

Construction Engineering



NED UNIVERSITY OF ENGINEERING AND TECHNOLOGY

COMPLEX ENGINEERING PROBLEM
CONSTRUCTION ENGINEERING
GROUP

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Modern Building Construction Method

When it comes to building construction techniques, many of today's methods have remained unchanged for hundreds of years. But as technology advances and job site demand evolve, new techniques are needed to solve contemporary building problems. Leveraging the power of digital design, cutting-edge software, advanced automation, and precision robotics, modern building techniques have rapidly revolutionized the construction industry.

But what exactly are these modern building techniques and how can they be applied to your next project?

What are Modern Method of Construction?

Modern methods of construction (MMC) are innovative building construction techniques used by construction professional the streamline the construction methods help lower costs and reduce construction time while driving sustainability.

Modern construction method involves both onsite and offsite techniques, and the specific MMCs used by a construction company will vary depending on the nature of project. There are different types of modern construction techniques used by construction professional which we should know about.

❓ Pre-engineered/Precast Flat Panel System:

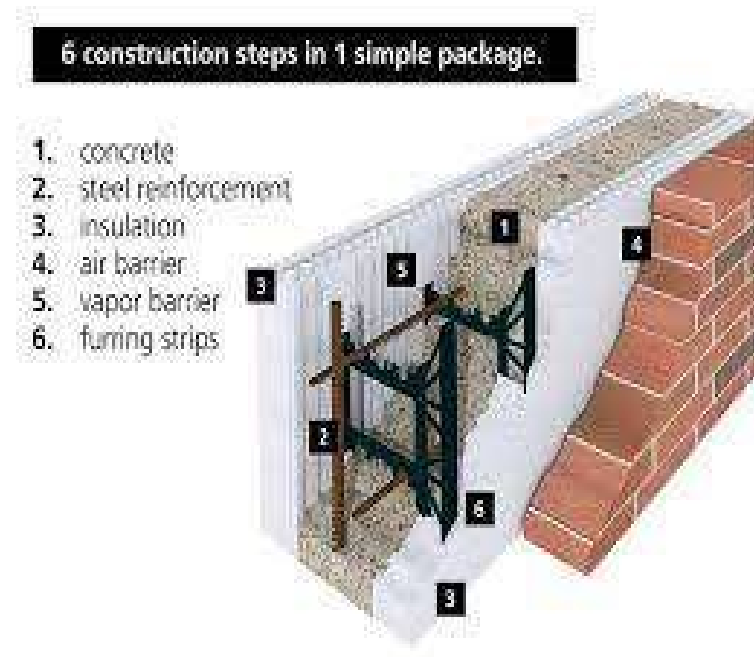
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Insulating Concrete Formwork (ICF) Technique:

- With an insulating concrete formwork (ICF) approach, builders use double-walled polystyrene panels as the basis for the wall of building. The empty panels are filled with construction-grade ready-mixed concrete to ensure a strong, durable structure. Airtight ICF systems provide excellent insulation for the both heat and sound and help building steady thermal mass energy.



Augmented Reality-Assisted Building:

Augmented reality (AR) has been touted as one of the most

innovative technologies adopted in the construction industry, and for good reason, Leveraging building information modeling (BIM) and wearable AR equipment, developers can explore fully-

rendered and completely accurate 3 rendering of particular structure. This is incredibly useful for preconstruction planning as well as determining specific materials required for construction in a new building system.

- **Timber Frame:**

- Using wood or timber frames is an indispensable modern building method thanks to advances in the manufacturing of engineered wood products. Engineered wood products (EWP) such as plywood panels are attached to the studs framed walls to provide structural support and surface area. Besides wood panels, there are also EWP posts and beams, which are designed to be stronger than similar components made from raw timber.

