

Construction Equipment Management for Construction of Dam Site

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Abstract: *The dam site engineering and construction works are one of the biggest project continuing and progressing day by day. Dams are very important structures as it deals with the major irrigation projects and water resource planning the dam site is large and takes much area and also require high endeavor for each of its work packages however most important part then remains as the execution of work and handling of large equipments and machineries. The economic dam site is one which is handled with economy of equipments thus here the part of concern is to have proper planning and management of equipments on dam site. Another part of concern is to complete the project on time where time for dam site is most important as the project is planned with proper weather forecasting and for efficient dam its also important to have the structure a good quality. Thus these three factors as economy, time, quality contributes to many factors of resources but much affected by equipments.*

Keywords: ownership cost, Operating cost, maintenance and repairs, equipment life

1. Introduction

The management of heavy construction equipment is a difficult task. Equipment managers are often called upon to make typical economic decisions involving the machines in their uses. These papers include those concerning acquisitions, maintenance, repairs, rebuilds, replacements, and retirements. The equipment manager must also be able to forecast internal rental rates for their machinery. Repair and maintenance expenditures can have significant impacts on these economic decisions and forecasts.

It is a management tool for planning and budgeting deferred maintenance capital improvement, equipment repair and replacement, and construction projects. The documentation begins at the ground level with identification of deferred maintenance, capital improvement, construction, and equipment replacement and repair needs by field station managers.

The Indian Construction Equipment sector has an estimated market size of 8.4 to 9.4 l Crores for the year 2015. The industry has been growing due to the large investments made by the Government and the private sector infrastructure developments.

2. Ownership Cost

Ownership costs are fixed costs. Almost all of these costs are annual in nature and include:

- Initial capital cost
- Depreciation
- Investment (or interest) cost
- Insurance cost
- Taxes
- Storage cost.

3. Total Ownership Cost

Total equipment ownership cost is calculated as the sum of depreciation, investment cost, insurance cost, tax, and storage cost. As mentioned earlier, the elements of ownership cost are often known on an annual cost basis. However, while the individual elements of ownership cost are calculated on an annual cost basis or on an hourly basis, total ownership cost should be expressed as an hourly cost. After all elements of ownership costs have been calculated, they can be summed up to yield total ownership cost per hour of operation. Although this cost may be used for estimating and for charging equipment cost to projects, it does not include job overhead or profit. Therefore, if the equipment is to be rented to others, overhead and profit should be included to obtain an hourly rental rate.

4. Cost of Operating Construction Equipment

The operating costs vary with the amount of equipment used and job-operating conditions. The best basis for estimating the cost of operating construction equipment is the use of historical data from the experience of similar equipment under similar conditions. If such data is not available, recommendations from the equipment manufacturer could be used.

4.1 Maintenance and Repair Cost.

The cost of maintenance and repairs usually constitutes the largest amount of operating expense for the construction equipment. Construction operations can subject equipment to considerable wear and tear, but the amount of wear varies enormously between the different items of the equipment used and between different job conditions. Generally, the maintenance and repair costs get higher as the equipment gets older. Equipment owners will agree that good maintenance, including periodic wear measurement, timely attention to

recommended service and daily cleaning when conditions warrant it, can extend the life of the equipment and actually reduce the operating costs by minimizing the effects of adverse conditions.

4.2 Tire Cost.

The tire cost represents the cost of tire repair and replacement. Because the life expectancy of rubber tires is generally far less than the life of the equipment on which they are used on, the depreciation rate of tires will be quite different from the depreciation rate of the rest of the vehicle. The repair and maintenance cost of tires as a percentage of their depreciation will also be different from the percentage associated with the repair and maintenance of the vehicle. Tire repair cost can add about 15% to tire replacement cost. So, the following equation may be used to estimate tire repair and replacement cost:

4.3 Consumable Costs

Consumables are the items required for the operation of a piece of equipment that literally gets consumed in the course of its operation. These include, but are not limited to, fuel, lubricants, and other petroleum products. They also include filters, hoses, strainers, and other small parts and items that are used during the operation of the equipment.

