SECTION 13

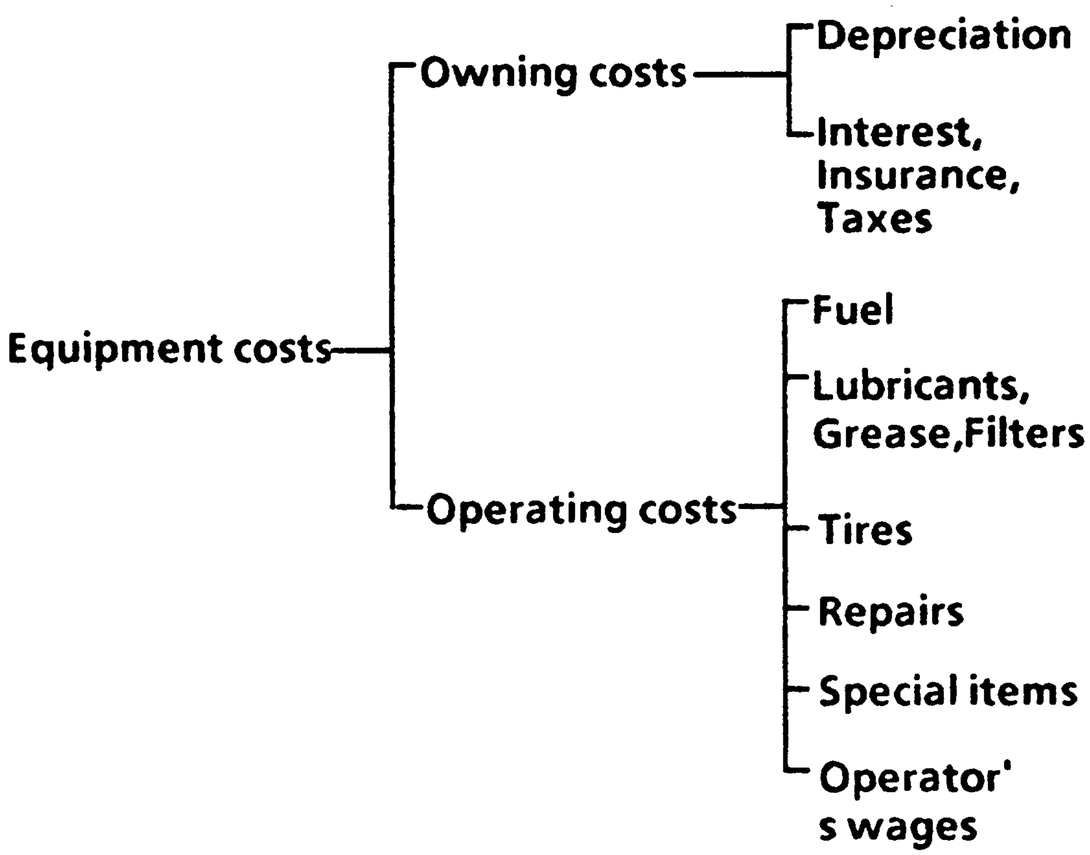
OWNING & OPERATING COSTS

CONTENTS

ESTIMATING THE OWNING & OPERATING COSTS.

Along with the trend for mechanization adopted for economical and satisfactory job accomplishment, equipment costs now occupy a large proportion of the overall construction cost. Therefore,the estimation of the equipment costs has become more important. Success or failure in a contract for a construction job is virtually dependent on the estimates of the equipment costs. In other words, careful consideration of the equipment costs is of prime importance,if a contractor is to fulfill the contract at a profit. Unless estimates are made properly, there will occur cases where a construction job cannot be accomplished at a profit.

There are two types of equipment costs: owning costs and operating costs. Owning costs refers to the costs incurred even if the machine is not working. They include depreciation,interest,taxes and insurance. Operating costs are the costs incurred in actually operating the machine. They include costs for repair, fuel, lubricants, tires, special items (consumable parts) and operator's wages.



We would like to explain one method of estimating the owning and operating costs of construction equipment. The owning and operating costs of construction equipment can vary widely because they are influenced by many factors: the type of work,the machine does,local prices of fuel and lubricants,interest rates,etc. Accordingly it is very dangerous to estimate the costs relying entirely on an established form of calculation method. In this Manual,however,we will make approximate estimates,in a sense of general application of the equipment costs. Accordingly,if users want the correct values of the costs,we hope that they will make estimates by taking into account their own reference data and territorial or environmental conditions.

The equipment owning and operating costs are calculated in units of $/m^3$, $/m^2$or $/h,etc.,depending on the type of construction work. The costs in $/m^3$ or $/m^2$ are obtained by dividing the cost in $/h by production ($m^3$/h) and thus,it is recommended that the owning and operating costs be calculated in the unit of $/h as generally accepted.

1.OWNING COST

The equipment owning cost is the expense required, as a matter of course, for the purchase and possession of the equipment as a property of its owner and consists of the following two items.

(1) Depreciation
(2) Interest, insurance and taxes

1-1.DEPRECIATION

In general, depreciation is a tax term referring to the legally permitted decline in value from the original purchase price of equipment which is an assessable property (expressed in units of years) . Depreciation referred to herein is a business practice for conserving the investment in the form of purchased equipment, in other words, for making preparations in a systematic manner for the fund necessary for replacing the existing equipment with new or any other equipment.

$$\text{Depreciation} = \frac{\text{Net Depreciation Value}}{\text{Depreciation Period in House}}$$

In table 2, KOMATSU gives the values for the depreciation periods from the viewpoint of economical life of equipment. These values, however, are given as a rough guide for estimating the depreciation period; the period may vary considerably according to the equipment operating conditions, the speed of fund collection desired by the user, environmental and economic conditions in its applied territory. Furthermore, it goes without saying that maintenance of equipment is a significant factor in determining the economical life of the equipment. Proper maintenance will extend the life of equipment. On the other hand, poor or improper maintenance will shorten the life. The net depreciation value is the net amount to be considered in the depreciation of equipment. In case of crawler-type tractors, their purchase prices are the net depreciation value. In wheel type equipment, their tire values should be deducted from the purchase prices. Because, unlike the undercarriages of crawler-type equipment, tires wear out earlier than the equipment chassis proper, and tires are not cheap. Further, there is a possibility of tires becoming unserviceable suddenly in unexpected accidents. Hence, it is right in tire depreciation to include their degrees of wear into the operating cost.

RESALE OR TRADE -IN VALUES

At the time of resale or trade-in, construction machines have a value.

Some users will hope that in terms of book value the machine will depreciate completely within the depreciation period. Other users will hope that the residual value expressed as resale value or trade-in value will be left. For these users the resale value or trade-in value is an important factor in reducing the capital invested. This value is also a factor when deciding to purchase a new machine.

The resale value or trade-in value changes greatly according to the territory. Therefore the conditions in that territory must be considered when determining these values. However, major factors in deciding resale value or trade-in value are the hours of operation, nature of work and working environment. The real resale value or trade-in value cannot be decided simply, but when a realistic value is decided it is subtracted from the purchase price to give the Net Depreciation value. It is then possible to obtain the depreciation from the Net Depreciation Value.

1-2.INTEREST, INSURANCE AND TAXES

Whether or not a purchased equipment is actually in operation, its users must pay interest, insurance and taxes. Interest refers to the interest on the investment, when the investment is covered by the user's own fund or to the interest on the debt, when the investment is covered by a debt. In either case, the interest will be an equal amount.

Insurance and taxes are imposed on the annual residual values of the equipment, which requires a knowledge of depreciation as prescribed by the tax law. The depreciation rate or the depreciation period (whether it is a fixed amount or a fixed rate) vary according to the country. For the correct values of insurance and taxes on the residual value in a country, the calculation formulas established in that country must be used.

Interest,insurance and taxes are imposed on the residual value which is the difference between the purchase price and the depreciated amount. This residual value decreases every year. However,when the user calculates owning & operating costs,it is convenient to consider interest,insurance and taxes as a constant amount paid out each year. For this reason,the machine will be considered here to depreciate by a constant annual amount. A calculation is made of the average value of the residual value at the beginning of each year within the depreciation period,and interest,insurance and taxes are imposed on this value. By dividing this value by the number of hours the user expects to operate the machine in one year,the hourly value can be calculated.

This can be calculated by using the following formula.

$$\text{Interest,insurance,tax} = \frac{\text{Factor} \times \text{Delivered price} \times \text{Annual rates}}{\text{Annual use in hours}}$$

The factor can be obtained by using Table 1 or can be calculated by the following formula.

$$\text{Factor} = 1 - \frac{(n-1)(1-r)}{2n}$$

where
n: Depreciation period

$$\text{r: Trade-in value rate} = \frac{\text{Machine worth at trade-in or resale time}}{\text{Delivered price}}$$

(example)

Delivered price	: $100,000
Annual rates	: 15%
Annual use in hours	: 2,000 hrs
Trade in value	: $25,000
Depreciation period (n)	: 4 years

Solution

$$r = \frac{25{,}000}{100{,}000} = 0.25$$

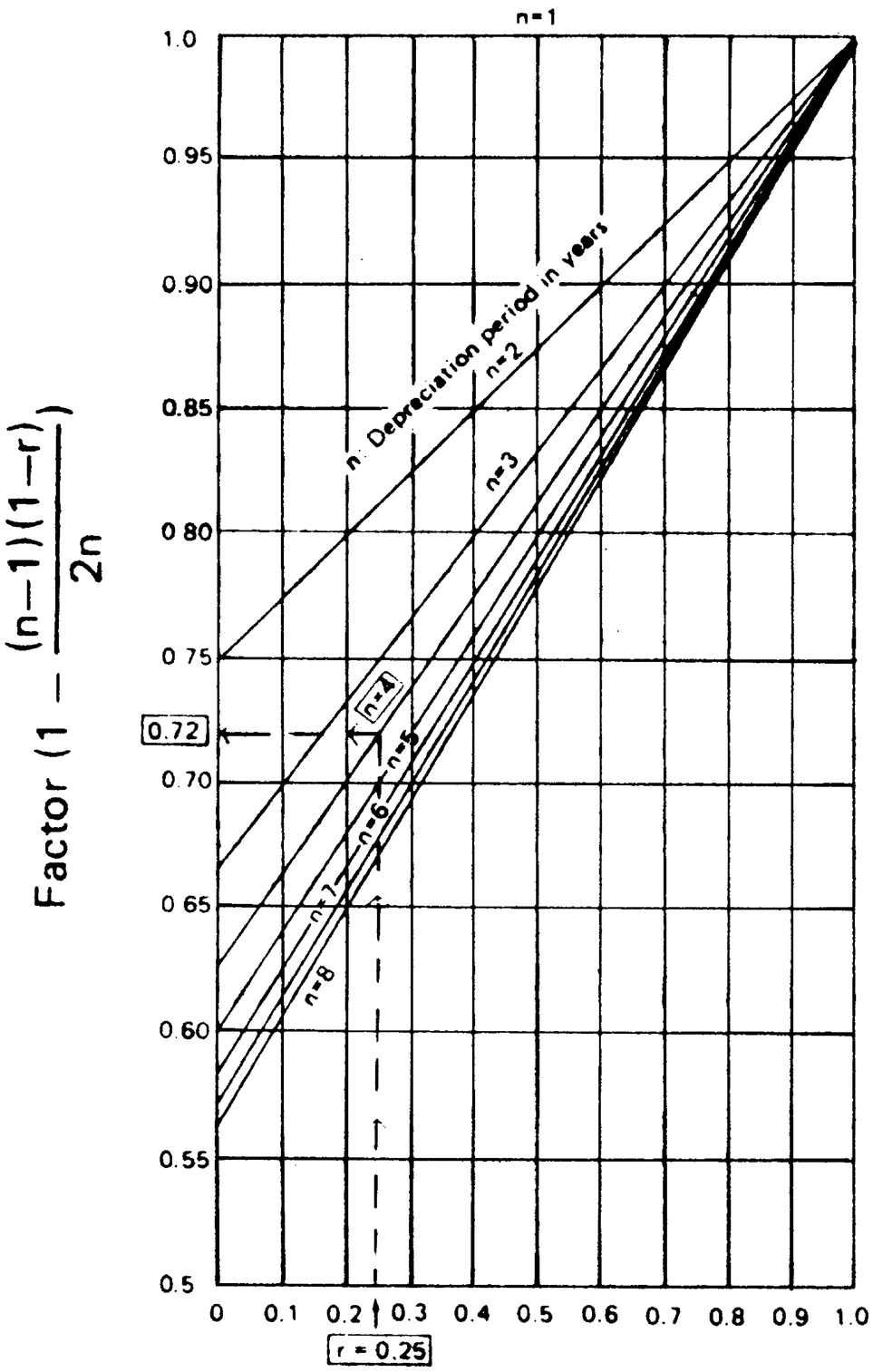
$$\text{Factor} = 1 - \frac{(4-1)(1-0.25)}{2 \times 4} = 0.72$$

