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COMPACT

Determining Costs of Logging-Crew Labor and Equipment

Stephen P. Bushman
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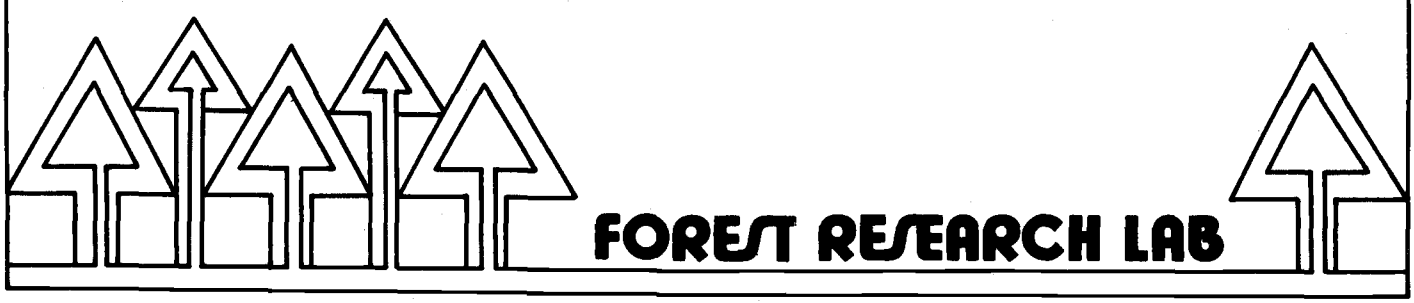

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Stephen P. Bushman
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Introduction

The forest-products industry operates under severe economic pressure. Many companies are forced out of business while others are forced to reduce their operations. One way to combat the pressure is to implement better cost control. This bulletin concentrates on cost control for independent logging contractors. It is a compilation of established procedures for tracking the cost components of logging-crew labor and equipment and of the records required for determining costs and production. Example calculations are given.

Data from two independent logging contractors, designated Company A and Company B, were collected from June 1986 to September 1986 so that actual record systems could be described and actual figures used as a basis for the examples of cost estimation by different procedures. (See pages 15 through 18 for examples that may be used as patterns for your own cost estimates.) Information on costs and payroll came from office records. Data for three yarding-and-loading crews (two from Company A and one from Company B) were collected by one member of each crew (usually the loader operator) who was responsible for supplying the required information on the specially prepared form shown in Appendix A, page 20. Such a form can be adapted to any type of logging operation. Although the data in this bulletin are from the Pacific Northwest for the year 1986, the principles can apply to all logging companies in any year. The methods are designed only for cost prediction and are not such that they should be used for computing taxes.

Cost and Production Records

Good cost and production records are needed for determining whether actual rates exceed or fall below bid rates, and for identifying areas of high cost or low production—therefore areas needing improvement. Cost and production records, combined with characteristics of timber-sale units, are vital for setting the bid rate for future timber sales; equipment-cost records are vital for determining the replacement age of equipment; and accurate records of both are vital for implementing a monetary-incentive system (see box).

Volume Reports

Volume reports are the basis of mill payment to the logging contractor. The basis may be total gross MBF, total net MBF, or a combination of gross and adjusted gross MBF. Most mills issue some sort of volume report to their logging contractors. Production figures that can be obtained directly from them are total net MBF, total gross MBF, adjusted gross MBF (the amount of usable utility cull or select cull), total loads hauled for the period, and total logs hauled for the period. Averages for MBF per day, MBF per load, logs per day, and logs per load can be derived from them. Some reports give such detail as the numbers of bureau scale-tickets, load receipts (mill receipts), and trucks; the delivery data; the number of logs on the load; and a breakdown of the volume on the load.

Monetary-incentive Systems

A monetary-incentive system establishes a price, or "cost goal," for any job from road construction to yarding (Olsen 1987). The negotiated price is usually stated as the price per unit of production ($/MBF or $/station). A total price is then generated by multiplying unit price by units produced. From this total, expenses such as those for labor, equipment, and penalties for safety or quality infractions are subtracted. The money remaining is the bonus pool, which may be distributed in a variety of ways, the crew receiving from 100 percent of the bonus to as little as a 50-percent share with the company.

The production discussed in this bulletin is the volume hauled and scaled from a particular timber sale or unit within a designated time. The volume designation is thousand board feet (MBF), although other units of measure, such as cunits, tons, or cords, may be applicable for other areas or timber sales. There are three means of collecting and analyzing production data: volume reports, truck-ticket tabulations, and individual-load tracking.

One of the strengths of volume reports is that they record cumulative production. A company that is interested in tracking production and costs on the basis of each sale can match volume produced to the costs incurred in the same time period.

A shortcoming of volume reports, especially if production is the basis of payment in a monetary-incentive program, is that they may not be accurate for a given period. Some loads hauled on the last day of a period may not be recorded until the next period, delaying determination of actual volume for an area. Also, volume reports do not show the production of individual sides or crews but reflect the production of all crews working on a timber sale.

Cold-decked material is shown only when it is hauled and scaled, which may be a problem if it is the product of more than one crew and if all material is hauled at the same time. It may be necessary to cross-reference individual loads to a volume report if discrepancies arise. Reports that do not identify individual loads make conflicts impossible to resolve. In a monetary-incentive program, individual loads should be tracked and cross-referenced to some type of scale report if necessary. Truck-ticket tabulations and individual scale-tickets make this possible.

Truck-Ticket Tabulations

In some areas, a truck-ticket tabulation is available from the log scaling and grading bureau. This sheet is a daily record of the volume scaled for a particular sale. It lists numerous items: purchaser; sale name; logging contractor; brand identification number; delivery point; scaling location; date scaled; date the report is issued; number of the bureau scale-ticket; load number (identification number of the U.S. Forest Service, Bureau of Land Management, or private owner); a breakdown of each load by gross board-feet, adjusted gross board-feet, net board-feet, and number of logs; and totals of each of the volume figures. This report is received from three to five days after the scaling date.

Truck-ticket tabulations have the advantage of being daily records of volume removed from a timber sale, and they provide most of the data needed to track production. However, if two or more crews are operating on one sale, the tabulations will not break out individual crew production. Another weakness of the tabulations is that a load hauled on one day may be reported on another. Also, the movement of crews from one unit to another is not recorded.

Individual-Load Tracking

The overall objective of tracking individual loads is to assign the production from a designated area to the proper crew. Computer-assisted systems for log tracking are available and can substantially reduce the delay and cost of manual tracking systems while providing detailed information (Sage 1987).

A relatively simple means of tracking volume is to have a loader operator or another member of the crew record an identification number for each load leaving the landing. It will be necessary to record movement of a crew to a new area if a monetary-incentive program is being used. Load identification numbers must be easily cross-referenced with truck-ticket tabulations or individual scale-tickets, which are obtainable from the scaling bureau or mill to which the loads are delivered.