Construction Materials

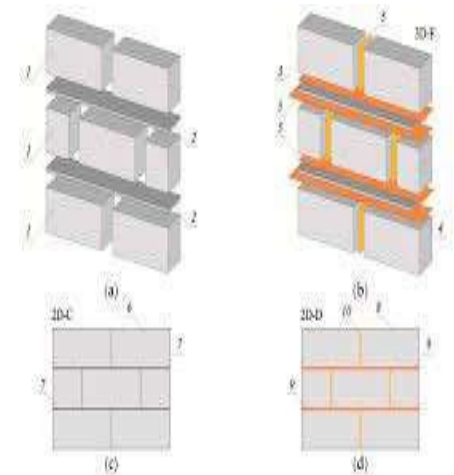
The three construction materials chosen for the Complex Engineering Problem are:

- Concrete
- Steel
- Glass

On the day of writing this report (12th December), Concrete and Glass have been explored to some extent.

Concrete

Concrete is one of the most important materials in construction practice around the world and even more so in the middle- eastern and south Asian region. It is a mixture of coarse and fine aggregate, cement and water. It is relatively economical and bears compressive loads extremely well. It is liquid initially hence it can be made into different shapes



Chemicals can be added to concrete while it is plastic which can increase its setting time.

Some of its drawbacks are:

Low tensile strength

Dangerously low ductility

Significant self-weight

Steel reinforcement is added to concrete to counter the low tensile strength and low ductility otherwise the failure would be abrupt and hence potentially life threatening. Low tensile strength also causes cracking in concrete which is aesthetically unpleasant.

Some latest concrete technologies include Ultra High Performance Concrete (UHPC) and Graphical concrete. In the local scene, traditional concrete of up to 6000 psi is usually used.

- Concrete is generally the most used construction material in comparison to other materials (i.e wood, steel) in all regions but that's even more true for Pakistan. Hence implementation of modern techniques and technologies related to concrete will spell a huge boost for local construction.
- Steel
- Steel and concrete go hand in hand as reinforced concrete which is the most common and important structural element. Its primary function is to resist the tension in the structure that plain concrete cannot bear. There are different grades of steel available commercially. The difference in grades is mainly dependent on percentage of carbon.

The more carbon steel has the more its strength and vice versa for ductility.

Some of the advantages of using steel are:

High tensile strength

Assists concrete in compression

High ductility

Structures may be constructed of steel and concrete or steel primarily. There are some famous bridges and towers made entirely of steel because of its high strength. Steel can also be made into cables to produce members of very high tensile strength commonly observed in bridges and large structures in general.

- Some disadvantages of steel are:
- Expensive
- Maintenance
- Thermal conductor (requires fireproofing)
- Susceptible to buckling
- Steel is not used commonly in the local scene. In the global industry new technologies are in place regarding steel construction such as the integration of advanced composite materials in steel which offers a better strength to weight ratio and corrosion resistance which results in stronger, lighter and more durable steel.

Construction equipments



Construction equipments:

- Tools and equipment are essential components in the construction industry for building, demolition, and excavation activities.
- These items range from simple hand tools like hammers, saws, and screwdrivers to heavy machinery like excavators, bulldozers, and cranes.
- The specific tools and equipment employed depend on the project's size, complexity, and construction task. Accurate maintenance and function of these tools and equipment are vital for a successful construction project

These equipments is use to save the time and perform the work with good efficiency over time to time.

These equipments use to perform same task repeatedly without being break.

TOOLS:

- Hand tools like hammers, saws, drills, and screwdrivers are used for cutting, and shaping materials.
- Power tools like circular saws, table saws, grinders, and sanders offer more power and efficiency than hand tools.
- Machine-operated tools like bulldozers, excavators, cranes, and forklifts are used for heavy-duty construction tasks, such as earthmoving, lifting, and transporting materials.

Besides these equipment it include many like Trenchers Cutter, Tower crane are large equipments it include scoop, pile driver (Used to drive piles into the soil to provide foundation support for buildings), paver and compactor in road construction, staff (in surveying), trowel or spirit level.

Here are some of the commonly used heavy equipment in construction

- **Excavators:** Excavators are important and widely used equipment in the construction industry. Their general purpose is to excavation but other than that they are also used for many purposes like heavy lifting, demolition, river dredging, cutting of trees, etc.
- **Backhoe:** Backhoe is another widely used equipment which is suitable for multiple purposes. The hoe arrangement is provided on the back side of the vehicle while loading bucket is provided in the front.

