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Modern Trends in Construction

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Abstract- Recent trends in construction become indispensible in the coming years to emphasize on sustainable development. The paper discusses the significance and scope of modern trends in construction techniques as foundations, foundation in problematic soil, walls, doors, windows, lintel and shelves, damp proofing, water proofing, floors, roofs. The paper emphasizes on using different types of materials in modern trends and for effectiveness in infrastructure building for rapid economic growth and development of a nation using recent advancements in the field of construction technology.

Keywords- walls, doors, windows

I. INTRODUCTION

Building construction is one of the earliest activities associated since the beginning of the human civilization as man has always needed a shelter against natural enemies and predator and also to protect himself from the vagaries of nature and the extremities of climatic and weather conditions. Thus, through all these centuries there evolved a variety of materials used for building purposes. The applications of these materials, natural as well as manufactured by man, have itself been subject to wide variations and innovations. Research and development has never stopped, but has ever continued to evolve newer materials and better techniques to apply them to the needs of the construction activities. Recent decades have witnessed the introduction of a large numbers of new materials and new types of construction methods to improve and economies upon the previous methods, and much development has been done both in India as well as abroad in this field. The objectives of this paper is to give you an idea of the new materials developed and the new techniques evolved in construction industry, which are important from the point of view of providing mass-housing for a growing population.

Modern Trends In Construction Technology

With the introduction of mechanization and mass production, there has been a vast improvement in construction techniques. New materials are being developed and new research is continuously in progress to affect economy and improve durability. Use of various forms of energies like electricity, gas, heating and cooling (refrigeration and air-conditioning), etc. have drastically changed the scenario. Availability of some of the conventional type of materials is getting reduced, while new and more efficient materials are being developed.

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I. Foundations

In olden days, the foundations are a simple foundations like step foundations for wall construction, etc. Now-a-days, special structural requirements are demanding special types of foundations like pile foundations, cassions, etc. Also various ground improvement techniques are used for problematic soils for better and economical foundation designs. Foundations are mainly divided in two groups:

(a) Shallow Foundation

When the width is greater than the depth of the foundation, e.g. wall and column footings, rafts, etc. the foundations are categorized as shallow foundations. These are generally used for soils with good bearing capacity.

(b) Deep Foundations

Those foundations where the depth is much larger than the foundation width are termed as deep foundations, e.g. piles, cassions, etc.

II. FOUNDATION IN PROBLEMATIC SOILS

In design of foundations, the imposed load and soil characteristics, e.g. bearing capacity and settlement, etc. are the main criteria. Special foundation techniques are required where the soil is problematic. Such soils are loose cohesion less soil with high water table, saturated fine silt, saturated clays, expansive clays (also known as black-cotton soil), etc. New methods of geotechnical soil exploration and field investigation provide solutions to such difficult problems.

Methods of Ground Improvement -

There are several methods of ground improvements, e.g. drains, stabilization, preloading, tamping, lime piles, etc. However, they are costly and require special equipment and skill to execute the work.

(a) Sand Drains or Sand Piles

These are used for quicker consolidation, though these are costly and sometimes tend to fail.

Rope drains are made of coir fabric. It is driven in ground by enclosing in steel pipes, which are subsequently withdrawn leaving the rope of fabric in place. After installing the drains the ground is loaded by sand gravel, etc. to produce the desired loading intensity.

(b) Granular Piles

These are made by making a boring hole in the soil by 200 mm diameter deep augur.The bore hole is cleaned and filled with sodium bentonite solution after withdrawing the casing. These granular piles use made by filling of 15 mm to 70 mm stone chips and 20-25% of sand in a compacted form.

(c) Skirted Foundation

A rigid RCC skirt is provided around a footing foundation confining the soil below it. This is known as a “soil plug”. Rigid skirting increases the bearing capacity and reduces the settlement appreciably.

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These types of foundations are suitable and commercially viable, if soil-bearing capacity is less than 75 kPa (7.5t/m^2).

(d)Under-reamed Piles

Under-reamed piles are now commonly used in expansive soils (known as black cotton soils) and also for transmission towers to resist the uplift pressure due to wind. The expansive soils exhibit swelling and shrinking characteristics due to moisture movement. Under-reamed piles are bored cast-in-situ concrete piles having one or more bulbs. Board compaction piles, pre-cast driven piles, and diaphragm walls are some of the techniques used to carry very heavy loads in poor soil conditions. Now-a-days heavy load structures like multi-storied apartment houses, fly-over and bridges becoming quite common.

