Chapter 2
Factors Affecting the Selection of Construction Equipment

2. Factors Affecting the Selection of Construction Equipment

2.1. General Information:

A problem which frequently confronts a contractor as he plans to construct a project is **the selection of the most suitable equipment**. He should consider the money spent for equipment as an investment which he can expect to recover with profit during the useful life of the equipment. A contractor does not pay for the construction equipment; the equipment must pay for itself by earning for the contractor more money than it cost.

A contractor can never afford to own all types or sizes of equipment that might be used for the kind of work he does. It may be possible to determine what kind and size of equipment seem most suitable for a given project, but this information will not necessarily justify the purchase of the equipment, he may own a type of equipment that is less desirable than the proposed one, but, it may be of benefit and less expensive than the proposed one.

"Anytime a unit of equipment will pay for itself on work certain to be done, it is a good business to purchase it. For example, if a unit of equipment costing $25000 will save $50000 on a project, a contractor is justified in purchasing it regardless of the prospects of using it on additional projects, or the prospects of selling it at a favorable price when the project is finished."

2.2. Standard Types of Equipment:

There is no clear definition of standard equipment. Equipment that is standard for one contractor may be special for another. But it may be defined as **the equipment that can be used economically on more than one project, its repair parts may be obtained more quickly,and it can be easily disposed of at more favorable price**.

2.3. Special Equipment:

It is the equipment that is manufactured for use on single project or for a special type of operation. Such equipment may not be suitable or economical for use on other project.

2.4. Replacement Parts:

Prior to purchasing equipment, the buyer should determine where spare parts are obtainable; otherwise the project may be delayed. If parts are not obtainable quickly, it may be wise to purchase other equipment, for which parts are quickly available, even though the latter seems less desirable.

2.5. The Cost of Owing and Operating Construction Equipment:

There are several methods of determining the probable cost of owning and operating construction equipment. No known method will give exact costs under all operating conditions. At best the estimate is only a close approximation of the cost.

Kept records for equipment previously used should give information which may be used as a guide for the particular equipment it was used under the same conditions.

Factors that affect the cost of owning and operating construction equipment include:

1. The cost of the equipment delivered to the owner.
2. The severity of the conditions under which the equipment is used.
3. The number of hours the equipment is used per year.
4. The number of years the equipment is used.
5. The care with which the owner maintains and repairs the equipment.
6. The demand for used equipment when it is sold, which will affect the salvage value.

When it is necessary to estimate the cost of owning and operating construction equipment prior to purchasing it, cost records, based on past performance generally will not be available, therefore the following costs should be considered:

2.5.1. **Ownership Costs**:

2.5.1.1. Depreciation cost.

2.5.1.2. Investment Cost.

2.5.1.1. Depreciation Cost:

Depreciation: Is the loss in value of a piece of equipment over time, generally caused by wearand tear from use, the profitable owner of equipment must recover this loss during its useful life.

Depreciation Accounting Value:

The depreciation accounting value (usually termed book value), is the systematic allocation of the costs of a capital investment over some specific number of years. This value can be calculated by subtracting the depreciation at m year times the no. of the year (m) from the actual cost of equipment.

There are number of methods to calculate the depreciation, but before calculating it using any method, close estimation of the following items must be known:

1. The purchase price (termed *P*).
2. The economic life of the equipment (termed *N*).
3. The estimated resale value at the close of the economic life, known as salvage value (termed *S*).

With these three items of information known or estimated, the depreciation can be calculated; the most commonly used methods are the following:

1. Straight-line (SL) method.
2. Sum-of-the-years (SOY) method.
3. Declining-balance method.

Straight-line method (SL):

This method is the easiest one to calculate and probably the most widely used method in construction. The annual amount of depreciation (Dm), for any year (m), is a constant value, and thus the book value decreases at a uniform rate over the useful life of the equipment. The equations used are:

- Depreciation rate, $R_m = \frac{1}{N}$ …… (2-1)
- Annual depreciation amount, $D_m = R_m(P - S) = \frac{(P - S)}{N}$ …… (2-2)
- Book value at year m, $BV_m = P - mD_m$ …… (2-3)

Or:

- Book value at year m, $BV_m = BV_{m-1} - D_m$ …... (2-4)

<u>**Example**</u>:

A piece of equipment is available for purchase for ($12000), has an estimated useful life of (5 years), and an estimated salvage value of ($2000). Determine the depreciation and the book value for each of the 5 years using the SL method.

