
Lecture Note for Contract, Specification and Quantity Surveying (CEng 5212)

COURSE DESCRIPTION

This course is intended to cover:

- 1. Specifications:** Types of specifications, Specification writing,
- 2. Quantity surveying:** material take off preparation and writing of bill of quantities,
- 3. Project cost estimation;** unit rate analysis and value of work.
- 4. Procurement and Contract:** The law of contract as applied to civil engineering constructions;
Types of Civil Engineering construction contracts; Contract documents; Conditions of contract;
Administration of contract, settlement of claims, Bidding theory, Preparation of tender, Tender Documents.

COURSE OBJECTIVE

- Understand different types of specification, know how to assure and control quality of construction materials and construction products,
- Prepare specifications and BoQ for construction projects,
- Work out quantity and types of material, manpower, and equipments needed for construction projects,
- Determine rates for construction activities using detailed cost estimation,
- Advice stake holders on preliminary and final costs of projects,
- Prepare payment certificates and final accounts of projects,
- Acquire knowledge on how to value projects,
- Acquire Sound Knowledge of Contract Documents and their conditions,
- Acquire sound knowledge on the different types of Delivery, Procurement and Contract Methods,
- Create / Formulate and Manage Tender and Contract Documents for Construction Projects,
- Understand processes involved in Procurement and Contract Management,
- Know how to administer Alterations, Claims and Disputes and
- Oversee appropriate procurement and contract method for the development of the Construction Industry in Ethiopia.

COURSE OUTLINE

1. GENERAL INTRODUCTION TO THE CONSTRUCTION INDUSTRY

- 1.1 Construction Management
- 1.2 Construction Industry
- 1.4 Construction Management Process
- 1.5 Ethiopian Construction Industry

2. SPECIFICATIONS

- 2.2. Definition
- 2.3. Purpose of Specification
- 2.4. Types of Specification
- 2.5. Specification Writing

3. QUANTITY SURVEYING

- 3.1. Introduction
- 3.2. Methods of Measurement
- 3.3. Quantity Surveying
- 3.4. Materials Take Off Preparation and Measuring of Quant
- 3.5. Writing Bill of Quantities and Preparation of Tenders

4. PROJECT COST ESTIMATION

- 4.1. Introduction
- 4.2. Information Required for Cost Estimation
- 4.3. Types of Costing or Estimation
- 4.4. Fundamental Approach to Construction Cost Estimation
- 4.5. Basic Cost Components of a Construction Project
- 4.6. Unit Rate Analysis

5. PROJECT VALUATION

- 5.1. General Introduction
- 5.2. Factors Affecting Value of an Asset
- 5.3. Types and method of Valuation

6. CONSTRUCTION PROCUREMENT

- 6.1. Stages in Construction
- 6.2. Introduction to procurement
- 6.3. Types of Procurement
- 6.4. Procurement and Contract Management
- 6.5. Procurement and Contract Delivery System
- 6.6. Procurement Management

7. CONSTRUCTION CONTRACT

- 7.1. Principles of Contract
- 7.2. Introduction to procurement
- 7.3. Types of Construction Contract
- 7.4. Contract Documents
- 7.5. Contract Administration
- 7.6. Claim and Dispute Management

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CHAPTER 1: GENERAL INTRODUCTION TO THE CONSTRUCTION INDUSTRY

1.1 Construction Management Defined

Construction is the mobilization and utilization of capital and specialized personnel, materials, and equipment to assemble materials and equipment on a specific site in accordance with drawings, specifications, and contract documents prepared to serve the purposes of a client. The organizations that perform construction usually specialize in one of four categories:

- a. Housing: including single-family homes and apartment buildings;
- b. Non-residential building: such as structures erected for institutional, educational commercial, light-industry, and recreational purposes;
- c. Heavy construction- highways, bridges, tunnels, railroads, waterways, marine structures, airports, etc.; and
- d. Industrial construction, such as power plants, steel mills, chemical plants, factories, and other highly technical structures.

The reason for such specializations is that construction methods, supervisory skills, labour, and equipment are considerably different for each of the categories.

Construction involves a combination of specialized organizations, engineering science, studied guesses, and calculated risks. It is complex and diversified and the end product is typically nonstandard. Since operations must be performed at the site of the project, every project is unique. Furthermore, because of exposure to the outdoors, construction is affected by both daily and seasonal weather variations. It is also often influenced significantly by the availability of local construction materials, labour, financing and equipment.

Construction contractors typically employ supervisory and administrative personnel, labour, materials, and equipment to perform construction in accordance with the terms of a contract with a client.

Construction management is the task which involves the planning, execution, and control of construction operations at the same time meeting the cost, quality and completion date objectives of the project. It also involves motivating and leading the human resource to achieve objectives of the project.

Planning requires determination of financing methods, estimating construction costs, scheduling of the work and selection of construction methods and equipment to be used.

In the execution, it is important to recognize that not only construction cost but also the total project cost increases with duration of construction time. Hence, fast execution of the work is essential. To achieve this end, construction management must ensure that labour, materials, and equipment are available when needed for the work.

Control of construction requires up-to-date information on progress of the work, construction costs, income, and application of measures to correct any of these not meeting schedules. Progress control typically is based on comparisons of actual performance of construction with scheduled performance indicated on master or detailed schedules. Lagging operations generally are speeded by overtime work or addition of more crews and equipment and expedited delivery of materials and equipment to be installed. Cost and income control usually is based on comparisons of actual costs and income with those budgeted at the start of the project. Such comparisons enable discovery of the sources of cost overruns and income shortfalls so that corrective measures can be institutes.

Construction management can be considered from two perspectives:

- a) **From contracts perspective** - after winning the contract, an individual or the construction company is responsible for performance of all the work and delivery of the finished project within a specific period of time and usually without exceeding estimated cost. This individual or company is referred to as a general contractor.

The general contractor primarily provides construction management for the entire project. This contractor may supply forces to perform all of the work but some of the work may be subcontracted to others. Nevertheless, the contractor is responsible for all of it. Completely in charge of all field operations, including procurement of construction

personnel materials, and equipment, the contractor marshals and allocates these reserves to achieve project completion in the shortest time and at the lowest cost. This is referred to as **Project Management**.

The contractor will have two prime objectives: (1) provision to the owner of a service that is satisfactory and on time; (2) making a profit.

From the client's (owner's) perspective - the client's construction manager can prepare cost estimates during the preliminary design and design development phases, as well as the final cost estimate after completion of the contract documents. During construction, the construction manager acts as an agent of the owner the construction manager assumes the duties of the owner for constructional and organizes a staff for the assumes the duties of the owner for construction and organizes a staff for the purpose. Other functions of construction management are to provide a resident engineer or clerk of the works; act as liaison with the prime design professional, general contractor and owner; keep job records; check and report on job progress; direct the general contractor to bring behind-schedule items, if any, up to date; take steps to correct cost overruns, if any; record and authorize with the owner's approval, expenditures and payments; process requests for changes in the work and issue change orders; expedite change of shop drawings; inspect construction for conformance with contract documents; schedule and conduct job meetings; and perform such other tasks for which an owner would normally be responsible. This task is usually referred to as **Contract Administration**.

1.2 Historical Development of Construction Management

Primitive man was a wonderer in search of food and shelter. Around 4000B.C man started settling down to community life. It took years to develop to a stage of organized human activity to carry out construction of a large scale.

The wonders of ancient human civilization such as the pyramid inevitably involved many workers (mainly slaves) and a lot of material that needed management of activities, material supplies and the human resources, though we don't find records. The Great Wall of China is another huge construction standing to date.

After formation of towns/cities and governments, people constructed walls around their towns/cities to protect themselves from invasion and looting. The tribal/town/city/government chiefs must have coordinated the residents of the town or city to carry out the construction.

Between 200 B.C. and 260 A.D. the Romans built many bridges. This was considered very important to rule the world. The construction operations must have required management of workers and material preparation and supplies.

In Ethiopian history we find that King Lalibella constructed Rock Hewn churches which are big in size of superb architecture in the 13th century. That must have required the management of the people involved in the work.

Until the early 19th century the architect was the master builder. He designed the project, purchased the materials, hired the craftsmen, and managed the construction. Some spent their entire lifetimes working on a single project. There were no such things as project schedules and cost control. The architect or master builder faced a simple technology and very few varieties of construction materials. He was virtually the sole interface between the owner and the project. Too, it should be pointed out that often the owner was not interested in a return on his investment in the tangible sense; the project may have been a monument to his ego, such as the pyramids, the palace at Versailles, and the Taj Mahal.

Rational and scientific methods of management began during the industrial revolution. Because many people gather and work in a factory, it was necessary to coordinate and lead the effort of these people to manufacture goods and facilities. Construction industry borrowed management principles from the manufacturing sector. As management concept developed in manufacturing, it did also develop in construction but with some lag.

As the construction industry expanded and the demand for space for commercial use increased, investors began to see new construction as a means to increase revenue. Obviously this dictated new, shorter methods for completing a project; the investor could hardly wait a lifetime for a return on his investment. With advancing technology the owner demanded more complex project that could meet functional requirements of light. New construction techniques made it possible to compress project schedules from a lifetime to a few years. Special skills were evolved, and

architects became concerned primarily with functions and appearance, while designers specialized in specific design disciplines.

Projects became more dynamic, requiring new management techniques. The management of construction evolved to a new skill, and the specialist was called a *general contractor*. The scope of these projects requires a tremendous work force of trade specialists in many disciplines. Few companies could keep a large work force steadily employed year-round. As a result the general contractor gave up his large work force and parceled out most of his work to specialty contractors.

The net result of this evaluation was fragmentation into special roles and functions. While the design function was subdivided into engineering functions such as architecture, structure, mechanical, electrical, and interior space, the construction function was shared by many specialty contractors, with the general contractor acting as the overall construction supervisor.

1.3 The Role of Construction Manager (Project Manager)

A project manager, in brief, has responsibility for all construction functions for a project, including coordination of the work of job superintendents, crew supervisors, and subcontractors, for a small organization, the proprietor may serve as project manager. For a large firm, an experienced project manager may be assigned responsibility for one large project or several smaller ones.

Success of a construction project depends heavily on the abilities of the project manager. This individual should have administrative and managerial skills and be familiar with all details of the contract documents. Knowledge of all phases of construction is essential. From daily inspection of projects assigned, the construction manager should keep abreast of the current job status.

Duties of project manager

Among the duties of a project manager are the following:

- Maintenance of contact with clients
- Allocation of workforce to projects and organization of units for project operation

- Coordination of the work of all units and divisions
- Periodic review and analysis of project costs, schedule, and progress
- Arranging for surveys and construction layout
- Instituting and supervising job safety programs
- Securing permits from government agencies
- Representing the contractor in jurisdictional disputes
- Dealing with changes and extras
- Submitting and obtaining approval of shop drawings and samples, and material certifications.
- Conducting conference and job meetings with key personnel and following up on decisions made

1.4 Stakeholders in the Construction Industry

Stakeholders in the construction industry consist of clients (owners), consulting firms, contracting firms, regulatory government agencies, financial institutions and material suppliers.

The **client** is the initiator and financier of the project. The client is the employer/buyer of the services of consulting and contracting firms.

Consultants (designers) are group of professionals whose purpose is to understand the needs of the client and turn those into design of the structure that would meet the needs of the client. This group consists of architect, structural, mechanical, electrical, sanitary engineers, who submit their designs in the form of drawings and specifications.

Contracting firms turn the design drawings and specifications into the actual structure desired by the client.

The purpose of **regulatory government agencies** is to issue regulations that should be satisfied by any design and construction to ensure safety and health of the public (end users of the facility).

Financial institutions consist of **banks** and **insurance companies**. **Banks** lend money to owners and/or contractors on interest. They help people invest and carry out business in cases they need more fund than their own savings.

Any business has got risk due to natural or man-made occurrences, and **insurances companies** help the loss due to such occurrences be shared among insurance holders. Therefore people will be encouraged to go into and carry out business, and will not be detracted by fear of risk of loss.

REFERENCE

1. Abebe Dinku, Construction Management and Finance, Addis Ababa University Press, Addis Ababa, 2003.
2. Abraham Asefa, lecture note, Department of civil engineering, Addis Ababa University, 2007.
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CHAPTER 2- SPECIFICATIONS

2.1 Introduction

Specification is one of the components that makes up the documents used for bidding and construction of a project. Specification is defined as the designation or statement by which written instructions are given distinguishing and/or limiting and describing the particular trade of work to be executed. In short Specification is a statement of particular instructions of how to execute some task.

In terms of an engineering project a specification contains a detailed written description of the quality of materials and workmanship necessary to complete the work. In the construction activity therefore, the scope of the work that is described in drawings includes such information as dimensions, form, or details while the specifications provide the description of the qualities of materials for construction.

Information that is best transmitted in written form is addressed in the specification while that which is best transmitted graphically will be addressed in drawings where both are so defined as to be mutually complementary and understood in conjunction.

In other words drawings show what is to be done in graphics form, specifications show how it is to be done by furnishing written descriptions to supplement the drawings.

Generally, specifications are written instructions which supplement the drawing to set forth the complete technical requirements of the work.

Therefore drawings and specifications in combination define the project in sufficient detail to enable the carrying out of the works.

Drawings and specifications should compliment each other and neither should overlap or duplicate the other.

Specifications are devices for organizing the information depicted on the drawings and they are written descriptions of the legal and technical requirements forming the contract document.

The main difference between specification and drawing is that drawings should generally show the following:

- Dimensions, extents, size, shape, and location of component parts.
- Location of materials, machineries and fixtures.
- Interaction of furniture, equipment and space.
- Schedules of finishes, windows and doors.

Specifications generally describe the following:

- Type and quality of materials, equipments, labor or workmanship
- Methods of fabrication, installation and erection
- Standards, codes and costs
- Allowance submittals and substitutions
- Cost included, insurance and bonds
- Project record and site facility

Specifications are written based on the prepared design, drawings, general and scientific trends of workmanship, quality expected, equipment involved, and materials to be used for the particular trade of work.

The specifications should clearly specify design and drawing, labor employment, materials to be used, construction method, equipment used.

Specifications should be clear, concise, and brief description of what is required to execute the proposed trade of work.

2.2 Purpose of Specification

The purpose of specifications generally includes:

- i. Guide the bidder at the time of tendering to arrive at a reasonable cost for the work.
- ii. Provide guidance for the execution of the work
- iii. Guide contractor for the purchase of materials

- iv. Serve as part of contract document to limit and describe the rights and obligations of each contracting parties.
- v. Guide the bidder to identify his capacity to execute the work
- vi. Serve as fabrication and installation guide for temporary and permanent works.
- vii. Guide the contractor for purchase and/or hiring of equipments.
- viii. Serve the owner to know what she/he is intended to receive.
- ix. Serve for the manufacturers of construction materials, equipments, tools etc. to grade, classify, and improve qualities of their products.
- x. Indicates method of testing and acceptance of final products.
- xi. Guide parameters for rejection of non conforming works.
- xii. Indirectly, the specifications are very much related to the legal considerations, insurance considerations, bidding requirements, alternates and options, rights, obligations and remedial measures for the contracting parties.

Note: in the events of conflicts between specification and drawings, the specification governs.

A clearly written specification will enable proper quality control and avoid disputes in administering construction projects.

2.3 Types of Specification

In general, specifications can be broadly classified into four categories:

- 1. Manufacturer's specification:** Manufactures prepare specification of their product for guidance of their users, which may include property description and installation guide lines.
- 2. Guide specification:** specification prepared by an individual or group of individuals based on manufacturer's specifications, established trends of workmanship, service and laboratory tests and research findings to be used as guide lines for preparation of contract specification.
- 3. Standard specification:** specifications which are intended to be used as reference standard in the construction of a project. The guide specification which has been standardized by recognized authority.

4. Contract (Project) Specification: The specification prepared for a particular project to accompany the drawings and other contract documents.

The specifications described above can be prepared following the format which has general and specific parts (General Specification and Specific Specification).

In the general part of the specification the following items are included:

- Administrative and Procedural Requirements
- Scope, definition
- Reference Organization and Standards
- Project Description, site facilities
- Submittals and quality assurance
- Delivery, storage and handling
- Project records, Insurances other general requirements

In the specific part of the standard specification the detailed description of the quality of items to be used and preparatory actions and methods of incorporating the items are included.

“**Technical Specification and Methods of Measurement for Construction of Buildings**”, of March 1991 is the standard specification which has been used as one of the contract document in our country.

In the general requirement part the following items which may be applied to any project and any trade of work are described in general terms:

- | | |
|---------------------------|-------------------------|
| ◆ 011 – General | ◆ 014 - Project Records |
| ◆ 012 - Site Description | ◆ 015 - Site Facilities |
| ◆ 013 - Quality Assurance | ◆ 016 - Cleaning Up |

In the specific part the different trades of works (excavation and earth works, concrete works etc.) are described in details and the method of measurement are given.

Specification can also be classified as Material and Workmanship Specification and Performance Specification.

I. Material and Workmanship Specifications

This form of specification includes,

- The description of the scope of the works,
- The *general and specific requirements* that are necessary for the execution of the work,
- Material requirements,
- Construction details, and
- Method of measurement and payments for completed works.

A. Material Specifications

For some items may focus on the physical and or chemical properties that can also be cross checked by tests and for others the performance characteristics may be the governing factors.

In some cases, a composition of the two types may be also applicable.

These descriptions generally include;

- Physical properties, such as strength, durability, hardness, and electricity.
- Chemical composition
- Electrical and thermal and acoustical properties
- Appearance including color, texture, pattern and finishes.

B. Workmanship Specifications: describes the desired results that need to be achieved in the works which include;

- Specify the desired results as to the quality of workmanship
- State any detailed construction methods or procedures necessary for the accomplishment of particular purposes.
- Stipulate any desired limitations or restrictions to be placed on the contractor's methods in the interest of coordination of the work.
- Give any precautions necessary for the protection of the work or adjacent property.
- Specify the methods of inspection and tests to which the work is to be subjected

II. Performance Specifications

Such types of specification, define the performance requirements for machinery and plant operating equipment. This allows the advance manufacturer and procurement of such equipment, or of the standard brands. Specification could be written in several ways, with the prime emphasis given to either the producer company's brand or the performance capacity of the material and so on.

Accordingly, there are the following types of technical specifications:

A. Proprietary Specifications

This specifications call for desired materials, producers, systems, and equipment by their trade names and model numbers.

For detailed descriptions reference should be made on manufacture's specifications.

They are of two types; Closed (sole) and Open or equal source.

Example: -

1. Water reducing agent shall be used in all concrete, in strict accordance with the manufacturer's printed instructions. Total air entrained shall be 5.0% plus or minus 1.0% of volume of concrete with required strengths maintained.
2. Air – Entraining Agent: “Darex” by W.R. Grace Company, “Aerolith” by Sonneborn Building Products or equal meeting ASTM C260 as approved by the architect.

B. Performance Specifications

Specifications which define products based on desired end results which are performance oriented.

Most appropriate when new or unusual products or systems are required or when innovation is necessary.

Describing the problems or condition under which the products or system must operate, and the parameters for the acceptable solutions is difficult and challenging.

Testing methods and evaluation procedures for defining the required performance must be explicitly specified.

Example: Stud shear connectors shall conform to the requirements of Article 4.26 of the American Welding Society.

C. Reference Specifications

Specifications which refer to levels of quality established by recognized testing authority or standards set by quality control authority. They are used in conjunction with other types.

Example: C – 25 Concrete.

D. Descriptive Specifications

Specifications which describe all components of products, their arrangements, and method of assembly, physical and chemical properties, arrangement relationship of parts of numerous other details.

The specifier shall take total responsibility for the function and performance of the product.

Example: “Supply and fix 40mm. thick flush wood door with hard wood frames and both sides covered with best quality 4mm thick ply wood. Price includes approved quality lock, hinges, three coats of varnish paint, door stopper and all necessary accessories to comply ES”.

E. Cash Allowance Specifications

Specifications meant to direct bidders to set aside a specified amount of money to be applied to the construction work at the direction of the specifier.

Example: “A lump sum of \$3,000.00 for purchase of hard ware, as defined by and specified in Specification sections of Division 8”.

2.4 Specification Writing

Basically specifications are not to be created; they are prepared based on existing standards, codes, guidelines, and laws.

When planning to write specifications one should start first of all with:

- An overall analysis of the work to be done, and
- The requirements necessary to achieve the required level of quality,
- Conditions under which it must be done,
- Materials required, and the
- Details of the construction

Hence preparing an outline of the details of the work is the first step in writing a good specification.

Specification writing embodies certain methods of presenting information and instructions.

When specifications are to be written, the following shall be taken to considerations:

a. Specification writing require:

- **Visualization** (Having clear picture of the system)
- **Research** (to know the legal impact correctly)
- **Clear thinking** (understanding things directly without misleading)
- **Organizing** (organizing what we know to write the specification)

b. Specification writing requires professional ability to read drawings.

- c. Specification writing require wide knowledge of the construction materials, various levels of workmanship, different construction equipments and method of construction to be employed.
- d. Specifications use simple and clear language such that it can readily be understood.
- e. Specifications shall be brief and short as much as possible (avoid long sentences with out punctuation)
- f. Specifications shall include all items affecting the cost of the work.
- g. Specifications shall be fair and do not attempt to throw all the risks and responsibilities on one of the parties signing the contract.
- h. Specifications shall avoid repetition of information shown on drawings to avoid mistakes and duplication between the specification and drawings.
- i. Specification shall not include inapplicable text and do not specify the impossible or anything not intended to be enforced.

2.4.1. References for Specification Writing

The following are useful references in specification writing:

- a. Codes and ordinances of governments, cities, or municipalities. E.g. EBCS
- b. Standards prepared by distinct societies and government agents. E.g. ACI standards, ASTM standards, BS, ES.
- c. Standards or model specifications prepared by manufacturers, professional societies, and government bodies.
- d. Master Specification and previous specifications.
- e. Information or experience acquired by personal observation and contract with trained or experienced people in the construction industry.

2.4.2. Specification Language

The specification writer should present his instructions regarding the particular work under consideration in such a manner that:-

1. The drawings are more clearly interpreted, not duplicated.
2. Rights, Obligations, and remedial measures shall be designated without ambiguity or prejudice.
3. Clearly express the extent of works under consideration therefore, the phraseology used in this regard shall be:
 - Judged by its quality not its length
 - Should be concise and short and written with commonly used words.
 - Punctuations are important but their usage shall be limited to few
4. Capitalizing the first letters is mandatory for the following expressions: -
 - a) Parties to the contract; e.g. Employer/Client/Contractor/ Engineer
 - b) Space within the building; e.g. Bed Room, Toilet, Living Room
 - c) Contract documents; e.g. Bill of Quantity, Working Drawing, Specification
5. Minimize the use of symbols.
6. Do not use foot notes, do not underline within a sentence for emphasis.
7. Words shall be used as follows: -
 - a) shall in place of must; use “shall” for the duties of the contractor or the consultant to represent the word “must”
 - b) “will” is used for the duties of the employer to represent the word “must”
 - c) Avoid the use of the word “must” and substitute by the word shall to prevent the inference of different degrees of obligation

- d) Avoid the use of words which have indefinite meanings or limitless and ambiguous in their meanings. For example, any, either, same, similar, etc.

2.4.3. Specific Guidelines for Specification Writing

Below are some specific guidelines that one needs to follow when preparing a specification:

- Be specific and not indefinite
- Be brief, avoid unnecessary words or phrases
- Give all the necessary facts
- Avoid repetition
- Specify in the positive form
- Use correct grammar
- Direct rather than suggest
- Use short rather than long sentences
- Do not specify both methods and results
- Do not specify requirements in conflict with each other
- Do not justify a requirement
- Avoid sentences that require other than the simplest punctuation.
- Avoid words that are likely to be unknown to the user of the specification (words with more than one meaning)
- Arrange the specification in the order of the execution of the work. E.g. Formwork, concrete mixing, concrete placing, curing, etc..
- Address measurement and payment issue
- Refer only to the principal parties in the contract, Owner, Engineer, Contractor.

- Use “these specifications” rather than “these specifications”. Use the plural.
- Workmanship should be in accordance with....
- Materials should confirm to-A reference specification.

Reference

- [1]. Kalin, M.; Weygant, R.S.; Rosen, H.J.; Regener, J.R., Construction Specification Writing: Principles and Procedures, 6th Edition, John Wiley & Sons, INC. , Hoboken, New Jersey, 2011.
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CHAPTER 3- QUANTITY SURVEYING

3.1 Introduction

In a civil engineering activity, the owner promises to pay the contractor an amount for the work that he does; this would then require that the actual works done be somehow estimated or measured for payment purposes. Once a construction project is completed or depending on the form of contract upon completion of certain parts of the work, the contractor must be paid for appropriately completed works.

To estimate how much a civil engineering project may cost, the actual quantities of materials, labor & equipment etc. that is needed for the construction work must be calculated at the beginning of the work. Such work of calculating the amount of materials and other incidentals necessary for the realization of the work is called quantity surveying.

Quantity surveying is a term or processes used in the construction industry to take measurements of civil works, prepare specifications, and estimate the cost of works either for each trade of work or for the whole project.

The term “surveying” means to inspect, study, review, investigate, asses, and hence “to measure” therefore the term “quantity surveying” means “quantity measuring” as applied to civil engineering projects.

Quantity surveying is the application of standard methods of measurement to quantify the amount of various items in a construction project, for the undertaking of valuation, and certifying payments.

The following tasks are covered in quantity surveying:

- preparation of Specification
- Taking measurements of civil works (Taking off quantities and preparing BOQ)
- Preparation of approximate (preliminary) cost estimate at the very early stage of the project

- Preparation of detail cost estimate at different stages (taking as built measurements and preparing payment certificates or approval of payment certificates prepared by taking measurements)
- Valuation of property

3.2 The purpose of quantity surveying

The purpose of quantity surveying or the preparation of Bill of quantities is:

- To assist the client to have an accurate estimate of the volume of work as well as the required budget.
- To assist in the accurate preparation of tenders, by providing uniform measurement of quantities.
- To give an accurate checklist of work accomplished
- To assist in the certification of payments
- To give insight into the required variation work amounts.

3.3 Measurement of civil works

Measurement of civil works includes the billing of each trade of work either from drawings or the building itself for defining the extent of works under each trade. In order to avoid ambiguity in measuring quantities, there is now a recommended principle of measurement in construction activities. Many professional organizations publish recommendations on units of measurement, degree of accuracy etc. this assists in setting a common parameter so that dispute is avoided.

The standard book, which is used in Ethiopia, is standard technical specification & method of measurement for construction of buildings by BaTCoDA, March 1991. Ethiopian Road Authority Standard Specification, 2002 is used for Road Construction.

3.3.1 Principles of Measurement

The following are list of the basic principles of quantity surveying, applicable to all items of work.

- Each work section of a bill shall contain a brief description of the nature and location of work.
- Work shall be measured net as fixed in position.

- Measure the full work area and adjust deductions later.
- Items which are to be measured by area shall state the thickness or such other information as may be appropriate.
- Items which are to be measured by length or depth shall state the cross-sectional size and shape, girth or ranges of girths or such other information as may be appropriate.
- Items which are to be measured by weight shall state the material thickness and unit weight if appropriate (Ex. Duct work)
- Piece of work shall be taken in numbers.
- For items of pipe work it shall be stated whether the diameter is internal or external.
- Mass voluminous and thick works shall be measured in volume (cubic meter)
- Thin, shallow and surface work shall be measured in area (meter square) specifying the thickness.
- Long and thin work shall be measured in length (linear measure, running meter)
- Bills are deemed to include labor, materials, goods and plant and all associated costs for fixing, assembling, etc.

3.3.2 Units of Measurement

Depending on the prevailing system of measurement in any locality, quantities may be measured in the FPS system or the metric system. Here in Ethiopia, the most common unit of measurement is the International System of Units, or the metric system of units in which the various items are measured as follows:

- For the measurement of length Meter (m)
- For the measurement of mass Kilogram (Kg)
- For the measurement of time Second (s)
- For the measurement of current Ampere (A)
- For the measurement of temperature Degree Kelvin (K)
- For the measurement of luminous intensity Candles (Cd)

3.3.3 Degrees of accuracy in Measurement

- All dimensions' measure to the nearest 0.01m
- Thickness of slab measure to the nearest 0.005m
- Wood work measure to the nearest 0.002m

- Steel work measure to the nearest 0.001m
- Reinforcement measure to the nearest 0.005m
- Road work measure to the nearest 0.005m
- Areas measure to the nearest 0.01 meter square
- Steel work areas measure to the nearest 0.001 meter square
- Volume measure to the nearest 0.01 meter cube
- Wood work volume measure to the nearest 0.001 meter cubes
- Weights measure to the nearest 1 kg

3.4 The Process of Quantity Surveying

There are four clearly defined steps in preparation of Bill of Quantities:

- I. Taking off
- II. Squaring
- III. Abstracting
- IV. Writing the final Bill of Quantity

3.4.1 Taking Off

This is a process of measuring or scaling dimensions from drawings and recording all dimensions in an easily understood format. This is coupled with the descriptions in the drawings and specification.

In this task the quantity surveyor “take off” the quantities from the drawings and determines the volume of work to be done for the various components. These quantities are calculated in a specially prepared format, as to aid accurate preparation and enable checking/rechecking or adjusting of amounts and correcting errors if any. These special formats are called “Take off sheets” or “Dimension Paper”. The dimension paper used for taking off is usually double-ruled as shown (A4 size).

Sample Take off Sheets

1	2	3	4		1	2	3	4	
----------	----------	----------	----------	--	----------	----------	----------	----------	--

- Column 1: Timesing column
- Column 2: Dimension column
- Column 3: Squaring column
- Column 4: Description column

TAKE-OFF SHEET			
			DESCRIPTION
			A.SUB-STRUCTURE
			1.Excavation & earthwork
			1.1. Bulk excavation
1	22.00		
	21.00		
	0.25		
		115.50	m³

Column 1: is used for stating the number of times an item occurs and is called the timesing column.

Column 2: is called dimension column as it is used to enter the dimensions of the items of works. The dimensions are entered in the order indicated below: Length, Width, Height or thickness.

Column 3: is called squaring column. The stated dimensions in column 2 are multiplied to determine the quantity of the work either in m, m², m³ or in Pcs. or No.

Column 4: is called description column and description of the work item is briefly stated.

A separate sheet (**Bar Schedule**) is used to prepare reinforcement quantities.