4.4 Fuel Cost

Fuel consumption is incurred when the equipment is operated. When operating under standard conditions, a gasoline engine will consume approximately 0.06 gal of fuel per flywheel horsepower hour (fwhp-h), while a diesel engine will consume approximately 0.04 gal/fwhp-h. A horsepower hour is a measure of the work performed by an engine. The hourly cost of fuel is estimated by multiplying the hourly fuel consumption by the unit cost of fuel.

4.5 Mobilization and Demobilization Cost

This is the cost of moving the equipment from one job site to another. It is often overlooked because of the assumption that the previous job would have already paid for it. Regardless of these calculations, the costs of equipment mobilization and demobilization can be large and are always important items in any job where substantial amounts of equipment are used.

4.6 Equipment Operator Cost

Operator's wages are usually added as a separate item and added to other calculated operating costs. They should include overtime or premium charges, workmen's compensation insurance, social security taxes, bonus, and fringe benefits in the hourly wage figure. Care must be taken by the companies that operate in more than one state or that work for federal agencies, state agencies and private owners. The federal government requires that prevailing scale (union scale) of wages be paid to workers on its project regardless of whether the state is a union state or not. This is a requirement of the Davis Bacon Act and most federal contracts will contain a section in the general conditions that

details the wage rates that are applicable to each trade on the project.

4.7 Special Items Cost

The cost of replacing high-wear items, such as dozer, grader, and scraper blade cutting and end bits, as well as ripper tips, shanks, and shank protectors, should be calculated as a separate item of the operating cost. As usual, unit cost is divided by the expected life to yield cost per hour.

5. Equipment Life

Construction equipment life can be defined in three ways: physical life, profit life, and economic life. Figure shows graphically how these different definitions relate to the life cycle of a typical piece of equipment. One can see in the graph that over the physical life of the machine, it takes some time for the new machine to earn enough to cover the capital cost of its procurement. It then moves into a phase where the equipment earns more than it costs to own, operate, and maintain, and finishes its life at a stage when the costs of its maintenance are greater than what it earns during the periods when it is in operation

5.1 Physical Life

Physical life is the age at which the machine is worn out and can no longer reliably produce. At this point, it will usually be abandoned or scrapped. As construction equipment ages. Maintenance and operating costs increase. The length of a piece of equipment's physical life and the rate at which its operating costs rise are affected by the care it receives while in use, the nature of the job it is doing, and the quality of the maintenance it receives. The axiom holds that regular expenditure of small amount of money for preventive maintenance abrogates the need to spend a large amount of money to replace major operating components. Thus, two completely identical pieces of equipment could in fact have widely varying physical lives depending on their maintenance and the severity of their operating conditions.

5.2 Profit Life

Profit life is the life over which the equipment can earn a profit. The retention beyond that point will create an operating loss. This essentially is the point where the machine seemingly spends more time in the repair shop than it does on the project site. Increasingly costly repairs exacerbate profit life as major components wear out and need to be replaced. Thus, the equipment manager must be able to identify when a particular machine is nearing or has reached this point and plan to replace it with a new machine while the major components are still functional.

5.3 Economic Life

Economic life equates to the time period that maximizes profits over the equipment's life. Equipment owners constantly strive to maximize production while minimizing the cost of production. Thus, selecting economic life span as the metric to make the equipment replacement decision is in

fact optimizing production with respect to profit. Therefore, the proper timing of equipment replacement prevents an erosion of profitability by the increased cost of maintenance and operation as the equipment ages beyond its economic life. Owners can determine the most economical time to replace the equipment by keeping precise records of maintenance and repair costs. Determination of the appropriate timing to replace a piece of equipment requires that its owner include not only ownership costs and operating costs, but also other costs that are associated with owning and operating the given piece of equipment. These include depreciation, inflation, investment, maintenance, repair, downtime, and obsolescence costs.

