

Chapter 04: Formwork and reinforcement of buildings structures

I- Formwork

Formwork is the structure, usually temporary, used to contain poured concrete and to mould it to the required dimensions and support until it is able to support itself. It consists primarily of the face contact material and the bearers that directly support the face contact material. False work is the more robust structure that holds temporary formwork in place is used in the temporary condition.

Formwork systems used for concrete frame construction have continued to develop significantly since the early 1990s. The major innovations have focused on on-site efficiency of production, health and safety, and environmental issues, driving the concrete construction industry towards ever-increasing efficiency.

Different formwork systems provide a wide range of concrete construction solutions that can be chosen to suit the needs of a particular development.

I-1 Traditional formwork:

For concrete construction normally consisted of bespoke solutions requiring skilled craftsmen. This type of formwork often had poor safety features and gave slow rates of construction on-site and huge levels of waste.

I-2 The modern formwork systems:

The main types of formwork systems in use now are:

- *System column formwork*



- *Horizontal panel*



Horizontal panel system

- *Slipform*



- *Jumpform:*



- *Vertical panel systems*

Vertical formwork panels on the construction of a residential building



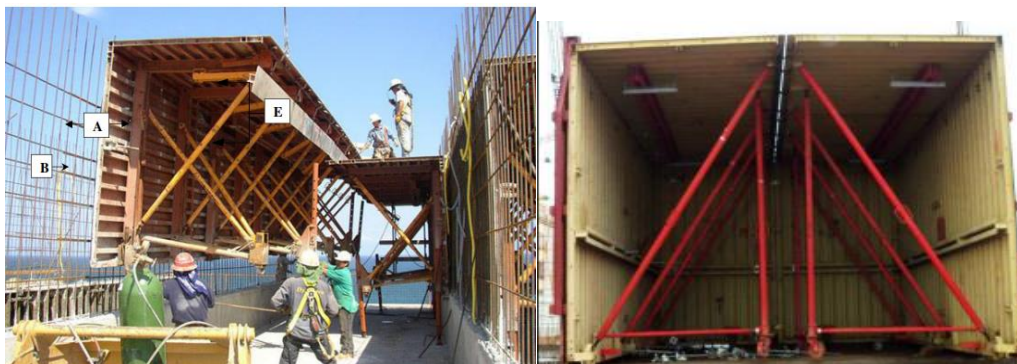
- *I- 3- Permanent formwork used in some types of hybrid concrete construction*

Still in use, but not as common as previously, are the types of forms that require swinging out from the side of the building. This is due to concerns about moving large objects over unprotected spaces:

- Table form/flying forms

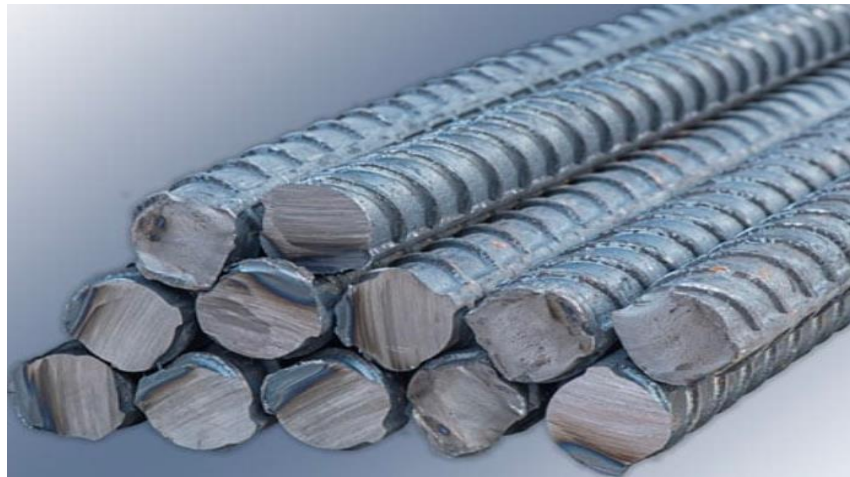


- Tunnel form



The modern formwork systems listed above are mostly modular, which are designed for speed and efficiency. They are designed to provide increased accuracy and minimise waste in construction and most have enhanced health and safety features built-in.

II- Reinforcement of buildings structures:



Reinforcement plays a crucial role in the construction industry, providing strength and stability to various structures. This essential component ensures that buildings can withstand external forces, such as natural disasters, load-bearing pressure, and the test of time. In this blog, we'll delve into the types of reinforcement used in construction and their respective applications, helping you gain a comprehensive understanding of their importance in building projects.

