LECTURE NOTES

ON

CONSTRUCTION MANAGEMENT

Diploma in Civil Engineering (6th Semester)

By

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-1 MANAGEMENT PROCESS

Management is an art of getting things done through and with the people in formally organized groups. It is an art of creating an environment in which people can perform and individuals and can co-operate towards attainment of group goal.

Management personal may be described as the people who design an organization's structure and determine how different aspects of the organization will interact.

Management process is a **process** of setting goals, planning and/or controlling the organizing and leading the execution of any type of activity, such as: a project

In general an organization's senior management is responsible for carrying out its management process.

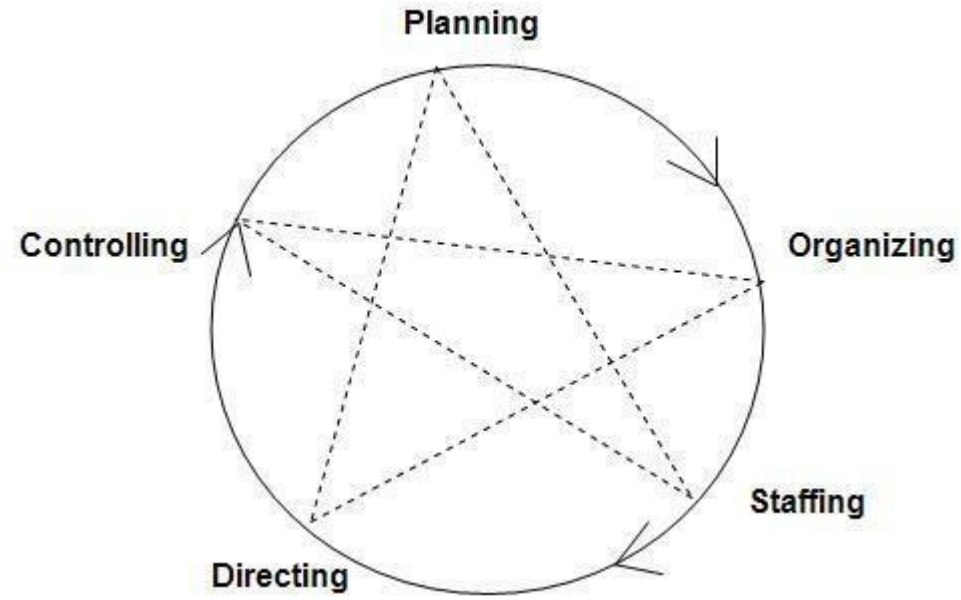
Importance of management

1. **It helps in Achieving Group Goals -** It arranges the factors of production, assembles and organizes the resources, integrates the resources in effective manner to achieve goals. It directs group efforts towards achievement of pre-determined goals. By defining objective of organization clearly there would be no wastage of time, money and effort. Management converts disorganized resources of men, machines, money etc. into useful enterprise. These resources are coordinated, directed and controlled in such a manner that enterprise work towards attainment of goals.
2. **Optimum Utilization of Resources -** Management utilizes all the physical & human resources productively. This leads to efficacy in management. Management provides maximum utilization of scarce resources by selecting its best possible alternate use in industry from out of various uses. It makes use of experts, professional and these services leads to use of their skills, knowledge, and proper utilization and avoids wastage. If employees and machines are producing its maximum there is no under employment of any resources.
3. **Reduces Costs -** It gets maximum results through minimum input by proper planning and by using minimum input & getting maximum output. Management uses physical, human and financial resources in such a manner which results in best combination. This helps in cost reduction.
4. **Establishes Sound Organization -** No overlapping of efforts (smooth and coordinated functions). To establish sound organizational structure is one of the objective of management which is in tune with objective of organization and for fulfillment of this, it establishes effective authority & responsibility relationship i.e. who is accountable to whom, who can give instructions to whom, who are superiors & who are subordinates. Management fills up various positions with right persons, having right skills, training and qualification. All jobs should be cleared to everyone.
5. **Establishes Equilibrium -** It enables the organization to survive in changing environment. It keeps in touch with the changing environment. With the change is

external environment, the initial co-ordination of organization must be changed. So it adapts organization to changing demand of market / changing needs of societies. It is responsible for growth and survival of organization.

6. **Essentials for Prosperity of Society -** Efficient management leads to better economical production which helps in turn to increase the welfare of people. Good management makes a difficult task easier by avoiding wastage of scarce resource. It improves standard of living. It increases the profit which is beneficial to business and society will get maximum output at minimum cost by creating employment opportunities which generate income in hands. Organization comes with new products and researches beneficial for society.

Functions/Role of management



1. **Planning**

   It is the basic function of management. It deals with chalking out a future course of action & deciding in advance the most appropriate course of actions for achievement of pre-determined goals.

   According to KOONTZ, "**Planning is deciding in advance - what to do, when to do & how to do. It bridges the gap from where we are & where we want to be**".

   A plan is a future course of actions. It is an exercise in problem solving & decision making.

   Planning is determination of courses of action to achieve desired goals.

   Thus, planning is a systematic thinking about ways & means for accomplishment of pre-determined goals. Planning is necessary to ensure proper utilization of human & non-human resources.

Organizing

It is the process of bringing together physical, financial and human resources and developing productive relationship amongst them for achievement of organizational goals.

According to Henry Fayol,

"To organize a business is to provide it with everything useful or its functioning i.e. raw material, tools, capital and personnel's".

To organize a business involves determining & providing human and non-human resources to the organizational structure. Organizing as a process involves:

- Identification of activities.
- Classification of grouping of activities.
- Assignment of duties.
- Delegation of authority and creation of responsibility.
- Coordinating authority and responsibility relationships.

2. Staffing

It is the function of manning the organization structure and keeping it manned. Staffing has assumed greater importance in the recent years due to advancement of technology, increase in size of business, complexity of human behavior etc. The main purpose o

\ staffing is to put right man on right job i.e. square pegs in square holes and round pegs in round holes. According to Kootz & O'Donell, "Managerial function of staffing involves manning the organization structure through proper and effective selection, appraisal & development of personnel to fill the roles designed un the structure". Staffing involves:

- Manpower Planning (estimating man power in terms of searching, choose the person and giving the right place).
- Recruitment, Selection & Placement.
- Training & Development.
- Remuneration.
- Performance Appraisal.
- Promotions & Transfer.

3. Directing

It is that part of managerial function which actuates the organizational methods to work efficiently for achievement of organizational purposes. It is considered life-spark of the enterprise which sets it in motion the action of people because planning, organizing and staffing are the mere preparations for doing the work. Direction is that inert-personnel aspect of management which deals directly with influencing, guiding, supervising,

motivating sub-ordinate for the achievement of organizational goals. Direction has following elements:

- Supervision
- Motivation
- Leadership
- Communication

Supervision- implies overseeing the work of subordinates by their superiors. It is the act of watching & directing work & workers.

Motivation- means inspiring, stimulating or encouraging the sub-ordinates with zeal to work. Positive, negative, monetary, non-monetary incentives may be used for this purpose.

Leadership- may be defined as a process by which manager guides and influences the work of subordinates in desired direction.

Communications- is the process of passing information, experience, opinion etc from one person to another. It is a bridge of understanding.

4. Controlling

It implies measurement of accomplishment against the standards and correction of deviation if any to ensure achievement of organizational goals. The purpose of controlling is to ensure that everything occurs in conformities with the standards.

An efficient system of control helps to predict deviations before they actually occur. According to *Theo Haimann*,

"Controlling is the process of checking whether or not proper progress is being made towards the objectives and goals and acting if necessary, to correct any deviation". According to Koontz & O'Donell "Controlling is the measurement & correction of performance activities of subordinates in order to make sure that the enterprise objectives and plans desired to obtain them as being accomplished". Therefore controlling has following steps:

a. Establishment of standard performance.
b. Measurement of actual performance.
c. Comparison of actual performance with the standards and finding out deviation if any.
d. Corrective action.
e. Management theories
f. It is a collection of ideas which set forth general rules on how to manage a business or organization.
g. Management theory addresses how managers and supervisors relate to their organizations in the knowledge of its goals, the implementation of effective means to get the goals accomplished and how to motivate employees to perform to the highest standard.

Management theories are implemented to help increase organizational productivity and service quality. Not many managers use a singular theory or concept when implementing strategies in the workplace

Contingency Theory

This theory asserts that managers make decisions based on the situation at hand rather than a "one size fits all" method. A manager takes appropriate action based on aspects most important to the current situation. Managers in a university may want to utilize a leadership approach that includes participation from workers, while a leader in the army may want to use an autocratic approach.

Systems Theory

Managers who understand systems theory recognize how different systems affect a worker and how a worker affects the systems around them. A system is made up of a variety of parts that work together to achieve a goal. Systems theory is a broad perspective that allows managers to examine patterns and events in the workplace. This helps managers to coordinate programs to work as a collective whole for the overall goal or mission of the organization rather than for isolated departments.