6. Maintenance and Repair Costs

Maintenance and repair costs are the crux of the equipment replacement decision and result from the cost of labor and parts used to maintain and repair the given piece of equipment. This is an incredibly dynamic system and can be affected by the following factors:

- Type of equipment.
- Age of the equipment.
- Operating conditions.
- Operating skill of the operator.
- Daily care by the operator.
- Maintenance department.
- Frequency and level of preventive maintenance.
- As a result, it is very important to keep accurate cost records to estimate maintenance and repair costs.

7. Acquiring Heavy Equipment

In the current construction marketplace, equipment manufacturers, used equipment brokers, and rental companies provide a means for a user with proper credentials and competence to acquire just about any heavy construction machine available on a temporary or permanent basis. There are numerous options to consider when deciding on heavy equipment acquisition and financing. Traditionally, the equipment purchase process was complete when the contractor selected a specific make and model of machine from a dealer. The buyer received financing with a down payment, often the trade-in of an older piece of equipment. The new piece of equipment was the loan security.

7.1 Leasing

Over the past several years there has been an increasing trend toward leasing as a way to finance construction equipment. It is usually easier to gain financial approval for equipment under a lease program than through conventional purchase financing. The lessee does not own the equipment and it is not shown as an asset on financial statements. Most leases run from 18 to 24 months. For large expensive equipment, leases can run as long as 84 months

7.2 Renting

The most obvious disadvantage of straight-out equipment rental is that there is no option for accruing equity.

Equipment rental has no impact on the balance sheet. It does, however, impact cash out-of-pocket. Rental payments reduce the company's earnings as an operating expense and since the equipment is not owned, there is no impact on depreciation. Dealer equipment rental programs offer many of the same advantages or benefits of lease programs. The contract period for rental provides complete flexibility, with contract periods as brief as a day or a week or as long as a month or a year.

8. The Buy, Lease, Or Rent Decision

Construction Accounting and Financial Management. The suggests the optimal approach for equipment acquisition based on customer needs or criteria.

As stated before, the buy, lease, or rent decision is most influenced by how long the equipment is needed. A short period of utilization favors renting and a longer period favors leasing or purchase. Along with the discussed financial analysis and comparison there are many non quantitative areas to be considered prior to the decision:

- Work volume.
- Nature and types of construction projects.
- Client requirements and expectations.
- Reputation and company perception to potential clients.
- Funding capabilities.
- Long-term financial goals.
- Relationship with equipment supplier.
- Company ownership policy.

A study of the acquisition and finance alternatives comes after identification of the need for a piece of equipment. This evaluation is a key component in the financial planning of the construction firm.

9. Objectives and Goals of Equipment Management

Maintenance objectives fall in two categories: the primary objective and the secondary objective. The primary objective of maintenance is the repair and upkeep of production equipment to ensure that it is kept in a safe and effective operating condition so that production targets can be met on time, in budget, and in good quality. The secondary objective of maintenance is to perform approved maintenance and repair work to the extent that such maintenance work does not reduce the planned operating hours per year upon which the equipments' hourly rental rates are predicated. Objectives help to ensure that the intended maintenance program can be carried out effectively. The fundamental objectives of a good planned maintenance program are as follows.

- Eliminate unnecessary maintenance
- Reduce work cost
- Reduce overall maintenance cost
- Reduce repair parts inventory
- Reduce lost production caused by failure during normal shift
- Increase productivity
- Extend the operating life of construction equipment

- Increase overall profit generated by equipment.

10. Conclusions

The described type for the selection of construction equipment has suggest its results in actual construction processes cases and has been of help to the persons responsible for this kind of decisions. Although some time and effort has to be invested in the development of all the criteria for each of the equipment involved in a construction project the decisions can be supported on a scientific method, thus being able to take fewer risks when purchasing equipment.

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