UNIT-1

Introduction to Construction Management

Learning Outcomes

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

- ✓ Discuss the key features of the Construction industry
- ✓ Understand the Role of Construction Supervisor
- ✓ Describe the importance of Construction Supervision, Inspecting and Testing Procedures.

Unit 1

Introduction to Construction Management

This unit presents a brief introduction to the construction industry. Construction is indeed one of the most important Industries on earth, dating backing to the beginning of civilisation. The evidence is all around us, serving as witnesses to the ingenuity of man. Relics of the construction prowess of ancient civilisations are dotted all over the modern world in Asia, North America, Europe, Africa, South America and many other regions. Some famous examples include the Pyramids of Egypt, the Taj Mahal of India, Roman Amphitheatres of Italy, and the Great Wall of China.

Modern construction has evolved from simple manual techniques into a complex maze of highly mechanised and orchestrated symphonies of activities, requiring billions of dollars in investment and serving as the second biggest source of employment in the world. Construction involves many field activities requiring the use of resources such as land, construction materials, labour, equipment and energy, etc., to achieve a pre-defined objective of raising structures such as roads, buildings, dams and just about any imaginable structure you will find around you.

Due to limited and very costly resources, construction has to be managed productively and efficiently using innovation, creativity and sound organisational and economic principles. Properly managed construction projects result in lower costs, completion of projects on time, and higher-quality structures.

In order to construct a successful organisational model for a successful construction project, it is important to study and understand the various components that make up a successful model. Construction activities must be cost-effective, using high-quality materials and performed within a limited timeframe to achieve quality end products.

The face of the construction industry has been changing rapidly in recent times. These advancements in modern construction methodologies and techniques, along with the emergence of more productive equipment, mean that industry players must remain on their toes to keep up with the latest construction technology. In order to remain relevant, companies must adopt new approaches to managing and building projects. The growth in technology has produced newer and better materials to use, newer techniques of accomplishing tasks at lower costs and with better time management skills, and newer equipment for more productive work, etc. Therefore, the human resource capacity must constantly update or upgrade knowledge and skills.

Market Size and its Importance

The achievements within the construction industry spanning thousands of years and involving a diversity of civilisations have been immense. Construction has produced different types of infrastructure ranging from small residential buildings to mega sports complexes and industrial buildings. Unsurprisingly, it remains one of the largest businesses on the planet, with a market capitalisation of trillions of dollars.

Construction has contributed to most advanced economies of the world through the provision of critical infrastructures of economic significance, especially in recent times. Investment in construction activities contributes a sizeable portion of a country's GDP, in terms of creating employment opportunities for workers to earn decent incomes and contribute to the economy.

Some established countries in Asia, such as Hong Kong and South Korea, rode the benefits of construction to attain their present level of economic success. China and Malaysia are following in their footsteps and have been investing heavily in mega construction projects for the last 50 years or so. It is a very powerful tool for development and economic progress.

Features of the Construction Industry

Some of the important features of the construction industry are described below:

Complexity

The modern construction industry is highly mechanised and complex; it involves complex interactions between a vast array of resources, such as thousands of skilled labourers, equipment such as cranes and earthmovers, logistics etc., all interconnected in thousands of activities. Activities may overlap simultaneously or in sequential discrete steps or even randomly – a phenomenon more complex than anything to be found in ordinary factories or manufacturing contexts.

Uniqueness

One way in which construction differs from other industries is the fact that no two projects are ever alike. In other words, each project is unique. This uniqueness of each project is defined by the nature of the site of construction and is also influenced by the weather and the ground conditions at each site location.

The construction supervisor and management team are critical to the success of every construction project. They are responsible for ensuring that plans and specifications are adhered to and for managing the limited resources available within the budget and delivering the complete project on time. Since there is little room for costly mistakes, it is incumbent on the supervisory team to be vigilant to ensure that mistakes are detected instantly and corrected immediately.

Mobility of Facilities

One major difference between the construction and mainstream manufacturing industries is that products resulting from construction are stationary, while those resulting from manufacturing tend to be mobile during value addition. The construction industry requires the movement of resources such as labour, equipment etc. from one place to another to create products under dynamic and hazardous working conditions. Manufacturing industries, on the other hand, require products at various stages of the product life cycle to be moved from one facility to the next for value to be added. Products are

standardised and easy to control, unlike construction where new techniques or modifications to existing techniques have to be developed to deal with the constantly changing working environment.

