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

GLOBAL HOUSING TECHNOLOGY CHALLENGE INDIA

Ministry of Housing and Urban Affairs
Government of India

Azadi Ka Amrit Mahotsav

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giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

# Light House Projects : LIVE LABORATORIES

## WEBINAR SERIES: Volume 3 – International Perspective

### e-Learning sessions on innovative techniques in new age construction

## Volume 3 -Session #05 on Light House Project Ranchi, Jharkhand

**Theme – International Perspective Innovative Technologies and Practices in LHPs**

**Date: 04.10.2023, Monday| Time: 15:00 – 17:00**

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*Light House Projects : Live Laboratories*
*Webinar Series*

# Emerging Construction Systems for Mass Housing

bmtpc

**Building Materials & Technology Promotion Council**
**Ministry of Housing & Urban Affairs**
**Government of India**

# Pradhan Mantri Awas Yojana - Urban

**Being implemented since June 2015, is one of the major flagship programmes being implemented by Government of India to provide all weather pucca houses to all eligible beneficiaries in the urban areas of the country through States/UTs/Central Nodal Agencies.**

**Four verticals: Beneficiary Led Construction/ Enhancement (BLC), Affordable Housing in Partnership (AHP), In-situ Slum Redevelopment (ISSR) and Credit Linked Subsidy Scheme (CLSS).**

# PMAY (U) Achievement (provisional)

[as on 25th September, 2023]

## Overall Sanctions for 1.19 crore Houses

### Construction of Houses ( Nos in lakh)

| Demand | Sanctioned | Grounded* | Completed* |
|---|---|---|---|
| 112.24 | 118.90 | 113.30 | 77.02 |

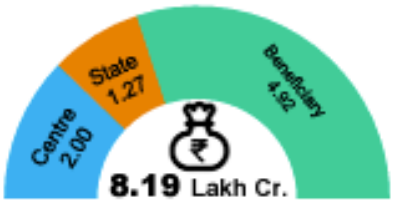
### Financial Progress (₹ in Cr)

| Committed | Released | Expenditure | UC Received |
|---|---|---|---|
| 1,99,944 | 1,52,154 | 1,43,243 | 1,43,056 |

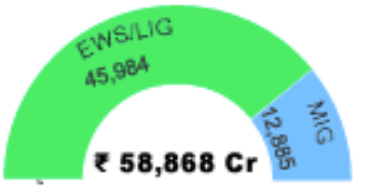

Houses in verticals (Nos in Lakh)

S- Sanctioned G- Grounded C- Completed


Beneficiaries under CLSS (in lakh)




Investment Approved (Rs in Lakh Cr.)

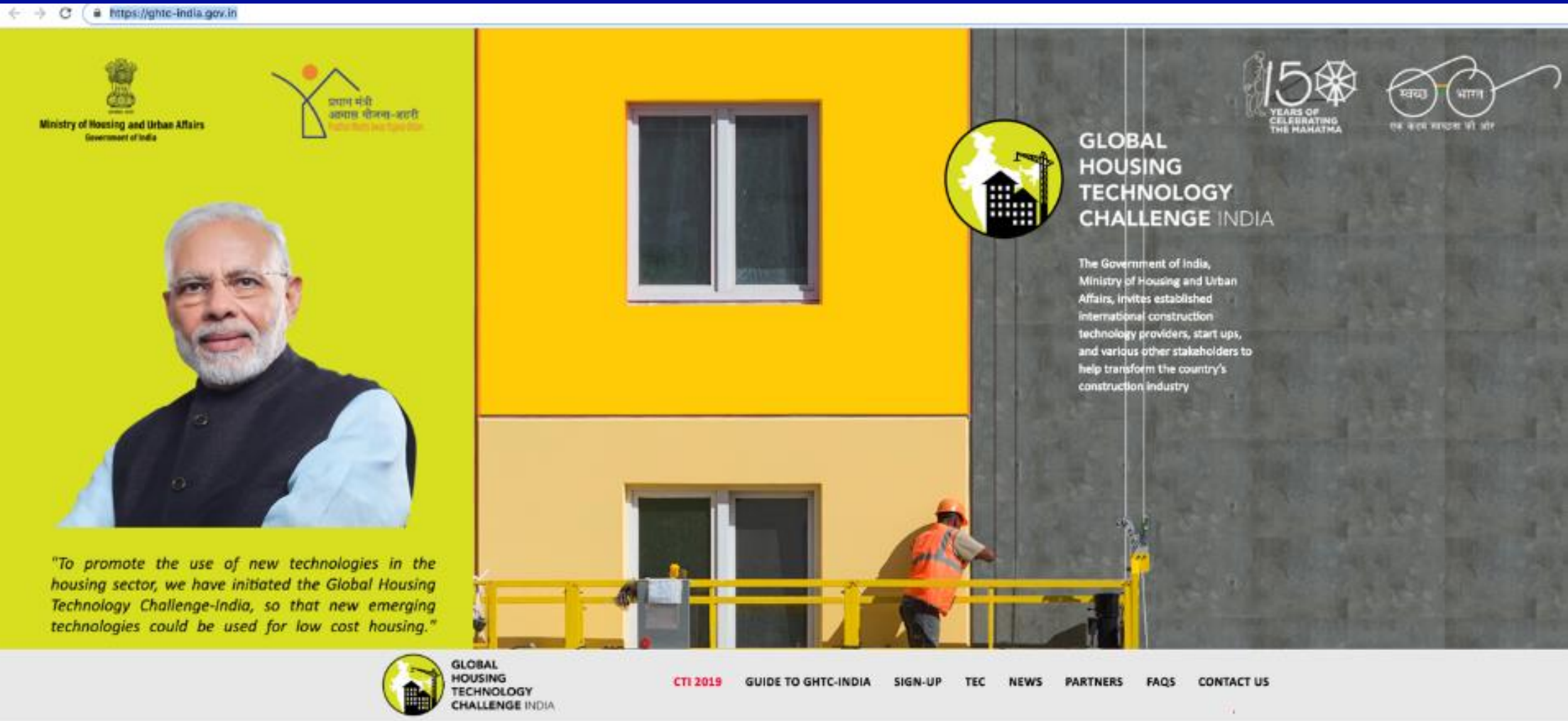



Interest Subsidy under CLSS (Rs in Cr.)

**16 lakh houses are being constructed using New Technologies**

GLOBAL HOUSING TECHNOLOGY CHALLENGE INDIA

# Global Housing Technology Challenge - India (GHTC-I)




**https://ghtc-india.gov.in/**

# Global Housing Technology Challenge - India (GHTC-I)

| Categories | Technology | Tech. Providers |
|---|---|---|
| *1* | ***Precast Concrete Construction System - 3D Precast volumetric*** | 4 |
| ***2*** | ***Precast Concrete Construction System – Precast components assembled at site*** | 8 |
| *3* | ***Light Gauge Steel Structural System & Pre-engineered Steel Structural System*** | 16 |
| ***4*** | ***Prefabricated Sandwich Panel System*** | 9 |
| *5* | ***Monolithic Concrete Construction*** | 9 |
| *6* | ***Stay In Place Formwork System*** | 8 |
| | Total | **54** |

# Light House Projects under GHTC-India

| Location | Technology | Houses |
|---|---|---|
|   | Prefabricated Sandwich Panel System | 1,024 |
|   | Monolithic Concrete Construction System | 1,144 |
|   | Precast Concrete Construction System-Precast Components Assembled at Site | 1,152 |
|   | Precast Concrete Construction System-3D Pre-Cast Volumetric | 1,008 |
|   | Light Gauge Steel Structural System & Pre-Engineered Steel Structural System | 1,000 |
|   | Stay in-place Formwork System | 1,040 |

- GHTC-India was launched to identify and mainstream innovative proven construction technologies from across the globe which are Cost-effective, Climate & Disaster Resilient, Sustainable and Green.
- Shortlisted Technologies will showcase 6 Light House Projects (LHPs) in 6 States through challenge process as **Live Laboratories.**
- **3S** Mantra of Skill, Scale & Speed for superior quality of construction

# Conventional Construction Systems

***business as usual approach***

The prevalent construction systems in India are:

***Load bearing Structure***

In this system, walls are constructed using bricks/stone/block masonry and floor/roof slabs are of RCC/stone/composite or truss. It is cast in-situ system and called load bearing system as load of structure is transferred to foundation and then to ground through walls.

***RCC Framed Structure***

In this cast in-situ system, the skeleton of a structure is of RCC column and beam with RCC slab. The infill walls can be of bricks/blocks/stone /panels. The load of the structure is transferred through beam and column to the foundation.

# 3D Precast Volumetric Construction

- Replacing cast in situ RCC structural frame with factory made structural components – 3D
- Customized factory made volumetric construction i.e. the entire module (room)

# 3D MONOLITHIC VOLUMETRIC Construction



Courtesy :

# Light House Project (LHP) at Ranchi, Jharkhand

**(Technology: Precast Concrete Construction – 3D Volumetric Construction)**

No. of Dwelling Units : 1008 Nos. (G+8)
No. of Block / Tower : 7 Blocks
Units in each Block / Tower : 144 Nos.

# 2D Precast Concrete Construction

- Replacing cast in situ RCC structural frame with factory made structural components – 2D planar elements
- Customized Factory made beams, columns, wall panels, slab/floors, staircases etc.

# Concrete components prefabricated in precast yard or site and installed in the building during construction





# CASTING OF PRECAST ELEMENTS

- Casting of partially precast slabs

# CASTING OF PRECAST ELEMENTS

Precast Beam

Precast slab

Precast Column

Precast Stairs

# STRUCTURAL SYSTEM

# FLOORS/ SLAB

- After erection of beams and column, partially precast slabs are placed with required bearing on the beams.

# FLOORS/ SLAB

- Finally the screed concrete (55mm thickness) is poured over the partially precast slab to ensure monolithic continuous action and ductile behavior of the structure.

# FLOORS/ SLAB

- Structural integrity and monolithic behavior is achieved in this technology through wet jointing using dowel bars/ continuity reinforcement placed at connection joints and filled with in-situ self-compacting concrete of higher strength in hollow cores of column.

# Light House Project (LHP) at Chennai, Tamil Nadu

**(Technology: Precast Concrete Construction System-Precast Components)**

No. of Dwelling Units : 1152 Nos. (G+5)
No. of Block / Tower : 12 Blocks
Units in each Block / Tower : 96 Nos.

