1. ROLE OF VARIOUS AGENCIES IN A CONSTRUCTION PROJECT

1.1 Parties involved in a construction project

Depending on the type of project, and the project delivery method selected by the owner, the main parties to a construction project include the following:

Owner/Client

A party, who owns or develops a project, engages parties to design and construct the project, and compensate those parties for their services and work.

Architect or engineer

A party engaged by the owner to design the project. An engineer is required to design and engineer specialized projects, such as public works (ie bridges, highways) or plants (ie manufacturing facilities, utilities).

General contractor and subcontractor

A general contractor is a party engaged by the owner to construct the project. The general contractor typically hires subcontractors to perform and complete separate parts of the project. Those subcontractors, in turn, may hire sub-subcontractors to perform a portion of the part of the project for which the subcontractor is responsible.

Design-builder

A party engaged by the owner to design and construct the project. A design-builder takes responsibility for both the design and construction functions, either with respect to the entire project or a portion of the project.

Consultant

A party engaged by the owner, architect, engineer or contractor to render professional assistance regarding a particular aspect of the work. For example, an architect might hire a specialty engineer; a contractor might hire a remediation consultant; a design-builder might hire an MEP (mechanical-electrical-plumbing) engineer; an owner might hire a construction manager to oversee the entire project or a professional to provide expertise regarding a specialized project, such as a water park, golf course, or manufacturing facility. Several consultants may render professional services on a single project, each engaged by and responsible to a different party.

Supplier

An entity from which materials are obtained that will become part of the project; for example, those who supply the steel, cement, wood, glass, tiles, and electrical and plumbing fixtures.

- labor suppliers
- material suppliers

Others

Transporters, clearing and forwarding agents, insurance companies, environmental activists, local government, journalists, political parties, user community.

1.2 The Role of Consultant Engineer

Information gathering, design delivery, implementation supervision, planning and scheduling, reporting to owner, motivating the work team, taking measures for project control, working as Project Management Consultant (PMC).

Consulting engineering is a professional service that provides independent expertise in engineering, science and related areas to governments, industries, developers and construction firms.

Consultation

Consultation occurs when a client, who needs an opinion on some engineering problems, avails himself of the expert knowledge and the experience of a consulting civil engineer. Consultations may be brief or extended and may sometimes require considerable travel and a substantial portion of the consultant's time.

Investigation

Most consultations usually require some study and investigation which involve analysis and simple computations while others may require field trips to observe and inspect equipment or structures. Still again, they may involve a review of studies, reports, investigations or communications prepared by other engineers or by the client's management.

Feasibility Reports

These reports are concerned with determining the feasibility of some projects while presenting the results of surveys, studies and

investigation carried out to confirm the engineering solution to be adopted in line with the financial cost. A feasibility study will usually include such items as purpose of study, requirements and needs of project, alternate solutions, estimated construction cost, recommendations and conclusion.

Engineering Design

Engineering design is the process of determining the physical characteristics and dimensions of a structure or project to be constructed or manufactured. These characteristics and dimensions are presented graphically on drawings, commonly referred to as blueprints by the layman. Such drawings, or plans, are supplemented by written documents called specifications.

Plans and Specifications are used to direct the contractor or the manufacturer on the details of work expected from him. Frequently, the design process includes the preparation of detailed lists of materials called bill of quantities which is used to procure all the materials needed for the construction or manufacturing work.

Procurement

The consultant often assists the client in the selection of contractors or in the purchase of materials for the award of contracts. Procurement usually involves the receipt of a proposal from one or more material suppliers and selection is made on a competitive or a negotiated basis.

On construction projects, particularly for government organizations, contracts are usually awarded on the basis of competitive bidding while the engineer will normally prepare the

contract documents in addition to drawings and specifications in conjunction with the client's legal officer.

With the plans, specifications and contract documents, bids are solicited from contractors or manufacturers through public notices issued in accordance with legal requirements. After the receipt of all interested tenders, bids are opened publicly, as a rule, read and tabulated by the consulting civil engineer who will then makes his recommendations to the client.

Construction Supervision

This activity consists of two parts – general supervision and resident supervision. General supervision involves the following:

a) Periodic visits to site

b) Consultation with the Owner/Client

c) Interpretation of plans and specifications

d) Checking working drawings and data

e) Processing & certification of contractor's payment estimates

f) Preparation of amendments to contractor's contract

g) Final inspection of project

h) Preparation of "as-built" drawings

Resident supervision however requires the consulting engineer to send a representative or a resident engineer to the site of the project. The resident engineer is responsible for detailed supervision and inspection to ensure that the project is constructed according to the plans and specifications. In addition, he also coordinates and expedites the activities of the contractors.

Legal Services

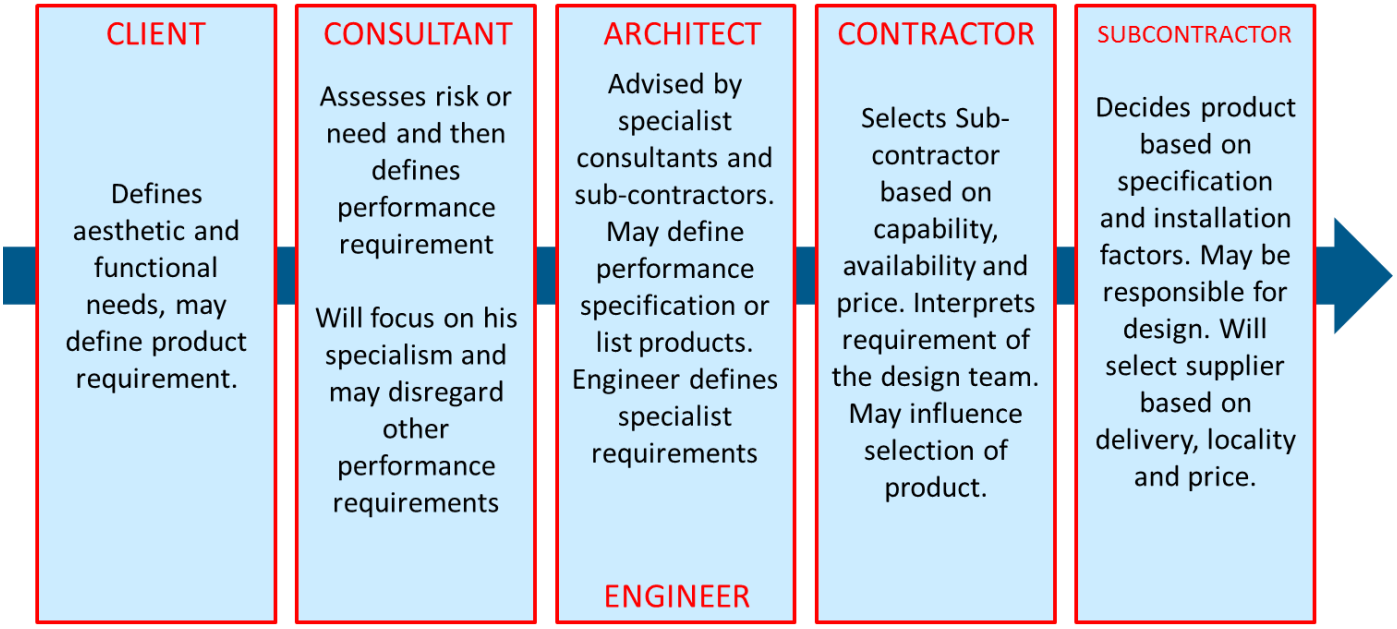
Often consulting civil engineers are requested to function as expert witnesses in the court proceedings and to advise clients and lawyers on engineering matters involved in legal procedures.