Chaos Theory

Change is constant. Although certain events and circumstances in an organization can be controlled, others can't. Chaos theory recognizes that change is inevitable and is rarely controlled. While organizations grow, complexity and the possibility for susceptible events increase. Organizations increase energy to maintain the new level of complexity, and as organizations spend more energy, more structure is needed for stability. The system continues to evolve and change.

Theory X and Theory Y

The management theory an individual chooses to utilize is strongly influenced by beliefs about worker attitudes. Managers who believe workers naturally lack ambition and need incentives to increase productivity lean toward the Theory X management style. Theory Y believes that workers are naturally driven and take responsibility. While managers who believe in Theory X values often use an authoritarian style of leadership, Theory Y leaders encourage participation from workers.

Management roles

A well-known researcher by the name of Henry Mintzberg identified three general management roles. They are interpersonal roles, informational roles and decisional roles.

Interpersonal Role

Management is largely about interpersonal relations between the manager and people both inside and outside the organization, such as employees, superiors, suppliers and customers. As a supervisor, Alexander will serve in his interpersonal role while acting as a figurehead, leader and liaison.

As a figurehead, he represents the face of the company when interacting with people. He also serves as a leader to his team and acts as a liaison between his team members and upper management. He may occasionally act as a liaison between the company and suppliers or customers.

Informational Role

Management is also about managing information. Alexander's informational role includes collecting information, receiving information and disseminating information. For example, Alexander will receive production goals from his boss and will disseminate, or communicate, them to his team. He will also collect information on current production and send it to his boss for review.

Decisional Role

Managers are decision makers. In fact, failure to make decisions will often lead to failure. Alexander's decisional role includes being an entrepreneur, disturbance handler, resource allocator and a negotiator. For example, manager must often seek creative solutions to problems just like an entrepreneur. He is also responsible for managing and allocating resources to accomplish his production goals. In addition he must handle unanticipated complications that disrupt his team and its goals, known as disturbance handling

Strategic Management

Strategic management involves the formulation and implementation of the major goals and initiatives taken by a company's top management on behalf of owners, based on consideration of resources and an assessment of the internal and external environments in which the organization competes.

Formulation of strategy involves analyzing the environment in which the organization operates, then making a series of strategic decisions about how the organization will compete. Formulation ends with a series of goals or objectives and measures for the organization to pursue. Environmental analysis includes the:

Remote external environment, including the political, economic, social, technological, legal and environmental landscape (PESTLE);

Industry environment, such as the competitive behavior of rival organizations, the bargaining power of buyers/customers and suppliers, threats from new entrants to the industry, and the ability of buyers to substitute products and

Internal environment, regarding the strengths and weaknesses of the organization's resources (i.e., its people, processes and IT systems)

Decision making Tools and techniques

When running a business, making the right decisions can lead to success, while making the wrongs can result to failure. With so much riding on each decision, it's important that thoughtful consideration is put into each one that needs to be made. To help them, many business leaders go through a thoughtful decision-making process.

While there are a wide variety of decision-making techniques and tools, many tend to revolve around the same key principles of figuring out the decision that needs to be made, considering and researching the options and reviewing the decision once it's been made.

The University of Massachusetts-Dartmouth outlines seven basic steps in effective decision-making

 Identify the decision to be made: After realizing that a decision must be made, you then go through an internal process of trying to clearly define the nature of the decision you must make.

 Gather relevant information: Most decisions require collecting pertinent information. Some information must be sought from within yourself through a process of self-assessment, while other information must be sought from outside books, people and a variety of other sources.

 Identify alternatives: Through the process of collecting information you will probably identify several possible paths of action, or alternatives. In this step of the decision-making process, you will list all possible and desirable alternatives.

 Weigh evidence: In this step, you draw on your information and emotions to imagine what it would be like if you carried out each of the alternatives to the end. You must evaluate whether the need identified in Step 1 would be helped or solved through the use of each alternative.

 Choose among alternatives: Once you have weighed all the evidence, you are ready to select the choice that seems to be best suited to you.

 Take action: You now take some positive action, which begins to implement the alternative you chose.

 Review decision and consequences: In the last step you experience the results of your decision and evaluate whether or not it has "solved" the need you identified in Step 1. If it has, you may stay with this decision for some period of time. If the decision has not resolved the identified need, you may repeat certain steps of the process in order to make a new decision.

Decision-making tools and techniques

While the basic principles might be the same, there are dozens of different techniques and tools that can be used when trying to make a decision. Among some of the more popular options, which often use graphs, models or charts, are:

- **Decision matrix**: A decision matrix is used to evaluate all the options of a decision. When using the matrix, create a table with all of the options in the first column and all of the factors that affect the decision in the first row. Users then score each option and weigh which factors are of more importance. A final score is then tallied to reveal which option is the best.
- **T-Chart**: This chart is used when weighing the plusses and minuses of the options. It ensures that all the positives and negatives are taken into consideration when making a decision.
- **Decision tree**: This is a graph or model that involves contemplating each option and the outcomes of each. Statistical analysis is also conducted with this technique.
- **Multi voting**: This is used when multiple people are involved in making a decision. It helps whittle down a large list options to a smaller one to the eventual final decision.
- **Pareto analysis**: This is a technique used when a large number of decisions need to be made. This helps in prioritizing which ones should be made first by determining which decisions will have the greatest overall impact.
- **Cost-benefit**: This technique is used when weighing the financial ramifications of each possible alternative as a way to come to a final decision that makes the most sense from an economic perspective.
- **Conjoint analysis**: This is a method used by business leaders to determine consumer preferences when making decisions.

Organizational structure

An **organizational structure** defines how activities such as task allocation, coordination and supervision are directed toward the achievement of organizational aims.[1] It can also be considered as the viewing glass or perspective through which individuals see their organization and its environment.

Line Organization:

Line organization is the simplest and the oldest type of organization. It is also known as scalar organization or military type of organization. In the words of J.M. Lundy, “It is characterized

by direct lines of authority flowing from the top to the bottom of the organizational hierarchy and lines of responsibility flowing in an opposite but equally direct manner."

An important characteristic of such type of organization is superior-subordinate relationship. Superior delegates authority to another subordinate and so on, forming a line from the very top to the bottom of the organization structure. The line of authority so established is referred as "line authority." Under this type of organization authority flows downwards, responsibility moves upwards in a straight line. Scalar principle and unity of command are strictly followed in line organization.

This type of organization resembles with the army administration or military type of organization. As in case of military, commander-in-chief holds the top most position and has the entire control over the army of the country, which in turn is developed into main area commands under major-generals.

Each area has brigade under brigadier-generals, each brigade is fabricated into regiments under its colonels, each regiment into battalions under majors, each battalion into companies under captains, each company sub-divided under its lieutenants and so on drawn to corporal with his squad.

2. Functional Organization:

F.W. Taylor, who is better known as the father of scientific management developed the concept of 'Functional Organization'. As the very name suggests, functional organization implies that the organization should be based on various functions. Taylor's functional approach is mainly based on principle of specialization and tries to bring about organizational balance.

The principle of specialization embodies the concept that both the workers and the supervisors can develop a higher degree of proficiency by separating the manual from the mental requirements. Taylor recommended that there should be fictionalization even at the shop level where workers have to produce goods. He felt that the usual practice of putting one foreman incharge of some 40 to 50 workers should be avoided.

Taylor's concept of Functional Foremanship (as he puts it), is a system comprising of eight different foremen discharging different functions. Every worker in the organisation is directly connected with these foremen.

The eight specialist foremen are:

(a) Route Clerk, (b) Instructions Card Clerk, (c) Time and Cost Clerk, (d) Shop Disciplinarian, (e) Gang Boss, (f) Speed Boss, (g) Repair Boss, and (h) Inspector. The first four bosses operate from Planning Department, whereas the other four are known as Executive Functional Bosses. They function in the production department.

A brief explanation of these eight functional foremen is given below:

(a) Route clerk:

He lays down the exact path or route to be followed by raw material transforming it into finished product.

(b) Instruction card clerk:

He prepares detailed instructions to be followed in doing the work as per the route laid down by the route clerk.

(c) Time and cost clerk:

He determines the total time to be taken in the completion of a product and also works out the cost of production per unit and total cost. He prepares various work schedules and cost sheets in order to have proper control over time and cost incurred in producing goods.

(D) Shop disciplinarian:

He is responsible for maintaining proper discipline in the organization. In fact, he is the guardian of orderliness in the factory. In the words of Kimball and Kimball Jr. "The shop disciplinarian is responsible for discipline and good order, fie is also the peacemaker and assists in adjusting wages."

He is helpful in resolving minor disputes regarding wages, holidays, working conditions and hours of work etc. He initiates a proper code of conduct in the organization.

(e) Gang boss:

He makes the availability of different machines and tools required by workers to carry out their work. He also provides various production designs, drawings, raw materials etc.

(f) Speed boss:

He controls the speed of different machines operating in the organization. He sometimes demonstrates the workers the proper speed with which the machines should operate. He undertakes proper supervision over speed of machines.