When obtaining the factor by using Table 1.
Enter Table 1 at r = 0.25.
Move vertically to n = 4 line and horizontally to left axis. Applicable factor is 0.72

$$\text{Interest,Insurance,Taxes} = \frac{0.719 \times \$100{,}000 \times 0.15}{2{,}000}$$

$$= \$5.39$$

Table 1 Factor of Interest, Insurance, Taxes



$$r = \frac{\text{Machine worth at trade-in or resale time}}{\text{delivered price}}$$

2.OPERATING COST

The equipment operating costs are proportional to the time that the equipment works. Items considered in this category are as follows:

(1) Fuel
(2) Lubricants,Grease,Filters
(3) Tires
(4) Repairs
(5) Special items
(6) Operator's wage

2-1.FUEL

More definite fuel consumption data can be obtained in the field.

It is possible,however,to anticipate the actual or approximate consumption values according to the actual operating conditions without measuring the consumption. Table 3 gives the hourly fuel consumption values for KOMATSU construction machines. In this table,the average values are given,provided that the job conditions are classified into three different ranges of application. If a user has data on certain operating conditions,more correct or realistic values will be obtained by applying these data in similar operating conditions,provided that the equipment is limited to the same type as that used in the users' data.

To estimate hourly fuel cost,select the job condition based on application and find hourly fuel consumption.

Hourly fuel cost = Hourly fuel consumption
X Local unit price of fuel

2-2.LUBRICANTS,GREASE,FILTERS

It is possible to measure the consumption of lubricants and grease in the same manner as the fuel consumption. The consumption values of lubricants and grease are also obtained by calculation on the basis of lubrication intervals,but they are affected greatly by the type of machines and their operating

conditions, which makes it difficult to specify the consumptions suited for various machines and their operating conditions. Hence,Table 4 gives the average consumptions on the data obtained in the past,which is available for your reference.
Prices of lubricants and grease vary in countries or areas and,therefore,the local price (price in that country or area) should be multiplied by the hourly consumption obtained from Table 4 for the cost of lubricants and grease in that country or area.
In KOMATSU construction machines,filter replacement intervals are standardized for each machine model. Thus, the cost of filter can be calculated from the local price of filter and the replacement interval. The hourly filter cost is the total of the hourly costs for each type of filter.

(example)

Hourly cost of filter A

$$= \frac{\text{No. of A filters} \times \text{local price of A filter}}{\text{Replacement interval of A filter}}$$

The same method is used for calculating the hourly filter cost of other filter.

For quick estimation,hourly filter costs are about 50% of hourly lubricants costs.

If they are used in the dusty terrain, the calculated value should be multipled by a proper factor.

2-3. TIRES

As has been described in Depreciation,tires are in the category of consumable parts and tires are generally expensive. Therefore,it is better to include the tire cost as an individual item in the operating costs. Tire cost is calculated by the following formula.

$$\text{Hourly tire cost} = \frac{\text{Tire Price}}{\text{Estimated Life}}$$

As tire prices vary in each country or area,the price of tires actually bought by a user should be applied. It is difficult to indicate definitely the tire life,because the tire life is affected by many factors. However,the general measurements for the life expectancy of tires can be indicated on the basis of past experience and data obtained from the tire manufacturers. Refer to Table 5.
In this table,the approximate life values are given for three different types of conditions. The optimum value for a certain ground condition is one of those obtained by a user in experience on similar ground conditions. When recapped tires are to be used,their prices and life expectancy must be changed correspondingly.

2-4. REPAIRS

Items such as fuel and lubricants contribute essentially to maintaining a machine in normal operating conditions. However, "repairs" covers, in general, actions to create the value by enabling a machine to operate in the normal conditions.
Components or parts of a machine will in due course wear and sometimes fail.
To keep a machine in a properly maintained condition,these components or parts must be replaced. It is natural for the repair cost of a machine to start from a small amount and gradually increase with time as the machine is operated.
The repair cost of a machine can be estimated actually as described above with respect to the machine operating time. However,in general,repair cost is considered as an average of total repair costs throughout the service life of a machine. In other words,it is based on the concept that part of repair cost to be paid later should be laid aside in advance. Repair cost is affected more greatly by the machine operating conditions than by any other cost items. In a specific job applications,calculation for repair cost should be made on the basis of the data accumulated

in the past. If such data are not available,the calculation should be made with due consideration of experience.

The hourly repair cost charts on Table 7 may be used, however, when local records are insufficient or non-existent.
As basic repair cost, the first 10,000 hours of service, parts cost in the area where import duty is not so high such as the U.S., and labor of $40.00 per hour are used. When a machcine is used for more than 10,000 hours, extended-life multipliers are given, which will apply to the entire use period, not just the additional hours. For use outside the U.S., where various expenses effect parts prices and where labor charges (please include shop and tool overhead and machanics wages) differ widely, the total cost is broken down into percentages for pars and labor. This will facilitate an easy adjustment to local conditions.
Komatsu has thoroughly studied user-repair costs in various applications and working conditions to establish these guidelines, which are the results of detailed examination of actual cost records.
As has been stated before,the repair costs depend much on the machine operating conditions,operating techniques or operator's skill,proper maintenance,etc. Thus,the repair cost must be used only for reference,not for forming the base for any warranty.

2-5. SPECIAL ITEMS

In the objects of repair, the repair cost are included the machine and its attachments. Some parts of a machine wear faster than the other. These parts are not included in the category of repair but in a group of special items. Ripper points,ripper shanks,grader cutting edges,etc. Life expectancy of these items is given in Table 6.

2-6. OPERATOR'S WAGE

The operator's hourly wages vary according to the country and area. Thus,the wages actually paid by users should be used.

3.EXAMPLE

PC200 is delivered for $92,811 at a job site.

Applications:
Mass excavation or trenching where machine digs all the time in natural bed clay soils. Some traveling and steady,full throttle operation.

Net Depreciation Value
Since the machine is a crawler-type,tires aren't involved.
This owner knows from experience that at trade-in time,the machine will be worth approximately 10% of its delivered price 4 years from now.
Trade-in value is $9,281
Net depreciation value = $92,811- $9,281 = $83,530

OWNING COST

Depreciation: See Table 2.
This application indicates medium-duty. Depreciation period is 10,000 hrs.

$$\text{Depreciation} = \frac{\$83,530}{10,000} = \$8.35$$

Interest,Insurance,Taxes
Owner plants to work machine during 4 years and about 2500 hrs. per year.

$$\text{Trade-in value rate} = \frac{\$9,281}{\$92.811} = 0.1$$

Caluculate the Factor according to depreciation period and trade-in value rate.
Enter the annual rates of interest,insurance and taxes and sum them.

$$\text{Annual interest, insurance,taxes cost} = \frac{0.66 \times \$92,811 \times 0.14}{2,500} = \$3.43$$

Sum the depreciation cost and annual interest,insurance,taxes cost for total owning.

OPERATING COST

Fuel: See Table 3.
The intended application is in medium range. The estimated fuel consumption from table is 12.5 litre/hr. Cost of fuel in this area is $0.2/litre.
Consumption x Unit cost = 12.5litre/hr x $0.2/litre = $2.5
Lubricants,Grease,Filters
Lubricants,grease: See Table 4
Filters : For quick estimation,hourly filter costs are about 50% of hourly lubricants costs.
Filters = Lubricants x 0.5 = $0.188 x 0.5 = $0.09
Tires are'nt involved,since the machine is crawler type.
Repairs: See Table 7.
In determining the depreciation period,we established the intended use of machine as medium-duty application. Applicable basic repair cost from Table 7 is $3.30 and the extended-life multiplier is 1.0.
Repairs = $3.30 x 1.0 = $3.30
Since the machine does not have fast wear parts like ripper points of bulldozer or cutting edge of motor grader,special item can be disregarded.
Operator's hourly wage in this area is $16.00.
Sum the fuel cost,lubricant grease filter costs,repair cost and operator's hourly wage for operating cost.

TOTAL HOURLY OWNING AND OPERATING COSTS

Sum the total owning cost and total operating cost.

Estimated Owning and Operating Costs

Machine & Model: Hydraulic excavator PC200
Attachments: Standard bucket 0.80 m³ (SAE heaped)
Delivered Price (including attachments): $92,811
Less Tire Price:
Front:
Rear:
Total Tire Price:
Delivered Price Less Tire:
Trade-in Value or Resale Value (optional): $9,281
Net Depreciation Value: $83,530

OWNING COSTS

Depreciation:

$$\frac{\text{Net Depreciation Value}}{\text{Depreciation Period in Hours}} = \frac{\$\ 83,530}{10,000} = \$\ 8.35$$

Interest, Insurance, Taxes:

Depreciation Period: 4 Years

$$\text{Trade-in value rate (r)} = \frac{\text{Trade-in Value or Resale Value}}{\text{Delivered Price}} = \frac{9,281}{92,811} = 0.1$$

$$\text{Factor} = 1 - \frac{(n-1)(1-r)}{2n} = 1 - \frac{(4-1)(1-0.1)}{2\times 4} = 0.66$$

Annual Rates: (Int. 10% , + Ins. 2.5 % , + Taxes 1.5 % = 14%) ÷ 100 = 0.14

Approximate Annual Use: 2500 Hours

$$\frac{\text{Factor x Delivered Price x Annual Rates}}{\text{Annual Use in Hours}} = \frac{0.66 \times 92,811 \times 0.14}{2,500} = \$\ 3.43$$

Total Owning Costs: $11.78

OPERATING COSTS

	Consumption		Unit cost		
Fuel:	12.5 litre/hr	×	$ 0.2/litre	•	$ 2.5
Lubricants, Grease, Filters					
Engine Oil:	0.102 litre/hr	×	$ 1.0/litre	•	$ 0.102
Transmission or Swing Machinery Oil:	0.007 litre/hr	×	$ 1.0/litre	•	$ 0.007
Final Drive Oil:	0.004 litre/hr	×	$ 1.0/litre	•	$ 0.004
Hydraulic Oil:	0.075 litre/hr	×	$ 1.0/litre	•	$ 0.075
Sub total				•	$ 0.188 • $ 0.19
Filters: (Sub total	$ 0.188	×	0.5	•	$ 0.09
Tires: Grease:	0.07 litre/hr	×	$ 1.5/litre	•	$ 0.11
Tire Price / Estimated Life				•	
Repairs: Basic repair cost x Extended-life multiplier	= $ 3.30	×	1.0	=	$ 3.30

Special Items:

Operator's Hourly Wage: $16.00
Total Operating Costs: $22.19

TOTAL HOURLY OWNING AND OPERATING COSTS: $ 33.97

Estimated Owning and Operating Costs

Machine & Model: _____

Attachments: _____

Delivered Price (including attachments): - _____

Less Tire Price:

