

SBQ 2423

Estimating the Costs of Plant and Machinaries

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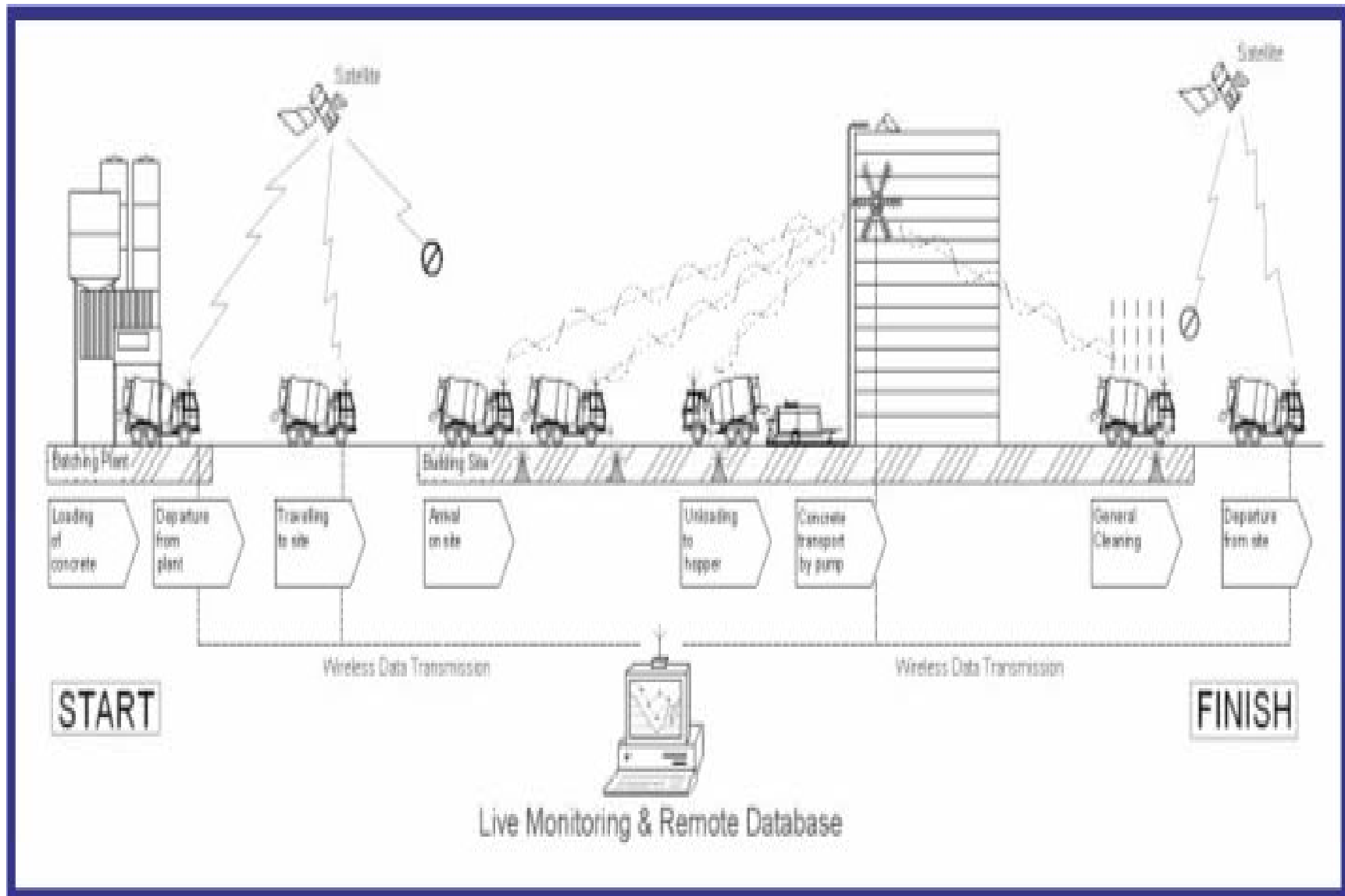
Lecture Topic

Estimating the Cost of Construction Equipment



Lecture Contents

- Introduction to Construction Equipment
- Equipment planning
- Equipment procurement sources and associated costs
- Construction tools



Introduction to Construction Equipment

- Equipment refers to all the equipment, tools and apparatus necessary for the proper construction and acceptable completion of a project.
- The construction equipment can be classified as;
 - Specific use
 - General use

Introduction to Construction Equipment (cont'd)

- Specific use – can only be used for either specific work item or items on the job.
- Can only be used for specific construction operations and is removed from the jobsite soon after the task is completed.
- Some typical equipment includes;
 - Tractors – heavy pushing and pulling works
 - Scrapers – load, haul and dump loose material
 - Front shovels – digging above the surface of ground
 - Hoes – excavation of pit, trenches
 - Loaders and backhoe loaders – handle and transport materials, excavate earth, backfill, loading and hauling unit
 - Hauling units – efficiently transport material
 - Compactor – perform soil compaction