The Labor Cost Component

The labor cost component considered here is the employer's contribution to the total labor cost: payroll, Workers' Compensation Insurance, State Unemployment Tax, Federal Unemployment Tax, Social Security Tax, and health insurance (if paid by the employer). Not considered here are employee deductions for Federal Income Tax, State Income Tax, Social Security Tax, or other employee contributions; nor are all possible employer contributions described. Some additional contributions might be paid vacation, retirement plans, travel pay, and administrative cost for running a monetary-incentive system (Olsen 1987). When such contributions are made by the employer, they must be included if an accurate labor cost is to be determined. Table 1 shows the proportion of each labor cost component to the total labor costs of Company A and Company B.

TABLE 1.

LABOR COST COMPONENTS EXPRESSED AS A PERCENTAGE OF THE TOTAL LABOR COSTS OF COMPANIES A AND B.

Cost component	Company A	Company B
Payroll (wages, salaries, pay to partners)	75.7	74.0
Workers' Compensation	14.7	15.5
Social Security Tax	4.8	5.3
State Unemployment Tax	2.6	2.2
Federal Unemployment Tax	0.5	0.4
Health and life insurance	1.7	2.6

Payroll

Payroll for logging companies includes base pay for time worked (including salary), overtime pay, assigned wages for partners (if any), and monetary-incentive pay. Other items such as holiday pay, sick-leave pay, and the value of lodging and meals would be added if provided by the company.

Payroll records can be kept in different ways. Company A's computerized payroll tracked regular pay, overtime pay, and salaries for the total company payroll and for individual sales (and logging sides). This is a convenient method when, as in Company A, as many as nine sides are operating at a time. Company B kept payroll records by a convenient ledger system similar to that used by accountants. Wages paid to crews are easy to determine from both kinds of records.

Workers' Compensation

Each state has different laws regarding workers' compensation. In Oregon, subject workers (any persons who furnish services for payment) are entitled to compensation and medical benefits for any accidental injury or disease resulting from employment. Death-benefits for survivors are also covered. Partners and corporate officers are not considered subject workers under the law but may elect coverage.

Premium rates for Workers' Compensation Insurance differ by industry classifications, at least seven of which apply to the logging industry (Table 2). Only the straight-time portion of pay is subject to premiums; if an employee makes $10 per hour for straight time and $15 per hour for overtime, an employer pays premiums only for the $10-per-hour rate for all hours worked. Monetary-incentive pay is subject to the same premiums.

TABLE 2.

WORKERS' COMPENSATION RATES FOR OREGON LOGGING CLASSIFICATIONS IN 1986.

Classification	Jobs covered	Rate[a] ($/$100 of payroll)
2702	All logging positions Falling and bucking (hand and mechanical) Mechanics (on logging site) Road, landing, and skidtrail construction during logging	27.50
2703	Mechanics (repair shop)	6.40
5511	Road, landing, and skidtrail construction before logging	12.15
0124	Brush piling (hand and mechanical) Slash burning Streamcourse cleanout	27.98
9310	Log-truck drivers	15.60
9309	Fire watch	8.75
8810	Clerical (separate office area)	0.56

[a] Rates vary among individual insurance carriers and change annually. Preferred rates may be as much as 10 percent less than rates shown.

Workers' Compensation Insurance relieves employers of the liability required by the law, but a high price is paid, second only to payroll when expressed as a percentage of total labor cost (Table 1).

The rates shown in Table 2 are what are called the "manual" rates of the insurance carrier. The rate the insured pays is not the manual rate, which goes through four adjustments—for experience modification, premium discount, Workers' Compensation Department tax, and workday tax. (See the Appendix for an overview of Oregon's Workers' Compensation and a discussion of these adjustments.)

Most logging companies pay Workers' Compensation monthly. An employer payroll report prepared by the insurance company is sent to the insured at the end of the month. This report includes dates, payroll description, job classification codes and rates, the experience-modification factor, and the tax rate for the Workers' Compensation Department. Although the payroll for each job classification is shown separately, the report is intended chiefly to show the entire monthly premium for a company.

The insured is responsible for filling in the payroll for each job classification and for calculating net and total premiums, including required taxes. The report is prepared in duplicate, and the original and the premium payment are returned to the insurance company.

A simplified formula can be used to compute a factor for determining the Workers' Compensation premium:

(Logging classification rate ÷ 100)
x experience modification
x (1 – premium discount)
x (1 + tax rate for Workers' Compensation Department)
+ 0.0012 for Workday Tax
= Workers' Compensation factor.

The payroll subject to the given logging classification rate is multiplied by this factor. (The value derived is only approximate.)

A typical payroll includes base pay and salaries, overtime pay, partners' wages, and monetary-incentive pay. It should be noted that only the straight-time portion of overtime pay is subject to Workers' Compensation premiums. If the full overtime pay is multiplied by the Workers' Compensation factor, premium cost will be overestimated. The assigned wage of partners must be prorated over several classifications if they allocate their time to more than one job classification.

The workday tax (see Appendix) is not exact since it is converted from a dollar-per-day figure to a ratio of workday tax per dollar of payroll. (The amount is usually small and variation should not make a large difference in labor cost.) Note that in the formula it has been converted to a ratio of $0.0012 of tax per $1 of payroll. This can be adjusted to fit individual situations. The formula for calculating the Workers' Compensation factor does not take into account the fact that the first $2,500 (1986 figure) of the annual premium is not subjected to a premium discount.

Most companies tracking labor cost will not need to consider the shortcomings of the formula when calculating a Workers' Compensation factor and can use the factor for the entire premium period.

Social Security Tax

All logging employees, including partners and those who are salaried, are subject to the Social Security Tax. The rates are set yearly by Congress and take effect on January 1. For 1986, the rate was 15.3 percent of gross wages to a maximum of $42,000 per employee. As the tax is split 50–50 between employer and employee, in 1986 each contributed 7.15 percent. The employer contribution to the tax is required to be paid within three banking days after payday. No tax is paid on any amount more than $42,000 in gross wages during a calendar year. Monetary-incentive pay is subject to the Social Security Tax; however, the tax is paid only if wages plus incentive pay remain below $42,000.

Federal Form 941, filed quarterly to the Social Security Agency, shows the total company payroll, the amount subject to Social Security Tax, and the employer contribution to the Social Security Tax. An employer can determine the ratio of Social Security payment to total wages by dividing the total Social Security Tax paid for the year by total company wages for the same year. For logging crews, it is easier to determine the total cost of Social Security by multiplying total crew wages by the nonadjusted rate for the Social Security Tax (employer's contribution). This method is satisfactory because few logging personnel make more than $42,000 in gross wages annually.

State Unemployment Tax

The State Unemployment Tax is wholly an employer contribution. The rate for Oregon is determined from a "benefit ratio" calculated by dividing the benefit charges (benefits distributed and charged to the employer account) by the taxable payroll for the same time period, which is a maximum of 12 calendar quarters preceding July 1 of the previous year. The taxable payroll for unemployment tax purposes is given an upper limit; for

example, in 1985 it was set at $13,000 and in 1986 at $14,000 gross wages per employee. The unemployment tax rate is determined by the benefit ratio—the higher it is, the higher the rate.

Calculations are made yearly by the State Unemployment Tax Agency and sent to the employer on November 15. The tax rate takes effect on January 1 of the following year and remains in effect until December 31 of that year. Incentive pay is considered wages, but payments to legally registered general partners are not. For 1986, Oregon's unemployment tax rates varied from a low of 2.2 percent of subject wages (the first $14,000 of gross wages per employee) to a high of 5.4 percent of subject wages.