Front: _____

Rear: _____

Total Tire Price: - _____

Delivered Price Less Tire: - _____

Trade-in Value or Resale Value (optional): - _____

Net Depreciation Value: - _____

OWNING COSTS

Depreciation:

$$\frac{\text{Net Depreciation Value}}{\text{Depreciation Period in Hours}} = \_\_\_\_\_ =$$ _____

Interest, Insurance, Taxes:

Depreciation Period: _____ Years

$$\text{Trade-in value rate (r)} = \frac{\text{Trade-in Value or Resale Value}}{\text{Delivered Price}}$$

$$\text{Factor} = 1 - \frac{(n-1)(1-r)}{2n} =$$

Annual Rates: (Int. ____ % , + Ins. ____ % , + Taxes ____ % = ____ %) ÷ 100 =

Approximate Annual Use: _____ Hours

$$\frac{\text{Factor x Delivered Price x Annual Rates}}{\text{Annual Use in Hours}} = \frac{\_\_\_\_ \times \_\_\_\_ \times \_\_\_\_}{\_\_\_\_} = \_\_\_\_\_$$

Total Owning Costs: - [ ]

OPERATING COSTS

	Consumption		Unit cost		
Fuel: - - - - - - - - - - -	_____	x	_____	=	_____
Lubricants, Grease, Filters					
Engine Oil:	_____	x	_____	=	_____
Transmission or Swing Machinery Oil:	_____	x	_____	=	_____
Final Drive Oil:	_____	x	_____	=	_____
Hydraulic Oil:	_____	x	_____	=	_____
Sub total		=	_____	=	_____
Filters:	(Sub total _____) x 0.5			=	_____
Grease:	_____	x	_____	=	_____

Tires:

$$\frac{\text{Tire Price}}{\text{Estimated Life}} = \_\_\_\_\_ =$$ _____

Repairs:

Basic repair cost x Extended-life multiplier = _____ x _____ = _____

Special Items: _____ _____

Operator's Hourly Wage: - _____

Total Operating Costs: - [ ]

TOTAL HOURLY OWNING AND OPERATING COSTS - - - - - - - - - - [ ]

Table 2-1 Guide of Depreciation Period Based on Application and Operating Conditions

	Condition 1	Condition 2	Condition 3
Crawler type tractors	· Pulling scrapers, agriculture implement. · Spreading work.	· Digging,dozing,ripping of soft rock,clay,most material. · Scraper pushing · Skidding · Land clearing	· Digging,dozing,ripping of hard rock.
D20-D37	12,000 Hr	10,000 Hr	8,000 Hr
D40-D85	15,000	12,000	10,000
D150-D355	18,000	15,000	12,000
D375-D475	22,000	18,000	15,000
Dozer shovels	· Loading of light material from stock pile with remarkable idle time.	· Continuous loading from stock pile. · Light excavation and loading.	· Bank excavation and loading. · Loading of blasted material.
D20-D65	12,000 Hr	10,000 Hr	8,000 Hr
D75-D155	16,000	13,000	11,000
Pipelayers	· Operation on stable ground,a little incline of machine.	· Most of pipe laying operation.	· Operation on poor ground, or on hard rock.
	18,000 Hr	15,000 Hr	12,000 Hr
Hydraulic excavators	· Slope finishing,light material digging,and other light-duty operation.	· Most excavating and loading. · Breaker operation.	· Excavation of hard bank.
PC20-PC40	10,000 Hr	8,000 Hr	6,000 Hr
PC60-PC400	12,000	10,000	8,000
PC650	22,000	20,000	18,000
PC1000-PC1600	40,000	35,000	30,000

Table 2-2 Guide of Depreciation Period Based on Application and Operating Conditions

	Condition 1	Condition 2	Condition 3
Motor scrapers	· Level or favorable well maintained haul road. · Easy-to-load materials. 16,000 Hr	· General scraper work. 12,000 Hr	· Loading and hauling of ripped rock. · Steep or rough haul road. 8,000 Hr
Off-highway dump trucks HD180-HD785 Others	· Level or favorable well maintained haul road. 25,000 Hr 50,000	· Various operation at mine, guarry and construction site. 20,000 Hr 40,000	· Remarkable overloading · Steep or rough haul road. 15,000 Hr 30,000
Articulated dump trucks	20,000 Hr	15,000 Hr	10,000 Hr
Motor graders	· Finishing and other lightduty operations. 20,000 Hr	· Most of road maintenance, repair and construction. · Snow removal. 15,000 Hr	· Maintenance or repair of hard surface road,remarkable scarifying and or ripping operation. 12,000 Hr
Compactors	· Spreading and compaction of sandy soil. 15,000 Hr	· Spreading and compaction of various types of soil with some rocks. · Break-down of comparatively small wooden products. 12,000 Hr	· Spreading and compaction of rocky material,high impact conditions. · Break-down of lumber, electric appliance, industrial products. 8,000 Hr
Wheel loaders WA20-WA40 WA70-WA470 WA500-WA800	· Loading of light material from stock pile · Operation with remarkable truck waiting time. 10,000 Hr 12,000 15,000	· Continuous loading from stock pile. · Light-duty excavation and loading. 8,000 Hr 10,000 12,000	· Bank excavation and loading. · Loading of blasted rock. 6,000 Hr 8,000 10,000
Wheel dozer	15,000 Hr	12,000 Hr	8,000 Hr

Table 3 Hourly Fuel Consumption

(1) Bulldozers

Range	Low		Medium		High	
Machine / Amount	U.S.Gal/hr.	Ltr./hr.	U.S.Gal/hr.	Ltr./hr	U.S.Gal/hr.	Ltr./hr.
D20/21A,E,P,PL	0.8 ~ 1.3	3 ~ 5	1.1 ~ 1.6	4 ~ 6	1.5 ~ 2.0	5.5 ~ 7.5
D31E,P	1.2 ~ 2.2	4.5 ~ 8.5	1.8 ~ 2.9	7 ~ 11	2.4 ~ 3.4	9 ~ 13
D37E,P	1.2 ~ 2.4	4.5 ~ 9	1.8 ~ 3	7 ~ 11.5	2.6 ~ 3.7	10 ~ 14
D40A,P	1.5 ~ 2.4	5.5 ~ 9	2.1 ~ 3.2	8 ~ 12	2.9 ~ 4.0	11 ~ 15
D41A,E,P	1.5 ~ 2.4	5.5 ~ 9	2.1 ~ 3.2	8 ~ 12	2.9 ~ 4.0	11 ~ 15
D50A,P	2.0 ~ 3.7	7.5 ~ 14	2.9 ~ 4.5	11 ~ 17	4.0 ~ 5.3	15 ~ 20
D53A,P	2.1 ~ 3.8	8 ~ 14.5	3.0 ~ 4.6	11.5 ~ 17.5	4.2 ~ 5.5	16 ~ 21
D58E,P	2.2 ~ 4	8.5 ~ 15	3.4 ~ 5	13 ~ 19	4.4 ~ 5.8	16.5 ~ 22
D60A	2.6 ~ 4.8	10 ~ 18	3.7 ~ 5.7	14 ~ 21.5	5.2 ~ 7.0	19.5 ~ 26.5
D60P	2.9 ~ 5.0	11 ~ 19	4.0 ~ 6.1	15 ~ 23	5.5 ~ 7.4	21 ~ 28
D60E	3.0 ~ 5.2	11.5 ~ 19.5	4.1 ~ 6.2	15.5 ~ 23.5	5.7 ~ 7.7	21.5 ~ 29
D63E	2.4 ~ 4.2	9 ~ 16	3.7 ~ 5.3	14 ~ 20	4.8 ~ 6.3	18 ~ 24
D65A	2.6 ~ 4.8	10 ~ 18	2.6 ~ 4.8	14 ~ 21.5	5.2 ~ 7.0	19.5 ~ 26.5
D65E,P	2.9 ~ 4.8	11 ~ 19	4.0 ~ 6.1	15 ~ 23	5.5 ~ 7.4	21 ~ 28
D68E,P	3.4 ~ 5.3	13 ~ 20	4.6 ~ 6.6	17.5 ~ 25	6.3 ~ 8.2	24 ~ 31
D75A	4.2 ~ 5.9	16 ~ 22.5	5.5 ~ 7.4	21 ~ 28	7.1 ~ 9.0	27 ~ 34
D83E,P	4.5 ~ 6.2	17 ~ 23.5	5.8 ~ 7.9	22 ~ 30	7.4 ~ 9.2	28 ~ 35
D85A,E,P	5.0 ~ 6.6	19 ~ 25	6.6 ~ 8.5	25 ~ 32	8.5 ~ 10.0	32 ~ 38
D150A	6.9 ~ 8.7	26 ~ 33	9.5 ~ 11.4	36 ~ 43	12.2 ~ 14.0	46 ~ 53
D155A	7.4 ~ 9.2	28 ~ 35	10.0 ~ 11.9	38 ~ 45	12.9 ~ 14.8	49 ~ 56
D355A	9.5 ~ 11.4	36 ~ 43	12.9 ~ 14.8	49 ~ 56	16.7 ~ 18.5	63 ~ 70
D375A	11.4 ~ 13.2	43 ~ 50	15.3 ~ 17.4	58 ~ 66	18.8 ~ 20.9	71 ~ 79
D455A	14.8 ~ 16.1	56 ~ 61	20.1 ~ 23.2	76 ~ 88	25.4 ~ 26.7	96 ~ 101
D475A	16.1 ~ 19.3	61 ~ 72	21.9 ~ 24.8	83 ~ 94	26.7 ~ 29.9	101 ~ 113
D50F	3.4 ~ 4.8	13 ~ 18	4.5 ~ 5.8	17 ~ 22	5.3 ~ 6.6	20 ~ 25
D60F	4.5 ~ 6.3	17 ~ 24	5.8 ~ 7.7	22 ~ 29	7.1 ~ 8.7	27 ~ 33

Low: Machine movement mainly consisting of idle running or traveling unloaded.
Medium: Average earth-moving,scraper hauling or easy pushing operation.
High: Ripping,heavy pushing,and operation continued without rest at full horsepower.

(2) Dozer shovels

Range	Low		Medium		High	
Machine \ Amount	U.S.Gal/hr.	Ltr./hr.	U.S.Gal/hr.	Ltr./hr	U.S.Gal/hr.	Ltr./hr.
D20S,Q	0.8 ~ 1.3	3 ~ 5	1.1 ~ 1.6	4 ~ 6	1.5 ~ 2.0	5.5 ~ 7.5
D21S,Q	0.8 ~ 1.3	3 ~ 5	1.2 ~ 1.7	4.5 ~ 6.5	1.6 ~ 2.1	6 ~ 8
D31S,Q	1.2 ~ 2.2	4.5 ~ 8.5	1.7 ~ 2.8	6.5 ~ 10.5	2.2 ~ 3.3	8.5 ~ 12.5
D41S,Q	2.0 ~ 3.0	7.5 ~ 11.5	2.8 ~ 3.8	10.5 ~ 14.5	3.6 ~ 4.6	13.5 ~ 17.5
D53S	2.4 ~ 3.8	9 ~ 14.5	3.7 ~ 4.8	14 ~ 18	4.9 ~ 5.8	18.5 ~ 22
D57S	3.3 ~ 4.4	12.5 ~ 16.5	4.6 ~ 5.7	17.5 ~ 21.5	5.9 ~ 7.0	22.5 ~ 26.5
D60S	3.4 ~ 4.8	13 ~ 18	4.8 ~ 5.8	18 ~ 22	6.1 ~ 7.1	23 ~ 27
D65S	3.4 ~ 4.8	13 ~ 18	4.8 ~ 5.8	18 ~ 22	6.1 ~ 7.1	23 ~ 27
D66S	3.4 ~ 4.8	13 ~ 18	4.8 ~ 5.8	18 ~ 22	6.1 ~ 7.4	23 ~ 28
D75S	4.5 ~ 6.1	17 ~ 23	6.3 ~ 7.7	24 ~ 29	7.9 ~ 9.5	30 ~ 36
D95S	5.8 ~ 7.1	22 ~ 27	7.9 ~ 9.2	30 ~ 35	10.0 ~ 11.4	38 ~ 43
D155S	8.7 ~ 10.0	33 ~ 38	11.9 ~ 13.2	45 ~ 50	15.1 ~ 16.4	57 ~ 62

Low: Operation mainly without full load on engine.
Medium: Average loading on ground or hill without full load on engine.
Loading operation accompanied by travelling from stockpile.
High: Continued digging(excavating)and loading operation with engine at full throttle.