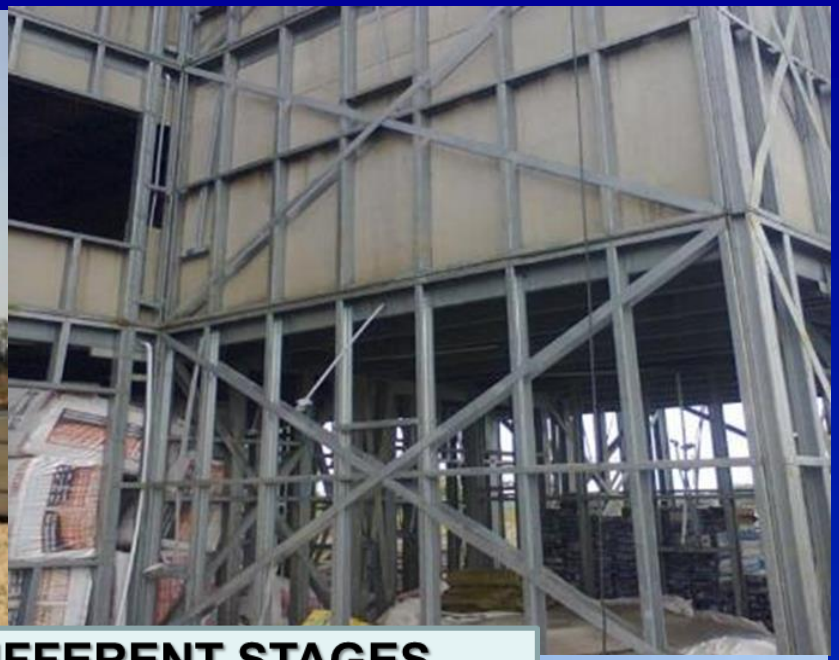
# PRE-ENGINEERED STEEL STRUCTURAL SYSTEM

- Replacing cast in situ RCC structural frame with factory made steel (hot rolled) structural system

Steel skeleton with Aerocon panel infills

# LIGHT GAUGE STEEL STRUCTURAL SYSTEMS

- Replacing cast in situ RCC structural frame with factory made light gauge steel (cold rolled) structural system



# ERECTION –DIFFERENT STAGES

# Light House Project (LHP) at Agartala, Tripura

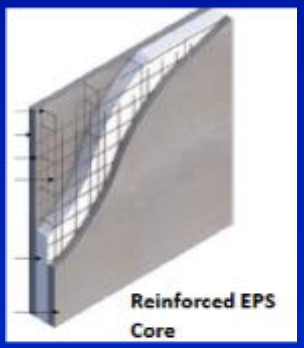
**(Technology: Light Gauge Steel Structural System & Pre-Engineered Steel Structural System)**

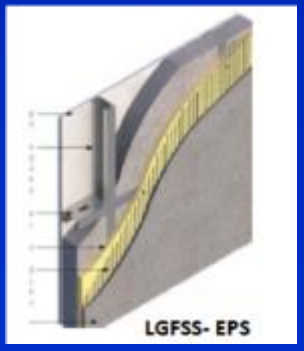
No. of Dwelling Units : 1000 Nos. (G+6)
No. of Block / Tower : 7 Blocks
Units in each Block / Tower : A(112), B(154), C(118), D(168), E(168), F(168) & G(112)

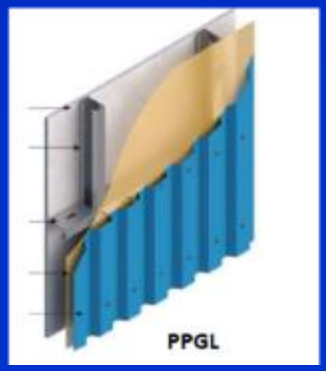
# PREFABRICATED SANDWICH PANEL SYSTEMS



- **EPS Core Panel Systems**
- **Other Sandwich Panel Systems**
  - **Fibre cement board**
  - **MgO Board**
  - **AAC panels**





- **Replacing brick and mortar walls with dry customized walls made in factory**

SINGLE

DOUBLE

# Rising EPS (Beads) Cement Panels

- Rising EPS (Beads) Cement Panels are patented panels from M/s Rising Japan Infra Pvt. Ltd. These are lightweight composite wall, floor and roof sandwich panels made of thin fiber cement/calcium silicate board as outer and inner faces with a core of EPS granule balls, adhesive, cement, sand, fly ash and other bonding materials in mortar form.
- The core material in slurry state is pushed under pressure into preset molds. Once set, it shall be moved for curing and ready for use with RCC or steel framed structure.
- These panels are presently manufactured by the firm in China and now plants are operational in Pune & Nagpur.

# Prefabricated Sandwich Panel System

- **Typical Wall Panel Dimensions**

| | |
|---|---|
| Length | 2440 mm (may be increased upto 3000 mm) |
| Width | 610 mm (may be altered as per requirement but should not be too wide since handling of the panels become difficult) |
| Thickness | 50-250 mm. Dimensions |

- In LHP at Indore, the height of panel is 3.0 mtr., width is 610 mm.
- The thickness of panels being used is 120 mm for external walls and 90 mm internal walls.
- The additional cladding at L and T joints are required with 60 mm thick panels to encase the steel structure.

# Prefabricated Sandwich Panel System

- **Photos of manufacturing plant**

A view of block with shear wall and PEB structure

## Floor/ Roof Slab

- The floor/ roof is deck slab which comprises of deck sheet, reinforcement with concrete screed

# Light House Project (LHP) at Indore, M.P.

**(Technology: Prefabricated Sandwich Panel System & Pre-Engineered Steel Structural System)**

No. of Dwelling Units : 1024 Nos. (S+8)
No. of Block / Tower : 8 Blocks
Units in each Block / Tower : 128 Nos.

# MONOLITHIC CONCRETE CONSTRUCTION

- Replacing cast-in-situ Formwork with factory made customized formwork systems
- Formwork material is Aluminium / composites / steel having 100 to 500 repetitions
- Assembly line construction i.e. placing the formwork, pouring the concrete, moving the formwork to upper level

# Monolithic Concrete Construction Technology

The conventional mode of construction is RCC framed structure with infill masonry walls whereas in this system, all walls, floors/slabs, stairs together with door & window openings are cast in-situ monolithically using specifically custom designed modular formwork made up of aluminium/plastics/steel/ composite.

The appropriate grade of concrete and reinforcement is used as per design and the entire casting of a modular unit is done in a single pour.

Being modular predesigned formwork system, it acts as a assembly line production and enables rapid construction of multiple/mass scale of units of repetitive type.

# Monolithic Concrete Construction



# Light House Project (LHP) at Rajkot, Gujarat

**(Technology: Monolithic Concrete Construction System)**

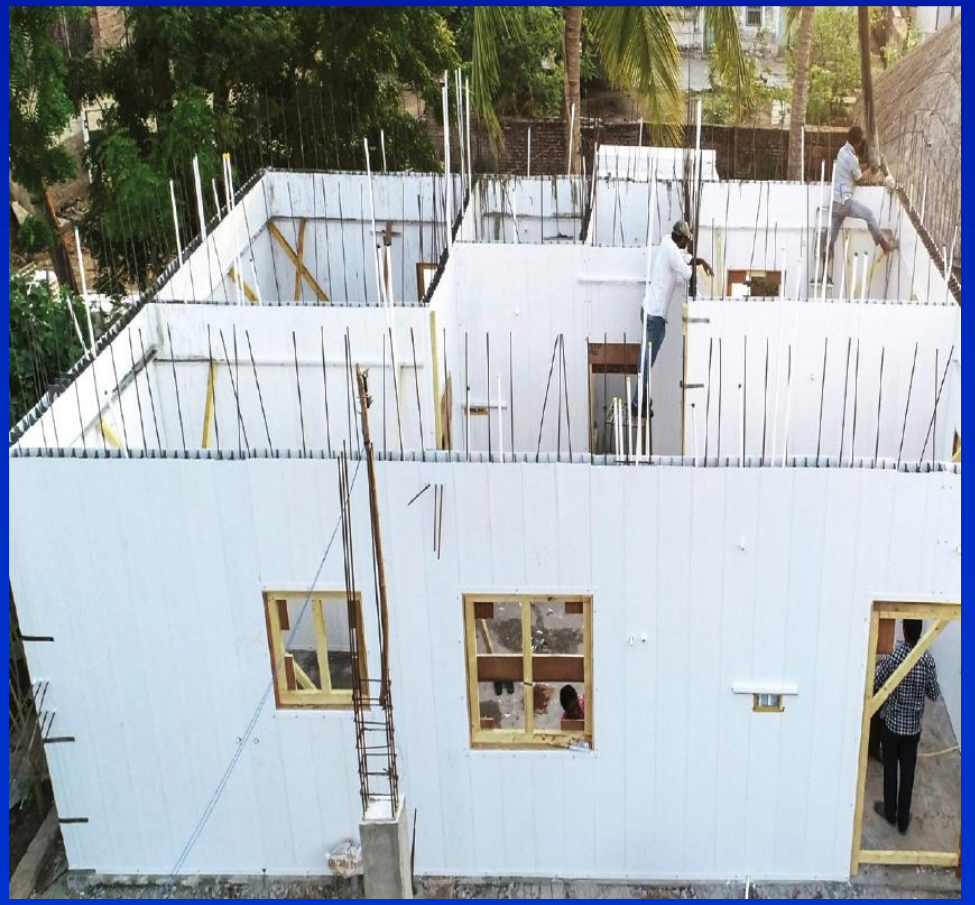
No. of Dwelling Units : 1144 Nos. (S+13)
No. of Block / Tower : 11 Blocks
Units in each Block / Tower : 104 Nos.


# STAY-IN-PLACE FORMWORK SYSTEM

- Replacing cast-in-situ Formwork with factory made formwork systems
- It is sacrificial formwork or lost formwork means formwork is left in the structural system to later act as insulation or reinforcement cage

# Stay-In-Place PVC Wall Forms

- This is a prefinished wall formwork from M/s Novel Assembler Pvt. Ltd. comprising of rigid Poly-Vinyl Chloride (PVC) based polymer components that serve as a permanent stay-in-place durable finished form-work for concrete walls.



- The extruded components slide and interlock together to create continuous formwork with the two faces of the wall connected together by continuous web members forming hollow rectangular components. The web members are punched with oval-shaped cores to allow easy flow of the poured concrete between the components.
- The hollow Novel Wall components are erected and filled with concrete, in situ, to provide a monolithic concrete wall.

## Wall Panels - Stay in Place PVC formwork System

- The formwork components are manufactured from extruded polyvinyl chloride (PVC).
- The extrusions consist of two layers, the substrate (inner) and Modifier (outer).
- The two layers are co-extruded during the manufacturing process to create a solid profile.