BAR SCHEDULE REINFORCMENT

Dr.No	Locations	Shape	Dia(mm)	Length (m)	No. of bars Mem.	No. of Mem.	Total No. of Bars	6mm	8mm	10mm	12mm	14mm	16mm	20mm	24mm			
Total length																		
Weight(kg/m)								0.222	0.395	0.617	0.888	1.208	1.578	2.468	3.551			
Total weight (kg)																		

XYZ Construction PLC

BAR SCHEDULE

2.4 Reinforcement bars cut to the size, bent to shapes, tied and placed in position

Item	Position	Diam(mm)	Shape	No.of bars	No. of bar member	Length	6	8	10	12	14	16
Isolated footing pads	F1	14		36	3	3.60	--	--	--	--	388.80	--
	F2	12		36	7	3.00	--	--	--	756.00	--	--
	F3	12		22	4	2.30	--	--	--	202.40	--	--
	F4	10		14	4	1.20	--	--	67.20	--	--	--
Foundati on columns	C1	16		6	6	3.00	--	--	--	--	--	108.00
	Stir up	6		6	6	1.00	36.00	--	--	--	--	--
	C2	16		14	3	3.00	--	--	--	--	--	126.00
	Stir up	6		6	3	1.00	18.00	--	--	--	--	--
	C3	12		6	2	4.00	--	--	--	48.00	--	--
	Stir up	6		12	2	0.99	23.76	--	--	--	--	--
	C4	16		10	4	3.00	--	--	--	--	--	120.00
	Stir up	6		6	4	1.00	24.00	--	--	--	--	--
	C5	14		4	2	4.10	--	--	--	--	32.8	--
	Stir up	6		13	2	0.90	23.40	--	--	--	--	--

3.4.2 Squaring:

This is the process of multiplying, adding, subtracting or dividing the recorded dimensions for the purpose of obtaining linear measures, areas, volumes etc

The dimensions entered in Column 2 are squared or cubed as the case may be, multiplied by the timising factor, and the result entered in Column 3. All squared dimensions should be carefully checked by another person before abstracting. Use two decimal places.

3.4.3 Abstracting:

The squared dimensions are transferred to abstract sheets and all similar dimensions are collected in the same category to obtain the total quantity of each item.

3.4.4 Writing the Final Bill of Quantities

After the abstract sheets have been completed and checked, the final bill of quantity is written. The dimensions are copied from the abstracts, and as each item is transferred it should be ticked by a vertical line from the abstract sheets. The description of each item in the final BoQ should be short, precise and descriptive as per the specification.

Billing is the process of collecting and entering to an accepted format all the measured quantities, by trade and work type, and filling in the total amount by multiplying with the unit rates.

3.5 Specification Worksheet (BOQ form)

It is the format which is used in a bill of quantity to list (include) a short description of the specification along with its measuring unit, quantity and unit prices to determine the total cost for each trade of item.

Project: XY					
Item	Description	Unit	Quantity	Unit price	Amount

ITEM	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
A. SUB-STRUCTURE					
<u>SITE AND FENCE WORK</u>					
1 EXCAVATION & EARTH WORK					
1.1	Clearing of the site to remove top soil and other rubbish materials to an average depth of 200mm.	m ²	87.00	6.00	522.00
1.2	Bulk excavation in ordinary soil to a depth not exceeding 1000mm.	m ³	87.00	45.00	3,915.00
1.6	Trench excavation for stone masonry foundation wall.to a depth not exceeding 1000mm.	m ³	45.00	40.00	1,800.00
1.6	Ditto but under hard core.	m ³	118.00	100.00	11,800.00
1.7	Cart away excavated material.	m ³	104.40	65.00	6,786.00
1.8	250mm thick basaltic or equivalent stone hard core well rolled, consolidated and blinded with crushed stone.	m ²	87.00	80.00	6,960.00
Total carried to summary birr					<u><u>31,783.00</u></u>

Basic principles of taking Off

- The following tasks are part of the Taking Off:
 - Describing the item,
 - Bracketing (relating the description to the quantity),
 - Timising,
 - Dotting on (adding to the timising factor),
 - The Ampersand (ditto),

- Waste calculations,
 - Deduction of items,
 - Correction of dimensions (nullifying).
- Drawings shall be fully understood and clearly detailed.
 - Works, which cannot be measured accurately, shall be expressed as provisional quantity (PQ) and will result in provisional sum (PS) and lump sum (LS)
 - There shall be the understanding that measurements are taken to the nearest cm.
 - Built items shall generally include all possible entrants like labor, materials (including storing, loading, unloading and handling), fixing, use of plant and equipment, wastage of materials, equipment; which will result in a better process for establishing prices and profit.
 - Prior knowledge of the regulations is necessary (For E.g. roofing is measured in horizontal projection).
 - Measurements of civil works shall be carried out in such a way that it can be easily checked and audited.

3.6 Types of taking Off

Mensuration – the calculation of geometric quantities such as length, area, and volume, from dimensions and angles that are already known.

Girth (perimeter) computation –linear measurement. There are various methods of taking off quantities for computation of girth.

In- to- in and out- to-out method –some wall lengths are taken out to out and others in to in (offsets are added to out to out lengths) and same are deducted from in -to-in lengths; used for any type of measurement irrespective of condition of symmetry.

Centre line method –suitable only when the cross sections of all walls are symmetrical. In this method Centre line length is found and same is used for taking off quantities (therefore only width and depth vary).

Crossing method –lengths and breadths of walls as shown in plan are taken for working out various items and this method is useful only if the offsets of footings are symmetrical.

A. Out – to - Out and In – to – In Method

- Long Wall (Out – to - Out) = Inner Length + 2 Times Thickness of the Wall
- Short Wall (In – to – In) = Inner Length - 2 Times Thickness of the Wall

B. Center Line Method

- All dimensions are taken center to center

C. Crossing Method

- Long Wall (Out – to - Out) = Inner Length + 2 Times Thickness of the Wall
- Short Wall (In – to – In) = Inner Length

3.7 Technical Specification and Method of Measurements for Building Project

The following specifications and methods of measurement are provided to guide the quantity surveyor in the preparation of quantities for a building project.

A typical building project will have the following work items.

	<u>A-SUB STRUCTURE</u>
1	Excavation and earth work
2	Concrete Works
3	Masonry work
	<u>B. SUPER STRUCTURE</u>
1	Concrete Works
2	Masonry Works
3	Roofing
4	Carpentry and Joinery
5	Metal Works
6	Finishing
7	Glazing
8	Painting
9	Sanitary installation
10	Electrical installation
11	Fence Work

3.7.1 Substructure

Any structure below the ground floor slab level including the basement, retaining walls, ground slab, grade beam, and foundation is called a substructure. In most of the cases, substructure work can be categorized as follows:

1. Excavation and earthworks (mandatory)
2. Concrete works (can be neglected sometimes)
3. Masonry works (mandatory)

3.7.1.1 *Excavation and earth work*

3.7.1.1.1 *Site clearance*

Carbonatious elements are not good in concrete, steel and timber works. In soils under structures even 5% of these elements will damage the structure. Therefore, these materials (including trees, bushes and the top 20 to 30 cm soil), termite hills, any other obstruction, have to be cleared. A working space of 1m is required on each side. It is sometimes necessary to prepare separate specification for obstructions (demolition works) because reusable items like doors and windows are there.

- To remove the top 20-30cm soil
- A working space of 1m is required on each side
- Measured in m²

3.7.1.1.2 *Bulk excavation*

Excavation to get reduced levels of every structural element below the ground level is called bulk excavation. They are subdivided as follows depending on the subsurface condition.

- Ordinary soil - with boulders and without boulders and can easily be removed by shovel.
- Weathered rock - it can be divided easily without blasting
- Rock- bedded rocks that cannot be dug without blasting (requires using explosives)

Note: - Working space for bulk excavation is 25 cm (not used for shallow masonry). Depth of excavation less than 30 cm – measured per m², depth > 30 cm per m³

- For building underground structures
- Working space of 25cm is required on each side
- Measured in m³ if depth of excavation is more than 30cm.

3.7.1.1.3 Pit excavation

- For isolated footing
- Expressed in m³
- Working space of 25cm is required on each side

3.7.1.1.4 Trench excavation

- For foundation wall
- Expressed in m³
- working space of 25cm is required on each side

3.7.1.1.5 Fill/embankment

Shall be measured in m³ of net volume to be filled. Fill is required because the reduced level of every structural element above the structure has to be covered. Excavation and embankment should not be added at a time in computing their volume, because their costs are different.

The major consideration under embankment is compaction. Compaction is done usually at 20 cm lift thickness. The subdivisions under fill are:

- *Back fill*: - filling by using the excavated soil but by removing coarse particles.
- *Borrow fill*: - filling by using fill material from another place when there is shortage of fill or when better quality material is required.

Total excavated= site clearance+ pit excavation+ bulk excavation+ trench excavation

3.7.1.1.6 Cart away

- = total excavated – back fill
- It is expressed in m³

3.7.1.1.7 Disposal

- Covers cleaning the building area including cart away

3.7.1.1.8 Sundry Items

- Application of termite proof solution, providing hard coring, dust blinding, expansion joints, etc are itemized as sundry items; measured in m².

3.7.1.2 Concrete for structures

3.7.1.2.1 Concrete for substructure

Cast in situ concrete – formed on site and requires formwork and reinforcement. Cast in situ concrete shall be measured by volume except in ribbed slabs and grouting.

Prefabricated concrete –fabricated (manufactured) in a factory and brought to the site and joined to make a building. It does not require formwork but needs a special care when connecting the different elements.

Pre-tensioned (Post tensioned) Concrete –involves in bending up the concrete itself to make it ready for the downward bending due to load

Concrete ancillaries - include windowsills, lintels, expansion joints, and permanent and temporary embedded materials. It is measured in ml or enumerated.

Grades of Concrete

- C5 - lean concrete, to protect the structural concrete from damage.
- C15 - for totally supported structural elements
- C20 - used for slabs; mix proportion is 1:2:4
- C25 - Commonly used grade of structural Concrete; mix proportion is 1:2:3
- C30 –Used for chemical stores and nuclear plants

3.7.2 Formwork

A temporary structural element, which supports slabs, beams in casting concrete. It shall be designed and erected to safely support, vertical and lateral loads that might be applied until such load can be supported by the concrete structure.

Period of removal (minimum):

- Vertical formwork to columns, walls and beams: 16 hrs
- Soffits formwork to slab: 21 days
- props to cantilever slabs: 14 days
- Soffits formwork to beams: 21 days
- Props to cantilever beams: 14 days

▶ Measured in m²

3.7.3 Reinforcement

The type and diameter should be clearly stated and shall be measured in Kg.

- Length of the bar is taken from the drawing and multiplied by weight per unit length to get the weight of the bar.

e.g. weight per length for $\Phi 6 = 0.222\text{kg/m}$

3.7.4 Masonry work/Stone work

Masonry works are works that are executed by laying building material units of specified dimension through a binding material such as mortar. Stone obtained from quarries shall be hard and sound, free from vents, cracks, fishers, discoloration or other defects that will adversely affect strength or appearance.

Stone chips to be produced shall not be less than 450 mm average and 380 mm in individual length. Stone for various masonry works shall be selected and shaped as follows:

- Stone for facing works shall generally be selected for consistency in grain, color and texture, throughout the work
- Stone for below ground work shall be chiseled from natural stone

Stone wall is measured by volume, whereas stone pavement is measured by area, specifying thickness.

- For foundation wall (measured in m³)
- hard core (measured in m²)

3.7.5 Superstructure

3.7.5.1 Concrete

- For slabs, beams, columns, staircase
- Measured in m³

3.7.5.2 Formwork

- Measured in m²

3.7.5.3 Reinforcement

- Expressed in kg.

3.7.5.4 Masonry works

- Measured in m³
- Commonly used for walls of buildings.

3.7.5.5 Roofing

- Roof cover is measured by area(m²)
- Items like downpipes are measured by length(m)

3.7.5.6 Carpentry and joinery work

- work on timber intended for structural purposes eg columns, beams, truss etc
- work on timber intended for finishing purposes eg floor finishes, doors and windows, ceilings, Cupboard etc

3.7.5.7 Steel structural work

- for beam, column, slab, truss, connections etc
- Usually measured in weight (kg)

3.7.5.8 Metal works

- Includes aluminum and iron works
- For door and window frames
- Measured in area

3.7.5.9 Finishing work

- Plastering
 - Measured by area (m²)
- Floor and wall finish
 - Measured by area (m²)
- Painting
 - Shall be measured in area (m²)
 - Special application to the edges should be measured in length.

3.7.5.10 Glazing

- Glazing shall be measured in area(m²)

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CHAPTER 4- PROJECT COST ESTIMATION

4.1 Introduction

Project Cost estimation is the process of valuing on monetary expression, including the cost of all possible entrants necessary for the planning, implementing and monitoring stages of the proposed project under consideration. Cost estimation is the determination of the probable cost of a project.

Project Cost includes:

- Preliminary investigation (project appraisal costs)
- Design and supervision (consultancy cost)
- Construction works (contractor's cost)
- Land owning cost, and
- Monitoring costs

An estimate serves a number of different functions, depending on the stage of the project, as shown below:

- Feasibility: Initially feasibility of the project need to be determined; the Feasibility Estimate is Conceptual.
- Schematic Design (Conceptual design): Sketches are prepared. Major elements are defined; Use a preliminary method to estimate cost. Cost of each element is established (cost plan).
- Design Development: Progressively the scope of the project is defined; A series of preliminary estimates are done during this phase to assure adherence to cost plan.
- Contract Document: Finalize drawings & Specifications; Designer's estimate to anticipate and check contractor's bid prices.
- Bidding Phase: Contractors prepare detailed estimate to submit bids.

- Construction Phase: Estimates are prepared for cost for cost Control and for change order evaluations.

Feasibility Estimate (Conceptual Estimate)

- Needed to make decision go/no go with project
- Costs include:
 - Land
 - Financing cost
 - Consultations/Studies
 - Engineering
 - Project Management
 - Construction
 - Operation & Maintenance

Preliminary Estimates and Cost Planning

- The Conceptual Estimate found during feasibility becomes the initial project *budget*
- Subsequent design development should remain within the limit of this budget
- For that purpose, several preliminary estimates are performed as more details become available through the design.
- Preliminary estimates assign cost to various assemblies (elements) of the project (Cost Plan). {substructure, superstructure, interior partitions & doors, exterior cladding ..etc.}
- Preliminary estimates allow for Value Analysis – Compare value of an element with its cost Consider Alternatives Select desired option.

Over all the main purpose of cost estimation can be summarized as follow:

- know the volume of work in reference to the fund available

- determine actual cost per unit of item
- identifying engineering estimate of the work for bidding purpose
- work out economical use of materials, labor and equipment
- in cases of variations to determine the extra cost to be incurred
- when there is escalation, to work out the escalation in cost

4.2 Information required for cost estimation

The following information is required to define cost per unit of work

- Correct information of the market price of the materials at the time of need to be used as a basic price
- Correct information of the rates of various categories of skilled and unskilled laborers as wage rates to be used for daily work rate
- Output of laborers per day for various types of items (productivity)
- Correct information of the rates of various categories of equipment and tools as rental rates to be used for major items of rates
- Up-to-date knowledge of the construction methods.

4.3 Knowledge and managerial skills for cost estimation

The following knowledge, managerial talents, and degree of construction experience make a good estimator.

- Ability to read and understand contract documents, with special skills in reading construction drawings for all specialties and related specifications.
- Ability to accurately take off the quantities of construction work for which he or she is preparing the detail estimate.

- Ability to visualize the future building from drawings, which usually requires some years of construction site experience.
- Knowledge of arithmetic, basic geometry, and statistics.

The following knowledge, managerial talents, and degree of construction experience make a good estimator.

- Familiarity with estimating software in depth and with available building cost databases.
- Knowledge of building construction methods.
- Knowledge of labor productivity, crew composition, and impacts of various forecasted site conditions on crew output.
- Possession of office managerial skills in organizing project-related cost information.
- Ability to work under pressure and to meet all bid requirements and deadlines

4.4 Factors Affecting Cost Estimation

Factors which affect the cost estimation are summarized as follow:

- Type and documentation of the project
- Construction scheduling
- Bidding environment
- Quality and availability of material and labor (given in specification)
- Construction facilities /tools and method of construction
- Location of the site: Transportation charges
- Proper management
- Land charges (lease)
- Nature of subsurface condition

NB: Cost due to construction is given special attention here; it includes cost due to material, cost due to labor, cost due to equipment, overhead costs and contractor's profit. In order to facilitate estimation of cost due to material, it is important to know the quantities of various elements involved in construction of various parts of the building work i.e. material break down is essential. Construction cost includes

- Cost due to material,
- Cost due to labor,
- Cost due to equipment,
- Overhead costs and contractor's profit.

Material Break Down -In order to facilitate estimation of cost due to material, it is important to know the quantities of various elements involved in construction of various parts of the building work

Example: Material Break Down for 1m³ C-25 concrete (1:2:3 mix)

Wet (fresh) concrete mix = 1m³

Quantity for dry base analysis= 1.55m³

Note: -1.5 to 1.6 times dry volume of the materials is required to get 1m³ of compact dense fresh concrete mix.

Volume of cement = $1/6 * 1.55 = 0.258\text{m}^3$

= $0.258\text{m}^3 / 0.035\text{m}^3$ per bag

= 7.4 bags of cement

Volume of Sand= $2/6 * 1.55 = 0.517\text{m}^3$

Volume of Coarse aggregate= $3/6 * 1.55 = 0.775\text{m}^3$

Volume of water= $0.62 * 0.258 = 0.1599\text{m}^3 = 0.16\text{m}^3$ (assuming w/c 0.62)

4.5 Purposes of Cost Estimation

- Determine actual cost per unit of item
- Identifying engineering estimate of the work for bidding purpose
- Work out economical use of materials, labor and equipment
- In cases of variations to determine the extra cost to be incurred
- When changes in cost due to legislation happens, to work out the escalation in cost

The following information is required to define cost per unit of work

- Correct information of the market price of the materials at the time of need to be used as a basic price

eg. 1qntl cement=200-240 birr; 1m³ sand =550birr

1m³ aggregate = 490 birr, 1 kg of reinforcement bar = 23birr

- Correct information of the rates of various categories of skilled and unskilled laborers as wage rates to be used for daily work rate.

eg. Forman: 9000birr/month; daily laborer: 80 birr/ day

- Output of laborers per day for various types of items (productivity)

Eg. Productivity=0.5 m³/hr

- Correct information of the rates of various categories of equipment and tools as rental rates to be used for major items of rates

Eg. mixer= 500 birr/day; loader= 450 birr/hr; vibrator= 100 birr/day

- Up-to-date knowledge of the construction methods.

4.6 Types of cost estimation

Estimation can be broadly classified as preliminary (approximate) and detailed.

4.6.1 Preliminary /approximate costing

This type of cost estimation is required to know the financial position of the client before costly detailed designs are carried out.

Such estimates are based on practical knowledge and cost of similar previous works.

Examples of approximate cost estimations are as follows: cost per functional unit, Plinth area method -cost per m², Cubical Content method –cost per m³.

A. Cost per functional unit

Hospital =cost per bed, Dormitory = cost per student, Cinema or theatre = cost per seat, residential buildings =cost per area, road works = cost per kilometer length, culverts or bridges = cost per meter span, water supply sewerage projects = cost per head of population.

B. Plinth area method cost per m²

Based on PLINTH AREA -roof area or external dimensions at the plinth level (Courtyard & open area shall not be included)

The rate per meter square is deduced from the cost of similar building projects in the locality.

Eg: 1m²=7500 birr (construction cost estimate for an apartment)

C. Cubical Content method –cost per m³

Based on cubical contents of various buildings, i.e. Plinth area of the building x height x cubic content rate.

Height should be taken from the top of flat roof (or halfway of the sloped roof) to the top of concrete in foundation.

4.6.2 Detailed cost estimate (based on item rate)

This is the most reliable and accurate type of estimate. The quantities of items are carefully prepared from the drawings and the total cost worked out from up to date market rates.

A detail cost estimate thus requires:

- Quantity surveying and
- Analysis of the different rates for the quantities prepared.

4.7 Basic Cost Components of a Construction Project

Basically the cost of any construction project comprises

- Direct costs, which include the direct cost of materials, labor as well as equipment and
- Indirect costs, which include but not limited to head office and site overhead costs.

A. Direct Construction Cost

Direct construction costs are all costs that can be specifically booked with an activity in a project. The direct costs mainly include material, labor, equipment and subcontract costs

- *Direct material costs* – These costs referring to the cost of materials, consumables and components used for executing an activity including the allowances for scrap and wastages.
- *Direct labor costs* – All costs related to the workers working on a specific activity such as carpenters, masons, erectors, painters, plumbers and so on.
- *Direct equipment costs* – These costs referring to the costs of machineries and plants used in executing a specific activity.
- *Subcontract costs* – In case some specific activities are subcontracted, the subcontract price will be considered as the direct cost of the activities to be executed by the subcontractor.

B. Indirect Construction Cost

Indirect construction costs are all costs, which cannot be directly booked under a specific activity in a construction project but required to keep the whole project operational.

These costs are also called overhead costs, which mainly include the head office and site overhead costs.

i. Head office overhead costs

Head office overhead costs are all costs required to run the whole operation of the construction company, which usually administers different projects at a time.

These costs are not usually associated with specific project but rather shared proportionally by all projects under the company

Some of the head office overhead costs are

- *Senior management costs and Indirect labor costs* – salaries and benefit package for senior Management, technical, administrative, marketing, finance and supply staffs.
- *Head office building costs* – Rental or depreciation cost
- *Bidding Expenses*
- *Expertise service costs* – external auditors, lawyers, management consultants and external trainings.
- *Office furniture and equipment*
- *Office running expenses* – expenses such as telephones, fax, internet services, stationery, mail services and so many others.
- *Transportation and travel expenses* - costs related to transportation, per diem and living expenses.

ii. Site overhead costs

Site overhead costs are all costs required to run the whole operation of a specific construction project at site level.

Some of the site overhead costs are

- *Site management costs and Indirect labor costs* – salaries and benefit packages of the site management members, general foremen, site engineers, office engineers, administrative and finance staffs, data collectors in the project site.
- *Mobilization and demobilization costs*
- *Site offices*
- *Office furniture and equipments*
- *Office running expenses* - expenses such as telephones, fax, internet service, mail service and stationery for the site office
- *Water and power supply; Access roads etc...*

C. Risk Allowance

Usually contractors incorporate risk allowances in their tender prices to compensate the negative impacts of different risks such as contractual, technical, political and economic risks.

D. Profit and Income Tax

construction projects are executed by contractors whereby these contractors will commit to invest their capital to get maximum possible profit from the contracts to be performed.

A profit margin entirely depends on the market competitiveness and company strategies.

Income tax=30% of gross profit

VAT= 15% of the construction cost

4.8 Rate analysis

Rate Analysis is the process of fixing cost per unit of measurement for the different item of works.

Total cost per unit of work (TC): Direct cost (DC) + Indirect cost (IC)

DC includes cost due to material (MC), cost due to labor (LC), cost due to equipment (EC), IC covers overhead costs, and contractors profit.

In order to facilitate estimation, Cost break down is essential.

PROJECT NAME	
BOQ REFERENCE	
ACTIVITY CODE	
UNIT OF MEASURE	

ACTIVITY DESCRIPTION

DIRECT MATERIAL COST					DIRECT LABOR HOURLY COST						DIRECT EQUIPMENT HOURLY COST				
Material Description	Unit	Quantity	Unit cost	Total cost	Labor by trade	No of labor	Basic salary	Labor index	UF	Total cost	Equipment description	No of equipments	Hourly cost	UF	Total cost
A - TOTAL DIRECT MATERIAL COST					B - TOTAL DIRECT LABOR HOURLY COST						C - TOTAL EQUIPMENT HOURLY COST				

D - Hourly crew productivity	Data
E - Direct material cost	A
F - Direct labor cost	B/D
G - Direct equipment cost	C/D
H - DIRECT UNIT COST	E + F + G
I - Site overhead costs	K1 * H
J - Head office overhead costs	K2 * H
K - INDIRECT UNIT COST	I + J

L - RISK ALLOWANCE	R1*E + R2*F + R3*C + R4*I + R5*J
M - GROSS PROFIT	P%/0.7 * (H + K + L)
N - TOTAL UNIT PRICE WITHOUT VAT	H + K + L + M
O - VAI IIF ADDED TAX (VAT)	0.15 * N
P - TOTAL UNIT PRICE WITH VAI	N + O
REMARK	

Example: -Calculate the Unit price for C -25 concrete per m3 of work (formwork and reinforcement rated separately). Assume 15% overhead and 20 % profit.

Solution: -

Total cost (TC) = Direct Cost (DC) + Indirect Cost(IC)

IC = (15% + 20%) of DC = 35 % of DC

Direct Cost (DC) = Material Cost (MC) + Labour Cost(LC) + Equipment Cost (EC)

Material cost (MC)

Cement	7.4 bags * 100birr/ bag	740 birr/m ³
Sand	0.517m ³ * 550 birr/m ³	284.35 birr/m ³
Aggregate	0.775m ³ * 490 birr/m ³	379.75 birr/m ³
Water	0.16m ³ * 3 birr/m ³	0.48 birr/m ³

Labour cost (LC)

Assuming the crew consists of a foreman, mason, four daily laborers, mixer operator and Vibrator operator and assuming a Crew productivity of 0.50 m³ per hr:

Personnel	Salary per hr	Indexed hr rate (120%)	Utilization factor	Lc/hr
Forman	9000birr/month/(26days/month* 8hrs/day) = 43.27 birr/hr	51.92	=1/4 =0.25 (assuming 4 crew under him)	12.98
Mason	100birr/day / (8hrs/day) = 12.5 birr/hr	15	1	15
Daily laborers (4)	4* 80birr/day / (8hrs/day) = 40 birr/hr	48	1	48
Mixer operator	75 birr/day /(8hrs/day) = 9.375birr/hr	11.25	1	11.25
Vibrator operator	75 birr/day / (8hrs/day) = 9.375 birr/hr	11.25	1	11.25
			Total (Birr/hr)	98.48
			Total LC (birr/M ³)	98.48/0.5 = 196.96

Equipment Cost (EC)

Assuming a mixer with a daily rental rate of 500Birr/hr and a vibrator with a daily rental rate of 100 birr/hr and equipment productivity of 0.5 m³ per hour:

Equipment	Hourly rental rate	Utilization factor	EC/hr
mixer	500birr/day/ (8hrs/day)= 62.5 birr/hr	1	62.5 birr/hr
vibrator	100 birr/day /(8hrs/day)= 25 birr/hr	1	25 birr/hr
		Total=	87.5 birr/hr/(0.5 m ³ /hr) = 175 birr/m³

$$DC = MC + LC + EC$$

$$DC = 1404.58 + 196.96 + 175 = 1776.54 \text{ Birr/m}^3$$

$$IC = 35/100 * 1776.54 = 621.789 \text{ Birr/m}^3$$

$$TC = (1776.54 + 621.789) \text{ Birr/m}^3 = 2398.325$$

$$\cong \mathbf{2400 \text{ Birr/m}^3}$$

The unit rate of C25 concrete = 2400 birr/m³

Example: If the quantity of C25 concrete was found to be 110 m³ from the takeoff; the total cost of concrete would be

$$\Rightarrow 2400 \text{ birr/m}^3 * 110 \text{ m}^3 = 264,000 \text{ birr}$$

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CHAPTER 5- PROJECT VALUATION

5.1 Introduction

Individuals universally exercise daily the art of valuation without realizing that, each exchange of property, of what so ever nature and character, involves an appraisal which at least is an elementary valuation.

Each exchange of property involves an estimate of the relative worth of the item exchanged.

In ordinary trade, value is estimated by the utmost instinctive decision that the price quoted is fair or unfair.

Valuation in general is defined as the art of estimating the fair monetary measures of the desirability of ownership of specific property for specific purpose.

For each property the value must be expressed in terms of some recognized medium of exchange, usually in the monetary units of the country in which the property is located.

In most uses of the term “value” as applied to property is a sense of worth, a desirability of ownership or possession or the exchangeability of property as it can be measured in terms of money.

The fundamental basis of the value of any specific property is the present worth to the present owner or to the would be purchaser or the probable future service expected from the property during its probable future productive life in service.

Valuation is altogether different from costing, because value is an assessed worth of an asset in the context of specific purpose and at particular period of time.

Valuation is purpose oriented and time frame related exercise.

Costing is qualitative; it is an exact science; where most of the parameters are well defined viz. material cost, transportation cost, labor cost, administration etc.

Essential Qualification for Value: In order that a commodity can have value, it must possess three essential qualification:

- It must possess utility
- It must be scarce
- It must be transferable or marketable

Value Dependent Factors: Property value differs according to the following factors:

- Value depends on place, time, circumstances and purpose;
- Economic solicitations such as depressions and boom;
- Supply and demand.

5.2 Various Definitions of Value

- **Market Value:** Market value is the value established in a public market by exchanges between willing sellers and willing buyers.
- **Replacement Value:** Replacement value refers to that of a property determined on the basis of what it would cost usually at the current price level to replace the property or its service with at least equally satisfactory and comparable property and service.
- **Real Value or Value to the Owner:** It envisages the intrinsic value to the owners as long term investment rather than the immediate realization which is characteristic of market value.
- **Liquidated Value:** It is an estimate of the sum, which the holder of the shares would be expected to receive in the event of the company being voluntarily wound up.
- **Speculation Value:** Some properties have future secret prospects, if one visualize it. This is referred as speculative value.
- **Forced Sale Value:** The value of a property where the owner is forced to sell the property due to the urgent and absolute necessity.
- **Reversionary Value:** It is the value of an asset to the owner after the expiry of lease period.
- **Book Value:** It is value of an asset as shown in accounts book. This is value on that particular day arrived by deducting total depreciation till date from its value on the date of its purchase.

- **Depreciated Value:** This is equal to the book value theoretically as for accounting is concerned. However, it is used to arrive at efficient economic value.
- **Face Value:** It is the price paid to purchase an asset.
- **Insurance Value:** It is the net replacement cost, keeping in mind depreciated condition of the asset.
- **Potential Value:** It is the value an asset could fetch if sold in open market at a later date due to potentiality.
- **Assessed Value:** Value of machinery realized on sale when its useful span of life is over, but has not become useless.
- **Scrap or Junk Value:** Value of any asset particularly that of a machine, realized when it becomes absolutely useless except for sale as junk.
- **Earning Value:** It is the present value of a property, which will start yielding an income in the future.
- **Distress Value:** When a property is sold at a lower price than which can be obtained for it in an open market.