Other Services

The list of services outlined above is by no means complete and a compilation of a complete list of services would be a formidable task and would serve no useful purpose. However, the listings given here adequately cover the range of services performed by a consulting civil engineer.

The engineer's role during the typical construction project is to administer the construction contract:

- Representing, advising, and consulting with the owner during the construction
- Selection/procurement and award of a contract to a competent contractor at a fair price (subject to the vagaries of the competitive bidding process)
- Receipt and review of the contractor's submittals (usually referred to as shop drawings)
- Review and approval of the contractor's requests or applications for payment
- Providing interpretations and clarifications of the requirements of the construction contract
- Managing the changes to the requirements of the construction contact and to the design
- Assisting the owner and contractor with resolution of disputes
- Providing observations of the work of the contractor as it progresses; and
- Upon completion of the work, evaluating whether the contractor has met the requirements of the construction contract and whether the owner has received value for the payments made to, or to be made to, the contractor.



1.3 The Role of Client

The Client has overall responsibility for the successful management of the construction project and is supported by other key duty holders such as the Principal Designer and Principal Contractor. The Client has a key influence on the outcome of a construction project, because the project is originated by the Client and pays for the work to be executed. For the successful delivery of a project, good working relationships between the duty holders are essential from the start.

The Client has specific duties at all stages of the project. These include:

• Ensuring that suitable management arrangements are made for the project;
• Selecting and appointing a competent and resourced Principal Designer;
• Selecting and appointing a competent and resourced Principal Contractor;
• Notifying the Health and Safety Executive (HSE) of certain projects

• Ensuring sufficient time and resources are allowed for all stages of the project;
• Providing the pre-construction information (PCI) to the designers and contractors;
• Verifying the adequacy of the construction phase plan (CPP) prior to work starting; and
• Verifying that suitable welfare facilities are in place prior to work starting.

There are three important phases within a construction project:
• **The pre-construction phase:** the inception, design and planning stage of a project (before the construction or building work starts);

• **The construction phase:** the start-to-finish stage of the construction or building work; and

• **The post-construction phase:** the practical completion of the construction or building work, including handover.

At each phase the Client has an important role to play.

The pre-construction phase:
The pre-construction phase is the period before site work starts. As the Client, you must ensure that construction work is properly planned, resourced and managed to protect the health, safety and welfare of those carrying out work on, or who may be affected by, your project.

Providing a Client Brief
A Client Brief is a useful way in which to outline your project requirements to others such as designers and/or contractors and helps to complying duties. A good Client Brief should:
• Describe the main function of the finished structure;
• Outline your motivation for initiating the project;

• Give your expectations (including for health and safety) during the project;
• Explain the design direction you have in mind;
• Establish a single point of contact for any Client queries or discussions during the project; and
• Set a realistic timeframe and budget. Your designer (architect) or contractor should be able to help you with developing a good brief.

Ensuring suitable management arrangements are made for the project

As the Client, you must make suitable arrangements to ensure that, throughout the planning, design and construction of a project, adequate thought is given to the health and safety of all those involved in or affected by the construction work.
To be suitable, the arrangements should focus on the needs of the particular project and be proportionate to the size of the project and risks involved in the work. Arrangements should include:
• Assembling the project team – appointing designers (including a Principal Designer) and contractors (including a Principal Contractor);
• Ensuring the roles, functions and responsibilities of the project team are clear;
• Ensuring sufficient resources and time are allocated for each stage of the project – from concept to completion;
• Ensuring effective mechanisms are in place for members of the project team to communicate and cooperate with each other and coordinate their activities;
• Determining how the Client will take reasonable steps to ensure that the Principal Designer and Principal Contractor comply with their separate duties. This could take place at project progress meetings or via written updates;

• Setting out the means to ensure that the health and safety performance of designers and contractors is maintained throughout; and

• Ensuring that workers are provided with suitable welfare facilities for the duration of construction work.

1.4 The Role of Subcontractor

The construction companies that execute the entire work without the subcontractor's are rare contribution. The non-adoption of this procedure would request a great amount of men and equipment that would be, at some moment, sub used. Facing that reality, two possibilities have emerged: to hire and lay out or to use subcontracting. The restriction to the first strategy is the existence of costs concerning relating to social welfare responsibilities relating dismissals. Besides, one cannot count with the certainty of labor availability precisely when it is needed for the execution of the activities.

Types of Subcontractor

Villacreses (1994) classifies the "several types" of subcontractors in three categories, depending on the service type:

· Subcontractors of basic activities: constituted mainly by concrete, masonry, masonry coatings and ceramic coatings;

· Subcontractors of technical specialties: they execute activities such as electric facilities, hydraulics, air-conditioning, among others;

· Labor or materials subcontracting specialties: painting, floors, windows, glasses, external coatings, foundations and cleaning are among the most important.

Subcontracting Advantage

Below are introduced some of the advantages obtained when using the subcontracting:

· Flexibility improves: flexibility can be defined as the ability of the company in responding to market changes, labor subcontracting improves the functional flexibility (the workers' functions), of volume (number of workers) and financial of the company (smaller fixed costs).

