ using\ Table\ 2$$

$$Hourly\ Depreciation\ for\ year\ 1 = \frac{\$75{,}872.50}{1000\ hours} = \$75.87\ per\ hour$$

$$Hourly\ Depreciation\ for\ year\ 2 = \frac{\$81{,}942.30}{1000\ hours} = \$81.94\ per\ hour$$

$$Daily\ Depreciation\ for\ year\ 1 = Hourly\ Depreciation \times 8\ hours$$

$$Daily\ Depreciation\ for\ year\ 1 = \$75.87 \times 8\ hours = \$606{,}96$$

$$Daily\ Depreciation\ for\ year\ 2 = Hourly\ Depreciation \times 8\ hours$$

$$Daily\ Depreciation\ for\ year\ 2 = \$81.94 \times 8\ hours = \$655{,}52$$

$$Weekly\ Depreciation\ for\ year\ 1 = Daily\ Depreciation \times 5\ days$$

$$Weekly\ Depreciation\ for\ year\ 1 = \$606{,}96 \times 5 = \$3{,}034.80$$

$$Weekly\ Depreciation\ for\ year\ 2 = Daily\ Depreciation \times 5\ days$$

$$Weekly\ Depreciation\ for\ year\ 2 = \$655{,}52 \times 5 = \$3{,}277.60$$

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D. Using the Sum of Digits Method

$$Sum\ of\ digits\ = \frac{n}{2}(n+1) = 15$$

$$n = number\ of\ digits = 5$$

$$number\ of\ digits\ = \{1,2,3,4,5\}$$

Table 3: Depreciation using Sum of Digits method

Year	Factor	Depreciation ($)	Book value ($)
1	$^{5}/_{15}$	148,333.00	381,667.00
2	$^{4}/_{15}$	118,667.00	263,000.00
3	$^{3}/_{15}$	89,000.00	174,000.00
4	$^{2}/_{15}$	59,333.00	114,667.00
5	$^{1}/_{15}$	29,667.00	85,000.00
	TOTAL	445,000.00	

$$Total\ Depreciation = Cost\ Price - Resale\ value$$

$$Total\ Depreciation = \$530{,}000 - \$85{,}000$$

$$Total\ Depreciation = \$445{,}000$$

Annual Depreciation vary hence the hourly, Daily and weekly, Depreciation will vary. (see Table 3.)

E. Depreciation using Capital Outlay Method

$$Cost\ Price = \$530{,}000$$

$$Interest\ over\ 5\ years\ @\ 8\%\ p.a = \$248{,}743.88$$

$$Total\ Amount = \$778{,}743.48$$

$$less\ Resale\ value\ = \$85{,}000.00$$

$$Total\ Depreciation = \$693{,}743.88$$

$$Total\ Depreciation = \$693{,}743.88$$

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$$Annual\ Depreciation = \frac{Total\ Depreciation}{lifespan} = \frac{\$\,693{,}743.88}{5\ years}$$

$$Annual\ Depreciation = \$138{,}748.78$$

$$Hourly\ Depreciation = \frac{Annual\ Depreciation}{Working\ life\ per\ annum} = \frac{\$138{,}748.78}{1000\ hours}$$

$$Hourly\ Depreciation = \$138.75\ per\ hour$$

$$Daily\ Depreciation = Hourly\ Depreciation \times 8\ hours$$

$$Daily\ Depreciation = \$138.75 \times 8\ hours = \$1{,}110.00$$

$$Weekly\ Depreciation = Daily\ Depreciation \times 5\ days$$

$$Weekly\ Depreciation = \$1{,}110 \times 5$$

$$Weekly\ Depreciation = \$5{,}550$$

4. Results

A. Using the Straight line method, the following were obtained:

   a) The total depreciation was $445,000
   b) The annual depreciation was $89,000
   c) The hourly deprecation was $89.00
   d) The daily depreciation was $712.00
   e) The weekly depreciation was $3560

B. Using the Capital Outlay Method, the following results were gotten
   a) The total depreciation was $ 693,743.88
   b) The annual depreciation was $ 138,748.78 per annum
   c) The hourly depreciation was $ 138.75 per hour
   d) The daily depreciation was $ 1,110
   e) The weekly depreciation as $ 5,550

C. Using the Declining Balance method
   a) The total depreciation was $ 445,000
   b) The annual depreciation varied from $ 162,445 in the first year to $ 37,574.41 in the fifth year. Thus the corresponding hourly, daily and weekly depreciations will also vary.

D. Using the Sinking fund method
   a) The total depreciation was $ 445,113.68 instead of $ 445,000. The difference was due to approximation using the sinking fund factor.
   b) The annual depreciation ranges from $ 75,872.50 in year one to $ 103, 223.70 in year five. Hence the corresponding daily, weekly and hourly depreciation for the various years will also vary.
   c) The depreciation is lowest in year one and rises gradual to the highest in year five.

E. Using the sum of Digits
   a) The annual depreciation is $ 445,000
   b) The annual depreciation for the various years varies from $ 148,333 in year one to $ 29,667 in year five. The depreciation is highest in year one and reduces gradually to $ 29,667 in year five.

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5. Conclusion

From the results it was realized that the total depreciation was $ 445,000 for the whole five-year lifespan of the plant. The annual depreciation of the plant depended on the depreciation method used. The annual depreciation varied from as low as $29,667 using the sum of digits method to a high of $ 162, 445 using the declining balance method. Depending on the method used, hourly, daily and weekly depreciation also varied.

For its simplicity and ease of use, the capital Outlay method proved to be reliable and accurate to use.

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Biographies

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