5.3 Essential Characteristics of Market Value

The essential characteristic for any asset for market value are:

- Vender must be willing to sell.
- Purchaser must be willing to purchase and must be a prudent one who can put the land to the most beneficial use.
- No compulsion on either in the transactions.
- Urgent necessity to purchase or sale to be discarded.
- Disinclination of vendor to be ignored.
- Sentimental value to the vendor will have place.

- Present and future uses known as potentials are to be taken into account.

5.4 Essential Requirements for Valuer

The essential requirements for a genuine valuer are:

- have thorough knowledge of estimation of cost and materials;
- have knowledge of the latest know how of construction materials and construction techniques;
- have knowledge of various laws and acts such as lease policy, land acquisition, and town planning etc.
- be able to make on organized study of the best available information on the subject of valuation;
- accept the responsibility as valuer and must adhere to the standard of excellence and;
- not be biased and at the same time must have ethical sense;
- Valuation work demands a professional skill.

5.5 Object of Valuation

The main objects of valuation are:

- When a seller wants to sell his property or when a purchaser wishes to purchase property.
- When a property is to be rented; its valuation is required.
- It becomes essential to value the property for fixation of different types of taxes.
- For insurance property; the premium depends on its value.
- When a government acquires a private property in the interest of public; its compensation is given to the owner.
- When a person wants a loan against the security of his asset, it is called a mortgage loan.

- Reinstatement- In case property owner wishes to reinstate his property, the valuation of asset becomes essential.
- To determine the future secret prospect a property has;
- For partition or dissolution of firms.
- To find depreciation value of an asset.
- When two different companies decide to amalgamate, or one company takes over the business of the other.
- Valuation is also essential if a property is required to be liquidated.

5.6 Factors Affecting Value of an Asset

The value of an asset depends on many factors:

- **Price Index:** present market rate of various material, labor, machinery etc. must be known to a valuer.
- **Location of property** has a lot of effect on value of a property.
- **Demand and supply** also affect the value of property.
- **Return** that can be fetched from the property.
- **Remaining useful life** of that asset
- **Functional use value**, flexibility utility i.e. possibility of alterations of its occupancy.
- **Neighborhood conditions.**
- **Local bylaws** restricting addition, alteration of building.
- **Outlook and elevation** of building.
- **Space utilization** and service.

5.7 Types of Valuation

There are various types of valuation;

1. Ordinary Valuation: In ordinary exchange of property; the value is determined by the judgment of the seller and the buyer, each taking into account the knowledge of the property, the prevailing exchange conditions, etc.

2. Formal Valuation: In formal valuation of property, the value is determined by judgment of **specially qualified valuers.**

Such valuation may be for use in property sell or for many other purposes, such as taxing property, securing loans, determining rents and establishing fair commodity prices.

3. Engineering Valuation: It is the art of estimating the value of specific properties where professional engineering knowledge and judgment are essential

5.8 Method of Valuation

The methods available to evaluate many property are given below:

- i. Valuation from life i.e. present book value.
- ii. Rental method of valuation
- iii. Land and building method
- iv. Evidence method based on comparison tendencies also called comparable sales method.
- v. Reproduction cost method
- vi. Global valuation method
- vii. Break up value method

A valuer prior to valuing any property must examine and collect the following details:

- Location of property with reference to road width, its frontage etc.
- Shape and size of property.
- Whether owned by singly or co-owner property particularly the plot.
- Whether it's lease hold or free hold.

- Restrictions of local bylaws for leasehold converted to free hold.
- Permissible maximum construction thereon.
- Whether it's commercial, residential or industrial.
- Restriction of sale or lease deed if any.
- Land rates fixed by authorities.
- Whether earlier registered documents contain provision for grant of sale permissible prior to sale.

A valuer prior to valuing any property must examine and collect the following details:

- Sale transactions for that particular type of land during the years to arrive to some realistic value.
- Whether any easement right exists. (Legal right to given to another party, other than the owner, to gain access to that property).
- Probable future development of that locality under consideration.
- Any other information available regarding the land such as filled up land, logged land etc. and regarding the building its year of construction, future expected life, etc.
- Whether all the taxes are paid till the date of valuation.

5.8.1 Valuation from Life

This method is generally used for equipment but also used for buildings in general.

In this method depreciated value of asset is calculated assuming that the cost of the building consists of both building and land.

Depreciation: Whenever any machine, equipment or a building performs useful work its wear and tear is bound to occur. This can be minimized up to some extent by proper care and maintenance but can't be totally prevented.

Obsolescence: is the depreciation of existing machinery or asset due to new and better invention, design of equipment of processes etc.

Methods of Depreciation Calculation: The following are the methods for calculating depreciation.

- **Straight line Methods**
- **Diminishing Balance Method**
- Sinking fund Method
- Annuity Charging method
- The Insurance Policy method
- The Revaluation or Regular Valuation method
- Machine Hour Basis method
- The Sum of the Year's Digits method

→ **Straight Line Method**

- This method assumes that the loss of value of machine is directly proportional to its age. It means one should deduct the scrap value from the original value and divide the remaining value by the number of years of useful life.

Let **C:** the Initial cost of a machine

S: Scrap value (salvage value)

N: Number of years of life (useful life) and

D: Depreciation amount per year

$$\text{Then, } D = \frac{C - S}{N}$$

Example-1

(a) A machine was purchased for Birr 450,000 on 1st January, 1991, the erection and installation work costs Birr 70,000. This was replaced by a new one on 31st Dec, 2010. If the scrap value was

estimated as Birr 150,000 what should be the rate of depreciation and depreciation fund on 15th June, 2000?

Total cost=Machine Cost+ Erection and installation changes

$$C=450,000 + 70,000 = 520,000 \text{ Birr}$$

Scrap values S= 150,000 Birr

Life of machine = From 1st January, 1991 to 31th Dec, 2010

$$= 20 \text{ years}$$

$$\rightarrow \text{Rate of depreciation; } D = \frac{C-S}{N} = \frac{520,000-150,000}{20} = \frac{370,000}{20}$$

Depreciation per year = 18,500 Birr only

Now, depreciation fund to be accumulated on 15th June, 2000 (i.e. from Jan 1st, 1991 to Jun 15th, 2000 there will be 9 installments):

Depreciation fund collected on 15th June, 2000 = 9 x 18,500 = **166,500 Birr only** **Ans.**

(b) If after 12 years of running, some assemblies are replaced and the replacement cost is Birr 150,000 what will be the new rate of depreciation?

$$\text{Book value in 12 years} = 520,000 - 12 \times 18,500$$

$$= 298,000 \text{ Birr}$$

Replacement cost = 150,000 Birr

$$\text{Hence, new book value} \quad \text{Then, } D = \frac{C-S}{N} \text{ Birr} \quad 0 = 448,000 \text{ Birr}$$

Scrap value = 150,000 Birr

Hence, the depreciation for the rest 8 years will be depreciable value (the assets book value less its estimated salvage value).

$$\text{Depreciable value} = 448,000 - 150,000 = 298,000$$

$$\text{New rate of depreciation} = \frac{298,000}{8} = 37,250 \text{ Birr}$$

Ans.

Example-2

Consider an excavator purchased for 3.1 million birr having a useful life of 5 yrs. Determine the depreciation and book value for each of the 5 years using straight line method. Assume a salvage value of $S = 860,000$ birr.

$$\text{Depreciation rate} = \frac{1}{N} = \frac{1}{5} = 0.2$$

$$D_n = \frac{3,100,000 - 860,000}{5} = 448,000 \text{ birr}$$

Ans.

To be left with a remaining value equal to salvage value at the end of the fifth, a yearly depreciation of 448,000 needs to be considered. Deducting the cumulative depreciated amount from the initial value of the asset we can determine the book value. In this was it is also possible to determine the book value at different points in time. For this example, the results are as presented on table 5.8 along with the process written under the table.

Table 5.8

Year	BV_{n-1}	D_n	BV_n
(1)	(2)	(3)	(4)
0	0	0	3,100
1	3,100	448	2,652
2	2,652	448	2,204
3	2,204	448	1,756
4	1,756	448	1,308
5	1,308	448	860

- Column (1): The period in years.
- Column (2): book value of the previous year (i.e. of year n-1).

- Column (3): depreciation value determined using straight line method (depreciable value/ N).
- Column (4): Book value of year n. Which is $BV_n = BV_{n-1} - D_n$

→ **Diminishing Balance Method**

- ❑ This is also called “Reducing Balance” Method. The diminishing value of machine is greater in the early years. It depreciates rapidly in the early times and slowly later-on.
- ❑ So under this method, the book value of the machine goes on decreasing as its existence continues.
- ❑ In this, let x be the fixed percentage taken to calculate the yearly depreciation on the book value.

Then $X = 1 - \left(\frac{S}{C}\right)^{\frac{1}{N}}$	Where, C = initial cost, S = Scrap Value, N=Number of the years of life.
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Example - 3

A lathe is purchased for Birr 800,000 and the assumed life is 10 years and scrap value Birr 200,000. If the depreciation is charged by diminishing balance method, calculate the percentage by which value of the lathe is reduced every year and depreciation fund after 2 years.

$$C = 800,000$$

$$S = 200,000$$

$$N = 10$$

$$X = 1 - \left(\frac{200,000}{800,000}\right)^{\frac{1}{10}}$$

$$= 1 - (0.25)^{1/10}$$

$$= 1 - 0.8706 = 0.1294$$

$$X = 12.94 \%$$

There is a depreciation of 12.94 percent of the purchasing value (i.e., $800,000 \times 0.1294 = 103,520$).

Depreciation fund after one year (D_1) = $BV_{n-1} * X = 800,000 \times 0.1294 = 103,520$ birr

Value of the lathe after one year (BV_1)

$$= 800,000 \times (1 - 0.1294) = 800,000 \times 0.8706$$

$$= \mathbf{696,480 \text{ birr}} \quad (\text{We can also determine it using } BV_1 = C - D_1)$$

The value of the lathe after 2 years

$$(BV_2) = BV_1 \times (1 - X)$$

$$= 696,480 \times 0.8706 = 606,355 \text{ birr}$$

Depreciation of year two = $696,480 \times 0.1294 \approx 90,125$ birr

Depreciation fund after two year (D_2) = $\sum D_i$

$$= 103,520 + 90,125 = \mathbf{193,645 \text{ birr}} \quad \text{Ans.}$$

5.8.2 Rental Method of Valuation (Capitalized Income Method)

This method is used for big premises like flats, hotels, and hostels, offices from which income can be produced or likely to be produced from the property.

This methods consists of ascertaining net rent per annum from the asset and multiplying this to years purchase. The procedure consists of:

- To find out **gross rent** likely to be received from the asset.
- To find **out goings** i.e. deduction: These are expenses incurred on the asset in the form of taxes, insurances, etc.
- To decide present value of birr per annum received in perpetuity i.e. Y.P. bases on required rate of interest.
- To asses values of property by multiplying net income per annum to Y.P.

5.8.3 Land and Building Method of Valuation.

In this method the valuation of land and part building constructed over it are made separately and the value of that asset is made by adding them.

If building does not exist then only land is evaluated.

Some of the points that need to be carefully seen in the valuation are:

- Recent sale instances of land in the neighborhood.
- Income yielding capacity and state of the money market.
- Value depends on supply and demand.
- Land value generally appreciate with time.
- Land value is based on the most advantageous way in which the land can be put to use.
- In case of lease hold land, all restrictions imposed on the use of the land to be taken into account.

The factors that affect the value of an asset in valuation by land and building method are listed below:

1. The valuation of land is based on its utility. This utility is affected by various factors such as: *Floor, shape of land, Frontage/depth ratio*
2. Situation of property: a locality based on its use can be classified as: residential, commercial, industrial or mixed.
3. Size of plot or land is also one of the factor.
4. Restriction on transfer of land.
5. Land cost is affected by urban land ceiling.
6. Return frontage or end plots.
7. Vista land having a front road.

5.9 Property Measurement

IVSC(International Valuation Standards Council) including member organizations concerned with the valuation of assets.

This committee has several IVS standards to address important issues.

The general IVS standards are:

- IVS 101 scope of work
- IVS 102 Investigation and compliance
- IVS 103 Reporting
- IVS 104 Bases of value
- IVS 105 Valuation approaches and methods

The Royal Institution of Chartered Surveyors (RICS) has set a number of standards and guidelines on property valuation to ensure consistency and the application of ‘best practice’ within the profession.

Code of Measuring Practice (RICS 2007b) defines the methods of measurement of buildings, together with when and how they should be used.

The principal methods used in property valuation and management work are: GEA, GIA, and NIA.

1. **Gross External Area (GEA):** area of a building measured externally at each floor level.

Includes:	Excludes:
<ul style="list-style-type: none">- Wall thickness and external projections- areas occupied by internal walls and partitions- columns, piers, chimney breasts, stairwells- lift rooms, plant rooms(whether or not	<ul style="list-style-type: none">- open balconies- open fire escapes- open sided covered ways- Open vehicle parking areas, terraces and the like

above roof level) open-sided covered areas	<ul style="list-style-type: none"> - minor canopies - any area with a headroom of less than 1.5m (except under stairways)
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2. Gross Internal Area(GIA): area of a building measured to the internal face of the perimeter walls at each floor level.

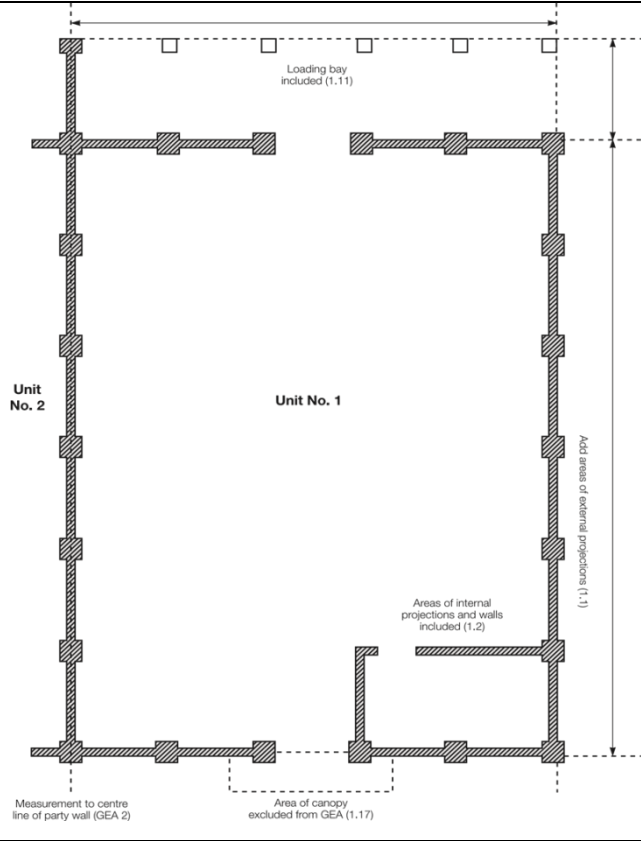
Includes:	Excludes:
<ul style="list-style-type: none"> - areas occupied by internal walls & partitions - service accommodation such as WCs, showers, changing rooms - columns, piers, whether free standing or projecting inwards from an external wall, chimney breasts, stairwells etc. - lift rooms, plant rooms, tank rooms, fuel stores, whether or not above roof level - open-sided covered areas (should be stated separately) 	<ul style="list-style-type: none"> - open balconies - open fire escapes - open sided covered ways - Open vehicle parking areas, terraces and the like - minor canopies - any area with a headroom of less than 1.5m (except under stairways)

3. Net Internal Area(NIA): usable area within a building measured to the internal face of the perimeter walls at each floor level.

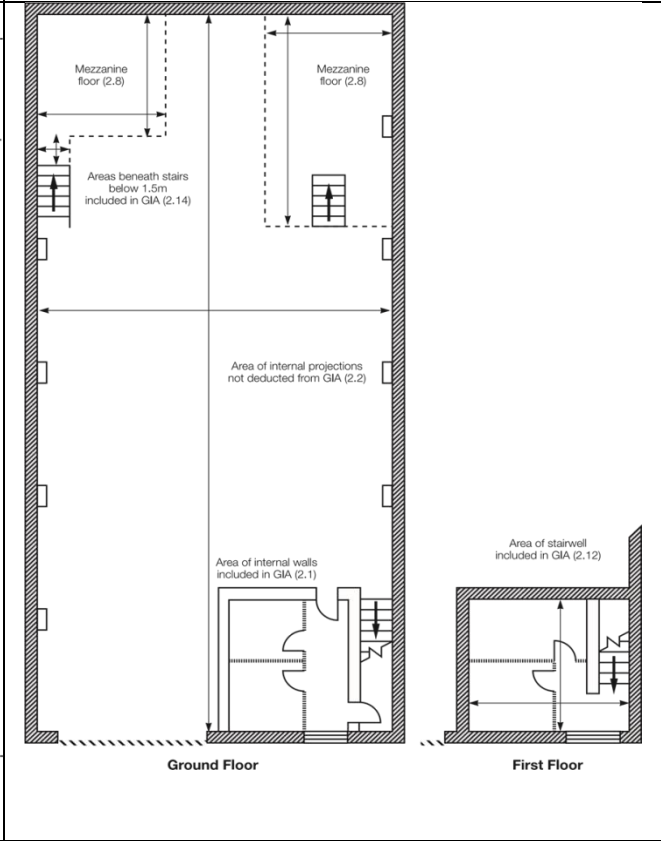
Includes:	Excludes:
<ul style="list-style-type: none"> - perimeter skirting, moulding, or trunking - Kitchens - any built in units or cupboards occupying useable areas (subject to height exclusion below) - partition walls or similar dividing elements - open circulation areas and entrance halls, 	<ul style="list-style-type: none"> - toilets and associated lobbies - cleaners' cupboards - lift rooms, boiler rooms and plant rooms other than those of a trade process nature - stairwells, those parts of entrance halls, landings and balconies - corridors and other circulation areas

corridors and atria	<ul style="list-style-type: none">- areas under the control of service or other external authorities- internal structural walls, walls enclosing excluded areas, columns, other projections- air conditioning, heating or cooling apparatus and ducting- areas with headroom of less than 1.5m- car parking areas
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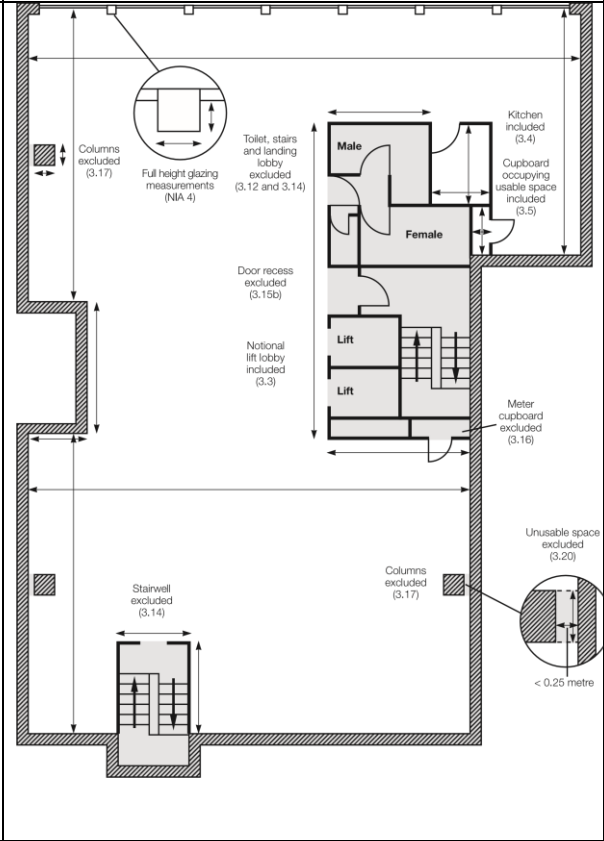
Example of appropriate dimensions for GEA



Example of appropriate dimensions for GIA



Example of appropriate dimensions for NIA



5.10 Valuation Approaches

The IVS 105 general standard present three generally recognized approaches: **cost, income and sales comparison approaches**.

Each of these principal valuation approaches includes different detailed methods of application.

5.10.1 Cost Approach:

Provides an indication of value using the economic principle that a *buyer will pay no more for an asset than the cost to obtain an asset of equal utility*, whether by purchase or by construction, unless undue time, inconvenience, risk or other factors are involved.

It calculates the current replacement/reproduction cost of an asset and makes deductions for physical deterioration and all other relevant forms of obsolescence.

It is done on the principle of substitution.

IVS 105 puts forward the circumstances where cost approach should be used as:

- When the market participant is able to recreate the asset (quickly and with no restriction).
- When the asset is not income generating and has a unique nature (specialized asset).
- The basis value is based on the replacement cost.
 - Specialized property/Unique asset: referring to its design, type of construction, size, location, function, the nature of the building designed.
 - Basis value: A basis of value is not a valuation approach or valuation method adopted but is a statement of the assumptions underlying the assessment of value or valuation

On a broader sense there are three cost approach methods:

- **Replacement cost method:** indicates value by calculating the cost of a similar asset offering equivalent utility,
- **Reproduction cost method:** indicates value by calculating the cost to recreating a replica of an asset, and

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- **Summation method:** a method that calculates the value of an asset by the addition of the separate values of its component parts.

Methods for estimating new Replacement/Reproduction Cost:

- **Detailed method (quantity survey method):** detailed estimate of all resources used for each component of the building. Considers the direct and indirect costs involved.
- **Unit-in-place method:** also called segregated cost method. It finds the cost of installed materials such as the cost to install the foundation, super structure etc. and considers the summation.
- **Comparative Unit (area/volume) method:** considers number of similar (design, type, and construction) properties. The value of the subject is compared with the most comparable buildings whose cost has been broken down to Cost/m².
- **Trending method:** estimating the new reproduction cost (not replacement cost) where an index/trend factor is applied to the property's historical cost to convert the known cost into an indication of current cost.

In the context of the cost approach, depreciation refers to “adjustments made to the estimated cost of creating an asset of equal utility to reflect the impact on value of any obsolescence affecting the subject asset”.

Normally we consider for the following types of depreciation:

- **Physical obsolescence:** any loss of utility due to the physical deterioration of the asset or its components resulting from its age and normal usage,
- **Functional obsolescence:** any loss of utility resulting from inefficiencies in the subject asset compared to its replacement such as its design, specification or technology being outdated, and
- **External or economic obsolescence:** any loss of utility caused by economic or locational factors external to the asset. This type of obsolescence can be temporary or permanent

5.10.2 Income Approach:

Provides an indication of value by converting future cash flow to a single current value. The value of an asset is determined by reference to the value of income, cash flow or cost savings generated by the asset. It is done on the principle of anticipation.

It states that income capitalization procedures try to take anticipation of future benefits to account and estimate their present value. This may involve either forecasting the anticipated future income or estimating the capitalization rate which implicitly shows the anticipated pattern of change in income over time.

The income approach is used as the primary basis for a valuation under the following circumstances the income-producing ability of the asset is the critical element affecting value from a market participant perspective, and reliable projections of the amount and timing of future income are available for the subject asset, but there are few, relevant market comparable.

Income approach has two methods:

- **Direct capitalization method:** an income capitalization method in which a single year's income is converted into an indicator of property value (annual cash flow projections) .
- **Discounted cash flow method:** requires an explicit forecast of the cash-flow over a predefined time horizon (derived by removing the growth from the discount rate).

5.10.3 Sales Comparison/ Market Approach:

“provides an indication of value by **comparing** the asset with **identical or comparable** (that is similar) assets for which price information is available”.

The preferred valuation approach when reliable, verifiable and relevant market information is available.

The comparative analysis performed focuses on similarities and differences among properties and transactions that affect value.

It is done on the **principle of substitution**.

IVS 105 puts forward the circumstances where market approach should be used as the primary basis for a valuation :

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- the asset has recently been sold in a transaction appropriate for consideration under the basis of value,
- the asset or substantially *similar assets* are actively publicly traded, and
- there are frequent or recent observable transactions in substantially similar assets.

- “should be used only when the subject asset is sufficiently similar to the publicly traded comparables to allow for meaningful comparison”.

Adjustments are made for any material differences between the comparable transactions and the subject asset.

Examples of common differences that could warrant adjustments may include, but are not limited to:

- Material physical characteristics (age, size, specifications, etc.),
- Relevant restrictions on either the subject asset or the comparable assets
- Geographical location (location of the asset and/or location of where the asset is likely to be transacted/used) and the related economic and regulatory environments,
- Profitability or profit-making capability of the assets,
- Historical and expected growth,
- Unusual terms in the comparable transactions,
- Differences related to marketability and control characteristics of the comparable and the subject asset, and
- Legal form of ownership.

5.11 Valuation Report

Minimal issues to be addressed in a valuation report:

1. Identification of the client any other intended user

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2. Purpose of the valuation
3. Basis value
4. Valuation date
5. Extent of investigation
6. Nature and source of the information to be relied upon
7. Assumptions made
8. Restriction on use, distribution or publication
9. Confirmation on that the valuation is undertaken in accordance with IVS.
10. Valuation approach and reasoning
11. Amount of valuation or valuation
12. Reporting the valuation
13. Date of the valuation report

Reference

- [1]. Parker, D., International Valuation Standards: A Guide to the Valuation of Real Property Assets, John Wiley & Sons, Ltd., UK, 2016.
- [2]. International Valuation Standards Council, IVS 105: Valuation Approaches and Methods: Exposure Draft, April 2016.
- [3]. Wyatt, P., Property Valuation in Economic Context, Blackwell Publishing, Oxford, UK 2007.

CHAPTER 6- CONSTRUCTION PROCUREMENT

6.1 Stages in Construction

Stages in the construction industry include:

- Inception and feasibility
- Planning and Design
- Tendering Stages
- Bid Evaluation
- Award of Contract
- Construction Stage
- Commissioning and Acceptance
 - Provisional Acceptance
 - Final Acceptance

6.1.1 Inception and feasibility

At this stage the owner puts his visions and wishes and with this as the starting point, the various groups (professionals) try to conceptualize the project and prepare a conceptual design. At this stage the owner will hire a consultant to formally design and develop the concept into a practicable project.

6.1.2 Planning and Design stage

Planning is a function of devising the cause for future with a vision, formulated for the future state of the organization or project. At this stage the consultant plans and designs the project based on the owner's requirement and the possible constraints.

6.1.3 Tendering stage

At these stage contractors are invited to offer their best technical and financial offers as per the conditions and specifications depicted in the contract documents. Usually a 2% of bid bond is required so as not let him disappear.

6.1.4 Bid Evaluation / Evaluation of Tenders

The bids are evaluated based on: • Compliance with the contractual terms and conditions, • Correction of bid prices, • Detailed analysis.

6.1.5 Award of Contract

After the negotiations have been successful; the contract will be awarded to the successful contractor. The formal Steps might include: • Write a letter of acceptance • Write the letter to proceed with the works • Performance bond: 10% a guarantee that he will do the job as per agreed There are different methods & types of construction contracts. The owner generally makes the selection. The type selected depends on the kind of work being performed and the conditions under which it is being performed.

6.1.6 Construction Stage

Here is where the actual execution of the works takes place as per scheduled.

6.1.7 Commissioning and Acceptance

Commissioning is a process whereby the contractor makes sure that all installed mechanical or electrical parts are operational. During commissioning, therefore all such parts are run in the presence of the client or his representative as per the conditions agreed. Acceptance has to stages: a. Provisional acceptance: In this acceptance, the client accepts the completed works on provisional basis for a period one year. During this period all payments except the retention money are paid. The other option is to release the retention money and require for a bank or insurance security. b. Final acceptance: At this stage the owner completely accepts the works executed and the retention money is released to the contractor. But if the client found out some construction default during this period, he can oblige the contractor to work out that default or the client himself worked it out from the retention money. The contractor is assumed to have completed his contractual obligation from this time on.

6.2 Introduction to Procurement

Procurement is a process used to select the lowest competitive and qualified bidder for procuring services, works or goods from potential competitors based on reasonable & relevant criteria.

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Construction Industry involves procurement and contract management systems in order to ensure fair competition and distributions of obligations and rights among stakeholders.

Competition helps:

- The Project Owners' to acquire the five rights (Counterpart, Cost, Time, Quality and Quantity) s/he is entitled to
- The Project Financiers' and Regulators' to value market principles and effective utilization of finance such that lowest qualified bids take the project, and
- The Project Providers' to get impartial and neutral Opportunity for business.

Procurement is a process used to select the lowest competitive and qualified bidder for procuring services or works or goods from potential competitors based on reasonable relevant criteria. It can also be expressed as a method used to employ or buy services or works or goods for the value (in the form of money) which includes reasonable profit. Essentially, a bid or tender is a binding offer or proposal to furnish certain specified promises for the amount stated in the tender.

Physical infrastructures are cost extensive and appropriate savings obtained through competition are the main factor behind the procurement process. An effective and efficient procurement method ensures the following rights called the "Five Rights". These are The Right Quality, The Right Quantity, The Right Cost / Price /, The Right Counterpart and The Right Time.

The Right Quality: It is indeed wasteful and not necessary to spend time, money and all the efforts for procuring unqualified services or goods or works. Therefore, it is essential to ensure whether such procurements are of the right quality. Right Quality is always based on two major factors. These are the technical expectation and the economic consideration, i.e.; Price & Availability.

While the technical quality can be insured by the provisions of specifications and checking their conformance reliability of the intended job; the economic consideration can be taken into account by the competition initiated using procurement processes. This implies that a tender

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document should, as much as possible, clearly specify the quality requirements and allow participation of qualified and experienced firms for tendering.

The Right Quantity: The quantity should be computed carefully and included in the BOQ correctly. This is because it has an effect on the project cost and site organization which is the bases for offering the right price. If the quantity is found mistakenly small, it will have consequential effects such as: • Project Budgeting will be affected due to excess quantities • Construction planning will be affected and cause under stocking • Tenderers can manipulate their offer due to it • Overzealous contract administration is caused, and • Contractor cash flow will be affected. On the other hand, if the quantity is mistakenly more, it will cause high stocking, more storing places and risk of spoilage; unhealthy practices due to over budget provisions; and manipulation in tendering. Therefore, provisions of the right quantity resolve the occurrences of the above stated effects. Two major factors that can play important role in providing the right quality are Take-Off-Sheet Measurements and Resources Allocations.