Multiplicity of Agencies

Many agencies are involved in construction projects, from the conception of the product through to the completion of the project. Each agency is expected to play a specific role in the course of the project life cycle. These agencies may include governmental agencies, land authorities, planning agencies, the fire department, and Town and Country Planning Councils, etc. Their roles may differ but, essentially, they ensure that the project complies with the laws of the land. They carry out inspections and provide certifications for various activities on site.

Organisation

The owner of the construction project normally advertises the project and invites tenders from prospective contractors to undertake the project. The contract is awarded to a successful bidder after a competitive bid process. The winning contractor then engages the services of subcontractors on contracts to execute various planned activities within a specified timeframe. Subcontractors may also employ hundreds of skilled workers to work on specialised aspects of the project. During the construction of larger-scale projects, it is very common to have thousands of employees working on diverse aspects of the project site. The complexity of large-scale projects necessitates a great deal of organisation and management of a large group of people who interact with one another in many ways to produce the final product within a limited time period.

Three groups of people are normally involved in a typical construction project:

- The owner
- The engineering group comprising managers, architects, structural engineers and civil engineers etc.
- The construction group consisting of a number of contractors and workers who perform the actual work.

These three groups interact in a well-organised way with no particular group having absolute control. Each group has a set of unique functions to perform at specific moments and their activities may overlap or occur sequentially. The owner is expected to exercise control of the finance and quality control, the engineering group ensures structural and aesthetic integrity, while the contractor motivates the workforce to execute the work professionally and to a very high standard to meet the deadline.

The main categories of activities of a construction project include:

i. Design and planning
ii. Executing construction work
iii. Supervision and inspection

Finance

Financial activities involved in construction can be classified into the following categories:

1. Investments in fixed assets, such as tools, equipment, machinery, catering and shuttering, etc.
2. Short-term finances, such as earnest-money and security deposits to meet the cash flow requirements at construction sites
3. Investment in the future through education, training, research, and development of human resources and technologies
4. Overheads in salaries and establishment of other expenses relating to advertisements and public relations, legal expenses and other related expenses required for the project to run smoothly

Funding sources include credit facilities, loans and securities. Frequently, the construction industry experiences cash flow issues due to the blockage of security deposits, earnest-money, and delayed payment of bills, among many other impediments.

Management

Since most companies' HQs are far away from the project site, it becomes difficult for the management to provide direct supervision and control of activities. This gives most projects' workforces autonomy in tackling their responsibilities. It is thus essential to have well-trained personnel who will execute their mandated activities professionally and on time to achieve satisfactorily high-quality products.

Productivity and Labour Quality

Productivity

The construction industry is not as productive as other industries, according to several studies. Historically, productivity in the construction industry has not been as high as one might have expected given the large number of people employed in this sector. Two main reasons may account for this low productivity:

- Supply issues
- Demand issues

Supply is hampered by the immobile nature of projects and the harsh conditions prevailing during the construction process. With regard to demand issues, one finds that demand for construction products tends to be seasonal or cyclic, resulting in a highly unpredictable market.

The lack of adequately-trained personnel is the single most important factor in low productivity records. The availability of well-trained personnel to make wise decisions in executing activities becomes very important for producing high-quality products. Highly trained human resources are lacking in areas that

would substantially improve construction productivity. Areas such as effective information management systems and design and equipment management are both in dire need of high-quality personnel.

Better productivity might be achieved through systematic planning and management of all aspects of construction projects using highly trained human resources at all levels as well as the best available techniques and equipment to produce quality products at lower cost and in shorter durations. Management and organisation of projects will entail coordination of interactions between the planning, design and execution stages of projects.

Labour Quality

Labour for construction work mostly depends upon the location of the project site. This means that the local workforce is normally employed to carry out various aspects of the construction. The quality of the labour employed will determine the quality of the final product. Workers may improve their skills through on-the-job learning, by trial and error, or by imitation.

Safety Hazards

A typical construction project is inherently dangerous because of the high propensity for accidents to occur. The wide range of working conditions involving supported structures, moving equipment and labour make the site a highly unpredictable environment. Consequently, there is a need to put in place safety measures to prevent accidents from occurring. Unfortunately, due to the rapidly changing conditions, it is not sufficient to adopt safety procedures from the static manufacturing environment for implementation on construction project sites.

Careful and adequate research needs to be conducted to determine the most effective types of safety procedure to implement on the site because losses resulting from construction accidents may be so significant that they will even wipe out profits.

Role of Construction Supervisor

The main duty of the construction supervisor is to motivate and coordinate the activities of other workers to complete the job on time. Supervisors serve as the link between workers and top management levels of the organisation. They operate at the first line of management. There are three levels of management: the top-level, the mid-level, and the first-line level.

