GLOBAL HOUSING TECHNOLOGY CHALLENGE INDIA

प्रधान मंत्री आवास योजना-शहरी
Pradhan Mantri Awas Yojana-Urban

Ministry of Housing and Urban Affairs
Government of India

Azadi Ka Amrit Mahotsav

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

RACHNA

RESILIENT, AFFORDABLE AND COMFORTABLE HOUSING THROUGH NATIONAL ACTION

Innovative Construction Technologies & Best Construction Practices

09/06/2022

Presented by South Cluster CSB Cell

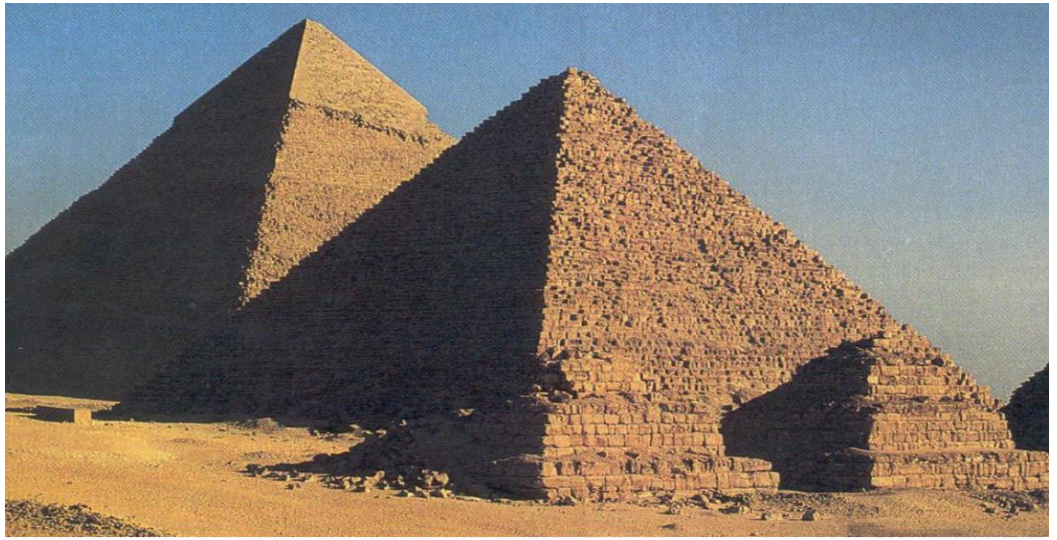
INTRODUCTION

Introduction:

This training is meant for people working at site whose skills reflect in the quality of construction.

Though termed as masons, these operators are to deal with foundations, concreting, reinforcements, form work, pavements, repairs and finishing.

So let us see what are the common errors seen in a built facility and how they are caused.



Construction methods are as old as ancient civilisations.

Light House Project

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Light House Projects

As a part of **GHTC- India**, six Light House Projects (LHP) consisting of about 1,000 houses each with physical & social infrastructure facilities is being constructed at six places across the country namely

1. Indore
2. Rajkot
3. Chennai
4. Ranchi
5. Agartala
6. Lucknow

These projects will showcase the use of the six distinct shortlisted innovative technologies for field level application, learning and replication. LHPs will demonstrate and deliver ready to live mass housing at an expedited pace as compared to conventional brick and mortar construction and will be more economical, sustainable, of high quality and durability. These projects shall serve as Live laboratories for all stakeholders including R & D leading to the successful transfer of technologies from the lab to the field

Prime Minister Narendra Modi during the foundation laying ceremony of Light House Projects in six States, via videoconference, in New Delhi on January 1, 2021. Twitter/@narendramodi

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LHP Indore

Prefabricated Sandwich Panel System

Number of Houses : 1024

- Factory made Prefabricated Sandwich Panel System is made out of cement or calcium silicate boards and cement mortar with EPS granules balls, and act as wall panels.
- These replace conventional brick & mortar walling construction practices and can be used as load-bearing and non-load bearing walling for residential and commercial buildings.
- Under this LHP, houses are being constructed using Prefabricated Sandwich Panel System with Pre-Engineered Steel Structural System.
- In this system the EPS Cement Panels are manufactured at the factory in controlled condition, which are then dispatched to the site. The panels having tongue and groove are joint together for construction of the building.

LHP Rajkot

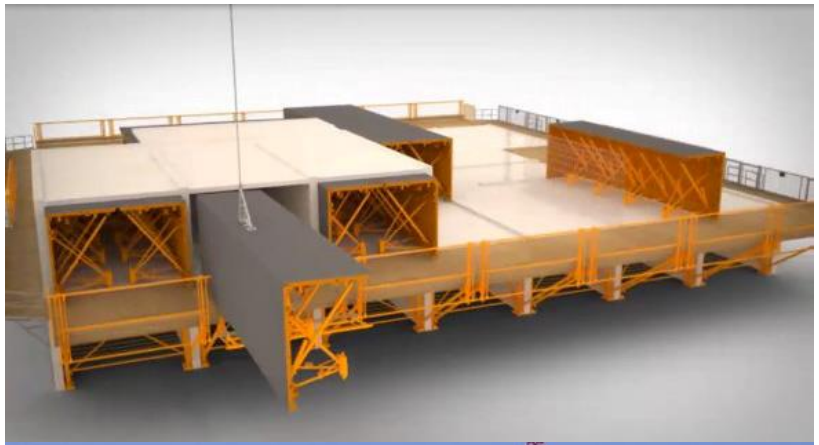
Monolithic Concrete Construction using Tunnel Formwork

- In 'TunnelForm' technology, concrete walls and slabs are cast in one go at site giving monolithic structure using high-precision, re-usable, room-sized, Steel forms or moulds.
- The system intends to replace the conventional RCC Beam-Column structure which uses steel/plywood shuttering.
- 'TunnelForm' system uses customized engineered steel formwork consisting of two half shells which are placed together and then concreting is done to form a room size module. Several such modules make an apartment.

Construction Process:

- Stripping of the formwork from the previous day.
- Positioning of the formwork for the current day's phase, with the installation of mechanical, electrical and plumbing services.
- Installation of reinforcement in the walls and slabs.
- Concreting

Number of Houses : 1144



LHP Chennai

Precast Concrete Construction System – Precast Components Assembled at Site

- Precast concrete construction is a system where the individual precast components such as walls, slabs, stairs, column, beam etc, of building are manufactured in plant or casting yard in controlled conditions. The finished components are then transported to site, erected & installed.
- The construction process comprises of manufacturing of precast concrete Columns, Beams and Slabs in steel moulds.
- The reinforcement cages are placed at the required position in the moulds. Concrete is poured and compaction of concrete is done by shutter/ needle vibrator.
- Casted components are then moved to stacking yard where curing is done for requited time. These precast components are installed at site by crane and assembled together through in-situ jointing and/or grouting etc.

Number of Houses : 1152

Ground Floor Column Work in Progress - March 2021

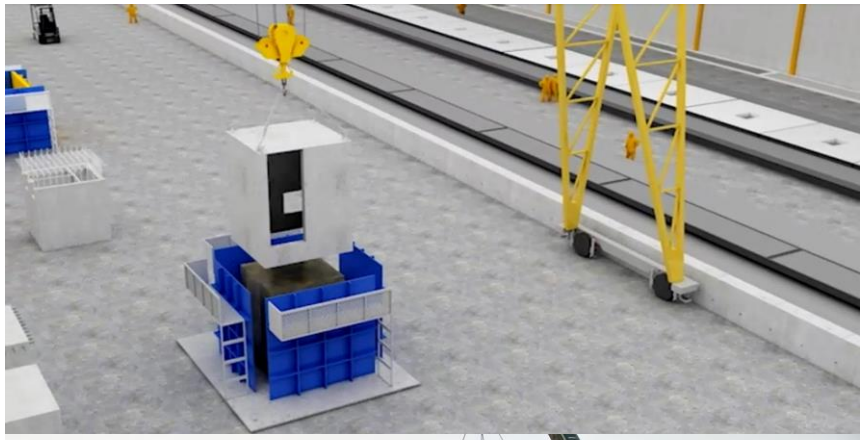
First Floor Column & Beam Erection - May 2021

LHP Ranchi

Precast Concrete Construction System – 3D Volumetric

- 3D Volumetric concrete construction is the modern method of building by which solid precast concrete structural modules like room, toilet, kitchen, bathroom, stairs etc. & any combination of these are cast monolithically in Plant or Casting yard in a controlled condition.
- These Modules are transported, erected & installed using cranes and push-pull jacks and are integrated together in the form of complete building unit.
- Factory finished building units/modules are installed at the site with the help of tower cranes. Gable end walls are positioned to terminate the sides of building.
- Pre stressed slabs are then installed as flooring elements. Rebar mesh is finally placed for structural screed thereby connecting all the elements together. Consecutive floors are built in similar manner to complete the structure.

Number of Houses : 1008



LHP Agartala

Light Gauge Steel Structural System & Pre-engineered Steel Structural System

- Light Gauge Steel Frame (LGSF) System uses factory made galvanized light gauge steel components. LGSF is used in combination with pre-engineered steel structural system for buildings above G+3 for longevity, speedier construction, strength and resource efficiency.
- The sequence of construction comprises of foundation laying, fixing of Pre-Engineered Steel Structural System, fixing of tracks, fixing of wall panels with bracings as required, fixing of floor panels, decking sheet, fixing of electrical & plumbing services and finally fixing of concrete walling panels with light weight concrete as infill.
- The other options of dry walling components such as sandwich panels with insulation material in between can also be used. Similarly, the floors can either by composite slab/deck slabs/precast hollow core slabs as per the need & requirements.

Number of Houses : 1000

LHP Agartala

PVC Stay In Place Formwork System

- Plant manufactured rigid poly-vinyl chloride (PVC) based polymer components serve as a permanent stay-in-place finished form-work for concrete walls. The formwork System being used acts as pre-finished walls requiring no plaster and can be constructed instantly.
- Construction is done in a sequential manner where at first, the Prefabricated PVC Wall panels and Pre-Engineered Steel Structural Sections as per the design are transported to the Site.
- Then, these Sections are erected on the prepared foundation using cranes and required connections. Floor is installed using decking sheet. Once the structural frame and floor is installed and aligned, wall panels are fixed on decking floor.
- The pre-fabricated walling panels having provisions of holes for services conduits, are fixed along with the reinforcement & cavities inside the wall panels are filled with concrete. Upon installment of wall panels, flooring and ceiling, the finishing work is executed.

Number of Houses : 1040

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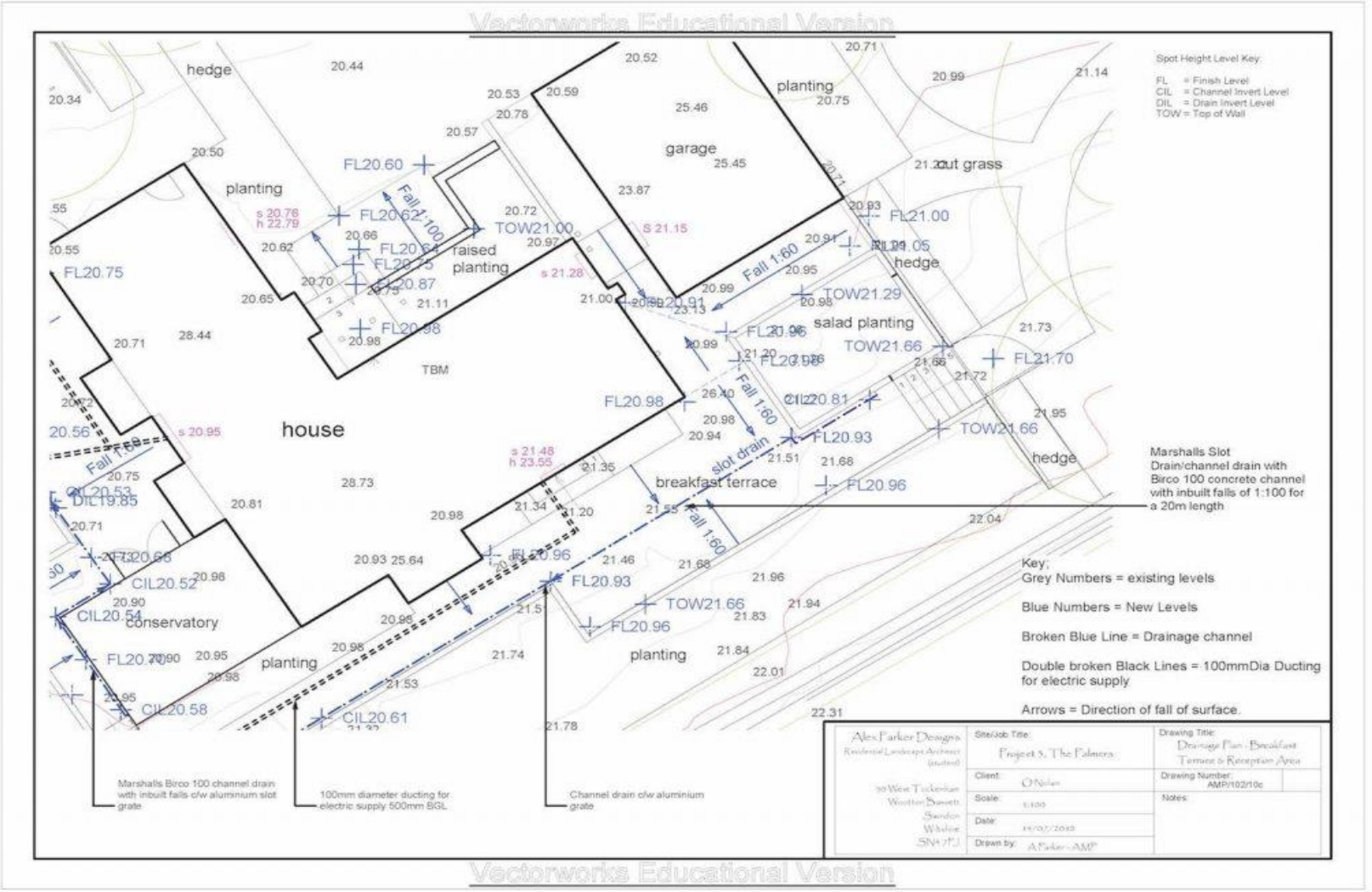
Construction Best Practices

INTRODUCTION



INTRODUCTION

LAYOUT OF SMALL BUILDING USING TOTAL STATION

1. On the plan supplied by an architect, number the column serially from left to right and top to bottom starting from top left corner.

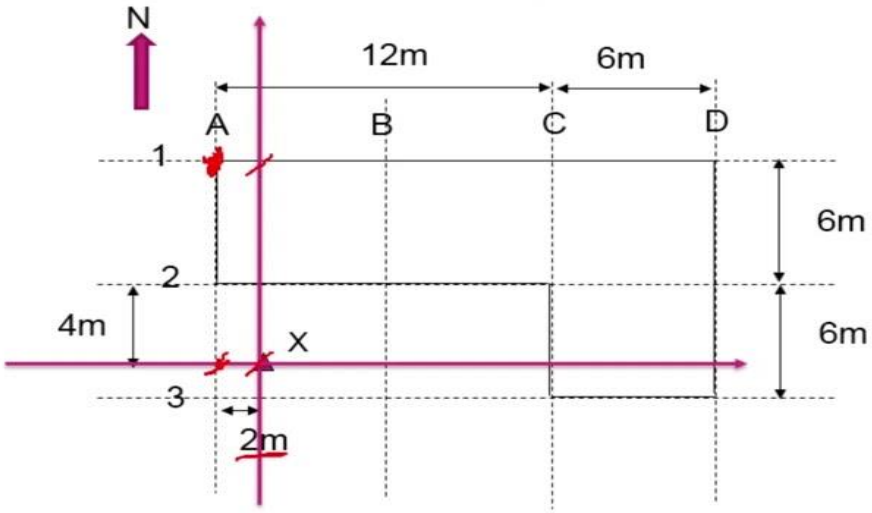
2. Work out coordinates of column centre with respect to one plot corner or well defined point, assuming line parallel to any one face of building as meridian.