The Right Cost / Price /: In strict terms the right cost usually relates itself very much to the quality expected to accomplish the task. It is clear to say that it is difficult to get the right cost, however to approach it, is a possibility. That is one of the causes for procurement to be processed. Tendering together with negotiation and market intelligence techniques is the only way that ensures the right cost and accomplishing the task successfully. Competition is the bases to determine the Right Cost or Price.

The Right Counter Parts: This is to guarantee that the parties agreeing to accomplish the task shall be fit to the job. That is, the Project Owner should know what his needs are as accurately as possible, be competent to act as an Employer and should possess the finance. The Consultant shall exercise reasonable skill, care and diligence in the performance of his obligations. If authorized to certify, decide or exercise discretion, the Engineer do so fairly between the client and the third party not as an arbitrator but as an independent professional acts by his skill and judgement. The contractor shall be able to execute and maintain the task successfully with due care, diligence and provide all labors including supervision thereof, materials, equipment, etc. Therefore, with the help of tendering, it is possible to select the right counterparts.

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The Right Time: The right time for the provision of resources and accomplishment of obligations of each party shall be set and agreed. This usually relieves the extra cost incurred on the parties which will make them to suffer. Besides if the project is not completed at the right time, its effects are devastating. To insure prevention of such happenings scheduling with regard to right timing is essential.

6.2.1 Types of Procurement

Procurement types can be classified based on the things to be procured and the way how they are procured

Bases	Things Procured	Bidders' Coverage	Geographical Coverage	Procurement Awareness	Procurement Steps
Types	Goods Services Works	Competitive Negotiated	International Regional National Local	General PN Specific PN	Single Two Staged Pre - Qualification Post - Qualification

Table: types of procurement

A. **Things to be Procured:** Based on things to be procured, procurement types can be classified into three major categories; namely, Procurement of Goods, Services and Works. Depending on the delivery system chosen during the contract planning phase, mixed types of procurement types can be adopted.

A -1. Procurement of Goods: Physical resources like Materials and Equipment's are made available using Procurement of Goods.

A -2. Procurement of Services: In the construction Industry procurement of services are often termed as consultancy services procurement. These include services like Pre-feasibility

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and Feasibility studies, Design and Contract Administration of projects, Construction Management Consultancy Services, Research or Study based Consultancy Services, etc.

A –3. Procurement of Works: In the CI procurement of works mean the procurement of contractors to carry out the actual physical infrastructures.

B. Bidders' Coverage: Generally, procurement types can be classified into Competitive and Negotiated Tendering when bidders' coverage is taken as a basis for classification.

B –1. Competitive Tendering: The objective of competitive bidding is to acquire the goods, or works, or services at the most economic cost to the project owner. Used for the selection of better and capable winning bidder among the various eligible firms. Competitive bidding can either be Open or Limited Competitive Bidding in the form for their invitations.

As their name implies, while Open competitive bidding allows all eligible bidders to participate; Limited competitive bidding allows a number of selected firms decided by the Project Owners in consultation with concerned parties for qualification. The major difference between open and limited competitive bidding is the addition of qualifying criteria beyond eligibility imposed on the procurement type for limited competitive bidding.

B –1.1 -Open Tendering

- all eligible bidders are allowed
- Consumes time for tendering and bid –evaluation
- Might result in incompetent bidder
- Results in better cost

B –1.2 -Limited Tendering

- only those passing a certain qualification criteria are allowed

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- Applicable when the project is urgent or unique
- Avoids the rejection of Bids which are non –responsive for technical evaluations
- Results in higher costs –professional negotiation

B –2. Negotiated Tendering

Under certain circumstances, which shall be rare in practice, direct appointment of an eligible firm can be exercised by Project Owners. The nomination of this direct invitation is usually based on good performance, acquaintance with the Project Owner, for supplementary agreements, etc. This kind of tendering is exceptionally exercised when the project under consideration is very urgent or needs special skill whereby the required skill is rarely available. The main disadvantage of this type of tendering is that the price offered can usually be higher than the competitive bidding.

C. Geographical Coverage:

Procurement can be made using any of the four methods based on geographical coverage: these are International, Regional, National and Local Tendering. Such types of procurements are generally caused by three major factors. These are Local Capacity, Financial Sources and Globalization.

When projects could not be carried out by local capacity, project owners are forced to make tendering out of their localities. Policies of the financial sources dictate the type of tendering geographically. For instance, donor financed projects are often practicing International or Regional Tendering. The World trend for Globalization and the principles of Free Trade and Trade Liberalization also encourages international tendering. In practice, Preference Margins in the range of 7% are applied to local, national or regional tenderers, which imply tender offers higher than 7 % will be given preference to encourage local participation.

D. Procurement Awareness: General and Specific Tendering

To enhance proof of competition and increase accessibility, projects are recommended to create awareness starting from its initiation. Following this requirement, General Procurement Notice is

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made during projects planning phase and it is only interests of the bidders are aroused because sufficient tender documents are not available. This approach is used:

- I. The Project Owners to
 - ✓ identify interested bidders to issue Invitations by letters and save time;
 - ✓ identify bidders relevant for the procurement required; and
 - ✓ protect loss of cost in preparing lots of tender documents.
- II. The Bidders to:
 - ✓ give sufficient time to assess the cost of the project;
 - ✓ protect loss of cost only to participate; and
 - ✓ encourage competent bidders who wary about law-balling to participate.

General Procurement Notice (GPN) is of two types. These two types are based on their purpose why and when they are notified. The first type is when the purpose is to create awareness and let bidders' prior information about upcoming projects such that they can follow up its development and include them in their plan. This type of GPN is used for procurement of works and goods and is often announced as soon as the design implementation service is started. The Second type is when the purpose is to determine interested bidders who could be invited in the form of Limited Competitive Tendering. This type of GPN is used for procurement of services and is often announced after financial sources are determined. GPN covers the Employer and its financiers for its project; Description of the project with its probable or planed implementation time; type of procurement method and address where further information can be obtained.

Specific Procurement Notice (SPN) is an Invitation for Tender or a Request for Proposal when the project is ready for implementation. SPN can be sent to those interested bidders identified following GPN directly. Otherwise, it should be advertised on the bases of enlarging opportunities. The contents of SPN are similar to The Form of Invitation to Tender.

E. Procurement Steps: Single Vs Two Staged; and Pre -Vs Post -Qualification Tendering

Single or Two Staged Tendering:

Procurement can be made using a single or two staged tendering process. They are related with whether tender packaging for submission separately and their evaluations are

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staged for a single or two steps when invitations are made. Often two staged biddings are made for the submission of technical and financial proposals separately and their evaluations one after the other.

Single: Bidders submit single proposal and the evaluation is carried out on the same.

Two Staged: When the bidders submit separate proposals and the evaluation will be carried out separately, usually financial then technical.

Pre or Post Qualification Tendering:

Pre-qualification – is an internationally accepted practice in procurement management. It would normally be required for civil works contract of which its nature and cost is large and complex. It is a procedure in which eligible bidders are invited to provide evidence of their ability to perform the services required by the employer. Prequalification is desirable because it enables the Employer to establish the competence of companies subsequently evaluated. It is also in the interest of contractors since, if prequalified, they will know that they are competing against a limited number of other firms, all of whom possess the required competence and capability.

Pre - qualification can be of two types. The First is when companies are already considered qualified during their licensing requirements which entitled them for a single stage tendering process. For such types of tendering, the most important tender evaluation criteria become the low priced bid. The Second is when two staged tendering is used to pre-qualify tenderers for their technical competency. Once bidders qualify for the tender, either the lowest priced bidder or the lowest evaluated bidder based on the weighted average of the technical and financial scores will be recommended for award.

Pre - qualification should be based entirely on the ability of the bidder to carry out the required works satisfactory. The following criteria are often used in determining this ability of the bidder;

- Experience and past performance,

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- Health, Safety and Environment Records, if any,
- Capability in respect of personnel and equipment,
- Organizational arrangement and facilities,
- Financial Status, and
- Schedule of Commitments.

Post –qualification: Post - qualification is a tendering type where Financial Evaluation is carried out first and rank bidders on the basis of their offer for tender price. That is, Technical Evaluation will be done after the Financial Evaluation. However, Technical Evaluation is performed step by step starting from the lowest financially evaluated bidder until technically or cumulatively qualified bidder is determined. The advantage of this approach is not to lose the lowest financially evaluated bidder and to save time during technical evaluations. However, Post qualification approaches often cause to fix evaluators on financial results and be locked and biased for successive technical evaluations.

6.3 Procurement and Contract Management

Procurement and Contract Management involves three major processes as shown in the figure:

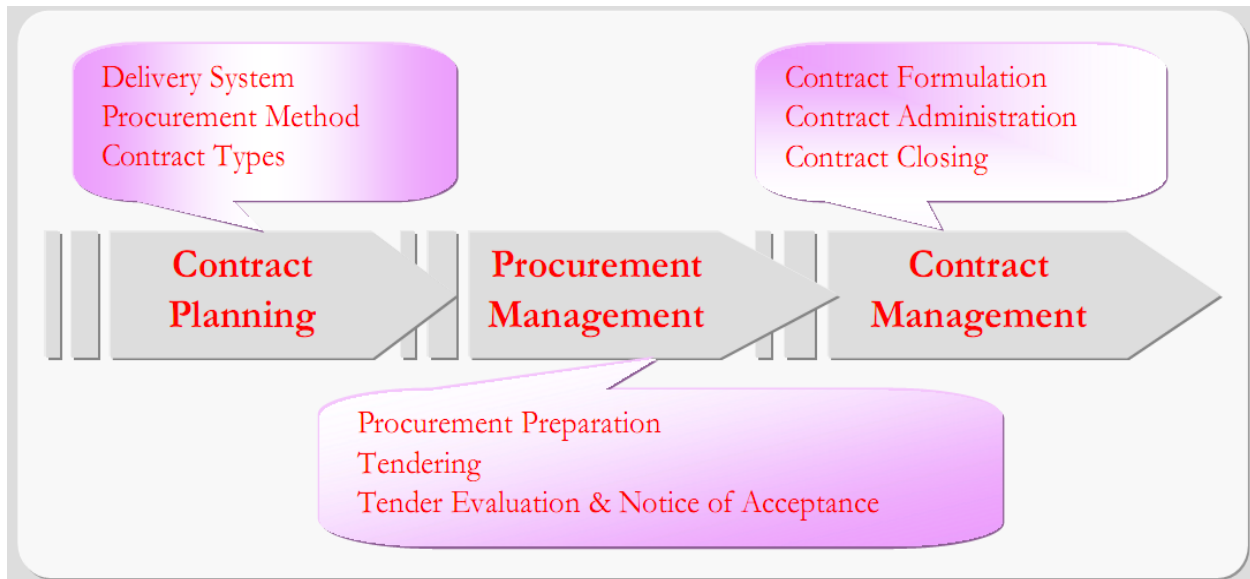


Figure: procurement and contract management process.

Contract Planning

Construction projects are components of a certain business or development demands. That is, they are formulated if and only if such businesses or development demands acknowledge their contribution and it is a must to involve them. This requirement is dealt during the basic / strategic planning phase of the overall business. This phase often passes through the identification, feasibility and financing stages of Programs or Projects. Contract is a customary tool used to implement formulated programs or projects. As a result, contract planning becomes part of this basic / strategic phase.

Contract planning includes decisions on proposed Delivery Systems, Procurement Methods and Contract Types to be followed and used together with its provisions for alterations. This is because such decisions are related to regulatory requirements such as:

- ✓ Ethical (Neutrality, Formality, and Impartiality);
- ✓ Economical: (Proof of Competition, Least Qualified and Evaluated Bidder);
- ✓ Accountable: (Obligations and Rights); HSE (Health, Safety and Environment); and
- ✓ Transparent: (Accessibility and Notice of Advertisement).

Procurement and Contract Management processes shall be based upon the approved contract planning provisions; that is, the contract delivery system, the procurement method and contract types decided upon. The approved contract provisions can only be changed following the change process stated in the contract planning document and if and only if:

- ✓ the Environment and Context considered are not correctly analyzed or changed,
- ✓ their application can remarkably affect the objective of the project, and
- ✓ procurement management process justifies change of the Contract Types.

Once the validity of the contract provisions are checked once again and taken for granted or other provisions are devised; Procurement Management followed by Contract Management can be initiated, planned, implemented, monitored and closed.

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Procurement Management

Procurement Management is a process of selecting individuals or organizations to carry out the intended services and / or works. Procurement Management is carried out based on the provisions made during the contract planning phase of the Procurement and Contract Process. It involves the preparation of procurement documents, their invitation and submission of tender proposals, and Opening and Evaluation of tenders. On the bases of results from tender evaluations, the procurement team will recommend the lowest responsive bidder for Contract Management Phase.

The following issues are necessary for a successful Procurement Management phase:

- Knowing and ensuring the implementation of procurement related National and International laws, rules and regulations,
- Adherence to the provisions made during the contract planning phase including their change processes that is; with respect to: Delivery Systems, Procurement Methods and Contract Types,
- Establishment of a flexible procurement team, and
- Adhering to the principles of Proof of competition, Impartiality, Neutrality, Accessibility and Formality.

Contract Management

Contract Management is a process of reaching contractual agreement for implementation, its administration and finally concluding the contract. Similar to the procurement management process, it shall be based on the provisions decided during the contract planning phase. It involves negotiation based on tender evaluation recommendations and signing of contractual agreement followed by its administration for contractual implementation, progress tracking, and changes, claim and disputes administrations.

The following issues are necessary for a successful Contract Management phase:

- Knowing and ensuring the implementation of contract related National and International laws, rules and regulations,

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- Adherence to the provisions made during the contract planning phase including their change processes, that is; with respect to delivery Systems, Procurement Methods and Contract Types,
- Identifying, recognizing and involving all potential or key stakeholders to form a contract team,
- Understanding, mapping and monitoring all contract conditions agreed upon, and
- To administer changes, claims and disputes.

6.4 Procurement and Contract Delivery Systems:

Procurement and Contract Delivery system is the way Project Owners together with Project Regulators and Financiers determine the assignment of responsibilities to Project Stakeholders along the Construction Process. Procurement and Contract Delivery system is often determined during the Basic Planning phase of Construction Project.

Generally, there are six types of Procurement and Contract Delivery systems. These are:

- Force Account,
- Design Bid Build (DBB),
- Design Build (DB) or Turnkey,
- Finance / Build Operate System (BOT),
- Construction/Facility Management Consultancy, &
- Alliances and Outsourcing.

Such Procurement and Contract delivery systems are developed overtime and are shown in Fig. below. The development was based on problem solving for the previous type and the Development of the Construction Industry technologically and management wise.

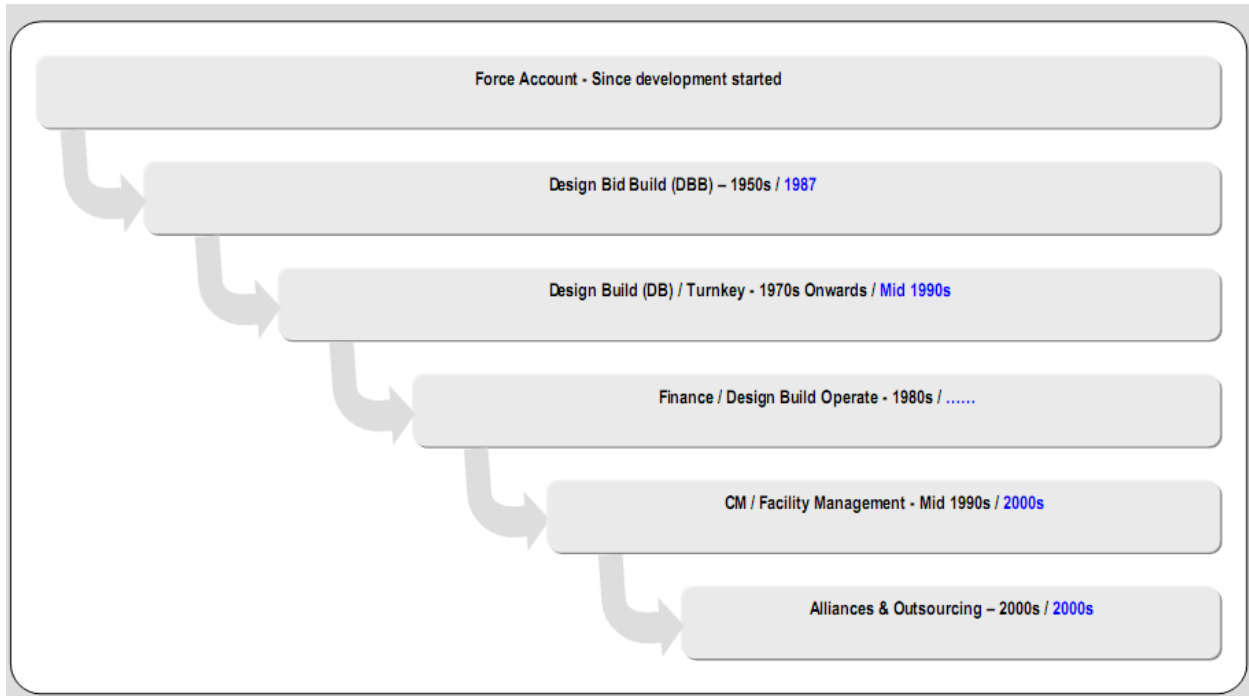


Fig. The different Procurement and Contract Delivery Systems and their development overtime

Force Account

When the Project Owners engage themselves to undertake the project, it is called a force account delivery system. Often such a system is promoted if the Project Owners believe that there is a comparative advantage in Cost, Time and Quality issues. Besides, when there is a lack of capacity from the private sector to undertake very large and technologically new projects, public companies do undertake such projects using Force account delivery systems

These days this type of delivery system is often used when projects are small and places are remote such that reaching them is difficult and in general they are not attractive enough to call the attention of Bidders. Besides when projects are spatially scattered and maintenance are to be done for schools, colleges, health centers etc., such cases can be applied.

Design Bid Build (DBB)

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Design Bid Build (DBB) This is the most practiced type of delivery system in the Construction Industry of Ethiopia since the 1987. After project owners did prepare the Basic Planning that identifies construction project programs, they call upon the participation of Design and / or Supervision Consultants either by tender or by negotiated contracts. This consultant will carry out the design together with the necessary tender documents which will be the bases for tendering to select contractors. These process is called Design - Bid - Build and hence the name for such delivery system.

In this type of delivery system, projects are divided into different packages interfacing to each other. Though the design and supervision consultant will be the prime professional on behalf of the owner and largely the administrator of the construction contract; the employer takes the responsibility of coordinating the various project packages and their respecting interfaces.

Besides, designers have not been required to guarantee results but rather methods. That is, they are held accountable on the basis of their superior knowledge and sufficient competency and ability to design with a reasonable degree of technical skills. As a result, contracts and courts focused on professional duty of care, not results or project goals. Contractors are also responsible to construct works with due care and diligence and complete them in accordance with the contract, but they are not held responsible for design deficiencies.

Since the 1980s, this traditional approach has become less popular due to the following factors:

- Severe Adversarial relations between the designer or contract administration consultant and the contractor
- Fragmented contract for the project owner
- Project owner responsibility for risks associated with the design and contract administration
- The inability of design and contract administration consultants to cope up with new construction technologies and constructability issues of their designs and constructability issues of their designs
- Severe adversarial relationships between Urban Planners and Architects on the one hand; and Architects and Engineers on the other hand on building projects

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The following standard forms of DBB Conditions of Contract are known for use for such delivery system:

- FIDIC White Book for Consultancy Services (Design and Supervision) and Red Book for Construction Works
- Standard Conditions of Contract for Construction of Civil Works, 1994; MWUD
- Standard Bid Document by PPA (Public Procurement Authority)

Design Build (DB) / Turnkey

Design Build or Turnkey Delivery system is a response to problems associated to the last two types of delivery systems. These were promoting privatization and its business like approach to enhance the Force Account System and reducing fragmentation, adversarial relations and Project Owners' risk which are recurrent manifestations in the DBB delivery system.

Design Build or Turnkey by principle reduces numbers of procurement processes engaged in the fragmented process and employ only one procurement process and a single contractor to provide the entire Construction Implementation Process (Design and Construction Implementations). In the 1970s, large firms began to offer both design and construction services in order to provide project owners with a single source for project delivery. At the beginning, this delivery system was limited to complex projects such as industrial, big plants and big infrastructural constructions. DB delivery system is common worldwide specifically for Private projects. This led lead contracting firms to form a team or consortium of designers and specialty contractors who work together to meet the entire demand. Such services are initiated after the Project Owner built the project concept during the basic planning phase and brought to the DB Contracting Firms. The project concept should clearly define the performance criteria such as output, input, waste and any other performances the employer may desire. This makes an additional responsibility to the contractor which is "fitness to purpose" according to the Orange Book of Fidic. Fitness to purpose is beyond the professional duty of care and places liability on the contractor for any failure of the design to perform the standards required.

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This delivery method is a response to problems associated to the last type of delivery systems. The complete design and building of the project is carried out by a single contractor. This reduces fragmentation, adversarial relations and Project Owners' risk.

Typical advantages of this system include:

- ✓ reducing fragmentation and adversarial relations between designers and constructors;
- ✓ minimizing Project owners' risk transferable due to Designers' faults;
- ✓ accountability and entire responsibility for both design and construction which entitle the employer to receive completed project is onto a single contractor;
- ✓ employers' responsibility to co-ordinate interfaces between different project elements is avoided;
- ✓ single point responsibility minimizes the opportunity to claims by the contractor due to design related issues;
- ✓ coordination between design and construction processes will also be enhanced (both in communication for constructability as well as in fast tracking); and
- ✓ the client budget or financial requirement is defined early enough in the development process.
- ✓ For this type of delivery systems, either joint ventures or firms with large design and construction capabilities were able to participate.

The disadvantage of this delivery system is loss of control, cost of tender and cost of risks.

- ✓ Since limited supervisory role by the employer representative is practiced; which is relatively flexible and makes the employer distanced from the whole process, the employer has little chance to understand what is developed and entertain variations in requirements implying loss of control.
- ✓ Contractors in order to provide reasonable offer, their tender cost is higher than in the case for DBB delivery system. This is because they need to carryout acceptable design for project cost offers. Though it was not practiced often, employers who shared costs related to tendering are informed to get seriously considered offers. World Bank suggested a Two staged procurement method based first on technical merit and followed by financial competition and not for more than six bidders.

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- ✓ The increase in risk transferred onto the contractor will be counterbalanced by the increase in contract prices which can be taken to include these costs of risks.

Projects carried out using DB delivery system are often called Turnkey Projects because a single contractor is responsible to hand over the completed facility and let the Project owner to turn the key and gets in. Often Turnkey projects use Lump-Sum contract type.

Finance / Build Operate Transfer (BOT)

Build - Operate - Transfer is a form of procurement and contract delivery system that promotes Public Private Partnership (PPP) in which a private company is contracted to finance, design, construct, operate for a certain period (usually 10 years) and transfer. BOT contractors look to project financiers for the realization of projects through equity contributions or credits. Such provisions are different from budgeted finances such that they involve no or limited re – course which means the project owner is not responsible for any liability other than force majeure and agreed upon claim adjustments. This obliges that projects should first be viable for revenue generation in order to payback its depts.

The Typical BOT contract is the process whereby a government grants a concession to a project development company to develop and operate what would normally be a public sector project, for a given period of time known as the concession period. BOT project involves a potentially complex contractual structure. The Operation period between completion and transfer gives the contractor an opportunity to verify the quality of the output of the services and works, and train the employer personnel on how to manage the facility afterwards. In some BOT contracts, defect liability period will be included in order to ensure the quality of the facility during transfer. This is because, operators in an attempt to save costs, may decrease operating and maintenance expenditures towards the end of the concession period.

Such delivery system requires appropriate packaging of projects and their definition clearly. It is advisable to start with small projects and tries to develop experience and expertise to make such delivery system successful. Most BOT projects failed because of their built up and engagement in very large projects which is an extremely risky business for contractors. Consortium of contractors is used to carry out such projects. The increasing popularity of the BOT project is

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largely due to a shortage of public funding and the opinion that the facility will be more efficiently managed by a private entity.

The following standard forms of BOT Conditions of Contract are known for use for such delivery systems: FIDIC Yellow Book

Construction / Facility Management Consultancy

Construction Management Consultancy Delivery System is a response to problems associated with DB and BOT where the Project Owner was not well represented for its benefit and the problem of fragmentation between Planning and Implementation. As a result, construction management consultancy firm is used to coordinate all activities from concept inception through acceptance of the facility. Facility management consultancy adds operation of facility during operation to Construction Management Consultancy.

Construction Management service in such delivery system include the management activities related to a construction program carried out during the Basic Planning, Design & Construction Implementation and its completion process that contributes for the successful completion of projects. The main difference of this delivery system is that, while all the others involve only during the implementation phase after major decisions was made during the Basic planning phase of the construction process, it is involved in the whole construction processes.

Construction Management Consultancy service are particularly attractive to organizations that involve in construction physical infrastructures such as MoE, MoH, Real Estate Organizations, MoWRs, MoT&C, etc. Construction Management Consultants then represents Project Owners to carry out the following services:

- ✓ Feasibility studies of Construction related services
- ✓ Plan and Monitor the Triple Constraints of Project Performances
- ✓ Lead and Organize regulatory systems of the Construction Industry
- ✓ Valuation, Quantity Surveying and Procurement and Contract Management Services

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A construction management consultancy firm is used to coordinate all activities from concept inception through acceptance of the facility.

There are two types:

CM at Risk –where the consultant is responsible for any risks associated with the project. This results in increase in cost

CM at Free –the client will bear all the risks.

Facility management – similar to construction management consultancy but adds operation of facility during operation for a certain period.

Partnering, Alliances, Outsourcing

The need for constructing quicker, cheaper and to a higher quality of physical infrastructure by clients and at the same time with very minimized or no dispute questioned fragmentation of packaging, costs related to wastes and overheads, single staged procurement systems, involving in less competitive and comparative advantage for services and works and existing stakeholders' relationships. As a result,

- ✓ running delivery system using Partnering and Alliances,
- ✓ specialized delivery system using Outsourcing,
- ✓ fast tracking, parallel and coordinated implementations using Concurrent Engineering and Just in Time principles

And focuses most on management of relationships and value adding to ensure quicker, cheaper and quality services and products with less disputes are recent developments. These systems require overcoming cultural and behavioral barriers among interest groups and control motivated performance based management. These types of delivery systems are often the bases behind DB, BOT, FM\CM consultancy delivery systems but they are most recent developments.

6.4.1 Procurement Management

Procurement Management process can be idealized into three major processes. These include Preparation, Tendering, and Evaluation (including Award Recommendation) Processes.

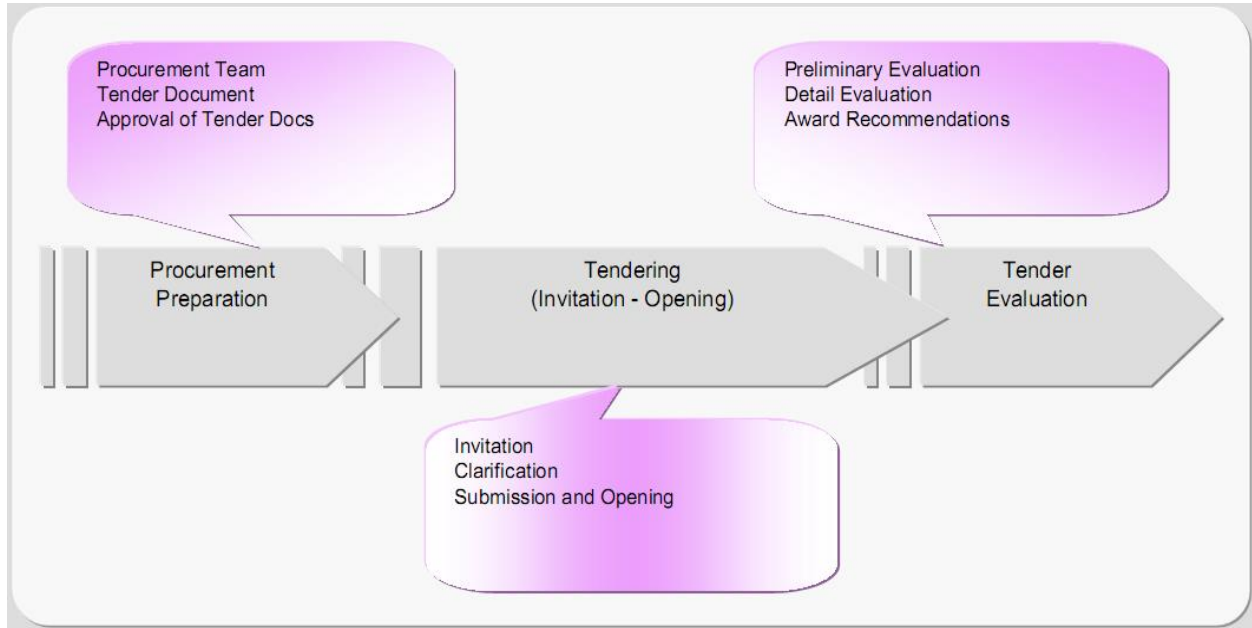


Fig. Procurement Management Process

A. Procurement Preparation phase: is meant for the formation of a Procurement Team; the preparation of Tender Documents and their approval for procurement implementations.

A.1. Formation of a Procurement Team: Ethiopian Procurement Regulation states that a Procurement team consisting of a minimum of five members shall be established. As Tender Evaluation is a joint technical and commercial exercise, the project owner shall consider that the necessary experts shall be composed in the procurement team.

A.2. Preparation of Tender Documents:

Are prepared to: Instruct bidders on the procedures for the preparation and submissions of bids, inform prospective bidders about the nature of things to be procured, inform bidders about the criteria for evaluation and selection of the successful bidder, and Lay down the Contract conditions, Delivery system, Procurement Methods and Contract types of the project

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Tender documents include:

1. Form of Invitation to Tender or Request for Proposals
2. Instruction to Tenderers (Standard and / or Particular information) or Terms of References;
3. Prequalification Documents if necessary
4. Forms of Tender
5. Forms of Contract Agreement
6. General and Particular Conditions of Contract
7. Bill of Quantities and Drawings
8. Technical Specifications & Methods of Measurement and
9. Other Forms, Formats and Schedules

A.3. Approval of Tender Documents: includes the checking, renewal and approval of tender documents.