# Fixing of Wall Profiles

# Services, Doors, Windows

## SERVICES

- Services lines are fixed inside the wall panels prior to concrete pour
- Openings are cut in the walls for electrical and plumbing interfaces

## DOORS, WINDOWS AND CONCRETING

- Capping panels are fixed on edges of doors & windows before fixing wooden frames to gain strength for concrete pour. The frames are removed once concrete is set. No gaps to be left in between panels.
- Water proofing/hydrophilic sealant installed to cover all gaps and prevent concrete leak
- All corners, doors, windows, stop ends are adequately braced
- Metal strip on external wall corners and aluminum angles on top third of walls
- Screws on window panels and bottom connectors
- Self Compacting Concrete shall be poured by boom pump with a 50mm dia. end hose
- Pour shall not be done more than 1 mt. at any point to ensure panels can withstand concrete pressure


BED ROOM
( 3055 X 3940 )

# Light House Project (LHP) at Lucknow, U.P.

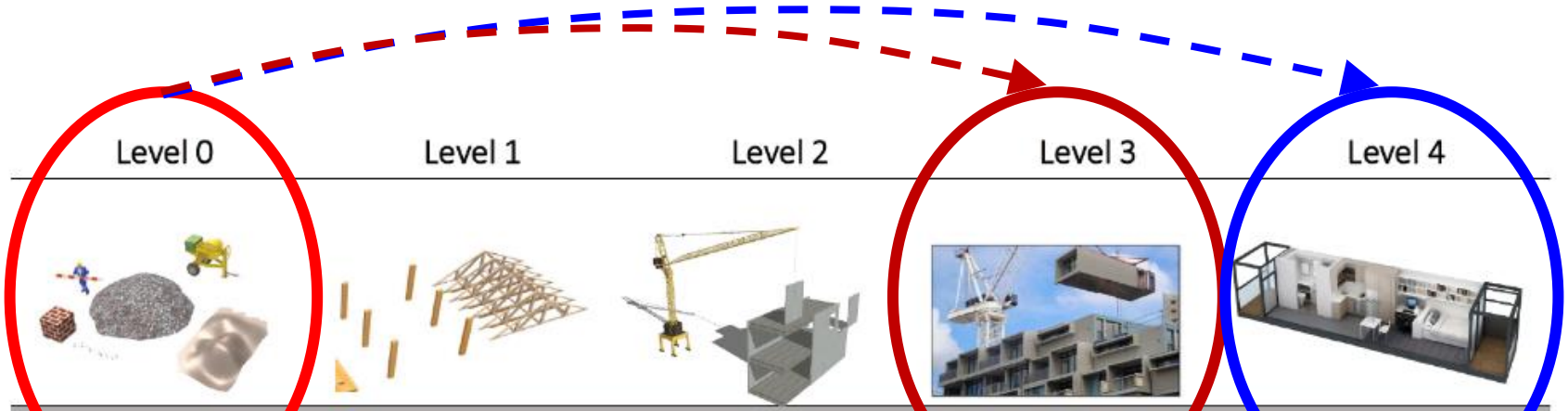
**(Technology: Stay in-place Formwork System & Pre-Engineered Steel Structural System)**

No. of Dwelling Units : 1040 Nos. (S+13)
No. of Block / Tower : 4 Blocks
Units in each Block / Tower : A(494), B(130), C(208) & D(208)

| Conventional Construction Systems | Alternate Construction Systems |
|---|---|
| Slow | Fast |
| Maximum Use of Natural Resources | Optimum use of Resources |
| Waste Generation | Minimum Waste |
| Air/Land/Water Pollution | Minimum Pollution |
| Labour Intensive | Industrialized System |
| Prescriptive Design | Cost-effective Design |
| Unhealthy Indoor Quality | Better health & Productivity |
| Regular Maintenance | Low Life Cycle Cost |
| Energy Intensive | Energy Efficient |
| Cast-in-situ Poor Quality | Factory Made Quality Products |
| High GHG Emissions | Low GHG Emissions |
| Unsustainable | Sustainable |

# Looking Back / Rear view

## Levels of Construction Technology




| Basic materials for site-intensive construction | Manufactured components | Linear or 2D components | 3D components in the form of modules | Modular components - fully finished and delivered to site |
|---|---|---|---|---|
| ✓ Involves more Labour<br>✓ Time consuming | ✓ Fabricated in Factory<br>✓ Can't be build On-site<br>✓ Assist in construction speed & quality | ✓ Series of Pre fabricated elements assembled to form the shell<br>✓ Requires on-site work | ✓ Volumetric, forms a completed part of the building<br>✓ Involves more than one trade in the factory | ✓ Finished interior & exterior surfaces<br>✓ Less on-site work |

**Source:** Gibb., A.G.F., *Off-site Fabrication—Pre-Assembly, Pre-Fabrication, and Modularization*

Courtesy : hoMission Abode All

www.bmtpc.org

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*"Creating Enabling Environment for Affordable Housing for All"*

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Aug – Sep 2023

## Volume 3 - Session #05 on Light House Project Ranchi, Jharkhand

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स्वच्छ भारत
एक कदम स्वच्छता की ओर

# LIGHT HOUSE PROJECT AT RANCHI

***GHTC-India Category***

**Precast Concrete Construction - 3D Volumetric**

***Technology***

**3D Modular Precast Magic Pods**

# CONTENTS

GLOBAL HOUSING TECHNOLOGY CHALLENGE INDIA

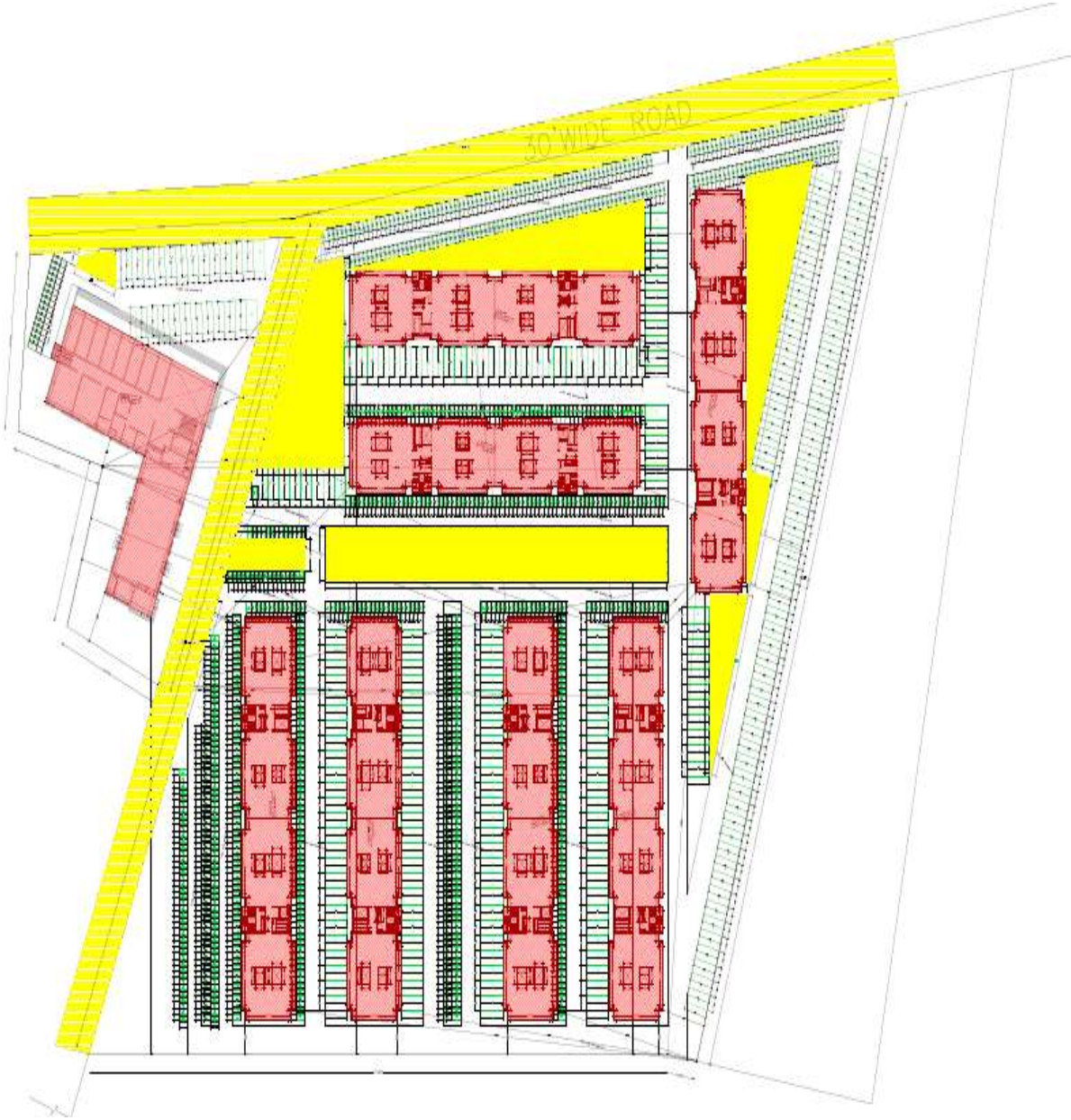
# Global Housing Technology Challenge - India (GHTC-I)

| ***Broad Category*** | ***Technologies (Nos.)*** |
|---|---|
| ***Precast Concrete Construction System - 3D Precast volumetric*** | 4 |
| ***Precast Concrete Construction System – Precast components assembled at site*** | 8 |
| ***Light Gauge Steel Structural System & Pre-engineered Steel Structural System*** | 16 |
| ***Prefabricated Sandwich Panel System*** | 9 |
| ***Monolithic Concrete Construction*** | 9 |
| ***Stay In Place Formwork System*** | 8 |
| **Total** | 54 |

