# Planning for Equipment

## Learning Outcomes

**By the end of this unit the learner will be able to:**

- ✓ Describe the process of equipment selection and planning
- ✓ Identify the role of financing and hire purchase options in equipment planning.

# Planning for  Equipment

During the planning stage, we may run across a situation where two different equipments can perform the same function but have to decide which one to choose. The equipment planner has to determine which one is most suitable for the task. The planner will have to calculate the production rates of the 2 equipments in order to select the lowest cost option. This unit will show you how to go about planning, selecting and matching the most suitable equipment to specific functions using some effective procedures to accomplish this feat.

## Equipment Selection

The following factors should be considered when selecting equipment to perform a function:

- Equipment productivity
- Product features and attachments
- Supplier support
- Cost

## Equipment Productivity

Determining the ideal size of equipment required to undertake task of known quantity and at a competitively low cost can be quite tricky. The best way to tackle such problem of ideal equipment size is to use past experience from suppliers of the equipment and the owner's own experience. Most suppliers are able to provide information of equipment performance under different operating conditions.

It is important to determine what is the primary use of equipment and also, identify other potential secondary functions. The primary usage is what determines the size of equipment and the extra features or attachments that would be suitable for the equipment to perform productively.

The productivity of equipment is usually influenced by the conditions of operation. In order to define equipment productivity, it is essential to understand all likely condition of operation because some equipments work best under certain condition than others. Experience and judgement would be required to understand local conditions such as the climate, topography and soil conditions.

When transporting large equipments, it is advisable to find out any legal restriction or laws governing these movements on local road networks. Permits for transporting equipment should be sought before proceeding. Alternatively, the equipment could be partially disassembled before transporting and reassembled again on the work site.

The operator's wage should also be considered when determining the size of equipment to use. Large equipment size coupled with high productivity will cause an increase in the wage bill of the operator. Also, obtaining equipment which is too large may not be economical. In contrast, when the equipment is too small for a particular work, it may have to undergo frequent maintenance and repair works.

## Product Features and Attachments

When contemplating features and attachments for equipments, it is important to evaluate the impact of these extra gadgets on the overall performance of the equipment you are thinking of enhancing. Generally, these attachments or extra features are intended to increase the productivity of machinery and improve the safety of workers. Careful analysis should determine all advantages and disadvantages of procuring attachments before actually renting or purchasing them.

Examples of how to increase productivity of equipment include:

- Using the right equipment with suitable attachment would increase productivity. You may increase a wheel loader's productivity by using extra features such as an automatic bucket control and other special purpose buckets depending on the nature of the task at hand
- Proactive diagnosis and adequate maintenance will help prevent equipment downtime and make it available for more work

The project's owner is directly responsible for the workers' safety. He must always take the safety of his workers seriously. The safety of workers must always be guaranteed by ensuring that warning signs and lights are properly displayed to ward of hazards, fire extinguishers are available, and all vehicles are fitted with working windshield wiper and seatbelts.

The correct type of tyres and tracks should be used, depending on prevailing conditions. Owners should work with suppliers to find the best and most economical equipment solution to problems with the help of previous records, experiences and regulations.

## Supplier Support

The equipment supplier is expected to play a pivotal role during the lifetime of the equipment on the work site. Replacement spare parts, servicing and guidelines of how to use the equipment optimally should be sought from the supplier. Support may involve regular inspection of equipments, serving and pre-negotiated price of purchasing the equipments from the owner. Alternatively, the arrangement could entail getting and using the equipment on short or long term lease.

## Cost

Besides all of the above points, one last factor to consider when obtaining equipments is the cost. This should be considered along with costs of servicing, maintenance and repairs and reselling. The decision to buy equipment should not only be based on the cost, but also the associated cost of operating the equipment should be considered.

## Equipment Planning

Equipment Planning refers to the steps that are taken to procure equipment and any strategy of implementation, which will put the equipment to good use in an economical way when the project takes off. This includes making detailed plans of different work cycles ahead of time and then getting the right equipment to carry activities to meet project objectives. In order to schedule projects, it is important to design an operational plan of activities as part of the overall project plan. Projects plans should highlight the objectives, which need to be satisfied, as well as, the procedures and methods required to meet these objectives.

After finalising all activities that need to be executed during the project lifespan, the next step requires specifying the equipments to e used to carry out the activities. It is also important to specify in the plan how the equipments will be used and the sequence in which they must be used. Next, the category or class and the number of equipments are also determined based on the production rates specified for the time-bound activities.

To arrive at reliable and realistic plan for equipments, the planning team has to have the required knowledge and experience of a similar sort of work. The team must be highly competent to make good decisions during the equipment planning phase. The planning team should also be highly skilled in analytical techniques such as the critical path method (CPM) to enable them carryout this important task of assigning equipment to each activity.

A time grid network of histograms shows how much equipment will need to be used and the duration of utilization is then developed. Equipments can only be used for duration of about 75% of its economic life on a project. Also, do not procure the maximum number of equipment at the start of the project. Instead, it is best to increase the number as the number of activities increase with progress of work. When a particular activity is completed as the tempo of work declines, the equipment should be transferred to another project in accordance with the project plan.

## Matching of Construction Equipment and Plant

Construction jobs require several plants and equipments to execute scheduled activities to meet all objectives of the project. These plants and equipments are deployed in a manner so that they work in a particular combination to produce the final outcome. For instance, the construction of a concrete dam requires several activities which are carried out using different types of equipment and plants at the same rate in such a manner that there will be no stoppage until the final product is achieved. This entails continuous availability of functioning equipment and raw materials by matching or synchronising the equipments and plants.