Introduction to Construction Equipment (cont'd)

- General use – this type of equipment has shared utilisation by all subcontractors on the construction site and is not associated with any particular work items or item.
- Some examples of general use equipment include:
 - Cranes – lifting and moving loads as well as assisting installation process
 - Air compressors – generate pressurized air to power hand tools such as pneumatic nailers, concrete vibrator etc
 - Floodlight and light towers – provide illumination for work area
 - Forklifts – handle loading and unloading of heavy bulk loads
 - Pumps – moving water from a source to needed area on site

Equipment planning

- Construction requires large quantities of materials handling, horizontally and vertically.
- The complexity of an operation increases as the requirement for final placing or installation increases.
- In general, equipment is designed to perform certain mechanical operations.
- Each piece of equipment has different operational characteristics and it may not be obvious which piece is best for a particular job.

Equipment planning (cont'd)

- Equipment planning involves the gathering and analysis of relevant information on a project, establishment of a project's scope and the specification of limits on a project.
 - Factors relating to time, money, location, competitive resources and coordination requirement must be identified and established.
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Equipment planning (cont'd)

- Equipment planning must identify the work to be done and establish:
 - Equipment lists and procurement schedules
 - Equipment productivity and a desired construction schedule
 - Realistic cost estimates of equipment

Equipment planning (cont'd)

- Factors influencing equipment selection – there are many factors that can influence the selection of equipment. It can be grouped into 3 categories:
 - Site conditions
 - Nature of work
 - Equipment characteristic

Factors influencing equipment selection

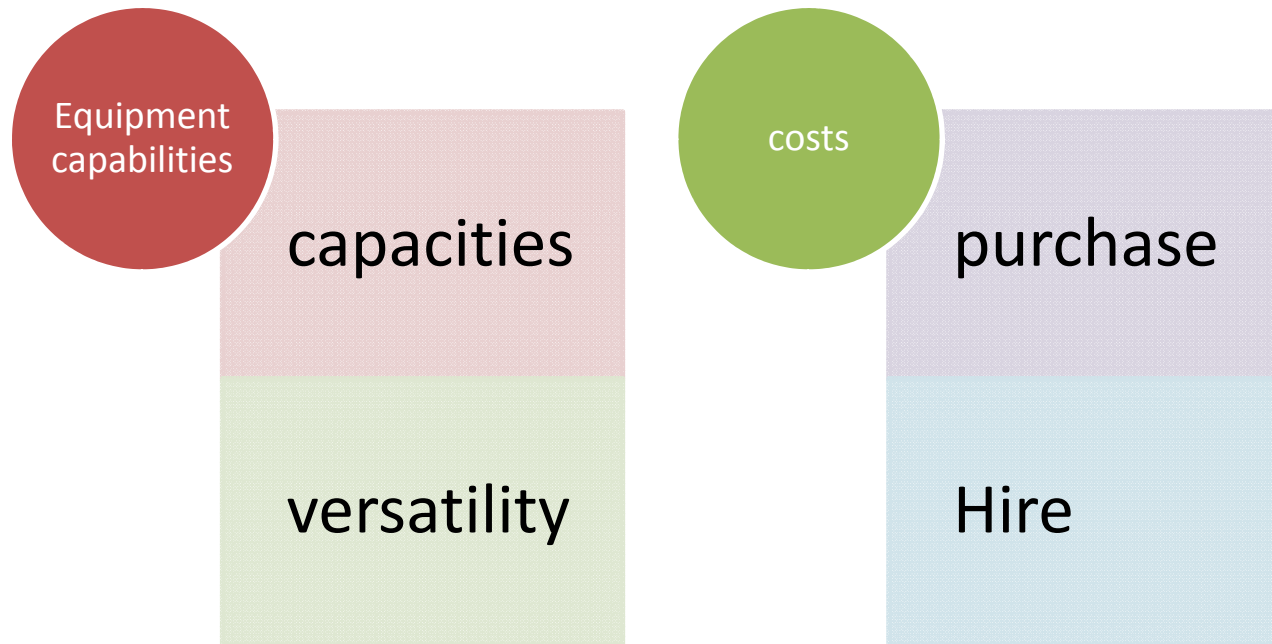
- **Site conditions** – primary site condition factors are:
 - Type of material to be handled, physical constraints on site and hauling distances.
 - Type of material to be handled – Eg. number of trees and their sizes
 - Physical constraints on site – Eg. Referring to site area and layout, surface condition, topography and adjacent neighborhood. The smaller the site area, the more straints it has on the mobility of equipment
 - Hauling distances – can affect the selection of equipment. For short haul, a loader can pick the load and move it to a dump area by itlself. But not economic for long distance.