# Summary of Six Light House Projects (LHPs)

| LHP Location | | | Chennai (Tamil Nadu) | Rajkot (Gujarat) | Indore (Madhya Pradesh) | Ranchi (Jharkhand) | Agartala (Tripura) | Lucknow (Uttar Pradesh) |
|---|---|---|---|---|---|---|---|---|
| **Sl. No** | **Particulars** | **Units** | | | | | | |
| 1 | Name of Technology | Name | Precast Concrete Construction System-Precast Components | Monolithic Concrete Construction using Tunnel Formwork | Prefabricated Sandwich Panel System | Precast Concrete Construction System – 3D Volumetric | Light Gauge Steel Frame System (LGSF) with Pre-Engineered Steel Structural System | Stay in Place Formwork System |
| 2 | No. of Houses | No. | 1,152 | 1,144 | 1,024 | 1,008 | 1,000 | 1,040 |
| 3 | No. of Floors | No. | G+5 | S+13 | S+8 | G+8 | G+6 | S+13 |
| 4 | Plot Area | Sqm | 33,596 | 39,599 | 41,920 | 31,160 | 24,000 | 20,000 |
| 5 | Per House Carpet Area | Sqm | 26.58 | 39.77 | 29.04 | 29.85 | 30.00 | 34.50 |
| 6 | Project Cost | INR (in Cr) | 116.27 | 118.90 | 128.00 | 134.00 | 162.50 | 130.90 |
| 7 | Per House cost (with infrastructure) | INR (in Lakh) | 10.09 | 10.39 | 12.50 | 13.29 | 16.25 | 12.58 |

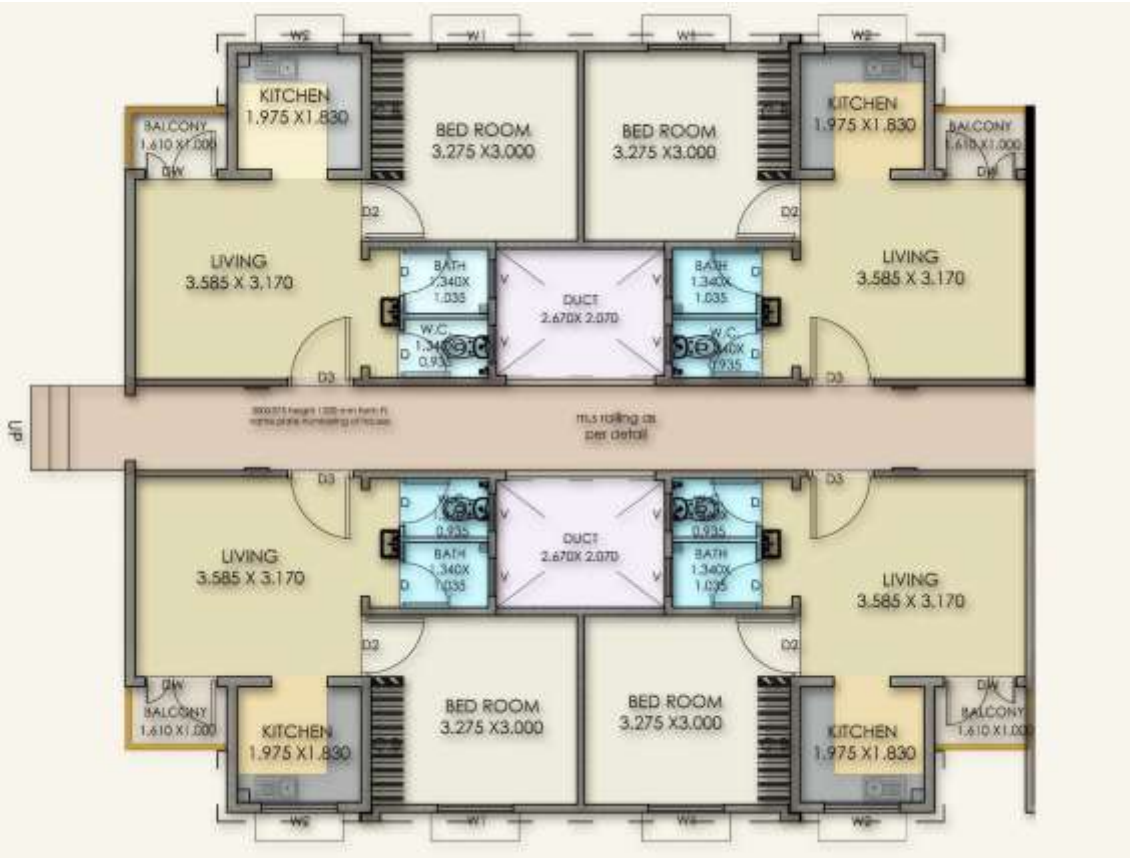
- There are 7 blocks in Ground + 8 configuration with 1008 houses along with basic and social infrastructure.
- Ground coverage of the project is 29.3% and FAR is 2.21.
- Green space is  20%.




Typical floor plan


- 16 dwelling units at each floor of building block with provision of lifts and staircases.

- Typical Dwelling Unit plan




Each dwelling unit consists of one hall, one bed room, a kitchen, WC, Bath and a balcony. The carpet area of each unit is 29.85 Sq.mt. The sizes of individual rooms & service areas conform to NBC norms.

**Other special features:**

- Green rating as per GRIHA
- Use of renewable resources:
  - Rain water harvesting
  - Solar lighting
- STP with recycling of waste water
- Fire Fighting System conforming to NBC
- Solid waste management

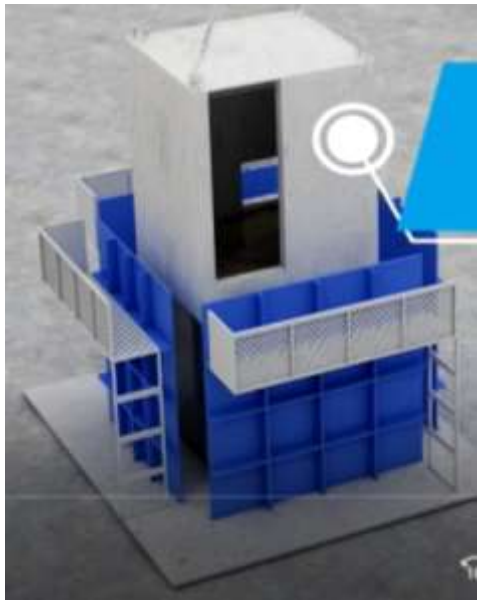
## Prevalent Construction Systems

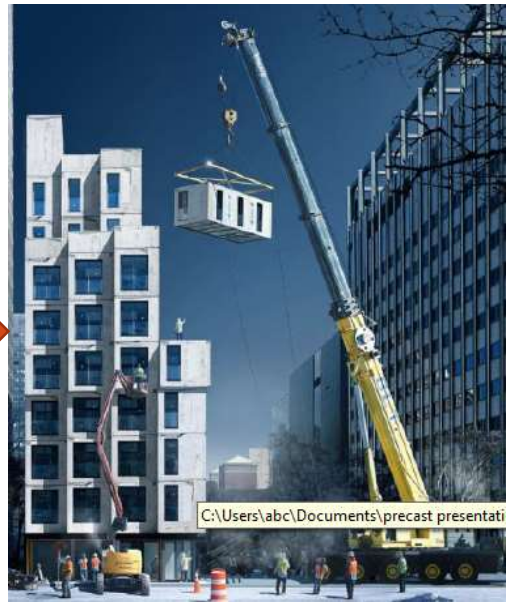
## Technology being Used

### Load bearing Structure

### RCC Framed Structure

### Precast Concrete Construction - 3D Volumetric






It is the modern method of building by which 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 transported, erected & installed using cranes and are integrated together in the form of complete building unit.

# Structural Elements

- Foundation
- Structural System comprising of 3D modules, walling panels & solid core pre-stressed slab

## Foundation

- Conventional as per geo-technical investigations, bearing capacity, soil strata, water table, etc.
- Raft foundation with RCC shear wall upto plinth level.
- Grade slab at plinth level.

# Structural system

## Manufacturing of structural modules

- 3D Steel Moulds are created as suiting to various sizes of Building units (Pods).
- High strength steel as per the structural design is placed inside 3D moulds.
- Electrical and plumbing lines are set up. Block outs for doors and windows are also set up at the same time.
- The pods are cast into their final shape using high-performance concrete.
- Strict quality checks are taken for each pod before they are transported for erection and assembly at the site.

# Casting Yard at Site

# Casting Yard at Site

# Casting Yard at Site

## Advantages of the System

- Upto 90% of the building work including finishing is complete in plant/casting yard leading to significant reduction in construction & occupancy time
- The controlled factory environment brings resource optimization, improved quality, precision & finish
- The required concrete can be designed using industrial by-products such as Fly Ash, Ground granulated blast furnace slag (GGBS), Micro silica etc. resulting in improved workability & durability, while also conserving natural resources. In this project Ground granulated blast furnace slag & silica fume is proposed in concrete.
- With smooth surface it eliminates use of plaster
- The monolithic casting of walls & floor of a building module reduces the chances of leakage
- The system has minimal material wastage (saving in material cost), helps in keeping neat & clean construction site and dust free environment
- Use of optimum quantity of water through recycling
- Use of shuttering & scaffolding materials is minimal
- All weather construction & better site organization

# Structural Elements

## Essential requirements

- Space for casting yard is required in addition to site for actual construction. The project is not viable if the factory is located far away. Setting up of casting yard requires time in month/(s) depending on project size & delivery schedule
- Boiler (In case of Steam Curing)
- Approach road to site for movement of high capacity trailers, Cranes etc.
- Site should have space for proper leveraging & functioning of cranes
- Requires skilled labour & strict supervision
- Plumbing & electrical services need to be pre-planned


Being first time mass scale field implementation of new technology the Light House Project at Ranchi is on

**Design & Build Basis**

Agency:

**M/s SGC Magicrete LLP, Mumbai**

Technology Provider:

**M/s Magicrete Building Solutions**

# Design Basis

- Structural System
  - Sub-structure up to the plinth level in Cast In-situ RCC (Raft foundation with Shear wall upto Plinth level)
  - Superstructure is designed as Shear wall system
- Safe Bearing capacity: 180 KN/$m^2$, depth of foundation 2.0 m
- Raft foundation as per IS:2950 (Part-1)-1981 (reaffirmed 2008)
- Wind speed: Basic wind speed ($V_b$=39 m/sec)
- Design wind speed:

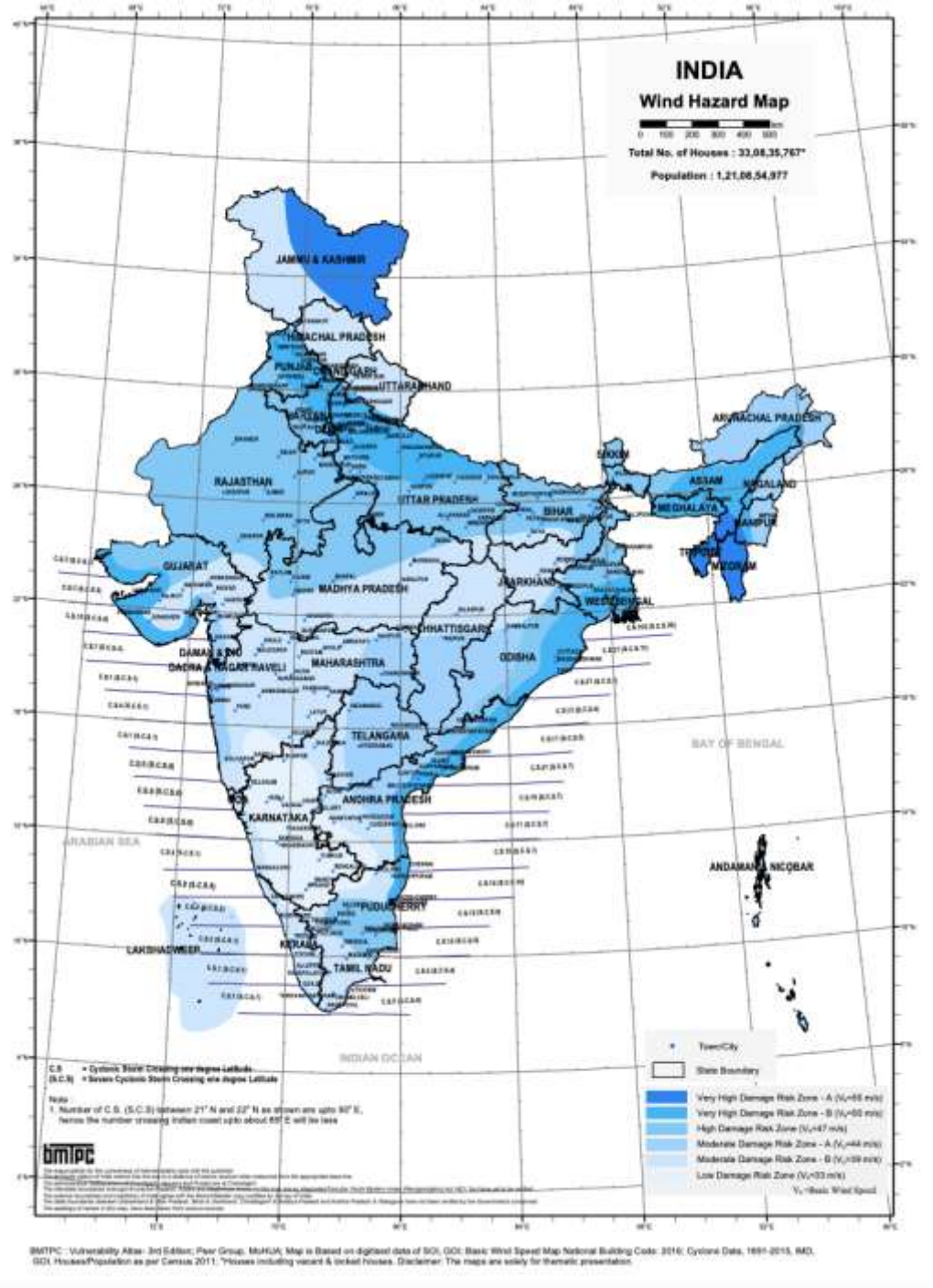
  $V_z=V_b.k_1.k_2.k_3.k_4$

  $k_1$ (Risk Coefficient)=1

  $k_2$ (Size factor)=as per height

  $k_3$ (topography factor)=1

  $k_4$ (importance factor)=1
- Wind Pressure ($P_z$) = $0.6.Vz^2$
- Wind pressure is converted into design wind pressure and then distributed at each storey as wind force.



# Design Basis

- Earthquake : Zone-II as per Seismic Zoning Map of India IS: 1893 (Part-1):2016
  - Designed as shear wall system with Response Reduction Factor=3 (Table-9 iv of IS: 1893 (Part-1):2016), Z=0.1,I=1.2, R=3, Damping Ratio=5%.
  - Design Horizontal Seismic Coefficient ($A_h$)

$$A_h=(Z/2).(S_a/g).(I/R)$$

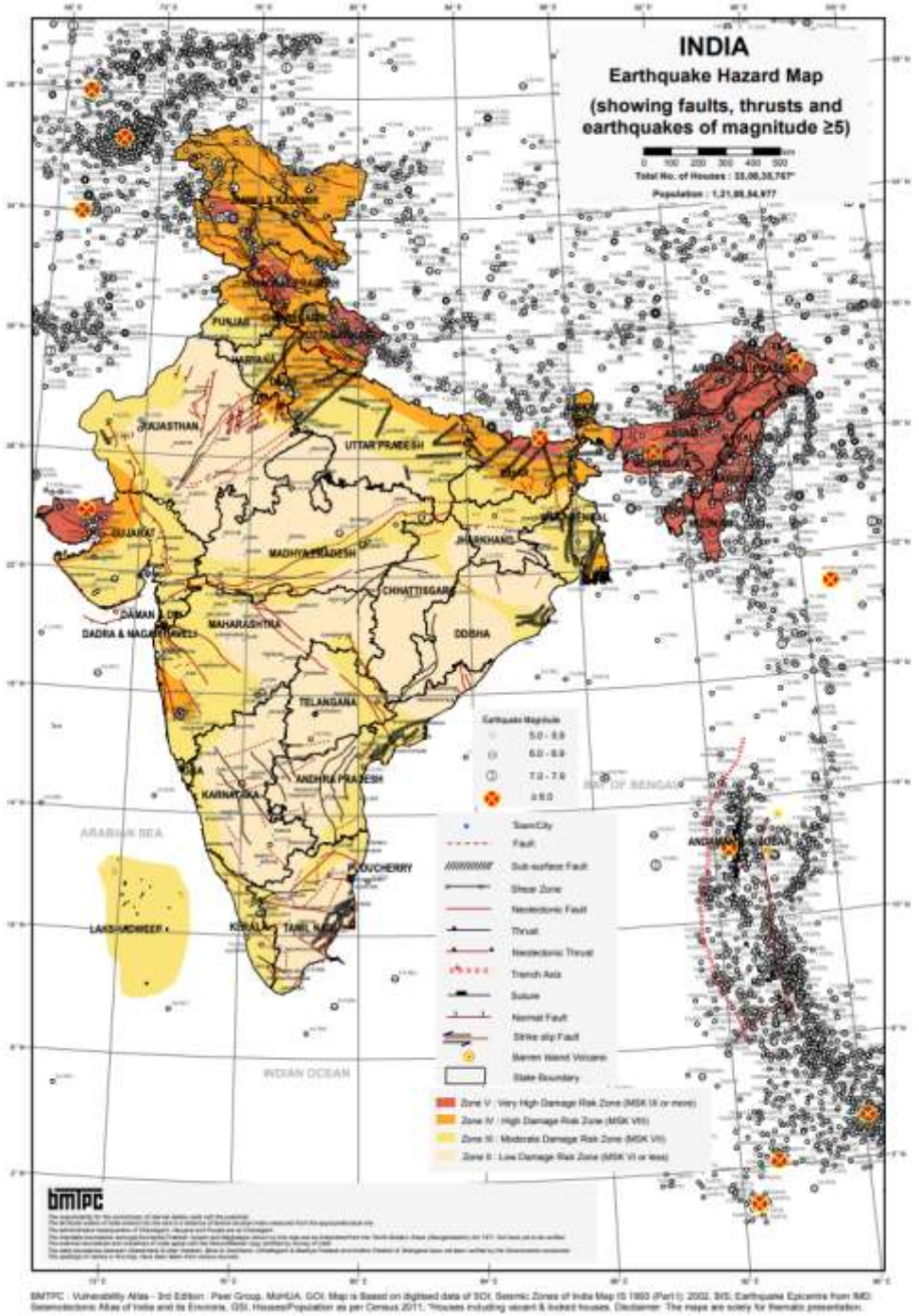
$S_a/g$ is design acceleration coefficient for different soil types corresponding to natural period (T) of building

  - Design Lateral Force ($V_B$)

$$V_B=A_h.W$$

W is seismic weight of building

- Precast slabs have rebar lattice girders projecting above precast surface. Whenever, two or more panels are forming one slab of a room, such panels have in-situ topping of reinforced concrete laid over slab after erection and the thickness of such screed is as recommended in IS: 1893 / IS: 13920 there by making them "composite". Staircase is also of precast RCC.
- Design has been carried out as per IS 456-2000 and NBC-2016.