(3) Pipelayers

Range	Low		Medium		High	
Machine \ Amount	U.S.Gal/hr.	Ltr./hr.	U.S.Gal/hr.	Ltr./hr	U.S.Gal/hr.	Ltr./hr.
D65C	1.3 ~ 2.4	5 ~ 9	2.1 ~ 3.2	8 ~ 12	2.6 ~ 3.7	10 ~ 14
D85C	1.8 ~ 2.9	7 ~ 11	2.6 ~ 3.7	10 ~ 14	3.4 ~ 4.5	13 ~ 17
D155C	3.4 ~ 4.5	13 ~ 17	5.3 ~ 6.3	20 ~ 24	6.9 ~ 7.9	26 ~ 30
D355C	4.2 ~ 5.3	16 ~ 20	5.8 ~ 6.9	22 ~ 26	7.4 ~ 8.5	28 ~ 32

(4) Hydraulic excavators

Range	Low		Medium		High	
Machine \ Amount	U.S.Gal/hr.	Ltr./hr.	U.S.Gal/hr.	Ltr./hr	U.S.Gal/hr.	Ltr./hr.
PC05	0.2 ~ 0.3	0.8 ~ 1.2	0.3 ~ 0.4	1.2 ~ 1.8	0.4 ~ 0.5	1.6 ~ 1.9
PC10	0.3 ~ 0.4	1.2 ~ 1.7	0.4 ~ 0.6	1.7 ~ 2.1	0.6 ~ 0.6	2.1 ~ 2.3
PC20	0.4 ~ 0.6	1.6 ~ 2.3	0.6 ~ 0.7	2.3 ~ 2.8	0.7 ~ 0.8	2.8 ~ 3.2
PC30	0.5 ~ 0.7	2.0 ~ 2.8	0.7 ~ 0.9	2.8 ~ 3.4	0.9 ~ 1.0	3.4 ~ 3.9
PC40	0.7 ~ 1.1	2.7 ~ 4.1	1.1 ~ 1.4	4.1 ~ 5.4	1.4 ~ 1.7	5.4 ~ 6.3
PC60,L,U	1.0 ~ 1.3	3.8 ~ 5.0	1.3 ~ 1.6	5.0 ~ 6.0	1.6 ~ 1.8	6.0 ~ 6.9
PC80	1.1 ~ 1.5	4.1 ~ 5.8	1.5 ~ 1.9	5.8 ~ 7.3	1.9 ~ 2.3	7.3 ~ 8.8
PC100,L,U	1.2 ~ 1.8	4.5 ~ 6.8	1.8 ~ 2.3	6.8 ~ 8.7	2.3 ~ 2.8	8.7 ~ 10.6
PC120	1.2 ~ 1.8	4.6 ~ 7.0	1.8 ~ 2.4	7.0 ~ 9.0	2.4 ~ 2.9	9.0 ~ 10.9
PC150,LC	1.5 ~ 2.2	5.6 ~ 8.5	2.2 ~ 2.9	8.5 ~ 10.8	2.9 ~ 3.5	10.8 ~ 13.2
PC150HD,NHD	1.3 ~ 2.1	5.1 ~ 7.9	2.0 ~ 2.6	7.7 ~ 9.9	2.6 ~ 3.2	9.9 ~ 12.1
PC180LC,LLC,NLC	1.8 ~ 2.6	6.7 ~ 9.7	2.6 ~ 3.1	9.7 ~ 11.7	3.1 ~ 3.7	11.7 ~ 14.3
PC200,LC	2.1 ~ 2.9	7.9 ~ 11.1	2.6 ~ 3.3	10.0 ~ 12.6	3.3 ~ 4.0	12.6 ~ 15.1
PC210,LC	2.2 ~ 3.0	8.2 ~ 11.5	2.7 ~ 3.2	10.3 ~ 12.2	3.5 ~ 4.2	13.2 ~ 15.8
PC220,LC	2.6 ~ 3.8	10.0 ~ 14.3	3.4 ~ 4.2	13.0 ~ 15.9	4.2 ~ 5.0	15.9 ~ 19.1
PC240,NLC,LC	2.6 ~ 3.8	10.0 ~ 14.3	3.4 ~ 4.2	13.0 ~ 15.9	4.2 ~ 5.0	15.9 ~ 19.1
PC280NLC,LC	2.9 ~ 4.5	11.0 ~ 17.0	3.8 ~ 5.0	14.5 ~ 19.1	4.7 ~ 5.4	17.7 ~ 20.5
PC300,NLC,LC	3.1 ~ 4.9	11.7 ~ 18.5	4.2 ~ 5.4	15.8 ~ 20.5	5.1 ~ 6.0	19.3 ~ 22.0
PC360LC	3.2 ~ 5.0	12.1 ~ 18.8	4.3 ~ 5.6	16.1 ~ 21.2	5.2 ~ 6.0	19.6 ~ 22.7
PC400,LC	4.8 ~ 5.9	18 ~ 22.5	5.5 ~ 6.7	20.9 ~ 25.5	6.3 ~ 7.8	23.8 ~ 29.5
PC650	6.9 ~ 9.0	26 ~ 34	8.5 ~ 11.1	32 ~ 42	10.6 ~ 13.2	40 ~ 50
PC1000	9.5 ~ 11.9	36 ~ 45	11.6 ~ 14.5	44 ~ 55	14 ~ 16.9	53 ~ 64
PC1600	13.7 ~ 17.2	52 ~ 65	16.9 ~ 20.9	64 ~ 79	20.6 ~ 25.1	78 ~ 95
PW60	1.1 ~ 1.5	4.1 ~ 5.5	1.5 ~ 1.7	5.5 ~ 6.6	1.7 ~ 2.0	6.6 ~ 7.6
PW100	1.7 ~ 2.5	6.6 ~ 9.3	2.5 ~ 3.0	9.3 ~ 11.3	3.0 ~ 3.4	11.3 ~ 12.8
PW150	1.6 ~ 2.3	6.2 ~ 8.7	2.3 ~ 2.8	8.7 ~ 10.5	2.8 ~ 3.2	10.5 ~ 12.0
PW210	2.1 ~ 2.9	7.9 ~ 11.1	2.6 ~ 3.3	10.0 ~ 12.6	3.3 ~ 4.0	12.6 ~ 15.1

Low: Light utility work considerable idling.
Medium: Continuous operation,with frequent periods at idles.
High: Continuous operation at full throttle.

(5) Off-highway dump trucks

Range	Low		Medium		High	
Amount / Machine	U.S.Gal/hr.	Ltr./hr.	U.S.Gal/hr.	Ltr./hr	U.S.Gal/hr.	Ltr./hr.
HD180	1.9 ~ 2.1	7 ~ 8	2.9 ~ 3.4	11 ~ 13	4.2 ~ 5	16 ~ 19
HD200	2.9 ~ 3.4	11 ~ 13	4.5 ~ 5	17 ~ 19	5.5 ~ 6.9	21 ~ 26
HD325	3.2 ~ 3.7	12 ~ 14	5.5 ~ 6.3	21 ~ 24	7.7 ~ 9	29 ~ 34
HD465	5 ~ 5.8	19 ~ 22	8.5 ~ 9.8	32 ~ 37	12.2 ~ 13.7	46 ~ 52
HD785	6.3 ~ 7.4	24 ~ 28	10.8 ~ 12.4	41 ~ 47	15.3 ~ 17.4	58 ~ 66
HD1200M	8.2 ~ 9.5	31 ~ 36	13.7 ~ 15.9	52 ~ 60	19.6 ~ 22.2	74 ~ 84
HD1200	9 ~ 10.3	34 ~ 39	15.1 ~ 17.2	57 ~ 65	21.1 ~ 24	80 ~ 91
HD1600M	11.1 ~ 12.9	42 ~ 49	19 ~ 21.7	72 ~ 82	26.7 ~ 30.1	101 ~ 114
HA250	-	-	-	-	-	-
HA270	-	-	-	-	-	-

CONDITIONS:

Low: Long loading time,downhill on load and good road maintenance.
Medium: Normal loading time,uphill on load(normal grade)and good road maintenance.
High: Short loading time,uphill on load(steep grade)and normal road maintenance.

(6) Wheel loaders

Range	Low		Medium		High	
Amount / Machine	U.S.Gal/hr.	Ltr./hr.	U.S.Gal/hr.	Ltr./hr	U.S.Gal/hr.	Ltr./hr.
WA20	0.3 ~ 0.8	1 ~ 3	0.5 ~ 1	1.8 ~ 3.8	0.8 ~ 1.2	2.9 ~ 4.5
WA30	0.4 ~ 0.9	1.5 ~ 3.5	0.7 ~ 1.2	2.5 ~ 4.5	1 ~ 1.6	4 ~ 6
WA40	0.8 ~ 1.3	3 ~ 5	1.2 ~ 1.7	4.5 ~ 6.5	1.6 ~ 2.1	6 ~ 8
WA70	1.1 ~ 1.6	4 ~ 6	1.5 ~ 2	5.5 ~ 7.5	1.8 ~ 2.4	7 ~ 9
WA100,WR11	1.1 ~ 2	4 ~ 7.5	2 ~ 2.8	7.5 ~ 10.5	2.5 ~ 3.6	9.5 ~ 13.5
WA120	1.3 ~ 2.2	5 ~ 8.5	2.4 ~ 3.2	9 ~ 12	3.2 ~ 4.2	12 ~ 16
WA150	1.5 ~ 2.4	5.5 ~ 9	2.5 ~ 3.4	9.5 ~ 13	3.4 ~ 4.8	13 ~ 18
WA180	2 ~ 2.9	7.5 ~ 11	3.4 ~ 4.2	13 ~ 16	4.2 ~ 5.5	16 ~ 21
WA200	2 ~ 2.9	7.5 ~ 11	3.4 ~ 4.2	13 ~ 16	4.2 ~ 5.5	16 ~ 21
WA250	2.4 ~ 3.4	9 ~ 13	3.8 ~ 4.9	14.5 ~ 18.5	5.1 ~ 6.5	19.5 ~ 24.5
WA300	2.4 ~ 3.7	9 ~ 14	4 ~ 5.3	15 ~ 20	5.3 ~ 6.9	20 ~ 26
WA320	2.5 ~ 3.8	9.5 ~ 14.5	4.4 ~ 5.4	16.5 ~ 20.5	5.5 ~ 7.1	21 ~ 27
WA350	2.9 ~ 4	11 ~ 15	4.5 ~ 5.5	17 ~ 21	6.1 ~ 7.7	23 ~ 29
WA380	3.4 ~ 4.5	13 ~ 17	5.3 ~ 6.3	20 ~ 24	7.1 ~ 8.5	27 ~ 32
WA400	3.7 ~ 5	14 ~ 19	5.5 ~ 6.9	21 ~ 28	7.9 ~ 9	30 ~ 34
WA420	3.8 ~ 5.1	14.5 ~ 19.5	5.8 ~ 7.1	22 ~ 27	8.2 ~ 9.2	31 ~ 35
WA450	4.5 ~ 5.8	17 ~ 22	6.1 ~ 8.2	23 ~ 31	8.5 ~ 11.1	32 ~ 42
WA470	5.1 ~ 6.5	19.5 ~ 24.5	6.9 ~ 9	26 ~ 34	9.5 ~ 12.2	36 ~ 46
WA500	6.1 ~ 7.4	23 ~ 28	7.9 ~ 10	30 ~ 38	11.1 ~ 13.2	42 ~ 50
WA600	8.5 ~ 10.8	32 ~ 41	11.6 ~ 14	44 ~ 53	15.9 ~ 19	60 ~ 72
WA800	14.8 ~ 16.4	56 ~ 62	20.3 ~ 22.2	77 ~ 84	28.3 ~ 30.6	107 ~116

CONDITIONS:

Low: Light utility work considerable idling.