In Oregon, the State Unemployment Tax is paid quarterly by the employer. All employee wages, including advances, are reportable when paid. For example, wages earned for the period March 15 to March 30 but paid on April 5 would be recorded in the second quarter (April–June). State Form 136, a quarterly reporting form, is completed by the employer and sent to the Oregon Employment Division. It contains the number of workers covered each month of the quarter; the total wages paid to covered workers for the quarter; excess wages—those paid during the quarter in excess of the taxable wage base; and taxable wages, which are calculated by subtracting excess wages from total wages. Also required on this report is a list giving Social Security number, name, number of weeks worked during the quarter, and total wages paid during the quarter for all employees.

The unemployment tax rate for a company decreases as more employee wages exceed the upper taxable limit. A prorated tax rate can be calculated by dividing the total State Unemployment Tax paid for all members of a crew by the total wages paid to the same crew members over the same time period (usually 1 year). The necessary dollar amounts can be obtained from unemployment tax records. This prorated tax rate should be calculated at least once a year because the upper limits of subject wages may change annually.

Federal Unemployment Tax

The Federal Unemployment Tax is also wholly an employer contribution. The tax rate is set by Congress and remains in effect for 1 year. For 1986, the rate was 0.8 percent of gross wages to an upper wage limit of $7,000 per employee. Monetary–incentive pay is considered wages. Payments to legally registered partners are not subject to the Federal Unemployment Tax.

The tax is paid quarterly by the employer by means of Federal Form 940, which shows total wages paid, excess wages paid, and the amount of Federal Unemployment Tax due. Individual employees are not listed on the Federal Unemployment Tax Form. Payment is due within one month of the end of the quarter.

Health Insurance

Company A paid monthly health–insurance premiums for all members of its logging crews employed three or more months. It tracked the cost for each employee by assigning a daily insurance rate and multiplying the rate by the number of days an employee worked on a particular crew—a time–consuming process. Company B had a health and life insurance plan for its three partners and for one hourly employee.

An easy way to track such health and life–insurance costs is to determine the amount of premiums paid for each dollar of total wages. Cost of insurance premiums for the logging labor force of a company for an entire year can be determined from the insurance company records and divided by total wages for the same time period. It may be necessary to determine a separate rate for partners and hourly employees, as for Company B. Monetary–incentive pay is not subject to the rates developed for health and life insurance.

Labor Overhead

The term used here to describe the labor costs incurred above the payroll for a crew is "labor overhead." Labor overhead is normally expressed as a percentage or ratio of wages.

Some contractors may include salaried employees with hourly–wage employees when determining labor overhead. This is accurate as long as the same labor overhead factors apply to both salaried and hourly employees. Labor overhead for partners should be calculated separately, since they are not subject to unemployment taxes and may not be subject to charges for Workers' Compensation. For example, assume the following rates:

Hourly and salaried employees	Labor overhead per $1 wages
Workers' Compensation	$0.2500
Social Security Tax	0.0715
State Unemployment Tax	0.0500
Federal Unemployment Tax	0.0080
Health and/or life insurance	0.0250
Total	$0.4045

Partners	Labor overhead per $1 wages
Social Security Tax	$0.0715
Health and/or life insurance	0.1250
Total	$0.1965

In this simple example, labor overhead is expressed in ratios, but it may also be expressed in percentages; e.g., "40.45% of wages," "19.65% of pay." Total wages of hourly and salaried employees are multiplied by one labor overhead factor, and any pay to partners who are assigned to a logging crew is multiplied by another. The total wages, partner pay, and labor overhead are added to attain a total labor cost for the crew.

Wages and salary	$10,000
Overhead factor	x 0.4045
Overhead cost	$ 4,045
Partner pay	$3,000
Overhead factor	x 0.1965
Overhead cost	$ 590
Total labor cost:	
Wages and salary	$10,000
Labor overhead	4,045
Partner pay	3,000
Labor overhead cost	590
	$17,635

This total labor cost can be divided by MBF produced in the same time period in order to determine labor cost per unit ($/MBF).

Table 3 shows labor overhead factors for Company A and Company B in 1986. The percentages are not fixed and are given only as examples.

Calculation of a labor overhead factor can simplify the tracking of labor costs. Computers are not required, and the data needed to derive it are available from existing records. However, it has several weaknesses, especially if the labor overhead cost is to be charged against a crew on a monetary-incentive system. First, multiplying total wages by the labor overhead factor subjects overtime pay to Workers' Compensation premiums. Since the premiums are calculated on straight-time wages for overtime hours, labor costs for a crew may be overestimated. Second, calculation of unemployment taxes and possibly of the Social Security Tax may be inaccurate because the prorated tax rates used in calculating the labor overhead may not be the actual rates paid.

TABLE 3.

LABOR OVERHEAD, EXPRESSED AS A PERCENTAGE OF 1986 WAGES, FOR COMPANIES A AND B.[a]

Cost component	Company A	Company B Without partners	Company B With partners
Workers' Compensation	21.51	29.10	21.00
Social Security	7.15	7.15	7.15
State Unemployment	3.90	4.20	3.03
Federal Unemployment	0.80	0.80	0.58
Health Insurance	2.50	0.28	3.53
Total	35.86	41.53	35.29

[a] State Unemployment Tax and Federal Unemployment Tax were not prorated in these calculations. The labor overhead may be lower if prorated tax rates are used.

If a logging contractor wishes to use a labor overhead factor to track labor costs for planning purposes, the use of an "unadjusted" factor is probably appropriate, especially if little overtime is worked during the season. But if overtime is frequent, straight-time wages and the straight-time portion of overtime wages should be multiplied separately by the Workers' Compensation factor. Total wages should be multiplied by the sum of the other employee overhead items in order to calculate labor cost, as in the following example. (Rates for State and Federal Unemployment Tax are prorated.)

Employee labor cost

Wages and salary:	
Straight-time portion	$27,500
Overtime portion	2,000
Total	$29,500
Labor overhead per $1 wages:	
Workers' Compensation	$0.2500

Other overhead items		
Social Security Tax		0.0715
State Unemployment Tax		0.0350
Federal Unemployment Tax		0.0028
Health and life insurance		0.0250
Total		$0.1343
Partner labor cost		
Total pay assigned to sale	$5,000	
Labor overhead per $1 pay:		
Social Security Tax		$0.0715
Health and life insurance		0.1250
Total		$0.1965

Total labor cost	
Total wages and salary	$29,500
Workers' Compensation overhead ($27,500 x 0.2500)	6,875
Other employee overhead ($29,500 x 0.1343)	3,962
Partner pay	5,000
Partner overhead ($5,000 x 0.1965)	983
	$46,320

If labor cost is being charged against a crew on a monetary-incentive program, it may be desirable to calculate the individual rate for all components.