· Productivity Increases: since, in a general way, the subcontracted teams are specialized in certain services, they start to present a larger productivity when compared with the company's own labor force. This probably happens due to effects of repetition, learning and concentration, besides the use of work organization methods

· Improves the Product's Quality: if qualified workers are used, the specialties of the labor take better quality products. However, subcontracting leads to control and coordination problems that can result in low quality products. on the other hand,
maintains that the quality of the products is not affected by the main contracting party's competence, and attributed it exclusively to the subcontractor's performance.

· Elimination of Sub-used Labor and Equipment Maintenance: now the companies that possess enough work fronts to provide services to the whole production team, maintaining it continually busy, are rare. This condition extends to the equipment that
would be sub-used.

· Easiness in Costs Control: the use of subcontractors with contracts of fixed price facilitates costs control and reduces the responsibility of the manufacturer's supervision.

· Reduction of Delays: as the productivity services executed with subcontracted labor is larger, if there is good programming and planning of the tasks and if other external factors don't to act directly, a reduction of delays results as natural effect.

1.5 The Role of Contractor

A contractor is anyone who directly employs or engages construction workers or manages construction work. Contractors include sub-contractors, any individual self-employed worker or business that carries out, manages or controls construction work. They must have the skills, knowledge, experience and, where relevant, the organizational capability to carry out the work safely and without risk to health.

Anyone who directly engages construction workers or manages construction work is a contractor. This includes companies that use their own workforce to do construction work on their own premises.

Pre-tender stage

- Proper study of tender documents
- Site visit and verification
- Unit price and balance loading
- Attend pre-tender meeting
- Inform the client/consultant any discrepancies in the design, BOQ and investigation reports
- Proper assessment of self-capability
- Decide bid or no bid
- Submit a responsive tender

Construction stage

- Establish site office
- Prepare the construction phase plan
- Arrange all required resources.
- Clearly mention roles and responsibility of working personnel

- Execute construction as per drawings, specification and instruction of the engineer
- Be responsible for the adequacy, stability and safety of all site operations and methods of construction
- Execute temporary works as necessary
- Keep proper records related to construction – site diary
- Insurance of the work and people
- Inform the client, through consultant, about any unexpected site conditions and any extra work that has cost implication
- Inform the delays and details of time extension required
- Subcontracting – get approval from the client/consultant
- Inform the engineer, if his experience shows the contrary to what has been designed and instructed. Inform about foreseeable risk to the engineer
- Prepare invoices and facilitate engineer in its checking
- Update schedule of work, prepare revised schedule to ensure timely completion
- Take appropriate steps on engineer's comment of too slow rate of work progress

Post construction stage

- Performance of regular preventive maintenance and servicing of the works during the Defects Liability Period
- Provide guarantees, test and similar certificates
- Providing operating and maintenance manuals
- Prior to Practical Completion, the contractor shall submit a proposed Schedule of 'As Constructed Drawings' for approval by the client.
- The Contractor shall provide a Post Construction Site Survey

The duties on contractors apply whether their workers are employees, self-employed or agency workers.

- Manage your work
- Co-operate with the other duty holders
- Consult with employees
- Prepare the construction phase plan
- Ensure welfare facilities are provided
- Ensure a site induction is provided
- Ensure the site is secure
- Appoint subcontractors and workers
- Provide the right supervision

Role of Consultant Engineer within FIDIC Contracts

The institution of the Consultant Engineer is well defined in **FIDIC** contracts, which have been developed based on the Anglo-Saxon law.

The Consultant Engineer has a contract administrator role, has **an independent and impartial position** and has qualities of **arbitrator** and **mediator** among the parties involved.

Within standard **Red Book** and **Yellow Book** contracts, the tasks of the Consultant Engineer are complex, having substantial importance in good implementation of the project.

The prerogatives of the Consultant Engineer in the FIDIC Books have also been taken over in the *Order of the Minister if Transportations and Infrastructure no. 1033/2011* on contracts for equipment and constructions, including design, implying construction of buildings and engineering works, contracts for

investment objects in the field of infrastructure for underground transport, financed form public funds.

The contractual conditions clearly set forth the actual **responsibilities** of the engineer and the way he/she needs to perform them as well.

- The Consultant Engineer, as specialist appointed by the Beneficiary, is a **key actor during the execution stage** for the works contracted by FIDIC Books.
  This guarantees for the Beneficiary that the works will be carried out in full accordance with contract's provisions; in this respect, he/she closely monitors the execution stage, by specialised inspectors or consulting business agents, ensuring that the Contractor fulfils the obligations agreed upon.
  For this purpose, the Consultant Engineer can send the Contractor written instructions or additional drawings necessary either for good works execution or for remediating potential defects, and the latter is to fully observe the changes and indications received from the Consultant Engineer.
- The Consultant Engineer has responsibilities for **solving crisis situations**, trying to obtain an agreement from both parties involved in the project (the Beneficiary and the Contractor). Should the parties face difficulties in finding a convenient way, the engineer can rule an impartial settlement, observing the FIDIC contract and takes into account the circumstances relevant in conflict dynamics.

  The Consultant Engineer finalizes the process for solving the problems occurred between the Beneficiary and the Contractor by notifying both parties, ensuring that the two parties involved comply with the agreement, until a potential revision of the contract.

- The Consultant Engineer is permanently in contact with the rhythm and the quality of works evolution and has the possibility **to request certain remediation works**, should the situation impose it.
  Concretely, he/she can rule removal and replacement of any equipment or materials that do not comply with the contract based on which he/she acts or order that any work that is not compliant with the contract should be carried out again. Furthermore, he/she can **request emergency works necessary for the safety of the works**within the project, as a result of an accident or of other unforeseen factors.
- The mission to bring the project to a successful conclusion can impose the Consultant Engineer to **adopt certain measures to stimulate works evolution**. Should the works drag on and tend to affect the execution program established, and the factors causing the delay of the deadlines do not allow an extension of the execution duration, the Consultant Engineer can request from the Contractor a justifying report, and an updated program as well for works evolution allowing the objectives set in the project to be reached.
- The responsibilities of the Consultant Engineer within FIDIC contracts also include **works taking over**. He/she issues the taking over certificate when works are completed, noting down the date when the works provide in the design were completed by the Contractor in accordance with the FIDIC contract adopted.

  Subsequently, based on the final taking over certificate, the Consultant Engineer authorizes that payments are made to the Contractor and issues the final payment certificate, which takes into account potential differences payable by/to the Beneficiary or Contractor.
  Should the contract provide payment to be made in several instalments, during works execution, he/she authorizes

interim works situations presenting the amounts requested by the Contractor in detail.