3. Create an excel document with 4 independent columns one for column number and rest three for N, E & H coordinates. Upload this file to total station by using transfer software provided with instrument.

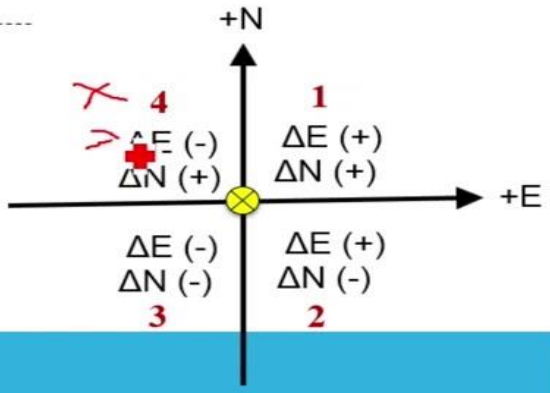
INTRODUCTION

INTRODUCTION

Example 1 (Setting out)



Produce the data required to set out the corners of the building A1, D1, D3, C3, C2, A2



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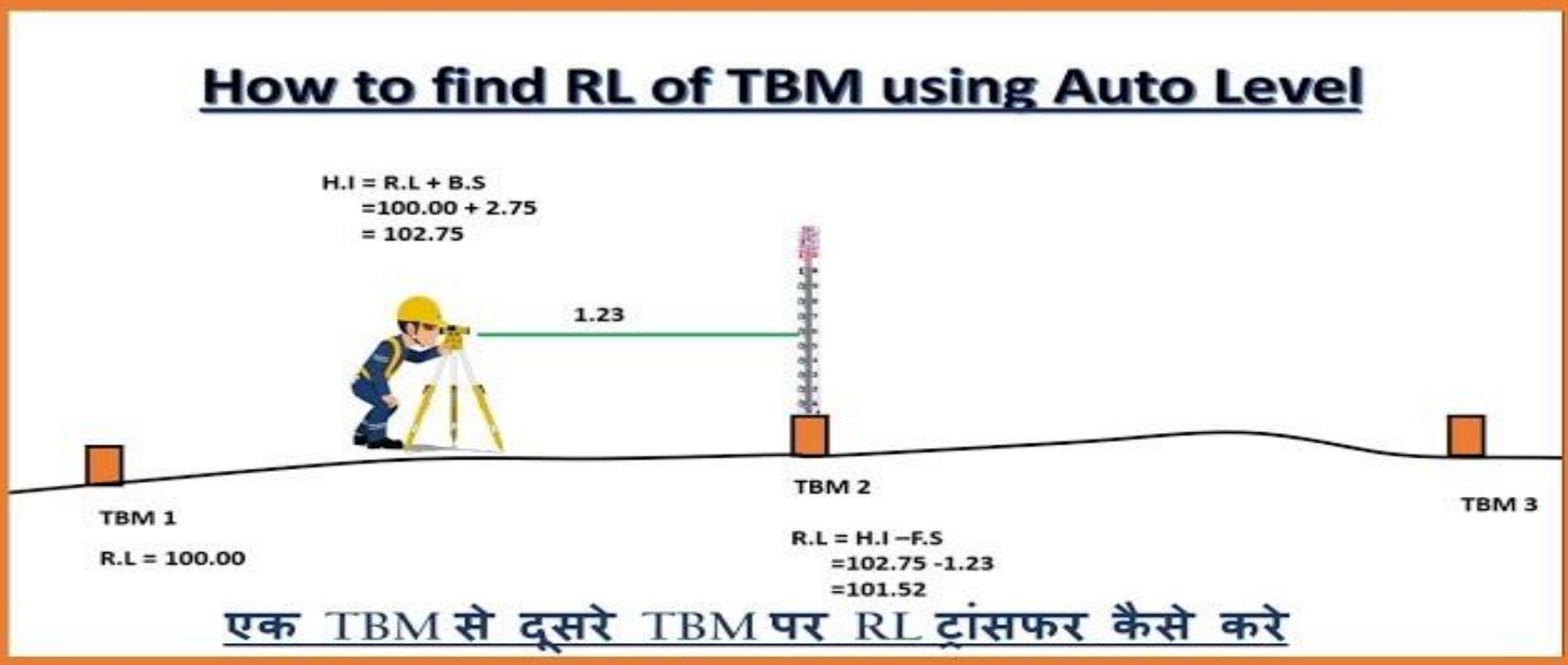
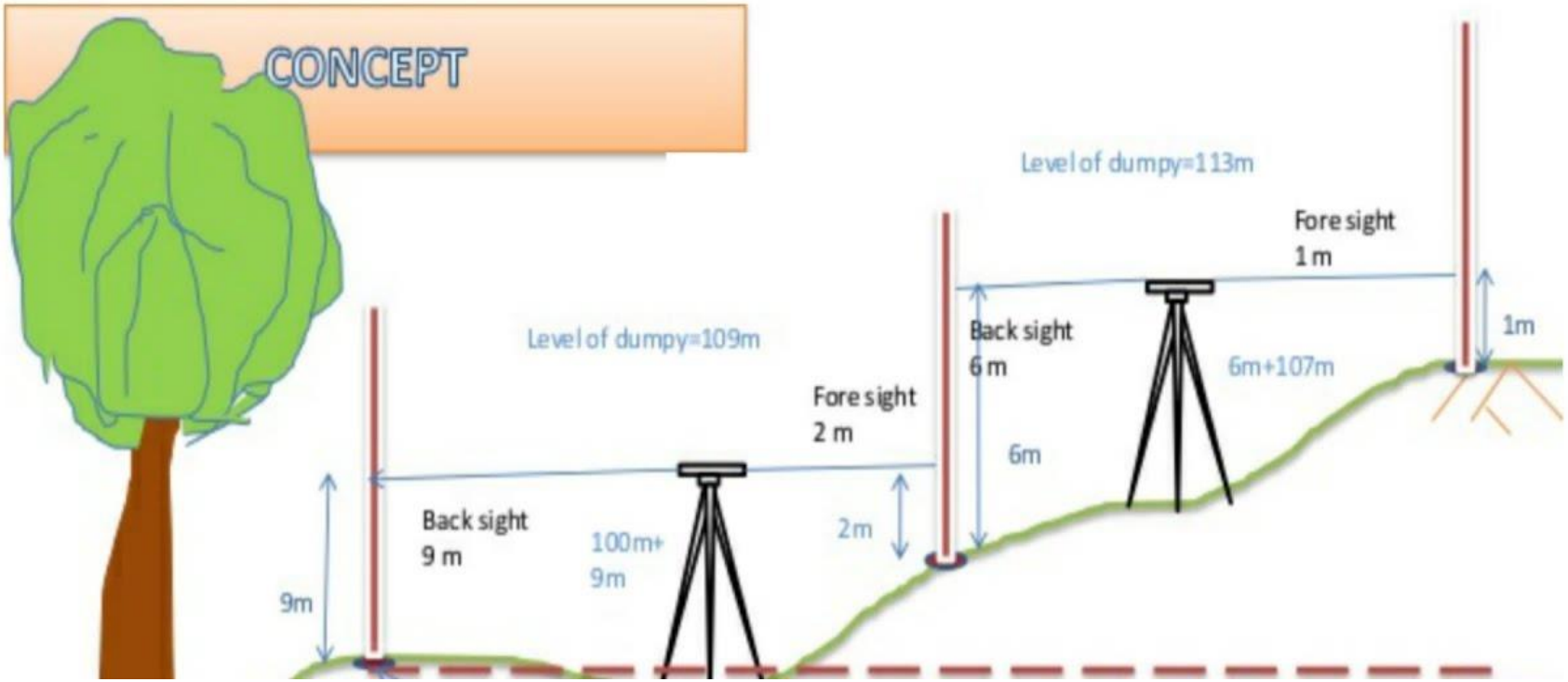


INTRODUCTION

How to Shift Level by Auto Level or Dumpy Level in Surveying



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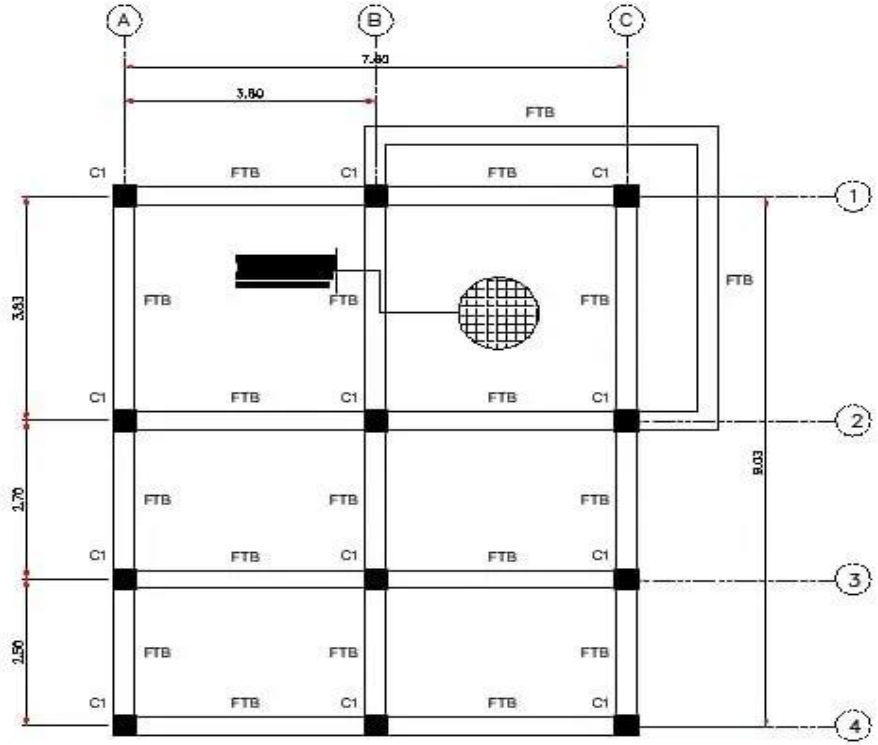
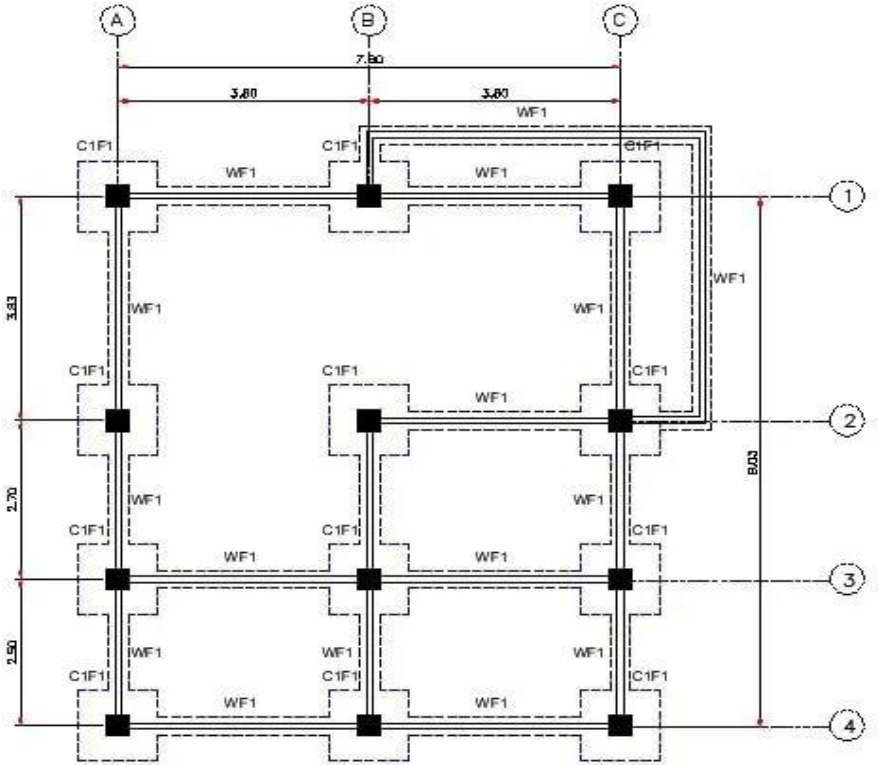
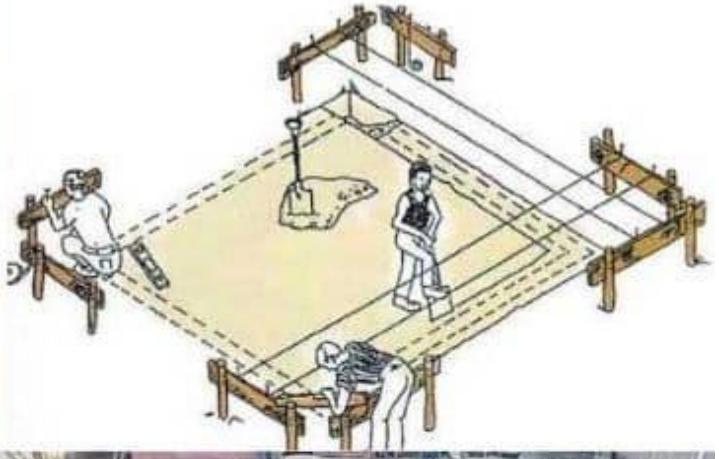