(g) Repair boss:

He is concerned with proper maintenance and repairs of machines for keeping them in working order. In the words of Spriegel, "His job of maintenance includes cleaning the machine, keeping it free from rust and scratches, oiling it properly and preserving the standards which have been set up for the auxiliary equipment connected with the machine such as belts, counter shafts and clutches." His main task is to undertake immediate repair of the defective machines so that the work may not suffer.

(h)Inspector:

He checks and certifies the quality of work i.e., whether or not it is up to pre-determined standards. Achievement of pre-set standards is confirmed by the inspector. He develops the feeling of quality consciousness among the workers. In order to carry out his job effectively, an inspector must possess proper knowledge and the technicalities involved in quality control.

3. Line and Staff Organization:

The line and staff organization is an improvement over the above mentioned two systems viz, line organization and functional organization. The line organization concentrates too much on control whereas the functional system divides the control too much.

The need was, therefore, for a system that will ensure a proper balance between the two. The need has been fulfilled by line and staff organization. The system like line organization also owes its birth to army.

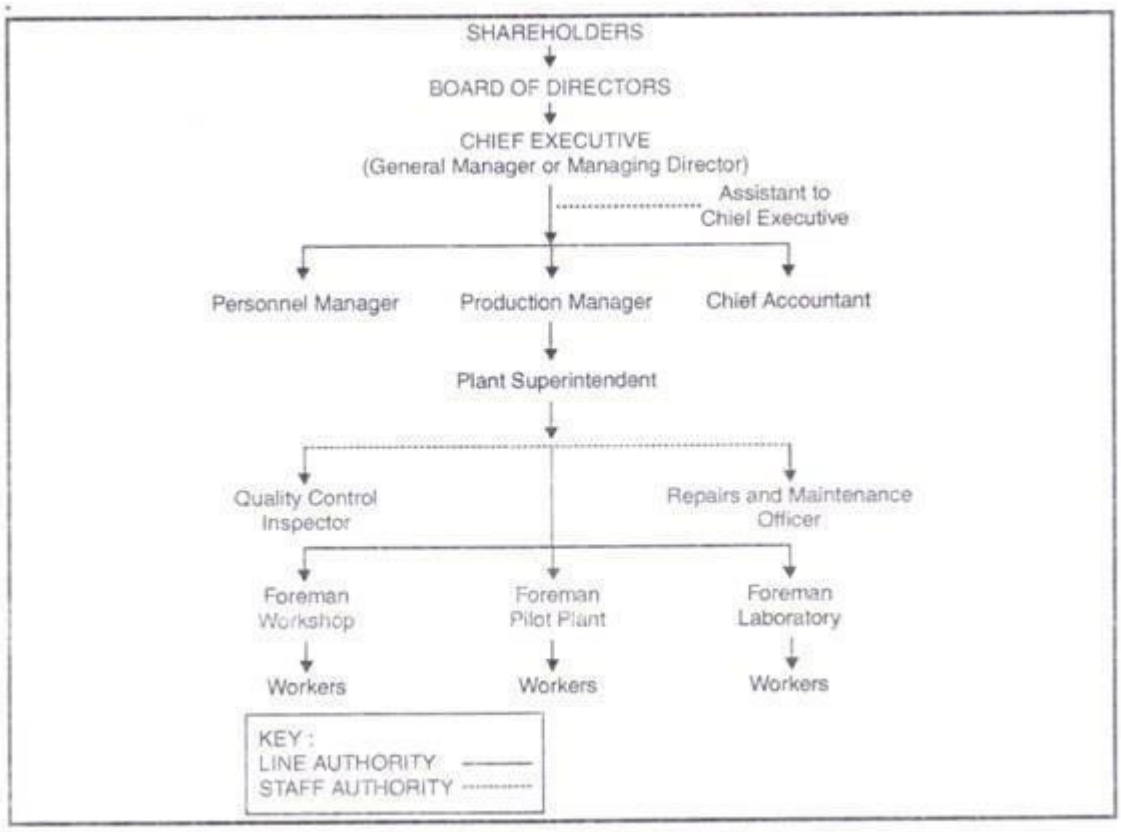
The commanders in the field who are line officers are assisted by the staff that helps them in formulating strategies and plans by supplying valuable information. Similarly in organization, line officers get the advice of the staff which is very helpful in carrying on the task in an

efficient manner. However, staff's role is advisory in nature. Line officers are usually assisted by staff officers in effectively solving various business problems.

The staff is usually of three types :

(a) Personal Staff:

This includes the personal staff attached to Line Officers. For example, personal assistant to general manager, secretary to manager etc. The personal staff renders valuable advice and assistance to Line Officers.



Showing Line and Staff Organisation

(b) Specialized Staff:

This category includes various experts possessing specialised knowledge in different fields like accounting, personnel, law, marketing, etc. They render specialised service to the organisation.

For example, a company may engage a lawyer for rendering legal advice on different legal matters. Similarly, it may engage a chartered accountant and a cost accountant for tackling accounting problems.

(c) General Staff:

This comprises of various experts in different areas who render valuable advice to the top management on different matters requiring expert advice.

Human resource management (**HRM** or simply **HR**) is the management of human resources. It is a function in the organizations designed to maximize employee performance in service of an employer's strategic objectives.

HR is primarily concerned with the management of people within organizations, focusing on policies and on systems.

HR departments and units in organizations typically undertake a number of activities, including employee benefits design, employee recruitment, "training and development", performance appraisal, and rewarding (e.g., managing pay and benefit systems).

HR also concerns itself with organizational change and industrial relations, that is, the balancing of organizational practices with requirements arising from collective bargaining and from governmental laws

Human resource management core functions

According to Mondy, human resource management has five core functions which are

- Staffing
- Human resource development
- Compensation and benefits
- Safety and health
- Employee and labor relations

HUMAN RESOURCES MANAGEMENT ACTIVITIES

A Human Resources Manager has several functions in an organization:

- Determine needs of the staff.

- Determine to use temporary staff or hire employees to fill these needs.
- Recruit and train the best employees.
- Supervise the work.
- Harmonize relationship between company and workers.
- Manage employee relations, unions and collective bargaining.
- Prepare employee records and personal policies.
- Ensure high performance.
- Manage employee payroll, benefits and compensation.
- Ensure equal opportunities.
- Deal with discrimination.
- Deal with performance issues.
- Ensure that human resources practices conform to various regulations.
- Push the employee's motivation.

Leadership

Leadership is both a research area and a practical skill encompassing the ability of an individual or organization to "lead" or guide other individuals, teams, or entire organizations

An effective leader is a person who does the following:

1. Creates an inspiring vision of the future.
2. Motivates and inspires people to engage with that vision.
3. Manages delivery of the vision.
4. Coaches and builds a team, so that it is more effective at achieving the vision.

Leadership brings together the skills needed to do these things. We'll look at each element in more detail.

UNIT-2

CLASSIFICATION OF CONSTRUCTION PROJECT

GENERAL INFORMATION

Over the past five or six years, we've published a number of articles discussing the different types of construction projects that exist in the United States.

Generally speaking, however, you can separate construction project types into three categories: (i) Private construction; (ii) State construction; and (iii) Federal Construction. Before getting into these three categories more specifically you may find some helpful information on this topic by reviewing these two articles:

Wikipedia's Entry for "Construction:" Section 1 contains a discussion of the "types of construction projects," and contains great detail about the different construction types. Their entry's perspective is a bit different from mine, because it discusses a "type" of construction by the character of the actual facility being constructed and not the party underwriting the costs. Their different types, therefore, are simply residential building construction, industrial construction, commercial building construction and heavy civil construction. This is okay and a good reference, but I disagree with the framework.

An Ezine article titled "Types of Construction Projects" is also pretty useful, despite being an SEO ploy. Again, however, this article stays with Wikipedia's framework of classifying the construction type by the character of the building itself.

1) PRIVATE CONSTRUCTION PROJECTS

The first type of construction project is the Private Construction Project. Put simply, private projects are projects of every type that are owned, controlled or commissioned by a private party. Private parties include individuals, homeowners, corporations, other business entities, non-profit associations, privately funded schools, hospitals, publicly traded companies, etc. Anything, in other words, that is not the government.

Private construction projects come in all different shapes and sizes, and this is when it's useful to look at the character of the work performed to segment private construction into different subcategories. These subcategories would include:

Residential Construction: Whenever construction work is being performed to a single-family residence or a residential facility with (usually) less than 3 or 4 units. If you are working on an apartment complex this would more likely be considered a commercial project instead of a residential project. Similarly, if you are working at a condominium, the work would be residential if upon a single unit, but if on the entire complex or the common elements, the work would more likely be considered commercial.

Commercial Construction: Commercial construction is the construction of any buildings or similar structures for commercial purposes. Commercial construction includes a huge variety of projects including building restaurants, grocery stores, skyscrapers, shopping centers, sports facilities, hospitals, private schools and universities, etc.

Industrial Construction: This is a relatively small segment of the construction industry. These projects include power plants, manufacturing plants, solar wind farms, refineries, etc. While termed "industrial construction," it is pretty interchangeable with "commercial construction."

2) STATE CONSTRUCTION PROJECTS

Some people get confused by the term "state" when talking about state construction projects because the term "state" can refer to projects commissioned by a county, city, municipality, government board, public school board or any other state-funded entity. The term "state construction" means, therefore, any government funded construction that is not "federal" – which is discussed in the next section.