DUETIES OF MATERIALS SUPPLIERS

A supplier is a person who supplies, sells, offers, or exposes for sale, leases, distributes or installs any biological or chemical substance or any plant to be used at a place of employment.

A supplier must:

- Supply plant (workplaces, sites, equipment), in a safe condition;
- Supply chemical and biological substances that are safe when instructions are followed correctly;
- Provide written instructions about how to use equipment safely;
- Maintain equipment in safe condition; and

.

Structural Engineers: Roles and Responsibilities

The role of the structural engineer is a key component in the construction process. Part of the wider discipline of civil engineering, structural engineering is concerned with the design and physical integrity of buildings and other large structures, like tunnels and bridges. Structural engineers have wide range of responsibilities - not least a duty to ensure the safety and durability of the project on which they are working.

Unlike architects, who must focus on the appearance, shape, size and use of the building, structural engineers must solve technical problems - and help the architect achieve his or her vision for the project.

What do structural engineers do?

Structural engineers work in offices and on construction sites - or may split their time between both contexts. Locations can be varied, including work in metropolitan and rural environments. Depending on the size of the project, structural engineers may also be required to work long hours - in teams consisting of professional, skilled and semi-skilled workers.

Structural engineers must have a strong grasp of physics, three-dimensional conceptual skills and creative problem solving. Outside of an ability to apply principles of mechanics, mathematics and physics to construct safe, sustainable buildings, the roles and responsibilities of structural engineers include:

Design: Many structural engineers deal primarily in the design of structures - calculating the loads and stresses the construction will have to safely withstand. Structural engineers should be able to factor in the different qualities and strengths delivered by a range of building materials, and understand how to incorporate support beams, columns and foundations.

Investigation: Before work can begin, structural engineers are involved in the investigation and survey of build sites to determine the suitability of the earth for the requirements of the upcoming project.

Communication: Structural engineers will be required to co-ordinate and consult with other members of their projects, including engineers, environmental scientists, architects and landscape architects. They may also be required to assist government bodies in their own inspections relating to the project.

Management: Structural engineers are often responsible for the organisation and delivery of materials and equipment for the needs of the construction project. The supervision and management of on-site labour may also be a necessity.

Training: Because of the safety issues involved in their work, structural engineers must be trained to strict standards. Most structural engineering courses require a related undergraduate degree in an engineering discipline. After graduation, structural engineers work towards professional qualifications - becoming Associated and then Chartered Members with the Institution of Structural Engineers.

Structural engineering courses can be very competitive and prospective candidates should look for practical experience to bolster their applications. After qualification, work experience placements are useful for getting a foot in the door of the industry - and developing network contacts.

Becoming a structural engineer takes a substantial amount of time and dedication - including a focus on professional development. Once qualified however, the learning process continues - as new methods and materials are introduced into the construction industry. Structural engineering jobs can take place across national and international contexts and involve work on some of the most exciting construction projects in the world.

Construction Documents

Drawings, plans, specifications, etc., associated with a construction project

Concept and Definition of Construction Project management

Construction is the process of preparing and forming buildings and building systems. Construction starts with planning, design, and financing and continues until the structure is ready for occupancy.

Construction management or construction project management is the overall planning, coordination, and control of a construction process from beginning to completion. Construction project management is aimed at meeting a client's requirement in order to produce a functionally and financially viable project.

What does Construction Project Management (CPM) mean?

Construction project management could be defined as the direction, regulation and supervision of a project from early development to completion. The ultimate goal of construction project management is the full satisfaction of client’s demands for a viable project both in terms of functionality and budget. There is a wide range of construction project types, such as commercial, residential, industrial and heavy civil.

The main concept of construction project management is closely connected to technical parameters like budget and execution but it also requires solid communication between all the agents (stakeholders, contractors, community).

The Role of a Construction Project Manager

A construction project manager is responsible for planning, coordinating, budgeting and supervising projects from the beginning to the end. In short, a construction project manager has to take care of the following:

-Put together the budget and negotiate cost estimates
-Arrange the work timetables
-Choose the most efficient construction method and strategies
-Stay in touch with the clients for work or budget related issues
-Discuss about technical and contract details with workers and other professional parties
-Keep an eye on the personnel in construction onsite
-Cooperate with building and construction specialists

Construction Project Management: The Primary Functions

Construction management is typically extended to a excess of different functions. The most important of them could be summarized to the following:

1. Specification of the project goals and the plans including drawing of scope, scheduling, budgeting, deciding upon achievement requisites and choosing project participants.

2. Boost of the resource effectiveness through the acquisition of workforce and of the necessary equipment.

3. Conduction of numerous operations through legitimate coordination and management of contracting, planning, estimating, design, and construction during the whole procedure.

4. Efficient development of solid communication between the agents for resolving any conflicts that may arise.

The Main Principles of Construction Project Management

It's no secret that construction project management is a quite complicated field. However, there are some fundamental principles that anyone who just entering the field should keep in mind.

Everything starts with the project owner reaching out to contractors in order to ask for bids. The managers of construction that are interested in carrying out the project will, then, offer a bid to the owner. The bid will include details about the amount of money that the project owner has to offer for the project to be completed. There are two types of bids:

1. Open bid: Open bids are inextricably connected to public projects. It's an auction where any contractor is welcome to make his offer. An open bid is normally openly promoted.

2. Closed bid: Private projects are based on closed bids. The project owner sends a bid invitation to a specific number of contractors.

After receiving all the bids for the particular project, the owner proceeds to the selection of the contractor through one of the following three methods:

1. Low-bid selection: In that case, the main focus of interest is the price. The construction management companies present the lowest bids they are open to complete the project for. The project owner selects the lowest offer and proceeds with it.

2. Best value selection: This process puts weight both on qualifications and price. The owner is choosing the most appealing bid both in terms of quality and money.

3. Qualifications-based selection: The present method is adopted when qualifications are used as the only criterion for the selection of the construction management company. A request for qualifications (RFQ) is helping the owner in order to acquire further information regarding the experience and the project organization competences of the contractor.

Contract Types:

When the selection procedure is completed, the type of contract has also to be agreed. Normally, there are four contract types:

1. Lump sum: The most popular kind of agreement. The owner and the contractor set a fixed price for the whole project. The price remains the same even if the total cost of the project is proven to be higher lower than the agreed amount.