The Equipment Cost Component

Any method used to determine equipment cost must be understood with respect to its limitations and sensitivity to fluctuations in costs, salvage values, and equipment life. Standard calculations of equipment cost include allowances for both ownership and operation (Mifflin and Lysons 1978, Sinclair et al. 1986). The ownership portion includes purchase price of new or used equipment, salvage or residual value, depreciation, property tax, insurance premiums, lost-opportunity cost (interest forgone), and any fees required for license and storage of the equipment. Operating costs include fuel, lubrication and oil, repair and maintenance, track or tire replacement, and wire-rope replacement. These components are used in standard engineering formulas for determining the average annual cost that must be recovered per piece of equipment if a company is to break even. In a monetary-incentive system, the cost would be charged against a crew working with a particular piece of equipment.

This discussion identifies equipment cost components that a logging contractor needs to track, available cost records, and methods of estimating costs. Examples are given of standard average-cost and marginal-cost calculations and adjustments for inflation.

Ownership Costs

Ownership costs, also known as fixed costs, occur whether a piece of equipment is being operated or sitting idle. The costs are expressed on an annual basis, commonly in dollars per scheduled machine hour (SMH). Scheduled machine hours are the estimated number of machine shifts per year multiplied by the average hours per shift.

Either an average-cost method or a marginal-cost method may be used for calculating ownership costs. Average-cost calculation is based on the average capital invested in a piece of equipment during its useful life. Since costs calculated by this method are for a base year, the effect of inflation should be taken into account by multiplying the current ownership cost by the annual inflation rate. It is important to realize that the costs calculated for a base year will not necessarily apply in future years.

For older or used equipment, marginal-cost calculation, which is based on actual costs for the year under consideration, may be preferable. The cost components discussed in the following sections—opportunity cost, property tax, insurance costs, and license fees and storage—are expressed in marginal-cost calculation as a ratio of the current market value. Ownership costs calculated with this method should be recalculated yearly because the market value of a piece of equipment fluctuates.

Ownership cost components and the records necessary for determining them are described individually in the succeeding sections.

Depreciation

Depreciation of logging equipment, the decrease in worth of the asset over time, is brought about by everyday wear that gradually lessens the capacity of a piece of equipment to perform its intended function. To a lesser extent, logging equipment may depreciate because of technological advances that make it obsolete.

In order to estimate equipment depreciation, a logging contractor must know five values: purchase price; track, tire, or line-replacement costs; salvage value; estimated useful life in years; and scheduled machine hours of use per year. Equipment dealers can provide purchase prices and track, tire, and line-replacement costs, but the remaining figures are not always easy to obtain. For example, salvage value can range from 0 to 30 percent of the original purchase price of a piece of equipment, and its estimated useful life and scheduled hours per year often change. If a company keeps records on similar pieces of equipment, salvage value and life can be more accurately predicted. (Neither Company A nor Company B kept records of this sort.)

Depreciation cost is calculated by subtracting the equipment salvage value from the purchase price and then dividing the result by the estimated useful life in years. Normally, purchase price is reduced by the cost of track, tire, or wire-rope replacement. If the scheduled machine hours per year are known, an hourly cost can be calculated. For example, the depreciable amount for a crawler tractor would be:

$150,000 purchase price plus tax and freight
- 10,000 track-replacement cost
$140,000
- 30,000 salvage value
$110,000 depreciable amount

If the estimated useful life of the tractor is 8 years and 1,600 machine hours are scheduled (200 8-hour shifts per year), depreciation cost per year = $110,000 ÷ 8 = $13,750, and cost per SMH = $13,750 ÷ 1,600 = $8.59.

This method, called straight-line depreciation, is commonly used for equipment cost calculations because of its simplicity and compatibility with the formula for determining average annual investment. Other considerations, primarily tax laws, might mean that another form of calculation of depreciation would be preferable (see Taylor 1966).

The Caterpillar Performance Handbook (Caterpillar Tractor Co. 1985) gives estimates of total ownership hours based on application and operating conditions of a piece of equipment. Table 4 is an adaptation of this guide.

This and other guides are based on actual machine hours operated. Since machines are scheduled yearly for more hours than they are operated, the ownership period must be adjusted. Assume that a small track-type tractor is operating under medium-impact conditions. The total machine life in hours given in Table 4 is 10,000. The machine is scheduled to work 1,600 hours annually (200 shifts averaging 8 hours), but it will actually operate only 6 hours of each 8-hour shift. The adjustment is made in this way: scheduled machine hours per year x (actual machine hours per shift ÷ scheduled machine hours per shift) = 1,600 x 6/8 = 1,200. Total life in years = total machine life in hours ÷ actual machine hours per year = 10,000/1,200 = 8.33 (round to 8.5 years).

The 8.5 years may be used to determine annual depreciation charges, but the hourly charge that must be recovered is based on scheduled machine hours. Depreciation per year = (purchase price - salvage value) ÷ number of years of equipment life = ($140,000 - $28,000) ÷ 8.5 = $13,176. Therefore, the charge to recover per SMH = $13,176 ÷ 1,600 = $8.24.

Opportunity Cost

Opportunity cost is the amount of money a logging contractor forgoes by investing in a particular piece of equipment. If capital is borrowed to purchase the equipment, the yearly interest (I), paid at the rate established by the lender, is the yearly opportunity cost. If cash is used for the purchase, the opportunity cost is the amount of money, or return, the contractor would be likely to receive if his money were invested elsewhere. A typical rate of return (sometimes called marginal rate of return, MARR) ranges from 10 to 15 percent. In one method of equipment-cost accounting, the yearly rate of return (expressed as a decimal) is multiplied by the average annual investment to determine the revenue needed to recover the opportunity cost. This cost is converted to a dollar-per-hour basis by dividing the total yearly opportunity cost by the machine hours scheduled for the year.

Many contractors do not calculate the established rate of return (I or MARR) for company investments. This should be done, because opportunity cost is a major component of equipment cost, and the selection of a realistic rate of return greatly influences the dollar-per-hour ownership cost of a piece of equipment.

Property Tax

Property tax is not assessed against licensed and registered pickup trucks or crew vehicles. It is charged against other pieces of equipment according to the market value assessed at the beginning

TABLE 4.

GUIDE FOR ESTIMATING OWNERSHIP LIFE OF LOGGING EQUIPMENT[a]