- This is well useful for excavating trenches below the machine level and using front bucket loading, unloading and lifting of materials can be done.
- **Dragline Excavator:** Dragline excavator is another heavy equipment used in construction which is generally used for larger depth excavations. It consists of a long length boom and digging bucket is suspended from the top of the boom using cable. For the construction of ports, for excavations under water, sediment removal in water bodies, etc. can be done by dragline excavator.
- **Bulldozers:** Bulldozers are another type of soil excavating equipment which are used to remove the topsoil layer up to a particular depth. The removal of soil is done by the sharp-edged wide metal plate provided at its front. These are widely used for the removal of weak soil or rock strata, lifting of soil, etc.

- **Graders:** Graders also called as motor graders are another type of equipment used in construction especially for the construction of roads. It is mainly used to level the soil surface. It contains a horizontal blade in between front and rear wheels and this blade is lowered into the ground while working.
- **Positive usage:**
 - Equipment is used to save time on site as compare to labor work.
 - It help in minimum chances of injuries and to lift heavy load and move from one place to another easily within time.
 - Through equipments we can calculate the production ,expected
 - Time take in excavation or any other process.

CHALLENGES AND PROBLEM:

- Like in case of crane if part of it broken or engine not start or any issue related to that so it will take time to recover.
- Improper handling of instruments which result in more time.
- Use of old equipments instead of new.
- Select the equipment according to requirement.
- Sustainability:
- It is important to select material base on good quality that donot break during working and don't damage the material on site.
- In case of large equipments proper maintainance should be taken place and proper monitering of equipments take place.

The Construction Process: Building Foundations

- Every construction project, from the small bathroom renovation to the towering skyscraper, has a similar process. Each project requires planning and design. You also need to consider inventory, resources, and manage supplies, the actual construction of the project needs to be managed, and there will be post-construction details to tie-up.

Project Initiation and Planning

Every construction project begins with a vision. The initiation phase involves defining the project scope, objectives, and constraints. Comprehensive planning, including feasibility studies budgeting, and risk assessment, sets the foundation for the subsequent stages.

Design and Engineering

- The design phase translates concepts into tangible plans. Architects and engineers collaborate to create blueprints that guide the construction process. This phase involves crucial decisions regarding materials, structural integrity, and adherence to local building codes.

Permitting and Regulatory Approvals

Before construction begins, obtaining necessary permits and approvals is imperative. Compliance with local regulations ensures that the project meets safety standards and environmental requirements. This stage often involves navigating bureaucratic processes to secure the necessary go-aheads.

- **Site Preparation**

Clearing the construction site, excavating, and preparing the ground are essential steps. This phase sets the stage for the actual building process. Proper site preparation ensures a stable foundation and facilitates subsequent construction activities.

- **Foundation Construction**

Building upon a solid foundation is paramount. Various foundation types, such as slab, crawl space, or basement, are chosen based on the project's requirements and site conditions. Precise execution in this phase is crucial for the overall stability and longevity of the structure.

Structural Framing

The skeleton of the building takes shape during the framing stage. Whether using steel, wood, or concrete, the structural framing provides the framework for walls, floors, and roofs. Attention to detail is crucial to ensure the structural integrity of the entire building.

Mechanical and Electrical Systems

MEP systems, including heating, ventilation, air conditioning, electrical, and plumbing, are installed to make the building functional. Coordinating these systems is essential for seamless operation and efficiency.

Interior Finishes

The interior finishes bring the project to life. Flooring, painting, cabinetry, and other finishes are applied to create a functional and aesthetically pleasing space. Attention to detail in this phase enhances the overall quality of the construction.

- Final Inspections and Handover
- Before the project is handed over to the client, thorough inspections are conducted to ensure compliance with regulations and quality standards. Any necessary adjustments are made, and the completed project is turned over to the owner.

THE END

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