Regulatory requirements enforced for:

- ✓ Budgeting, Credit, Assistance and Grant Policies;
- ✓ Health, Safety and Environmental Requirements; and
- ✓ Professional, Ethical and Legal Requirements

B. Tendering Phase includes Invitation, Clarification, Submission and Opening of tenders. Normally open tenders are floated for a period between 30 to 45 days. Limited and Negotiated tenders can be invited between 7 to 15 days. Invitations shall widen opportunities to the project owner by reaching all potential and eligible competitors.

B.1. Invitation: the invitation to tender shall clearly state:

- ✓ The owner and his desirous service or works
- ✓ Eligibility requirements,
- ✓ Place to get further information,

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- ✓ Where to purchase & submit tender documents,
- ✓ How long the tender will be floated,
- ✓ How should the tender offer be packed, and
- ✓ When and where submission and opening of tender will take place.

B.2. Clarifications: - can either be requested by interested bidder or carried out using a pre - tender clarification meeting. Issues clarified shall be sent (written) to all bidders participating for the intended services or works. The bidders shall submit their offer on or before the submission date and time including the issues clarified. Late bids are automatically rejected.

B.3. Tender Opening: Bids shall be opened in public on the date, at the time and place mentioned in the invitation to tender and stipulated in the tender documents. Ethiopian practice (public): Two representatives from MWUD, Project Owner, Consultant (if available), and Contractors (Who wish to attend) by themselves or by their representatives shall attend during the tender opening ceremony.

The following will be carried out during tender opening: -

1. Tender Attendee members shall take their place and be registered,
2. Tender box opened and checked for faulty things,
3. Check the tender is the right one,
4. Bids will be opened one after the other,
5. All necessary data which deem useful such as Project Name, Name of bidder, Bid Bond Amount, Tender Price, etc. will be read aloud and recorded at the opening of bids.
6. Bidders representative shall sign a register to attest their presence during opening, and
7. Tender committee members shall sign on the Tender

C. Tender Evaluation Phase: is made to determine and make award recommendation for the least evaluated bidder using preliminary and detail evaluations. The recommended winner may

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or may not necessarily be the lowest bidder. Factors such as technical qualification, completion time, commercial terms of the offer, etc are used in determining the least evaluated bidder.

Note: -Least bidder may not necessarily be the winner.

C.1. Preliminary Evaluations: includes Eligibility and Arithmetic Review requirements. Before commencing the actual evaluation, it is useful and recommended to complete a Basic Data Sheet for each tender to record key information and enable coding.

Eligibility Requirements: Tenders are subjected to eligibility qualifications before they enter to bid and their respective evaluations.

- ▶ Most often sited issues considered in eligibility requirements are:
 - ✓ Valid & Up to date Trade and Professional License,
 - ✓ Valid provision of Bid Security or Bond,
 - ✓ Completeness and submittals of all required documents,
 - ✓ Signature & Sealing Requirements, and
 - ✓ Appropriate Invitation, Packaging and Submission Requirements.
 - ✓ Completeness and submittals of all required documents,
 - ✓ Turnover requirements fulfilled
 - ✓ Power of Attorney, Signature & Sealing Requirements

These eligibility requirements together with basic alterations of the conditions of the tender will be considered for responsiveness or not. If the bidder offer provided weighs a major deviation from the tender condition, the tender will be considered non - responsive and could not be further considered. But if it is minor deviation, either the procurement team use their discretionary power to request clarification or the case will be recorded and taken up during negotiation if the respective winner become the least evaluated tender. When the first approach is chosen, the bidder is not allowed to change any information that can substantially affect the tender evaluation. Responsive to Tender is based on the deviation from the bid conditions. The more major deviations are witnessed the bid will be rejected based on non –responsiveness to bid conditions.

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Major Deviations: Affecting the validity of the bid; Rejection or Disqualifying conditions stated; Substantial effect on the Bid Price

Minor Deviations: Do not affect the project triple constraints; Do not result in change of Bid Price; Non conditional tenders

Arithmetic Review: Most tenders are often submitted hastily and it is common to have arithmetic error. Evaluation without arithmetic check will ultimately result in disputes. Therefore, it is a formal evaluation process to review arithmetic before carrying out detail evaluations. Arithmetic review can be done if and only when financial proposals are opened.

C. 2. Detail Evaluations: include Technical, Commercial and Financial Qualification requirements. Evaluations at this stage should first and foremost critically see the technical and commercial offers and establish system that can ensure common bases for comparison. Finally, the Financial offer will be updated using Absolute Results from Commercial comparisons

Technical Requirements: Will be carried out according to the criteria set. E.g. Pre –Qualification Criteria.

Commercial Evaluation: This includes Benefit Forgone due to Completion Time; Additional Costs due to differences in Foreign Currency Exchange and Advance Payment requirements; and Provisions of Domestic or Regional Preference Margins.

Domestic and / or Regional Preference: Domestic or regional preference margin is a provision to give preference to local companies even if their bid offer is not better. a percentage often equals 7.5 -10 % for construction works.

Financial Offer Comparison: After all commercial comparisons are considered on the same bases; the Tender offer will be adjusted based on the Cost -Benefit principle

Rejection of All Tenders:

Though is solely the power of the employer to decide, for the sake of fairness it is recommended that such rights shall be exercised in the following cases:

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Note: Checks on front loading shall also be carried out.

Commercial Evaluation: This includes Benefit Forgone due to Completion Time; Additional Costs due to differences in Foreign Currency Exchange and Advance Payment requirements; and Provisions of Domestic or Regional Preference Margins

1. *Benefit forgone due to completion time*

The *Benefit Forgone (BF)* due to additional completion time can be computed using the following expressions:

$$BF = (FV - TO) / (1 + i)^n; \quad FV = TO (1 + i)^n$$

Where: TO = Tender Offer after Arithmetic Check;

n = Completion time in days

i = Discount Rate = 0.05 % per day = 1.5 % per month; FV = Future Value

2. *Additional cost due to Foreign Currency Exchange requirements*

Used when the tenders have provisions to quote different currencies.

For currency conversion, selling rates of Bank published by an official source and applicable for transactions shall be used.

Additional cost due to Foreign Currency Exchange requirements can then be determined using selling rates at:

- 15 days prior to tender submission date
- Tender Opening Date
- Decision for Award or Expiry of Tender Validity date

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3. *Additional Cost due to Advance Payment*

Occurs when different amounts of advance payment are requested as part of the tender offer.

The Additional Cost due to differences in mobilization advance requirements can be computed from the following expressions:

$$AP_{AC} = \{(AP \times TO) / 100\} - PV;$$

$$PV = A \times PWF; \quad A = \{(AP\%) \times TO\} / n; \quad PWF = \{(1 + i)^n - 1\} / \{i(1 + i)^n\}$$

Where: AP = Advance Payment Requirement in %;

TO = Tender Offer after Arithmetic Check;

i = Discount Rate = 0.04 % per day;

n = Completion time in days

PWF = Present Worth Factor; PV = Present Value

4. *Domestic or regional factor*

Domestic or regional preference margin is a provision to give preference to local companies even if their bid offer is not over by a percentage often equals 7.5 - 10 % for construction works.

This implies that domestic or regional companies can be awarded the tender even if they are not lowest in tender price of the evaluated bidders using all the other criteria.

Financial offer comparison

After all commercial comparisons are considered *on the same bases*; the Tender offer will be adjusted based on the *Cost - Benefit principle* which involves adding costs and benefits foregone. That is:

$$TO_{\text{evaluated}} = (TO + BF_{CT} + AC_{AP} + AC_{FE} + AC_{PM})$$

Where $TO_{\text{evaluated}}$ = Tender offer evaluated

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TO = Tender offer after arithmetic check

BF_{CT} = Benefit forgone due to completion time

AC_{AP} = Additional cost due to advance payment

AC_{FE} = Additional Cost due to foreign exchange

AC_{PM} = Additional cost due to preference margin

Tender Evaluation Example Cont....

Preliminary Evaluation: Preliminary evaluation covered two major parts; Eligibility Responsiveness and Arithmetic Review. For Eligibility Responsiveness, the six tender offers were critically examined and Table 1 below has summarized the findings. Valid provision of Bid Security / Bond and Turnover Requirements are separately computed and presented in Tables 2 & 3. Accordingly, all bidders except S and W were found responsive for eligibility requirements and considered for remaining evaluation processes.

Table 2. tender security responsiveness

NO	Bidders	Cat.	Tender offer	Tender security		Selling exchange		Type of TS	Responsiveness
				Amount /USD/	Type /USD/	rate/usd/	%TS to TO		
1	DCM	F	88574358	159485.85	CPO	1usd=31.6	5.689855364	Valid	R
2	CGTS	L	111253031.1	1306190	CPO	1usd=31.7	1.174071382	Valid	R
3	CGCS	L	91166179.65	1255952	CPO	1usd=31.8	1.377651235	Valid	R
4	CECCS	F	106687623.5	200952.38	CPO	1usd=31.9	5.952044857	Valid	R
5	CGCA	L	121124851.4	1507142.85	CPO	1usd=31.10	1.244288709	Valid	R
6	CBAS	L	114373242	1255952.38	CPO	1usd=31.11	1.09811732	Valid	R

Required Minimum Tender Security = 1 % of TO

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Table 3 Turnover requirement responsiveness

Tenderers	R	S	T	U	V	W
2015	1806376302	''''	''''	11296390000	''''	22855590
2016	61690985262	''''	''''	8315705000	''''	46888160
2017	2163951007	1718980	''''	10937005000	''''	63403480
2018	2752555550	33297285	''''	12080175000	''''	91888860
2019	''''	110343990	315800314.4	''''	270725000	90497600
Currency	Egyptian pound	Birr	Birr	USD	Birr	Birr
Ex. Rate	1USD=15.81	1USD=31.6	1USD=31.6	1	1USD=.31.6	1USD=31.6
USD EQUV.	87106188.28	3491898.418	9993680.835	12080175000	8567246.835	2907875.316
Responsiveness	R	NR	R	R	R	NR
required turnover=5,000,000 USD .taking their maximum turnover over the five year						

Eligibility Requirements	R	S	T	U	V	W
Valid and Up to date Trade and Professional License	R	R	R	R	R	R
Valid and Up to date Membership to Financier Organizations	R	R	R	R	R	R
Completeness and submittals of all required documents	R	R	R	R	R	R
Power of Attorney, Signature and Sealing Requirements	R	R	R	R	R	R
Appropriate Invitation, Packaging and Submission Requirements	R	R	R	R	R	R
Valid provision of Bid Security or Bond **	R	R	R	R	R	R
Turnover requirements fulfilled **	R	NR	R	R	R	NR
** Table 2 & 3; Annex 2 showed their eligibility Responsiveness.						

Arithmetic Review, the tender offer of four responsive bidders is checked and their tender offer after arithmetic check and any additions or reductions due to rebate and alternative offers are tabulated in Table Below.

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Tenderers	R	T	U	V
TENDER OFFER	88574358	91166179.65	106687623.5	121124851.4
TO after art. check	88897346.7	91251918.1	106654994.4	119995199.2
Change %	0.36	0.1	0.03	0.93
Rebate %		3		
TO after rebate	88897346.7	88514360.56	106654994.4	119995199.2

Benefit forgone due to completion time

No	Bidders	Cat.	Rev. Tender Offer (RTO)	Completion Time		(n) Differences in Completion Time	FV = TO (1 + i) ⁿ	FV - RTO	BF = (FV - RTO) / (1 + i) ⁿ
				Cal. days	Months				
2	R	I	88,897,346.70	645.00	21.50	---	---		---
3	T	I	88,514,360.56	705.00	23.50	2.00	91,189,707.11	2,675,346.55	2,596,856.56
4	U	I	106,654,994.40	705.00	23.50	2.00	109,878,641.61	3,223,647.21	3,129,071.03
5	V	I	119,995,199.20	705.00	23.50	2.00	123,622,054.10	3,626,854.90	3,520,449.32
i = 0.05 % per day = 1.5 % per month									

Additional cost due to advance payment

No	Bidders	Rev. Tender Offer (RTO)	Adv. Loan	Completion Time		A = {(AL% x TO) / n}	PWF = $\frac{\{(1+i)^n - 1\}}{\{i(1+i)^n\}}$	PV = A * PWF	APAC = $\frac{\{(AP \times TO) / 100\} - PV}{RTO}$
				Cal. day	Month				
2	R	88,897,346.70	20	645.00	21.50	826,952.06	18.85	15,589,242.80	2,190,226.54
3	T	88,514,360.56	-	705.00	23.50	-	-	-	-
4	U	106,654,994.40	-	705.00	23.50	-	-	-	-
5	V	119,995,199.20	20.00	705.00	23.50	1,021,235.74	20.37	20,804,200.85	3,194,838.99
i = 0.04 % per day and i = 1.2 % per month									

Additional payment due to foreign exchange rate

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Tenderers	R	T	U	V
Tender Offer (TO)	88897346.7	88,514,360.56	106,654,994.40	119,995,199.20
Foreign Currency Component	55%		50%	15%
Foreign Exchange 15 days before TO	1 USD = Birr 31.6			
USD Equivalent	1,547,263.95	-	1,687,579.03	569,597.46
Local Currency 15 days before TO	48,893,540.69	-	53,327,497.20	17,999,279.88
Foreign Exchange on Bid Closing	1 USD = Birr 31.65			
Local Currency on Bid Closing Date	48,970,903.88	-	53,411,876.15	18,027,759.75
Foreign Exchange on date of decision	1 USD = Birr 31.75			
Local Currency on date of decision	49,125,630.28	-	53,580,634.05	18,084,719.50
Additional Cost due to Foreign Exchange				
On Bid Closing Date	77,363.20	-	84,378.95	28,479.87
On Date of Decision	232,089.59	-	253,136.85	85,439.62

Financial comparison: The additions due to commercial offer Comparison and their effects to the Tender Offer for evaluation on equal bases is computed and summarized in Table below. Detail Computations for each of the commercial offer comparisons are shown in the three Tables above.

Tenderers	R	T	U	V
TO after Arithm. Check	88,897,346.70	88,514,360.56	106,654,994.40	119,995,199.20
BF due to Completion Time Variations	-	2,596,856.56	3,129,071.03	3,520,449.32
AC due to Advance Payment Variations	2,190,226.54	-	-	3,194,838.99
AC due to Foreign Exchange Variations				
On Bid Closing Date	77,363.20	-	84,378.95	28,479.87
On Date of Decision	232,089.59	-	253,136.85	85,439.62
Domestic Preference (7.5 %)	6,667,301.00	-	7,999,124.58	-
TO for Evaluation				
On Bid Closing Date	97,832,237.44	91,111,217.12	117,867,568.97	126,738,967.38
On Date of Decision	97,986,963.83	91,111,217.12	118,036,326.87	126,795,927.12
Ranking	2	1	3	4

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CHAPTER 7- CONSTRUCTION CONTRACT

7.1 Principles of contract

7.1.1 General Back Ground

Contract is a written agreement between or among two or more parties whereby each party promises to do or not to do something and agrees to terms (conditions and Warranties) set out in the contract.

Conditions of Contract are terms in which parties in the contract are governed / administered with. That is, it is an administrative law which is the legally binding part of the contract. These promises and terms shall be enforceable by law and incorporates the Rights, Obligations and Remedial rights of each contracting parties. Generally, a contract is an agreement or willful promise enforceable at law. However, not all agreements or promises are contracts. Some may lack enforceability at law.

A construction contract is a product of an agreement between the employer & the contractor & it is enforceable at law. “Enforceable at law” means that if the agreement reached between the employer & the contractor breached (deviations occur from the promises) by one of the parties, the aggrieved party, either the employer or the contractor, may bring a legal action against the other to demand the enforcement of its rights with the support of law.

7.1.2 Legal definition of a contract

According to Article 1675 of the Civil Code of Ethiopia: *“A contract is an agreement whereby two or more persons as between themselves create, vary or extinguish obligations of a proprietary nature.*

The definition contains the following elements. These are:

- That the contract is an agreement;
- The agreement is to be made between two or more persons; The Form of Agreement, in the construction contract, clearly presents the Agreement reached between the employer & the contractor.
- That the agreement is binding between such two or more persons;

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- The agreement is to create, vary & extinguish obligations;
- That the nature of obligations is proprietary or patrimonial meaning it can be expressed in monetary form;

The construction contract clearly fulfills all the elements given to the definition of contract.

7.1.3 Elements of a Contract

According to Article 1678 (Elements of *Contract*) of the Civil Code: *No valid contract shall exist unless:*

- The parties are capable of contracting and give their consent_sustainable at law.
- The object of the contract is sufficiently defined and is possible and lawful.
- The contract is made in the *form* prescribed by law.

The following are the fundamental elements of contract.

- Capacity of the contracting parties;
- Consent of the contracting parties;
- Object of the contract; and
- Form of contract, if any;

A. Capacity

Capacity means competence to enter into a legally binding agreement. Parties entering into an agreement or contract shall, therefore, be capable of contracting.

Legal capacity is of two types.

- Personal (Own) capacity; and
- Representative (Agent) capacity;

Capacity of persons is legally presumed unless the contrary is proved. Persons could be:-

- Natural (physical) persons; or
- Juridical (legal) persons;

I. Natural Persons

Natural or physical persons are human beings. Their legal capacity is determined by law. The scope of capacity of physical persons is relatively unlimited unless the contrary is proved.

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Physical persons are the subject of rights & duties from birth to death. See Article 1 of the Civil Code.

II. Legal Persons

Legal persons are of two types in terms of determining their coming into being & their legal capacity. These are:-

- By legislation; (In case of public bodies); and
- By registration; (In case of non-public bodies);

The existence of public bodies (Ministries, Commissions, Bureaus, Authorities, Agencies ...) & their legal capacity to enter into contract & bind themselves emanates from the Civil Code & the special legal instrument (legislation), which establishes that specific public body.

The following may not have (legal) capacity to enter into contract & bind themselves. These are:-

- Minors (under the age of 18);
- Companies adjudged or declared bankrupt;
- Judicially and Legally interdicted;
- Persons, whose civil rights are suspended by the court;
- Non-nationals, unless permitted by law or special prerogative;
- Non-authorized Agents;
- Agents, whose Power of Attorney has been revoked;
- Agents , the Scope of their Power of Attorney does not cover the intended; and others;

Natural persons or legal persons may enter in to contract directly by themselves (in their own capacity) or through other persons called Agents.

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The power of agents (i.e. their representative capacity) should always be checked, with respect to construction project, at:

- The tendering stage;
- The negotiation stage;
- The contract signing stage; and
- The Contract implementation stage;

The Power of Attorney creates a derivative legal capacity for agents.

B. Consent

Consent is a declared will of the individual to enter in to contract. It is the willingness of the parties to enter in to a legally binding relation.

Consent of the intended contracting parties decomposes in to:-

- Offer; and
- Acceptance;

i. Offer

Offer is defined as a proposal expressing the declared willingness of the offeror to enter in to an agreement, if the offer is accepted. Offer is a legal process which is a declaration of willingness or intent to be bound by specific terms set out.

Offer may be made:-

- Orally;
- In writing;
- By sign; By conduct; and
- By specially stipulated manner for acceptance.

Characteristics of Offer: These are that the offer should be:-

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- Certain;
- Communicated;
- Unconditional;
- Distinguished from invitation to treat;

ii. Acceptance

Acceptance is a declaration of will to enter into a legally binding contract. By acceptance, a contract shall be completed, where the offeree accepts the offer without any reservation.

Forms of Acceptance: The following could be forms of acceptance.

- Orally;
- In writing;
- By sign;
- By conduct;
- As specially stipulated by the offeror;

Defects in Consent

Consent given in the process of offer & acceptance should be free from defects in consent or vices of consent. Defects in consent or vices of consent are the following.

- Mistake: Mistake is defined as a misunderstanding of or erroneous belief about a matter of fact or a matter of law.
- Fraud: Fraud means a false representation, by means of a statement, conduct made knowingly or recklessly in order to gain a material advantage.
- Duress: Duress means a threat of imminent danger, which may be a future, or immediate danger posted against the contract himself or his nearest relatives.

C. Object of Contract

The object of contract is the very obligations of the contracting parties e.g., in the construction contract, the obligations of the employer and the contractor. The possible objects, i.e. the obligations of the contracting parties, of contract are:-

- Obligation to do (perform);
- Obligation not to do; or
- Obligation to deliver;

The obligations of the contracting parties could be divided in to two broad terms: Promises; and Considerations;

The object of contract (i.e. both promises & considerations) shall be:- Sufficiently defined; Possible; Lawful; Not immoral. The object of a construction contract shall be sufficiently defined. The object of contract, even though sufficiently defined, it has to be possible or capable of performing. It shall also be lawful. Contract agreements cannot serve to achieve illegal objectives.

D. Form

Form may mean types of contract. Form may also mean the making of the contract orally or in writing. The contract is to be made in certain prescribed form; it means that contract should be made in writing. In this case, form is related with the validity & proof of the contract itself. By form, under these circumstances, we mean the making of the contract in writing, if the law imperatively prescribes so or if the parties voluntarily wish to do so.

7.1.4 Why Use Contracts in Construction

The purposes of a contract in construction are:

- To describe scope of work
- To establish time frame
- To establish cost & payment provisions
- To set forth obligations & relationships

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- To manage multiple risks
- To establish control mechanisms
- To minimize disputes
- To improve economic return on investment

7.2 Types of Construction Contract

There are many types of construction contracts, which are applicable based on the prevailing specific project conditions and largely the interest of the owner, as listed below:

- A. Lump sum fixed price contract
- B. Lump sum fixed price and escalation contract
- C. Lump sum fixed price and schedule rate contract
- D. Lump sum fixed price with escalation and schedule rate contract
- E. Unit rate contract
- F. Unit rate and escalation contract
- G. Schedule rate contract
- H. Schedule rate and escalation contract
- I. Cost plus percentage of cost contract
- J. Cost plus fixed fee contract
- K. Cost plus percentage of cost with guaranteed maximum cost contract
- L. Cost plus fixed fee with guaranteed maximum cost contract
- M. Target cost incentive contract

7.2.1 Lump sum fixed price contract

The contractor agrees to execute the project based on a fixed lump sum price which is not subject to any variations unless the drawings and specifications are altered beyond the maximum limit stated in the contract conditions by the owner. The contractor is fully responsible to quantify the volume of works based on the given specifications and drawings.

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Overestimating the volume of works will result in losing the job, if it is on competitive basis and underestimating the volume of works will result irreversible loss, which cannot be corrected during the execution of the contract at any level. Moreover, the contractor must be in a position to estimate the influence of cost escalation in the future during the execution of the project and these anticipated additional costs should be incorporated in the tender prices. A lump sum contract is more suitable for works for which contractors have prior construction experience. The experience enables the contractors to submit a more realistic bid.

Advantages of Lump sum fixed price contract

- The owner decided whether to start or shelve the project knowing the total lump sum price quoted by different contractors.
- The contractor can earn more profit by in-depth planning and effective management at site.

Disadvantages of Lump sum fixed price contract

- All competing contractors are required to carry out enormous take off works where only one contractor will be successful. It consumes excessive time of the contractors.
- All bidding documents such as the technical specifications and drawings have to be clearly prepared and delivered during tendering stage to the contractor.
- Claims and variation works are very difficult to handle in this kind of construction contracts due to the absence of agreed unit rates.
- Contractors tend to include higher percentages of contingencies in their tender prices to cover price escalation, take off errors, clarity of drawings and specifications which inevitably raises the tender prices.
- Unless the bidding documents are sound and sufficient enough to define the intended projects, contractors may not compete on the same ground.

7.2.2 Lump sum fixed price and escalation contract

Lump sum fixed price and escalation contract is basically the same as that of the lump sum fixed price contract except it includes allowances for price escalations. This type of construction contract contains a provision whereby the contract value can be adjusted based on the specified price indices included in the contract. Such construction contracts usually reduce the risk to the contractor during periods of high inflation. The inclusion of price escalation provision also benefits the owner in terms of getting lower tender prices in such a way contractors usually add large contingencies for price escalations.

7.2.3 Lump sum fixed price and schedule rate contract

This is another extension of lump sum fixed price contract but it incorporates unit prices of different activities which will help to manage variation works and claims during execution of the project. Moreover, the contractor shall not account contingencies for additional works and claims but contingencies for price escalation of materials, labor and equipment shall be considered in the tender prices.

7.2.4 Lump sum fixed price with escalation and schedule rate contract

The lump sum fixed price with escalation and schedule rate contract minimizes the inclusion of contingencies in tender prices by contractors. In this case, contractors shall not account contingencies in their tender prices for additional works and claims as well as price escalations. Moreover, price escalations, variation works and claims are better handled by this type of contract during the execution of the project.

7.2.5 Unit/Item Rate Contract

In this case, the construction contract is based on priced bill of quantities whereby estimated quantities of certain well defined work items and their respective fixed unit prices are agreed upon.

The estimated quantities may increase or decrease during the execution of the project and the contractor is obliged to accept these variations without additional costs as far as these variations in quantity are within the agreed limits with the owner. The unit rate contract is the most commonly used for all public and governmental projects whereby the estimated quantities and specifications of works are well known in advance.

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Advantages of Unit Rate Contract

- There is no need for detailed drawings as in the case of lump sum contracts and these detailed drawings can be prepared after the award of the contract.
- Changes in drawings and quantities can be made as required by the owner within the agreed limits.
- Additional works and claims can be handled in a better way especially when the priced bill of quantities includes these additional work items and claims.
- It gives a better opportunity to compete on the same ground.

Disadvantages of Unit Rate Contract

- The total cost of the project can only be known upon completion of the project.
- The contract doesn't contain provision for price escalation and the contractor may increase his construction cost estimates.
- Clearly defined work specifications shall be prepared in advance and issued with the bidding documents to contractors participating in the tender.
- The preparation of technical specifications and estimated bill of quantities may take longer time, which will affect the overall completion of the intended project.

7.2.6 Unit Rate and Escalation Contract

The unit rate and escalation contract is generally the same with unit rate contract except it contains a provision for price escalations based on specified price indices. Such provisions reduce the risk to the contractor during periods of rapid inflation and also benefit the owner in terms of getting lower tender prices in such a way that contractors usually add large contingencies for price escalations. In this type of contract, contractors are not advised to consider future price escalations in their unit cost analysis to develop a better competent tender price.

7.2.7 Schedule Rate Contract

Basically, the schedule rate contract is based on only agreed unit prices of the intended work items without estimated quantities of the works. In this type of contract, detailed work specifications and general drawings are usually used during tendering.

Advantages of Schedule Rate Contract

- There is no need for detailed drawings and these detailed drawings can be prepared after the award of the contract.
- Changes in drawings and quantities can be made as required by the owner without limits.
- Additional works and claims can be handled in a better way than all other type of contracts.

Disadvantages of Schedule Rate Contract

- The total cost of the project can only be known upon completion of the project and the owner does not even have indicative cost of the project as that of the unit rate contract.
- This construction contract doesn't contain provision for price escalation whereby the contractor may increase his construction cost estimates.
- Clearly defined and detailed technical specifications shall be prepared in advance and issued with the bidding documents to contractors participating in the tender.
- It is very difficult to evaluate and select a better offer from different tender offers in the absence of estimated bill of quantities.

7.2.8 Schedule Rate and Escalation Contract

The schedule rate and escalation contract is a continuation of the schedule rate contract except it contains a provision for price escalation based on specified price indices as discussed for all the other types of contracts.

In this type of contract, contractors are not advised to consider future price escalations in their unit cost analysis to develop a better competent tender price.

7.2.9 Cost-Plus Percentage of Cost Contract

The contract is agreed between the owner and the contractor based on the actual direct cost records plus agreed percentage of these actual direct costs expended by the contractor to cover overhead costs as well as profit and income tax. Cost plus percentage of cost contracts are usually suitable when the nature of the work may be such that;

- It is impossible or impracticable to prepare complete drawings and specification due to unusually pressing speed of construction is required or
- Major changes during construction are expected such as finishing works which may deteriorate the agreed contract or
- It may be difficult to define properly the scope of works such as underground works with poor or no geological studies.

In this kind of contract, it is very important to have a common understanding regarding the accounting methods to be followed during execution of the project.

Advantages of Cost plus Percentage of Cost Contract

- The contractor executes works to the best interest of the owner resulting in good quality of works.
- The project can commence as early as possible even before detailed drawings and specifications are finalized.
- Changes in design and method of constructions, if required, can easily be carried out by the contractor without disputes.
- The progress of works can be speed up to the maximum possible shortening the overall completion time of the project.

Disadvantages of Cost plus Percentage of Cost Contract

- The total cost of the project is unknown until completion of the project putting the owner in financial difficulties.
- It encourages the contractor to increase the actual direct costs of the project unnecessarily as the contractor's profit increases with the increment of these costs.

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In the cost plus percentage of cost contract, the contractor shall focus mainly on identification of company head office overhead costs, site overhead costs and relevant income tax laws as well as anticipated profit. Moreover, it is also very important to estimate the total scope of work, which is very important in fixing the percentage of cost.

7.2.10 Cost Plus Fixed Fee Contract

One of the major shortcomings of the cost plus percentage of cost contract is the tendency of the contractor to increase the cost of the project and cost plus fixed fee contract discourages this tendency of the contractor.

In this case, the contract is based on actual direct costs plus fixed fee and the amount of fixed fee covers the overhead costs, profit and income tax of the contractor. However, cost plus fixed fee contract has also the following disadvantages as compared to the cost plus percentage of cost contract:

- The scope of works shall be properly defined in advance to reach an agreement on the fixed fee with the contractor.
- Claims and disputes may occur when major changes are required by the owner during execution of the project.
- The contractor will insist higher fixed fee depending on the clarity of the defined scope of works.

In this type of contract, the contractor has to be very careful in identifying all other anticipated costs other than the direct costs to fix the amount of fixed fee. Moreover, the time for completion of the project has to be predicted based on the defined scope of works as most of overhead costs are time related costs to the contractor.

7.2.11 Cost Plus Percentage of Cost with Guaranteed Maximum Cost Contract

In Cost plus percentage of cost contract is the owner doesn't know the total cost of the project before its completion. In this regard, the cost plus percentage of cost with guaranteed maximum cost contract resolves this problem in such a way the contract is based cost plus percentage of cost contract but a fixed maximum cost of the project is agreed upon. If the cost of the project exceeds the guaranteed maximum cost, the contractor absorbs these excess costs. In this way, a

ceiling project price is established, in which the owner is assured that this ceiling project cost will not be exceeded.