Vehicle	Operating conditions and estimated hours of use		
Track-type tractors	Intermittent full-throttle operation. No impact. Scraper pulling. Most agricultural drawbar, stockpile, and landfill work.	Medium impact conditions. Production dozing in clays, sands, gravels. Most land clearing and skidding applications.	Continuous high impact conditions. Heavy rock ripping. Pushloading and dozing in hard rock. Tandem ripping.
Small	12,000 hours	10,000 hours	8,000 hours
Large	22,000 hours	18,000 hours	15,000 hours
Wheel skidders	Intermittent skidding for short distances. No decking. Good underfooting: level terrain, dry floor, few if any stumps.	Continuous turning, steady skidding for medium distances, moderate decking. Good underfooting: dry floor with few stumps and gradual rolling terrain.	Continuous turning, steady skidding for long distances, frequent decking. Poor underfooting: wet floor, steep slopes, numerous stumps.
	12,000 hours	10,000 hours	8,000 hours
Off-highway trucks and tractors	Well maintained haul roads. Construction use mostly on well maintained roads.	Varying loading and haulroad conditions. Typical road-building use on a variety of jobs.	Consistently poor haulroad conditions. Extreme overloading. Oversized loading equipment.
	25,000 hours	20,000 hours	15,000 hours
Wheel loaders	Intermittent truck loading from stockpile. Free flowing, low density materials. Light snowplowing. Loading and carrying on good surfaces, short distances, no grades.	Continuous truck loading from stockpile. Low- to medium-density materials in properly sized bucket. Loading from bank in good digging. Loading and carrying on poor surfaces, slight adverse grades.	Loading shot rock (large loaders). Handling high density materials with counterweighted machine. Steady loading from very tight bank. Continuous work on rough or very soft surfaces.
Small	12,000 hours	10,000 hours	8,000 hours
Large	15,000 hours	12,000 hours	10,000 hours
Track-type loaders	Intermittent truck loading from stockpile. Minimum traveling, turning. Free flowing, low-density materials with standard bucket. No impact.	Bank excavation, intermittent ripping, basement digging of natural clays, sands, silts, gravels. Some traveling. Steady full-throttle operation.	Continuous work on rock surfaces. Large amount of ripping of tight, rocky materials. High-impact conditions.
	12,000 hours	10,000 hours	8,000 hours
Motorgraders	Light road maintenance. Light snow removal. Large amounts of traveling.	Haul-road maintenance. Road construction, ditching. Medium to heavy snow removal.	Maintenance of hardpack roads with embedded rock. Continuously high load factor. High impact.
	20,000 hours	15,000 hours	12,000 hours

[a] Adapted from the Caterpillar Performance Handbook (Caterpillar Tractor Co. 1985).

of the year. The rates vary with location of the equipment on January 1. Company A equipment, for instance, was located in several counties and school districts; as a result, five different property tax rates were assessed for equipment of varying market values. To simplify calculation, a weighted average property tax rate should be applied against each piece of equipment.

Property tax records are readily available. An individual billing is sent to the owner of the property for each tax-base area. The bill includes the tax rate, expressed in dollars per thousand dollars of market value, and the total market value of the equipment at the given tax-base location. Individual pieces of equipment are not identified, but the property tax for an individual piece can be determined by expressing the weighted average rate as a ratio of market value and by multiplying the average annual investment by this ratio. If the property tax rate is $13.50 per $1,000 market value, the ratio is $0.0135 per dollar. Therefore, the hourly charge for property tax = (average annual investment x 0.0135) ÷ number of scheduled machine hours.

Since the tax rate is based on the true cash value of a piece of property, this method is valid only for calculating an average annual tax payment. It will not give the actual annual property tax, which will be higher or lower, depending on the age and market value of the equipment being costed. However, the average annual payment may be used for planning purposes or for calculating monetary incentives.

Insurance

Most logging contractors carry insurance on their logging equipment and vehicles that will cover the cost of loss due to fire, theft, or other damage. The insurance cost must be calculated in the hourly rate for owning a piece of equipment. Companies A and B determined insurance rates for equipment on the basis of dollars per thousand dollars of market value, much the same as for property tax. The market value used by the insurance company is the same as that for property tax assessment, which simplifies calculation of insurance charges.

Insurance rates for a piece of equipment are given on the insurance policy or are available from the insurance agent. Company A and Company B had blanket policies with rates of approximately $8.00 per thousand of market value, regardless of equipment age. The method for calculating the yearly insurance charge for logging equipment is the same as that for calculating property tax. Vehicles, such as pickups used for crew travel, are not charged the same rate as other logging equipment but typically are charged a monthly policy premium. The total yearly insurance payment is easily calculated from these monthly payments.

Storage Fees

If there is a charge for storage of a piece of logging equipment, it must be reflected in the dollar-per-hour rate of ownership cost. Company A and Company B had no storage fees, but kept their equipment on job sites during the year or stored it at their own properties. If storage is charged, it can be treated as a percentage of average annual investment, much like property tax or insurance, or the actual rate can be determined by dividing the annual storage charge by the scheduled machine hours for the year.

License Fees

Logging equipment, including fire trucks, is not subject to licensing fees, but trucks used for highway travel are subject to a fee that must be divided by the yearly scheduled machine hours to obtain the dollar-per-hour charge. Another option is to treat license fees as a percentage of the average annual investment.

Operating Costs

Operating costs, known also as variable costs, are those for fuel and lubrication; tire, track, and wire-rope replacement; and repair and maintenance. They must be converted to cost per SMH and added to ownership costs to derive total cost per SMH. The succeeding paragraphs describe each cost component and the records available to logging contractors for tracking them. Some standard formulas, guidelines, and references for estimating operating costs when records are lacking are also given.

Fuel and Lubrication

Company A did not measure fuel or lubricant consumption but rather estimated the amount of fuel used per machine hour for each piece of equipment. Company B used a meter to track fuel consumption and machine hours but did not

track use of lubricants. Both companies would benefit from more detailed tracking.

It is important to convert estimates of fuel and lubricant consumption based on actual machine hours to consumption based on scheduled machine hours. For example, if a piece of equipment uses 4 gallons of fuel per hour and works only 6 hours of a scheduled 8-hour shift, fuel consumption per SMH = 4 gallons x (6 hours ÷ 8 scheduled machine hours) = 3 gallons. This figure can be multiplied by cost-per-gallon to obtain cost per SMH for fuel consumption: 3.0 gallons x $0.80 = $2.40.

In many instances, fuel and lubricants are delivered to the job site. The receipt usually shows the amount and type delivered and the unit cost for each. In order to calculate accurately the average fuel and lubricant cost, records must be kept for a year or longer. A weighted average cost for a gallon of diesel and gasoline can be calculated from the records. The total cost of lubricants for a given period are divided by the total cost of diesel and gasoline for the same period in order to derive the cost of lubricants for each dollar of fuel.

Another option for a logging contractor is to use current costs of fuel and lubricants and to update them when major price changes occur. This is easy but requires accurate estimates of fuel and lubricant consumption.

Lubrication cost per hour can be estimated by multiplying fuel cost by the prorated lubricant cost. For example, if fuel consumption is $3 per SMH, diesel cost is $0.80 per gallon, and lubricant cost is $0.16 per $1 of fuel (prorated cost), a realistic cost for fuel would be 3 gallons x $0.80 = $2.40 per SMH, and for lubrication $0.16 x $2.40 = $0.38 per SMH.

The Caterpillar Performance Handbook (Caterpillar Tractor Co. 1985) contains several tables that show hourly consumption of fuel and lubricants for different classifications and uses of equipment. Another option is to use a formula (adapted from Miyata 1980) for estimating number of gallons per machine hour:

$$GPMH = (L \times FHP \times LF) \div LPG,$$

where L = pounds of fuel used per horsepower-hour, FHP = rated horsepower at the flywheel at governed engine rpm, LF = load factor (the portion of full-rated flywheel horsepower used during normal operations), and LPG = weight of fuel in pounds per gallon. Typical values for these variables are given in Table 5.

TABLE 5.