Medium: Non-stop operation,but over longer haul distances,or work on basic loader cycle with frequent periods at idles.

High: Non-stop operation on basic loader cycle.

(7) Wheel dozer

Range	Low		Medium		High	
Amount / Machine	U.S.Gal/hr.	Ltr./hr.	U.S.Gal/hr.	Ltr./hr	U.S.Gal/hr.	Ltr./hr.
WD600	-	-	-	-	-	-

CONDITIONS:

Low: Machine movement mainly consisting of idle running or traveling unloaded.

Medium: Average earth-moving,scraper hauling or easy pushing operation.

High: Heavy pushing,and operation continued without rest.

(8) Motor graders

Range	Low		Medium		High	
Amount / Machine	U.S.Gal/hr.	Ltr./hr.	U.S.Gal/hr.	Ltr./hr	U.S.Gal/hr.	Ltr./hr.
GD200A	1.2 ~ 1.6	4.5 ~ 6	1.8 ~ 2.2	7 ~ 8.5	2.5 ~ 2.9	9.5 ~ 11
GD300A	1.3 ~ 1.8	5 ~ 7	2.1 ~ 2.5	8 ~ 9.5	2.9 ~ 3.3	11 ~ 12.5
GD461A	2.1 ~ 2.6	8 ~ 10	3.2 ~ 3.7	12 ~ 14	4.2 ~ 4.8	16 ~ 18
GD510series	2.4 ~ 3.2	9 ~ 12	3.7 ~ 4.5	14 ~ 17	5 ~ 5.8	19 ~ 22
GD520series	2.5 ~ 3.3	9.5 ~ 12.5	4 ~ 4.8	15 ~ 18	5.3 ~ 6.1	20 ~ 23
GD610,620series	2.6 ~ 4	10 ~ 15	4 ~ 5.3	15 ~ 20	5.5 ~ 7.1	21 ~ 27
GD661A	3.4 ~ 4.4	13 ~ 17	5.3 ~ 6.3	20 ~ 24	7.1 ~ 8.2	27 ~ 31
GD663A	3.2 ~ 4	12 ~ 15	4.8 ~ 5.8	18 ~ 22	6.3 ~ 6.6	24 ~ 28
GD705series	3.2 ~ 4.8	12 ~ 18	5 ~ 6.9	19 ~ 26	7.1 ~ 8.7	27 ~ 33
GD825A	4.5 ~ 6.1	17 ~ 23	7.1 ~ 8.7	27 ~ 33	9.8 ~ 11.4	37 ~ 43

CONDITIONS:

Low: Minor repair,leveling,and traveling without load.
Medium: Average road maintenance job,scarifying operation and light duty snow-removal.
High: Ditch-digging,graveling the surface and heavy-duty operation such as ripping.

(9) Motor scrapers

Range	Low		Medium		High	
Amount / Machine	U.S.Gal/hr.	Ltr./hr.	U.S.Gal/hr.	Ltr./hr	U.S.Gal/hr.	Ltr./hr.
WS16	9 ~ 10.5	34 ~ 40	13.2 ~ 14.8	50 ~ 56	17.4 ~ 19	66 ~ 72
WS16S	7.7 ~ 8.7	29 ~ 33	11.1 ~ 12.4	42 ~ 47	14.8 ~ 15.9	56 ~ 60
WS23	15.9 ~ 17.7	60 ~ 67	22.5 ~ 24.8	85 ~ 94	30.1 ~ 32	114 ~ 121
WS23S	8.7 ~ 10	33 ~ 38	12.7~ 14	48 ~ 53	16.6 ~ 18	63 ~ 68

CONDITIONS:

Low: Haul of dirt on flat road in good condition or movements without full load on engine.
Medium: Application in typical road construction work.
High: Continued haul of dirt on rugged surface.

(10) Compactors

Range	Low		Medium		High	
Amount / Machine	U.S.Gal/hr.	Ltr./hr.	U.S.Gal/hr.	Ltr./hr	U.S.Gal/hr.	Ltr./hr.
WF22A	5.7	21.6	8.2	31.1	10.7	40.5
WF22T	5.7	21.6	8.2	31.1	10.7	40.5
JV60series	-	-	-	-	-	-
JV80series	-	-	-	-	-	-
JV100series	-	-	-	-	-	-
JV110series	-	-	-	-	-	-
JV140series	-	-	-	-	-	-
JV180series	-	-	-	-	-	-

CONDITIONS:

Low: Light dozing and compacting.
Medium: Normal dozing and compacting.
High: Heavy dozing and compacting on heavy material.

(11) Portable air compressors

Range	Low		Medium		High	
Amount / Machine	U.S.Gal/hr.	Ltr./hr.	U.S.Gal/hr.	Ltr./hr	U.S.Gal/hr.	Ltr./hr.
EC35Z	1.3	5	1.7	6.5	2	7.5
EC50Z	1.7	6.5	2.3	8.5	2.6	10
EC75Z	2.3	8.5	2.8	10.5	3.3	12.5
EC105Z	3.3	12.5	4.2	16	5	19
EC170Z	5	19	6.3	24	7.7	29
EC210Z	5.8	22	7.1	27	8.6	32.5
EC260Z	7	26.5	8.7	33	10.6	40

(12) Disesl generator sets

	Load factor	EG33	EG40	EG60	EG85	EG125	EG150	EG220	EG275
Fuel consumption (Ltr./hr.) (50 Hz/ 60 Hz)	100 %	7.5/9.2	9.3/10	13.7/15.4	17/20	27.1/30.6	29.1/35	43/47.7	50/60
	75	5.4/7.2	7.1/7.8	10/11.9	12.3/15	20/23.8	22.1/27.4	31.8/35.9	37/46.5
	50	3.4/5.1	5/5.5	6.6/8.4	7.7/10.6	13.5/17.1	14.4/20	21.4/25.3	23.5/33.5
	25	1.3/3	2.6/3.3	3/4.7	3.3/5.8	6.5/10	7.4/12.6	11/14.7	10/20
Interval for refilling fuel tank (hr.)	100 %	10/8.2	9.1/8.5	8.8/7.8	9.4/8	9.6/8.5	10/8.3	7/6.3	6/5
	75	13.9/10.4	12/10.9	12/10	13/10.7	13/10.9	13.1/10.6	9.4/8.4	8.1/6.5
	50	22/14.7	17/15.5	18.2/14.3	20.8/15.1	19.3/15.2	20.1/14.5	14/11.9	12.8/9
	25	57.7/25	32.7/25.8	40/25.5	48.5/27.6	40/26	39.2/23	27.3/20.4	30/15
Fuel tank capacity(Ltr.)		75	85	120	160	260	290	300	300

	Load factor	EG300	EG350	EG380	EG480	EG500	EG580	EG600
Fuel consumption (Ltr./hr.) (50 Hz/ 60 Hz)	100 %	66.2/75	77.7/92.7	69.7/78.5	100/112	100/112	120/133	120/133
	75	50.3/58.2	57.4/72.4	52.1/61	75.3/88.2	75.3/88.2	90.6/103	90.6/103
	50	33.5/41.5	37.1/52.9	34.4/43.2	51.8/63.5	51.8/63.5	60/73	60/73
	25	17.6/24.7	16.8/32.7	16.8/25.6	25.9/40	25.9/40	30.6/42.4	30.6/42.4
Interval for refilling fuel tank (hr.)	100 %	6/5.3	5.2/4.3	7/6.2	9.5/8.5	4.9/4.4	7.9/7.1	4.1/3.7
	75	8/6.9	7/5.5	9.4/8	12.6/10.8	6.5/5.6	10.5/9.2	5.4/4.8
	50	11.9/9.6	10.8/7.6	14.2/11.3	18.3/15	9.5/7.7	15.8/13	8.2/6.7
	25	22.7/16.2	23.8/12.2	29.2/19.1	36.7/23.8	18.9/12.3	31/22.4	16/11.6
Fuel tank capacity(Ltr.)		400	400	490	950	490	950	490

Table 4 Approx. Hourly Consumption-Lubricants

Note:

*(1) Including lubricant oil of compressor for Portable Air Compressor

*(2) Including the oils in the torque converter, main clutch and steering cases, differential, etc.

*(3) Including the oils in the tandem case of Motor Grader.

Application	*(1) Crankcase		*(2)Transmission		*(3)Final Drives		Hydraulic Control		Grease	
Unit Q'TY / Machine Model	U.S. Gal	Ltr.	U.S. Gal	Ltr.	U.S. Gal	Ltr.	U.S. Gal.	Ltr.	lb	kg
D20/21A,E,P,PL	0.01	0.02	0.01	0.03	0.01	0.01	0.01	0.02	0.044	0.02
D31E,P	0.01	0.02	0.02	0.06	0.01	0.02	0.01	0.03	0.044	0.02
D40/41A,E,P	0.01	0.05	0.01	0.05	0.01	0.01	0.01	0.02	0.044	0.02
D50/53A,P	0.02	0.06	0.02	0.06	0.01	0.01	0.01	0.03	0.044	0.02
D58E,P	0.02	0.06	0.02	0.06	0.01	0.01	0.01	0.03	0.044	0.02
D63E	0.02	0.06	0.02	0.06	0.01	0.02	0.01	0.03	0.044	0.02
D60/65A,E,P	0.02	0.06	0.03	0.11	0.02	0.07	0.03	0.11	0.044	0.02
D68E,P	0.02	0.06	0.03	0.11	0.02	0.07	0.03	0.11	0.044	0.02
D75A	0.03	0.12	0.04	0.14	0.02	0.06	0.03	0.11	0.044	0.02
D83E,P	0.03	0.12	0.04	0.16	0.02	0.07	0.03	0.11	0.044	0.02
D80/85A,E,P	0.03	0.10	0.02	0.06	0.02	0.05	0.02	0.06	0.044	0.02
D150/155A	0.07	0.25	0.04	0.14	0.03	0.11	0.03	0.10	0.044	0.02
D355A	0.08	0.29	0.05	0.19	0.04	0.14	0.03	0.10	0.044	0.02
D375A	0.05	0.20	0.04	0.15	0.02	0.07	0.02	0.06	0.044	0.02
D455A	0.08	0.31	0.07	0.25	0.05	0.18	0.05	0.19	0.044	0.02
D475A	0.07	0.28	0.05	0.19	0.02	0.09	0.02	0.09	0.044	0.02
D20/21S,Q	0.01	0.02	0.01	0.03	0.01	0.01	0.01	0.02	0.022	0.01
D31S,Q	0.01	0.02	0.02	0.06	0.01	0.02	0.01	0.03	0.022	0.01
D41S,Q	0.01	0.05	0.01	0.05	0.01	0.02	0.01	0.04	0.022	0.01
D53S	0.01	0.05	0.01	0.05	0.01	0.02	0.01	0.04	0.022	0.01
D57S	0.03	0.11	0.02	0.09	0.01	0.03	0.02	0.06	0.022	0.01
D60S/65S	0.02	0.06	0.03	0.11	0.01	0.05	0.02	0.06	0.044	0.02
D66S	0.03	0.10	0.01	0.02	0.01	0.02	0.01	0.04	0.044	0.02
D75S	0.03	0.11	0.03	0.12	0.01	0.04	0.02	0.06	0.044	0.02
D95S	0.03	0.11	0.04	0.12	0.02	0.09	0.03	0.10	0.044	0.02
D155S	0.07	0.25	0.04	0.14	0.03	0.12	0.05	0.18	0.044	0.02