II. Walls

Some of the modern techniques in construction of masonry walls are discussed below:

(a) Cavity Wall Construction

This type of construction is done where good heat insulation is required like AC buildings, etc. A 200 mm thick cavity wall consists of a 50 mm air gap between the 75 mm masonry leaves. These two leaves are tied together by metal tiers, bricks or concrete blocks (maximum spacing 460 mm vertically and 750 mm horizontally). Besides heat insulation, it keeps the inner face of walls dry and can conceal.

(b) Masonry with Non-conventional Bonds

You are already familiar with English and Flemish bonds in conventional brick masonry walls. However, some non-conventional types of bonds have been introduced to obtain economy in materials and cost and also to have better resistance against moisture penetration. Also it calls for better aesthetics and even surfaces.

(c) Hollow Concrete Block Masonry

This masonry is produced according to IS: 2185-1967. It is of 400 mm length and 200 mm height and the width of 300, 200 or 100 mm. Its advantages are reduced mortar consumption, lightweight and faster construction. A disadvantage is the appearance of shrinkage cracks in masonry if proper precautions are not taken while constructing it.

III. DOORS, WINDOWS, LINTELS AND SHELVES

(a) Doors and Window Frames

As timber has become costly, timber door frames are gradually being replaced by angle iron door-frames and reinforced concrete door frames. In the termite-infested areas these types of window frames are very useful. The anti-termite is an added feature to the cost of timber windows and doors. The only difficulty is to fix them into place a skilled manpower is needed.

(b) Frameless Shuttering

CBRI has developed frameless shutters working on pivot and fork system. These look simple and are easy to install and economical in its construction. They have been widely used in buildings, thus reducing the overall cost of doors.

(c) Pre-cast RC Lintels

Pre-cast lintel makes construction faster by eliminating shuttering, centering, etc. at lintel level. It, therefore, provides an overall saving in materials and labour for correcting it. In case of changes over external windows both lintel and chajja may be pre-cast together.

(d) Pre-cast Shelving Units

Similarly, we can have pre-cast shelving units of different modular construction schedule. These shelves look good and require less time to construct.

III. Damp-proofing and Water-proofing

Dampness is one of the most common and serious defects in buildings. It may be due to capillary rise of water from foundation, direct penetration of moisture through joints of walls, roof, etc. or lay leaking pipes and water mains. The common constructional defects causing leakage are:

- Absence of DPC or a defective damp proof course (DPC),
- Defective floors,
- Porous masonry work,
- Defective water supply and sanitary pipes,
- Insufficient water proofing of roofs, parapets and their joints, and
- Defective construction at chajja and lintel joining with walls.

(a) Damp Proof Course Insertion in Existing Walls

In walls constructed without DPC, an insertion of bituminous felt is made by making a semi-cut in the wall at horizontal bed joint. Another method is by injecting latex silicate after making holes at suitable intervals.

(b) Damp-proofing with Silicone Compounds

Where dampness is caused by large exposed surfaces on walls the treatment consists of an under coat of bentonite clay and water-proof chemical compounds dissolved in water. The finishing coat is alone of sodium silicate with some water-soluble chemicals.

(c) Application of Sediments to Joints and Cracks

In case of leakage caused through joints and cracks, bituminous sealant is applied under pressure after cleaning and opening it.

(d) Flat RCC Roofs

Water proofing is done by mud phuska with brick bites. Initially, a coat of hot bitumen @ 1.7 kg/m^2 of roof area or polyethylene sheet is laid. Over this 100 mm average mud phuska rendered by cowdung plastring is laid, over which one-time layers of brick tiles is laid and pointed with 1:3 cement water. This is a traditional method along with lime terracing.

(e) Ferrocements

It is a latest type of construction being highly crack resistant, impervious and resistant to thermal change. It can be used with advantage as an ideal light weight construction. It is produced by providing a layer of galvanised square or hexagonal mesh with 20/24 gauge wire. The 5 mm thick cover blocks are inserted to maintain cover above roof surface. Cement slurry is spread over the roof surface before laying the 1: 3 cement sand mortar of 20 mm thick. Water-proofing compounds (2-4%) are added to the dry mix. Water-cement ratio is kept at 0.4. The usual curing is started after 12 hours of laying the mortar.