2. Unit price: When there are objective difficulties in deciding the final price in advance, this method is preferred. The project owner offers materials with a particular unit price in order to reduce spending.

3. Cost plus fee: A cost plus fee contract is the best contract agreement for contractors. On top of the project's total cost and the agreed fixed fee for the contractor, any other unpredictable expenses have to be covered by the owner after in the end.

4. Guaranteed maximum price: The last type of contract doesn't differ much than the previous one. The key difference is the maximum set price which can't be best in this case.

Project Management Processes

The bidding process is over and now is time for all the people involved in the project to make it happen. In general, every project has a standard life cycle, regardless of its special characteristics. This structure could be outlined to four basic stages:

1. Project Initiation

During the first phase, the objective and the feasibility of the project are determined. This is a crucial stage of the whole process, since it can indicate whether this project is a good opportunity or not. If necessary, a feasibility study is conducted and based on its results a recommended solution/plan is issued.

Once everything is decided, a project initiation document (PID) is created. The project initiation document provides the groundwork for the construction plan and is one of the most vital artifacts in project management.

2. Planning Phase

The project planning stage is where the team singles out all the work to be done. It's an ongoing activity almost to the end of the project. The main priority, during the planning phase, is to plan time, costs and resources for the project. Based on those requirements the team is developing the strategy that has to be followed. This is also known as scope management. Another important document that has to be prepared is a work breakdown structure (WBS), a checklist that divides all the necessary work into smaller more functional categories.

As soon as the budget, schedule and work have been defined the project is almost ready to begin. The next step of this really important process is risk management. At this point, the team should examine all the potential threats for the project and come up with solid solutions. Finally, a communication plan is, also, necessary as it will establish an efficient information flow between the project stakeholders.

3. Execution Phase

In the execution phase, the construction project management plan is put to work. As a rule, this phase is divided in two main processes: the executing and the monitoring and controlling. The project team makes sure that the required tasks are being performed. At the same time, progress is monitored and changes are being made accordingly. As a matter of fact, a project manager spends most of the time in the step of monitoring and depending on the information that he gets redirects the tasks and maintain the control of the project.

4. Closing Phase (Closure)

The final stage of the project represents its official completion. The project manager is evaluating what went well and refers to any potential failures. In the end, the team conducts a project report, calculates the final budget and offer information about any tasks that remain unfinished. The project report in combination with the analysis of the potential failures will be valuable feedback for future construction projects.

The Legal Aspect of a Construction Project

A construction project is consisted of many different details. One of the most vital that no project manager should overlook has to do with its legal parameters. A well-prepared construction project manager should always be in position to offer answers in potential legal disputes or risks that may emerge. In that way, the whole project is secured and built on strong foundations. In general, there are five main areas that should be taken into consideration:

1. The parties: This category refers to anyone who is involved in the construction project (contractors, consultants, sub-contractors, purchaser etc.)

2. Contracts: Even though there are certain fixed contract forms for construction projects, many times there is a need for changes in the agreements so legal advice is more than necessary.

3. Legislation & Regulation: A solid legal team can make sure that all the different legislations and regulations are followed properly.

4. Procurement: The procurement process refers to the purchase of all the different materials and services that are necessary for a construction project. It is crucial, then, that the whole project is thoroughly regulated from a legal aspect.

5. Insurance: It's no secret that, there are plenty of physical dangers on a construction site. That's why, a project manager should have been informed and taken care of every little detail concerning the insurance agreements.

What is the difference between construction management and project management?

A Construction Manager can be, and usually is, a Project Manager, but a Project Manager is not necessarily a Construction Manager.

The job of a construction manager can be very challenging on a large construction project. Usually, my counterparts on the contractor's side are the construction managers.

A construction manager:

- Assembles and manages the project schedule.
- Notifies the Owner of possible delays, usually when they want more time to complete the work
- Schedules resources and equipment
- Hires subcontractors and manages their costs and tries to keep them on schedule
- Orders materials
- Recognizes changes to the contract and requests changes from the owner
- Negotiates pricing with the Owner
- Coordinates with the Owner
- Provides cost estimates for changes in the work for change orders.
- Provides certifications as necessary to ensure payment for the materials
- Develops the staging or phasing plan
- Acts as facilitator for weekly partnering meetings, construction meetings, scheduling meetings, safety meetings, etc.

As you can see, they are very busy. They can make or break a project.

A Project Manager is primarily looking at schedule and budget, but may do more depending on their position. The job of a Project Manager is very similar to a Construction Manager, but Project Managers exist in a

wide array of fields, such as roadway design, computer design, computer fabrication, real estate,...the list is endless.

I am a Project Engineer/Project Manager.

- I assemble and manage the project schedule for the design process or for consultant work on any of my design or construction projects.
- I negotiate scope and fee with consultants who will do work on my Project. We put together a consultant agreement that we will use for the project that includes what they are going to do, how much it will cost to do it, and when they will do it.
- I manage consultant invoices on a monthly basis and make sure there is still money left to do the remaining work.
- I work with various other departments within the transportation department in order to complete my project on schedule. For example, the Environmental Branch is helping me on one project to get the proper Environmental Permits. I make sure that they are completing the work that I need on schedule.
- I request funding if my project doesn't have enough.
- I complete my own tasks as needed to stay on schedule and within budget.
- I facilitate Project Progress meetings.
- I close out the agreements.
- I may have multiple projects that I am managing.

So, you see, the jobs aren't very different, it just depends on the venue.

STAGES IN THE CONSTRUCTION PROCESS

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

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

- Completion

Each of these stages is discussed below in more detail.

1. Concept

All construction projects begin with planning and design also referred to as "architectural programming." Numerous overlapping steps occur during this conceptual or design phase, prior to actual construction of the project.

An **architect** is the primary designer of a building or project and controls the overall design, specifications, finished materials (e.g., brick, paint, carpet, wall covering, etc.), and other architectural features of the building. In addition, the architect supervises the engineers responsible for the structural, mechanical, electrical, lighting and plumbing design of the building. Engineers must always conform to the design requirements of the architect. Each member of the design team must also be licensed with the proper state licensing authorities where the facility is located.