FOOTING TIE BEAM FRAMING PLAN



FOUNDATION PLAN

INTRODUCTION



Building Layout & Foundation Layout

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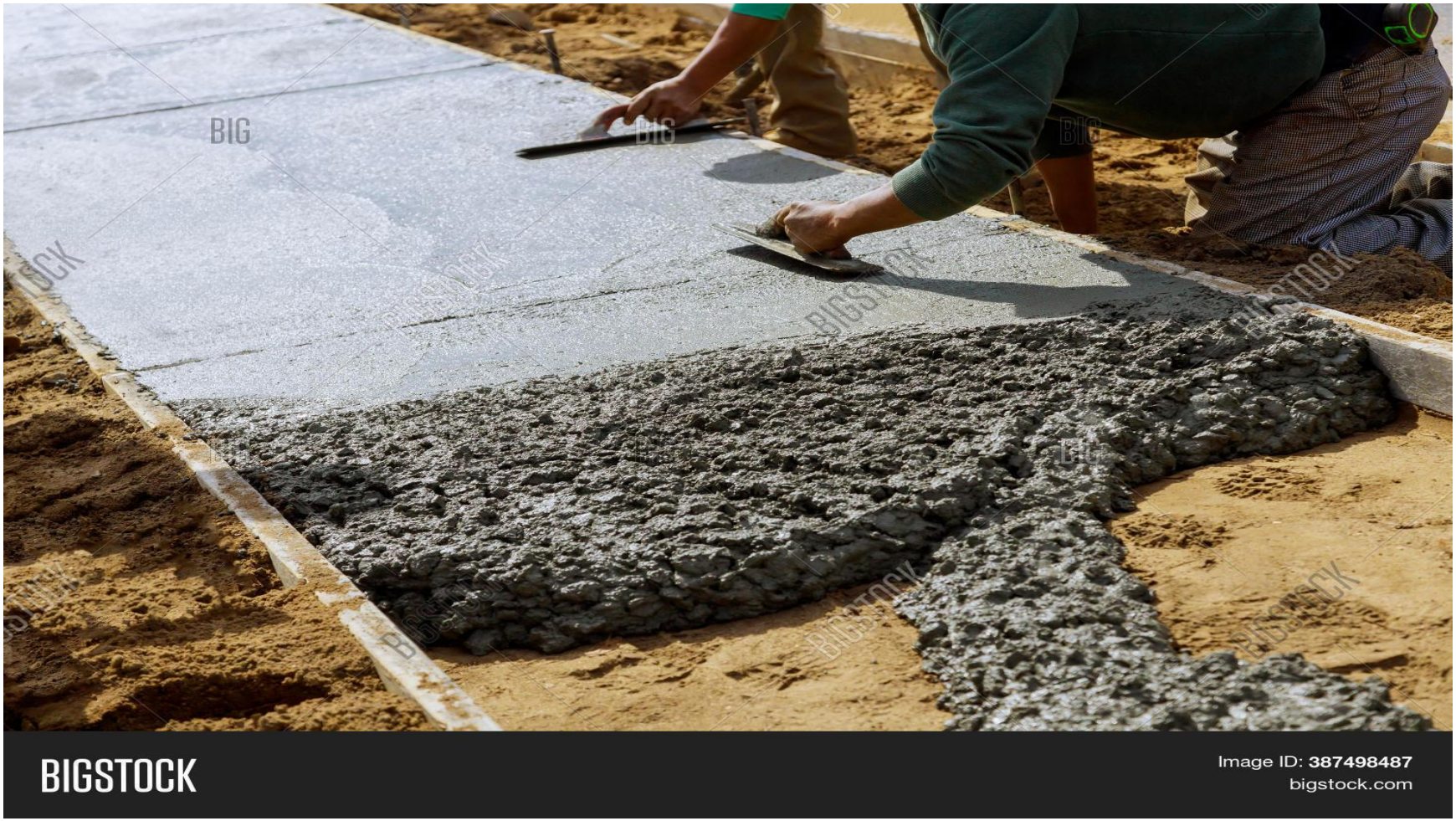


INTRODUCTION

INTRODUCTION

BITUMINOUS CONCRETE LEVELLING

INTRODUCTION

Column Starter / Kicker Marking

INTRODUCTION

Column Starter Concrete

Earth

Excavation

Excavation is the process of removing the earth to form a pit in the ground. It can be done both manually using tools on smaller sites and using bulldozers and backactors for large scale excavations. A trench is an excavation in which the depth exceeds (is bigger than) the width.

Hazards of Excavation Trench

Working in trenches and excavations is hazardous to both the workers who work inside them, and to workers on the surface. Cave-ins or collapses of the sides of the trenches can trap the workers.

There are two basic methods of protecting workers against cave-ins:

- Sloping
- Temporary protective structures

Earth

Sloping

Sloping involves cutting back the trench wall at an angle that is inclined away from the work area of the excavation. The angle of slope required depends on the soil conditions. Benching is a similar method to sloping.

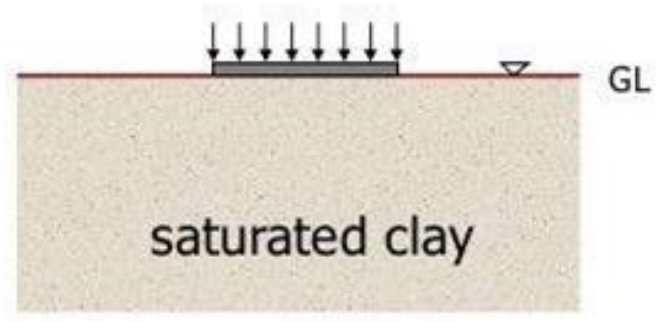
Temporary protective structure

A structure or device in an excavation, trench, tunnel or excavated shaft that is designed to provide protection from cave-ins, collapse, sliding or rolling materials, and includes shoring, trench boxes, trench shields and similar structures.

Earth

Consolidation

Consolidation is the compression of soil by the expulsion of water from voids of the soil. It is a natural process and it takes a long time. This is done by loading the saturated soil externally.



Consolidation by rammer/roller in Layers is the solution to get 95% compaction

Transportation

Trucks are used for transporting the the excavated soil from the construction site to the dumping location.

Compaction

Compaction is the compression of soil by the expulsion of air from the voids of the soil. This requires mechanical energy and is a quick process.

Earth

Soil Stabilization

Soil stabilization is a method of improving soil properties by adding and mixing other materials to it. Soil stabilization is a method of enhancing the shear strength parameters of soil and thus increasing the bearing capacity of the soil.

The following are some common soil stabilization methods

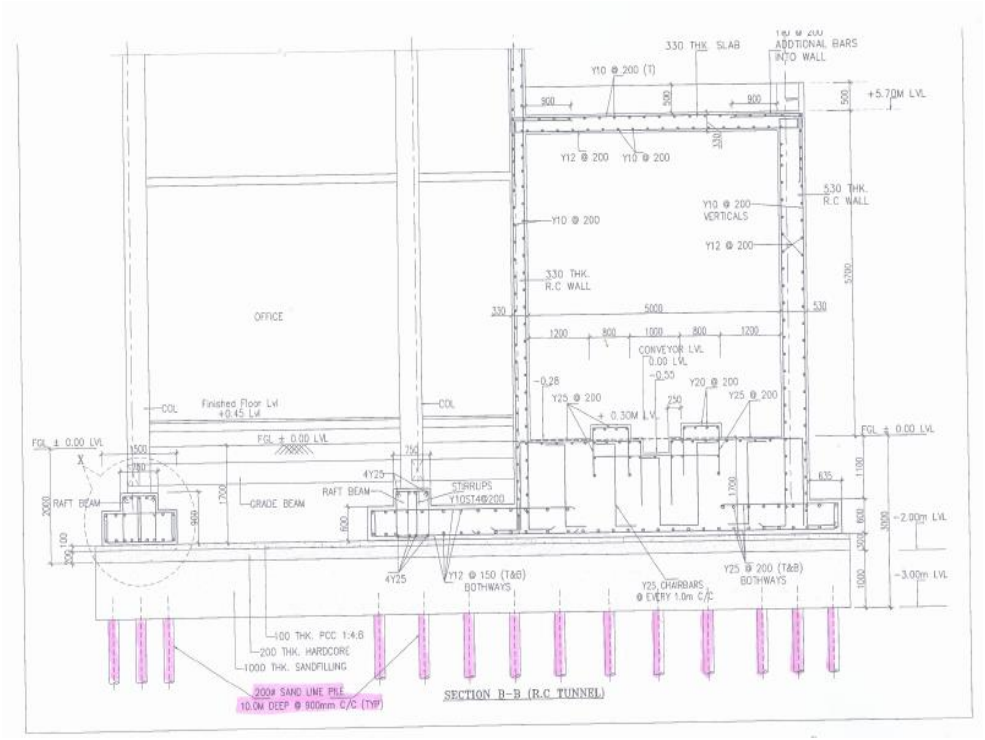
1. Mechanical Stabilization
2. Lime Stabilization
3. Cement Stabilization
4. Chemical Stabilization
5. Fly ash Stabilization
6. Soil Nailing for Vertical Force

Driven Piles

Driven piles, also known as displacement piles, are a commonly-used form of building foundation that provide support for structures, transferring their load to layers of soil or rock that have sufficient bearing capacity and suitable settlement characteristics.

Bored Piles are easier to build

Earth


330 THK. SLAB
ADDITIONAL BARS INTO WALL
Y10 @ 200 (T)
+5.70M LVL
Y12 @ 200
Y10 @ 200
530 THK. R.C WALL
Y10 @ 200 VERTICALS
Y12 @ 200
330 THK. R.C WALL
OFFICE
CONVEYOR LVL. 0.00 LVL
Y25 @ 200
Y20 @ 200
+ 0.30M LVL
COL
Finished Floor Lvl +0.45 Lvl
FGL ± 0.00 LVL
RAFT BEAM
GRADE BEAM
4Y25
STIRRUPS Y10ST4@200
Y12 @ 150 (T&B) BOTHWAYS
Y25 @ 200 (T&B) BOTHWAYS
Y25 CHAIRBARS @ EVERY 1.0m C/C
-2.00m LVL
-3.00m LVL
100 THK. PCC 1:4:8
200 THK. HARDCORE
1000 THK. SANDFILLING
200ø SAND LIME PILE 10.0M DEEP @ 900mm C/C (TYP)
SECTION B-B (R.C TUNNEL)

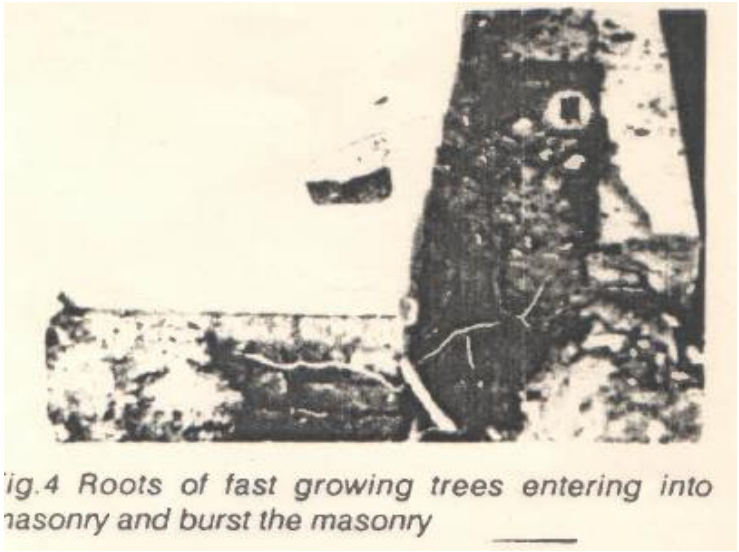
Earth

Stone Columns

Like most ground improvement techniques, stone columns are used to reduce settlement and increase load-bearing capacity. They also accelerate soil consolidation as a result of the drainage capacity of the granular material within the columns, which act as pore or water pressure evacuation points. Stone columns are particularly effective in improving slope stability and preventing liquefaction by increasing shear strength within a soil.

Careless loading behind retaining walls can damage the side walls.

Fast growing tree roots can enter building and damage the walls.

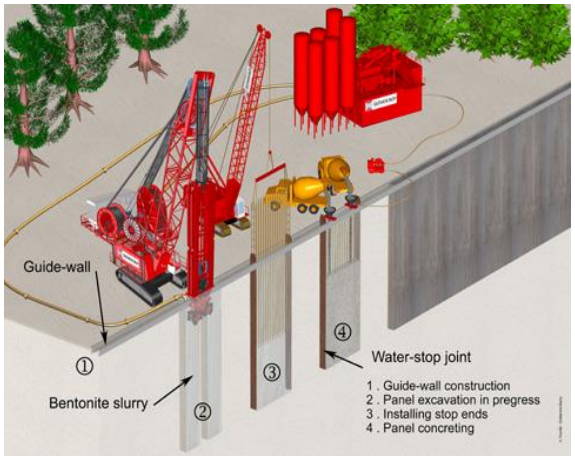


ig.4 Roots of fast growing trees entering into asonry and burst the masonry

Earth

Sand -Lime Pile

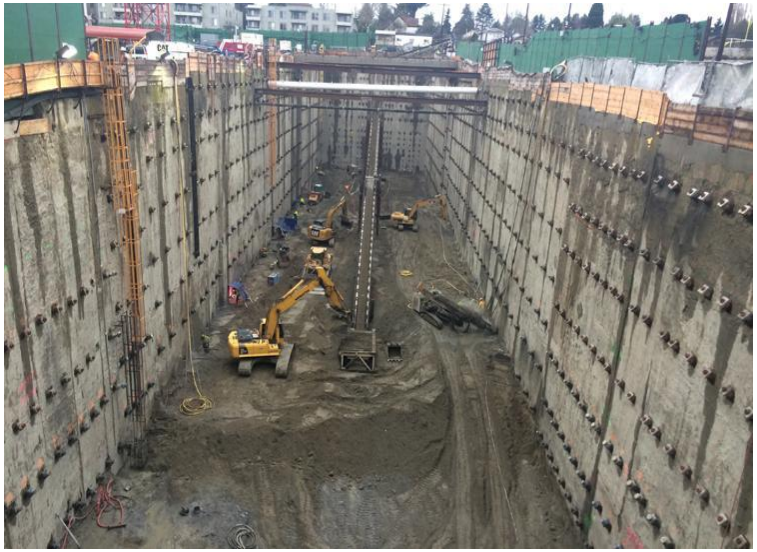
This method of pile is to improve the soft clay layer by using both partially replaced sand piles with/without confinement. This research is performed to study the effect of sand pile to improve the bearing capacity and to control the settlement.



Hardcore

'Hardcore' is the construction term used to denote 'engineered' infill material that is placed within the confines of a building foundation (after removal of any unsuitable ground layers) in order to support a ground-bearing floor slab.

Deep excavation needs protection by soil nailing. Diaphragm wall is another method to ease deep excavation.



Sand

Sand is very commonly used in construction, often providing bulk, strength, and stability to other materials such as asphalt, concrete, mortar, render, cement, and screed. Sand is also used as a base layer is known as 'blinding', which is laid above a layer of hardcore to provide a clean, level, and dry surface for construction works.

Mortar

Mortars are typically made from a mixture of sand, a binder, and water. Sand helps to prevent mortar shrinkage. It also prevents cracking of mortar during setting. Well-graded sand increases the density of mortar.

Filling

- The foundation soil has more clay and silt content with water, river sand is used to provide uniformity for the foundation bed (especially for PCC bed).
- The footing is placed directly on the rock bed, even a small sensible amount of vibration on the earth (during an earthquake) will make the structure collapse.
- Sand is used to minimizing that resistance. Even though we use anti-termite in foundations, there may be some weak spots for termite entry. This is one of the reasons why we use sand (with anti-termite treatment) below the foundation.

Mortar

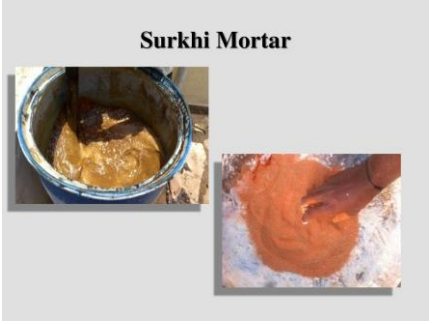
Mortar

Mortar is a homogeneous mixture, produced by uniform mixing of a binder with inert material and water to make a paste of required consistency. It is used to bind a masonry unit and gives full bearing against one another.

3 to 5 parts sand **1 part cement** **½-⅔ part water**

Composition of Mortar

Modern mortars are typically made from a mixture of sand, a binder such as cement or lime and water.