Lubricants Consumption
Hydraulic Excavators

Application	*(1)Crank case		Transmission or Swing Machinary		*(2)Final drives		Hydraulic control		Grease	
Unit Q'TY / Machine Model	U.S. Gal	Ltr.	U.S. Gal	Ltr.	U.S. Gal	Ltr.	U.S. Gal.	Ltr.	lb	kg
PC05	0.002	0.007	-	-	0.001	0.001	0.003	0.001	0.02	0.01
PC10	0.002	0.008	-	-	0.001	0.001	0.006	0.023	0.04	0.02
PC20	0.003	0.010	0.001	0.002	0.001	0.001	0.005	0.018	0.04	0.02
PC30	0.003	0.011	0.001	0.002	0.001	0.001	0.005	0.018	0.04	0.02
PC40	0.006	0.022	0.001	0.003	0.001	0.001	0.009	0.035	0.07	0.03
PC60,L	0.005	0.020	0.001	0.002	0.001	0.003	0.012	0.044	0.07	0.03
PC80	0.005	0.020	0.001	0.002	0.001	0.003	0.012	0.044	0.09	0.04
PC100,L	0.007	0.026	0.001	0.005	0.002	0.006	0.015	0.055	0.11	0.05
PC120	0.007	0.025	0.001	0.005	0.002	0.006	0.015	0.055	0.11	0.05
PC150,LC	0.012	0.047	0.002	0.007	0.001	0.005	0.018	0.067	0.13	0.06
PC150HD,NHD	0.006	0.026	0.002	0.005	0.002	0.008	0.015	0.055	0.13	0.06
PC180LC,LLC,NLC	0.013	0.050	0.002	0.007	0.001	0.003	0.018	0.067	0.15	0.07
PC200,LC	0.027	0.102	0.002	0.007	0.001	0.004	0.020	0.075	0.15	0.07
PC210,LC	0.027	0.102	0.002	0.007	0.001	0.004	0.020	0.075	0.18	0.08
PC220,LC	0.027	0.103	0.002	0.007	0.001	0.004	0.020	0.075	0.18	0.08
PC240,NLC,LC	0.027	0.103	0.002	0.007	0.001	0.004	0.020	0.075	0.18	0.08
PC280NLC,LC	0.028	0.105	0.002	0.007	0.003	0.011	0.020	0.075	0.22	0.10
PC300,NLC,LC	0.032	0.121	0.003	0.012	0.003	0.011	0.030	0.113	0.22	0.10
PC360LC	0.032	0.121	0.003	0.012	0.003	0.012	0.030	0.113	0.26	0.12
PC400,LC	0.033	0.124	0.003	0.012	0.003	0.012	0.030	0.113	0.26	0.12
PC650	0.042	0.158	0.009	0.035	0.021	0.080	0.063	0.240	0.35	0.16
PC1000	0.054	0.204	0.011	0.041	0.024	0.090	0.086	0.325	0.40	0.18
PC1600	0.080	0.304	0.020	0.074	0.022	0.085	0.198	0.750	0.44	0.20
PW60	0.005	0.020	0.002	0.006	0.002	0.006	0.012	0.044	0.07	0.03
PW100	0.013	0.050	0.002	0.008	0.005	0.018	0.015	0.055	0.11	0.05
PW150	0.006	0.024	0.002	0.009	0.005	0.020	0.025	0.095	0.13	0.06
PW210	0.028	0.106	0.003	0.010	0.005	0.018	0.020	0.075	0.18	0.08

*(1) Including lubricant of PTO case. *(2) Including lubricant of differential gear box.

Lubricants Consumption
Dump Trucks,Wheel Loaders

Application	*(1)Crank case		*(2)Transmission		*(3)Final Drives		Hydraulic Control		Grease	
Unit Q'TY / Machine Model	U.S. Gal	Ltr.	U.S. Gal	Ltr.	U.S. Gal	Ltr.	U.S. Gal.	Ltr.	lb	kg
HD180	0.08	0.32	0.01	0.03	0.01	0.02	0.02	0.08	0.04	0.02
HD200	0.08	0.32	0.02	0.08	0.01	0.02	0.03	0.10	0.04	0.02
HD325	0.03	0.13	0.04	0.14	0.01	0.03	0.03	0.13	0.04	0.02
HD465	0.06	0.23	0.05	0.20	0.02	0.09	0.05	0.18	0.04	0.02
HD785	0.07	0.26	0.06	0.21	0.05	0.18	0.13	0.49	0.07	0.03
HD1200M	0.12	0.45	0.22	0.84	0.06	0.23	0.10	0.38	0.11	0.05
HD1200	0.12	0.45	-	-	0.06	0.22	0.10	0.38	0.11	0.05
HD1600M	0.14	0.52	0.35	1.32	0.07	0.28	0.09	0.35	0.11	0.05
HA250	-	-	-	-	-	-	-	-	-	-
HA270	-	-	-	-	-	-	-	-	-	-
WA20	0.002	0.006	0.002	0.009	0.005	0.018	0.003	0.012	0.002	0.001
WA30	0.003	0.01	0.002	0.009	0.006	0.022	0.005	0.018	0.002	0.001
WA40	0.005	0.017	0.002	0.009	0.005	0.020	0.007	0.025	0.002	0.001
WA70	0.005	0.017	0.003	0.013	0.004	0.016	0.005	0.019	0.002	0.001
WA100	0.007	0.025	0.005	0.020	0.004	0.014	0.010	0.038	0.002	0.001
WA120	0.007	0.026	0.005	0.020	0.004	0.014	0.010	0.038	0.002	0.001
WA150	0.013	0.048	0.005	0.020	0.004	0.014	0.010	0.038	0.002	0.001
WA180	0.013	0.049	0.005	0.020	0.004	0.014	0.012	0.044	0.002	0.001
WA200	0.022	0.083	0.008	0.031	0.005	0.017	0.007	0.026	0.002	0.001
WA250	0.020	0.076	0.008	0.031	0.005	0.017	0.008	0.032	0.002	0.001
WA300	0.023	0.085	0.009	0.032	0.006	0.024	0.008	0.030	0.002	0.001
WA320	0.023	0.085	0.009	0.032	0.006	0.024	0.008	0.030	0.002	0.001
WA350	0.021	0.081	0.016	0.060	0.012	0.045	0.010	0.038	0.002	0.001
WA380	0.022	0.083	0.014	0.053	0.012	0.045	0.010	0.038	0.002	0.001
WA400	0.026	0.100	0.016	0.061	0.015	0.055	0.014	0.052	0.002	0.001
WA420	0.029	0.108	0.014	0.054	0.016	0.062	0.014	0.052	0.002	0.001
WA450	0.031	0.117	0.016	0.062	0.016	0.060	0.018	0.070	0.002	0.001
WA470	0.031	0.119	0.016	0.062	0.016	0.060	0.018	0.070	0.002	0.001
WA500	0.038	0.145	0.017	0.065	0.020	0.075	0.020	0.075	0.002	0.001
WA600	0.052	0.196	0.031	0.118	0.029	0.110	0.028	0.108	0.002	0.001
WA800	0.068	0.256	0.037	0.140	0.095	0.360	0.073	0.275	0.002	0.001
WD600	-	-	-	-	-	-	-	-	-	-

Lubricants Consumption
Graders,Scrapers,Compactors

Application	*(1)Crank case		*(2)Transmission		*(3)Final Drives		Hydraulic Control		Grease	
Unit Q'TY Machine Model	U.S. Gal	Ltr.	U.S. Gal	Ltr.	U.S. Gal	Ltr.	U.S. Gal.	Ltr.	lb	kg
GD200A	0.01	0.05	0.003	0.01	0.003	0.01	0.02	0.06	0.04	0.02
GD300A	0.02	0.06	0.003	0.01	0.02	0.06	0.02	0.06	0.04	0.02
GD461A	0.01	0.03	0.01	0.03	0.02	0.06	0.01	0.03	0.04	0.02
GD500 series	0.03	0.11	0.01	0.03	0.02	0.09	0.01	0.03	0.04	0.02
GD600 series	0.03	0.11	0.01	0.04	0.02	0.09	0.01	0.03	0.04	0.02
GD700 series	0.04	0.16	0.01	0.04	0.03	0.13	0.02	0.08	0.09	0.04
GD825A	0.04	0.16	0.01	0.04	0.03	0.13	0.02	0.09	0.09	0.04
WS23	0.08	0.29	0.09	0.35	0.04	0.16	0.04	0.17	0.13	0.06
WS23S	0.04	0.15	0.06	0.23	0.02	0.08	0.05	0.17	0.13	0.06
WS16	0.12	0.46	0.04	0.16	0.07	0.26	0.01	0.30	0.09	0.04
WS16S	0.04	0.14	0.06	0.21	0.02	0.08	0.04	0.17	0.09	0.04
WS22A,T	0.06	0.22	0.02	0.09	0.04	0.14	0.05	0.19	0.07	0.03
JV60 series	-	-	-	-	-	-	-	-	-	-
JV80 series	-	-	-	-	-	-	-	-	-	-
JV100 series	-	-	-	-	-	-	-	-	-	-
JV110 series	-	-	-	-	-	-	-	-	-	-
JV140 series	-	-	-	-	-	-	-	-	-	-
JV180 series	-	-	-	-	-	-	-	-	-	-

Application	(1)Crank case	
Unit Q'TY Machine Model	U.S. Gal	Ltr.
EC35Z	0.013	0.05
EC50Z	0.016	0.06
EC75Z	0.026	0.10
EC105Z	0.048	0.18
EC170Z	0.066	0.25
EC210Z	0.087	0.33
EC260Z	0.100	0.38
EG33	0.004	0.016
EG40	0.005	0.017
EG60	0.006	0.024
EG85	0.012	0.046
EG125	0.025	0.095
EG150	0.025	0.095
EG220	0.035	0.131
EG275	0.031	0.116
EG300	0.062	0.233
EG350	0.062	0.235
EG380	0.038	0.145
EG480	0.120	0.454
EG500	0.120	0.454
EG580	0.121	0.458
EG600	0.121	0.458

*(1) Including lubricant oil of compressor.

Table 5 Approximate Tire Life

Machine	Easy Condition	Medium Condition	Severe Condition
Motor Scrapers	3,000	2,000	1,000
Towed Scrapers	5,000	4,000	3,000
Off-Highway Dump Trucks	3,500	2,500	1,500
Articulated Dump Trucks	3,500	2,500	1,500
Motor Graders	3,000	2,000	1,000
Wheel Loaders	3,000	2,000	1,000
Wheel Dozers	3,000	2,000	1,000
Hydraulic Excavators	3,000	2,000	1,000
	Traveling on well-maintained roads, or in silt or sand, tire wear is normal.	Traveling on gravelly surfaces, tire wear is normal but occasionally cut by rocks.	Tire wear mostly due to rock-cut, liable to puncture frequently.

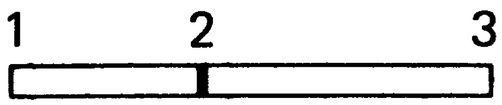
The life varies with brand and material. Tires may be used above or below the tire life expectancy given in this table.

