



UNIT-6

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.

Unit 6

Planning for Equipment

During the planning stage, we may come across a situation in which two different pieces of equipment performing the same function are available; we must then decide which one to choose. The equipment planner has to determine which one is more suitable for the task. The planner will have to calculate the production rates of the two pieces of equipment in order to select the lower-cost option. This unit will show you how to go about planning, selecting and matching the most suitable equipment for specific functions using some effective procedures to accomplish this task.

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 a task of known quantity and at a competitively low cost can be quite difficult. The best way of determining the 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 on equipment performance under different operating conditions.

It is important to determine the primary use of the equipment as well as other potential secondary functions. The primary usage is what determines the size of equipment and the extra features or attachments that will enable 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 conditions of operation because some equipment works better under certain condition than others. Experience and judgement will be required to understand local conditions such as climate, topography and soil conditions.

When transporting large items of equipment, it is advisable to ascertain any legal restrictions or laws governing these movements on local road networks. Permits for transporting equipment should be sought before proceeding. Alternatively, the equipment might be partially disassembled before transporting and reassembled on the work site.

The operator's wage should also be considered when determining the size of equipment to use. Large pieces of equipment coupled with high productivity will cause an increase in the operator's wage bill. In addition, it may not be economical to obtain equipment that is too large. In contrast, when the

equipment is too small for a particular job, it may have to undergo frequent maintenance and repair work.

Product Features and Attachments

When contemplating features and attachments for equipment, it is important to evaluate the impact of these extra gadgets on the overall performance of the equipment you are seeking to enhance. 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 the advantages and disadvantages of procuring attachments before actually renting or purchasing them.

Examples of how to increase productivity of equipment include the following:

- Using the right equipment with suitable attachments will increase productivity. You might 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 wipers 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, experience 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 on how to use the equipment optimally should be sought from the supplier. Support may involve regular inspection of equipment, servicing and pre-negotiating the price of purchasing the equipment from the owner. Alternatively, the arrangements might entail procuring and using the equipment on a short- or long-term lease.

Cost

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

Equipment Planning

Equipment planning refers to the steps that are taken to procure equipment and any strategy of implementation that will put the equipment to good use in an economical way when the project gains

momentum. This includes making detailed plans of different work cycles in advance and then procuring 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. Project plans should highlight the objectives to be achieved 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 is to specify the equipment to be used to carry out the activities. It is also important to specify in the plan how the equipment will be used and the sequence in which it will be used. Then, the category or class and amount of equipment are determined based on the production rates specified for the time-bound activities.

To devise a reliable and realistic plan for equipment, the planning team must have the required knowledge and experience of 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 to carry out this important task of assigning equipment to each activity.

A time grid network of histograms shows how much equipment will be needed, and the duration of utilisation is then developed. Equipment can only be used on a project for about 75% of its economic life. Moreover, do not procure the maximum amount of equipment at the start of the project. Rather, it is advisable to increase the amount as the number of activities increases with the progress of work. When a particular activity is completed and 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 items of equipment to execute scheduled activities to meet all the objectives of the project. These plants and equipment are deployed in such a manner 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 equipment and plants.

Nevertheless, when constructing a dam, we expect uninterrupted synchronisation of all activities between the aggregated crushing processes, the conveyor system, the concrete mixer, the concrete-transporting vehicles such as the agitator trucks, dump trucks or cranes and the concrete vibrators. Each piece of equipment 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 costs 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 sections, construction forms, assembly points etc. The rule for

an excellent layout is to ensure that the area is properly arranged to reduce the time it takes to transport materials from storage area to project area. The time taken to move equipment to the work site should also be minimal.

Equipment 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. For example, the layout at a dam's construction site should be designed to accommodate multi-functionality of equipment and provide adequate room for manoeuvring during the execution of activities such as hoisting, shifting, frameworks, positioning reinforced bars, and blasting, all of which are undertaken in the construction of a dam.

The layout should be designed in such a way that it can regulate and systematise itself and be able to teach a large number of workers in such a manner that they will learn how things should function on the job within a short time. Thus, the whole project becomes fixed when the equipment is selected and the layout subsequently developed, making the job a 'done deal' provided the right equipment has been procured and the layout is reliably functional. When all this is done correctly, costly mistakes which slow down progress can be avoided altogether.

It is instructive to build a small model of the layout to check the validity of the actual layout and equipment. The model also helps to reveal any hidden aspects that were previously overlooked during the layout design phase. Models of equipment can serve as a guide to obtaining critical information and can provide guarantees before embarking on large-scale procurement and operations which require substantial capital.

Financing

It is advisable for a contractor to obtain equipment for construction work through financial arrangements with third parties such as banks. In this way, he/she will conserve his own capital to take care of other aspects of his business.

Ways of financing equipment include the following:

- i) Entering into financial contracts with suppliers. This arrangement usually requires a down payment of between 10-15% of the cost of equipment, with 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 equipment until the contractor has made 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; 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 a good credit rating may negotiate for interest payments to be made on a declining balance at each stage of repayment, rather than being based on the full cost of the equipment.
- ii) Another way of securing financing is through commercial corporations purposely created to finance the purchase of construction equipment. However, this method is also expensive as these companies tend to charge high interest rates on the full cost of the equipment, even though this

interest rate may be considered as income tax deductible.

- iii) Equipment-leasing companies buy equipment and rent them out to customers. These companies may consist of banks or other groups of companies who combine to undertake such ventures.
- iv) The contractor or buyer may approach the bank directly if he/she has a good credit rating and sufficient cash at hand. He/she will be required to furnish the bank with an equipment note listing the items of equipment and their cost prices. A cash discount of 10-15% of the cost price can be secured to pay the supplier. Banks tend to finance approximately 75% of the cost of equipment, with the remaining 25% being financed by the contractor. Loan terms are more favourable with regard to repayment dates and interest rates. Light, heavy and ultra heavy-duty equipment requires two, three and four years respectively for repayment of loans. Payment is usually on a monthly or quarterly basis. The banks must be informed and paid any difference due before the equipment is sold or transferred outside the country.

Hire-Purchase Options

To acquire additional equipment, the contractor may:

- Purchase
- Rent with an 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 reach the right decision with regard to which approach to choose, cost analysis should be carried out.

Advantages of Purchasing Equipment

- Regular availability of equipment
- Higher frequency of use
- 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. This finance might have been used for other investments.
- Equipment may become obsolete with time as newer equipment becomes available
- Purchasing specialised equipment may close the door to other profitable opportunities elsewhere that would require the use of different equipment.
- There is a 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 renting 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/she can use the equipment to perform sufficient work but is unsure of

how much equipment time will be involved. This arrangement can result in higher rental rates than normal.

Owning and Operating Costs

Different methods of determining the cost of owning and operating equipment exist, but the best method is only capable of providing a mere estimate of the true cost. One way of determining operating costs is to glean information from previous equipment records, but this is subject to the conditions under which it was used. Factors such as the cost of equipment, conditions of operating equipment, duration of use per year (i.e., the total number 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 equipment 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 (2019), Construction Planning, Equipment and Method*
- ✓ *Robert Peurifoy, Clifford J. Schexnayder, Aviad Shapira, Robert Schmitt (2020), Construction Planning, Equipment, and Methods*