Solution:

$$R_m = \frac{1}{5} = 0.2$$

$$D_m = 0.2(12000 - 2000) = \$\ 2000 \text{ per year}$$

m	BV_{m-1} ($)	D_m ($)	BV_m ($)
0	0	0	12000
1	12000	2000	10000
2	10000	2000	8000
3	8000	2000	6000
4	6000	2000	4000
5	4000	2000	2000

Sum-of-the-years method (SOY):

This is an accelerated method, which is a term applied to accounting methods which permit rates of depreciation faster than straight line. The rate of depreciation is a factor times the depreciable value (P-S). This factor is calculated as follows:

$$R_m = \frac{N - m + 1}{SOY} \qquad \text{...... (2-5)}$$

$$SOY = \frac{N(N+1)}{2} \qquad \text{...... (2-6)}$$

SOY can be calculated by a accumulating the years of the equipment life such as if the useful life was 5 years then SOY=1+2+3+4+5=15.

$$D_m = R_m(P - S) = \frac{N - m + 1}{SOY}(P - S) \qquad \text{...... (2-7)}$$

$$BV_m = P - mD_m = P - m\left(\frac{N - m + 1}{SOY}(P - S)\right) \text{ or } BV_m = BV_{m-1} - D_m \qquad \text{...... (2-8)}$$

Example:

A piece of equipment is available for purchase for ($12000), has an estimated useful life of (5 years), and an estimated salvage value of ($2000). Determine the depreciation and the book value for each of the 5 years using the SOY method.

Solution:

Using Eq. (2-6): $SOY = \frac{N(N+1)}{2} = \frac{5(5+1)}{2} = 15$, or $SOY = 1 + 2 + 3 + 4 + 5 = 15$

Using Eq. (2-5):

$$R_m = \frac{N - m + 1}{SOY} = \frac{5 - m + 1}{15}$$

Using Eq. (2-7):

$$D_m = R_m(P - S) = \frac{5 - m + 1}{15}(12000 - 2000)$$

$$D_m = \frac{5 - m + 1}{15}(10000)$$

$$D_m = R_m(10000)$$

Then tabulate the results as follows:

year	R_m	D_m (\$)	BV_m (\$)
0		*0*	*12000*
1	$\frac{5-1+1}{15} = \frac{5}{15}$	$R_m(10000) = 3333$	$12000 - 3333 = 8667$
2	$\frac{5-2+1}{15} = \frac{4}{15}$	$R_m(10000) = 2667$	$8667 - 2667 = 6000$
3	$\frac{5-3+1}{15} = \frac{3}{15}$	$R_m(10000) = 2000$	$6000 - 2000 = 4000$
4	$\frac{5-4+1}{15} = \frac{2}{15}$	$R_m(10000) = 1333$	$4000 - 1333 = 2667$
5	$\frac{5-5+1}{15} = \frac{1}{15}$	$R_m(10000) = 667$	$2667 - 667 = 2000$

∗ Notice that the allowable depreciation in this method is different for each year of the equipment life.

Declining-balance method:

This method is alsoan accelerated depreciation method that provides for larger portions of cost to be written off in the early years; this method nearly approximates the actual loss in market value with time.

Declining methods range from 1.25 times the current book value divided by the life to 2.00 times the current book value divided by the life (the latter is termed double declining balance).

The estimated salvage value (S) is not included in the calculation, but the book value cannot go below the salvage value.

Following are the equations necessary for the use of the declining balance methods:

1. Depreciation rate, R:

– For 1.25 declining balance (1.25DB)method, $R = 1.25/N$ …… (2-9)

– For 1.50 declining balance (1.50DB)method, $R = 1.50/N$ …… (2-10)

– For 1.75 declining balance (1.75DB)method, $R = 1.75/N$ …… (2-11)

– For double declining balance (DDB)method, $R = 2/N$ …… (2-12)

2. The allowable depreciation D_m for any year m and any rate R would be:

$D_m = (BV_{m-1})R$ …… (2-13)

3. The book value for any year m would be $BV_m = BV_{m-1} - D_m, \Rightarrow BV_m \geq S$ ..… (2-14)

Since (BV) can never go below (S), the declining balance method must be forced to intersect the value (S) at time (N).

Example:

A piece of equipment is available for purchase for ($12000), has an estimated useful life of (5 years), and an estimated salvage value of ($2000). Determine the depreciation and the book value for each of the 5 years using the DDB method.