Table 6 Approximate Usable Hours of Special Items

Item	Easy Range	Medium Range	Severe Range
Ripper Point	150	30	15
Shank Protector	1,500	450	150
Shank	7,000	3,500	2,000

Table 7

INSTRUCTION: For estimating hourly repair costs, input the chart for the particular machine and decide the basic factor for the relevant job conditions. Operating conditions areas for each bar are:



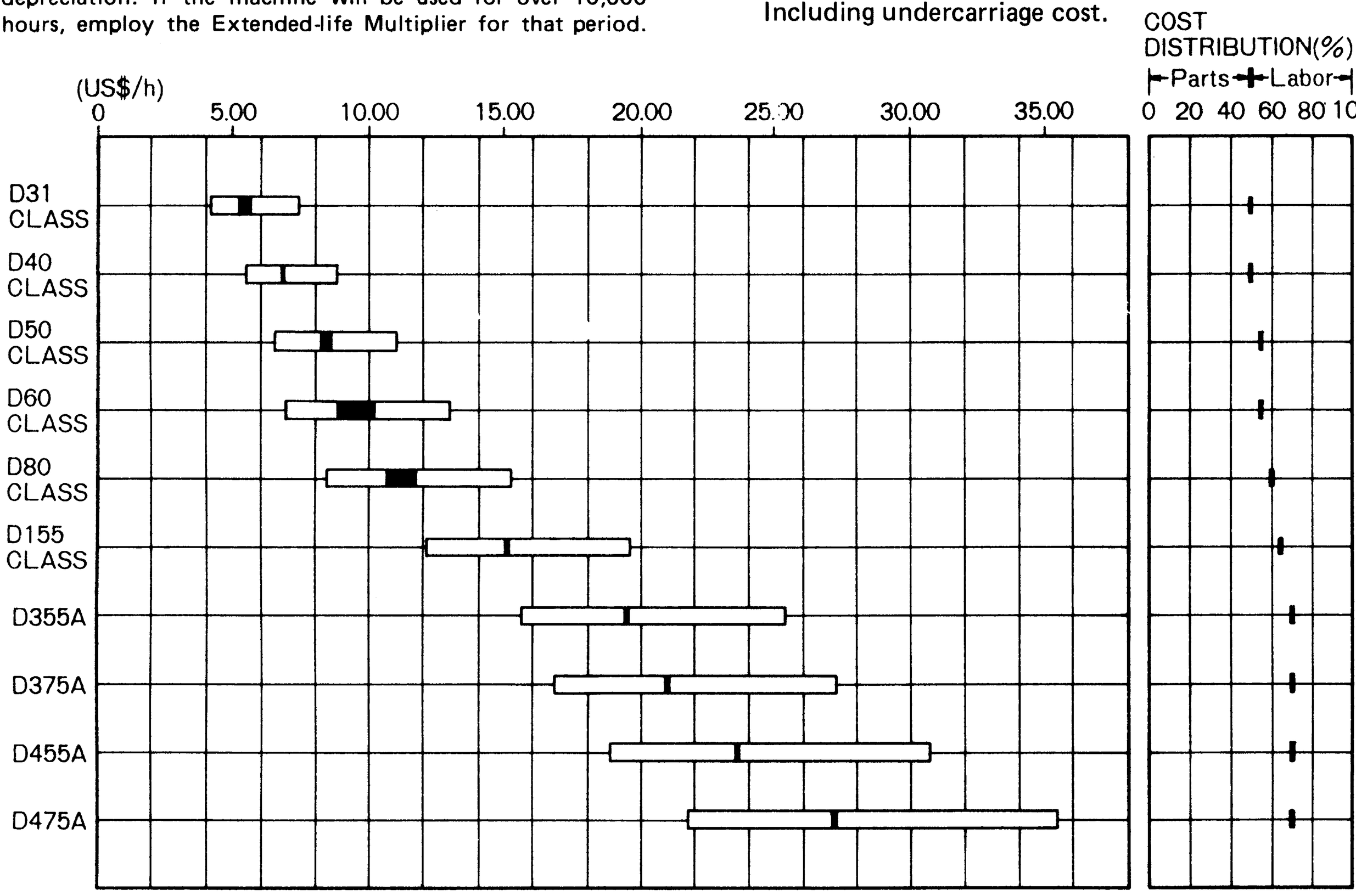
These basically match the definitions in the section on depreciation. If the machine will be used for over 10,000 hours, employ the Extended-life Multiplier for that period.

BULLDOZERS

Extended-life Multipliers

0-10,000 hours	1.0
0-15,000	1.1
0-20,000	1.3

Including undercarriage cost.

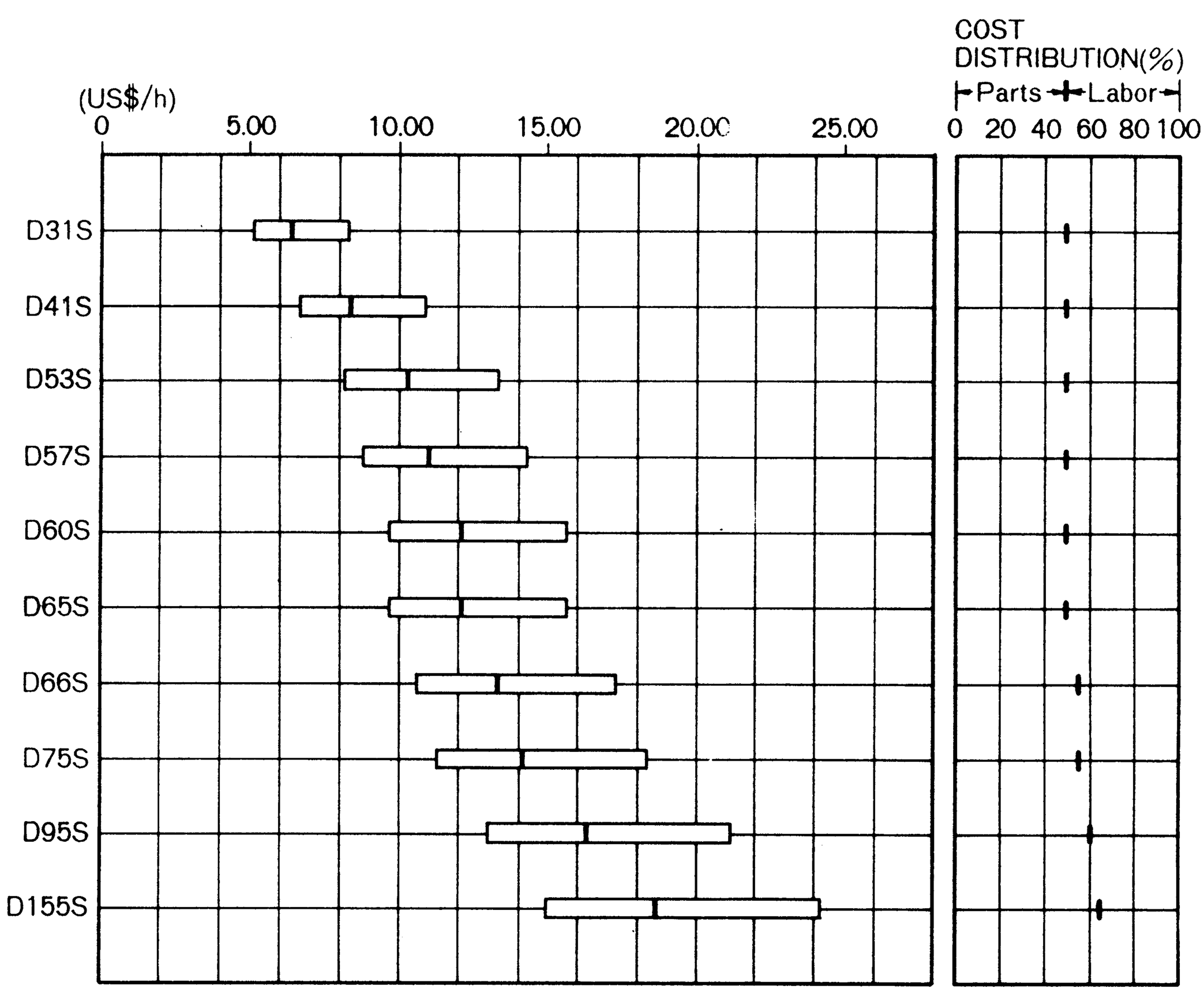


DOZER SHOVELS

Extended life Multipliers

0-10,000 hours	1.0
0-15,000	1.1

Including undercarriage cost.