Types of Mortar

- Lime Mortar
- Lime – Surkhi Mortar
- Mud Mortar
- Cement Mortar

Mortar


Sand
Cement
Water
Ingredients mixed and turned over three times to ensure all the materials are thoroughly mixed.
Mortar heap opened out to take water.


Fera (Measuring Box)

Masonry

MASONRY - TYPES

- BRICK MASONRY
- STONE MASONRY
- BLOCK (CONCRETE HOLLOW / SOLID , AAC, POROTHERM) MASONRY
- VENEER MASONRY
- GABION MASONRY
- COMPOSITE MASONRY

Masonry

BRICK MASONRY

Masonry

STONE MASONRY

© CanStockPhoto.com - csp61327616

Masonry

BLOCK MASONRY

Masonry

VENEER MASONRY

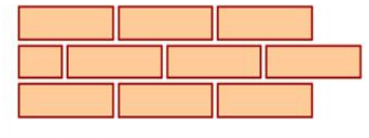
Masonry

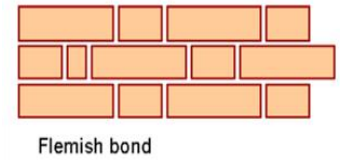
GABION MASONRY

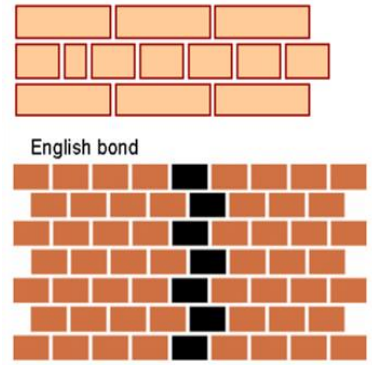
Masonry

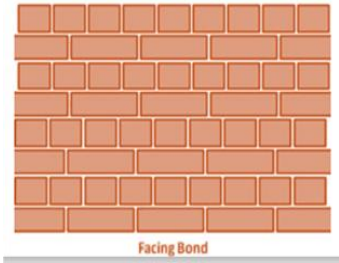
TYPES OF BONDS

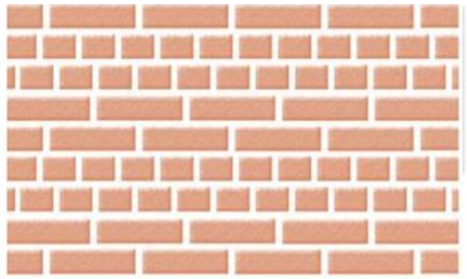
- Stretcher bond
- Flemish bond
- English bond
- Header bond
- Facing bond
- Double English cross bond
- Raking bond
- Zigzag bond
- Garden wall bond

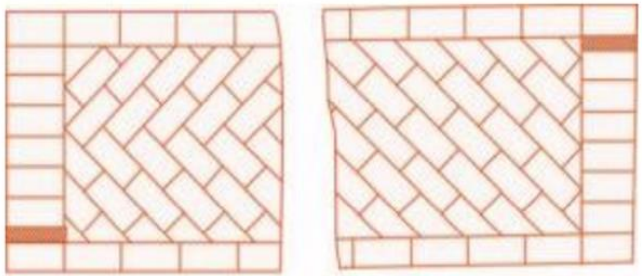












Masonry

TYPES OF BRICKS

Concrete Block Masonry

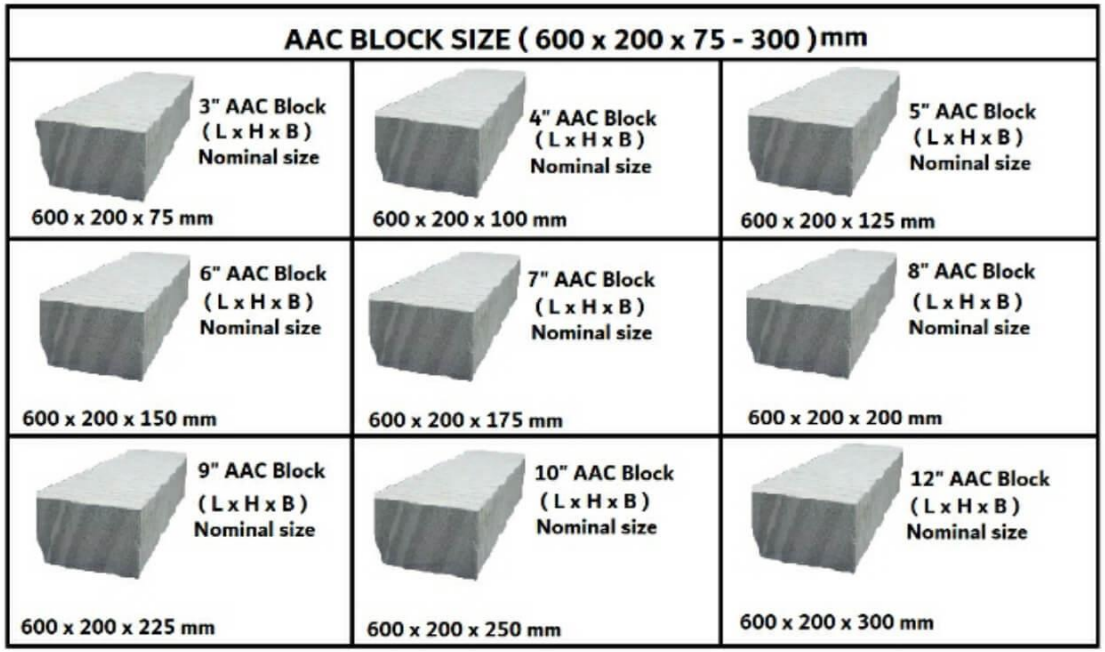
Concrete blocks are made from cast concrete (e.g. Portland cement and aggregate, usually sand and fine gravel, for high-density blocks). Lower density blocks may use industrial wastes, such as fly ash or bottom ash, as an aggregate.

These blocks come in a variety of dimensions and textures, from traditional smooth surfaces to fluted or rough finishes, as well as special units for corners or for beams with longitudinal reinforcements. The dimensions of these blocks range from the classic 8x8x16 inches (approx 19x19x39 cm) which is meant for structural use, to a size of 8x3.5x39 inches (approx 19x9x39 cm) for partitioning walls

Aerocon/ AAC Blocks

AAC blocks are a precast, foam concrete, sustainable construction material made from aggregates of quartz sand, calcined gypsum, lime, portland cement, water and aluminium powder.

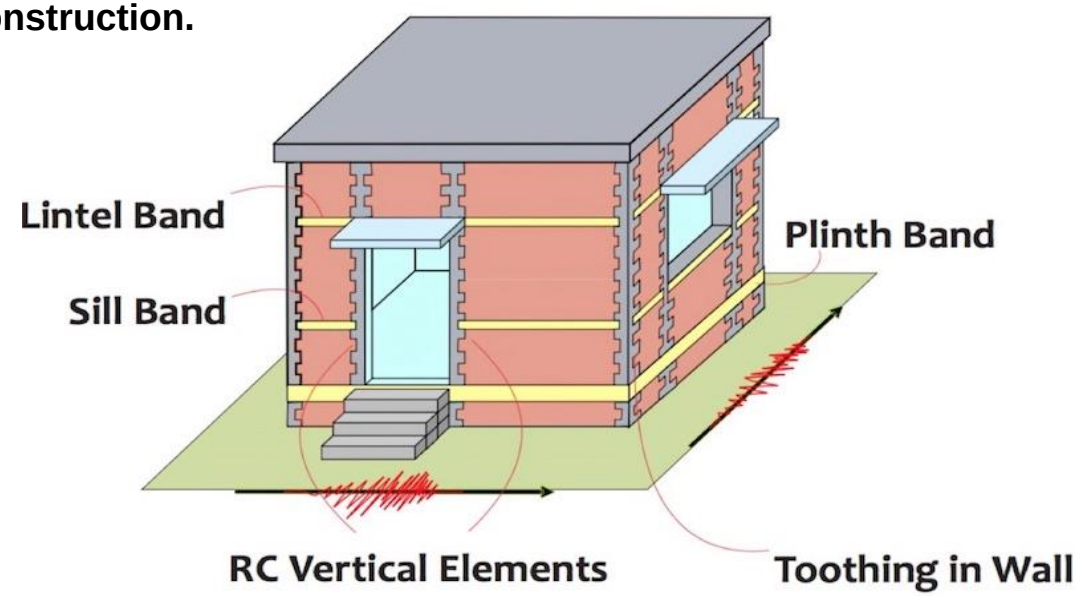
Burnt clay blocks unlike bricks, these blocks have cavities and are manufactured through extension machine.



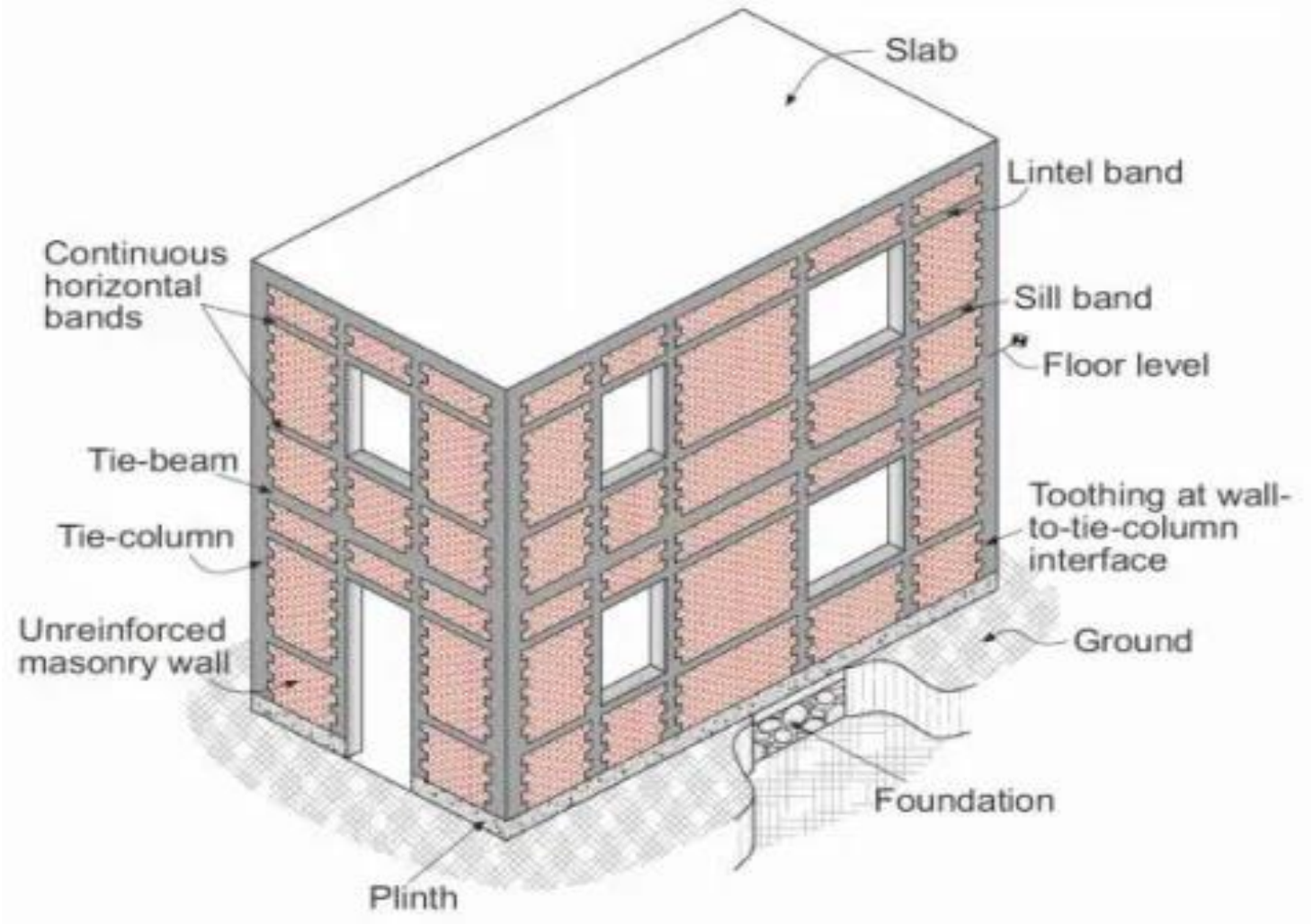
Seismic Performance

Good seismic performance of modern **confined masonry construction** practiced in many countries **relies on two key features, namely confinement and bond between masonry walls and reinforced concrete confining elements that enclose these walls.** These two features were perceived by builders and engineers in India since the 1897 Assam earthquake. “Assam type housing” that emerged in the earthquake-affected area utilizes the concept of lateral confinement, while the 1931 Baluchistan earthquake demonstrated the importance of bond for improved seismic performance of masonry structures.

Master-plan of the permanent campus of Indian Institute of Technology Gandhinagar, a fully residential campus on 400 acres of land envisages the construction of 36 confined masonry buildings, including three- and four-story faculty and staff residences and hostels. This paper describes the campus development project, including the design process and the challenges faced during design and construction.



Seismic Performance

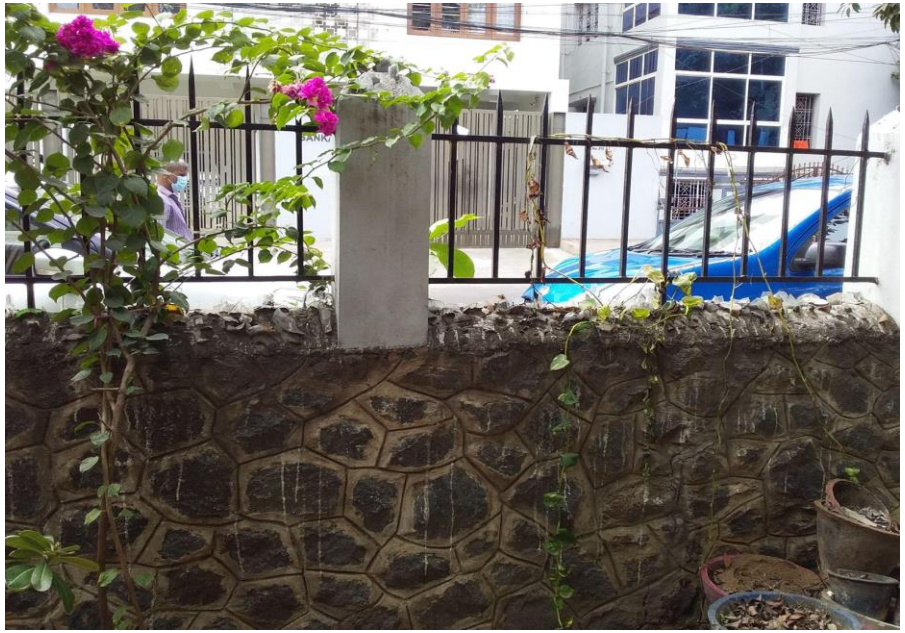


Stone

Based on the arrangement of the stone in the construction and degree of refinement in the surface finish, the stone masonry can be classified broadly in the two categories, Rubble and Ashlar masonry.