FUEL WEIGHT, CONSUMPTION RATE, AND LOAD FACTOR FOR DIESEL AND GASOLINE ENGINES.[a]

Engine type	Weight, lb/gallon (LPG)	Consumption, lb/hp-hr (L)	Load factor (LF) Low	Medium	High
Gasoline	6.0	0.46	0.40	0.55	0.70
Diesel	7.1	0.42	0.40	0.55	0.70

[a] Adapted from Sessions, unpublished report, and from Miyata 1980.

Lubricant GPMH can be estimated by formulas adapted from Sessions (unpublished report):

Crankcase oil	GPMH = 0.0002	x FHP
Transmission oil	GPMH = 0.00007	x FHP
Final drives	GPMH = 0.00005	x FHP
Hydraulic controls	GPMH = 0.00002	x FHP

These formulas are for machines having normal oil changes and no leaks. The estimates should be increased 25 percent when machines are operating in heavy dust, deep mud, or water. In machines with complex and high-pressure hydraulic systems, such as forwarders, processors, and harvesters, the consumption of hydraulic fluids can also be much greater. One rule of thumb is that the cost of lubricants and grease is five to fifteen percent the cost of fuel.

Note that the estimates of fuel and lubricant consumption must be converted to gallons per SMH as previously discussed. The cost per gallon of fuel or lubricants can then be multiplied by gallons consumed per SMH to obtain the cost in dollars per SMH.

Tire, Track, and Wire-Rope Replacement

Since tires, tracks, and wire-rope usually do not have the same life as the piece of equipment, costs of these items should be estimated separately at the time of purchase. Labor for replacement should be included in this cost. An estimate of the life of each item must be made so that dollar-per-hour cost can be determined.

Replacement costs used in standard equipment-cost formulas are often based on the assumption that new parts are used to replace the ones worn

out. However, it is not uncommon for used tracks or tires to be purchased or for these items to be salvaged from other machines. Partial replacement of tires or tracks is also not uncommon. Estimates of tire, track, and wire-rope life vary widely with operator, terrain, harvest conditions, and weather.

A record-keeping system that tracks yearly replacement costs for individual pieces of equipment is desirable for determining accurate costs. A cumulative hourly cost can be derived by determining total replacement cost and dividing it by the machine hours scheduled during the same period. For example, if, for a 3-year period, the total cost of track replacement is $10,000 and the total scheduled machine hours are 4,800, total cumulative hourly cost for track replacement = $10,000 ÷ 4,800 hours = $2.08.

There are few sources for estimates of tire, track, or wire-rope life. Tire and track life are often expressed in hours, wire-rope life in total production before replacement. Equipment dealers, manufacturers, and logging supply companies may be able to give an estimate of life. The Caterpillar Performance Handbook (Caterpillar Tractor Co. 1985) estimates tire life on the basis of application:

"A" tires wear through tread because of abrasion only

"B" tires wear out or fail prematurely because of rock cuts, rips, and nonreparable punctures

"C" tires seldom wear through tread before having to be discarded because of rock cuts

On the basis of these applications, estimated tire life in hours is:

	A tires	B tires	C tires
Skidders	4,000–6,000	2,000–4,000	1,000–2,000
Wheel loaders	3,000–6,000	1,000–3,000	500–1,000
Off-highway trucks	4,000–6,000	2,000–4,000	1,000–2,000

These values must be converted to scheduled machine hours by the same method described in the section on fuel and lubricant consumption. The values are based on the assumptions that new tires are run to destruction (not necessarily recommended), that standard machine tires are used, and that neither sudden failures due to exceeding tire load rate nor premature failures due to punctures occur.

Estimates of track life, which depend on operating conditions, terrain, and operator, must be made on the basis of company records.

The U.S. Forest Service has developed a guide for wire-rope life for cable logging systems in the Pacific Northwest (McGonagill 1975). This guide (Table 6) assumes that the wire-rope is properly maintained and used in accordance with the manufacturer's recommendations.

An estimate of wire-rope life expressed in total production can be converted to an estimate expressed in scheduled machine hours if the following parameters are known: gross MBF (or other measure) produced between replacements, estimated average production (gross MBF) per day, and average scheduled hours per shift. For example, if gross MBF produced between replacements = 6,000, estimated gross MBF produced per day = 40, and average scheduled hours per shift = 8.5, the number of days between replacements = 6,000 MBF ÷ (40 MBF/day) = 150, and the number of scheduled machine hours between replacements = 150 days x 8.5 hours per day = 1,275.

To determine the cost of line replacement, the length of wire-rope to be replaced and the price per unit length must be known. If wire-rope length = 2,500 feet and the price per foot of wire-rope = $1.34, replacement cost is 2,500 x $1.34 = $3,350. The cost per SMH for wire-rope replacement becomes $3,350 ÷ 1,275 scheduled machine hours = $2.63.

Repair and Maintenance

Repair and maintenance costs may include everything from routine maintenance to major overhauls of engines, transmissions, clutches, brakes, or other major components. Normally, both parts and labor are included. (Routine lubricant and oil changes are often covered under lubrication and oil costs, while cost of shop facilities and mechanics' vehicles are included in administrative overhead.)

Neither Company A nor Company B kept repair and maintenance records for individual pieces of equipment. Parts and supplies were often recorded under one expense account so that the cost of parts for repair of an individual piece of equipment was difficult to determine. (Each company employed full-time mechanics so that total labor

TABLE 6.

WIRE-ROPE LIFE EXPRESSED IN MILLION-BOARD-FOOT TOTAL PRODUCTION (DATA FROM USDA FOREST SERVICE, McGONAGILL 1975).

Logging system	Line use	Line size (inches)	Line classification	Line life (MMBF)
Standing skyline	Skyline	1 3/4	6 x 21	20 to 25
		1 1/2	6 x 21	15 to 25
		1 3/8	6 x 21	8 to 15
	Mainline	1	6 x 26	10 to 15
	Haulback	3/4	6 x 26	8 to 12
		7/8	6 x 26	8 to 12
Live skyline	Skyline	1 1/2	6 x 21	10 to 20
		1 3/8	6 x 21	8 to 15
		1	6 x 26	6 to 10
	Mainline	1	6 x 26	10 to 15
		3/4	6 x 26	8 to 12
		5/8	6 x 26	8 to 12
	Haulback	7/8	6 x 26	8 to 12
		3/4	6 x 26	8 to 12
		1/2	6 x 26	6 to 10
	Slackpulling	7/16	6 x 26	5 to 8
Running skyline	Mainline	1	6 x 26	8 to 12
	Haulback	3/4	6 x 26	4 to 8
High lead	Mainline	1 3/8	6 x 26	8 to 15
		1 1/8	6 x 26	6 to 12
	Haulback	7/8	6 x 26	6 to 12
Carriage	Skidding	1/2	6 x 26	0.5
		7/8	6 x 26	3 to 5
Strawline		3/8 to 7/16	6 x 19	5 to 8
Skyline chokers		1/2 to 3/4	6 x 25	0.2 to 0.3
Guylines			6 x 25	4 years[a]

[a] Not subject to volume yarded.

cost for repair and maintenance could have been tracked if desired.) Company A estimated total repair and maintenance cost for each piece of equipment, but the estimates were not accurate enough for a monetary-incentive program. Company B assigned a total repair and maintenance cost to the operating timber sale, which again would not be sufficiently accurate for a monetary-incentive program.