Still, when constructing a dam, we expect uninterrupted synchronisation of all activities between the aggregated crushing processes, conveyor system, the concrete mixer, the concrete transporting vehicles such as the agitator trucks, dump truck or cranes and the concrete vibrator. Each of these equipments should work at the same rate as the previous one and should be capable of handling all materials assigned to it; otherwise the entire production may be stalled or interrupted leading to additional cost being incurred.

## Construction Plant and Job Layout

The project overseer is tasked with preparation of the job site layout. The layout consists of scaled drawings of all items to be used on the construction site. Items include space for offices, material storage, warehouses, steel members and section, construction forms, assembly point etc. The rule for an excellent layout is to ensure the area are properly arranged to reduce the time it takes to transport materials from storage area to the project area. The time taken to move equipment to the work site should also be minimal.

Equipments and materials for similar purposes should be stored together. Cement bags should be stacked in such a way that the older bags, which were delivered for storage, will be used first before the newer ones are. For example, the layout at a dam's construction site should be designed to accommodate multi-

functionality of equipments and provide adequate room for manoeuvring during the execution of activities such as hoisting, shifting, frameworks, positioning reinforced bars and blasting, which are all undertaken in the construction of a dam.
The layout should be designed so that it can regulate and systematize itself and be able to teach a large number of works in such a manner that they can learn how things should function on the job within a short time. Thus, the whole project becomes fixed when the equipments are selected and the layout subsequently developed, making the job a done deal, provided the right equipments have been procured and the layout are reliably functional. When done right, costly mistakes which slow down progress could be avoided altogether.
It is instructive to build a small model of the layout to check the validity of actual layout and equipments. The model also helps to bring out any hidden aspects which were previously overlooked during the layout design phase. Models of some equipment can serve as a guide in obtaining critical information and provide guarantees before embarking on large scale procurement and operations which require substantial capital.

## Financing

It is best if a contractor obtains equipment for construction work through financial arrangements with third parties such as banks. This way, he will conserve his own capital to take care of other aspects of his business.
Ways to finance equipments includes:

i) Entering into financial contract with suppliers. This arrangement usually requires a down payment of between 10-15% of the cost of equipment and the remainder paid via monthly instalments. This arrangement usually results in the issuance of a note and conditional sales contract showing records of credit, debt and monthly payments of the principal and interest rate to be made. The supplier retains ownership of the equipments until the contractor make the last payment. However, with this type of arrangement, the interest rate is usually astronomical and may even reach more than 50% of what the supplier obtains from the bank or the interest may even be based on the full value of the equipment until full payment is made. This type of arrangement should be avoided due to double interest rate charges. A buyer (contractor) with good credit rating may negotiate for interest payment to be made on declining balance at each stage of repayment and not based on the full cost of equipment.
ii) Another way to secure financing is through commercial corporations purposely created to finance purchase of construction equipments. But this method is also expensive as these companies tend to charge high interest rates on the full cost of equipment, even though this interest rate may be considered as income tax deduction.
iii) Equipment leasing companies buy equipment and rent them out to customers. These companies may consist of banks or other groups of companies who decided to come together to undertake such ventures.
iv) The contractor or buyer may approach the bank directly if he has a good credit rating and sufficient cast at hand. He will be required to furnish the bank with equipment note which lists equipment items and their cost prices. A cash discount of 10-15% of the cost's price can be secured to pay the supplier. Banks tend to finance approximately 75% of the cost of equipment and the remaining 25% is financed by the contractor. Loan terms are more favourable with regards to repayment date

and interest rates. Light duty equipment, heavy duty equipment and ultra heavy duty equipment require 2, 3 and 4 years respectively for repayment of loans. Payment is usually on monthly or quarterly basis. The banks must be informed and duly paid any difference due before the equipments are sold or transferred outside the country.

## Hire-Purchase Options

To acquire additional equipment, the contractor may:

- Purchase
- Rent with option to purchase the equipment
- Lease the equipment

It is usually more economical to purchase the equipment if it is for long term use, while it is better to rent when short term use is being considered. To help in making the right decision with regards to which approach to choose, cost analysis should be carried out.

## Advantages of Purchasing Equipment

- Regular availability of equipment
- Frequency of use is higher
- Equipment is likely to be well-maintained

## Disadvantages of Purchasing

- It is more expensive
- There are opportunity costs of using personal finance to purchase equipment. It could be used for other investments
- Equipment may become obsolete with time as newer ones arrive on the scene
- Purchasing specialize equipment may close the door to other profitable opportunities somewhere else which would require the use of different equipment
- There is temptation to use the equipment beyond its expected lifetime resulting in lower productivity

Renting is usually ideal when the equipment is for short term use only. But the cost of rent can be quite high, as well. A second option for renting with the option to buy can also be considered. This is ideal when the contractor believes he can use the equipment to perform sufficient work but is unsure of how much equipment time is involved. This arrangement can result in high rental rates than normal.

## Owning and Operating Cost

Different methods of determining the cost of owning and operating equipment exist but, the best method is only capable of providing just an estimate of the true cost. One way of determining operating costs is to glean information from previously used equipment records but, this is subject to conditions under which it was used. Factors such as cost of equipment, conditions of operating equipment, duration of use per year (i.e., the total amount of hours used), age of equipment, maintenance and repair conditions, and the demand for the equipment on the used equipment market should help determine the cost of owning and operating the equipment.

To estimate the cost of owning and operating equipments without any past records, the buyer should consider calculating costs associated with the following: capital investment and depreciation, repairs and maintenance, and fuel and lubricant costs.

## Further Reading:

- ✓ ***Peurifoy, (2010), Construction Planning, Equipment and Method***
- ✓ ***Robert Peurifoy, Clifford J. Schexnayder, Aviad Shapira, Robert Schmitt, (2010), Construction Planning, Equipment, and Methods***