Random Masonry

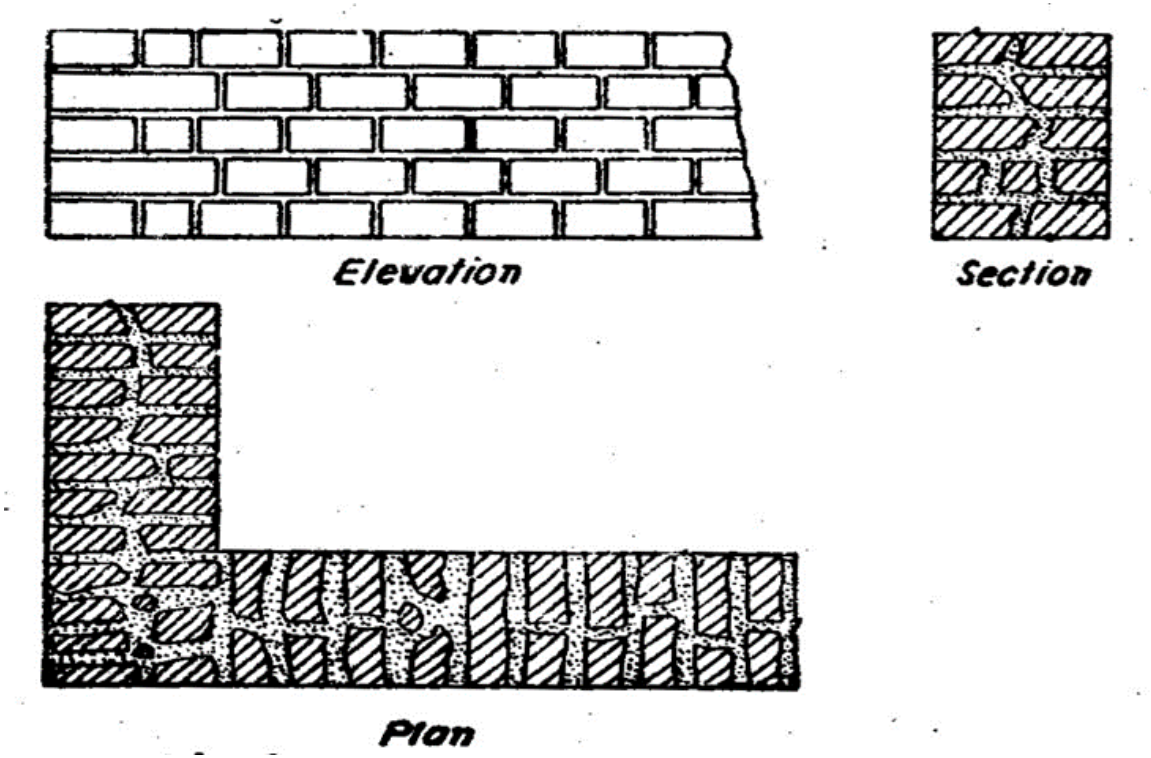
In this category, the stones used are either undressed or roughly dressed having wider joints. This can be further subdivided as uncoursed, coursed, random, dry, polygonal and bint.



Stone

Regular Course

In this type of stone masonry the uniform height stones are used in horizontal layers not less than 13cm in height. Generally, the stone beds are hammered or chisel dressed to a depth of at least 10cm from the face. The stones are arranged in such a manner so that the vertical joints of two consecutive curse do not coincide with each other as shown in figure



Stone

Stone Aggregate

Aggregate, in building and construction, material used for mixing with cement, bitumen, lime, gypsum, or other adhesive to form concrete or mortar.

Crushed stone or angular rock is a form of construction aggregate, typically produced by mining a suitable rock deposit and breaking the removed rock down to the desired size using crushers.

Quarry Dust

Quarry dust is a waste obtained during quarrying process. It has very recently gained good attention to be used as an effective filler material instead of fine aggregate. In the present study, the hardened and durable properties of concrete using quarry dust were investigated.

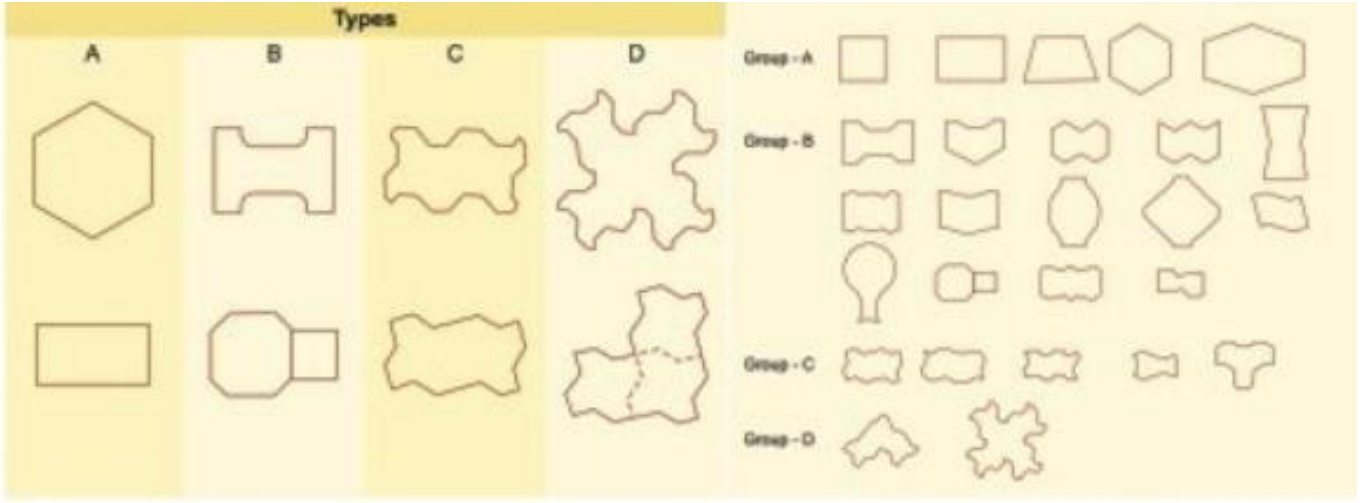
- A compressed earth block (CEB), also known as a pressed earth block or a compressed soil block, is a building material made primarily from damp soil compressed at high pressure to form blocks. Compressed earth blocks use a mechanical press to form blocks out of an appropriate mix of fairly dry inorganic subsoil, non-expansive clay and aggregate.
- If the blocks are stabilized with a chemical binder such as Portland cement they are called *compressed stabilized earth block* (CSEB) or *stabilized earth block* (SEB).
- **As compared to mud bricks, compressed earth blocks or CEB are solidified and compressed through chemical changes that take place as they air dry. Hence, the compression strength of the CEB usually exceeds those of typical mud bricks.**

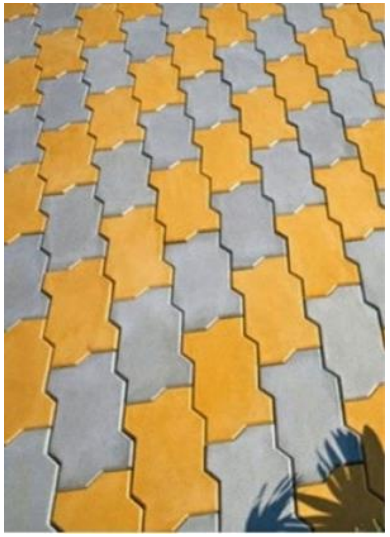
Paving Block

Paver block or Paving block is one of the most popular flexible surface treatment options for exterior pavement applications. These blocks are aesthetically pleasing, comfortable to walk on, extremely durable, and easy to maintain.

There are two types of paver blocks:

- Concrete Paving Block
- Clay Paving Blocks
- Abrasion resistance for pressed concrete blocks





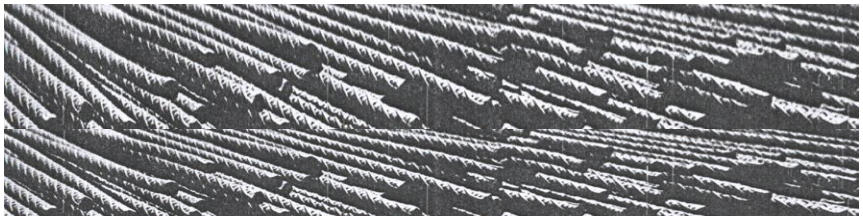
Steel

Reinforcement

Steel reinforcement are steel bars that are provided in combination with plain cement concrete to make it reinforced concrete. Hence these structures form steel reinforced cement concrete structure (R.C.C). Steel reinforcement is commonly called as 'rebars'. Surface is of regular shaped deformations.

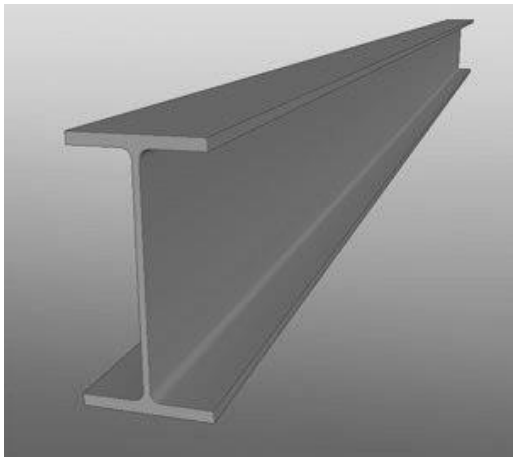
Cold twisted (CTD) or TMT bars are used.

GRIP BARS Developed by SERC and Produced by TISCO



Rolled Steel Joint

A rolled steel joist (RSJ) is a common type of beam used for structural steelwork. It is also known as an ‘I-beam’. A RSJ is a beam with an ‘I’ or ‘H’-shaped cross-section that comes in a variety of standard sizes. It is a very efficient form for carrying bending and shear loads in the plane of the web.They are formed by hot rolling, cold rolling or by extrusion.



Steel

Pipes

Steel pipes are utilized as building piles when the soil is too thin to support the weight of big structures. Scaffolding poles are made from steel pipes and allow construction workers to access areas of the building that are out of reach.

Cast Iron

Cast Iron Pipes

Cast iron pipes are arguably one of the oldest kinds of pipes in the market. Because of their toughness and long shelf life, it's no surprise that many centuries-old waterways and sewage drains in European countries still use these pipes up until today. Apart from sewage and drainage systems, you'll also find cast iron pipes in high-rise or even other low-height and residential spaces. They're particularly useful for storm drains that can help prevent flooding and reduce water contamination for plumbing systems. Cast iron as columns in building are also used.

Galvanized Iron

Galvanized iron or steel is the same as standard iron, the only difference is that it features a layer of zinc. The added layer of zinc helps to protect the iron from rust and corrosion. Without it, the iron will be exposed to moisture and oxygen from its surrounding environment.

PCC

- Plain cement concrete is the mixture of cement, fine aggregate(sand) and coarse aggregate without steel. PCC is an important component of a building which is laid on the soil surface to avoid direct contact of reinforcement of concrete with soil and water.
- The main reason of providing PCC is to provide a rigid impervious bed to RCC in the foundation before starting any RCC or masonry work directly on the excavated soil, PCC is done to form a leveled surface and to avoid laying concrete on soil directly so as to avoid mixing with soil and also to prevent soil extracting water from RCC thereby weakening it.
- Plain concrete is also used as a dense gravity provider in thick walls or in floors.

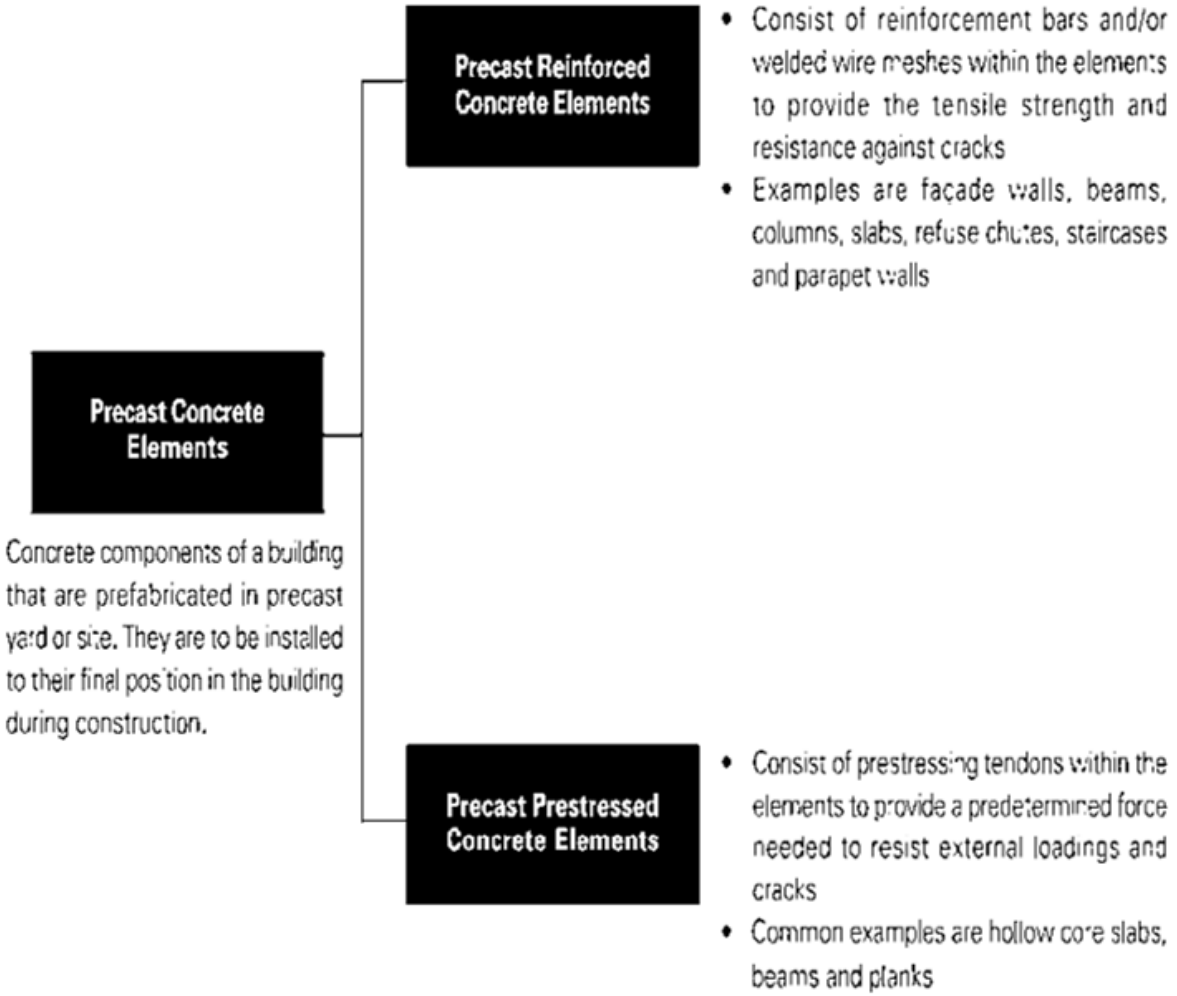
Precast Concrete

The precast concrete is transported to the construction site, lifted and positioned at the predetermined place.