- **Planning & Architectural Programming** During the initial stages of the design process, the architect(s) and engineer(s) have a number of client meetings in order to determine the purpose and objective of the proposed construction. The primary activities, for which the project is being constructed, as well as the relationships between spaces, are reviewed. Consideration is also given to how well the completed project relates to adjacent buildings (if any) and its surroundings. The preliminary programming produces a list of solutions, alternatives, feasibility studies and costs estimates. After a review of the programming statement, schematic plans are prepared.
- **Schematic Plans** Schematic plans are the first plans of a facility and show the interrelationship between spaces and activities. All of the parties (architects, engineers, and the client) review the schematic plans and make recommendations, as necessary. Any changes are then incorporated into the final schematic plans. Revised schematic plans are also known as "preliminary plans," and provide a graphic view of the project, the refined details of how the project will look, and the relationship of all spaces.

Once the preliminary planning phase is complete, the project then enters a stage involving the preparation of contract bid documents and working drawings.

2. Contracts and Bid Documents

In order to solicit construction bids, the builder must provide potential bidders with working drawings and plans for the proposed structure, as well as project specifications, the terms of which are spelled out in contracts.

- **Contract/Working Drawings/Plans** All projects, whether they involve new construction or expansion of an existing structure, require the preparation of contract documents. The contract working drawings and plans provide a pictorial representation of the construction work, and specify or lay out the designer's intentions for the facility. The drawings illustrate, among other things, the appearance, layout, equipment, and amenities of the project. These drawings show the architect's plan/design for the building's overall appearance, such as finish materials, floor plans, sizes, and use of each building area. Engineers design the building's structural, mechanical, electrical, plumbing and communication systems.

The architect also begins to gather project data to deal with problems or situations that are expected to arise during the construction process, such as local zoning requirements, local infrastructure, traffic, environmental and population impact, acoustic, energy, lighting, and aesthetic considerations. Various consulting engineers may also be utilized to solve specific project problems.

Numerous drawing plans are involved in a construction project, including the following.

- **Architectural Plans** The architectural plans indicate the layout of the project, such as floor plans, elevations, and details of the construction and architectural finishes. These plans are typically numbered sequentially with the prefix "A" for "architectural." "Plan view," the most common type of an architectural plan, is an

overhead view of the spaces on a specific floor. These plans also indicate the length, width and various heights of the structure and floor elevations. Plans may show notes of specific construction information and may also contain details on a specific portion of work.

Exterior elevations show the exterior and the exterior finishes, and are similar to photographs of the exterior. Architectural schedules on the plans indicate the door types, windows, hardware, plumbing, and light fixtures in each room.

In preparing the plans, the architect utilizes graphic symbols, instead of words, to indicate various facility conditions. These symbols indicate the various types of material, sizes, and room finishes to be used. Symbols may be shown on the plans themselves or in the legends of the plans.

A civil engineer is responsible for the proper drainage of a site, as well as the design of land improvements, such as paving, curb and gutter design, retaining walls, and drainage culverts. Site plans prepared by the civil engineer indicate the existing and proposed grades of the land and the specific location of the facility on the land.

- **Structural Plans** The structural plans are prepared by structural engineers and show the structural design of a building. These plans incorporate foundation planning with considerations for rain, snow, wind, earthquakes, and other natural phenomena. Structural engineers design the facility for both "live" and "dead" loads of the building. Live loads consist of the people, furniture, and other items that are not part of the building, but are supported by the building. Dead load is simply the weight of the building or structure itself.
- **Mechanical Plans** Mechanical plans are prepared by a mechanical engineer to show the design of the various mechanical systems in the building. These systems must be designed to incorporate the proper air conditioning, heating, and ventilation equipment, as well as adequate plumbing, to meet the needs for all of the building's designated activities.

Like the structural engineer, the mechanical engineer must design the mechanical building systems to meet building "loads." For example, office work produces a certain level of heat load, whereas cooking in a commercial kitchen may produce greater heat loads. The energy use of the air conditioning, heating, pumps, and other building equipment are monitored by the mechanical engineer and are considered when specifying building equipment for an efficiently designed building system. Mechanical plans are numbered with the prefixes "P" for "plumbing" and "H" for "heating, ventilating, and air conditioning."

- **Electrical Plans** Electrical plans are prepared by an electrical engineer, and show the electrical distribution system for the efficient distribution of power in a building. The plan design includes the distribution of electrical power from the utility company and the distribution to power-specific equipment. Engineering design factors for the overall electrical "load" of a building must also be considered (e.g., proper sizing and arrangement of transformers, panel boards, circuits, wires, conduits and power to the various machines, equipment and activities in the building). Electrical engineers may also handle the lighting design requirements of the building, as well as specialty areas such as a central security monitoring system, a computerized control system, and fire and smoke management systems. Electrical plans are numbered with the prefix "E" for "electrical."
- **Contract Specifications** The second part of the contracts and bid documents stage is the preparation of project specifications, also known as "specs." Specs instruct the contractor how to build the project, and consist of contract documents, the technical specifications of the materials and the quality of the materials to be installed, and the workmanship for installation of the materials. Given the amount of information that is required to be included, specs have to be organized in a coherent manner. The most widely accepted system for arranging construction specifications is called the CSI Master Format. The CSI format, developed by the Construction Specification Institute, requires four categories of

information: bidding requirements, contract forms, contract conditions, and technical specifications.

- **Bidding requirements** Bidding requirements describe the conditions of the bid to the owner, and encompass the Invitation to Bid, the Instructions to Bidders, the Information Available to Bidders, the Bid Forms and Attachments, and the Bid Security Forms. The type of contract between an owner and a contractor dictates the form of the bidding conditions.
- **Contract Form** Contract forms are divided into sections, including the Agreement, the Performance and Payment Bonds, and the Certificates.
- **Contract Conditions** The contract conditions include the General Conditions and Supplementary Conditions.
- **Technical Specifications** The technical specs are generally prepared for each specific project in the CSI Master Format and these include hundreds, perhaps thousands of individual items that will be installed in the project.

3. Bidding

The third stage of the construction process is bidding. Once an owner determines that a project is feasible and that construction financing is available, the owner will solicit bids or proposals from general contractors and/or specialty contractors. Owners generally use trade publications and newspapers in order to invite contractors to bid on a construction job. A copy of "The Notice to Contractors" will be shown in the project's specifications, providing contractors with the bidding procedures.

The following is the sequence of events to prepare a contract bid:

1. The contractor obtains a copy of the plans and specifications from the owner in order to prepare a formal estimate of the construction cost or bid (experienced construction personnel prepare the bids).
2. The contractor reviews the contract plans and specifications to determine how to build the project and to consider all the limitations or conditions the owner requires for the project.