An estimate of the dollar-per-hour cost for repair and maintenance under varying operating conditions for different classes of equipment can be read directly from the charts in the Caterpillar Performance Handbook (Caterpillar Tractor Co. 1985). An "extended-life multiplier" is used to adjust the cost for total estimated hours of machine use. The costs are only averages, and the handbook recommends that a Caterpillar dealer be consulted for more accurate figures. Repair and maintenance for the undercarriage is excluded and must be calculated separately. The costs do not include an increase for inflation and therefore must be revised yearly.

Repair and maintenance costs may also be estimated as a percentage of depreciation. Ranges typically given (McGonagill 1975, Miyata 1980, Sessions, unpublished) are:

Chainsaw	90–100%
Crawler tractor	90–100%
Rubber-tired skidder (cable)	50–90%
Rubber-tired skidder (grapple)	60–100%
Cable yarder	50–65%
Radio-controlled carriage	100%
Swingboom loaders (hydraulic)	50–80%
Swingboom loaders (cable)	30–60%
Rubber-tired front end loader	90%
Hydraulic felling shear	50–80%

For example, if the depreciation cost for a cable yarder is $8.00 per hour, repair and maintenance cost per SMH = $8.00 x 0.50 = $4.00. Repair and maintenance costs estimated with this technique will vary with life, hours of use per year, purchase price, and salvage value assigned to a piece of equipment. These percentages should not be used for estimating anything other than repair and maintenance; however, they are commonly used with the average-cost method because of their simplicity.

Adjustment for Inflation

The example calculations in this bulletin are for a given year. It should be remembered that new estimates must be made annually to account for economic change. The following simple method of accounting for inflation of equipment costs does not take into consideration many complicating and sometimes offsetting factors in the calculation of inflation, but it is useful for an approximation of increased cost.

Assume that cable-loader costs for 1987 are those in the example for average-cost calculation on page 16 and that the loader will be used in 1988. The 1987 base-year ownership cost can be inflated by the general inflation rate, estimated to be 6 percent (0.06) for 1988, by the formula current-year ownership cost x (1 + general inflation rate) = next-year ownership cost. A cost of $22.93 per SMH in 1987 would therefore be inflated in 1987 thus: $22.93 x (1 + 0.06) = $24.31.

Operating costs must also be inflated by multiplying by 6 percent. When this is done, total operating cost is $11.41 and total ownership and operating cost is $35.72 per SMH. Note that inflation in one year has caused an increase of $2.03 per SMH.

An Example of Average-Cost Calculation

The example calculations shown here are for a cable loader newly purchased in 1987. Values are averages from two Pacific Northwest companies. Readers may wish to fill in their own values for a new machine on the right.

OWNERSHIP PORTION OF COSTS

		User values:
Purchase price plus sales tax and freight minus cost of tire replacement (P)	P = $190,000	
Salvage value (S), 20% of P	S = $38,000	
Estimated years of life (N)	N = 8	
Estimated scheduled machine hours (SMH) per year (200 8-hour shifts)	SMH = 1,600	
Average annual investment (AAI) $= \frac{(P - S)(N + 1)}{2 \times N} + S$ $= \frac{(190{,}000 - 38{,}000)(8 + 1)}{2 \times 8} + 38{,}000$	AAI = $123,500	
Inflation-free interest rate (I), or marginal rate of return (MARR)	I or MARR = 12% (0.12)	
Property tax rate	$14.50 per $1,000 market value or $0.01450 per $1 AAI	
Insurance rate	$8.75 per $1,000 market value or $0.00875 per $1 AAI	
Straight-line depreciation per year $= \frac{(P - S)}{N} = \frac{(190{,}000 - 38{,}000)}{8}$	$19,000.00	
Interest per year = AAI x I = $123,500 x 0.12	$14,820.00	
Property tax per year = AAI x 0.01450 = $123,500 x 0.01450	$1,791.00	
Insurance per year = AAI x 0.00875 = $123,500 x 0.00875	$1,081.00	
Total ownership cost per year (depreciation + interest + property tax + insurance)	$36,692.00	
Total ownership cost per SMH = $36,692 ÷ 1,600	$22.93	

OPERATION PORTION OF COSTS

		User values:
Fuel consumption per machine hour	2 gallons	
Actual machine hours per day	7.5	
Fuel consumption per SMH = 2 gallons x (7.5 actual machine hours ÷ 8 SMH)	1.9 gallons	
Fuel consumption per year = 1.9 gallons x 1,600 SMH	3,040 gallons	
Cost of fuel per gallon	$0.80	
Fuel cost per year (3,040 gallons x $0.80)	$2,432.00	
Fuel cost per SMH (1.9 gallons x $0.80)	$1.52	
Lubrication and oil cost per year ($0.20 x $1 fuel = 0.20 x $2,432)	$486.00	
Lubrication and oil cost per SMH ($0.20 x $1 fuel = $0.20 x $1.52)	$0.30	
Repair and maintenance per year (50% of $19,000 depreciation)	$9,500.00	
Repair and maintenance per SMH ($9,500 ÷ 1,600)	$5.94	
Subtotal operating costs per year	$12,417.00	
Subtotal operating costs per SMH ($12,417 ÷ 1,600)	$7.76	
Tire–replacement cost per SMH $= \frac{\text{replacement cost}}{\text{estimated life in SMH}} = \frac{\$10,000}{3,333}$	$3.00	
Tire–replacement cost per year ($3.00 x 1,600)	$4,800.00	
Total operating cost per year	$17,217.00	
Total operating cost per SMH	$10.76	

TOTAL EQUIPMENT COST

Ownership and operation cost per year	$53,909.00	
Ownership and operation cost per SMH	33.69	

The total equipment cost shows that for each hour the loader is scheduled to work it must recover $33.69 to break even. This is the amount a crew on a monetary–incentive system would be charged hourly for use of the loader. A daily charge could also be determined from this cost.

An Example of Marginal-Cost Calculation

This example calculation is for an old cable loader for which purchase price and estimated equipment life are difficult to establish. Values are averages from two Pacific Northwest companies. Readers may wish to fill in their own values for an old machine on the right.

The average annual investment (AAI) in marginal-cost calculation is the current market value of the piece of equipment. For simplicity of calculation, the market value is set at the fair market value at the beginning of the year. Tire and wire-rope replacement costs are included in the current market value with this method. (These items may also be estimated separately. The section, "Tire, Track, and Wire-Rope Replacement" gives an example of estimating wire-rope cost from production.)