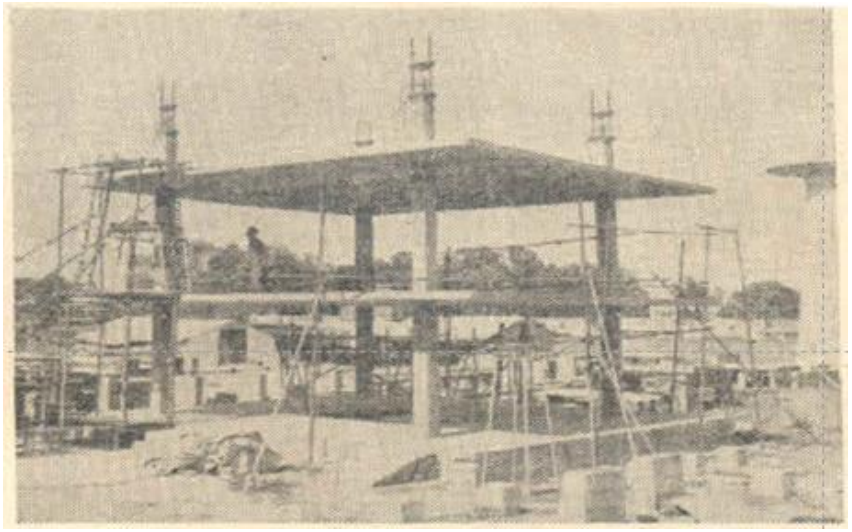
TYPES OF PRECAST

Depending on the load-bearing structure, precast systems can be divided into the following categories:

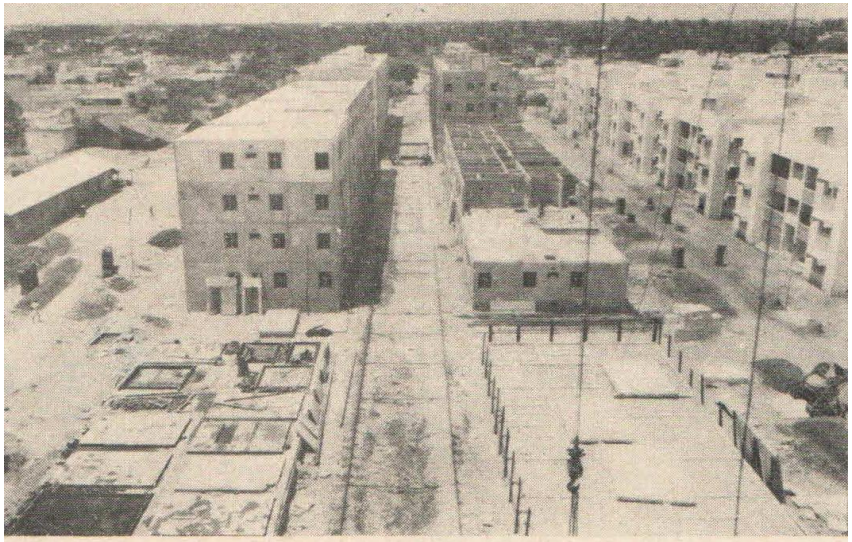
- Large-panel systems
- Frame systems
- Slab-column systems with shear walls
- Small elements
- Trusses
- Other Long Products
- Lift Slabs



Precast Concrete



Second floor slab on position

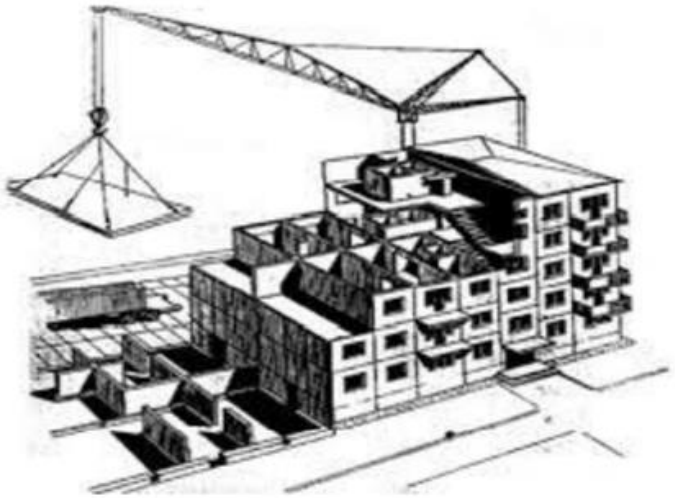


A view of the housing project at Madras using large panel prefabrication developed by SERC

Precast Concrete

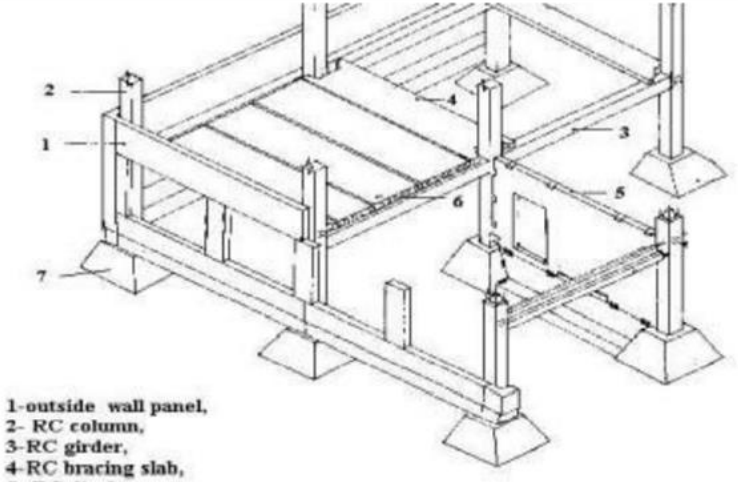
LARGE PANEL SYSTEMS

Large-panel system refers to multistory structures composed of large wall and floor concrete panels connected in the vertical and horizontal directions so that the wall panels enclose appropriate spaces for the rooms within a building



FRAME SYSTEMS

- In Frame system are constructed using linear elements or spatial beam, column.
- Precast beam-column sub-assemblages have the advantage that the connecting faces between the sub-assemblages can be placed away from the critical frame regions;
- The beam-column joints accomplished in this way are hinged



1-outside wall panel,
2- RC column,
3-RC girder,
4-RC bracing slab,
5- RC diaphragm,
6- RC ceiling slab,
7- RC foundation

Precast Concrete

SLAB-COLUMN SYSTEMS WITH SHEAR WALLS

• These systems rely on shear walls to sustain lateral load effects, whereas the slab column structure resists mainly gravity loads.

• There are two main systems in this category:

➢ Lift-slab system with walls

➢ Prestressed slab-column system

LIFT –SLAB SYSTEM

• The load-bearing structure consists of precast reinforced concrete columns and slabs.

• Precast columns are usually two stories high.

• All precast structural elements are assembled by means of special joints.

• Reinforced concrete slabs are poured on the ground in forms, one on top of the other.

• Precast concrete floor slabs are lifted from the ground up to the final height by lifting cranes.

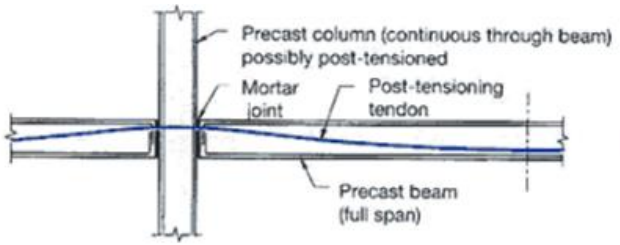
• The slab panels are lifted to the top of the column and then moved downwards to the final position.

• Temporary supports are used to keep the slabs in the position until the connection with the columns has been achieved.

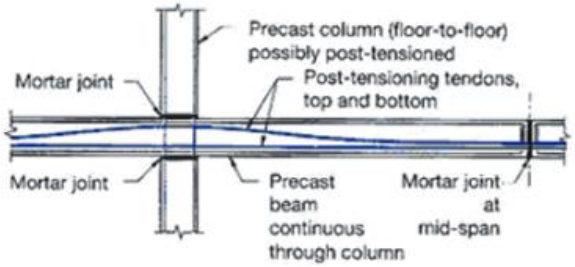
Precast Concrete

THE PRESTRESSED SLAB-COLUMN

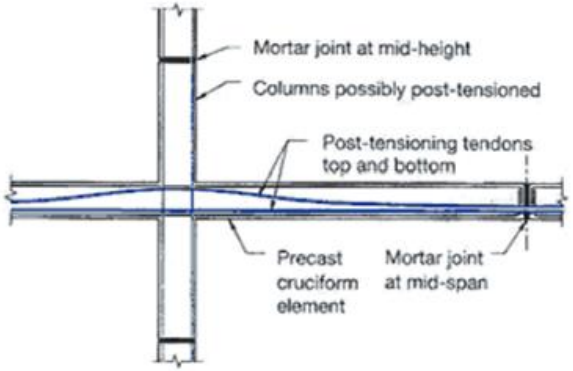
- System uses horizontal pre-stressing in two orthogonal directions to achieve continuity.
- The precast concrete column elements are 1 to 3 stories high. The reinforced concrete floor slabs fit the clear span between columns.
- After erecting the slabs and columns of a story, the columns and floor slabs are pre-stressed by means of prestressing tendons that pass through ducts in the columns at the floor level and along the gaps left between adjacent slabs.
- After pre-stressing, the gaps between the slabs are filled with in situ concrete and the tendons then become bonded with the spans. Seismic loads are resisted mainly by the shear walls (precast or cast-in-place) positioned between the columns at appropriate locations



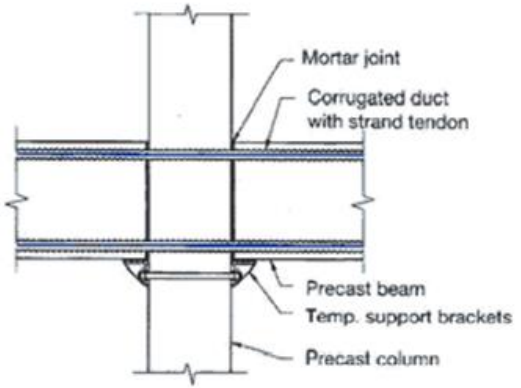
(a) Column Continuous Through Beam



(b) Beam Continuous Through Column



(c) Cruciform



(d) Typical Connection Detail (adopted from [4])

Precast Concrete

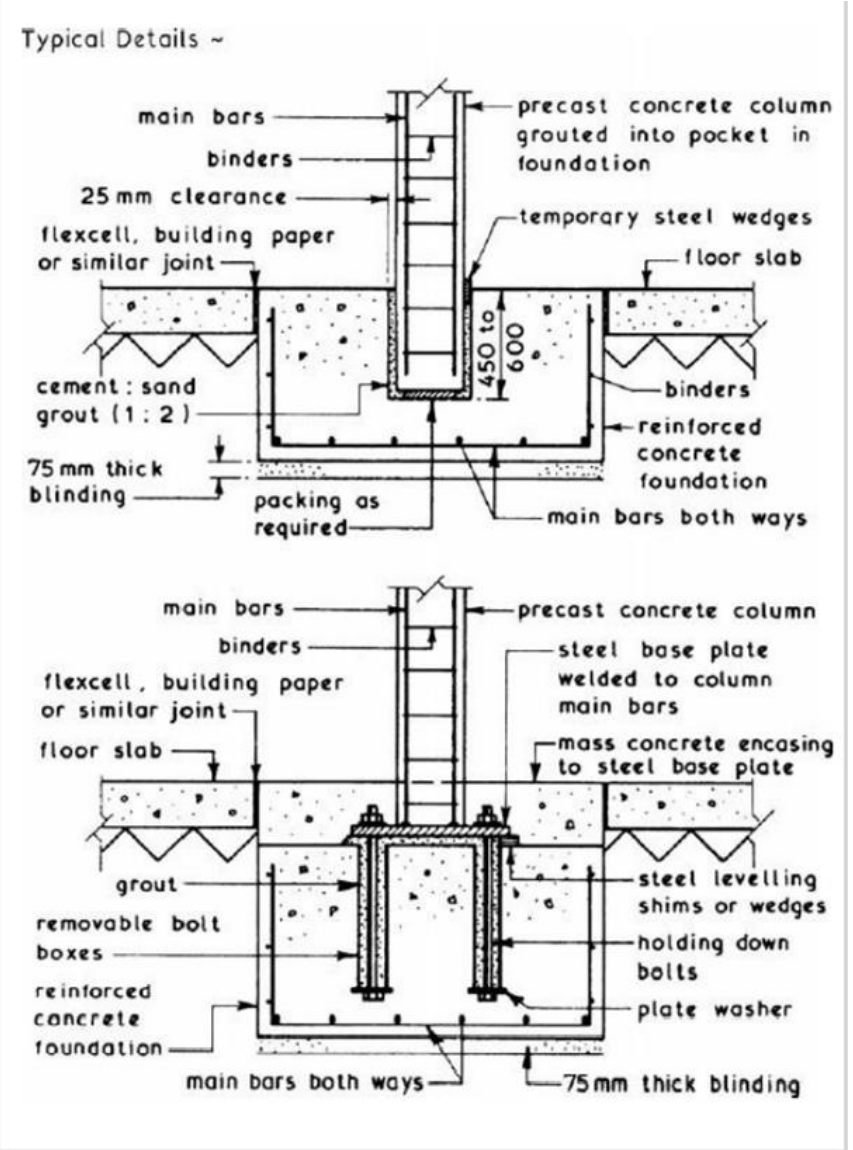
PRE-CAST STRUCTURAL BUILDING COMPONENTS

Structural Building Components	Non-Structural Building Components
Foundation	Door frames
Columns	Window frames
Beam walls	Parapet Jallee
Floor roofs	Parapet
	Paving
	Cupboard planks

Precast Concrete

FOUNDATION (STRUCTURAL COMPONENT)

- For light to medium loadings the preferred method of connection is to set the column into a pocket cast into a reinforced concrete pad foundation.
- Heavy column loadings are encountered it may be necessary to use a steel base plate secured to the reinforced concrete pad foundation with holding down bolts

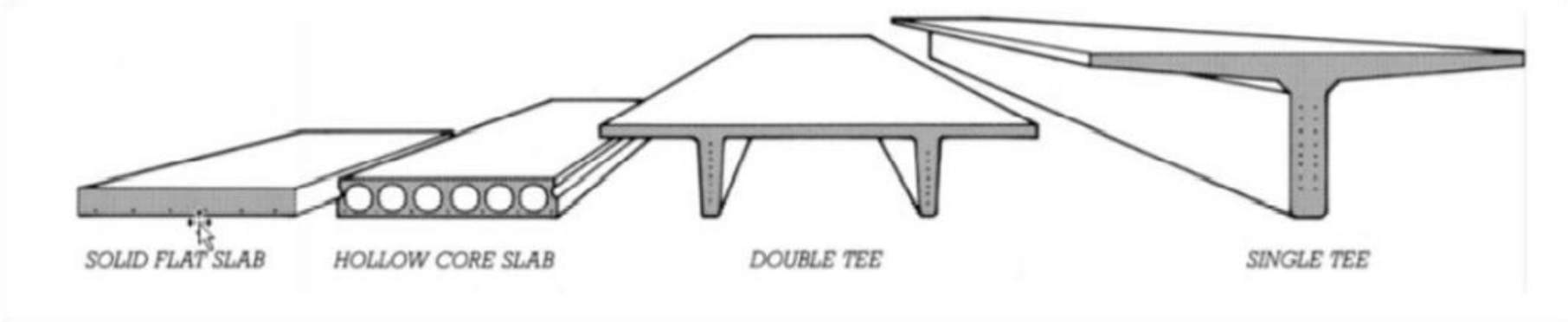


Precast Concrete

FLOORS (STRUCTURAL COMPONENT) :