7.2.12 Cost Plus Fixed Fee with Guaranteed Maximum Cost Contract

The contract is based on the actual cost of the project plus fixed fee as well as the maximum cost of the project is also agreed whereby if the actual cost of the project exceeds the maximum guaranteed cost, the contractor absorbs these excess costs.

Disadvantages

- The scope of work shall be defined in depth where the contractor will be able to predict properly the time and cost.
- Claims and disputes may occur and usually difficult to settle even when minor changes are required by the owner during execution of the project.
- The contractor will insist for higher fixed fee and guaranteed maximum costs considering future price escalations.

7.2.13 Target Cost Incentive Contract

Even though, the cost plus fixed fee with guaranteed maximum cost resolves the main problems of the owner in the cost plus percentage of cost contract, more risks are transferred to the contractor, which may be reflected through high tender prices. Therefore, the target cost incentive contract is designed to provide an incentive to the contractor to reduce the overall total costs of the project.

The target cost incentive contract is usually applied in combination with the following types of contracts:

- Cost plus percentage of cost
- Cost plus percentage of cost with guaranteed maximum cost
- Cost plus fixed fee with guaranteed maximum cost

7.2.14 Target Cost Incentive Contract

In the application of target cost incentive contract, there are different incentive mechanisms such as:

- i. Applications of variable percentages of cost depending on the total actual cost of the project with the cost plus percentage of cost contract.
- ii. Excess cost sharing with the contractor, in case the contractor completed the project less than the guaranteed maximum cost with the Cost plus percentage of cost with guaranteed maximum cost and Cost plus fixed fee with guaranteed maximum cost contracts.

7.3 Contract Documents

The tender documents become contract documents if completed by the prospective contractor, and finally agreed & signed by the parties. The Tender Document, in addition to the following shall also include the Invitation for Bids & Instruction to Tenderers & Amendments thereto, if any. The following are typical tender (contract) documents in the Construction Contract & divided into legal, commercial & technical parts.

I. The Legal Part

- The Contract Agreement;
- The (latest) Minutes of Meeting, if any;
- The Letter of Acceptance(Award);
- The Tender (NB: Including the Appendix to Tender, if any);
- The Special Conditions of Contract;
- The General Conditions of Contract;
- Others, if any;

II. The Commercial Part

- The Performance Security Form;
- The Payment Security Form;

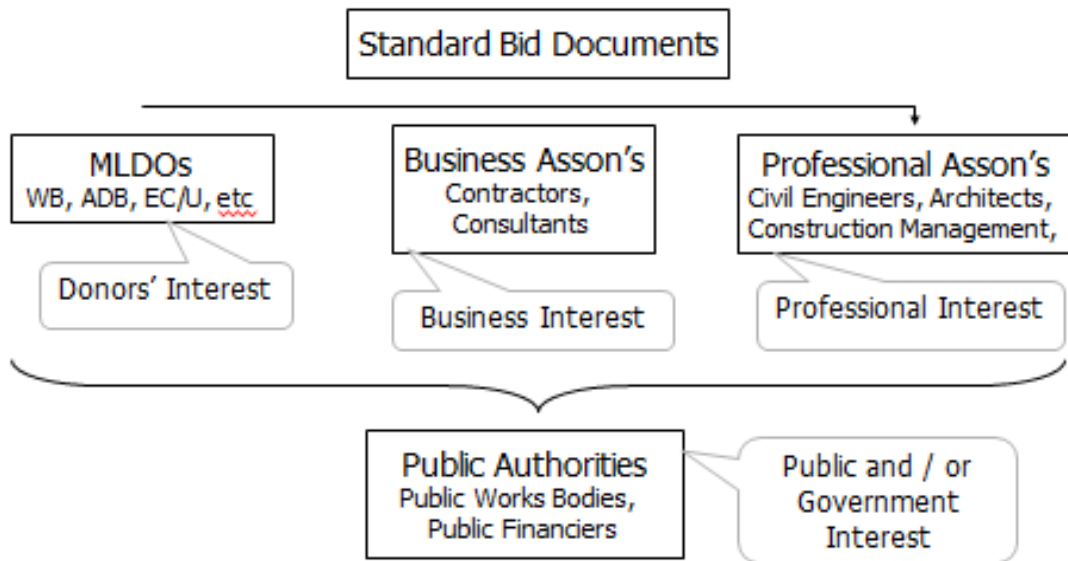
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- The Advance Payment Guarantee Form;
- The Bid Security Form;
- The Insurance Forms;
- The Retention Money Security Form; Others, if any

III. The Technical Part

- The Technical Specifications;
- The Drawing;
- The Bill of Quantities;
- Others, if any;

The Contract Agreement shall also declare the priority of the Contract Documents i.e. which Contract Document shall have precedence or priority over the other in case of ambiguity or discrepancy between or among the relevant Contract Documents.



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7.3.1 Standard Conditions of contract

The condition of contract is a document that states the obligations and rights of the parties and detail conditions under which the contract is to be carried out.

Some of the subjects to be defined in the conditions of contract are:-

- Definitions & interpretations
- Duty & responsibilities of the engineers
- Contract period
- Method of payment and periods
- Retention money
- Payment for materials on site
- Payment for variation orders
- Escalation (wages, cost of materials)
- Procedures on sub-contracting
- Insurance & indemnities
- Liquidated damages
- Granting of extension time
- Conditions for contract termination

In Ethiopia Construction Industry the following standard conditions of contracts are commonly used:

- FIDIC (1987) – Condition of Contract
- PPA, Standard Bid Document
- MoWUD, Standard Condition of Contract (1994)
- BaTCoDA, Condition of Contract

7.3.2 FIDIC Conditions of Contract

FIDIC is the international federation of national associations of independent consulting engineers. Its full name is Federation International Des Ingenieurs-Conseils ; Founded in 1913 by the national associations of three European countries (France , Belgium and Switzerland)

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FIDIC has evolved into a leading body for development of model standard forms of contract for use in the international construction industry.

The following editions are relevant with respect to international construction contract (Red Book)

- First Edition August, 1957;
- Second Edition July, 1969;
- Third Edition March, 1977;
- Fourth Edition September, 1987;
- Fourth Edition (a supplement) Summer 1992 ; (NB: Amendments with regard to some of the Provisions of the Conditions of Contract)
- Fourth Edition (further amendment) November, 1996 (NB: in relation to Dispute Adjudication Board, Payment on Lump Sum Basis & Late Certification.)

In (1999 & 2006) FIDIC has published the following conditions of contract. These are:-

- Conditions of Contract for Construction for Building and Engineering Works Designed by the Employer: *The Construction Contract* (New Red Book);
- Conditions of Contract for Plant and Design-Build for Electrical and Mechanical Plant, and for Building and Engineering Works, Designed by the Contractor: *The Plant and Design/Build Contract* (New Yellow Book);
- Conditions of Contract for EPC/Turnkey Projects: *The EPC/Turnkey Contract*: (Silver Book);
- Short form of Contract: *The Short Form* (Green Book);
- *Conditions of Contract for Construction*: For Building and Engineering Works Designed by the Employer: Multilateral Development Bank(MDB) Harmonized Edition, March, 2006, FIDIC;

The obligations of the contractor, under the said conditions of contract, may be generalized as follows.

- Completion obligation;
- Quality performance obligation;

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- Timely performance obligation;
- Obligation to provide securities, indemnity & insurance;
- Obligation to supply information & notice;
- Administrative obligation;
- Obligation up on or after completion;

Please refer FIDIC; Multilateral Development Bank(MDB) Harmonized Edition, March, 2006.

7.3.3 MoWUD Conditions of Contract

Officially, known as “Standard Conditions of Contract for Construction of Civil Work Projects”. It has been in practice since December, 1994. It contains 75 clauses including Form of Agreement & Form of Performance Bond. Its structure & content resembles that of FIDIC Standard Conditions of Contract for Civil Engineering Works. The Project Delivery System adopted is that of Design-Bid-Build.

The type of contract is based on BOQ i.e. it is an ad measurement contract type (see Clauses 55-57). The role of the Engineer is maintained under this standard condition of contract.

The general framework of the said conditions of contract includes the following items,

- Definitions & interpretation,
- Engineer & engineer’s representative,
- Assignment & subletting(of the construction contract),
- Contract documents,
- General obligations (of the contractor),
- Provision of labour, materials & workmanship,
- Commencement time & delays,
- Maintenance & defects,
- Alterations, additions & omissions,
- Plant, temporary works & materials,

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- Measurement,
- Provisional sums,
- Nominated subcontractors,
- Certificate & payment,
- Remedies & power(in case of the default of the contractor),
- Special risks (of the employer),
- Frustration(of the contract),

7.3.4 PPA Conditions of Contract

The PPA, under its legal mandate provided under The Public Procurement Proclamation, it has prepared & issued certain standard tender & contract documents for the purpose of public procurement. The conditions of contract are applicable to the procurements of the federal government. It has been in practice since 2006.

The Standard Conditions of Contract cover the following types of procurement. These are Standard Conditions of Contract for the procurement of:-

- Consultancy Services;
- Non-consultancy Services;
- Works;
- Goods; Including Simple Request for Quotations & Local Purchase Order;

7.3.4.1 Procurement of Works

The Standard Conditions of Contract for the purpose of the procurement of Works have been prepared for International Competitive Bidding (ICB) & National Competitive Bidding (NCB), separately. User's Guide has been also prepared, separately, both for the ICB & the NCB. The Conditions of Contract have been also prepared both in Amharic & English language. The conditions of contract are based on Design-Bid-Build project delivery system.

The type of contract could be based on BOQ, in which case it becomes measurement based. Or based on Activities Schedule, in which case it becomes lump sum. The role of the engineer is envisaged.

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The documentation is divided into the following three parts, namely,

- i. Bidding Procedure;
- ii. Schedule of Requirements; and
- iii. Contract;

i. Bidding Procedure and Documentation

Under this part, the following are included, namely,

Section 1: Instruction to Tenderers (ITB);

- General;
- Bidding Documents;
- Preparation of Bids;
- Submission of Bids;
- Bid Opening & Evaluation;
- Award of Contract;

Section 2: Bid Data Sheet (BDS)

Section 3: Evaluation & Qualification Criteria (EQC)

- Average Annual Volume of Construction Work;
- Experience as Prime Contractor;
- Acquisition of essential Equipment(by way of ownership, hire or lease);
- Personnel;
- Liquid Assets and/or Credit Facilities;
- The issue of Joint Venture;

Section 4: Bidding Forms

- Bid Submission Form;

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- Priced Schedules (BOQ or Schedule of Activities);
- Bid Security;
- Qualification Information;

Section 5: Eligible Countries

ii. Schedule of Requirements and Documentation

Section 6: Schedule of Requirements

- Scope of Works;
- Technical Specification;
- Drawings;
- Bill of Quantities or Activity Schedule;

iii. Contract and Contract Documentation

Section 7: General Conditions of Contract

- The GCC is composed of 62 Clauses.
- It contains the following parts.
 - General; (Clause 1-Clause 26)
 - Time Control; (Clause 27-Clause 32)
 - Quality Control; (Clause 33-Clause 36)
 - Cost Control; (Clause 37-Clause 54)
 - Finishing the Contract; (Clause 55-Clause 62)
- **General:** This section includes the following items:
 - Definitions, interpretations, language & law, engineer's decision, delegation, communications, sub-contracting, other contractors, personnel, employer's & contractor's risks, insurance, site investigation reports, queries about the special conditions of contract, contractor to construct the works, the works to be completed by the intended completion date, approval by the engineer, safety, discoveries, possession of site, access to

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site, instructions, disputes, procedure for disputes, replacement of adjudicator.

- **Time Control:** This section includes the following items:
 - Program, extension of the intended completion date, acceleration, delays ordered by the engineer, management meetings, and early warning.
- **Quality Control:** This section includes the following items:
 - Identifying defects, tests, correction of defects, uncorrected defects.
- **Cost Control:** This section includes the following items:
 - BOQ or activity schedule, change in the BOQ or activity schedule, variations, payment for variations, cash flow forecasts, payment certificates, payments, compensation events, tax, currencies, price adjustment, retention, liquidated damages, bonus, advance payment, securities, day works, and cost of repairs.
- **Finishing of Contract:** This section includes the following items:
 - Completion, taking over, final account, operating & maintenance manuals, termination, payment upon termination, property, and release from performance.

Section 8: Special Conditions of Contract (SCC)

Section 9: Contract Forms

- Which includes: Agreement; Performance Bank Guarantee; Performance Bond; Advance Payment Guarantee;

7.4 Contract Administration

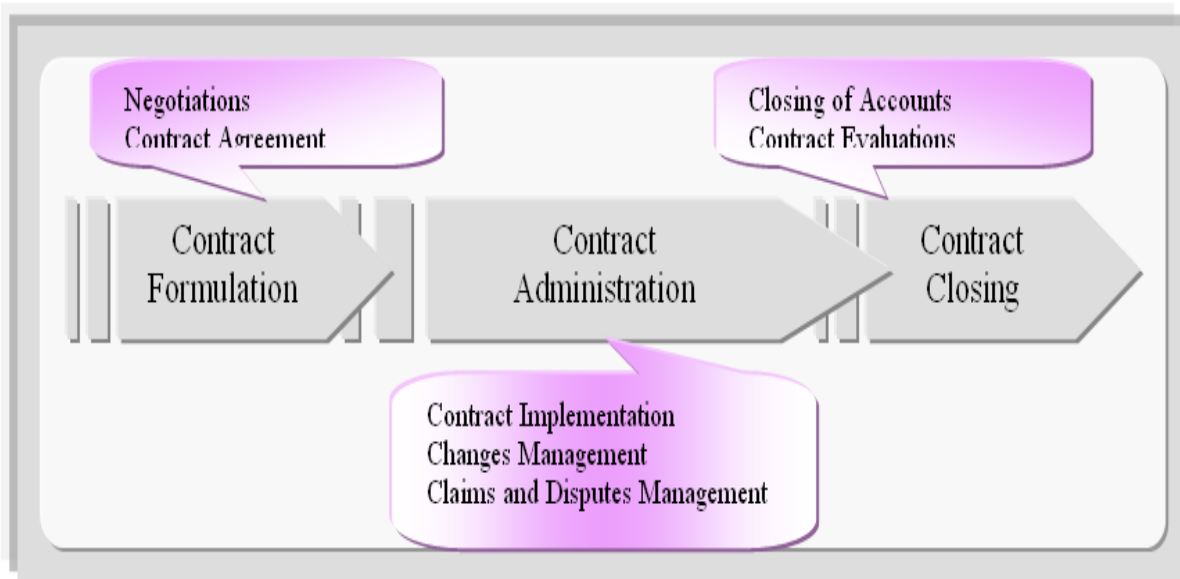


Figure: Contract Management Process

Identifying contractual responsibilities of Stakeholders;

- Reviewing the Terms of Contract Documents
- Extract Monitoring Responsibilities
- Preparing Monitoring Responsibility Summary Sheets

Determining and understanding the construction components of the project including;

- Reviewing the Contract Drawings and Technical Specifications
- Extract the Construction Methods and Sequences
- Prepare Construction Methods and Over all Sequences Sheets
- Review submitted (Integrated) Schedules and Breakdowns for operations such as Organizational Breakdowns, Resources Breakdowns & Schedules and Time Schedules.
- Report Project Status daily and / or periodically and Completions.
- Certify qualities of materials, shop drawings, samples, workmanships and works.
- Measure Works, Record Site Potentials and Certify Payments and Completions
 - Take off sheet and Bending Schedules are used for Measurement of Works

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- Method of Measurement is according to standard practices
- Site Potentials such as material, equipment and Manpower on site together with appropriate site organization is recorded
- Advance, Interim and Final Payments are certified
- Mediate Disputes.

Refer the different Reporting formats and documents listed here under:

- Site Book
- Site Diary
- Correspondence letters
- Weekly Report
- Monthly Report
- Payment Certificate
- Requisition for Material Testing
- Requisition for Drawings
- Work Order
- Resident Engineer's Instruction
- Control and Approval form for different construction Stages
- Approved Variations
- Claims Filled

7.4.1 TIME

Time is an extremely important issue in construction. Together with cost and quality, it is a primary objective of project management, and a major criterion by which the success of a project is judged (Charmer 1990).

On the Date of Possession; “possession of the site shall be given to the contractor who shall thereupon begin the Works, regularly and diligently proceed with the same and shall complete the same on or before the Completion Date.” This identifies the three basic time-related issues as

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commencement, progress and completion. In fact there are also two other issues: the contractor's continuing obligations after completion, and the extensions of time which may be available to the contractor when the work is delayed by certain specified causes.

7.4.1.1 Commencement

The issues at the beginning of the contract involve:

- Giving possession of the site to the contractor,
- The timing of this possession and
- Potential delays to the possession.

Normally, possession should take place not more than two months after the successful contractor has been awarded the contract.

Possession of the site

An employer who fails to give the contractor possession of the site may be liable to pay damages for breach of contract. This is so despite provisions in the contract for the contract administrator to postpone all or any part of the works, since it seems that such provisions may not be used to postpone the entire project. However, the employer is not deemed to *guarantee* possession and will therefore not be liable if the contractor is prevented from gaining access by some third party, such as unlawful pickets, over whose activities the employer has no control. In most conditions of contract the contractor is entitled to possession of the *whole* of the site, even though access to some parts may not be required until a later stage of the project.

Date for Possession of the site

Most Construction contracts will name a date on which the contractor is to be given possession of the site, after which the contractor may commence the works. If possession is not then given on the date specified, the employer will lose the right to recover liquidated damages from the contractor in the event of late completion. If the contract contains no specific commencement provision, then the contractor must be given possession at such a time as will enable the work to be completed by the completion date

7.4.1.2 Progress

Where a construction contract fixes a date for completion, but makes no provision as to the rate at which the works are to progress, it appears that the courts will not imply any such term.

This is because, in the absence of any indication to the contrary, the contractor has absolute discretion as to how the work is planned and performed, provided only that it is completed on time. Furthermore, while many contracts require the contractor to submit a program for the execution of the works, this in itself does not mean that there is a contractual obligation to keep to that program.

From an employer's point of view, it would be very inconvenient to have no control at all over the progress of the contract works. It is for this reason that most construction contracts require the contractor to maintain a satisfactory rate of progress throughout the project.

7.4.1.3 Completion

A contractor cannot truly be said to have totally performed the contract if a single item of work is missing or defective. From a practical point of view to delay the handover of something as complex as a large building for a trivial breach would cause enormous inconvenience. As a result, most contracts require the contractor to bring the works to a state described by such expressions as practical completion or substantial completion. Whether or not a building is 'complete' in this sense is normally a decision for the contract administrator, based on an inspection of the works and the exercise of reason.

Effects of Completion

When the contract administrator certifies that the works have been completed, a number of consequences will follow. Precisely what these are will depend upon the terms of the contract concerned, but the following are typical:

- The employer is entitled and obliged to take possession of the contract works.
- The contractor's responsibility (if any) for insuring the contract works comes to an end.
- Any liability of the contractor to pay damages for late completion ceases.

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- Moreover, this liability will not be revived if the work is later found to contain defects, for such a discovery does not retrospectively invalidate the certificate.
- The contractor usually becomes entitled to the release of certain portion of the accumulated retention money.
- The Defects Liability Period begins.

Contractors Obligation after Completion

There are further obligations imposed on the contractor after completion. After the issue of the “Certificate of Provisional Acceptance” marks the start of the “Defects Liability Period”, which lasts as per the special condition of contract. Any defects, shrinkages or other faults arising during this period due to defective materials or workmanship must be put right by the contractor at its own expense.

During the Defects Liability Period is that the contract administrator should issue a schedule of such defects to the contractor not later than fourteen days after the end of the defects liability period, and the contractor then has a reasonable time to put them right. Once this has been done, the contract administrator will issue a ‘Certificate of Completion of Making Good Defects’, final acceptance of the project will take place, following which the contractor becomes entitled to the remaining part of the retention money.

7.4.1.3.1 Completion Obligation According to FIDIC

1. Basic Obligation

Clause 4.1: During Performance Period

- Completion of the whole of the Works in accordance with the Contract up to Take Over(Clause 10) of the Works

Clause 11.1: During Defects Liability Period

- Executing outstanding works; and
- Remedying of defects & damages in the works;

2. Extent of Completion Obligation

- Clause 15.1 to execute variations orders;

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- Clause 17. 4 rectification of losses or damages to the works arising out of the Employer's Risks;
- Clause 7.6 executing remedial or urgent works;
- Clause 9.1 cum Clause 8.2(a) carrying out of works to achieve tests on completion for the purpose of Taking Over (Clause 8.29b));

3. Excuse from Completion Obligation

- Clause 19. 7 due to legal or physical impossibility;
- Clause 17. 3 in case of the occurrence of the Employer's Risks;
- Clause 8.8 in case of suspension of the Works by the Employer;
- Clause 16.1 in case of legitimate suspension of the Works by the Contractor;
- Clause 16.2 in case of termination of the Contract by the Contractor due to the default of the Employer;
- Clause 15.5 in case of termination of the Contract by the Employer for its convenience;
- Clause 8.11 in case of termination of the Contract for the whole of the Works due to prolonged suspension caused by the Employer;
- Clause 19.6 in case of optional termination of the Contract by the Contractor or by the Employer due to prevention of performance by force majeure;

7.4.1.3.2 Extension of Time

Most building contracts contain express provisions under which the period allowed for the contractor to undertake and complete the works can be extended. These provisions cater for delays that are neither the fault nor the responsibility of the contractor. Such provisions obviously benefit the contractor, who will not be liable to pay damages for delay during the

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period for which time is validly extended. In addition, and less obviously, the power to extend time is also for the employer's benefit.

Grounds for Extension of Time

A fundamental point is that the time for completion can only be extended where the contract permits, and strictly in accordance with the contract provisions. If delay is caused by some event which the contract does not cover, then the contractor cannot claim an extension, nor can the employer insist on giving one. The following are relevant events under which a time extension can be allowed:

- Force Majeure
- Exceptionally adverse weather conditions
- Loss or damage occasioned by the Specified Perils
- Civil commotion, strike, lock-out etc.
- Compliance with the contract administrator's instructions
 - Discrepancy in or divergence between contract documents,
 - Variations,
 - The expenditure of provisional sums,
 - The postponement of any work to be executed under the contract,
 - Any action to be taken concerning fossils, antiquities and other objects of interest or value,
 - Nominated Sub-contractor and nominated suppliers.
- Opening up and inspection of defective work
- Delay in the supply of information
- Delay on the part of nominated sub-contractors/ suppliers
- The execution of work not forming part of the contract
- The supply of materials by the employer

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- The exercise by the government of any power which directly affects the works
- Carrying out of work by statutory power
- Failure by the employer to give access over employer's land

Grounds for Extension of Time According to FIDIC

- Clause 8.4(a) due to Variation;
- Clause 8.4(b) see below in conjunction with other relevant Sub-clauses;
- Clause 8.4 (c) due to exceptionally adverse climatic conditions;
- Clause 8.4 (d) due to unforeseeable shortages in the availability of personnel, or Goods caused by epidemic or governmental action;
- Clause 8.4(e) due to any delay, impediment or prevention caused by or attributable to the Employer, the Employer's personnel (including the Engineer see Clause 1.1.2.6) or the Employer's other contractors;
- Clause 8.4(b)cum Clause 1.9(a) due to delay in issuing drawing & instructions by the Engineer to the Contractor;
- Clause 8.4(b) cum Clause 2.1(a) due to delay in providing access to the Site by the Employer;
- Clause 8.4(b) Clause 4.7(a) due to delay caused due to error in Setting out;
- Clause 8.4(b) cum Clause 4.12(a) delay due to unforeseeable physical conditions;
- Clause 8.4(b)cum Clause 4.24(a) delay caused due to discovery & reporting of Fossils;
- Clause 8.4(b)cum Clause 7.4(a) delay caused by the Employer in relation to Testing;
- Clause 8.4(b)cum Clause 8.8 delay caused by suspension as ordered by the Engineer;
- Clause 8.4(b)cum Clause 8.11 delay caused due to prolonged suspension provided the Contractor opted for resuming the performance of the Works after such prolonged suspension;

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- Clause 8.4(b)cum Clause 16.1(h) delay caused to the Contractor due to suspension or reduction in the progress of the Works by the Contractor due to delay in payment;

7.4.2 Payment

The provisions relating to payment concern the way the contractor is paid by the employer. The primary obligation upon the employer is to give the contractor the sum of money which forms the consideration for the contract. Money must be paid promptly and fully unless there are specific reasons for withholding it.

Contract Price

The contract price is dealt with in different ways by different contracts. If the contract is admeasurement, the bid by the contractor is based upon the work described and quantified in the contract bills.

If any quantities are altered because of variations in the client's requirements, then the contract sum will be altered. Otherwise, the contractor is paid the amount of the tender.

Time of Payment

It is common practice in the construction industry, for payment of the contract sum to be made by installments. This is because the total value of each contract forms a large proportion of a contractor's annual turnover. Payment by installments should eliminate the need for the contractor to borrow money pending final payment. The time of payment should be as clearly depicted in the contract document.

7.4.2.1 *Payment Obligation as per FIDIC*

a) Payment of the contract price

- Clause 14.2 cum Clause 14.7(a) in relation to Advance Payment;
- Clause 14.7(b) in relation to Interim Payment;
- Clause 14.13 cum Clause 14.7(c) in relation to Final Payment;
- Clause 14.9 in relation to the first half of the Retention Money;
- Clause 14.9 in relation to the second half of the Retention Money;

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b) Other Payment Obligation (relative to claims or otherwise)

- Clause 1.9(b) payment of cost & profit due to delay in issuing drawings & instructions by the Engineer;
- Clause 2.1(b) payment of cost & profit due to delay caused in providing access to the Site;
- Clause 4.7 payment of cost & profit due to error in Setting out;
- Clause 4.12(b) payment of cost due to delay caused by unforeseeable physical conditions;
- Clause 4.24(b) payment of cost in case of discovery & reporting of Fossils;
- Clause 7.4(b) payment of cost in case of Testing for which the Employer is responsible;
- Clause 8.9(b) payment of cost in case of suspension of Works;
- Clause 10.3(b) payment of cost & profit in case of interference with Tests on Completion;
- Clause 11.6 payment of cost in case of further tests for which the Employer is responsible;
- Clause 13.7 cum 14.3(b) payment of cost in case of Adjustment for Changes in Legislation;
- Clause 13.8 payment of cost in case of Adjustment for Changes in Cost;
- Clause 14.3(a) cum Clause 13.2 payment of additional payment to the Contractor derived from savings due to the effects of Value Engineering;
- Clause 14.8 payment of financing charges in case of delay in payment;
- Clause 15.4(c) entitlement to a balance of costs, if any, in case of termination of the Contract by the Employer due to the default of the Contractor, after completion of the Works by the Employer or another contractor;
- Clause 16.1(b) payment of cost & profit in case of suspension & reduction of the progress of the Works by the Contractor;

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- Clause 16.4 payment of any loss or damage sustained by the Contractor due to termination of the Contract by the Contractor due default of the Employer;
- Clause 17.4(b)cum Clause 17.3(f) & (g) payment of cost & profit in case of Employer's risks;
- Clause 19.7 payment of costs in relation to Plant, Materials, other costs & liabilities, cost of removal of the Temporary Works, cost of the repatriation of Contractor's Personnel;
- Clause 20.1 cum Clause 14.3 payment of claims;

7.5 Variation

7.5.1 Introduction

Construction project usually undergoes through a complex process, which requires close cooperation and coordination among the stakeholders. The construction process is influenced by highly changing variables and unpredictable factors that could result from different sources. The different stages of construction projects are, inception/ conceptual stage, design development, procurement, construction, testing and commissioning and operation. Design plays an important role in improving the development of construction industry. A good design will enhance value generation, reduce variation, dispute and improve the work flow. "In a perfect construction world there would be no change orders" (anonymous). Unfortunately there is no perfect construction world. Therefore change is a fact of life for construction project and it is inevitable.

Changes or variations result from the necessity to modify aspects of the construction project in reaction to circumstances that develop during the construction process. Variations are common in all types of construction projects. The nature and frequency of variation occurrences vary from one project to another depending on various factors.

Variation work is the work that can be imposed with in the contract documents. It is a change or alteration to the plans or specifications for a number of reasons implicit in the original agreement, these reasons could include, but are not limited to,

- Omissions in the design documents,
- Recognition of better methods or materials to achieve the required effect,

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- Resolution of problems recognized or resolution of unforeseen conditions not anticipated, and
- Similar adjustments with in the intent of the original contract.

7.5.2 Types of Changes

There are several types of changes in the construction work process. Changes can be classified into:

1. Formal Changes
2. Constructive Changes
3. Cardinal changes
4. Design Related Changes
5. Payment changes

1. Formal Changes: Formal changes are change order which is directed by the owner or owner's representative.

2. Constructive Changes: is a type of change that lacks the formal directive authorizing a change in work.

3. Cardinal changes: is as intensive as it changes the entire character of the work required under the contract.

4. Design Related Changes: Design error can be considered as a change to the construction Contract.

5. Payment changes: Disputes arise when one party fails to pay the other.

7.5.3 Causes of Changes

With respect to causes that lead to changes, changes can be divided into two categories:

1. Technical Changes
2. Administrative Changes

With respect to their originators changes can be categorized:

1. Owner related changes

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2. Design Consultant related changes
3. Contractor related changes
4. Other changes

I. Technical Changes

In the category of technical changes, there are four types of causes namely

- Planning and design
- Underground conditions
- Safety considerations
- Natural incidents

A. Planning and design:

This type of change order is primarily due to defects, errors and omission in design and planning, such as mistakes in quantity and estimates, planning mistakes, inadequate arrangement of contract interface, inconsistency between drawings and site conditions and citation of inadequate specification.

B. Underground conditions:

Examples of this cause include insufficient site investigation by the design party, or additional requirements for underground improvements or enhancement of underground monitoring/sensing, and different underground condition.

C. Safety Consideration:

Rescheduling project activities or even adopting a new construction method may be required.

D. Natural Incidents:

Natural factors may bring about consequential incidents, such as landslides, flooding and failure of temporary formwork or earth-retaining shields.

II. Administrative Changes

The category of administrative changes consists of:

- Changes of work rules/regulations: The work rules or regulations enforced during the initial period of planning and design may be revised by the governing agency later in the construction stage.
- Changes of decision making authority: Project risks incurred by the change of decision making authority are external and beyond the control of both the client and the contractor.
- Special needs for project commissioning and ownership transfer: the user party, during the course of commissioning, may raise request to modify its requirements for the built facility.
- Neighborhood pleading: Usually neighborhood concerns are considered in the stage of planning and design.