3. The contractor solicits bids from subcontractors, estimates their direct material and labor costs, and evaluates the ultimate profit potential of the contract. The amount of the bid covers the estimated costs and a profit for the construction project.
4. The owner evaluates all of the submitted bids and then awards the contract.
5. The contract document and specs contain the project start and completion dates, the progress billing procedures, the insurance requirements, and other pertinent information.

The preparation of a bid is the first step in the cost control system of a construction project. The agreed-upon bid price then becomes the budget by which the actual expenditures are measured and drawn against. The object of a cost control system is to provide the general contractor and/or owner with information regarding actual project costs versus the anticipated or budgeted costs. These cost comparisons become essential for internal control purposes.

Standard cost manuals, such as the "R. S. Means Building Construction Cost Data," are used by a general contractor to compute a bid. These guides contain a compilation of cost data for each phase of construction. There are also construction cost data guides for both union and non-union wage rates. If the Service examiner needs to estimate construction costs as part of the analysis of a study, it is important to use the proper wage rates.

Subcontractors bid jobs in much the same way that a general contractor does. A subcontractor may also solicit bids from sub-subcontractors for specialty construction.

Working drawings and specifications provide information to allow general contractors to estimate the project's construction costs. Along with using their own estimators, a contractor usually has the subcontractor's and the material supplier's information readily available. If necessary, a general contractor can perform the preliminary details and/or shop drawings (see discussion on Appendix page 6.6-10) in order to estimate the proper costs to construct various parts of a building. The general contractor gathers all the information from his estimators and subcontractors and then adds in an amount for overhead and profit. This

final cost estimate is used in the competitive bidding for the construction of a project.

The cost estimate of a building or project is broken down and organized by the construction divisions shown in the specifications. The cost estimate is further detailed by trade and by item. The general contractor may also have a bank of information in order to estimate labor and material costs. Otherwise, the contractor will rely on any of several cost estimating manuals.

4. Construction (Field Work)

The fourth stage of the construction process, called fieldwork, is the actual construction of the project. Fieldwork is broken down into building permits, subcontractors, scheduling subcontractors, shop drawings, project submissions, and change orders.

- **Building Permits** Before construction can begin, the appropriate municipality must issue a building permit. Specifications and blueprints must be provided to the municipality's building department, along with the application for a permit. The period of time for a permit to be approved can be lengthy, especially in the case of new construction. The general contractor or owner may also be required to submit results of soil testing, environmental impact studies, and any other necessary testing or studies. Sometimes, a public hearing is mandated, if there is opposition to the project. In most cases, a permit is issued within a few months. The cost of the permit and any related studies may be the responsibility of either the owner or the general contractor.

  Construction projects must also follow the standards of the applicable building code. A building inspector will be involved at various construction stages in order to verify that the project is being constructed according to municipal code.

- **Subcontractors** Subcontractors range from a one-man operation to nationwide, publicly traded corporations, or divisions of larger corporations. Subcontractors are distinguished from general contractors by their limited scope of work, which usually involves a special skill, knowledge, or ability. Subcontractors, which include plumbers,

electricians, framers, and concrete workers, generally enter into contracts with the general contractor and may provide the raw materials used in their specialty areas. The general contractor, not the owner of the property, pays the subcontractors. Materials purchased by the subcontractors are generally delivered directly to the job site. The subcontractors' work may either be completed in stages, or it may be continuous.

- **Scheduling of Subcontractors** The general contractor schedules the subcontractor's work so that the construction runs smoothly and is completed on schedule. The general contractor is also responsible for scheduling the subcontractor in such a way that one subcontractor does not hold up another. This order on subcontractor sequencing is known as the "critical path."

  An example of the sequence in scheduling subcontractors for a small project is as follows:

1. Clear the land (which may include demolition of existing structures)
2. Excavate the land (which may include digging holes and leveling)
3. Pour the foundation
4. Frame steel and/or concrete
5. Rough framing
6. Rough electrical
7. Concrete flooring
8. Roofing
9. Heating and air conditioning
10. Ductwork for heating and air conditioning
11. Elevators and/or escalators
12. Sprinklers and other safety equipment
13. Install electrical fixtures
14. Insulate and weatherstrip
15. Frame windows and door sashes
16. Install tile and marble
17. Install suspended acoustical ceilings
18. Install toilets, sinks and other plumbing fixtures

19. Paint walls (inside and out)

- **Shop Drawings** Working drawings only include enough detail to show the general contractor the overall layout of the building. The individual specialty trades and suppliers use working drawings to produce shop drawings for items such as granite finishing, cabinets and countertops, structural steel, etc. Shop drawings detail the specific building components and are usually produced after the final design phase but before the beginning of the construction phase. Drawings are prepared in accordance with the instructions on Document A201. The architect/engineer will also check each shop drawing for precise measurements and for compliance with the intended building design.
- **Project Submissions** Project submissions are an important part of the construction process. Each installed building item must receive the architect's approval to ensure that the item or product is in conformance with technical specifications. Project submissions illustrate each item's intended use, function, method of attachment or installation requirements, and placed-in-service date. When the project is started, the architect and /or engineer monitors the contractor's progress and often approves the progress payments made to the contractors. The architect/engineer may also make modifications to the building plans as needed.
- **Change Orders** Change orders are the written contract revisions that increase or decrease the total contract price. Change order documents contain the change order number, change order date, a description of the change, and the amount of the change order. Contractors, based on the terms of the contract, may also issue orders.

5. Construction Payments

The fifth stage of the construction process is the construction payments stage. All construction contracts extend over a period of time. The order of any business operation is to collect money as soon as work is complete. When a contractor completes a prescribed amount of work, the owner pays the contractor for the completed work.

- **Specifications for Payment** The specifications for contract payments are shown in Document, under the "General Conditions for Construction Contracts." Document contains Forms. Form requires that the contractor break down the bid into various parts of work. The project designer (architect or engineer) critically reviews the G702 schedule of values that are prepared by the contractor and either accepts or rejects them. The close scrutiny of this form is due to the future release of funds that will be used to pay for the progress (and ultimately the completion) of construction. This form also provides the first basis for the construction cost control on a project. The architect and/or engineer have a legal and fiduciary responsibility for the accuracy of the cost allocations. The architect and the owner also want an adequate and timely distribution of funds to ensure smooth progress payments and to ensure that there will be the necessary funds to pay for the completion of the last portion of the project.