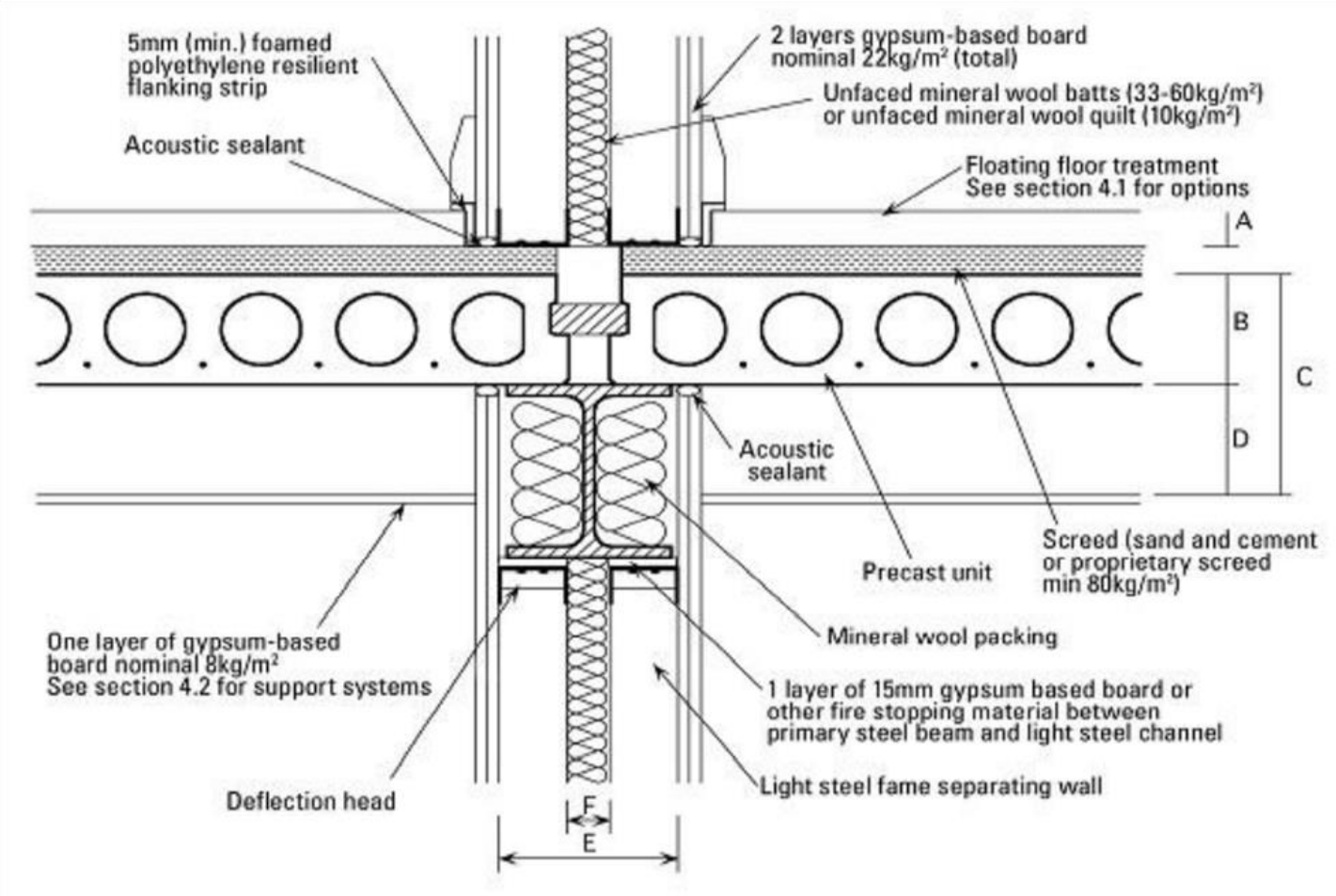
TYPES

- Precast reinforced concrete floor system
- Precast hollow floor unit
- Precast concrete plank floor units
- Precast concrete tee beam
- Plate floors
- Lift slabs



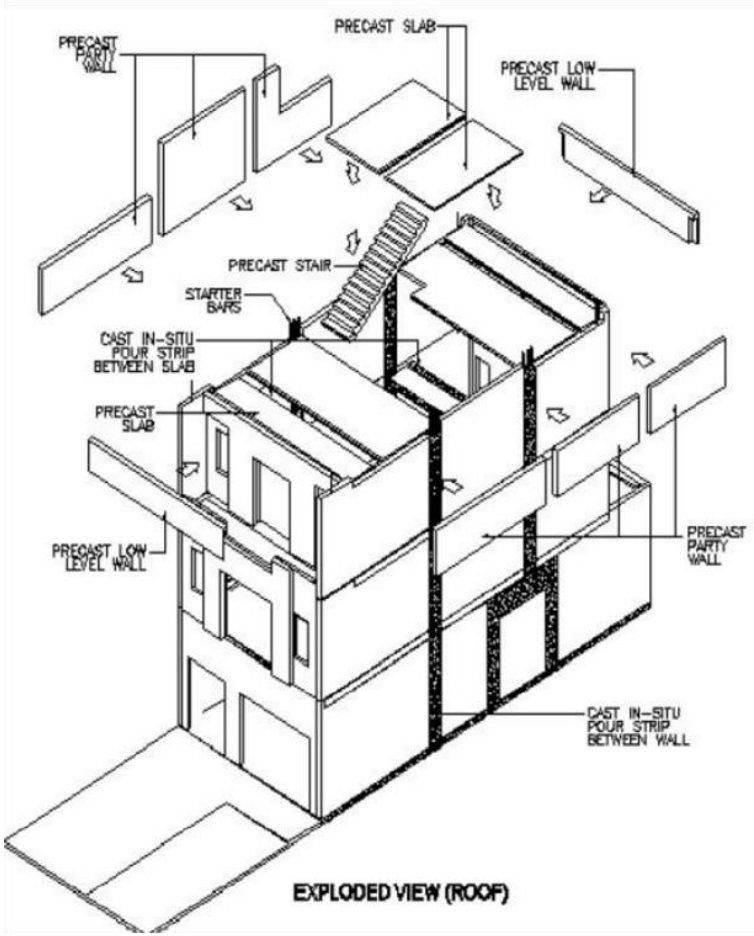
Precast Concrete

PRE CAST - FLOOR SLAB



Precast Concrete

ROOF STRUCTURAL COMPONENT



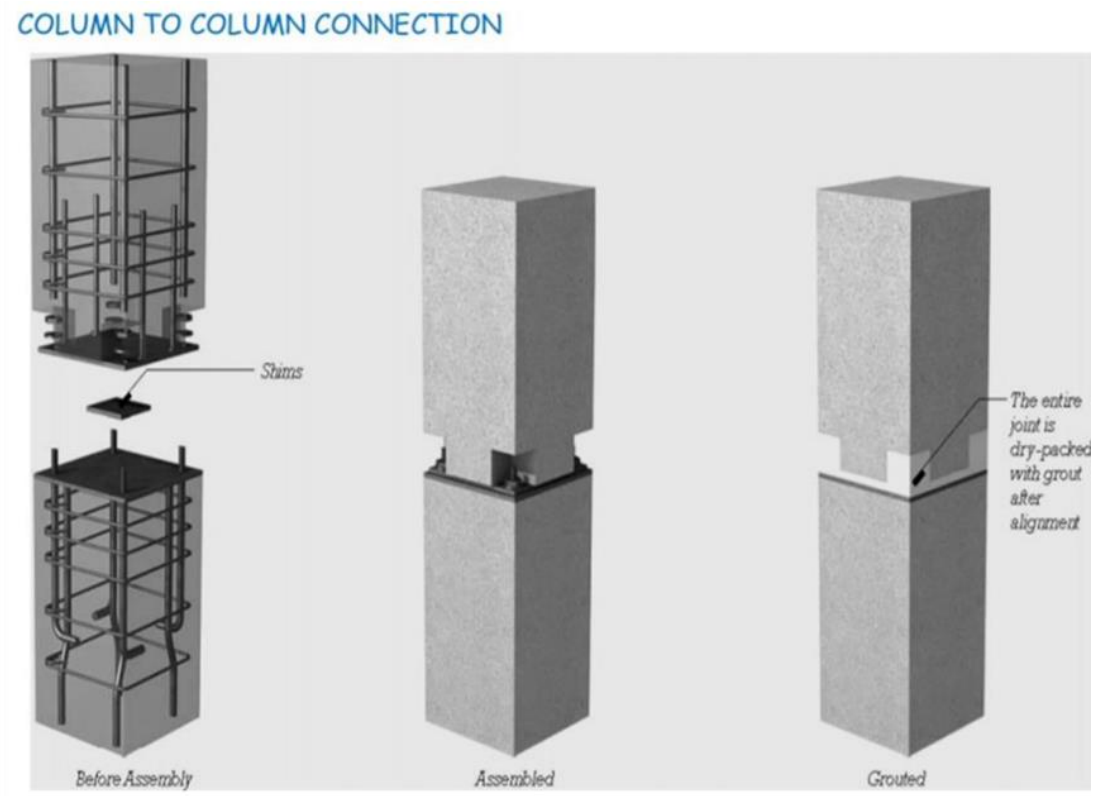
Precast pre-stressed slabs spanning between walls with composite in-situ topping for roof

Precast Concrete

COLUMNS
(STRUCTURAL COMPONENT)

• Column to Column Connection - precast columns are usually cast in one length. They are either reinforced with bar reinforcement or they are prestressed according to the loading conditions.

• If column to column are required they are usually made at floor levels above the beam to column connections and can range from a simple dowel connection to a complex connection involving in-situ concrete.

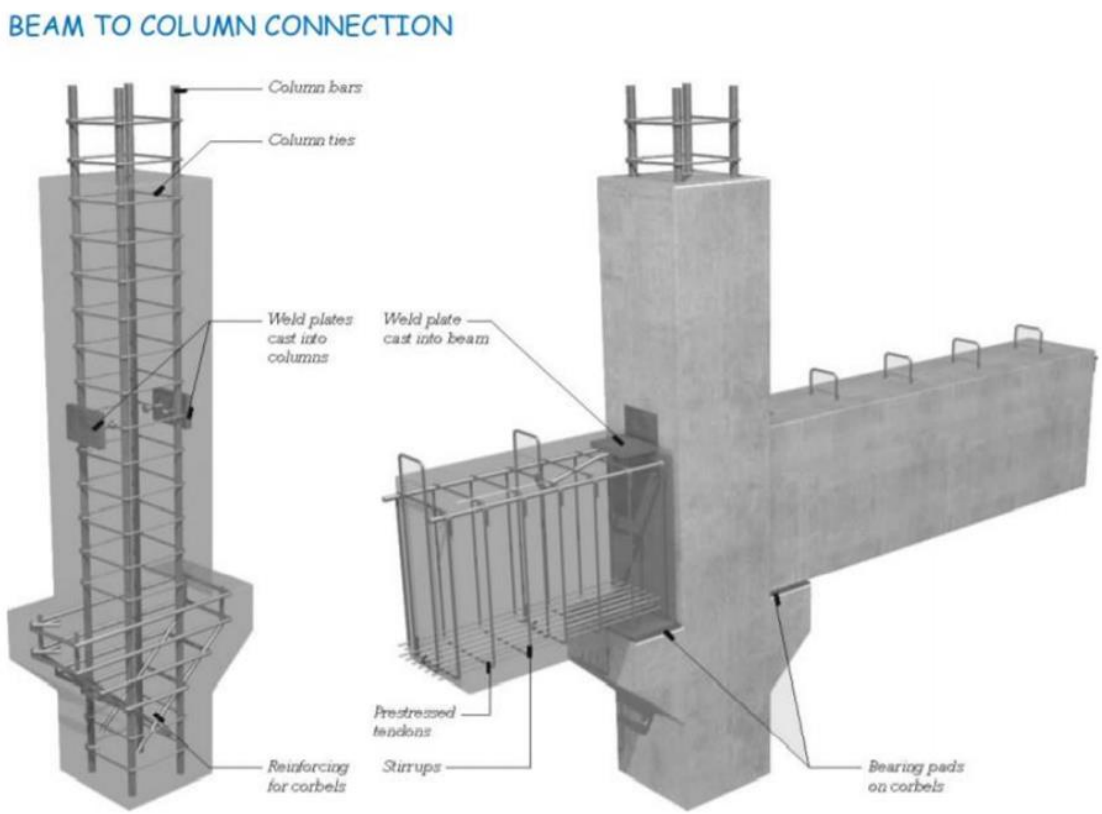


Precast Concrete

BEAMS (STRUCTURAL COMPONENT)

Beam to Column Connections - as with the column to column connections the main objective is to provide structural continuity at the junction. This is usually achieved by one of two basic methods:

- Projecting bearing haunches cast onto the columns with a projecting dowel or stud bolt to provide both location and fixing.
- Steel to steel fixings which are usually in the form of a corbel or bracket projecting from the column providing a bolted connection to a steel plate cast into the end of the beam



Precast Concrete

Installation

The on-site installation of precast components can be a high-risk activity involving the use of heavy plant, cranes and personnel working at height. Consideration should be given therefore to safeguarding against risks when receiving delivery, moving, and placing units.

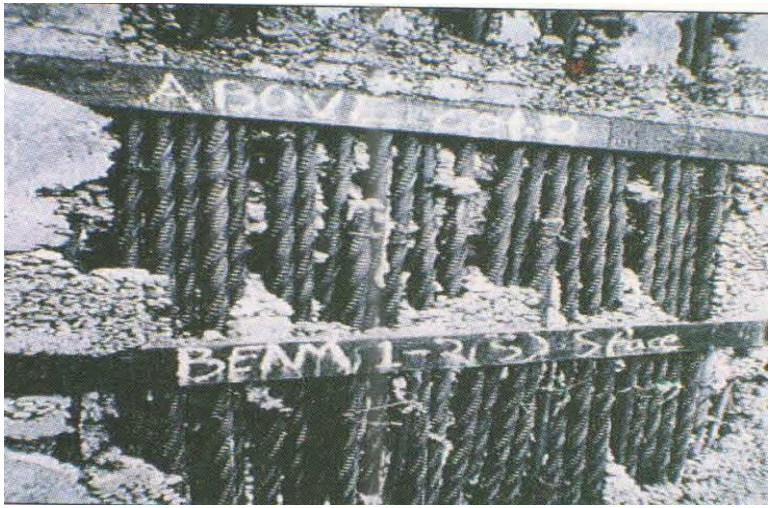
Precasting can be carried out at a casting yard, in or near the site, or in a factory. A key aspect of determining whether to use site or factory precasting is transport costs. Factory work offers superior quality for obvious reasons, so if there is a factory close to the site, it makes sense to use it.