OWNERSHIP PORTION OF COSTS

		User values:
Current market value (CMV), including tires and wire-rope	CMV = $40,000	_____
Estimated market value at end of year	$30,000	_____
Estimated scheduled machine hours (SMH) per year (200 8-hour shifts)	SMH = 1,600	_____
Company interest rate (I), or marginal rate of return (MARR)	I = 12% (0.12)	_____
Property tax rate	$14.50 per $1,000 CMV or $0.01450 per $1 AAI	_____
Insurance rate	$8.75 per $1,000 CMV or $0.00875 per $1 AAI	_____
Depreciation per year ($40,000 – $30,000)	$10,000.00	_____
Interest per year (CMV x I = $40,000 x 0.12)	4,800.00	_____
Property tax per year (CMV x 0.01450 = $40,000 x 0.00875)	580.00	_____
Insurance per year (CMV x 0.00875 = $40,000 x 0.00875)	350.00	_____
Total ownership cost per year (depreciation + interest + property tax + insurance)	15,730.00	_____
Total ownership cost per SMH ($15,730 ÷ 1,600)	9.83	_____

Note that the marginal-cost method yields a lower ownership cost ($9.83 per SMH) than the average-cost method ($22.93 per SMH). This difference is significant when a company plans bids on timber sales or charges for a piece of equipment. The operating-cost estimate will be higher than with the average-cost method because of equipment age.

OPERATION PORTION OF COSTS

Fuel consumption per machine hour	2 gallons	
Actual machine hours per day	7.5	
Fuel consumption per SMH = 2 gallons x (7.5 actual machine hours ÷ 8 SMH)	1.9 gallons	
Fuel consumption per year = 1.9 gallons x 1,600 SMH	3,040 gallons	
Cost of fuel per gallon	$0.80	
Fuel cost per year	$2,432.00	
Fuel cost per SMH	$1.52	
Lubrication and oil cost per year	$486.00	
Lubrication and oil cost per SMH	$0.30	
Repair and maintenance per year (estimates of actual cost)	$15,000.00	
Repair and maintenance per SMH ($15,000 ÷ 1,600)	$9.38	
Total operating costs per year	$17,918.00	
Total operating costs per SMH ($17,918 ÷ 1,600)	$11.20	

TOTAL EQUIPMENT COST

Ownership and operation cost per year	$33,648.00	
Ownership and operation cost per SMH ($33,648 ÷ 1,600)	$21.03	

Note that total equipment cost is $33.69 per SMH with the average-cost method and $21.03 per SMH with the marginal-cost method.

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Appendix A: Daily Production and Compliance Report

Below is an example form for collecting cost and production data for a single work shift.

DAILY PRODUCTION AND COMPLIANCE REPORT

IDENTIFICATION

SALE NAME: UNIT NUMBER _____

DATE _____ DAY OF WEEK S M T W TH F S

TYPE OF COMPLIANCE WORK (IF ANY) _____

CREW INFORMATION

NAME	HOURS (TOTAL)	COMPLIANCE WORK HOURS

EQUIPMENT INFORMATION

EQUIPMENT ID	HOURS TOTAL	HOURS COMPLIANCE	DOWN TIME/REASON	FUEL

PRODUCTION

NO. OF TRUCKS LOADED AT LANDING _____

LOAD ID NUMBERS: FROM _____ TO _____
FROM _____ TO _____

ESTIMATE OF COMPLIANCE WORK COMPLETED (ACRES, STATIONS) _____

MISCELLANEOUS

LANDING CHANGE TIME _____ TEMPORARY-ROAD AND SKIDTRAIL CONSTRUCTION TIME _____

COMMENTS: _____

FORM FILLED OUT BY: _____

Appendix B: An Overview of the Oregon Workers' Compensation System

The National Council on Compensation Insurance (NCCI) collects payroll and claims statistics annually from insurance carriers and uses the information to develop annual "pure" premium rates that are limited to the amount required for payment of claims and that exclude expenses of individual insurance carriers. The carriers modify the NCCI rates to cover administrative and business expenses. Rates differ by industry classification according to relative hazard.

The rates for Oregon carriers may be twenty-five percent greater than those established by the NCCI. The cost of claims is transferred directly to the insured in the form of premiums. The 1986 rate for logging in Oregon was approximately $27 per $100 of payroll, the $27 premium paid by the logging company.

Classification rates vary slightly among insurance carriers. Some give a preferred rate, which can reduce premiums as much as 10 percent for those companies with consistently good safety records that pay a certain minimum amount each year. Classification rates, updated annually by NCCI, take effect on January 1. If the insured company has a premium period other than January 1 to December 31, the rates at the time of premium renewal remain in effect for the entire premium period. A revised rate is assigned at the start of the next period.

The classification rates are adjusted in four ways before a final premium is set. The adjustments are an experience modification, a premium discount, a Workers' Compensation Department tax, and a workday tax.

Experience Modification

The experience modification rating is the means by which manual rates based on job classification averages can be adjusted to reflect loss expectations of an individual company. Deviation from the average rate is modified according to the claim characteristics of the insured. If losses are lower than expected, the manual rates are adjusted downward; if higher than expected, the rates are adjusted upward. The actual and expected losses of an insured company are calculated by the NCCI over a base period, usually 3 years.

The experience modification is calculated on the first 3 of the preceding 4 years. For example, the experience rating for policy year 1987 would be calculated from company claims statistics for 1983, 1984, and 1985. The NCCI weights frequency of accidents higher than severity of accidents; therefore, a company with many minor accidents may have a higher rate than a company with one or two severe ones.

Experience modification has several implications for monetary-incentive programs. First, a company with one or two bad safety years in the previous 4 years will pay a high rate even though a current crew (which might be new) has a good safety record. Second, the experience rating is determined for the company as a whole; a safe crew will pay for an unsafe one. A company with several crews may need to devise a system for deducting incentive pay from a crew having frequent accidents. A well-administered monetary-incentive program should not cause an increase in accidents because of haste or carelessness. Members of yarding and loading crews can be made aware that experience-modification rates can bring the cost of Workers' Compensation down and increase the incentive pay available.

Premium Discount

A discount, based on the expected adjusted premium during a policy year, is applied after experience modification. No discount applies to the first $2,500 of the annual premium. For 1986, premium discounts were as follows:

Adjusted premium	Discount
$2,501 to $10,000	6%
$10,001 to $30,000	10%
$30,001 to $50,000	12%
$50,001 +	14%

Worker's Compensation Department Tax

A tax is applied to the net premium (experience-modification premium minus premium discount) in order to cover the administrative costs of the Workers' Compensation Department and the Workers' Compensation Board. The rate, set by the Oregon State Legislature, is the same for all companies and remains in effect for the entire policy period. For 1986, it was 12 percent of the net premium.

Workday Tax

A tax is assessed for each day or part day worked by each employee. Since January 1, 1984,

the rate has been $0.26 per full day or part day per employee. The worker contributes $0.14 and the employer the remaining $0.12. This tax is used to support the Handicapped Workers' Reserve Fund, the Workers' Reemployment Reserve Fund, and the Retroactive Reserve Fund.

BUSHMAN, STEPHEN P., and ELDON D. OLSEN. 1987. DETERMINING COSTS OF LOGGING–CREW LABOR AND EQUIPMENT. Forest Research Laboratory, Oregon State University, Corvallis. Research Bulletin 63. 22 p.

Small, independent logging contractors can benefit from the established procedures of cost control and cost planning compiled in this report. Ways of tracking labor and equipment costs of a logging crew and the production records available for determining the volume removed from an area for a given time are described. Example costs are from Oregon contractors, but the principles can apply to logging companies elsewhere. Cost and production for a given time period can be used to determine the unit cost of production.

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Address Correction Requested