A. Owner related changes

1. Change of plans or scope by owner
2. Change of schedule by owner
3. Owner's financial problems
4. Replacement of materials or procedures
5. Change in specifications by owner

B. Contractor related changes

1. Unavailability of equipment
2. Differing site conditions
3. Defective workmanship
4. Unfamiliarity with local conditions
5. Contractor's lack of required data

C. Design Consultant related changes

1. Change in design by consultant

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2. Errors and omissions in design
3. Conflicts between contract documents
4. Inadequate working drawing details
5. Noncompliance design with government regulations
6. Noncompliance design with owner's requirement
7. Change in specifications by consultant

D. Other changes

1. Weather conditions
2. Safety considerations
3. Change in government regulations
4. Change in economic conditions
5. Socio-cultural factors
6. Unforeseen problems

7.5.4 Effects of Variation

Variation order impact on the project cost and/or progress varies with the following:

- The larger the scope (measured by the cost), the greater the impact.
- The later in time the change order is implemented, the greater the impact.
- The better the management of the change order process, the less the impact.

There are many effects of variation order to either parties of the construction project. Some well-known ones include: Delay, Cost overrun, Claim and Dispute .

7.5.5 Variation According to FIDIC

According to FIDIC each variation may include

- Changes to the quantity of any item of work included in the contract (however such changes do not necessarily constitute a variation),
- Changes to the quality and other characteristics of any item of work,
- Changes to levels, positions and/or dimensions of any parts of the works,

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- Omission any works unless it is to be carried out by others,
- Any additional work, plants, material or services necessary for permanent works, including any associated tests on completion, bore holes and other testing or exploratory work, or
- Changes to the sequence or timing or the execution of works.

The contractor shall not make any alteration and/or modification of the permanent works unless and until the engineer instructs or approves variation.

7.5.6 Guarantees and Bonds

A bond or guarantee is an arrangement under which the performance of a contractual duty owed by one person (A) to another (B) is backed up by a third party (C). What happens is that C promises to pay B a sum of money if A fails to fulfill the relevant duty. In this context A is commonly known as the principal debtor or simply principal; B is called the beneficiary; and C is called the bondsman, surety or guarantor.

7.5.6.1 Bid Bonds

Bid Bonds guarantee that the bidder will carry out the terms of a contract at the bid price upon award of the bid. Thus it is a guarantee that a contractor will enter into a contract at the amount of bid and post the appropriate performance bonds, providing financial assurance that the bid has been submitted in good faith. These bonds are used by owners to pre-qualify contractors submitting proposals on contracts.

Bid bonds have two purposes:

- i. To guarantee that the contractor will enter into a contract if determined to be the lowest responsive bidder and
- ii. To guarantee the contractor will provide the required payment and performance bonds, and insurance policies.

When the performance and payment bonds have been submitted, the contractor is released from the bid bond obligations.

7.5.6.2 Performance Bonds

Performance bonds guarantee the performance of the contract requirements at that stated bid price. In effect, the surety is saying it guarantees the performance of the contractor, or it will complete the project as described in the plans and specifications. Performance Bonds guarantee the contractor will faithfully perform the contract or the terms of the contract. This protects the owner from financial loss should the contractor fail to perform the contract in accordance with its terms and conditions. Performance bonds frequently incorporate payment bond (labor and materials) and maintenance bond liability.

While a bid bond is submitted with the bid, a performance bond is submitted by the winning bidder upon award of the contract. The surety is in the position of being asked to guarantee the contractor's performance. Therefore, the contractor must demonstrate an ability to perform before the surety is willing to issue payment and performance bonds. The sureties will visit the contractor's home office and job sites, and will contact the owners of recently completed contracts.

If a contractor defaults on performance of the contract, the surety has three basic choices:

- Buy back the bond. This amounts to giving the owner a check for the amount of the penal value of the bonds.
- Replace the contractor. Negotiate or advertise for bids for the purpose of obtaining another contractor to finish the work.
- Finance the contractor. The bonding company runs the risk of spending more than the value of the bond, but this is still a common option because the contractor is familiar with the project.

7.5.6.3 Payment Bonds

Payment Bonds ensure subcontractors, laborers and material suppliers used in fulfilling a contract will be paid. A payment bond is a contract bond that guarantees payment of the contractor's obligation under the contract for subcontractors, laborers and material suppliers associated with the project, providing assurance that they will be paid if the contractor defaults.

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The payment bond is a protection for those supplying labor or materials to a public job. In most cases, payment bonds and performance bonds are issued together as one bond; the same application covers both.

7.5.6.4 Advance Payment Bonds

These are bonds or guarantees given to the owner by the contractor assuring the owner that the contractor will pay back any advance payment that he has received.

7.6 Price Adjustment

The purpose of a Price Adjustment clause is to provide a mechanism for reimbursing contractors for changes in input prices over which they have no control at all. The adjustment to be applied to the amount otherwise payable to the Contractor, as valued in accordance with the appropriate schedule and certified in payment Certificates, shall be determined from formulae for each of the currencies in which the contract price is payable.

No adjustment is to be applied to work valued on the basis of cost or current prices.

Where:

- “P_n” is the adjustment multiplier to be applied to the estimated contract value in relevant currency of the work carried out in period “n”, this period being a month unless otherwise stated in the Appendix to Tender.
- “a” is a fixed coefficient, stated in the relevant table of adjustment data, representing the non-adjustable portion in contractual payment.
- “b”, “c”, “d” Are coefficients representing the estimated proportion of each cost element related to the execution of the works, as stated in the relevant table of adjustment data; such tabulated cost elements may be indicative of resource such as labor, equipment and materials;
- “L_n”, “E_n”, “M_n”.... Are the current cost indices or reference prices for period “n”, expressed in the relevant currency of payment, each of which is applicable to the relevant tabulated cost element on the date 49 days prior to the last day of the period (to which the particular payment Certificate relates); and

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- “Lo”, “Eo”, “Mo”,..... are the base cost indices or reference prices expressed in the relevant currency of payment, each of which is applicable to the relevant tabulated cost element on the Base Date.

7.7 Claim and Dispute Management

7.7.1 General Introduction

The success of a project can be understood if it is completed on time, within budget, and with all claims resolved. Among other reasons, contract document interpretation and modification resulting in change to the contract sum or time for completion of construction may cause submission of claim. Claims and construction might be inseparable, unless a relentless attempt has been made by the contracting parties to the construction contract to avoid their occurrence.

In its general sense a claim is a request for compensation for dealing with a situation that differs materially from what was anticipated by the parties at the time of entering into the contract. Though one can come across several definitions, let's next look at some examples.

Definition of Claim

- Hughes and Barber (1983) defined claim as :-

“Claim means simply a request, demand, application for payment or notification of presumed entitlement to which the contractor, rightly or wrongly at that stage, considers himself entitled and in respect of which agreement has not yet been reached.”

- Hoare (2006) defined claim as :-

“demand what is due.”

- Defined in ERA's Claims Manual (SMEC) as :-

“A claim is an assertion of a right to property, money or a remedy”

- American Institute of Architects (AIA) Document A201, General Conditions of the Contract for Construction, states that a claim is a

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“demand or assertion by one of the parties seeking, as a matter of right, payment of money or other relief with respect to the terms of the contract.”

Claim is legally defined as an assertion to right. The nature of right may relate to time, financial, or other remedies. Claim is therefore a substantive demand, for example, by the Contractor against the Employer.

The employer may have its own substantive demand against the contractor. We can call this a counterclaim. It is an independent demand originated from the same contractual relationship. There are also other basis of claims (like extra contractual or tort claims, or in case where no contract exists, or if one existed, the contract is found to be void, or ex gratia claim...) as presented on Table 7.5 (1).

Table 7.5 (1): Category of claim

<p>Contractual: are claims made under the expressed provisions of contract.</p> <ul style="list-style-type: none"> • terms of contract define the situations in which they may be made and how they may be handled. 	<p>Extra- contractual: claims which have no basis in the contract documents.</p> <ul style="list-style-type: none"> • These could have their basis in common law. 	<p>Ex-gartia: claims where there is no contractual provision to rely on, nor any breach or tort by the client.</p> <ul style="list-style-type: none"> • might be made to recover cost incurred by the contractor, the expenditure of which gave benefit to the employer, but for which there are no grounds for recovery under the contract.
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Other factors relative to the performance of obligations by each of the parties may also give rise to unanticipated claims. Whatever the sources of construction claims may be, the success of the project depends on how well the owner, consultant, and contractor manage these claims. An

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unresolved claim is the basis for the existence of construction disputes. The basis of remedy for the claims or disputes may be the contract and/or the applicable law. Dispute in simple terms is a difference in a line of thought. It is claim that cannot be resolved by the parties to the construction contract without the intervention of an independent third party.

Claim is mostly concerned with entitlements and liabilities arising under, or as a result of, a legally valid contract. A construction claim can therefore be a demand for payment of additional compensation, adjustment of the parties' respective contractual obligations, Extension of Time or compensating delay damages, or any other change with regard to the contractual conditions or terms. Project participants need to understand the contract provisions governing claims and disputes.

Claim in practice can also be understood in different ways based on the perceptions held by contractual stakeholders. A claim can be perceived as a disguised form of blackmail; as a last chance to bail out of a losing job, and as an assertion to a contractual right.

Categories of Claim

Claims generally can be categorized as

I. Claims under the contract (Contractual claims):-

- Clauses define the basis of valuation to be adopted.

Claims under this category can further be classified as (i) Event and remedy specified in contract which could mainly be due to ambiguities and inadequacy of the conditions of contract; and (ii) breach of contract for which the remedy is specified in the contract, as the clauses define the responsibilities of the contracting parties.

7.7.2 Types of Claim

A. Time Related Claims: Claims associated with delay or in time completion of projects where either of the following six Entitlements or Penalties are subjected to:

- Time extension only
- Liquidated damages only
- Time extension and cost
- Concurrent compensations
- Bonus
- Reliving of obligation

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compensation

According to FIDIC time related claims include:

- Delay in supply of documents or drawings; (see FIDIC Clause 6.3 & 6.4)
- Adverse physical obstructions or physical conditions; (see FIDIC Clause 8.5)
- Fossils & articles of value or antiquity (archaeological and geological findings); (see FIDIC Clause 4.23)
- Tests required but not provided for; (see FIDIC Clause 36.5)
- Suspension of the progress of the works; (see FIDIC Clause 8.10)
- Failure to give possession of site; (see FIDIC Clause 2.1)
- Other specified events;

B. Cost Related Claims: Claims associated with monetary compensation where either of the following entitlements or penalties are entertained for:

- Additions requiring rate adjustments
- Price changes
- Provisional sum adjustments

Cost related claims are mainly due to variation, measurement changes, adverse physical conditions, employer's risks, compliance with statutes, regulations; price fluctuations, currency and other economic causes; defects and unfulfilled obligations(NB: It relates to breach of the Contract); failure to commence, critical or non-critical delays, suspension of work, release from performance, default & termination; delay in certifying payments.

C. Default by Contracting Parties: Claims associated with non-performances of contractual obligations such as delay in payment certificates, suspensions and terminations, and reduction of the progress of the execution of works.

7.7.3 Major Heads of Claims

i. Disruption Claims

- delays in access to site
- changes in design
- delays in providing drawings
- delays in providing instructions
- failure to respond to a request for information within a specified time.

ii. Prolongation Claims

- The amount and nature of extra or additional work
- Exceptionally adverse climatic conditions
- Any delay, impediment or prevention by the Employer
- Other special circumstances which may occur other than through a default of or breach of contract by the contractor.

iii. Acceleration Claims

- Result from an increase in the quantity or scope of work without a corresponding extension of time. Acceleration claims may include:-
 - the costs of working additional hours
 - providing extra labour
 - providing extra or different equipment

7.7.4 Causes for Claims

Causes for claims may be the occurrences of deviations from the promises made under the construction contract during the performance of the Construction Contract.

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These deviations may reflect themselves in terms of or in relation to completion time, construction cost, quality performance, and safety requirement.

Factors such as poor or unclear tender and/or contract documents, poor or inadequate administration of responsibilities by stakeholders, and unforeseen or uncertain situations during execution of the construction project may also cause claims. Change conditions, additional works, and delay for cost overruns and time extension are also categories of factors that contribute to the emergence of claim.

7.7.5 Damages Suffered and Compensations

A. Damages suffered by the Employers

→ Liquidated Damages

Actual delay damage caused by the contractor (rental costs, loss of use, financing costs, overhead, supervisory costs, consequential damages)

A. Damages suffered by the Employers

- Abandonment by the Contractor
- Defective performance by the Contractor.

B. Damages suffered by the Contractors

- Extended home office overhead
- Idle equipment and labour
- Escalation of labour and materials
- Extended insurance and bond costs
- Interest (delayed progress payments, interest on investments)
- Claim preparation cost
- Litigation costs and Consequential damages

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→ Extension of Time

Before going into the details of addressing extension of time lets us see how it is dealt with under construction contracts, for example under FPPA-SBD NCB 2011.

Clause 73: Extension of Intended Completion Date

The Contractor may request an extension of the Intended Completion Date if he is or will be delayed in completing the contract by any of the following causes:

- Exceptional weather conditions in the Federal Democratic Republic of Ethiopia;
- Artificial obstructions or physical conditions which could not reasonably have been foreseen by an experienced Contractor;
- Compensation Event occurs or a change order for modification is issued which makes it impossible for completion to be achieved by the Intended Completion Date;
- Administrative orders affecting the date of completion other than those arising from the Contractor's default;
- Failure of the Public Body to fulfill his obligations under the Contract;
- Any suspension of the works which is not due to the Contractor's default;
- Force majeure;

The following are relevant events under which a time extension can be allowed

- Loss or damage occasioned by the Specified Perils
- Civil commotion, strike, lock-out etc.
- Compliance with the contract administrator's instructions
 - Discrepancy in or divergence between contract documents,
 - Variations,
 - The expenditure of provisional sums,

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- The postponement of any work to be executed under the contract,
 - Any action to be taken concerning fossils, antiquities and other objects of interest or value,
 - Nominated Sub-contractor and nominated suppliers.
-
- Opening up and inspection of defective work
 - Delay in the supply of information
 - Delay on the part of nominated sub-contractors/ suppliers
 - The execution of work not forming part of the contract
 - The supply of materials by the employer
 - The exercise by the government of any power which directly affects the works
 - Carrying out of work by statutory power
 - Failure by the employer to give access over employer's land

Type of schedule impact

- **Delay:** A delay is an event that prevents the contractor from completing the work within the contractually specified performance period, a slowing down of the work without stopping it entirely, triggered by something other than a formal directive from the owner to stop work. It is simply a loss of time.
- **Disruption:** an impact that alters the contractor's planned work sequence or flow of work expected at the time of bidding, which results in increased difficulty, cost, and/or time.
- **Change:** when a contractor takes on any type of work that deviates from the original contract, or from the scope of work or plan of action reasonably anticipated under the contract, that results in an increase in performance time, the contractor may seek an adjustment.

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- It must be identified as truly being a **change from the original contract** or merely a situation that **should have been anticipated** by the terms of the original agreement before determining its impact on the schedule.
- **Suspension**: is a **written directive** by the owner to stop all work on the project, either because the contractor has failed to perform in accordance with contract documents, or at the owner's convenience, until the owner has raised the suspension of work.
- **Termination** is a permanent stoppage of work of all or a portion of the contract, and the contract is terminated [Default and Convenience].

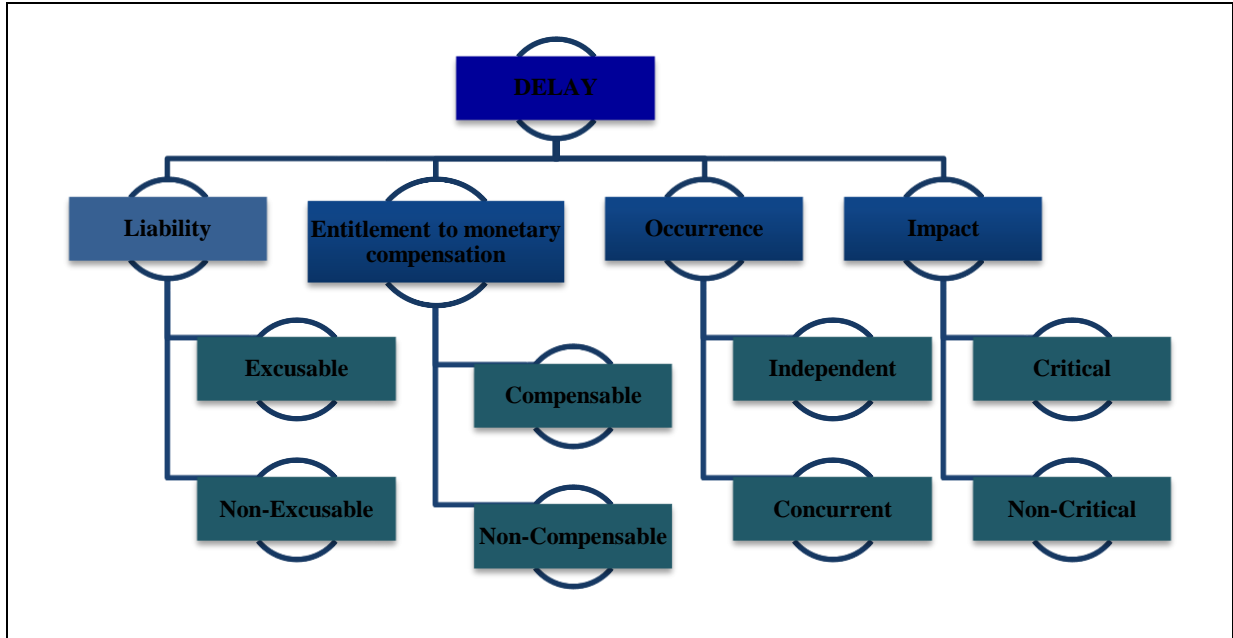
Here are the basic steps required to apply delay analysis technique and measure the impact a delay will result on the project objective:

- Recognized that an event has occurred that differs from the established which potentially has an impact on the schedule and is attributable to a party,
- Establish the schedule of record,
- Classify the delay

Delays are classified into one of the following four categories:

- Critical and non-critical delay
- Excusable and non-excusable delay
- Compensable and non-compensable delay
- Concurrent delay

Construction delay could be classified based on four different grounds of liability of the contractor for the delay event; and entitlement to monetary compensation; the relationship among the occurring delay events (occurrence); and impact it creates as presented by Figure 7.5 (2).



i. Classification based on Liability

a. Excusable Delay is a delay to completion which is caused by matters deemed to be **outside the control of the contractor**. In case of such delays, the contractor is excused from performing the contract on time and has the right to have extra time.

Includes those delays for which the **employer is responsible** – from the point of view of the contractor, these are often described as excusable delays and are usually compensable.

Where the project is completed late because of excusable delays, the contractor will usually be granted an **extension of time**, will **not have to pay liquidated damages to the employer** and is likely to be able to claim the direct costs and losses resulting from the delay to completion.

Examples of excusable delays usually include events such as late possession of the site, employer-inspired changes and variations and, late information from the design team when the employer is responsible for producing the design.

The contractor will not have to pay liquidated damages to the employer and is likely to be able to claim the direct costs and losses resulting from the delay to completion.

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- b. **Non-Excusable Delay:** delays that result from contractor risk and the client compensates his losses according to liquidated damages.

In addition to becoming liable to pay the employer liquidated damages the contractor will not be granted an EOT or cost compensation and may become.

Those for which the contractor is responsible– from the point of view of the contractor, these are often described as culpable or inexcusable delays and are usually non-compensable.

Anything that the contractor could have prevented, such as progress being slower than planned (delays in execution); failing to schedule workers properly (lack of labor); late delivery of materials; putting right incorrect work; project management problems and, ; and the late provision of information where the contractor is responsible for producing the design.

ii. Classification based on Entitlement of monetary compensation

Another issue in relation to delay damage is the time-related costs.

- a. **Compensable Delay:** scenario where contractor is liable for time extension and cost compensation. It is a period of time during which a critical delay event is experienced which is the Employer's risk event and expressly identified as being **recoverable** under the contract terms.
- b. **Non- Compensable Delay:** when the delay event is caused solely at the fault of the contractor. Is a period of time during which a critical delay event is experienced which is the **Contractor's risk event** and **not** expressly identified as being **recoverable** under the contract term. The contractor will **not** be granted an extension of time for culpable or **inexcusable delays** and may become liable to pay the employer liquidated damages.

iii. Classification based on Occurrence

- a) **Concurrent Delay:** Those for which neither the contractor nor employer is responsible – these are often described as neutral delays and are excusable but non-compensable. Such delay events occur dependent to each other, often taking place during the same time and/or on parallel paths of the project activity network.
- b) **Independent Delay**

iv. **Classification based on Impact**

Classified as Critical and Non-critical: events will be classified in to on of these two classes depending on whether or not the delay is responsible for extending project duration or not.

Although most analysts favor a particular type of analysis, there are a number of factors that will steer the analyst to one method or another. Some of the factor are the contract requirements; the schedule, information and records available; the nature and complexity of the dispute and the delaying events; the expertise of the analyst and familiarity with the techniques; and agreement of technique. The amount of time available, the cost of the analysis and the amount in dispute: cost of the analysis is generally directly related to the total time required to undertake. There is definitely a trade-off between accuracy and proportionality of cost.

There are different analysis methods available to determine schedule impact analysis techniques. Some of the techniques are global impact method, net impact method, as-planned Vs as-built method, collapsed as-built method, time impact analysis, impact as-planned method, window method.

- 1. Global Impact:** the delays plotted on a summary of a bar chart and **total delay** is calculated as a straightforward **sum** of the individual delays. As it does not make allowance for concurrent delays in parallel activities, and does not scrutinize delay types this method has a limitation of including over-estimate in the actual overall delay.
- 2. Net Impact:** similar to the global impact technique but it depicts **only the net effect of all claimed** delays on a bar chart. Net effect of all delays is plotted on a bar chart based on the as built schedule and compared with the as-planned. As this method does not use network programs it may misinterpret the true effect of delayed activity on completion date.
- 3. As-planned vs As-built:** is an observational technique that compares the baseline or other planned program to the as built program. It advantageous in that it is simple to understand and relatively simple to perform. Its limitation is that it does not scrutinize delay type.

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- 4. Collapsed As-Built:** starts with the as-built program, and removes one party's delay from the program to collapse it, leaving those delays caused solely by the other party. In this method, excusable delays are subtracted from the as-built program, to determine what would have happened but for those events. It has risen to a level of acceptability almost equal to that of the window method, while being less costly to produce.

Its limitations is that it does not consider the dynamic nature of the project's critical paths and highly subjective and subject to manipulation

- 5. Time Impact Analysis:** Is a CPM based method, the analysis of delaying events is done at the time they occur. It allows comparison of the as-planned date just **before** the delay occurred and **after**. It concentrates on a specific delay or delaying event, not a time period containing delays or delaying events. It provides a systematic and objective method of quantifying the effect of delays on a project.

- 6. Impacted As-Planned :** the impact of the delays on the contractor's as-planned schedule is measured. The various delays are formulated as activities and added to the as-planned network in chronological order showing the effect of delay at a time and demonstrating how the project is being delayed.

The amount of delay equals the difference in completion dates between the schedules before and after the impacts.

- 7. Window analysis :** Is a dynamic delay analysis method in which delay analysis is performed by using extracted schedule windows. It divides the total project duration into smaller time periods defined by changes to the project critical path where these smaller time periods are referred to as "**windows**".

It addresses the classification of delays and concurrency; a clear delineation of cause and effect; and bias to one party or another and the ease with which the outcome can be manipulated. The critics argue window analysis is document intensive places a heavy reliance on accurate project records, including systematic program updates.

Next we have an example demonstrating the use of some of the methods.

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Source: [Brimah, N. Construction Delays Analysis Techniques- A Review of Application Issues and Improvement Needs, July 2013, Buildings 2013,3,506-531;doi:10.3390/buildings3030506]

- **Objective DAT:** is to calculate the project delay and work backwards to try to identify.
- Let's consider a project that involves the construction of a small garage with the necessary approach drive-in as shown in the activity on arrow network diagram.

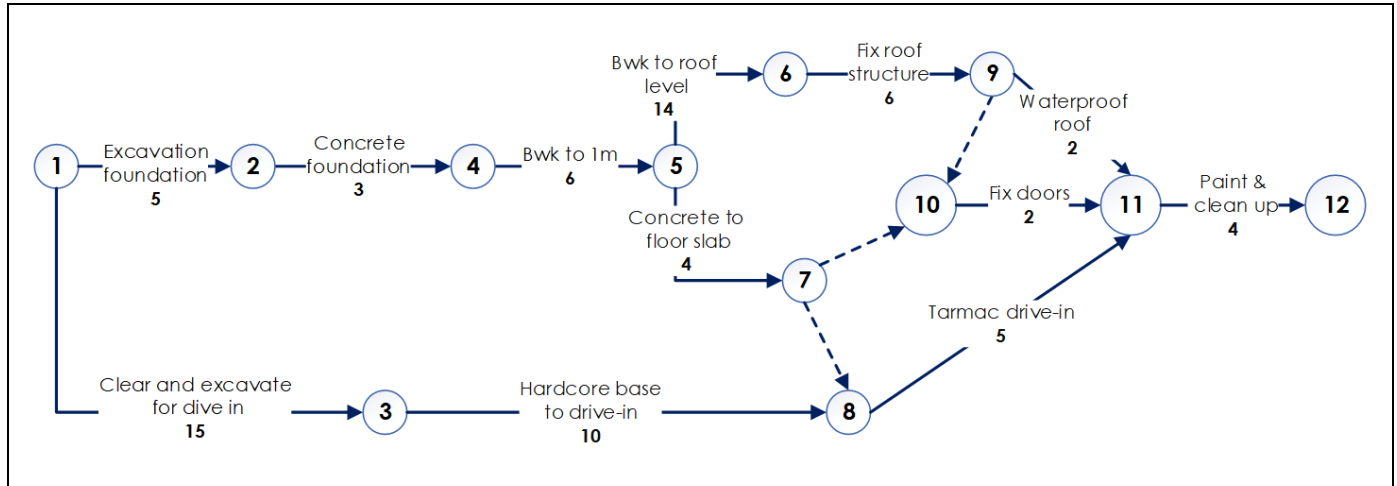
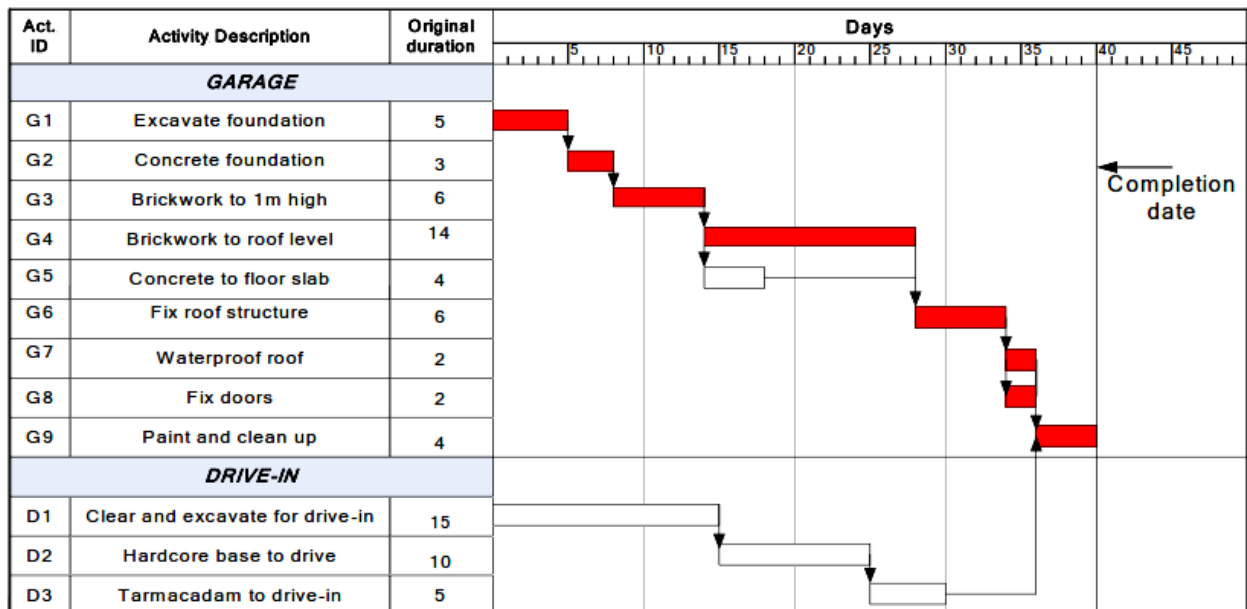


Figure 1: Network diagram of the project



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Figure 2: As-planned schedule

Total project duration=40 days.

Critical path



Project progress was affected by three types of delays events for which :

- the contractor assumes the risks of costs and the time consequences involved, which are often categorized as “**Non excusable – Non compensable**” delays (**NN**);
- the contractor is entitled to both time extensions and recovery of extra cost consequential upon the delay [“**Excusable Compensable**” delays (**EC**)];
- no party has control over or bears the risks involved, (e.g., acts of God and strikes), which are often termed as “**Excusable Non-compensable**” (**EN**) delays.