Solution:

Using Eq. (2-12); calculate R: $R = \frac{2}{N} = \frac{2}{5} = 0.4$

Using Eq. (2-13); calculate D_m: $D_m = 0.4(BV_{m-1})$

Using Eq. (2-14); calculate BV_m: $BV_m = BV_{m-1} - D_m$

Then tabulate the results as follows:

year	D_m ($)	BV_m ($)
0	0	12000
1	$0.4(12000) = 4800$	$12000 - 4800 = 7200$
2	$0.4(7200) = 2880$	$7200 - 2880 = 4320$
3	$0.4(4320) = 1728$	$4320 - 1728 = 2592$
4	$0.4(2592) = 1037$	$2592 - 1037 = 1555$
4	592	$2592 - 592 = 2000$
5	0	2000

Example:

A piece of equipment costing ($10000) new, with a (5 years) useful life, and an expected salvage value of ($1000) is being considered for purchase. Calculate the yearly ownership costs using the three methods of depreciation. ,

Solution:

1. SL method:

$R_m = \frac{1}{5} = 0.2$

$D_m = 0.2(10000 - 1000) = \$\ 1800$ per year

m	BV_{m-1}($)	D_m($)	BV_m($)
0	0	0	10000
1	10000	1800	8200
2	8200	1800	6400
3	6400	1800	4600
4	4600	1800	2800
5	2800	1800	1000

2. SOY method:

Using Eq. (2-6): $SOY = \frac{N(N+1)}{2} = \frac{5(5+1)}{2} = 15$, or $SOY = 1+2+3+4+5 = 15$

Using Eq. (2-5): $R_m = \frac{N-m+1}{SOY} = \frac{5-m+1}{15}$

Using Eq. (2-7): $D_m = R_m(P-S) = \frac{5-m+1}{15}(10000-1000), D_m = \frac{5-m+1}{15}(9000)$

Then tabulate the results as follows:

year	R_m	D_m($)	BV_m($)
0		0	10000
1	5/15=0.333333333	$Rm(9000) = 3000$	$10000 - 3000 = 7000$
2	4/15=0.266666667	$Rm(9000) = 2400$	$7000 - 2400 = 4600$
3	3/15=0.2	$Rm(9000) = 1800$	$4600 - 1800 = 2800$
4	2/15=0.133333333	$Rm(9000) = 1200$	$2800 - 1200 = 1600$

5	*1/15=0.066666667*	$Rm(9000) = 600$	$1600 - 600 = 1000$

3. DDB method:

Using Eq. (2-12); calculate R: $R = \frac{2}{N} = \frac{2}{5} = 0.4$

Using Eq. (2-13); calculate D_m: $D_m = 0.4(BV_{m-1})$

Using Eq. (2-14); calculate BV_m: $BV_m = BV_{m-1} - D_m$

Then tabulate the results as follows:

year	D_m (\$)	BV_m (\$)	
0	*0*	*10000*	
1	$0.4(10000) = 4000$	$10000 - 4000 = 6000$	
2	$0.4(6000) = 2400$	$6000 - 2400 = 3600$	
3	$0.4(3600) = 1440$	$3600 - 1440 = 2160$	
4	$0.4(2160) = 864$	$2160 - 864 = 1296$	
5	$0.4(1296) = 518.4$	$1296 - 518.4 = 777.6$	*<1000*
5	*296*	$1296 - 296 = 1000$	

2.5.1.2. **Investment Costs**:

Owning equipment costs money, one part of ownership costs is Investment costs which include the following:

- The interest on the money invested.
- Taxes of all types which are assessed against the equipment.
- Insurance.
- Storage.

The rates for these costs vary among different owners, with location and whether or not the equipment is actually used.

The average annual cost of interest (I), is based on the average value of the equipment ($\bar{P}$) during its useful life, which can be calculated based on straight-line depreciation as follows:

$$\bar{P} = \frac{P(N+1) + S(N-1)}{2N} \quad \text{…… (2-15)}$$

Where:

$P =$ total initial cost

$\bar{P} =$ average value

$N =$ life in years

$S =$ Salvage value

If there was no salvage value, then Eq. (1-15) would be:

$$\overline{P} = \frac{P(N+1)}{2N} \qquad \text{…… (2-16)}$$

For the purpose of illustration only, the following rates for investment costs will be used:

– Interest on borrowed money, 12%
– Taxes, insurance and storage, 8%

2.5.2. **Operating costs**:
2.5.2.2. Maintenance cost.
2.5.2.3. Repair parts cost.
2.5.2.4. Lubrication and fuel.