Factors influencing equipment selection (cont'd)

- **Nature of work** – factors such as payload, total quantity of work and construction schedule .
 - Payload – direct relation with the capacity of the equipment selected. Eg. A crane must be able to lift the maximum load the work may require
 - Total quantity of work – can influence and justify the selection of higher capacity equipment
 - Construction schedule – a tighter schedule often requires higher productivity, thus, bigger capacity, more mobility and faster deployment

Factors influencing equipment selection (cont'd)

- Equipment characteristic – refers to equipment capabilities and costs.



Equipment capabilities

Capacities

- Maximum allowable payload and volume that can be handled

Versatility

- Degree of applicability of a unit to perform many different operations

Equipment procurement sources and associated costs

- Equipment costs rank second in uncertainty and their effect on the outcome of any anticipated profits from a job after labour costs.
- There is two type of equipment procurement namely;
 - Purchasing
 - Hire/rental

Equipment procurement sources and associated costs (cont'd)

- Purchasing of equipment gives the advantage to the contractor to have absolute control on the use and disposition of equipment.
- Costs associated with this option is known as ownership costs and it can be broken down into 6 categories;
 - Initial costs
 - Depreciation
 - Investment
 - Insurance
 - Tax
 - Storage

Initial costs

- Is the total cost a contractor pays to purchase a piece of equipment and have it shipped to a jobsite or equipment yard.
- Generally it is made of;
 - Price at the factory and used equipment price
 - Extra options and accessories
 - Sales tax
 - Freight
 - Assembly or setup charges

Depreciation

- Depreciation in cost estimating has two aspects:
 - A tax-deferred expense -
 - Decline in market value due to age, wear, deterioration and obsolescence.



Depreciation (cont'd)

- Cost against income that reduces the income taxes of incorporation

Investment Cost

- Investment cost represents the cost of investment or the tying up of a company's capital in equipment.
- If the capital used to purchase equipment is borrowed, the investment cost is the cost of the interest paid on that borrowed amount.



Insurance Cost, Tax and Storage Cost

- Insurance cost - Represents the cost of fire, theft, accident and liability insurance for equipment.
 - The tax amount - Covers licensing fees or any applicable taxes associated with the equipment.
 - Storage – all the costs directly associated with equipment storage such as the storage yard rental and maintenance, utilities and wages for the guards.
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Equipment Operating Costs

- Direct costs associated with equipment operations.
 - Unlike ownership cost, operating cost is not a fixed cost but a variable one, directly proportional to the amount of work performed or operating hours.
 - It is incurred only when the equipment is used.
 - Eg. Fuel, grease, Oil, Electricity, Tires and Repairs
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Equipment Operating Costs (cont'd)

- Mobilization and demobilization charges and operator charges are not included in equipment operating costs
- Operating costs vary from:
 - the type of equipment used
 - the nature of work
 - Working conditions of the equipment



Cost of Renting Equipment

- This is increasingly popular procurement method.
 - The primary advantage is the ability to procure the right piece of equipment for the job when the unit is needed.
 - It allows for more specific equipment selection as more choices are usually available from renters than the contractor's presently owned fleet.
 - Most rental companies calculate their rates on a monthly basis. And it varies from 2% -5% of the cost of equipment.
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Cost of Leasing Equipment

- The distinguishing factor between leasing and renting is the duration of time.
- Leasing equipment is often considered when a piece of equipment is needed for more than six months.
- A lease is a contract conveying business the right of use for a stated period of time, specified property, plant or equipment owned by another party in exchange for periodic rental payment.



Cost of Equipment Mobilization and Demobilization

- Equipment moving and setup costs or mobilization costs, dismantling or demobilization costs can be substantial and must be considered.
- Mobilization, demobilization and downtime costs can be added to the equipment procurement cost in order to determine the adjusted procurement cost for a piece of equipment.

Equipment Operator and Oiler

- The cost for an operator and oiler are not included under equipment costs but should be included under direct labour costs associated with the work.
- As with equipment operating costs, the cost for an equipment operator and oiler are variable costs that can be determined simply by multiplying the associated wage rate of the required craft with the operating hours of a specific piece of equipment.



Construction Tools

- This is vital components of the construction process.
- The development of tools has tremendously increased the productivity of construction work
- Therefore the use of proper tools can lead not only to greater work efficiency, but also reducing labour costs.
- Although it can be assumed that each subcontractor would furnish the necessary additional tools, the contractor would need to supply other miscellaneous tools.
- Eg. Wheelbarrows, buckets, rope, hoses, hammers and picks.
- As a markup on payroll, the cost of tools and minor equipment is about 3%- 6%

Reference and further readings

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The End

- Thank you