State construction projects can take a variety of forms.

They can be pretty traditional projects like the construction of a public school or government building (like a court room). These projects can also be pretty sophisticated, such as the construction of a bridge, sewer line, highways, etc.

3) FEDERAL CONSTRUCTION PROJECTS

Federal construction projects are very similar to state projects. Just like state projects they can take on a variety of forms: very simple and traditional, and very complex. And the stuff being constructed can be pretty similar to the stuff constructed by state authority: courthouses, government buildings, flood control projects, etc.

Major Types of Construction Projects In planning for various types of construction, the methods of procuring professional services, awarding construction contracts, and financing the constructed facility can be quite different. The broad spectrum of constructed facilities may be classified into four major categories, each with its own characteristics.

Residential Housing Construction Residential housing construction includes houses and high-rise apartments. During the development and construction of such projects, the developers usually serve as surrogate owners and take charge, making necessary contractual agreements for design and construction, and arranging the financing and sale of the completed structures. Residential housing designs are usually performed by architects and engineers, and the construction executed by builders who hire subcontractors for the structural, mechanical, electrical and other specialty work.

Level of influence vs. project duration The residential housing market is heavily affected by general economic conditions. Often, a slight increase in total demand will cause a substantial investment in construction, since many housing projects can be started at different locations by different individuals and developers at the same time. Because of the relative ease of entry, many new builders are attracted to the residential housing construction. Hence, this market is highly competitive, with potentially high risks as well as high rewards.

Institutional and Commercial Building Construction Institutional and commercial building encompasses a great variety of project types and sizes, such as schools and universities, medical centers and hospitals, sports facilities, shopping centers, warehouses and light manufacturing plants, and skyscrapers for offices and hotels. The owners of such buildings

may or may not be familiar with construction industry practices, but they usually are able to select competent professional consultants and arrange the financing of the constructed facilities themselves. Specialty architects and engineers are often engaged for designing a specific type of building, while the builders or general contractors undertaking such projects may also be specialized in only that type of building. Because of the higher costs and greater sophistication of institutional and commercial buildings in comparison with residential housing, this market segment is shared by fewer competitors. Since the construction of some of these buildings is a long process which once started will take some time to proceed until completion, the demand is less sensitive to general economic conditions than that for housing construction.

Specialized Industrial Construction Specialized industrial construction usually involves very large scale projects with a high degree of technological complexity, such as oil refineries, steel mills, chemical processing plants and coal-fired or nuclear power plants. The owners usually are deeply involved in the development of a project, and prefer to work with designers-builders such that the total time for the completion of the project can be shortened. They also want to pick a team of designers and builders with whom the owner has developed good working relations over the years. Although the initiation of such projects is also affected by the state of the economy, long range demand forecasting is the most important factor since such projects are capital intensive and require considerable amount of planning and construction time. Governmental regulation such as environmental protection can also influence decisions on these projects.

Infrastructure and Heavy Construction Infrastructure and heavy construction includes projects such as highways, tunnels, bridges, pipelines, drainage systems and sewage treatment plants. Most of these projects are publicly owned and therefore financed either through bonds or taxes. This category of construction is characterized by a high degree of mechanization, which has gradually replaced some labor intensive operations. The engineers and builders engaged in infrastructure construction are usually highly specialized since each segment of the market requires different types of skills. However, demands for different segments of infrastructure and heavy construction may shift with saturation in some segments. For example, as the

available highway construction projects are declining, some heavy construction contractors quickly move their work force and equipment into the field of mining where jobs are available.

The Construction Process is composed of six distinct stages, which are:

- Concept.
- Contracts and Bid Documents.
- Bidding.
- Construction.
- Construction Payments.
- Completion.

The functions of a Construction Manager:

- Construction Management is the overall planning, coordination and control of a project from inception to completion aimed at meeting a client's requirements in order to produce a functionally and financially viable project.
- e Construction Management is project management that applies to the construction sector.
- The functions of construction management typically include the following:
- Specifying project objectives and plans including delineation of scope, budgeting, scheduling, setting performance requirements, and selecting project participants.
- Maximizing resource efficiency through procurement of labour, materials and equipment.
- Implementing various operations through proper coordination and control of planning, design, estimating, contracting and construction in the entire process.
- Developing effective communications and mechanisms for resolving conflicts.
- Main responsibilities of a Construction Manager
- The most common responsibilities of a Construction Manager can be classified as follows:
- Project Management;
- Planning;
- Cost Management;
- Time Management;
- Quality Management;
- Contract Administration;
- Safety Management;
- Construction management Professional Practice (which includes specific activities like defining the responsibilities and management structure of the project management team, organizing and leading by implementing project controls, defining roles and

responsibilities and developing communication protocols, and identifying elements of project design and construction likely to give rise to disputes and claims.

- For those currently looking for a job as a Construction Manager, there could not be a better time. The sector is growing, and there are plenty of opportunities available. Check out our top Construction Manager jobs, or call our teams around the UK (links below) to talk over your job search or job vacancy requirements.

Construction Planning

An administrative process by which suitable line of action is selected out of the various alternatives available for the project work is called planning

Importance of construction project/construction planning

- Planning helps to minimize the cost by optimum utilization of available resources.
- Planning reduces irrational approaches, duplication of works and inter departmental conflicts.
- Planning encourages innovation and creativity among the construction managers.
- Planning imparts competitive strength to the enterprise.

Importance of Construction Management:

- Construction management practices invariably lead to "maximum production at least cost". A good construction management, results in completion of a construction project with in the stipulated budget.
- Construction management provides importance for optimum utilization of resources. In other words, it results in completion of a construction project with judicious use of available resources.
- Construction management provides necessary leadership, motivates employees to complete the difficult tasks well in time and extracts potential talents of its employees.
- Construction management is beneficial to society as the effective and efficient management of construction projects will avoid, escalation of costs, time overrun, wastage of resources, unlawful exploitation of labor and pollution of environment.

Stages of construction planning

1. Pretender planning
2. Contract planning

Pretender planning

The majority of work secured by a contractor is done so by some form of competitive tendering process.

The importance of gaining as much information as possible about the proposed contract and site cannot be over emphasized.

The contract documentation and tender drawings will provide a useful starting point but most Estimators will need to visit the proposed site to get a 'feel' for the contract and the environment in which the work will take place.

The initial examination of a site may be divided into 3 stages:

- The Site Visit
- The Desk Top Study
- Soil Exploration / insitu testing (These usually result in laboratory analysis of soil samples and a formal report for use by the tender team).

The extent of this investigation is in reality often limited to the site visit and desk top information which increases the risks taken by the contractor.

The extent upon which the estimator will complete each of these stages will depend upon the complexity of the contract, the need to secure the new work.

Thus the site visit and the recording of such information to relay back to the tender team will have a profound effect upon the tender figure eventually arrived at and submitted to the client.

Site visit will vary according to whether the site is Compact (Traditional enclosed area) or Extended (sewers runs, pipelines or coastal defences).

Considerations will include:

- Access and egress points to the site present
- Temporary roads and access points needed
- Ground conditions especially where bore hole information has not been provided within the contract documents.
- Standing surface water / ponding
- Excavations which can be examined.
- Water courses
- Surface contamination
- Existing buildings on the site
- Dumped rubbish or other clearance items
- Excavation challenges including machinery assessment removal of or storage of spoil
- Obvious service location and type of service
- Potential vandalism in the area

- Security arrangements and the type of hoarding or fencing required
- Temporary buildings location and type
- Adjacent buildings type and proximity
- Crane operation and access
- Local restrictions pedestrian restrictions / police restrictions local events
- Local knowledge

Many other considerations will apply on a site by site basis and most companies adopt a standardized site visit report or check list to ensure that items are not overlooked.

The Preliminaries section is very important in establishing the overall tender costs and will contribute a considerable percentage to the overall

Contract planning

It is the planning after the acceptance of a tender and award after a contract. It includes following

1. Preparation of labor requirement
2. Material statement chart
3. Master plan for carrying the work
4. Detailed drawings
5. Dates are decided for making orders for supply of material
6. Sequence of operations and their inter relationship to be planned

Methods of construction management

1. Critical path method
2. Program evaluation and review technique
3. Lean construction method
4. Line of balance method

Among the above first two are mostly followed

CRITICAL PATH METHOD

The critical path method (CPM) is a project modeling technique developed in the late 1950s by Morgan R. Walker of DuPont and James E. Kelley Jr. of Remington Rand.

CPM is commonly used with all forms of projects, including construction, aerospace and defense, software development, research projects, product development, engineering, and plant

maintenance, among others. Any project with interdependent activities can apply this method of mathematical analysis.

The essential technique for using CPM is to construct a model of the project that includes the following:

1. A list of all activities required to complete the project (typically categorized within a work breakdown structure),
2. The time (duration) that each activity will take to complete,
3. The dependencies between the activities and,
4. Logical end points such as milestones or deliverable items.