2.5.2. **Operating costs**:

Operating costs are those costs associated with the operation of a piece of equipment. Operating costs usually occur only when the equipment is being used; it includes:

2.5.2.1. **Maintenance and Repair Parts cost**:

The annual cost of maintenance and repairs may be expressed as a percent of the annual cost of depreciation.

2.5.2.2. Lubrication and fuel.

Fuel Consumption:

When operating under standard conditions, a gasoline engine will consume approximately (0.06 gal, 0.23 liter) per each flywheel horsepower hour, while a diesel engine will consume approximately (0.04 gal, 0.15 liter)per each flywheel horsepower hour.

Engines used in construction industry seldom operate at a constant output or at a rated output, except for short periods of time, also, construction equipment is seldom operated the entire 60 min in an hour.

$$\textit{Fuel consumed per hour} = \textit{operating factor} \times \textit{hp} \times \textit{engine consumption} \qquad \text{…… (1-17)}$$

Lubricating Oil Consumption:

The quantity of lubricating oil used by an engine will vary with the size, the capacity of the crankcase, the condition of the piston rings and the number of hours between oil changes. A formula may be used to calculate the quantity of oilrequired as follows:

$$q = \frac{hp \times f \times 0.0027(kg/hp-hr)}{0.89(kg/l)} + \frac{C}{t} \qquad \text{…… (1-18)}$$

$q =$ Quantity of oil consumed (l/hr)

$hp =$ Rated horsepower of the engine

$f =$ Operating factor

$C =$ Capacity of crankcase (gallon or liter)

$t =$ Number of hours between oil changes

Examples illustrating the cost of owning and operating construction equipment:

Example-1:

Determine the probable cost per hour for owning and operating a (1.5 m^3) diesel engine crawler power shovel, the following information will apply:

Cost of equipment	$82260
Shipping cost	$2448
Unloading &assembling at destination	$220
Engine	160 hp
Crankcase capacity	22.71 liter
Hours between oil changes	100 hr
Operating factor	0.6
Useful life, with no salvage value	6 years
Hours operated per year	2000
Weight	61700 kg
Cost of fuel per liter	0.33 $/liter
Cost of oil per liter	0.53 $/liter
Maintenance	100% of Depreciation
Investment	12% of Average Value

Solution:

Fuel consumed per hour = operating factor $\times$ hp $\times$ engine consumption

Fuel consumed per hour = 0.6 $\times$ 160 $\times$ 0.15= 14.4 liter

$$q = \frac{hp \times f \times 0.0027(kg/hp-hr)}{0.89(kg/l)} + \frac{C}{t}$$

$$q = \frac{160 \times 0.6 \times 0.0027}{0.89} + \frac{22.71}{100} = 0.52 \ liter$$

Cost to owner:	
Cost of equipment	82260
Shipping cost	2448
Unloading &assembling at destination	220
Total Cost	84928

Average value of the equipment $\overline{P}=\frac{P(N+1)}{2N}=\frac{84928(6+1)}{2(6)}$	
Average value of the equipment $(\overline{P})=$	49541

Annual Costs:	
Depreciation: $D=\frac{P}{N}=\frac{84928}{6}$	14155
Maintenance: $M=100\%D=1(14155)$	14155
Investment: $I=12\%\overline{P}=0.12(49541)$	5945
Total Annual Fixed Cost	34255

Hourly Costs:	
$34255/2000$	17.13
Fuel: $14.4(0.33)$	4.75
Lubrication Oil: $0.52(0.53)$	0.28
Total Cost per hour, excluding labor	$22.16

Example-2:

Determine the probable cost per hour for owning and operating a (20 m^3) truck with six rubber tires, using the following information:

Cost of Equipment	$92623
Cost of tires	$12113
Engine, Diesel	250 hp
Crankcase capacity	53 liter
Hours between oil changes	80 hr
Operating factor	0.6
Useful life, with no salvage value	5 years
Life if tires	5000 hrs
Repairs to tires	15% of depreciation of tires
Maintenance	50% of Depreciation
Investment	20% of Average Value
Hours operated per year	2000
Cost of fuel per liter	0.33 $/liter
Cost of oil per liter	0.53 $/liter

Solution:

Because the tires have different life than the truck, they should be treated separately to calculate the depreciation of each.

