

## 1.1 Introduction:

Concrete is an important structural material and offers many advantages over structures made with other building materials. It is widely used for making buildings construction such as high rise buildings, pavements, bridges, highways, dams. It has good characteristics such as compressive strength, durability, fire resistance and reduces building maintenance costs and provides a longer service life. These factors and others make the selection of reinforced concrete an economical alternative.

Forms are extremely important in concrete construction. They are defined as a temporary structure whose purpose is to provide support and containment for fresh concrete until it can support itself. It molds the concrete to the desired shape and size, surface finish and controls its position and alignment. Concrete forms are engineered structures that are required to support loads such as fresh concrete, construction materials, equipment, workers, various impacts, and sometimes wind. The forms must support all the applied loads without collapse or excessive deflection.

Formwork system development has paralleled the growth of concrete construction throughout the 20th century. As concrete has come of age and been assigned increasingly significant structural tasks, formwork builders have had to keep pace. Form designers and builders are becoming increasingly aware of the need to keep abreast of technological advancements in other materials fields in order to develop creative innovations that are required to maintain quality and economy in the face of new formwork challenges.

A formwork system is defined as “the total system of support for freshly placed concrete including the mold or sheathing which contacts the concrete as well as supporting members, joists and stringers that act as primary and secondary beams, hardware, and necessary bracing.” Formwork system can be classified as:

1. **Formwork:** means the surface, support and framing used to define the shape of concrete until it is self-supporting.
2. **Falsework:** means the necessary support system that holds the formwork in the correct position. Or by other words if constructed properly, this mechanism of a plywood skin supported by timber wallings provides ample support for the setting concrete. The mechanism of transferring these loads to a solid support can be performed by numerous methods which are collectively known as falsework.

Formwork System can be also classified as: Vertical Formwork (Column and Wall) and Horizontal Formwork (Slab and Beam).

The possible loads acting on formwork are Vertical, Horizontal and Lateral loads. Vertical loads are usually associated with the dead load of the placed concrete and formwork and the live load of workers and their equipment. Internal pressures on vertical formwork result from the liquid or semi-liquid behavior of the fresh concrete. External forces such as wind exert horizontal loads on the forms, requiring bracing systems for lateral form stability.

Materials used in fabricating formworks include Timber, Metal and Plastics. Timber is commonly available material and has excellent strength, weight and cost factor. The initial cost of metal formwork is more than timber formwork but the number of reuses of metal formwork is higher than that of timber. In long run metal formwork can be economical.

Formwork is the largest cost component for a typical multistory reinforced concrete building. The cost of formwork exceeds the cost of the concrete or steel, and, in some situations, the formwork costs more than the concrete and steel combined. Formwork cost accounts for 40% to 60% of the cost of the concrete frame and for approximately 10% of the total building cost.

For some structures, placing priority on the formwork design for a project can reduce the total frame costs by as much as 25%. This saving includes both direct and indirect costs. Formwork efficiencies accelerate the construction schedule, which can result in reduced interest costs during construction and early occupancy for the structure. Other benefits of formwork efficiency include

increased jobsite productivity, improved safety, and reduced potential for errors.

The selection and effective use of formwork also dominate the success of a project in terms of speed, quality and dimensional accuracy of the final product.

## 1.2 Objectives of the Research:

There are specific objectives from this research to reduce the cost of formwork mentioned as follow:

- 1- To Study the different construction systems of **formwork** and **falsework** that achieve the work required for the project and materials used in fabricating.
- 2- To study of the effectiveness of the systems and the different types of Formwork systems used.
- 3- To study the design and construction of Formwork.

## 1.3 Research importance:

Formwork is a very significant portion of the project, as much as 60% of the final cost of the finished concrete project, and it's the first factor in determining the schedule of the project.

The purpose of formwork is to safely support the reinforced concrete until it has reached adequate strength. Thus, formwork is a temporary support for the permanent steel and concrete. The designer is responsible for producing a forming system that is safe, economical, and easily constructible at the jobsite. The overall quality of the completed project is highly dependent on the formwork.

This research presents the principles and techniques for analysis, design and construction of formwork for concrete structures. Because each structure is

unique, the formwork must be designed and fabricated based on the specific requirements of each job. The level of effort required to produce a good formwork system is as important as the level of effort required to produce the right combination of steel and concrete for the structural system of the structure. Formwork for concrete structures has a significant impact on the cost, time, and quality of the completed project.

## 1.4 Methodology:

- 1- Formwork requirements: Four major objectives must be considered; cost, safety, time, and quality of the completed project.
- 2- Types and Materials used in formwork.
- 3- Systems used in formwork.
- 4- Loads and pressures on formwork.
- 5- Design and construction of formwork.

## 1.5 The organizational steps for the research:

**CHAPTER (1):** A general introduction to the subject of the study, research objectives, the importance of research and the research methodology.

**CHAPTER (2):** This chapter deals with types & systems, materials and accessories used in Formwork construction.

**CHAPTER (3):** This chapter deals with different types of loads acting on the Formwork in addition to design and construction of Timber Formwork.

**CHAPTER (4):** This chapter deals with application for Timber Formwork.

**CHAPTER (5):** This chapter deals with final summary and recommendations.