Table 1: Delay events that affected the sample project

Activity	As planned duration	Chronology of delay	Delay description	Type	Start date (day)	End date (day)	Duration (days)
Concrete foundation (G2)	3	1	Contractor had a labor problem so it took 3 days extra to complete activity G2.	NN	6	9	3
Clear and excavate for drive-in (D1)	15	2	Contractor encountered unforeseen adverse ground condition during excavation of the drive-in.	EC	10	17	7
Brickwork to roof level (G4)	14	3	Activity G4 did not start immediately after completion of its predecessor as-planned due to 1-day delay by the contractor’s brick supplier.	NN	15	16	1
Concrete to floor slab (G5)	4	4	Contractor advise the owner on the need to increase the thickness of the floor slab. This change required 1 extra day to accomplish.	EC	19	20	1
Hardcore base to drive-in (D2)	10	5	After 5 days working on activity D2, the owner suspended works for 3 days as a decision on the suitability of the hardcore material was being made.	EC	24	28	4
Brickwork to roof level (G4)	14	6	The owner ordered the contractor to add an extra window after the completion of G4. This design change caused 2-days delay.	EC	30	32	2
Hardcore base to drive-in (D2)	10	7	A quality control test revealed that certain sections of the drive-in base were poorly constructed. This defective work resulted in 5 days of rework by the contractor.	NN	31	36	5
Tarmacadam to drive-in (D3)	5	8	There was a 4-days delay by the owner in making available to the contractor as owner-furnished equipment for activity D3.	EC	38	42	4
Waterproof roof (G7)	2	9	It took the contractor 3 more days to complete activity G6.	NN	40	43	3
Fix doors (G8)	2	10	The owner changed his mind on type of the door used for the garage so ordered the contractor to make changes. This caused 3 extra days of work.	EC	40	43	3

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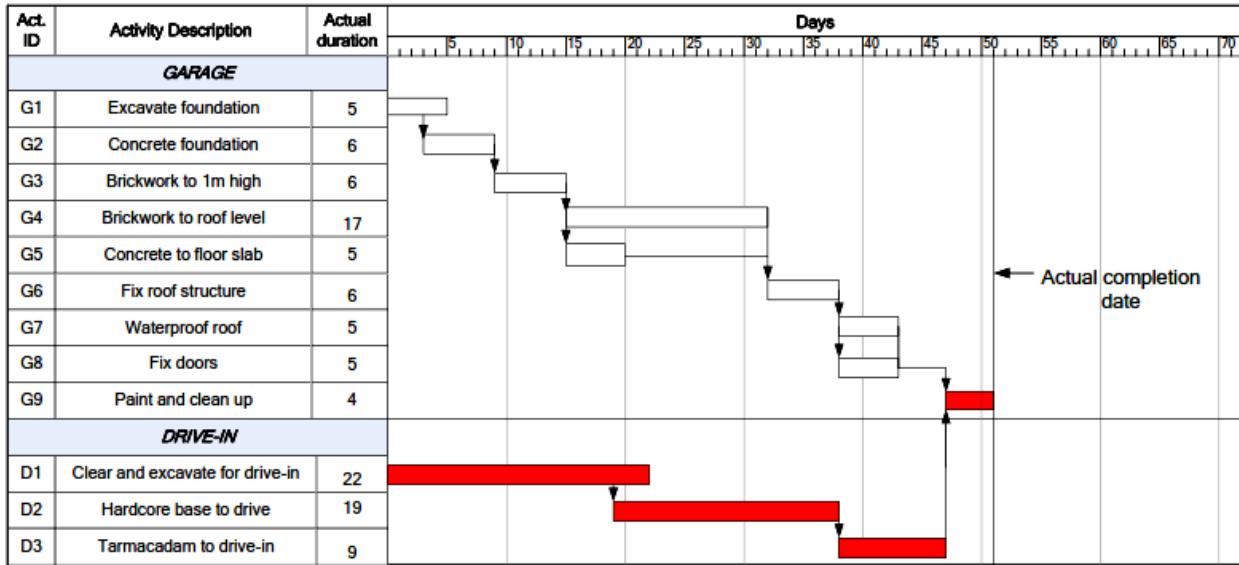
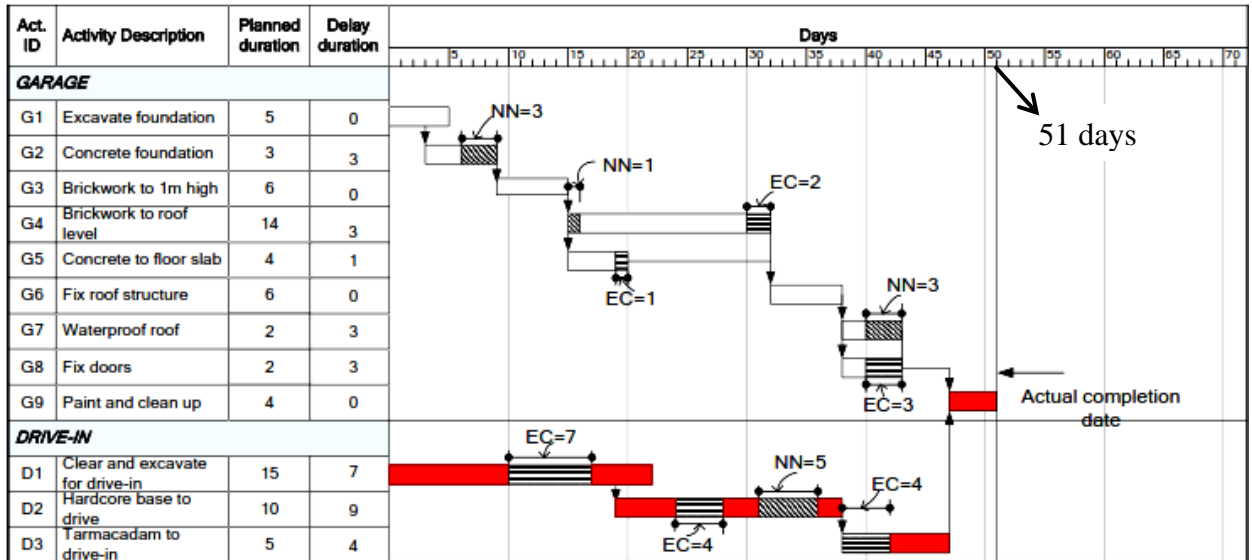


Figure 3: As-built schedule

- Including all the delays that occurred during construction of the project.
- The total duration of 51 days and a critical path along the drive-in activities.



- To distinguish between the various delays:

EC delays are indicated in dark horizontal strips and



NN delays in dark diagonal strips



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- **The as-built program:** shows changes in the planned sequence between some of the activities:
 - o the first two activities of the garage show a change in the logic relationship from finish–start to start–start logic with a 2 days lag.
 - o the first two activities of the drive-in shows similar logic with a lag of 3 days in between.

a. As-Planned Vs. As-Built

- All encountered delaying events are depicted on the as-built schedule.
- The difference between the as-planned and as-built completion dates is the amount of time for which the claimant will request for compensation.
 - **Sum of contractor-caused delays (NN) = $\sum NN_i = 3 + 1 + 5 + 3 = 12$ days**
 - **Sum of owner-caused delays (EC) = $\sum EC_i = 7 + 1 + 4 + 2 + 4 + 3 = 21$ days**
- The Assumption is that concurrent delay due to both parties is 12 days (i.e. the lower of the above two types of delay).
 - ➔ Net project delay for which the owner is responsible= **21-12= 9 days.**
- From Figures 2 and 4: we can see that the planned project duration was 40 days where as the as-built project duration is 51 days.
 - ➔ The net total project delay = **51 – 40 = 11 days**
- The balance is the **contractor responsibility: 11 – 9 = 2 days.**

b. Collapsed As-Built

- Involves removing the delays of each party from the as-built network so that the resulting schedule will give the completion date of the project but for the delays of the other party.

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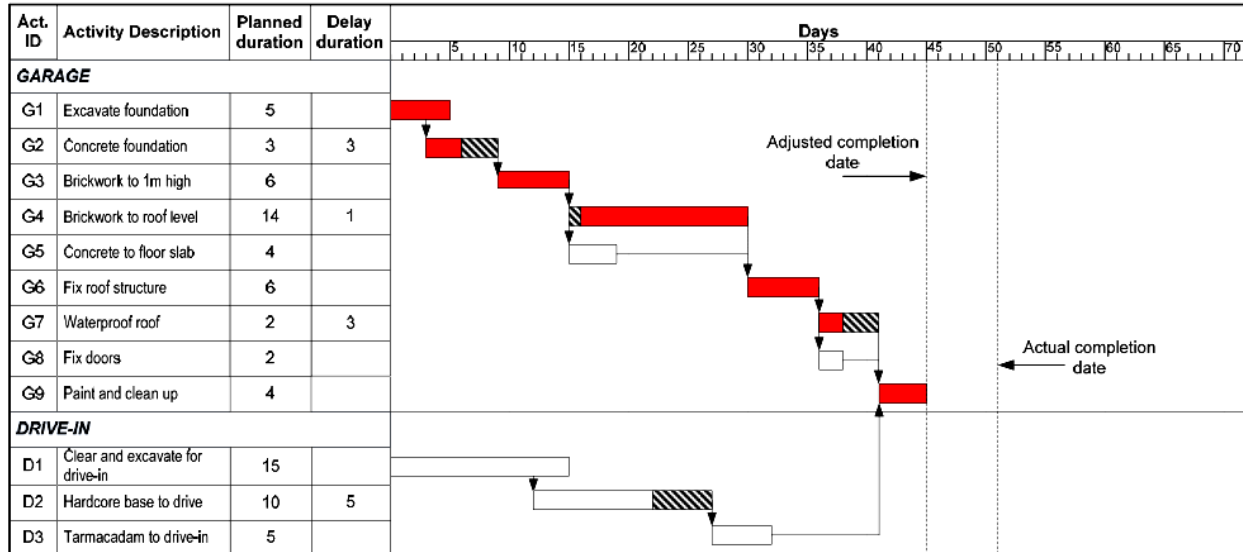


Figure 5: As-built schedule with owner's delays subtracted.

- **Contractor's point of view:** all owner-caused delays were subtracted from the as-built schedule resulting in a collapsed as-built schedule of completion date as day 45 and critical path G1-G2-G3-G4-G6-G7-G8-G9.
- Compared with actual completion date= $51-45=6$ days (Owner responsible delay: could be charged as **compensable delay**).
- Compared with original schedule= $45 - 40 = 5$ days → Caused by the contractor.
- Removing the delays of the owner from the as-built.

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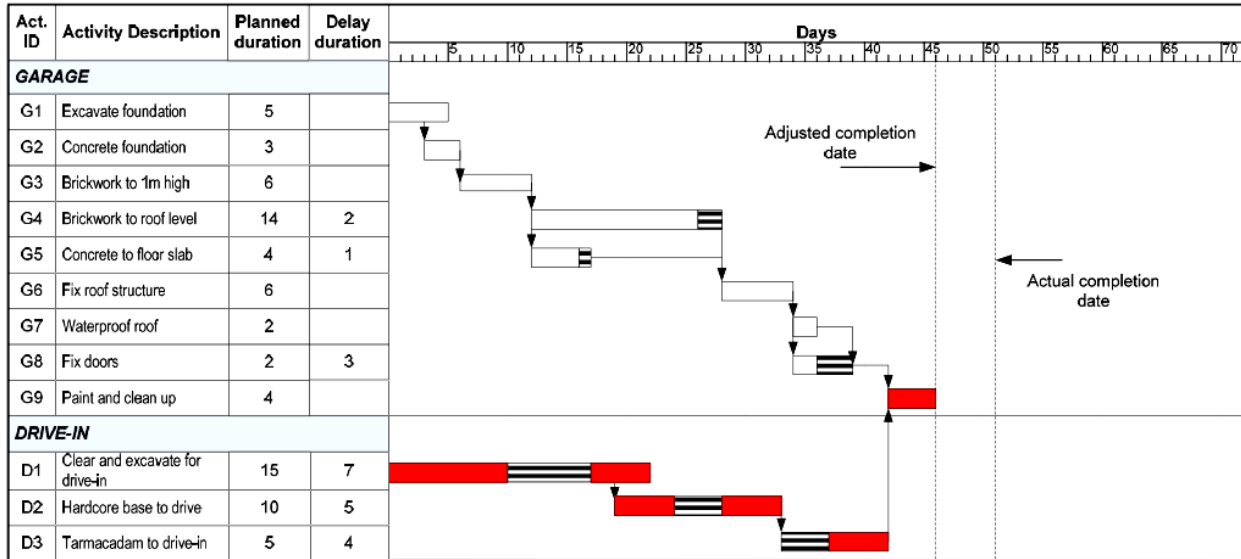


Figure 6: As-built schedule with owner’s delays subtracted.

- **Owner’s point of view:** all contractor-caused delays were subtracted from the as-built schedule resulting in a collapsed as-built schedule of completion date as day 46 and critical path D1-D2-D3-G9.
- Contractor responsible delay (could be charged for **liquidated damages**).
- Compared with actual completion date= $51-46=5$ days
- Compared with original schedule= $46 - 40 = 6$ days → Caused by the owner.

c. Window Analysis

- The total project period is first broken into discrete time periods at days 10, 21, 32, 40 and 51, resulting in 5 “window” periods.
- Analysis was carried out for each “window” successively at the various updates as shown in Figures 7–11 next.

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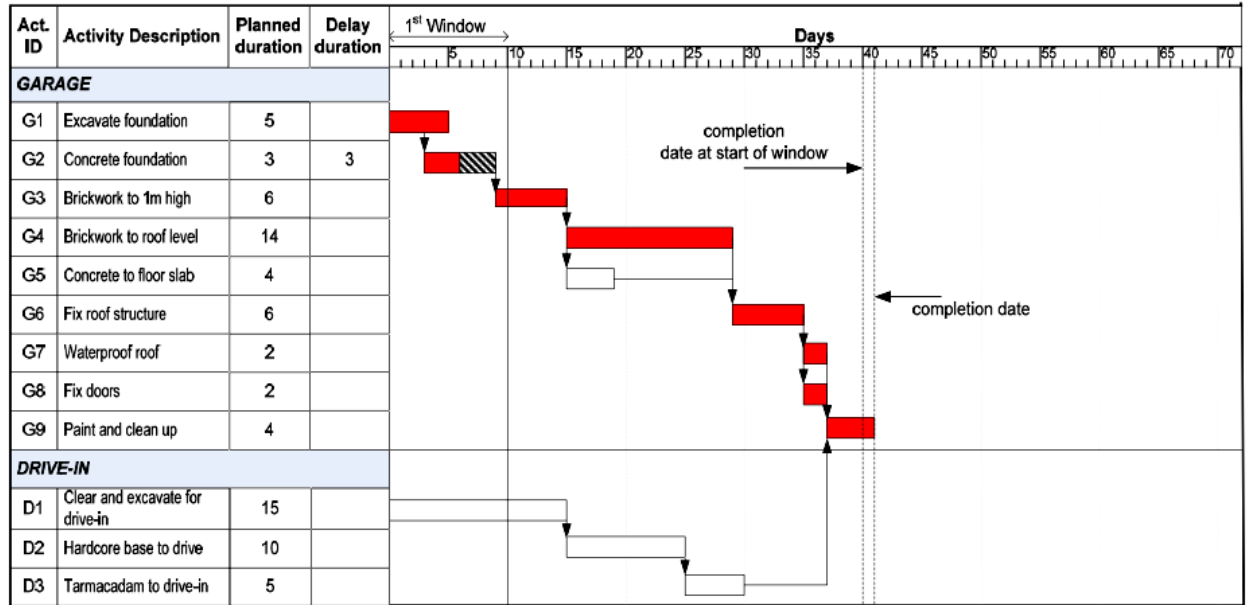


Figure 7: Updated schedule on day 10.

- There was **1-day slippage** at the end of the 1st window due to **3 days'** delay by the contractor on the critical path G1-G2-G3-G4-G6-G7-G8-G9.
- **2nd Window**

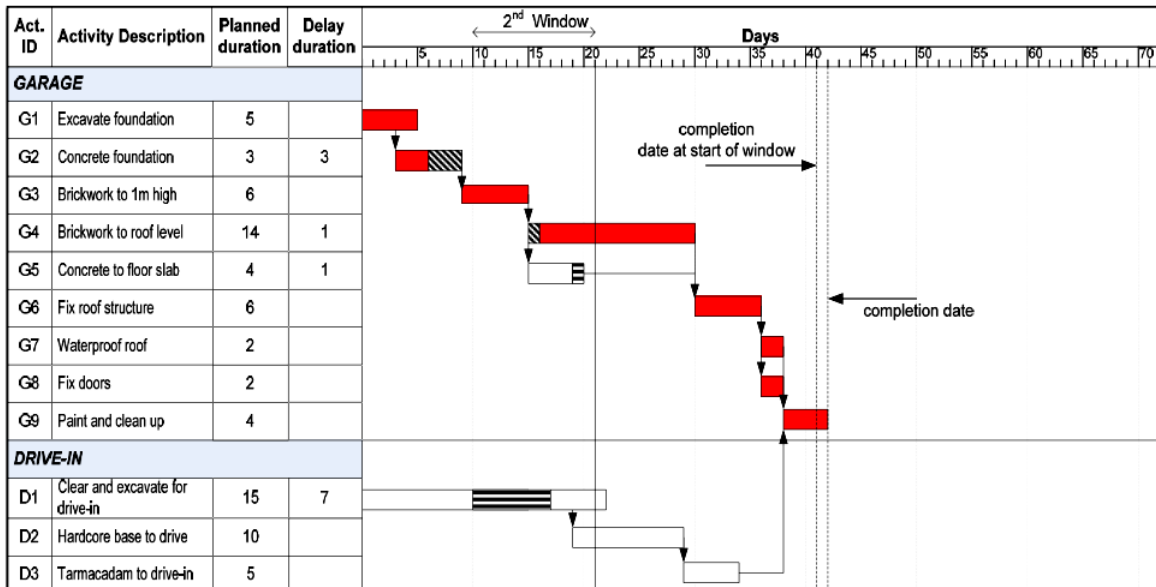


Figure 8: Updated schedule on day 21.

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- The updated schedule at the end of the 2nd window showed **1 day slippage** due to **1-day** delay by the contractor on the critical path G1-G2-G3-G4-G6-G7-G8-G9
- **3rd Window**

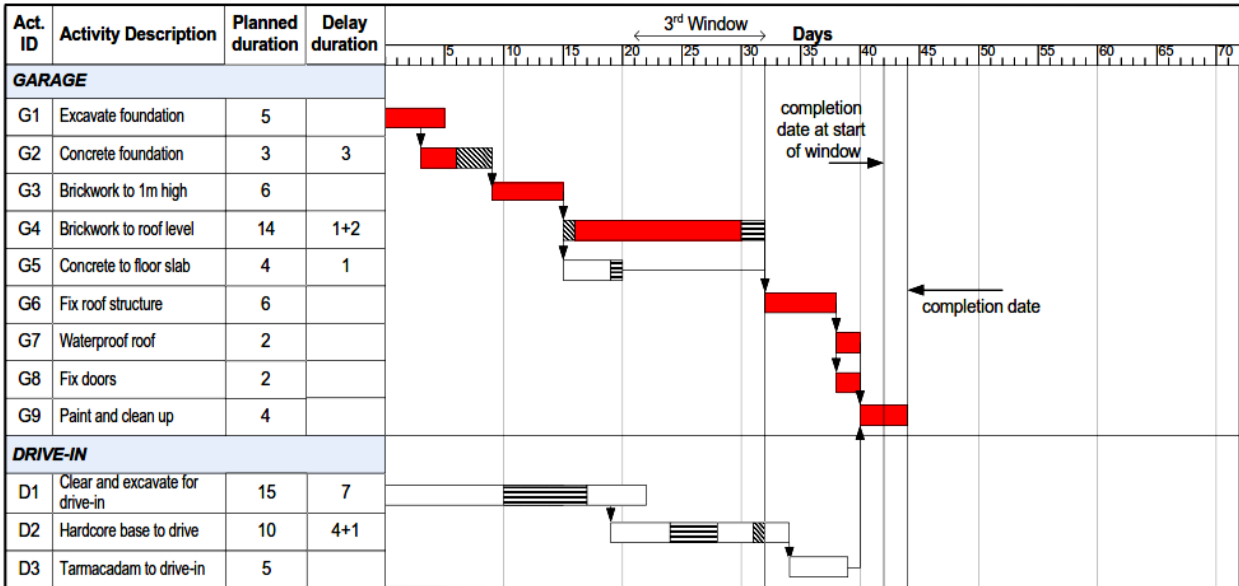


Figure 9: Updated schedule on day 32.

- There was **2 days** of project delay at the end of the 3rd window as a result of **2 days** delay by the owner on the critical path.
- **4th Window**

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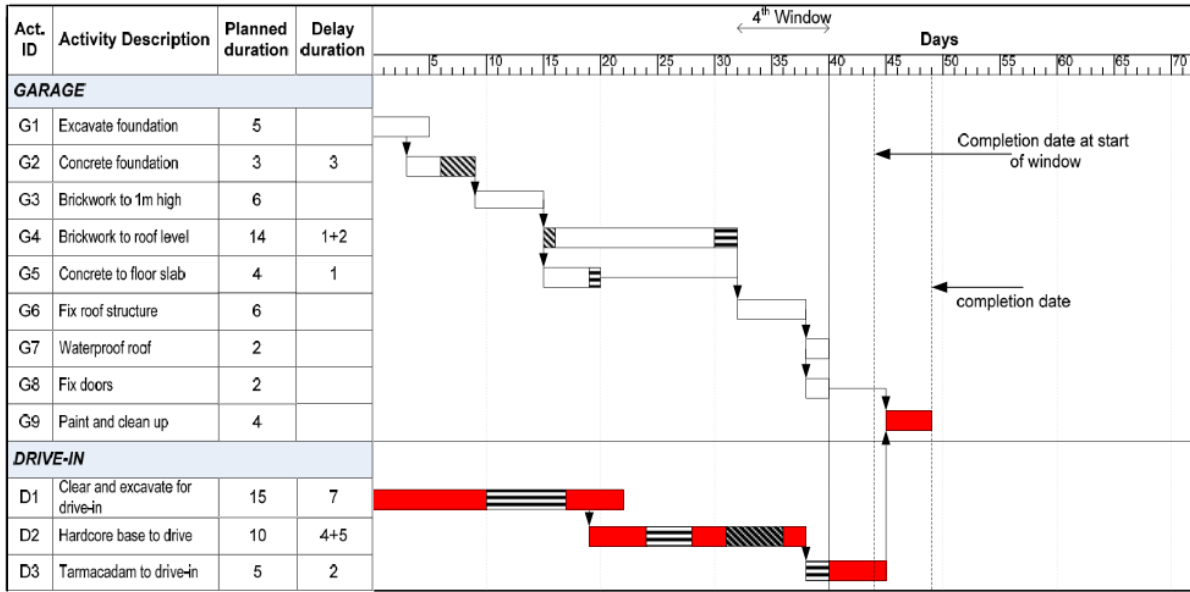


Figure 10: Updated schedule on day 40.

- The critical path changed to D1-D2-D3-G9 at the end of the 4th window, resulting in **5 days** slippage. Within this window:
 - o the contractor's delay responsibility is 2 days and
 - o the owner is 3 days.

- **5th Window**

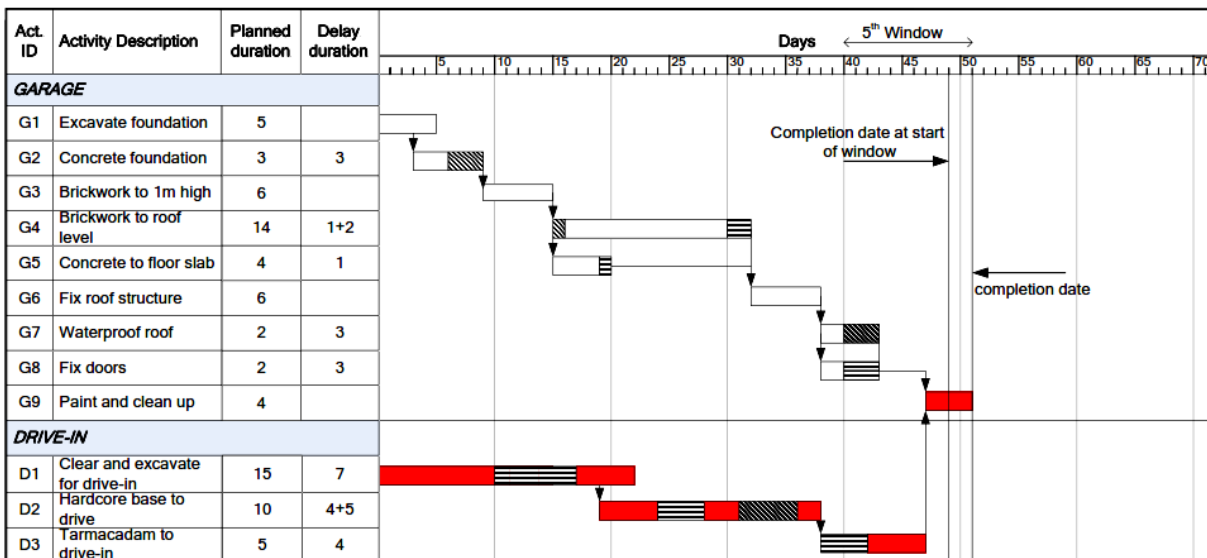


Figure 11: Updated schedule on day 51.

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- At the end of the last window, further 2 days’ slippage was caused by the owner along the critical path, D1-D2-D3-G9.
- Table 2 gives a summary of the results of this analysis.

Table 2: Window analysis result

Window Number	Schedule update (Days)	Completion date (Days)	Delays in Window	
			EC	NN
0(Start)	0	40	0	0
1	10	41	0	1
2	21	42	0	1
3	31	44	2	0
4	39	49	3	2
5 (Completion)	51	51	2	0
Total			7	4

- The contractor is responsible for 4 delays to the project whilst the owner is responsible for 7 days’ delay.

7.7.6 Requirements for Claims

For the claim to be successful, it has to **fulfill certain valid requirements**. These requirements are related to substantive requirements; procedural requirements; and proof requirements.

A. Substantive Requirements: By substantive requirement we mean supporting or giving justification for the claim by specifically citing or invoking the provisions of the Construction Contract; and/or of the applicable law.

The provisions of contract mean the relevant clause in the contract, which has been signed between the parties. The provisions of the applicable law means, the relevant article of the law, which is applicable to the contract, for e.g. The Civil Code.

The substantive requirement is also called the legitimacy requirement. Submitting a claim, without first establishing its legitimacy, under the Contract and/or under the applicable law is a futile exercise with no guaranteed return. Pursuing claims costs money & also corporate time.

B. Procedural Requirements

By procedural requirement we mean the serving of the required prior written notice to the designated party under the contract. This is called intention to claim. This prior written notice shall also be given within the contractually designated time scale. The time scale might be specific or reasonable.

The contract under consideration may specify such time scale in either way. Clause 20 of FIDIC is illustrative in this instance. There are also other clauses, which specify other (lesser or subjective) time scales depending up on the specific type of claims. The non-observance of the procedural requirement may result whole or partial loss of the substantive claim.

C. Proof Requirements

By proof requirement we mean the submission of the relevant documentation, which supports/corroborates the claims under consideration. The relevant documentation may relate, for example, to:

- Time (delay & disruption) claims;

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- Cost (additional payment) & profit claims;
- Variations claims; and
- Other construction claims;

They may contain a form of letters, notices or otherwise. In case of disputes the proof requirement, in addition to the relevant documentation, may also include factual witnesses; expert opinion; site visit or inspection; etc.

The claim process, presented on figure 7.5 (2), is generally includes three procedures claim submittal; claim processing; and claim enforcement.

A. Claim Submittal

This is a process by which the claimant is obliged to claim within a reasonable period of time (28-30 days in most contracts) followed by the claimant's preparation for all substantial documents & legal aspects supporting its entitlements for an official submittal.

This constituted that a claim has been filed for its consideration if all the three sub-processes called Claim Notification, Claim Preparation & Claim Submittal are fully undertaken by the claimant.

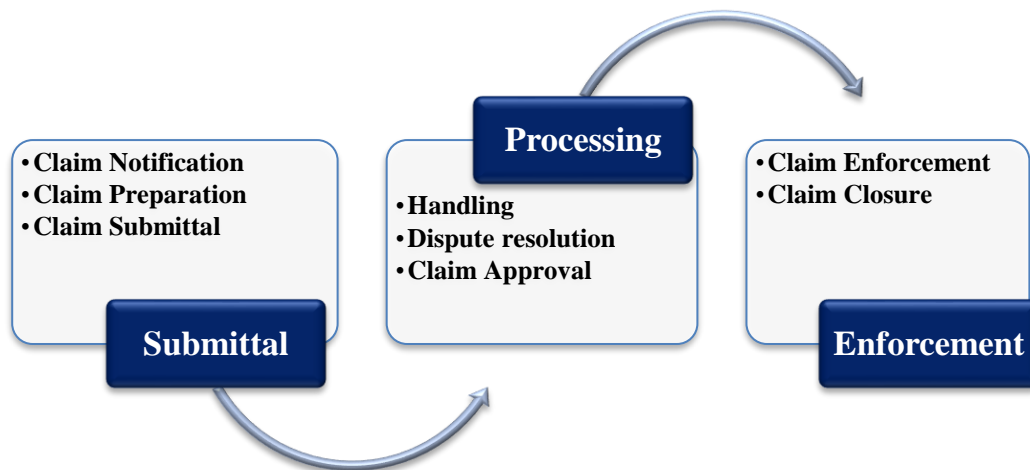


Figure 7.5 (2) : Claim administering process

B. Claim Processing

This phase further includes three sub-processes of claim handling, dispute resolution and claim approval.

- i. **The Claim Handling:** This sub-process initiates **checking of the claim** whether, it is legally or contractually supported or not, documents provided are valid and reliable to substantiate the claim for consideration or not, and overall procedural requirements have been followed or not.

After verifying the validity of the claim proper **computations & evaluations** will be carried out to present the proposed compensation for the contractual parties the claim is applicable to.

- ii. **Dispute Resolution**

The contractual parties will pass through different dispute resolution system depending on their acceptance over the proposed compensation varying from the simplest mediation by the consulting engineer to the final court ruling in the form of litigation.

Three types of dispute resolution systems are well recognized. These are,

- **Preventive** Dispute Resolution System; (by use of partnering, dispute resolution advisors, facilitators, ...)
- **Amicable** Dispute Resolution System; (through negotiation, mediation, conciliation, mini-trial, ...)
- **Judgmental** Dispute Resolution System; (through Dispute Adjudication Board, Arbitration, Litigation...)

Where dispute was handled in any form of its resolution system, it is termed as Dispute Resolution.

- iii. **Claim Approval**

Once the contractual parties agree on the final outcome of the claim process, then they have reached in to a stage where the claim is approved.

C. Claim Enforcement

This phase is sub-divided in to the following two sub-processes of claim enforcement and claim closure. The claim enforcement sub-process will entertain the inclusion of the approved claim into payment certificates where their enforcement is due. Once this compensation or entitlement is due in accordance with the approved claim and its enforcement requirements, then it is concluded for its closure. In order to account for such an administration process contracts provide claim clauses with in their provisions in their conditions of contract.

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