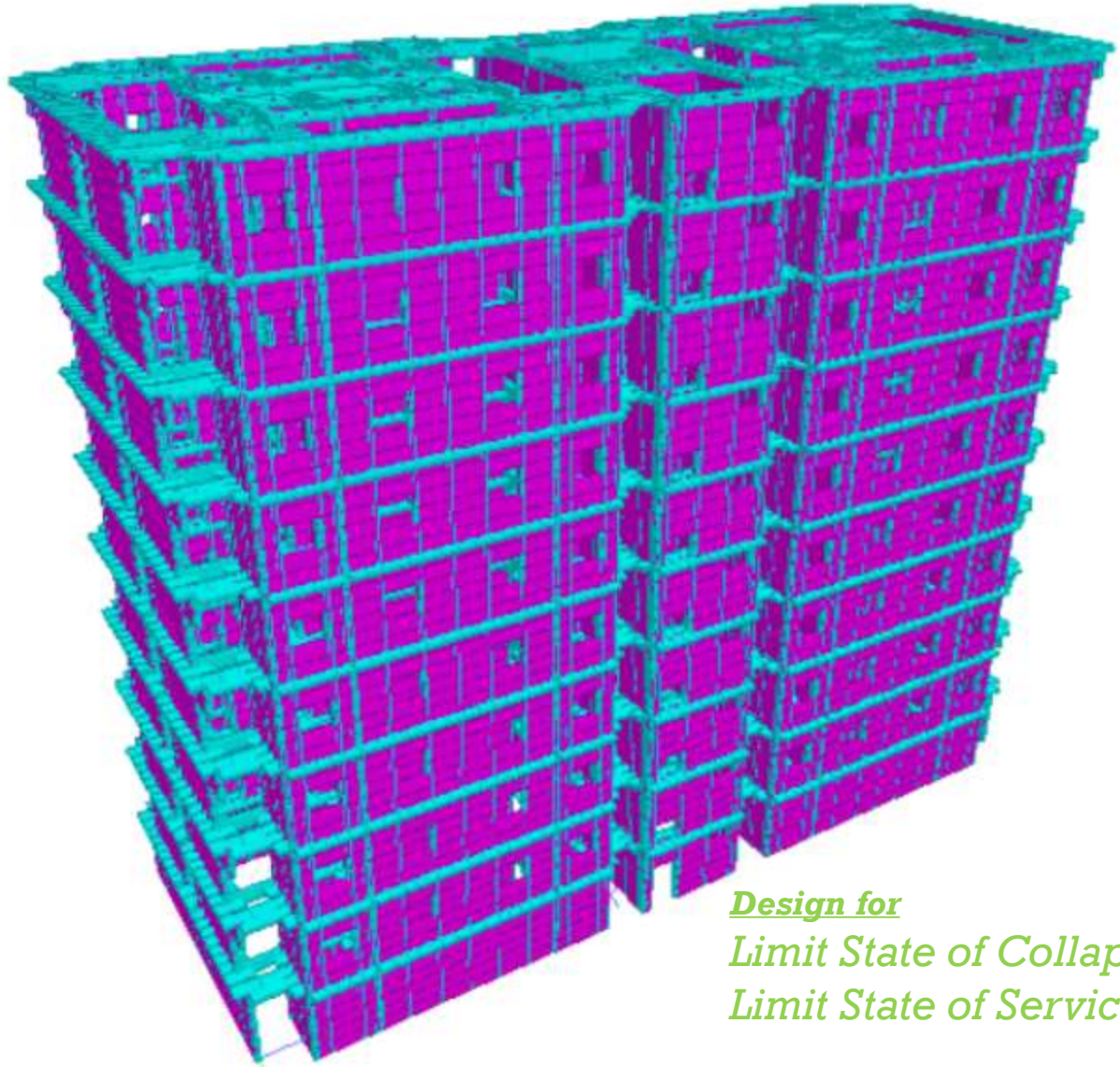


# STRUCTURAL ANALYSIS & DESIGN

- 3D Model of typical tower

- Load Combinations :
  - 1.5 (DL+LL)
  - 1.2 (DL+LL±EL/WL)
  - 1.5 (DL±EL/WL)
  - 0.9DL ±1.5EL/WL

*(EL/WL implies Earthquake/Wind Load in +X, -X, +Y, and –Y, directions . Lateral forces shall be considered acting from all directions but one at a time.)*



- Steel structural system can be easily modeled in the CAD software such as STAADPRO, ETABS, SAFE, SAP, ABACUS and others for detailed structural analysis.
- 2D/ 3D Static and dynamic linear and non-linear analysis can be carried out using these software.
- The software can also be used for structural design as per Indian Standards.
- AUTOCAD for drawings

***Design for***

*Limit State of Collapse*

*Limit State of Serviceability*

# Construction Sequence

- Sub-Structure: Foundation
- Super-structure: Structural System comprising of 3D modules, walling panels & solid core pre-stressed slab
- MEP: Plumbing & Electrical
- Finishing

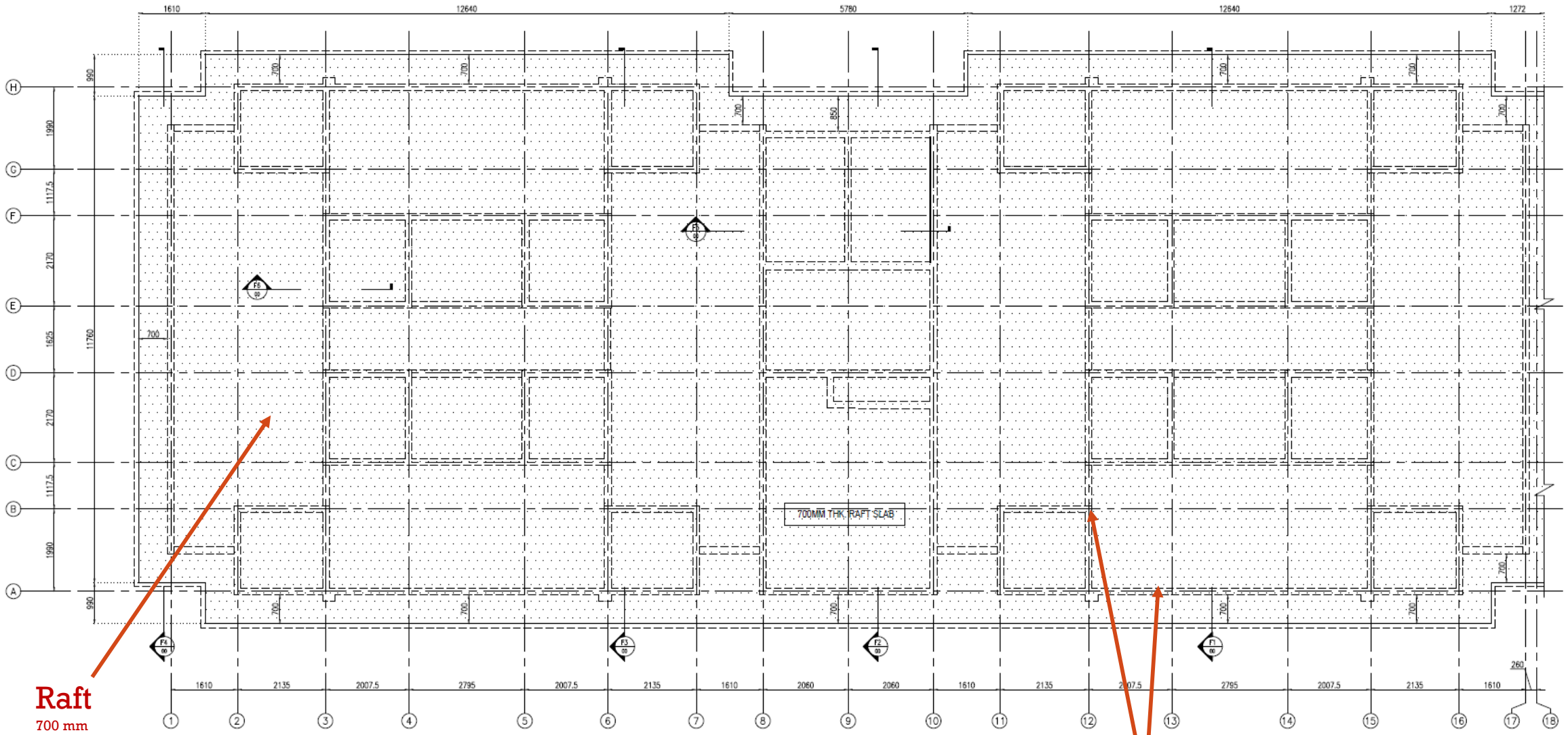
# Construction Sequence

Construction sequence in the project;

- Making the designed foundation of the building ready, while manufacturing of precast concrete structural modules are taking place at the factory.
- 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 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.

# FOUNDATION

# Structural Drawings

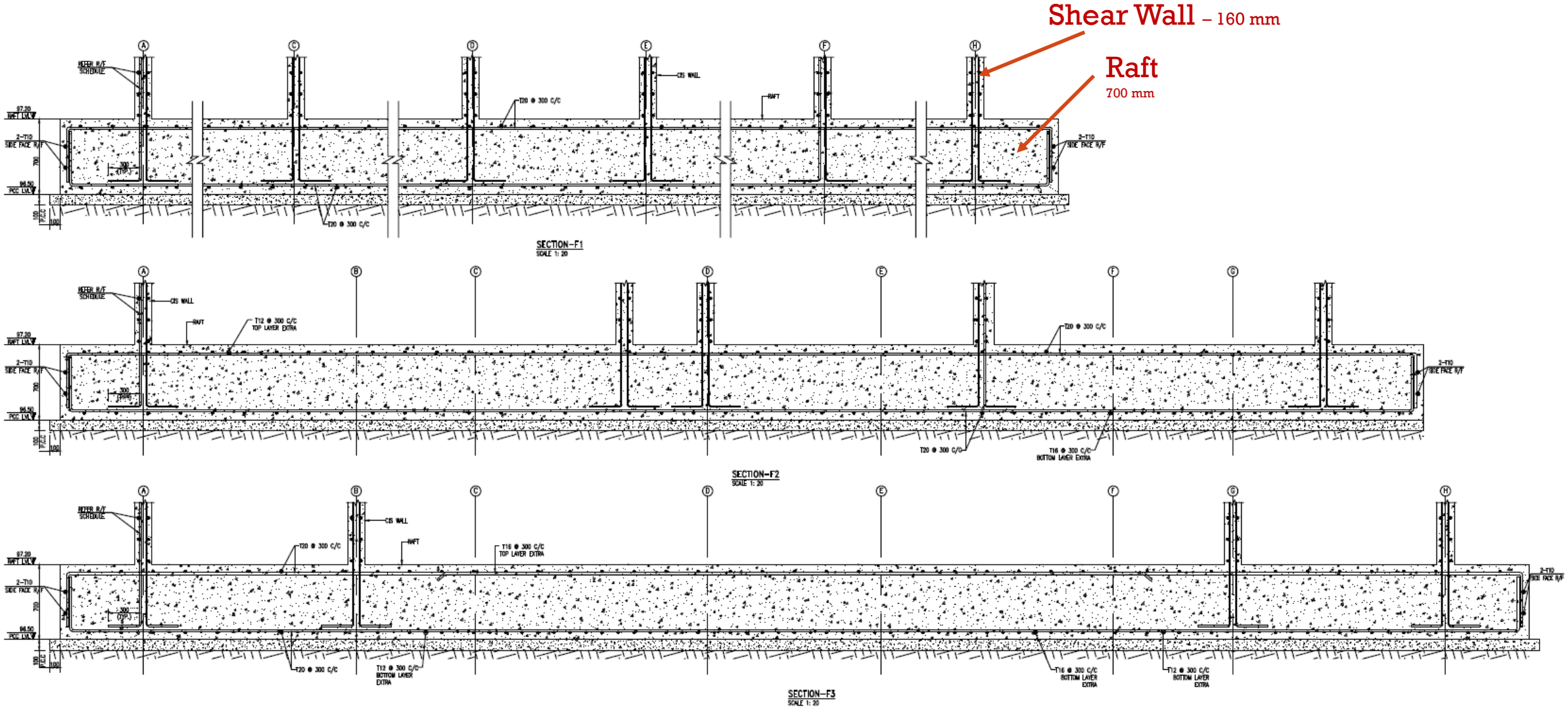



Raft
700 mm

Shear Wall – 160 mm

# FOUNDATION

# Structural Drawings



# FOUNDATION

## Concrete & Reinforcement Steel Specifications

| Item | Concrete Grade |
|---|---|
| Raft foundation, Precast Shear wall, Precast Partition walls (Non-Load bearing) | M30 |
| Precast Pre-stressed solid slab | M50 |
| Structural Screed | M35 |