Cost to owner:	
Cost of Equipment	92623
Cost of tires	12113
Net cost less tire	80510
average value of the equipment $\overline{P} = \frac{P(N+1)}{2N} = \frac{92623(5+1)}{2(5)}$	55574

Annual Costs for truck:	
Depreciation: $D = \frac{P}{N} = \frac{80510}{5}$	16102
Maintenance: $M = 50\%D = 0.5(16102)$	8051
Investment: $I = 20\%\overline{P} = 0.2(55574)$	11115
Total Annual Fixed Cost	$35268
Hourly Costs:	
Hourly ownership cost $35268/2000$	17.63
Fuel: $0.6 \times 250 \times 0.15(0.33)$	7.43
Lubrication Oil: $\frac{250 \times 0.6 \times 0.0027}{0.89} + \frac{53}{80} = 1.12(0.53)$	0.59
Tire depreciation: $12113/5000$	2.42
Tires repairs: 0.15×2.42	0.36
Total Cost per hour, excluding labor	$28.43

2.6. Economical Life of Construction Equipment:

The owner of construction equipment should be interested in obtaining the lowest possible cost per unit of production. In order to accomplish this objective he must follow an informed program of equipment replacement. ***When should equipment be replaced***? If the owner replaces it too soon, he will experience an unnecessary capital loss, whereas, if he waits too long, the equipment will have passed its period of economic operation.

In order to determine the most economical time to replace equipment, accurate records of maintenance and repair costs and downtime must be kept for each machine. The owner must consider all costs related to the ownership and operation of the equipment, and the effect which continued use will have on these costs.

The costs to be considered are:

1. Depreciation and replacement.
2. Investment.
3. Maintenance and repairs.

4. Downtime.
5. Obsolescence.

An analysis of the effect which hours of usage will have on each of these costs will establish the time at which a machine should be replaced.

2.6.1. Downtime Costs:

Downtime is the time that a machine is not working because it is undergoing repairs or adjustments. Downtime tends to increase with usage. Availability is a term that indicates the portion of time that a machine is available for production, expressed as a percent. For example, if a machine is down 5% of the time, then its availability is 95%.

Example:

A machine's operation cost is (6 $/hr), has an average downtime of (5%), calculate the machine availability if it was used (2000 hr/year).

Solution:

The cost per hour for downtime $= 0.05 \times 6 = 0.3 \ (\$ / hr)$

The annual downtime cost for machine $= 0.3 \times 2000 = 600 \ (\$ / year)$

Productivity of a machine:

Productivity is a measure of the ability of equipment to produce at its original rate. If the productivity of a machine decreases with usage, the effect of this decrease is to increase the cost of production, which is equivalent to an increase in the cost per hour for continuing to use the equipment.

2.6.2. Obsolescence Costs:

Improvements in the productive capacities result in lower production costs. These improvements, whose advantages can be gained only by the replacement of older equipment with newer one, decrease the desirability of continuing to use the older equipment. For example, if a new machine will reduce production costs by 10%, when compared with production costs for an existing machine, the latter will suffer a loss in value equal to 10%. This is defined as an obsolescence loss.

2.7. Sources of Construction Equipment:

Contractors and other users of construction equipment are concerned with a decision as to whether to purchase or rent equipment. Under certain conditions it is financially advantageous to purchase, whereas under other conditions it is more economical and satisfactory to rent it.

There are at least three methods under which a contractor may secure the use of construction equipment:

1. Purchase the equipment.
2. Rent the equipment.
3. Rent the equipment with an option to purchase it at a later date.

The method selected should be the one that will provide the use of the equipment at the lowest total cost.

Each of the three methods has both advantages and disadvantages which should be considered prior to making a decision. If the cost was the only factor to be considered, then an analysis of the cost under each method should give the answer. If other factors should be considered, they should be evaluated and applied to the cost as a basis on which to reach a decision.

The correct decision for one contractor will not necessarily apply for another contractor.

Advantages of purchasing equipment compared to renting it are:

1. It is more economical if the equipment is used sufficiently.
2. It is more likely to be available for use when needed.
3. Because ownership should assure better maintenance and care, purchased equipment should be kept in better mechanical condition.