PROGRAM EVALUATION REVIEW TECHNIQE

The **program** (or **project**) **evaluation and review technique**, commonly abbreviated **PERT**, is a statistical tool, used in project management, which was designed to analyze and represent the tasks involved in completing a given project. First developed by the United States Navy in the 1950s

PERT is a method to analyze the involved tasks in completing a given project, especially the time needed to complete each task, and to identify the minimum time needed to complete the total project.

PERT vs CPM

COMPARISION	**PERT**	**CPM**
Meaning	PERT is a project management technique, used to manage uncertain activities of a project.	CPM is a statistical technique of project management that manages well defined activities of a project.
What is it?	A technique of planning and control of time.	A method to control cost and time.
Focus on	Event	Activity
Model	Probabilistic Model	Deterministic Model
Estimates	Three time estimates	One time estimate
Appropriate for	High precision time estimate	Reasonable time estimate
Management of	Unpredictable Activities	Predictable activities
Nature of jobs	Non-repetitive nature	Repetitive nature
Critical and Non-critical activities	No differentiation	Differentiated
Suitable for	Research and Development Project	Non-research projects like civil construction, ship building etc.

COST OPTIMIZATION

Cost optimization optimizes cost and one or more responses at the same time to determine the factor settings that are both cost-effective and produce acceptable values for the responses. Often the factor settings that produce the best results are the most expensive to do. Cost optimization determines a compromise between minimizing cost and optimizing the responses.

UNIT 3

RESOURCE PLANNING

The resources needed for the construction industry are:

1) Men, skilled and unskilled.

2) Material such as cement, steel, bricks, aggregates, etc.

3) Machines such as trucks, cranes, etc. to facilitate construction.

Limited resources have to be utilised with in a given time to get maximum benefit in terms of construction output.

The five categories of resource planning techniques include

1. Resource Loading
2. Resource Aggregation
3. Resource Availability Analysis
4. Resource-Constrained Scheduling
5. Resource Leveling

Resource Loading

• Resource loading allows the planner to assign resources such as labor, equipment and materials to each activity in the project schedule.

• These units might be craftsmen, pieces of equipment or quantities of construction materials.

• Craftsmen or equipment the norm.

Resource Aggregation

• Resource aggregation totals each type of resource used in the schedule for each time unit between scheduled project start and finish.

• Look at the early and late start and finish dates.

• Remember your resource requirements for the critical path doesn't change only the float activities

• You like to see a bell curve on your resource aggregation always keeping in mind the early and late dates on the items with float.

• EX-Average daily manpower per week graph

Resource Availability Analysis

• Simply compares the amount of resources required to the maximum amount of resources that are available for use.

• In the real world can we get more resources.

Time-and-Resource-Constrained Scheduling

• Time constrained or resource constrained.

• Time use an end date.

• Resources schedule the project on available resources.

Resource Availability Analysis

• Simply compares the amount of resources required to the maximum amount of resources that are available for use

• In the real world can we get more resources.

• When the assigned resources exceed those available:

– Shift non-critical activities within the schedule

– Obtain more resources

– Extend the schedule to lower the demand during the original schedule.

Time and Resource Constrained Scheduling

• Schedules can be time constrained or resource constrained but not both.

– Time use an end date

– Resource schedules the project on available resources

• Time- get more resources

• Resource- a shortage extend the time

Resource Leveling

• Attempts to keep the requirements for a construction resource as constant as possible over the duration of the project.

• Non-critical activities are shifted within the schedule using the available total float in order to level resource usage and the planned project completion date is unchanged as a result of the leveling process.

• This techniques are used when the project duration is fixed.

• Maximizing the effects of resource leveling requires performing both a backward and forward pass again through the network.

• The primary objective is to reduce the peaks and valleys without increasing the duration.

• Delaying those activities to the last available space.

• Use of algorithms and the software program for this class.

Stores

A wide variety of stores and equipment is utilized for construction work. This includes building materials like bricks, stone, aggregates, cement, lime, steel bars, structural steel, sanitary fittings, water supply, electrical stores and fittings as well as a variety of machinery and equipment ranging from survey and drawing instruments to transport and special purpose vehicles like dumpers, bulldozers and other earthmoving equipment, batching and mixing plants for concrete, vibrators, drilling and pumping equipment, air compressors, pile drivers and a host of other items. Special types of equipment may be necessary for some works like bridge construction and for large works it may be necessary to provide material handling equipment like cranes, lifts, conveyors etc.

Issue of Stores Material

Materials are issued from stock for the following purposes.

1. for use on works either by contractors or departmentally.
2. for dispatch to other subdivisions or departments.
3. for sale to contractors, employees and other outside parties.

Materials are issued only on receipt of an indent, FormNo.7, signed by the divisional or sub divisional officer. Five copies of the indent are prepared, using carbon paper. One copy is retained by the indenter and the other copies sent to the supplying authority. The storekeeper of the stores finds out from the stock balances if the quantities indented can be issued. If it is not possible to issue the whole quantity, he records the quantities that are actually issued on all the four copies of the indents and puts his signatures on them.

At the same time he makes corresponding entries of issues on the 'bin cards'. He also obtains the signature of the indenter on one copy, which is retained as a voucher in support of the transaction. One copy is returned to the indenter and the remaining two are sent to the divisional office for further record.

Issue of Material to Contractors

Sometimes it is desirable to retain the supply of the certain materials in the hands of the Government. The use of items of good quality can be ensured by supply is made by the Government from its stock. Items like cement, steel, bricks, asphalt material etc., are therefore generally issued to contractors even though the contract may be for completed items of work.

When the supply of certain items from the stock is envisaged, the contract should specify the following.

1. The full description of the materials to be supplied by the Government for use on works.
2. The place of delivery.
3. The rate including the storage rate, to be charged to the contractor for each item.
4. The contractor shall be responsible for obtaining the items and making payment there of at the rates specified, by deduction from bills.
5. No carriage or incidental charges are to be borne by the government beyond the place of delivery. The cost of material issued to the contractor for use on a work should ordinarily be recovered by deduction from the first bill authorising payment for the work. The divisional officer may, however, permit recovery in phases to the extent the material is actually used in the construction at the time of payment. Moreover stores should not be issued to contractors in bulk long before they are actually required due to the risk of pilferage and misuse. The issue of stores to the contractors should therefore, be regulated and restricted to the actual requirements over a reasonable period of time.

Materials at Site Account

In the case of minor works in which transactions relating to the materials at site are not likely to be heavy, an account in form P.W.D VI-83 should be maintained of all departmental materials

brought on to the site of a work. This should clearly show the sources and quantities of all receipts and of their issues to the work as the transactions occur.

The detailed account of the material issued to the work is known as the 'materials-at-site account'.

All departmental materials brought on to the site of work for use on that work, from any source, should be entered as receipts in the 'Materials-at-site accounts', immediately on their receipts giving a reference to the measurement book.

The register of material-at-site account should show separately for each material:

(i) The estimated requirement.
(ii) The issue rate.
(iii) Receipts, issues and balances, month to month
(iv) Net issues at the end of each month.

After completion of work, a theoretical calculation of the quantities of materials used on each subhead is made on the basis of the magnitude of work executed. These are recorded in Part I and Part II indicating the surplus or deficit as per actual consumption and the theoretical calculations, together with an explanation of the difference. Part III of the form is a statement showing the disposal of material remaining unused as per 'Material-at-site accounts'. The unused material is disposed off in the following manner.

(i) Transfer to stock, provided the items are serviceable and are likely to be required for other works.

(ii) Transfer to other works in progress, if required.

(iii) Sale of the items those are no longer required.

Indent

Material should issue only on receipt of an indent, form 7 signed by the divisional or the sub-divisional officer. These indents on stores are demands on store keeper signed by authorized persons to issue to bearer to be charged to a particular job or department and signified there in.

Invoice

The store keeper will prepare and sign the form of the invoice attached to the indent according to the supply as actually made. Simultaneously an entry should be made in the register of stock issues Form 8.

Bin Card

This is a card, which is attached to each Bin, or the container for stores a record of all materials entering or leaving the bin and the balance of materials in hand is kept in this card.

Scheduling

Scheduling means the preparation in advance of a list of different activities and their order of sequence to carry out any work as per the planned programmme.

For completing a project as per the plan, scheduling should be known to not only to the project managers, but also to all the links in the system namely engineers, supervisors, contractors and other coordinating agencies.

Scheduling includes the following:

1. Determination of the amount of work to be done.
2. The order in which the work is to be performed at each stage
3. The time when each part of the work will start.

4. Allocation of the quantity and rate of output of departments.
5. The date of starting of each unit of work at each stage along the route to be followed.

Need for scheduling

A project usually is a one-time effort. Every project will have its own features and they are of non-repetitive nature. In order to complete a project efficiently, the project manager must plan and schedule. During the course of project he will have to re plan and schedule due to unexpected progress, delay or due to technical conditions. The main aspect of project management will be scheduling different activities in an acceptable time span and finally with controlling the progress of scheduled work.

Advantages of Scheduling

For construction work of any importance, planning and scheduling is indispensable the following advantages are obtained thereby.