- Mix design for concrete and all Concrete work shall conform to IS 456-2000 & Liquid retaining structures shall conform to IS 3370:2009
- All Super structure precast walls, Reinforcement Steels are to be HYSD/TMT bars of Fe 500 as per IS 1786-2008.
- Flooring Pre-stressed solid slabs: fpu = 1860 $N/mm^2$
- Structural Screed: Fe 500 of wire mesh

# Concrete mix design

| Cement Name | Conc. Grade | Water (kg) | Cement (kg) | W/C Ratio | Fine Aggregate (kg) | Coarse Aggregate (kg) | | ADMIXTURE (kg) | YIELD (kg per cubic metre) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 10 mm | 20 mm | | |
| JK Lakshmi PSC | M-30 | 136 | 390 | 0.35 | 658 | 644 | 644 | 1.56 | 2473 |

28 days Target Strength: M30 38.25 Mpa

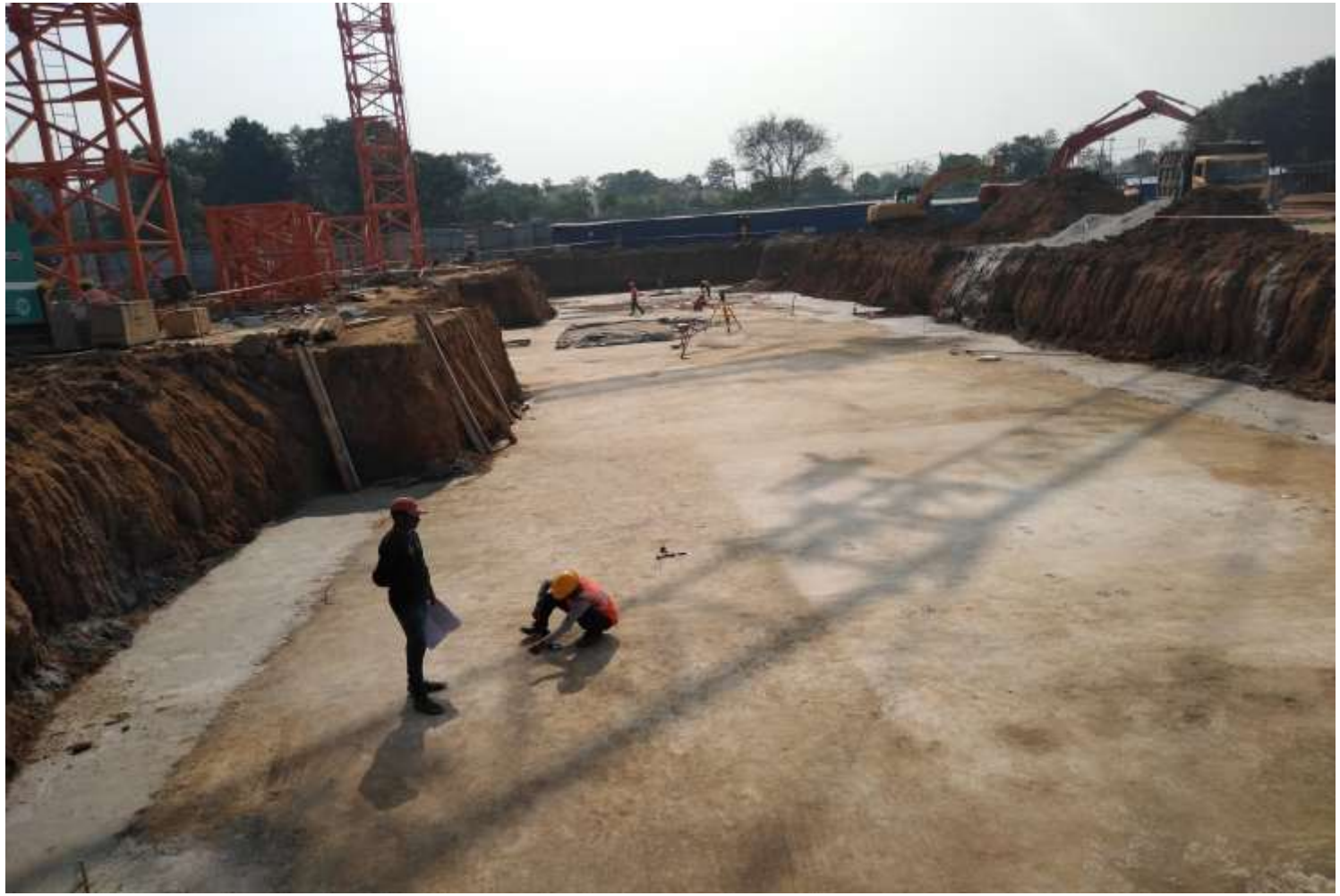
Design Slump range for the above mix: 100 mm

Portland slag cement has been used in the design mix of the Concrete, making the concrete **green and sustainable,** by conserving natural resources i.e. lime stone.

# Batching Plant

To bring resource efficiency, optimization of building materials and for quality control, a computerized batching plant has been established at site.

# FOUNDATION



- The project starts with layout and excavation.
- After the layout at site, the excavation of each block is done using mechanical excavators up to the required depth of foundation which is 2.0 m for blocks.

# FOUNDATION

- The foundation work starts with the PCC of 100 mm thickness (M10 Grade)

# FOUNDATION

- Reinforcement and shuttering for raft foundation

# FOUNDATION

- All building blocks have Raft foundation with 700 mm thick M-30 Concrete.

# FOUNDATION

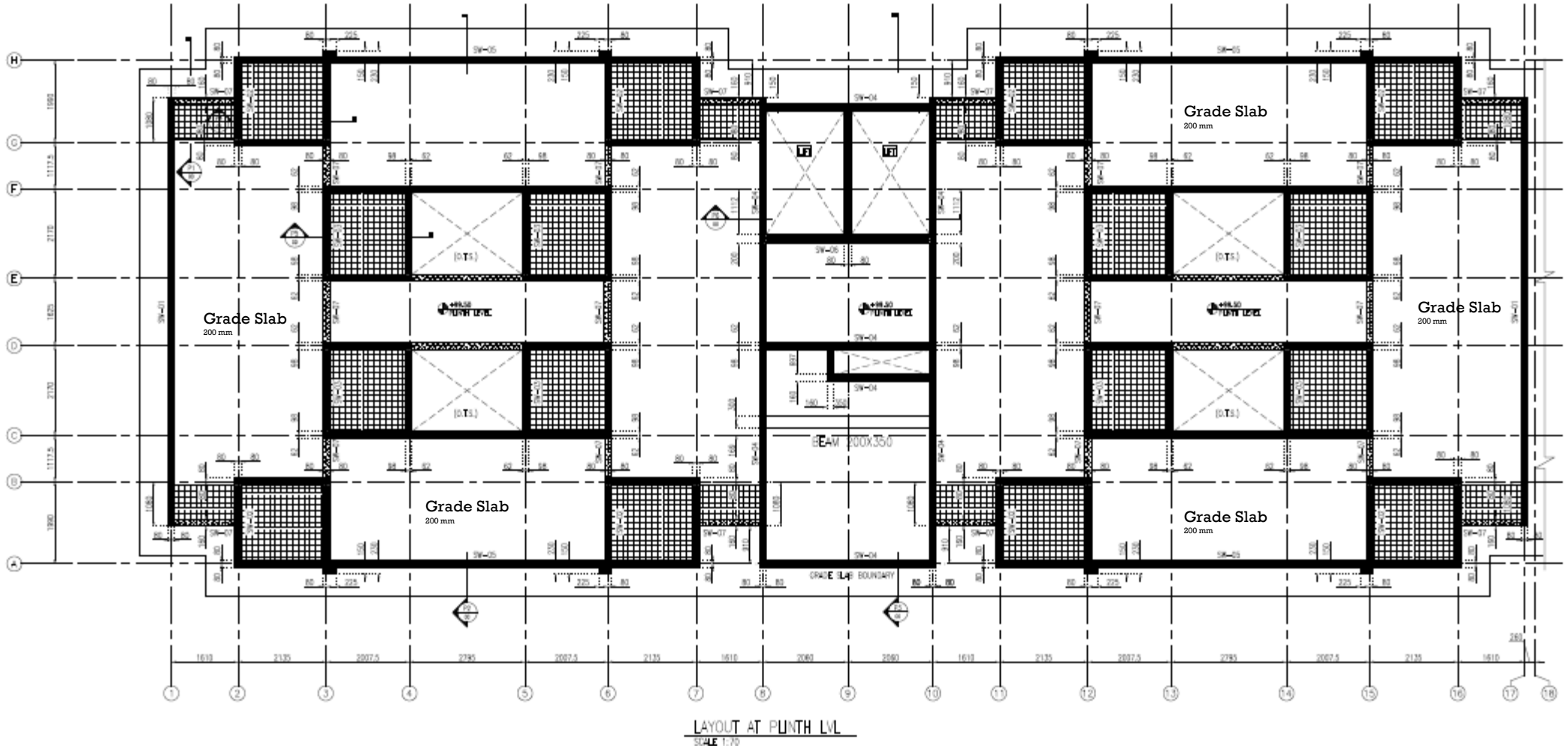
- Shear wall of M30 Grade Concrete are being cast upto plinth height over already laid cured raft.

# FOUNDATION


- Deshuttering from wall.

