

## **2. DESIGN PHASE**

### **2.1. ORGANIZATION OF THE TENDER FOR THE CONTRACT: AEC - ARCHITECTURE / ENGINEERING / CONSULTING (DESIGN TEAM) OR DESIGN-BUILT**

#### **2.1.1. Choosing the form of the contract**

It is during this phase that detail planning starts followed by basic engineering, detailed engineering, procurement, construction and turnover of the facility to the owner.

During the design development the construction manager independently investigates costs and availability of systems proposed by the designer. He advises the designer or the engineer as to the availability and costs of possible alternate systems. During design development the construction manager performs necessary periodic reviews of the proposed design in order to monitor preestablished budgets and cost limitations.

Conceptual engineering of the project should be done concurrently with the preliminary planning. Decisions are made as to the source of the technology to be used.

The construction manager reviews preliminary specifications prepared by the architect-engineer, including quality control standards and criteria for site development, plumbing, electric, and site utilities. In accordance with the review of the total design, which may include design aspects such as the architectural, civil, mechanical, electrical, and structural plans, the construction manager considers both construction feasibility and possible economy that may be affected by different choices of proposed materials and construction methods.

At the conclusion of the preliminary design stage, the construction manager makes a very important estimate. This is the first point at which major structural, mechanical, and electrical systems have been defined. This information combined with the spatial solution of the schematic design, can be cost-estimated with a higher degree of accuracy.

Prior to completion of the final design plans, the construction manager together with the architect-engineer will analyze the total design effort and establish the appropriate decision of work for the final contract documents and plans and specifications.

The next stage in the life cycle is Construction planning. It is a fundamental and challenging activity in the management and execution of construction projects. It involves the choice of technology, the definition of work tasks, the estimation of the required resources and

durations for individual tasks, and the identification of any interactions among the different work tasks.

Construction planning consists of three steps: (1) Determination of the job steps or activities that must be performed to construct the project, (2) Ascertainment of the sequential relationships among these activities, and (3) The presentation of this planning information in the form of a network. However these three actions usually proceed more or less simultaneously with one another rather than as discrete and successive steps.

A good construction plan is the basis for developing the budget and the schedule for work. Developing the construction plan is a critical task in the management of construction. In addition to these technical aspects of construction planning, it may also be necessary to make organizational decisions about the relationships between project participants and even which organizations to include in a project.

Procurement is an important job that follows construction planning. It can make or break the profit situation on a specific contract and for the company as a whole. Procurement involves purchasing of equipments, materials, supplies, labour, and services required for construction and implementation of a project.

The major individual components of materials management includes:

- requisitioning: including specifying, designing and material takeoffs,
- inquiry,
- receipt of vendor offers,
- technical and commercial bid analyses,
- bid conditioning,
- issuing purchase orders,
- expediting vendor documents,
- expediting vendor orders,
- inspection during manufacture/fabrication,
- shop testing/acceptance,
- traffic or transport of the material from the plant/shop to the jobsite,
- receipt of the material at the jobsite, and,

- closeout of purchase orders.

The scheduled smooth and uninterrupted flow of materials to the site represents a very important determinant of project success.

Procurement methods and practices differ with individual firms and projects; nevertheless certain principles are common to each general approach to construction procurement.

The Procurement process is affected by a number of different factors and hence should not be performed in isolation. It should not be performed without considering the design and construction schedule of a project. It is essential that procurement be considered as a grand plan involving a number of stages.

After the completion of the construction project, which includes acceptance of work, contract closeout, subcontractor evaluation, inspection and testing and mechanical acceptance, turnover of the facility to the owner, takes place. Following the project closeout, direction of the plant startup activities comes under the owner's startup manager at the time of mechanical acceptance. One individual the startup manager is named to assume the responsibility for commissioning the plant and for starting it up. Frequently the plant may be turned over to the owner on a system-by-system basis or all at one time depending upon the size of the project. The owner's project manager makes sure that the plant has been completed and is ready for customer acceptance. Once the facility is accepted, it is under the care and custody of the owner.

### **Design-Build Contracts**

Whilst the traditional form of procurement as detailed in the previous sections, is the most commonly used for international projects, there is an increasing requirement for Employers to combine the design and construction process into one contract.

There are various reasons for this approach, which has tended to be led by Private Sector Clients and these include:

- Overlapping of the design and construction processes to provide an overall shorter period for project implementation.
- Dealing with only one organisation for both of the processes.
- Incorporating more cost effective construction techniques into the design process
- Simplification of the contractual relationships

- Avoiding conflict of responsibilities between the Designer and the Contractor
- Seeking a lump sum for the whole project and so avoiding remeasurement of the works

There is now an increasing interest in this form of procurement from Public Sector Clients, although there are more difficulties in this approach due to ensuring there is complete transparency in the adjudication of tenders. There may be problems in evaluating the quality, both in the short-term and also long term of the alternative design proposals made by the competing Contractors, which leads to subjective evaluation and hence potential cause for complaints by Contractors not awarded the contracts.

Design and Build contracts are normally undertaken based upon the Employers providing their outline design requirements and the details of the performance requirements of the end product. These requirements are termed the “Employer’s Requirements” and are the basis upon which competing companies tender. There are usually contract terms that allow the Employers to vary the works during the construction process but this tends to be more complicated and costly compared to using a traditional form of procurement when the Contractor is only responsible for the construction. The difficulty of varying the works during the construction may be seen as a major disadvantage to the design-build process and so Employers should only adopt the process if they are likely not to alter or vary the works significantly once the contract has been awarded.

### **Turnkey Contracts**

A Turnkey contract is very similar to a Design-Build contract, except that it anticipates there will be no change to the works by the Employer once the contract has been let.

The Employers will normally use this type of procurement process when the project is to maximise the design and construction capabilities for the Contractor in providing the end product. The Employer, having once awarded the contract, will not interfere with the Contractor executing the project. The Contractor will be judged on the performance of the end product, which will be made available to the Employer at the “turn of the key”.

An example of this type of project may be a hotel to be built fully furnished and equipped and ready for occupancy once the contract is completed.

## **Procurement Process for Design-Build and Turnkey Projects**

As the Employer is passing more risk to the Tenderers, the Employer must allow greater time for the tender period. In addition, the Employer must be very careful in drawing up the details of his “*Employer’s Requirements*” as these will be the basis for the Tenderers evaluating their costs. Subsequent changes to the Employers Requirements can prove very costly.

As with the traditional procurement system a prequalification may be undertaken, especially as a wider range of skills are necessary from the Contractor i.e. design as well as construction capabilities need to be demonstrated.

The Contract Tender Documentation will be somewhat different from traditional documents, as instead of the Tender Drawings, Bills of Quantities, and Specifications, in their place will be the Employer’s Requirements which set out technical and performance statements that are to be met by the Tenderers.

In addition, the Contract Conditions will be different. In the case of the New FIDIC documents referred to in Chapter 3 the relevant documents are as follows:

- “Conditions of Contract for Plant and Design-Build”
- “Conditions of Contract for EPC / Turnkey Projects” (EPC is an abbreviation for Engineering, Procurement, and Construction)

The tender submission, adjudication and award processes are similar to the traditional methods explained in earlier Sections. In the case of Turnkey projects and sometimes Design-Build projects there will be the requirement to negotiate details of the tender submissions in order to reach a satisfactory contractual agreement between the Employer and the Contractor. This is often caused by the increased complexity of the projects and resolving the performance requirements and their cost implications. Again this approach is more easily dealt with in the Private Sector than the Public Sector due to reasons of transparency of selection of the successful Contractor.