1. Alternative methods of construction and the effects of likely constraints can be examined at the planning stage and the most economical methods identified.
2. The time of starting each activity is known and therefore prior and adequate arrangements for the provision of resources, such as men, material, machines and money at each stage of construction can be made.
3. Resource utilisation can be optimised and the available resources directed towards various activities to the best advantage.
4. The actual progress of each activity can be monitored with reference action in speeding up the work taken up, before it causes a hindrance in other related activities.
5. The effect of any changes that takes place due to variations in productivity errors, whether geological conditions or modifications made in the original plans can be properly evaluated and the program suitably amended.
6. The inter-relationship of various activities and the relative importance of each at any stage of construction are known and this help in fixing priorities properly.
7. The ultimate advantage to be gained by scheduling is that the construction work can be executed in an efficient manner without wastage of any of the inputs, resulting in maximum possible economy.

A construction project consists of a sequence of various activities like preparation of the site, foundation, substructure, super structure, fittings, finishing, and other activities. Some of the activities may be of critical nature and if the activity is not completed in estimated time, it delays the entire project. The sequence of activities in the construction of a building is given below.

1. Earth work in excavation.	6. BW in super structure	11.Flooring
2. P.C.C bed and BW in foundation	7. Sanitary work	12.Electricalworks
3. D.P.C	8. RCC	13.Sanitary works
4. Precasting RCC lintels	9. Door panels	14.White washing
5. Casting RCC columns	10.Plastering	15.Sanitary fittings

SCHEDULING BY BAR CHARTS

The bar chart lists various activities involved in a construction project and the period of time that each activity takes for completion. Indicate in the form of a horizontal bar plotted to a suitable time scale against each activity.

Bar charts are suitable for determining the resources, such as materials, labour, machinery and finance, required for construction work Bar chart is simple, easily understandable and widely used method of scheduling. However it has certain limitations, firstly it is difficult to depict complicated interdependencies of various items of work. It does not give actual progress of the work. It is not possible to know the peak rate of work necessary for timely completion of a project.

The bar chart, therefore, is a static representation and does not respond to the dynamic happening son the construction site of a complex project.

Critical path method of scheduling

Critical Path Method is a network method. In CPM the project is analysed into different activities whose relationships are shown on the network diagram. The limitations of the bar charts can be overcome with the Critical Path Method. CPM is widely used in construction industry by a number of private and public organizations.

The concept of CPM is that only a small number of critical activities take most of the estimated project time. Speeding up the rest of the activities has no effect on the completion of work. Only these critical activities need to be speeded up and the rest of the activities can be allowed to proceed normally. The work can then be completed by the target date.

Basic network construction

A network diagram is a graphical representation of the sequence in which various activities of a project are under taken and the relationship among them.

BUDGET

Budgeting has come to be accepted as an efficient method of short-term planning and control. It is employed, no doubt, in large business houses, but even the small businesses are using it at least in some informal manner. Through the budgets, a business wants to know clearly as to what it proposes to do during an accounting period or a part thereof.

The technique of budgeting is an important application of Management Accounting. Probably, the greatest aid to good management that has ever been devised is the use of budgets and budgetary control. It is a versatile tool and has helped managers cope with many problems including inflation.

DEFINITION OF BUDGET

The Chartered Institute of Management Accountants, England, defines a 'budget' as under:

“A financial and/or quantitative statement, prepared and approved prior to define period of time, of the policy to be pursued during that period for the purpose of attaining a given objective." According to Brown and Howard of Management Accountant "a budget is a predetermined statement of managerial policy during the given period which provides a standard for comparison with the results actually achieved."

Essentials of a Budget

An analysis of the above said definitions reveal the following essentials of a budget:

(1) It is prepared for a definite future period.

(2) It is a statement prepared prior to a defined period of time.

(3) The Budget is monetary and *I* or quantitative statement of policy.

(4) The Budget is a predetermined statement and its purpose is to attain a given objective.

A budget, therefore, be taken as a document which is closely related to both the managerial as well as accounting functions of an organization.

BUDGETARY CONTROL

Budgetary Control is the process of establishment of budgets relating to various activities and comparing the budgeted figures with the actual performance for arriving at deviations, if any. Accordingly, there cannot be budgetary control without budgets. Budgetary Control is a system which uses budgets as a means of planning and controlling.

According to I.C.M.A. England Budgetary control is defined by Terminology as the establishment of budgets relating to the responsibilities of executives to the requirements of a policy and the continuous comparison of actual with the budgeted results, either to secure by individual actions the objectives of that policy or to provide a basis for its revision.

Brown and Howard defines budgetary control is "a system of controlling costs which includes the preparation of budgets, co-coordinating the department and establishing responsibilities, comparing actual performance with the budgeted and acting upon results to achieve maximum profitability."

The above definitions reveal the following essentials of budgetary control:

(1) Establishment of objectives for each function and section of the organization.

(2) Comparison of actual performance with budget.

(3) Ascertainment of the causes for such deviations of actual from the budgeted performance.

(4) Taking suitable corrective action from different available alternatives to achieve the desired objectives.

Objectives of Budgetary Control

Budgetary Control is planned to assist the management for policy formulation, planning, controlling and co-coordinating the general objectives of budgetary control and can be stated in the following ways:

(1) ***Planning:*** A budget is a plan of action. Budgeting ensures a detailed plan of action for a business over a period of time.

(2) ***Coordination:*** Budgetary control co-ordinates the various activities of the entity or organization and secure co-operation of all concerned towards the common goal.

(3) ***Control:*** Control is necessary to ensure that plans and objectives are being achieved. Control follows planning and co-ordination. No control performance is possible without predetermined

standards.

Thus, budgetary control makes control possible by continuous measures against predetermined targets. If there is any variation between the budgeted performance and the actual performance, the same is subject to analysis and corrective action.

Advantages of Budgetary Control

The advantages of budgetary control may be summarized as follows :

(1) It facilitates reduction of cost.

(2) Budgetary control guides the management in planning and formulation of policies.

(3) Budgetary control facilitates effective co-ordination of activities of the various departments and functions by setting their limits and goals.

(4) It ensures maximization of profits through cost control and optimum utilization of resources.

(5) It evaluates for the continuous review of performance of different budget centers.

(6) It helps to the management efficient and economic production control.

(7) It facilitates corrective actions, whenever there is inefficiencies and weaknesses comparing actual performance with budget.

(8) It guides management in research and development.

(9) It ensures economy in working.

(10) It helps to adopt the principles of standard costing.

Limitations of Budgetary Control

Budgetary Control is an effective tool for management control. However, it has certain important

limitations which are identified below:

(1) The budget plan is based on estimates and forecasting. Forecasting cannot be considered to be an exact science. If the budget plans are made on the basis of inaccurate forecasts then the budget progamme may not be accurate and ineffective.

(2) For reasons of uncertainty about future, and changing circumstances which may develop later on, budget may prove short or excess of actual requirements.

(3) Effective implementation of budgetary control depends upon willingness, co-operation and understanding among people reasonable for execution. Lack of co-operation leads to inefficient performance.

(4) The system does not substitute for management. It is mere like a management tool.

(5) Budgeting may be cumbersome and time consuming process.

UNIT 4

CONTRACT

Introduction

Contract is an undertaking by a person or a firm to do any work under certain terms and conditions, which should invariably be in writing. The work may be for the construction or maintenance and repairs, for the supply of labor or the transport of materials, etc.

Contractor means a person or a firm who undertakes any type of contract. Usually this term is confined to the contractors who are engaged in construction or execution of works or repairs.

The system through which the works are carried out by the contractors, who arrange all the materials, labor and equipment required for proper completion of the works is known as the contract system. The work should satisfy the specifications with expected quality .It should also be completed within the stipulated time.

Types of Contract Agreements

Contract agreements fall into the following two clauses.

1. Piece-work agreements. 2. Contracts.

Piece-work agreements.

- These are agreements for doing the work at agreed rates,without reference to the total quantity of work or time. Small works or piecework up to Rs.5000/- are got done through the contractors by piecework agreement.
- Piecework agreements are of the following types.
  1. Piece-work. 2. Work Order.

Piece-work: In piece-work, the quantity of work is not mentioned and only the rate is mentioned. This agreement is used

(i) For small works (ii) when it is necessary to start work in anticipation of the formal acceptance of the contract and (iii) for running contract.

Work Order: Work order is used for petty works; work orders may sometimes also mention the time limit within which the work is to be completed. No formal agreement is drawn up with the contractor as in the case of piece-work when the work is awarded by a work order.

Types of Contracts

Contracts are of the following types.

1. Item rate Contracts.
2. Percentage Rate Contracts.
3. Lump sum contracts.

Tender: A Tender is the contractor's bid in writing offering to execute the specified work of construction, supply of materials etc., at the rates and amounts indicated, within the time limit and under conditions specified and agreed to.

Necessity of Tenders: Works, which are to be awarded to contractors, are publicised to enable a sufficient number of interested parties to bid. The lowest bid is generally accepted, unless there are good reasons for not doing so. The process of inviting bids and accepting them is known as tendering. The bid is usually made on the tender forms specified by the owner. The following tender documents are made available along with the tender forms to enable contractors to bid for the job.