Transportation

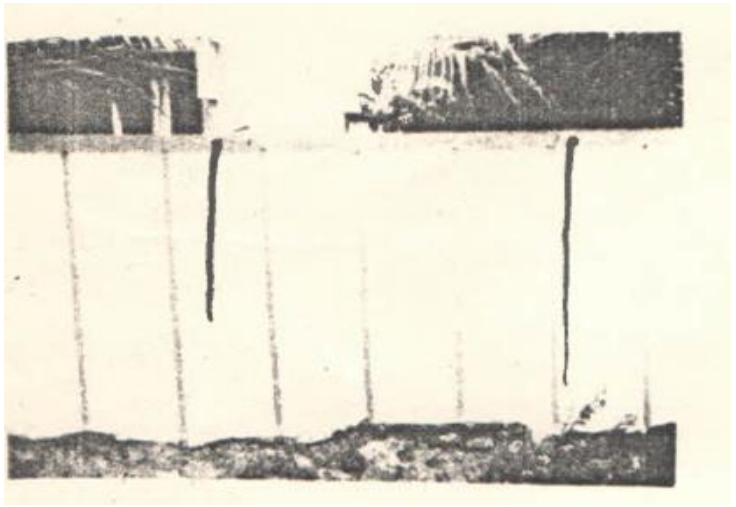
- The precast concrete element will be unloaded on special racks placed in the storage area.
- The precast elements will be loaded and delivered on trailer with proper supports, blocking, cushioning, etc. to minimize or prevent damage during transit.

Why Defects are noticed?

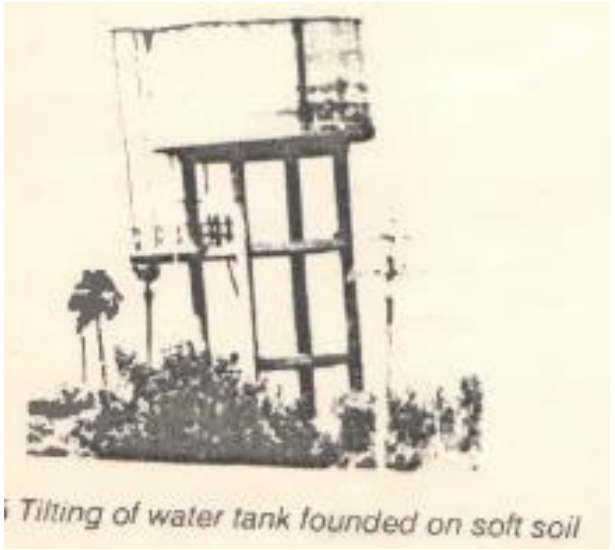
- Settlement of soil
- Cracks
  - Structural
  - Upward Pressure
  - Surface
- Cracks in concrete
  - Shrinkage
  - Temperature changes
  - Steel corrosion
  - Honey Combs



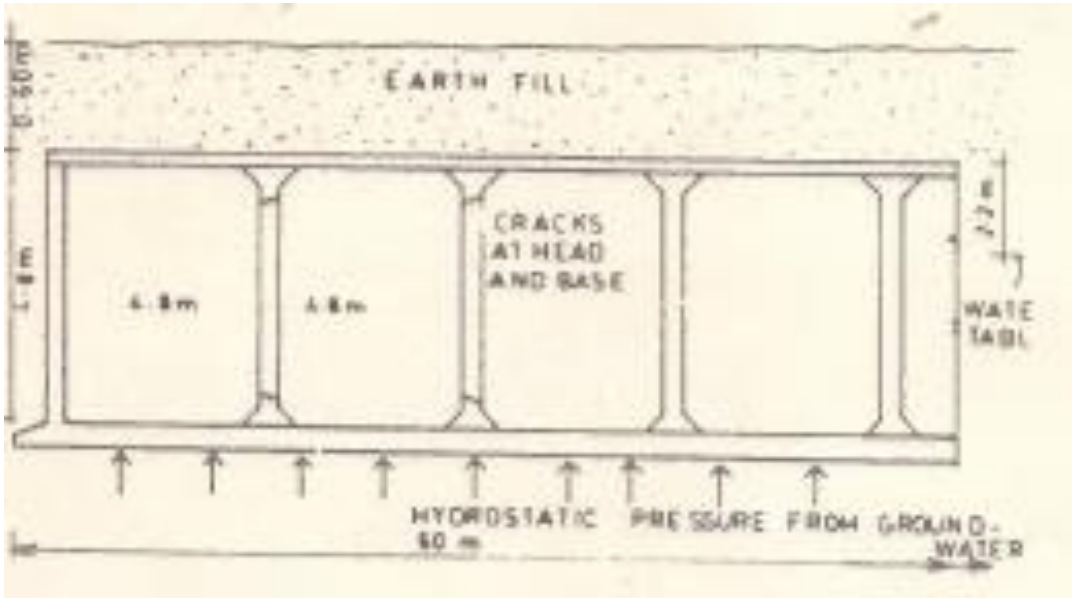
Incorrect planning & placing of reinforcement steel causes segregation concrete



Cracks in compound wall wider at top



Tilting of water tank founded on soft soil



GLOBAL HOUSING TECHNOLOGY CHALLENGE INDIA

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Pradhan Mantri Awas Yojana-Urban

Ministry of Housing and Urban Affairs
Government of India

Azadi Ka Amrit Mahotsav

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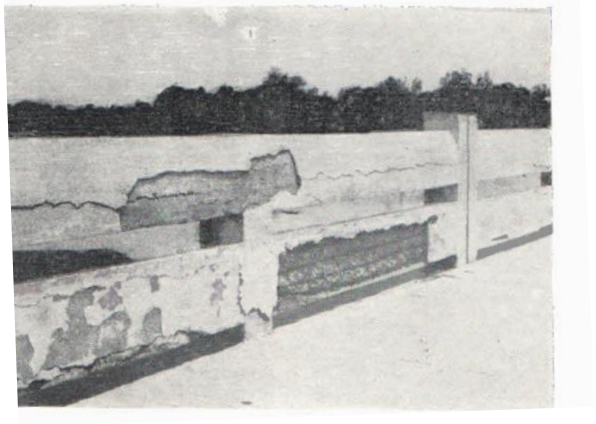
- Expansion Joints / Leakage
- Pavements
  - Settles
  - Abrasion
  - Water table below



Corrosion damage to railings of a bridge

Corrosion damage to an Exposed ceiling of shell Roof

- Cracks in concrete
  - Shrinkage
  - Temperature changes
  - Steel Corrosion

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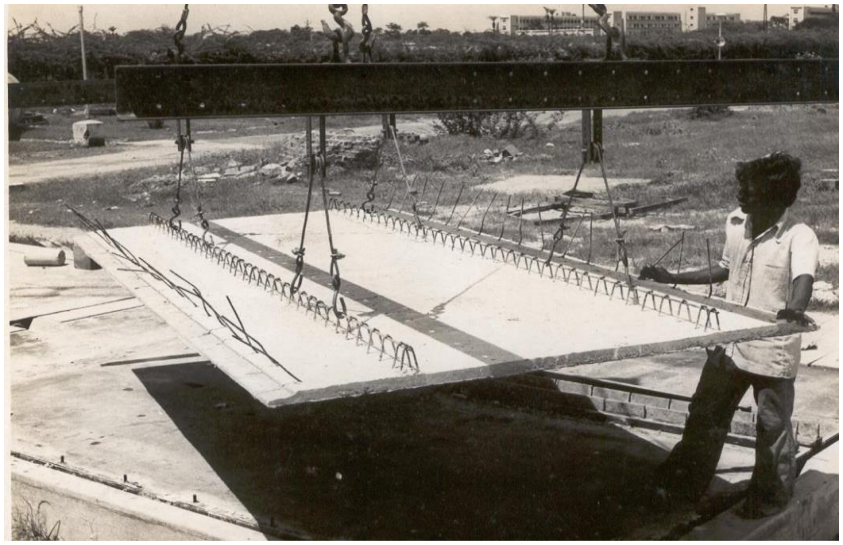
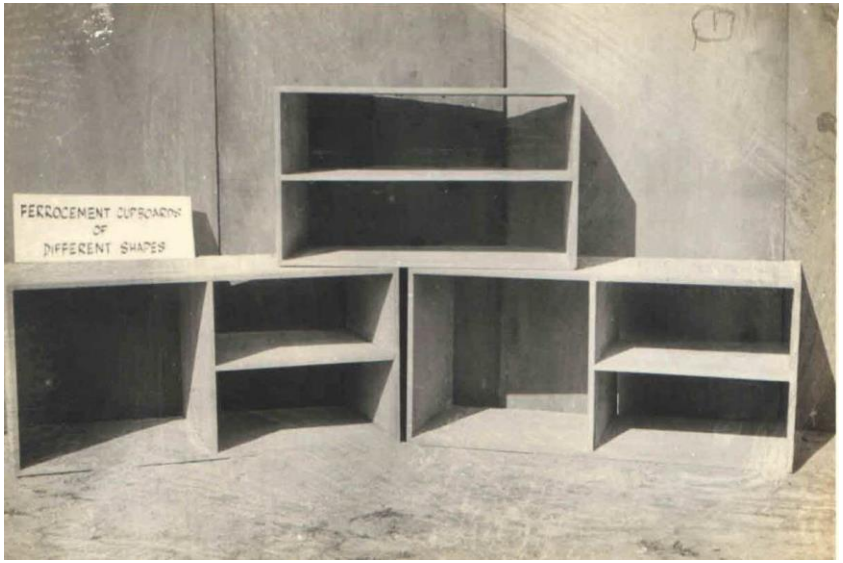
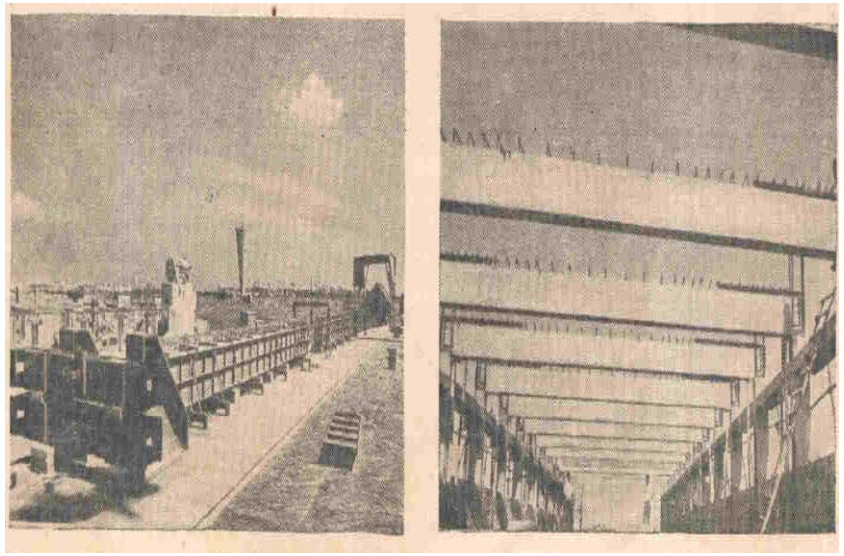
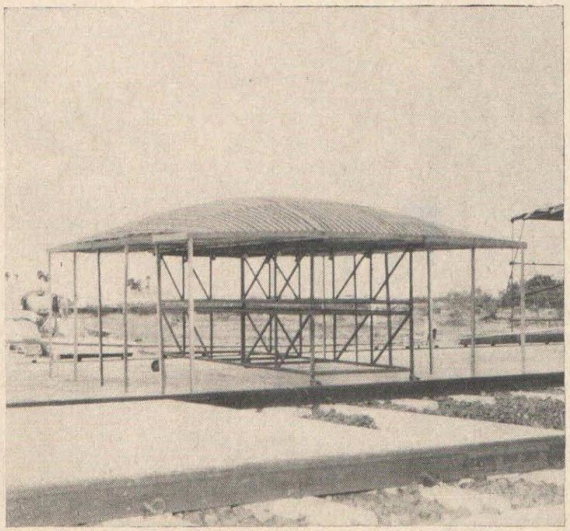






Prefabrication development over the years

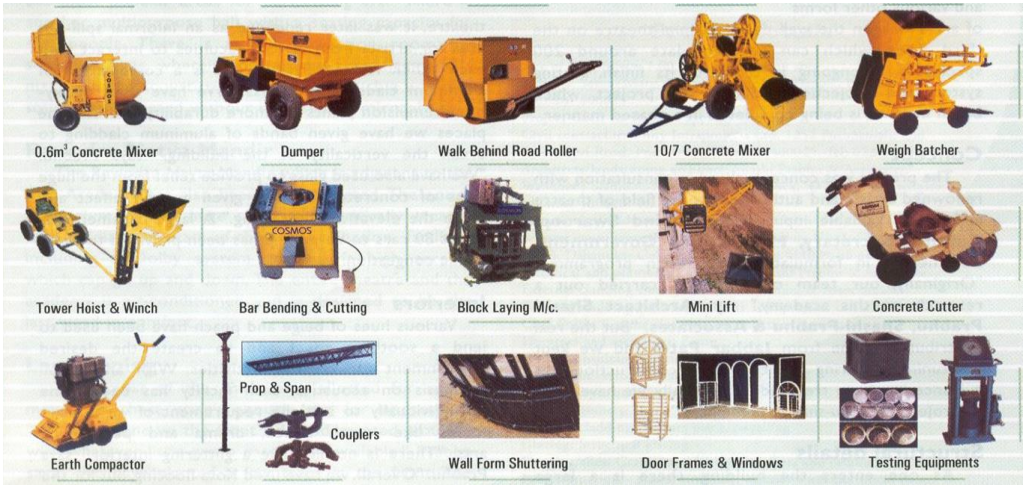


Foldable mobile formwork

Houses with brick funicular shell roofs at Tada, Andhra Pradesh

A number of new equipment products are now in use in construction

- Tower Cranes
- Bar Bending / cutting
- VDC Flooring
- RMC
- Concrete pumps
- Several Form system including Aluminium forms



Masonry

- Bricks
- Frog up / down
- Hold Fasts

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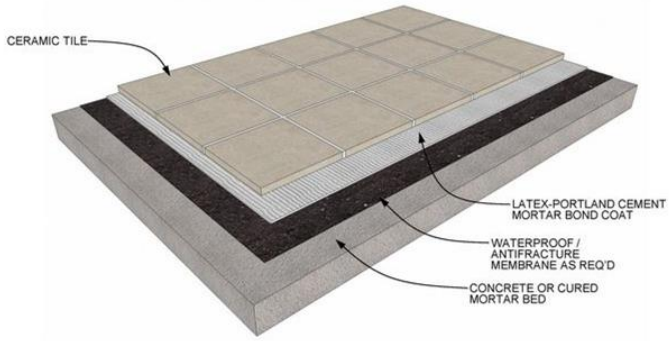
Masons are also required to do plastering and floor finishing.

Plaster is made up using lime, cement, gypsum and their combinations

What are basic requirement of Finished plaster?

- ➔ Smooth even surface
- ➔ Free of cracks
- ➔ Flatness is measured as no projection/depression in a 3m square possibly with a 3mm tolerance



To ensure good plastering

- ➔ have coherent blend easy to work with
- ➔ curing by spray to ensure freedom from cracks
- ➔ Pre wetting of walls to reduce absorption of water from mortar

- Floor finishes are in concrete with smooth finish or broom finish.
- Finish in panels of 15m2 or less to avoid shrinkage cracks.
- Floor grinding or broom brushing are done on floor to ensure degrees of smoothness.

- Use appropriate tools to work with if the final floor finish is of Kota, Cuddapah, Stones, tiles, marble or granite slabs. The plaster finish should be rough to increase the bonding.
- Painting on plastered wall should be with appropriate paints externally or internally.
- On walls fresh with locked in moisture, membrane painting be avoided.
- Bubbles or Flakes will appear on membrane paints if locked in moisture escapes.