Top-Level Management

They formulate the objectives and policies of the company.

Mid-Level Management

They are mostly involved in the procurement of materials, labour and equipment management. They may also be responsible for highly specialised duties such as lift installation and HVAC.

First-Line Management

This level is usually composed of the construction supervisors. It is the lowest level of management, taking instructions from the mid-level and reporting back to them during the course of construction.

Responsibilities of the Construction Supervisor

The responsibilities of the construction supervisor include ensuring that all work is of the desired quality, costs do not overrun the budget due to errors, and the work is completed on time.

Duties of Construction Supervisor

- Instructs workers on what to do
- Motivates workers to accomplish all objectives
- Encourages a sprit of teamwork
- Ensures workers are disciplined
- Deal with all manner of conflicts arising at the work site
- Promotes a good relationship between the workers and the general public
- Ensures plans and schedules are adhered to by regular inspection and quality control
- Trains and develops the workforce to meet new challenges

Construction Supervisor and the Phases of Construction Project

The construction supervisor should be familiar with the various phases of the project. The following phases are normally devised for construction projects:

- Conception of the building based on requirements of the owner or user
- Determining the feasibility of the project and comparing alternatives
- Preparing detailed designs, drawings, and resource cost estimates
- Translating construction ideas from paper into reality using resources.

Project construction sites can be executed by the owner or by a contractor. Construction by the owner is termed ‘departmental construction’. It requires the owner to form his own company and engage the services of an engineer and contractor. The second method is to employ the services of contractors. The contractor-type construction involves both the owner and the contractor appointing their individual supervisors to oversee the project.

The owner’s supervisor must ensure that all specifications and plans are being followed by undertaking regular planned or unplanned inspections of activities on the site. His responsibilities include the following:

i) Ensure that construction is carried out according to the contract drawings and specifications
ii) Ensure that the contractor follows the agreed schedule

iii) Ensure that quality standards of materials, processes and workmanship are maintained

Supervision for the Owner/Consultant

The owner's supervisor can achieve success in the field by doing the following:

- Submit daily progress reports to the owner's engineer
- Work with the contractor's team frequently
- Clarify any aspects of the work that the contractor does not understand or is unsure about
- Demand the highest-quality standards from the contractor
- Deal discreetly and fairly but resolutely with the contractor's staff in the field on all aspects of the work to ensure high-quality work
- Solve problems commensurate with his/her expertise and escalate them to the site engineer when problems are beyond his/her ability to solve or will require the supervision of more senior personnel
- Take timely actions to correct deviations from plans
- Report serious problems to the site engineer immediately
- Use discretion and professionalism when implementing contract specifications but receive occasional advice from the site's engineer and work within the limits of his/her responsibility and authority
- Be tactful or diplomatic when dealing with field staff
- Maintain proper documentation including registers, equipment documents and labour documents, etc.
- Keep a work order book containing instructions from management to the contractor
- Request early inspection and approval of completed portions of work to avoid delays
- Help the engineer to prepare accounts and issue payments to the contractor
- Maintain all contract documents such as drawings and specifications at each phase of the project

Supervision for the Construction Agency

If the owner decides to secure the services of a construction agency to undertake the project with the assistance of a construction supervisor, the construction agency must ensure that the structure is completed on time, at the agreed cost and to the specified quality standard.

Before beginning construction activities, the supervisor for the construction agency should ensure that:

- All drawings are ready, including detailed working drawings
- Detailed bills of quantities are available
- Information on all resources required are available and ready
- Suppliers and workers are ready to begin

- Execution plans for activities are developed and milestones and completion dates finalised
- The project manager and his team of engineers have been selected to oversee technical aspects of the project

For a supervisor to succeed comprehensively with a project, he/she must study and understand all contract requirements, designs, drawings and specifications and any other relevant documents. He/she must also study the programme of construction prepared by the project engineer and his team and devise realistic schedules for activities for each day of the week or a weekly schedule to keep up with the overall project plan

Sample of a supervisor's schedule for a typical day:

Table 1.1

Supervisor's Schedule For A Typical Day

1. Brick masonry for the superstructure of Building 1 to be continued
2. Excavation for the foundation of Building 2 to be started today. Labour team to be organised, instructions to be given to them, necessary tools to be issued
3. Excavation work should he completed by tomorrow evening; make request to the field engineer to inspect the work tomorrow and approve the foundation so that laying the concrete bed for the foundation can commence in two days time
4. Send a requisition to the store to supply cement, to place an order for a supply of sand and aggregates so that these materials can be delivered to the site by tomorrow evening.
5. Request the project office to supply the working drawings of RCC slab to help estimate resource requirements
6. Send a note to the accounts department to arrange for the payment of wages to labourers at the end of the week
7. Submit reports to the project office

The above list of activities is not exhaustive and should be seen as of an indicative nature only.