1. Layout plan.
2. Set of drawings, including working drawings.
3. Detailed specifications or reference to standard specifications for each item of work
4. Schedule of stores to be issued by the owner indicating the rates and their place and issue.
5. Schedule of tools and plant and other facilities to be made available by the owner, indicating the conditions, hire changes and the place of delivery.
6. General conditions of the contract including time limits.
7. Special conditions of the contract that may have to be highlighted.
8. Amount of Security deposits to be paid /deducted.

Tender Notice: Whenever works are to be let out on contract, tenders are to be invited from the registered contractors or both registered and unregistered contractors depending on the

magnitude and nature of the work by issuing notice in newspapers. The notice that includes various particulars of work is named as Tender Notice.

Contract Agreement

Contract agreements are fall into the following categories:

1. Contracts
2. Piece work agreements

Contracts are classified as:

1. Percentage Rate contracts.
2. Item Rate contracts.
3. Lump sum contracts.

Piece-work agreements are of following types

1. Piece work 2. Work order

Conditions of Contract

The Conditions of contracts includes the following

1. Time of completion of work.
2. Volume of work.
3. Specifications of work.
4. Rates of payment.
5. Penalties for default on the part of the contractor etc.

Payment to Labour- N.M.R. Format

Except for the regular and work charged establishments, all persons engaged departmentally for the execution of works are considered as casual labour. Their wages are drawn on "Muster rolls".

Muster rolls are prepared in the prescribed form. The Nominal Muster Roll (N.M.R) form consists of two parts.

Part I of N.M.R. form consists of necessary columns for entering the names of labour, designation, father's name, their attendance particulars, rates of wages and the total amount payable for each labour. N.M.R form has the provision for entering the total amount of the muster, signature or left hand thumb impression of the labour as a receipt. At the bottom of this

form, the person preparing such N.M.R form should sign before submitting to A.E / D.E.E who in turn verifies the details entered and makes the payment.

Part II of the muster roll is used for recording the name of work, amount of work done in cases in which the work is susceptible to measurements. Other details like the number of measurement book, pages in which the measurements are recorded will also be entered in this part. If the work is not susceptible to measurement, a remark to that effect is recorded.

Some important instructions regarding the preparation of Muster rolls are:

1. Duplicate copies of muster rolls should not be prepared
2. Separate muster rolls are prepared for each period of payment. Labour may be paid more than once a month depending upon local conditions and practices.
3. The daily record of attendance and times should be recorded in such a way as to leave no possibility of tampering or making unauthorized entries.
4. After the muster roll has been passed, payment should be made as early as possible.
5. A record of wages that remains unpaid must be kept in a register of unpaid wages.
6. Subsequent payment of unpaid wages is recorded in the hand receipt. A note of the same is recorded in the register of unpaid wages as well as in the muster roll.
7. Wages that remain unpaid for three months must be reported to the divisional office.
8. Progress of work done by the labour is recorded and is to be compared with departmental rates.
9. Muster rolls are checked with reference to entries in the measurement book to the extent of 50% in the sub-divisional and 50% in the division office, when the divisional engineer makes payments.

Measurement Books (M-BOOKS)

The measurement book, (common Form No. 298) is a most important record since it is the basis of all accounts and quantities whether the work is done by daily labour, piece work, Schedule

contract, lump-sum contract or of materials received.

It is the original record of actual measurements or accounts and forms a reliable record as it may have to be produced as evidence in court of law.

All the books belonging to a division should be numbered serially and the pages of each book should be machine numbered.

A register of M-Books should be maintained in Form PWD VI-20, in the divisional office showing

(a) The serial number of each book,

(b) The names of sub-divisions to which issued,

(c) The date of issue and the date of its return, so that its eventual return to the divisional office may be watched.

A similar register should be maintained in the sub divisional office showing the names of the sub-divisional officer and section officers to whom measurement books are issued.

Books no longer in use would be withdrawn promptly even though not completely written up.

All completed measurement books containing measurements of the works executed by contractors, having running accounts should be sent to the Divisional Office for final record after final bills have been paid to the contractors.

The following instructions should be observed carefully while recording detailed measurements in the M. Book.

1. Topmost lines under columns 1 to 4 on each page of a measurement book should invariably filled in the field.

2. Any lines not required should be carefully scored out in order to prevent additional entries being made later on

3. Only Executive, Deputy Executive or Asst. Executive Engineers should record detailed measurements.

UNIT 5

MANAGEMENT INFORMATION SYSTEM

Types of labour

Construction labour can broadly divided into two types

1. Casual labour 2. Regular establishment

Casual labour: Casual labour is employed as and when required for the execution of work, payment is made on the basis of the number of days the labour works. There is no provision of leave, except the weekly holidays. This is also known as daily labour.

Regular Establishment: Regular establishment generally includes supervisory personal that are required for more or less continuous period during construction. They are paid monthly wages and entitled to leave and other benefits. The employees may be temporary or permanent. Permanent employees have great security of service and may be entitled to more service benefits than the temporary employees.

Labour welfare-Human relation

Construction is the largest industry in India and most of the employees who are working in construction industry are labours and skilled workers. As the nature of construction work is Temporary the workers are recruited as and when required for the execution of work and are retrenched when no longer needed.

Construction labour is migratory in nature, moving from one site to another site, and the labour attached to big contractors tends to migrate to new work sites taken up by them.

Construction

labour has not been able to organize itself to the extent that labour in factories and other organized sectors of trade has. This is mainly because the construction labours do not

have a permanent place of work. Consequently construction labour has extremely poor bargaining power and this situation is fully exploited by employers. The construction labour beside low wages, they live in crowded unsanitary temporary huts built at the construction sites in unhygienic surroundings without basic amenities of life.

For the welfare of the labour, the Governments have, from time to time, brought out labour laws.

Labour laws are classified into the following types

- Laws concerning the working conditions of labour.
- Laws concerning wages and other payments to labour.
- Laws concerning the social security of labour.

These laws are proved very much helpful to the labour for improving their living conditions.

Labour Insurance

Insurance laws are applicable only to regular employees.

In construction industry most of the labour is of casual nature and insurance laws are not applicable to them. For the welfare of casual labour, different Acts such as Minimum wagesAct, Compensation Act etc. are passed by the Government.

Payment of Wages

The remuneration given to workers for work performed

by them is known as wages. Wages are of two types.

1. **Nominal wage:** This is the remuneration paid to the worker in the form of money, but it does not include the value of any other benefit that may be provided.

2. **Real Wage:** Labour is often entitled to different benefits, such as leave, medical care, house rent allowance, bonus etc. If the value of such benefits is added to the nominal wage, it is known as real wage.

Wages are paid to the labour based on two methods:

1. Depending upon time devoted to the work. This method is known as time rate system.

2. Depending upon the quantity of work performed.

This method is known as piece rate system.

Time Rate system

In Time rate system of payment of wages, a suitable rate of payment is fixed per unit of time devoted to work by the labour. The unit of time can be hours, days, weeks or months.

The rate of payment for casual labour is fixed per day and that of regular employees per month in the construction industry.

The advantages of this system are:

1. It is simple and easily understood by labour.

2. The quality of work will be good.

3. The workers do not get overstrained.

There are, however, the following disadvantages in the system

1. Constant supervision is required.
2. Effective cost control cannot be ensured.

Piece Rate System

In this system payment is made on the basis of the output of the workers. The work done by each labour is measured and payment is made at the agreed rate. Thus a worker can make more money by increasing his output. The rate of each item of work is fixed on the basis of the past record of output.

Minimum Wages Act, 1948

The Minimum wages Act of 1948 was passed for the welfare of labour and provided for fixing the minimum rate of wages of labour. The Act aims at making provisions for the statutory fixation for the minimum rate of wages in number of industries where there are extensive chances for the exploitation of labour.

The main provisions of Minimum wages Act are:

1. The setting of advisory committees to collect information on which the minimum wages are based.
2. The wages of a worker in any scheduled employment shall be paid on a working day by:

(i) The 7th day after the last day of the wage period if the establishment has less than 1,000 employees.

(ii) The 10th day after the last day of the wage period if establishment has more than 1,000 employees.

3. The wages of an employee should be paid without any deductions except those items given below.

(i) Fines in respect of acts of omission.
(ii) Absence from duty.
(iii) Loss of goods directly attributed to the neglect of the employee.
(iv) House accommodation provided by the employer.
(v) Amenities and services provided by the employer.
(vi) Income tax
(vii) Subscription to the provident fund.
(viii) Recovery of advances.

(ix) Deductions ordered by the court.

(x) Payments to co-operative societies / Life Insurance Corporation.

Workmen Compensation Act, 1923

The Workmen Compensation Act passed to protect the victims of accidents and their families from hardships out of and in the course of employment. The Act covers workers employed in hazardous occupations as specified in the schedule but excludes those employed in clerical or administrative work. The Act provides for payment of compensation in case of accidents on work sites. The compensation, however, is not payable for injuries due to

(i) Disobedience or negligence,

(ii) Non observance of safety measures

(iii) Consumption of liquor

(iv) Diseases which are not contracted as a result of the occupation. In the case of the death of a worker, compensation is paid under all circumstances.