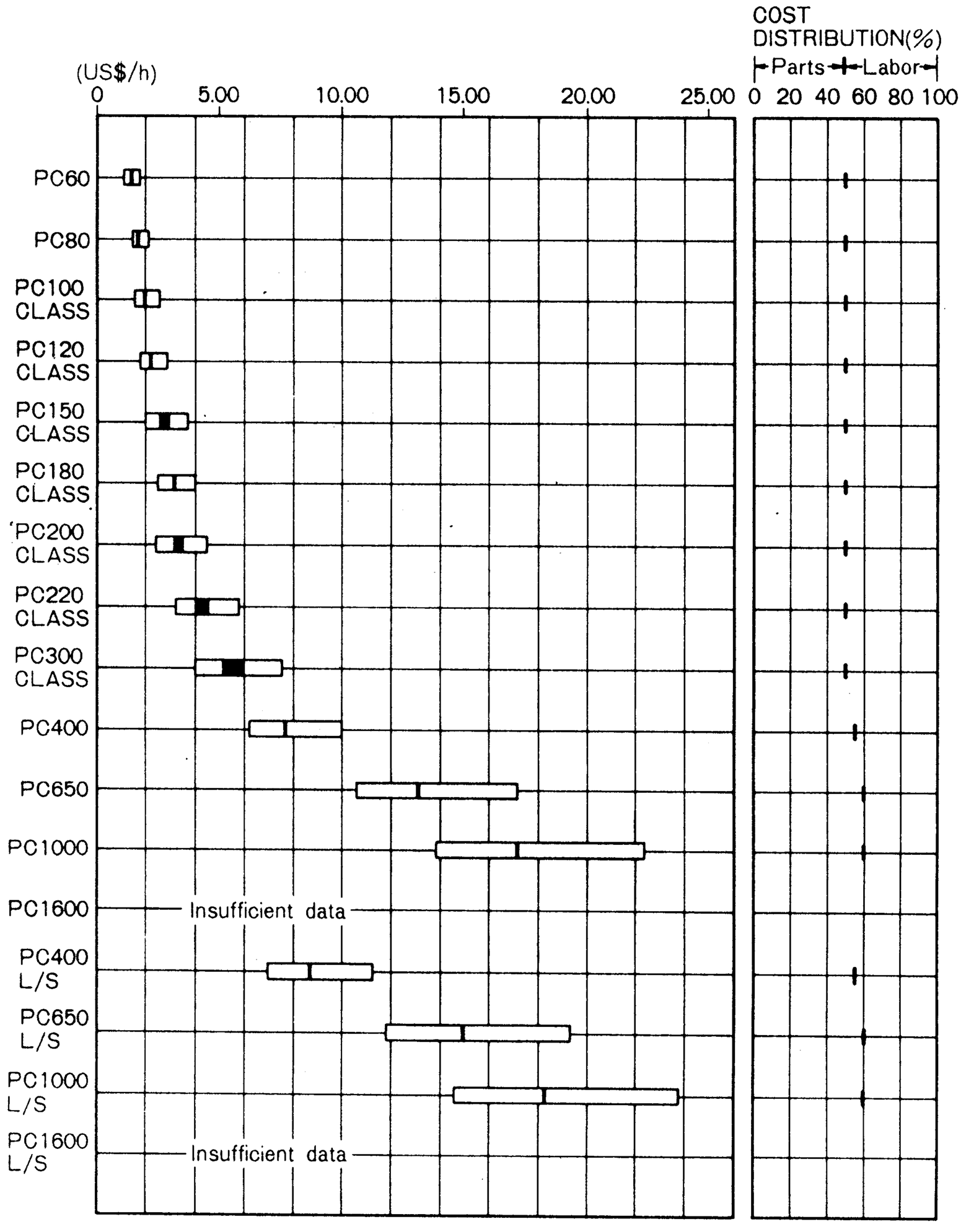


HYDRAULIC EXCAVATORS

Extended-life Multipliers

0-10,000 hours	1.0
0-15,000	1.1
0-20,000	1.2
0-30,000	1.4

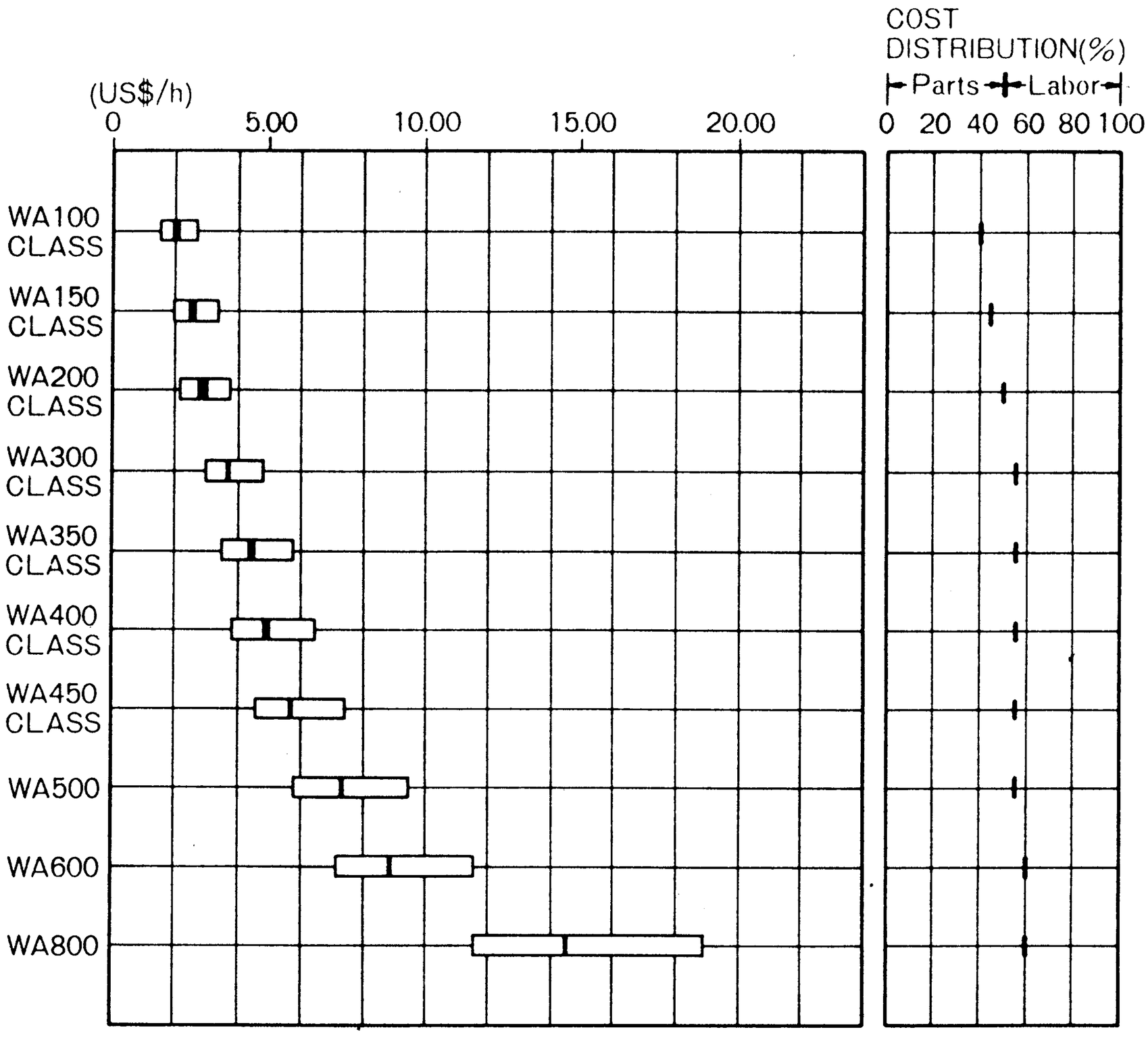
Including undercarriage cost.



WHEEL LOADERS

Extended-life Multipliers

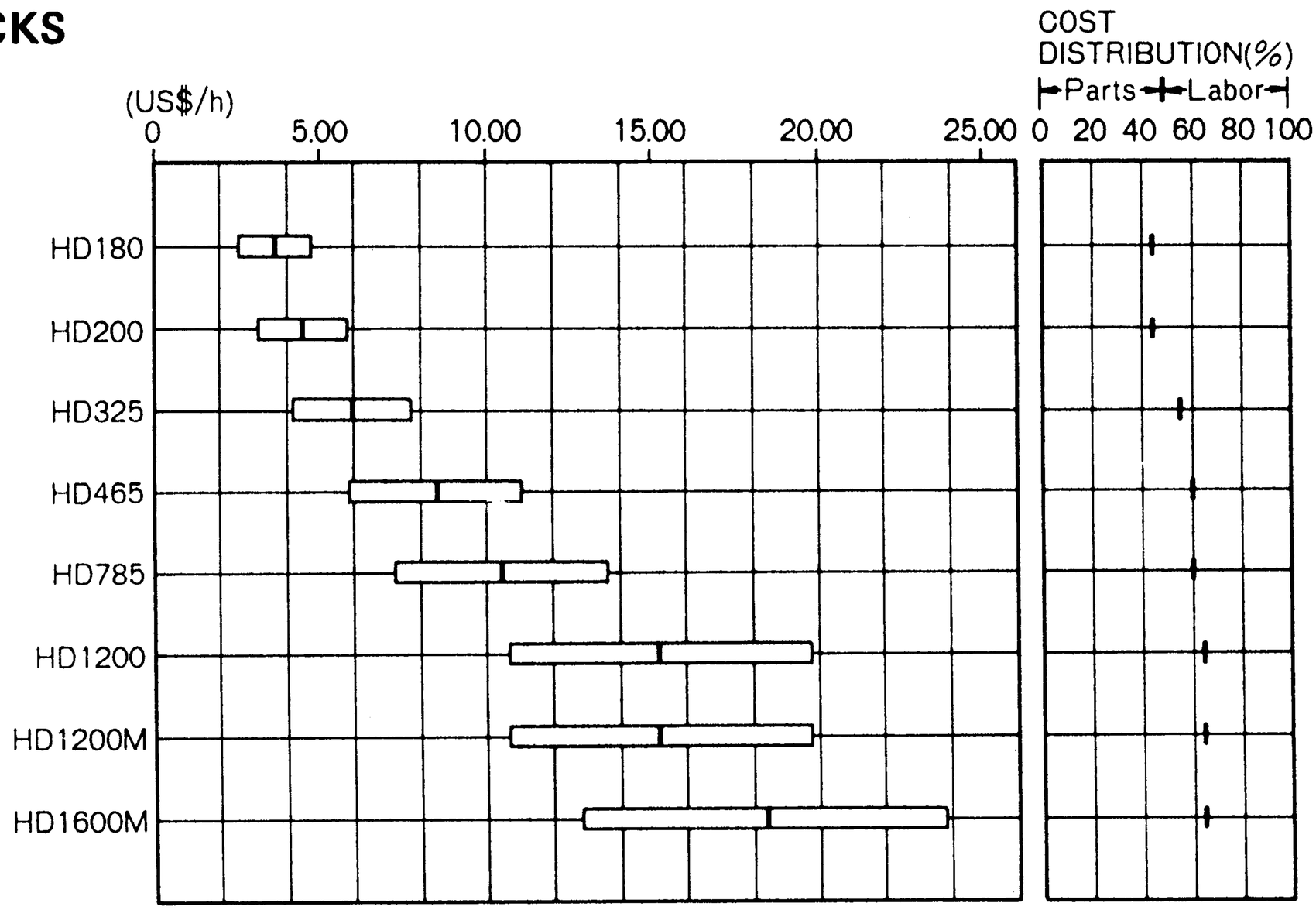
0-10,000 hours	1.0
0-15,000	1.1
0-20,000	1.3



OFF-HIGHWAY DUMP TRUCKS

Extended-life Multipliers

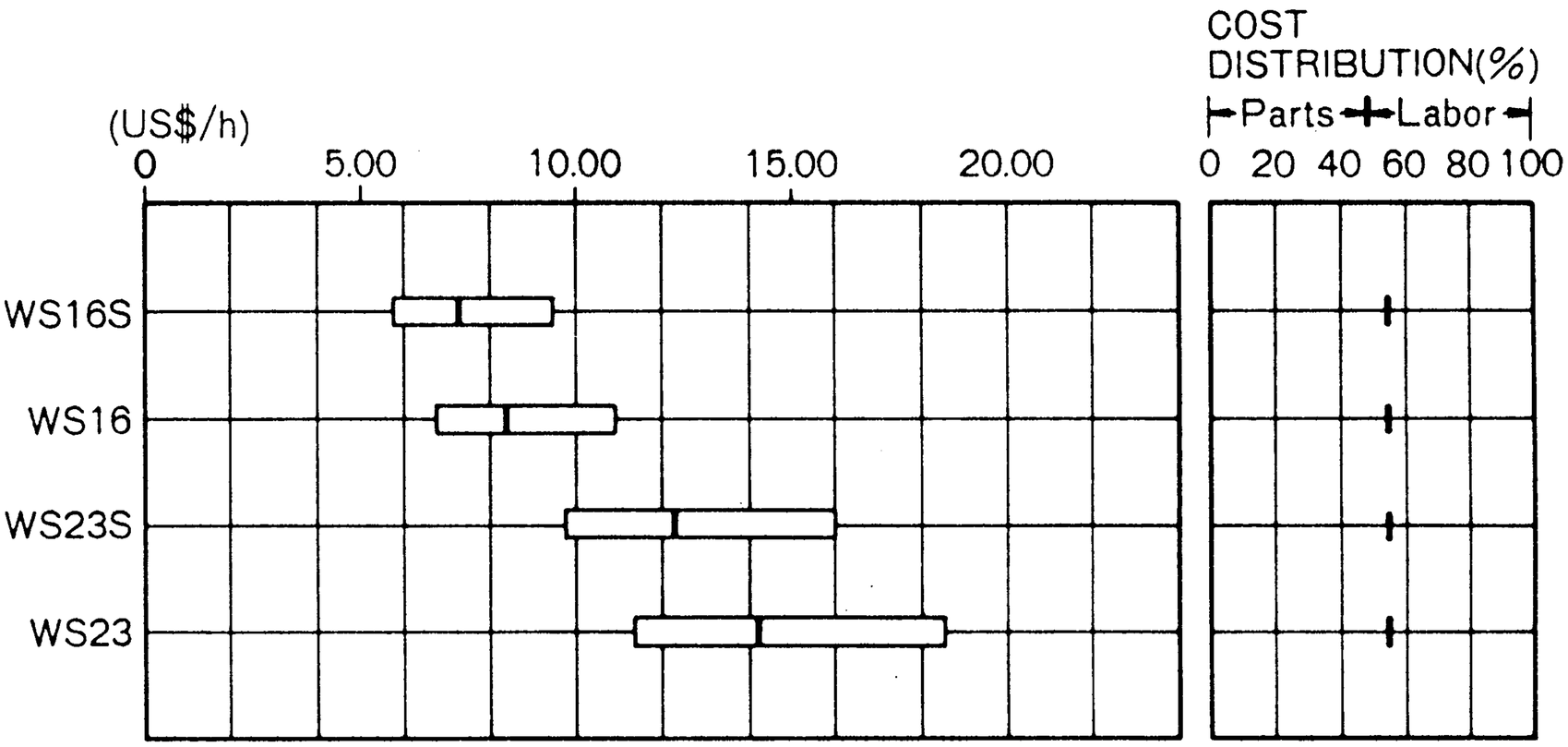
0-10,000 hours	1.0
0-15,000	1.05
0-20,000	1.10
0-30,000	1.20
0-40,000	1.40



MOTOR SCRAPERS

Extended-life Multipliers

0-10,000 hours	1.0
0-15,000	1.1
0-20,000	1.2



MOTOR GRADERS

Extended-life Multipliers

0-10,000 hours	1.0
0-15,000	1.1
0-20,000	1.2