  It is extremely important for the Service examiner to analyze the form. This document provides a breakdown and analysis of the construction costs and, since it is prepared by 3rd parties, it provides an element of objectivity.

- **Change Orders** The architect/engineer may make modifications or change orders to the construction plans as needed. Change orders should be reviewed for any agreed changes to the payment schedule.

6. Completion

The final phase of the construction process is known as the completion stage, and it readies the building for occupancy.

- **As Built Plans** After a facility or project is completed, the architect and contractor prepare a set of plans known as the "as built plans." These plans represent exactly how the facility was constructed and they also incorporate all the changes to the original construction plan. It is very important that the Service examiner utilize the "As-Built Plans" when reviewing a cost segregation study because these represent the actual construction of the project.

- **Notice of Partial Completion** In some instances, the owner may desire to occupy a portion of the completed building. In that case, local building officials conduct an inspection to determine if that portion of the facility meets all building codes and is safe to be occupied. If approval is granted, a "Certificate/Notice of Partial Occupancy" is issued.
- **Notice of Substantial Completion** Local building officials issue this notice when 95 % of the construction is complete.
- **Notice of Completion/Certificate of Occupancy** A "Notice of Completion" is requested by the contractor/owner when the building is 100% complete. The project must pass a final inspection by local building officials in order for the "Notice of Completion" and the "Certificate of Occupancy" to be issued. These documents are recorded at the office of the local recorder and the property will be then appraised for property tax purposes.

Defects Liability

The defects liability period is a form of warranty that is guaranteed either by the retention of the contractor’s performance security and corresponding bank guarantee, at the end of the period of performance of the contract. The defects liability period can also be covered by retentions made from payments to the contractor over the life of the contract. These retentions are usually no more that 10% of the contract value.

The defects liability security is kept to cover any repairs or defects found in the infrastructure built by the contractor. If a defect in the infrastructure is detected during the defects liability period, the contractor is notified and given the opportunity to repair the defect. If the contractor is unable or unwilling to repair the defect, the purchaser has the right to use the funds retained for such purposes from the contractor.

Once the defects liability period passes, if no defects were discovered or those discovered were satisfactorily repaired by the contractor, the retention money is returned to the contractor or the defects liability guarantee released as stipulated in the contract.

Working with Local government:

Completing a new construction project, renovation, or addition to your current business facility is never as easy. The process takes time to develop a detailed plan, acquire the materials necessary, and coordinate with local government agencies. That last part is particularly important to the smooth completion of any commercial construction project.

Local government agencies exercise a moderate level of control over any commercial construction project. Generally speaking, the larger a

project is, the more you can expect to have to work with your local government. How local government is involved in construction project and the steps that can be taken to ease working with local government during the construction process.

How Local Government is Involved

Local governmental entities exercise control over what construction projects can take place and where. The larger your project is, the more you can expect to deal with local officials throughout the process. For example, a renovation or addition project may only require meetings and approval from your local government staff to ensure fire, plumbing, and mechanical codes are followed throughout the process.

When it comes to constructing a new facility for your company, you will find your company and construction partner interacting with local government officials more frequently. For starters, you'll need to ensure that the property you have targeted for construction is zoned for your commercial needs. What are the proper set-back requirements from adjoining properties? Will the project need a variance or conditional use permit in order to be constructed in its planned location? What are the height requirements? Will it need a fire suppression system? Will a traffic study be required? What is the city review process? These questions and more abound throughout the development process. Local government officials will also need to provide building permits allowing your company to complete your construction.

As with other projects, construction requires compliance with local and national fire, plumbing, mechanical, fuel, and energy conservation codes. Depending upon the green building initiatives adopted by your local government, you'll need to adhere to those standards when preparing your construction project.

Working with Local Government: You and Your Construction Partner

The construction process faces enough hurdles without worrying about running afoul of local government officials and construction guidelines. When you work with the right construction partner, you might find that the construction process is much smoother. A good construction company works hard to foster and maintain a positive working relationship with local governmental agencies.

By selecting the right construction partner to work with, you'll find the construction process will move much smoother. Team members from the construction company have the kind of relationship that allows them to sit down with local officials and discuss the outlined plan for your new project. This allows the company to assess the needs and expectations of your local government before starting your project.

Topics that should be discussed in a meeting with local government officials include, but are not limited to, the following:

- Site coverage
- Set-backs
- Drainage
- Erosion control
- Lighting issues
- Neighborhood concerns
- Traffic flow
- Utilities
- Zoning

Depending on the scope of your project, it might be necessary to expand the working relationship with local government officials to include participation in various meetings, committees, and other regulatory bodies. This includes but is not limited to:

- Economic development commissions
- Planning commissions
- City council meetings
- Fire Marshall meetings
- Watershed districts
- Department of Natural Resources
- Environmental Protection Agency

Do's and Don'ts Working with Local Government

When you're working with your local government, remember the following do's and don'ts that will make your partnership easier and your construction process smoother:

Do: Always obtain the proper permits and licenses before commencing construction. File any initial reports that local agencies require, ensuring you remain compliant and have permission to proceed with construction. Meet with local officials early and often to foster a solid working relationship.

Don't: Never assume that your project is compliant without meeting with local officials. Allow inspectors and other government officials with transparent information and easy access to your site when requested. Resisting government requests introduces unnecessary tension in the relationship and can cause your project to drag on longer than intended.

HOME ASSIGNMENT:

1. List down various agencies or parties involved in a construction project funded by World Bank. Write down the role of newly elected local government in donor funded project in remote areas of Nepal.

2. Discuss the role of contractor under FIDIC/PPMO contract for construction of 50 KM long agriculture road in Surkhet district of Nepal. Also explain at least four important issues during implementation phase that contractor has to take more attention to complete the project on schedule time.

3. Mention the various parties involved in a construction of rural gravity water supply project funded by Nepal Government. Why insurance companies of Nepal are not trustful & functioning not well in construction project of Nepal.

4. Explain about design built project model. What relationship would you expects within each party such as client, consultant and contractor as per FIDIC model of condition of contract?

5. Discuss about the role of engineer under FIDIC/PPMO contract. What are the administrative functions to be carried out by FIDIC engineers during project management?

6. Explain elaborately important and major roles for a Client during pre-tender stage of a urban road project.
7. Explain elaborately the role of contractor's manager during implementation of a urban road construction.