ACCIDENTS

Accidents are due to

(i) Human causes such as poor eye sight, negligence, effect of intoxicants, (ii) Mechanical causes such as inadequate safety devices, live electrical equipment, unreliable scaffolding etc. and

(iii) Environmental causes. Such as poor lighting, heat, noise etc.

The result of an accident may be:

1. Temporary disablement, which may be total or partial.
2. Permanent total disablement.
3. Permanent partial disablement.
4. Death.

Contract labour act, 1970

The contract labour Act, 1970 was passed to regulate the employment of contract labour in certain establishments. It also provides for improving the service conditions of contract labour. The Act is of importance to the construction industry where works are executed through contractors or by contract labour.

The Act applies to every establishment and contractor employing twenty or more workmen.

The Act does not apply to

establishments in which only work of an intermittent or casual nature is performed.

The Act provides for the constitution of a Central Advisory Contract Labour Board under the Central Government and of state Advisory contract labour Board under each State Government to advise the Central and State Governments on matters arising out of the administration of the Act and to carry out the functions assigned to it under the Act.

CLASSIFICATION OF LABOUR LAWS

In India Labour Laws may be classified under the following heads:

I. Laws related to Industrial Relations such as:

1. Trade Unions Act, 1926
2. Industrial Employment Standing Order Act, 1946.
3. Industrial Disputes Act, 1947.

II. Laws related to Wages such as:

4. Payment of Wages Act, 1936
5. Minimum Wages Act, 1948
6. Payment of Bonus Act, 1965.
7. Working Journalists (Fixation of Rates of Wages Act, 1958)

III. Laws related to Working Hours, Conditions of Service and Employment such as:

8. Factories Act, 1948.
9. Plantation Labour Act, 1951.
10. Mines Act, 1952.
11. Working Journalists and other Newspaper Employees' (Conditions of Service and Misc. Provisions) Act, 1955.
12. Merchant Shipping Act, 1958.
13. Motor Transport Workers Act, 1961. 28
14. Beedi & Cigar Workers
15. Contract Labour (Regulation & Abolition) Act, 1970.
16. Sales Promotion Employees Act, 1976.
17. Inter-State Migrant Workmen (Regulation of Employment and Conditions of Service) Act, 1979.

18. Dock Workers (Safety, Health & Welfare) Act, 1986.

19. Building & Other Construction Workers (Regulation of Employment & Conditions of Service) Act, 1996.

20. Building and Other Construction Workers Welfare Cess Act, 1996

21. Cine-Workers and Cinema Theatre Workers (Regulation of Employment) Act, 1981

22. Dangerous Machines (Regulation) Act, 1983

23. Dock Workers (Regulation of Employment) Act, 1948

24. Dock Workers (Regulation of Employment) (Inapplicability to Major Ports) Act, 1997

25. Employment of Manual Scavengers and Construction of Dry Latrines (Prohibition) Act, 1993

26. Industrial Employment (Standing Orders) Act, 1946

27. Mines and Mineral (Development and Regulation Act, 1957

28. Plantation Labour Act, 1951

29. Private Security Agencies (Regulation) Act, 2005

IV. Laws related to Equality and Empowerment of Women such as:

30. Maternity Benefit Act, 1961

31. Equal Remuneration Act, 1976.

V. Laws related to Deprived and Disadvantaged Sections of the Society such as:

32. Bonded Labour System (Abolition) Act, 1976

33. Child Labour (Prohibition & Regulation) Act, 1986

34. Children (Pledging of Labour) Act, 1933

VI. Laws related to Social Security such as:

35. Workmen's Compensation Act, 1923.

36. Employees' State Insurance Act, 1948.

37. Employees' Provident Fund & Miscellaneous Provisions Act, 1952.

38. Payment of Gratuity Act, 1972.

39. Employers' Liability Act, 1938

40. Beedi Workers Welfare Cess Act, 1976

41. Beedi Workers Welfare Fund Act, 1976

42. Cine workers Welfare Cess Act, 1981

43. Cine Workers Welfare Fund Act, 1981

44. Fatal Accidents Act, 1855

45. Iron Ore Mines, Manganese Ore Mines and Chrome Ore Mines Labour Welfare Cess Act, 1976

46. Iron Ore Mines, Manganese Ore Mines and Chrome Ore Mines Labour Welfare Fund Act, 1976

47. Limestone and Dolomite Mines Labour Welfare Fund Act, 1972

48. Mica Mines Labour Welfare Fund Act, 1946

49. Personal Injuries (Compensation Insurance) Act, 1963

50. Personal Injuries (Emergency Provisions) Act, 1962 51. Unorganised Workers' Social Security Act, 2008

CONDTRUCTION INDUSTRY AND SAFETY

Construction is a high hazard industry that comprises a wide range of activities involving construction, alteration, and/or repair. Examples include residential construction, bridge erection, roadway paving, excavations, demolitions, and large scale painting jobs. Construction workers engage in many activities that may expose them to serious hazards, such as falling from rooftops, unguarded machinery, being struck by heavy construction equipment, electrocutions, silica dust, and asbestos.

The information, tools, and resources provided in these Construction Industry web pages are designed to assist those in the industry - whether worker or employer - to identify, reduce, and eliminate construction-related hazards.

Types of hazards on construction sites

• Chemical • Physical • Biological • Ergonomic

Chemicals can exist in the form of

• dusts, fumes, fibers (solids)

• liquids, mists

• gases, vapors

Chemical Hazards

A health hazard can affect the entire body or many organs, or affect only specific tissues, organs, or parts of the body.

Physical Hazards

Physical hazards are different types of energy which may be hazardous to workers.

• Noise

• Vibration

• Temperature extremes

• Radiation

Biological Hazards

Exposure may occur during demolition, renovation, sewer work, work on air handling systems, or other construction work from contact with contaminated or disease-carrying

• soil

• water

• insects (mosquitoes, ticks)

• bird, bat droppings

• animals

• structures

Ergonomic Hazards

Ergonomic hazards can cause painful and disabling injuries till example Musculoskeletal Disorders (MSDs) .

This following situation may causes these injuries:

• heavy, frequent, or awkward lifting

• repetitive tasks

• awkward grips, postures

• using excessive force, overexertion

• using wrong tools for the job or using tools improperly

• using improperly maintained tools

• hand-intensive work

Causes of accidents (HSE, 2003)

• **Workers and work-team**

– Actions/behavior – Capabilities including knowledge and skills – Communication – Immediate supervision – Workers' health/fatigue

• **Workplace** – Site conditions (excluding equipment, material & weather) – Site layout/space – Working environment (light/noise/hot/cold) – Working schedule – Housekeeping

Costs of accidents

- direct costs and
- indirect costs

Direct costs:

The direct costs are insurance. These include medical costs and others workers' compensation insurance benefits as well as liability and property-damage insurance.

Indirect costs

Below are the lists of indirect costs:

Transportation costs – include the cost of emergency transportation, together with the cost of other personnel that were necessary to get to the injured worker to proper medical facilities

Wages paid to injured worker for time not worked – include all the time in which the worker was not actually doing his or her job and for the wages paid.

Cost incurred because of delays which resulted from accident – other crews affected or delayed; equipment idled; duration of project lengthened; plus all wages, rental fees and indirect supervision costs that occurred as a result of the accident.

Costs of overtime necessitated by accidents – overtime occurred because of the accidents

Loss of efficiency of crew – decrease of crew efficiency due to low morale or reshuffling that might occur to replace an injured worker.

Cost to break in and/or teach replacement worker – hiring new worker would include training and orientation Costs for clean-up, repair or replacement and stand-by costs – normally accidents involves spillage, cave-ins vehicle damage, material wastage or site clean-up.

Extra wage costs, slower returned worker – normally when a worker return to the job site and is partially and/or temporarily disabled, the worker is probably working at a different, less demanding job or less efficient at the former job.

Costs to reschedule work – include time spent to review and reschedule the project due to investigations or project being temporarily suspended by the authorities. Costs of wages for supervision as a result of the accidents – include all time spent on the accident and its results: caring for the worker's medical treatment, investigation, completing forms, disseminating information, visiting the worker, planning to prevent recurrence, appearance in court.

Hazard identification

• Systematic recognition of any aspects of a project which have a potential to be a danger to these persons working on worksite or being around the project.

• Example of hazards present in : working at heights, use of ladders and scaffolds, collapse of temporary structures, use of vehicles, mechanical plant & equipment, etc.

Reasons and benefits to improve health and safety in construction

• Responsibility;

• Economic reasons;

• Impact of safety on overall performance;

• Contractor's performance;

• Control of accident causes Responsibility

• Safety is everyone's responsibility.

• It is a moral and legal obligation of employers to provide a safe working place and of employees to work safely.

• **Employer's duty of care to employees as covering the following areas:**

– safe system of work; – a safe place of work; – plant and machinery that is safe to use; – competent supervision and/or suitable training; and – care in the selection of fellow employees.