Disadvantages of owning equipmentcompared to renting it are:

1. It may be more expensive than renting.
2. Purchasing may require a substantial investment of money or credit that may be needed for other purposes.
3. The ownership of equipment may influence a contractor to continue using obsolete equipment after superior equipment has been introduced.
4. The ownership of equipment designed primarily for a given type of work, may induce a contractor to continue doing that type of work, whereas other work requiring different types of equipment might be available at a higher profit.

5. The ownership of equipment might influence a contractor using the equipment beyond its economic life, thereby increasing the cost of production unnecessarily.

Once the decision is made whether to purchase or rent, the next decision to be made is whether to simply rent or rent with an option to purchase. The latter alternative will result in a higher rental cost as some of the periodic rental charges will be applicable towards the purchase price of the equipment. This is an attractive alternative if the renter of the equipmentbelieves he may have enough use for the equipment to purchase it, but is not too sure that the utilization will be as high as predicted.
This kind of rental agreement results in higher hourly charges than straight rental agreement.
If the contractor intends to buy the equipment after renting it for a period of time, then 90% of the rent charges will be discounted from the total actual cost of the equipment.

Example:
A crawler bulldozer having the information shown below; the contractor intends to rent this equipment for 8 months with an option to buy it later. Determine the probable cost per hour for owning and operating this equipment.

Actual cost	$30500
Salvage cost	$3000
Engine	160 hp
Crankcase capacity	53 liter
Hours between oil changes	80 hr
Operating factor	0.6
Useful life	5 years
Operating hours per year	2000
Cost of owning and operating the equipment in the case of purchasing it (excluding labor)	18.2 $/hr
Rental period	8 months
Rental charges per month	$2651
Operating hours per month	175 hr
Maintenance (90% of Depreciation)	
Investment (13% of Average Value)	
Cost of fuel per liter	0.33 $/liter
Cost of oil per liter	0.53 $/liter

Solution:

Actual Cost		$	30500
Rent charges	$8 \times 2651 =$	$	21208
Discount on rent	$21208 \times \frac{90}{100} =$	$	19087
Remained cost	$30500 - 19087 =$	$	11413

From the above cost remained, it's obvious that the contractor can buy the equipment after 8 months with less than 1/2 the price, and the equipment still has a useful life time equal to $\left(5 - \frac{8}{12} = 4.33\,yr\right)$ in addition to the salvage value at the end of that useful life.

The calculation of the probable cost per hour for owning and operating this equipment, for the remaining period of its useful life is as follows:

Remaining cost		$	11413
Salvage cost		$	3000
Average cost	$\overline{P} = \frac{11413(4.33+1) - 3000(4.33-1)}{2(4.33)} =$	$	5871
Depreciation cost	$D = \frac{P - S}{N} = \frac{11413 - 3000}{4.33} =$	$	1943
Maintenance as if the equipment is new=90% of depreciation			
Maintenance	$M = 0.9 \times \frac{30500 - 3000}{5} =$	$	4950
Investment	$I = 13\%\overline{P} = 0.13(5871) =$	$	763
Total fixed cost/yr	1943+4950+763=	$	7656

Fixed cost/hr	$\frac{7656}{2000} =$	$	3.83
Fuel cost	$0.6 \times 160 \times 0.15(0.33) =$	$	4.75
Lubrication oil cost	$\left(\frac{160 \times 0.6 \times 0.0027}{0.89} + \frac{53}{80}\right)(0.53) =$	$	0.51
Total Cost per hour, excluding labor = 3.83+4.75+0.51= $ 9.09			

So if the contractor buys the equipment after renting it for 8 month, he will be able to resume using the equipment for the remaining of its useful life with acceptable and reasonable cost $\left[(9.09)\$/hr < (18.2)\$/hr\right]$

HW/

Example:

Determine the probable cost per hour for owning and operating a truck with rubber tires after renting it for 6 month with an option to buy it later. Make use of the following information:

Actual truck cost	$50000
tires cost	$10000
Engine	160 hp
Crankcase capacity	60 liter
Hours between oil changes	80 hr
Operating factor	50%
Useful life	6 years
Operating hours per year	2000
Rental period	6 months
Rental charges per month	$2500
Tires useful life	5000 hr
Maintenance for truck (60% of truck's Depreciation)	
Maintenance for tires (15% of tires' Depreciation)	
Investment (12% of Average Value)	
Cost of fuel per liter	0.25 $/liter
Cost of oil per liter	1.50 $/liter