The supervisor should ensure that the following facilities are available on the site:

i. Site offices, site stores, workshops and canteens, etc. along with the necessary furniture, ventilation and lighting, etc.
ii. Access to the site, as well as various units such as site office, stores, and workshops, etc.
iii. Adequate parking facilities and unloading platforms for incoming materials

iv. Toilets suitably located - separate toilets for women
v. Adequate supply of water for drinking, washing and construction operations
vi. Arrangements for regular cleaning of office, stores, canteen etc
vii. Ensuring adequate safety precautions on site by:

a) Promoting safe stacking of materials
b) Encouraging safe handling of materials
c) Insisting on the use of protective wear such as helmets, gloves, gumboots and goggles where necessary
d) Providing fencing around excavated trenches
e) Ensuring good housekeeping on site
f) Providing first-aid boxes
g) Employing trained workers and operators
h) Ensuring proper maintenance of equipment
i) Providing training to workers and creating safety awareness amongst them

The supervisor should maintain documents containing the following:

- File containing list of contact details of all persons connected to the project including details of the owner(s), officials of local authorities, Government officials, suppliers, police department etc.
- Folder for approved drawings and specifications
- Contract documents
- Construction programme (e.g. in the form of a bar chart)
- Files containing important letters
- Work order book
- Progress chart
- Registers for materials, use of equipment, labour employed
- Record of tests carried out on materials and works
- A general plan of work showing all work completed each day

Daily diary containing the following:

- Details of works in progress
- Notes on weather conditions
- Names of visitors
- Number of hours worked
- Details of work carried out by subcontractors, labour contractors,
- Workers employed on work site
- Materials arrived; issued to subcontractors, consumed on works

- Equipment details such as hours worked, fuel or power used, repairs and maintenance output etc.
- Any other relevant details.

Construction Supervision and Inspection and Testing

The supervisor is expected to carry out inspection and testing continuously from the beginning of the project until its completion.

Inspection

This is carried out in order to check the quality. Construction materials may be inspected to ensure they meet quality specifications in terms of colour, size and composition. Inspections may be carried out while work is in progress to ensure that:

i. The correct quantities of materials are used
ii. The sequence specified by the activities schedule plan is being followed
iii. Correct procedures are applied during activities to ensure high-quality standards
iv. Final output of activities meets the desired specifications in dimensions and contents

The right person (at the right time) should be chosen to carry out the inspection in order for the inspection programme to be successful.

Supervisors are required to perform regular inspections of construction work. For contract jobs, the owner may ask his engineer to inspect the work to ensure everything is going according to plan and within budget. Inspections are carried out on materials and can be performed at any stage of the work. If the contract stipulates that certain phases must be inspected by the engineer, the supervisor must arrange for this well in advance and record details of the inspection in the work order book. To avoid remedial work or the rejection of work, the supervisor must be pre-emptive to spot mistakes quite early and report to the necessary authority to correct them immediately. Such prompt actions will prevent unnecessary delays due to remedial work or rejection and will avoid extra costs.

Construction Supervisor's Role in Ensuring Progress

The construction supervisor is directly responsible for ensuring that progress is made according to schedules. It is his/her duty to ensure that progress is consistently maintained by doing the following:

- Studying the construction programme prepared by the project manager or project engineer.
- Preparing detailed programmes to expand on the schedules and preparing schedules for organising the resources required for the work.
- Having in place a systematic approach to writing daily progress reports.
- Ensuring that all specifications and requirements of the project are being followed.

- The supervisor must also regularly check the quality of work and compare it with quality control specifications to determine whether the project is on the right track or not. He/she should correct any deviations promptly if he/she is in a position to do so; otherwise, deviations should be reported to the site engineer immediately for prompt corrective measures to be implemented.

Further Reading:

- ✓ **Barbara J. Jackson (2010), *Construction Management JumpStart***
- ✓ **Stephen Emmitt, Christopher A. Gorse (2010), *Barry's Introduction to Construction of Buildings***
- ✓ **Frank Harris, Ronald McCaffer (2013), *Modern Construction Management***