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IV. FLOORS AND ROOFS

Here some of the recent techniques introduced in roof slab construction are reported.

(a) Thin RC Ribbed Slab

It consists of pre-cast RCC ribs 110 mm × 2200 mm up to 1.2 m c/c with 50 mm thick cast-in-situ RC flange above.
The flange portion is cast using plane simple plywood shuttering panels covered with GI sheets. Compared to conventional in situ RC slab, this method results in saving of 20-35% in overall costs.

(b) Waffel Unit Flooring System

Due to usage of pre-cast moulding materials this type of flooring system is faster in construction and saves time.

(c) Lift Slab Construction

In this construction system, several slabs are cast one over another. After completing the casting and attaining strength they are lifted up using the hydraulic jacks of the order of 70 tons capacity. If the height is more than 4 storeys, the columns are also extended in a staged manner. The slabs are fixed to the column by means of collars, which are embedded in the slab, and shear plates, which are welded to the column reinforcement at the correct floor level.
It is convenient to cast floors one on the top of other, without having to erect and dismantle shuttering, which cost 30 percent of the total cost of slab. Productivity is increased as all the slabs are cast at the ground level. However, in India, so far the lift slab construction has been done only at experimental stage. In lift slab construction, all the slabs of multistoried building are cast at the ground level one above the other with a separating medium in between. They are then lifted to their final position by means of jacks and are permanently "connected" to the columns. The walls are filled in later on. The foundations and columns are built in the traditional RCC or steel construction. The slabs can be cast every alternate day. After the slabs have attained sufficient strength, they are lifted by using hydraulic jacks (of 70 t capacity). The slabs are connected to the jacks by high tensile wires. All jacks are simultaneously controlled from a single consol. The lift rate may be 1.2 to 4 m/hr. The slabs are fixed to the columns by means of collars (embedded in the slab) and shear plates, which are welded to the columns. This type of constructional shuttering costs about 1/3rd of the total costs of the slab and also the rate of erection is faster.

(d) Ferrocement

Flooring/Roofing

Ferro-cement is a highly versatile form of reinforcement work and it is a crack proof material. It has more life because quality rich cement concrete mortar is used in this type of construction. These are used in many forms depending on the requirement. These may be pre-cast units or cast-in-situ.

Types of material in modern trends and their uses-

Rapid technological progress in the recent decades has caused a big change in the production techniques of the traditional building materials like bricks, tiles, timbers, cement, concrete, etc. At the same time newer materials like polymers, bituminous compounds and plywood products have come into greater use in the construction industry.

I. Bricks and tiles

Mechanized methods of production
(a) Soil Preparation
(b) Moldings
(c) Drying
(d) Firing.

II. Special Bricks

Some special bricks are being produced to cater for the special needs as required as following:
(a) Engineering Bricks
(b) Coloured Bricks
(c) Perforated Bricks
(d) Modular Bricks

III. Cement

(a) Wet Process
(b) Dry Process
(c) Semi-dry process

IV. Concrete

(a) Lightweight Aggregate Concrete
(b) Cellular Concrete (Aerated Concrete)
(c) Admixtures in Cement Concrete

V. Floor Finisher

(a) In-site floor finish, or
(b) Jointed floor finishes.

VI. Timber Products

(a) Seasoning
(b) Wood Preservation
(c) Building Boards
(d) Insulation Boards
(e) Hard Boards

VII. Bituminous Compounds

(a) Asphaltic Roofing Sheet
(b) Bitumen Based Damp Proof Course

VIII. Polymers and Plastics

(a) Plastics
(b) Fibres
(c) Rubber
(d) Paints

IX. Main techniques in polymerization process:

(a) Mass Polymerization
(b) Solution Polymerization
(c) Emulsion Polymerization
(d) Suspension Polymerization

V. CONCLUSION

We can say that now in days the technology is working on different aspects and new techniques are developed day by day for fulfilling the requirements of construction. The developing of new material with mixing of no. of different elements and make a new material with different characteristics is the new thing comes in everyday life. In short we are developing different new techniques as well as different materials for growing up of construction field and we have to develop these for environment and human's goodness purpose.

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