II-1 Definition:

Reinforcement in construction refers to the use of materials, typically steel, that are embedded in concrete or masonry structures to enhance their strength, load-bearing capacity, and resistance to external forces. These materials work in conjunction with concrete to form a composite material known as reinforced concrete, which combines the tensile strength of steel with the compressive strength of concrete.

II-2 Types of Reinforcement:

There are several types of reinforcement used in construction, each with its unique properties and applications.

Steel Rebars: Reinforcing bars, or rebars, are the most common type of reinforcement used in construction. They are made of high-strength steel and come in various diameters and grades to suit different applications. Steel rebars are versatile and can be bent, shaped, and positioned according to the requirements of the structure.

Steel Mesh: Steel mesh or welded wire mesh is a grid-like arrangement of steel wires, welded together at their intersections. This type of reinforcement is typically used in slabs, pavements, and precast concrete products to improve their tensile strength and distribute loads evenly.

Fiber Reinforced Concrete (FRC): FRC incorporates short, randomly distributed fibers into the concrete mix, which improves its tensile strength, reduces cracking, and enhances durability. Commonly used fibers include steel, glass, synthetic materials (such as polypropylene), and natural fibers (like sisal).

Prestressed Concrete: In prestressed concrete, steel strands or wires are placed under tension before the concrete is cast, creating internal stresses that counteract external forces. Once the concrete hardens, the tension is released, resulting in a stronger and more durable structure. Prestressed concrete is commonly used in the construction of bridges, beams, and slabs.

Post-Tensioned Concrete: Similar to prestressed concrete, post-tensioned concrete involves applying tension to the steel reinforcement after the concrete has hardened. This technique allows for greater control over the distribution of stresses within the structure and can be used to construct longer spans, thinner slabs, and more complex shapes.

II-3 Applications of Reinforcement in Construction:

Building Foundations: Reinforcement is critical in foundation construction, as it ensures the structure can bear the weight of the building and resist soil pressure. Steel rebars and mesh are typically used in foundations, such as footings, piles, and raft foundations.

Beams and Columns: Reinforced concrete beams and columns form the skeleton of a building, providing support for floors, roofs, and walls. Steel rebars and prestressed concrete are commonly employed in these applications to improve load-bearing capacity and resistance to bending.

Slabs and Floors: Reinforcement is essential for concrete slabs and floors, helping to distribute loads evenly, minimize cracking, and improve overall strength. Steel mesh, rebars, and fiber-reinforced concrete are frequently used in these applications.

Retaining Walls: Retaining walls are designed to hold back soil, and reinforcement is crucial for ensuring their stability and preventing collapse. Steel rebars and mesh are typically used in retaining wall construction.

Bridge Construction: Reinforcement is vital in bridge construction to support the weight of vehicles and pedestrians and withstand environmental factors like wind, earthquakes, and temperature fluctuations. Prestressed and post-tensioned concrete are widely used in bridge construction to achieve longer spans and enhanced durability.

Earthquake-Resistant Structures: In regions prone to seismic activity, reinforcement is crucial in ensuring the safety and stability of structures during earthquakes. Properly designed and installed reinforcement can help dissipate seismic energy and minimize damage. Steel rebars, fiber-reinforced concrete, and prestressed or post-tensioned concrete are commonly used in earthquake-resistant construction.

High-Rise Buildings: The construction of high-rise buildings demands robust reinforcement to support the immense weight and height of the structure, as well as to resist wind loads and other external forces. Steel rebars, prestressed concrete, and post-tensioned concrete are frequently employed in high-rise construction to provide the necessary strength and stability.

Marine and Coastal Structures: Reinforcement is vital in marine and coastal structures, such as piers, breakwaters, and seawalls, to ensure their durability and resistance to harsh environmental conditions, including saltwater exposure and wave action. Fiber-reinforced concrete and corrosion-resistant steel rebars are often used in these applications to enhance the longevity of the structures.

Precast Concrete Elements: Precast concrete is used to produce standardized elements, such as wall panels, beams, and columns, which are then transported to the construction site for assembly. Steel mesh, rebars, and fibers are commonly incorporated into precast concrete products to improve their strength, durability, and ease of installation.

Tunnels and Underground Structures: The construction of tunnels and other underground structures, such as metro stations and utility networks, relies heavily on reinforcement to provide support and stability. Steel rebars, mesh, and fiber-reinforced concrete are frequently used in these applications to ensure the safety and longevity of the underground infrastructure.

Conclusion

Reinforcement in construction is indispensable for ensuring the strength, stability, and durability of various structures. By understanding the different types of reinforcement and their specific applications, engineers and architects can design and construct buildings and infrastructure that are resilient, safe, and built to last. The numerous applications of reinforcement across the construction industry underscore its critical role in shaping the built environment and making it capable of withstanding the test of time and the forces of nature.