# STRUCTURAL SYSTEM

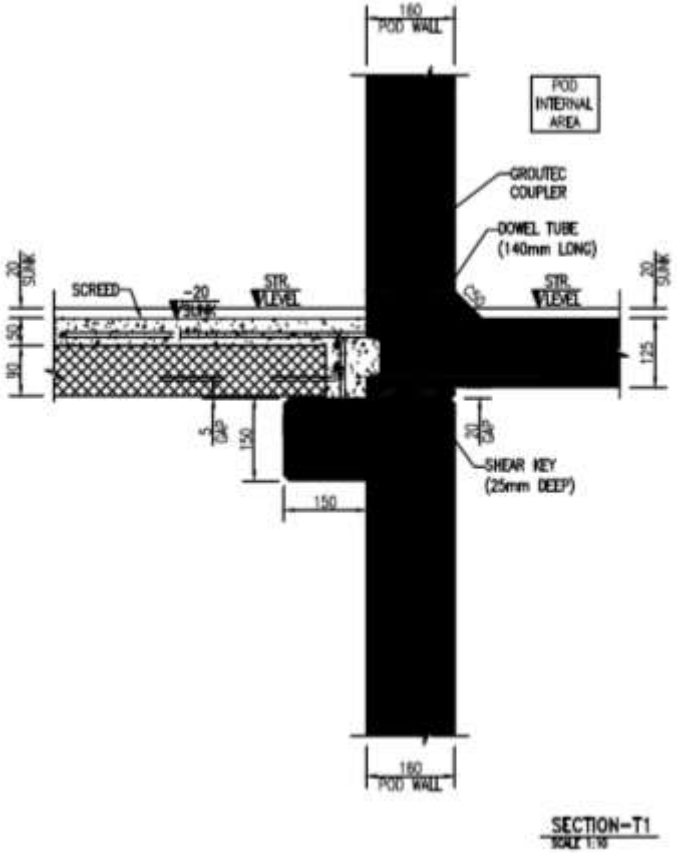
- Structural Plans and Connections

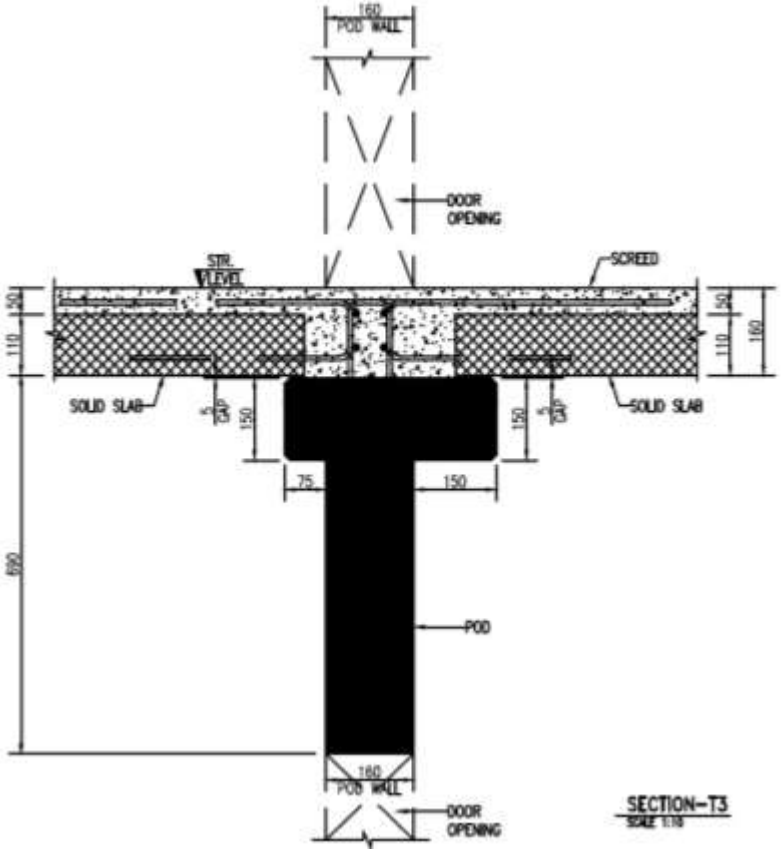


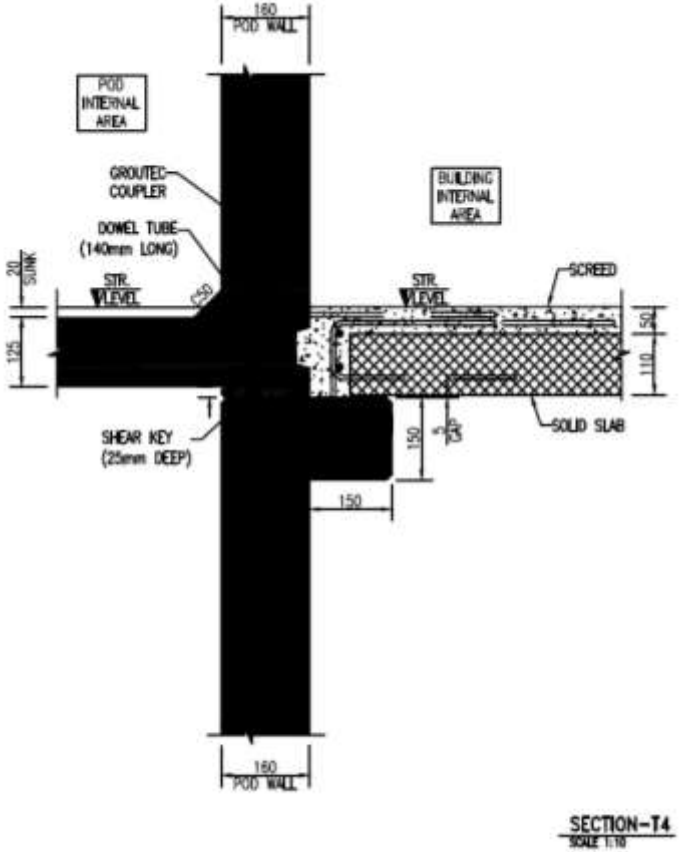

Plinth level Framing Plan

# STRUCTURAL SYSTEM

- Typical Connection Details

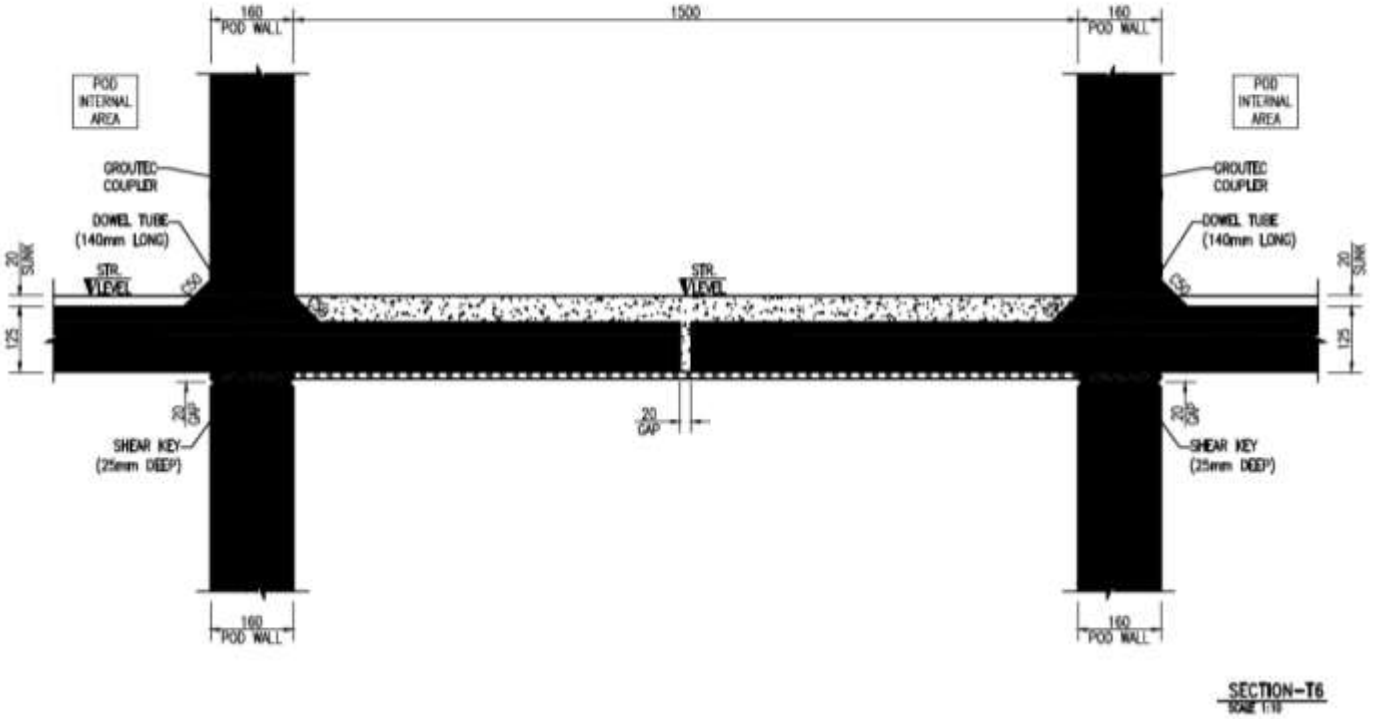


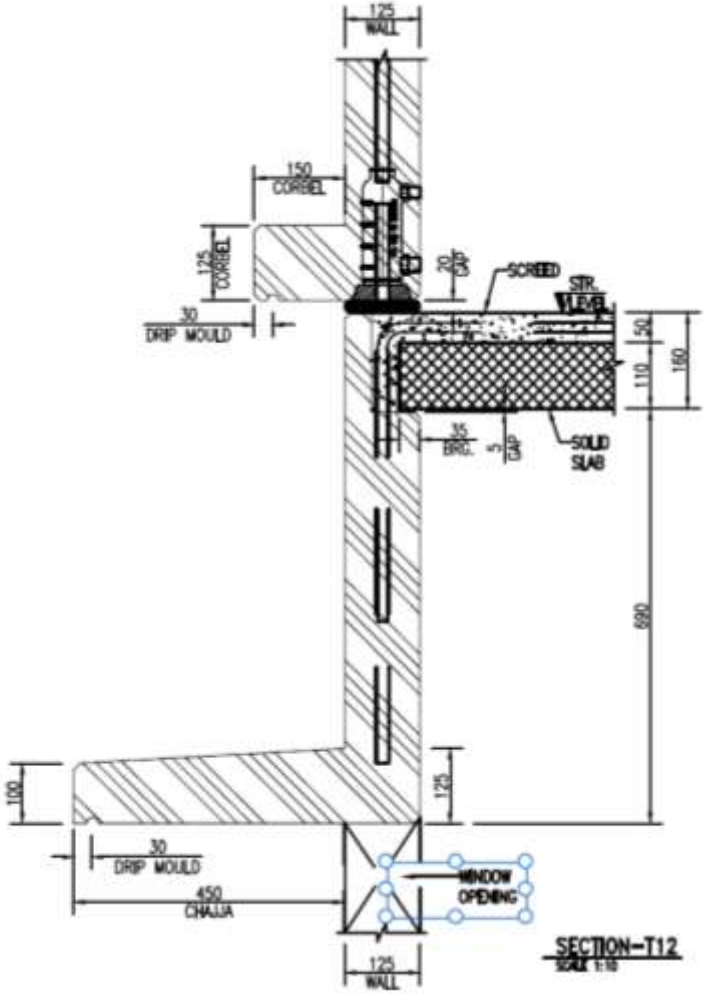



# STRUCTURAL SYSTEM

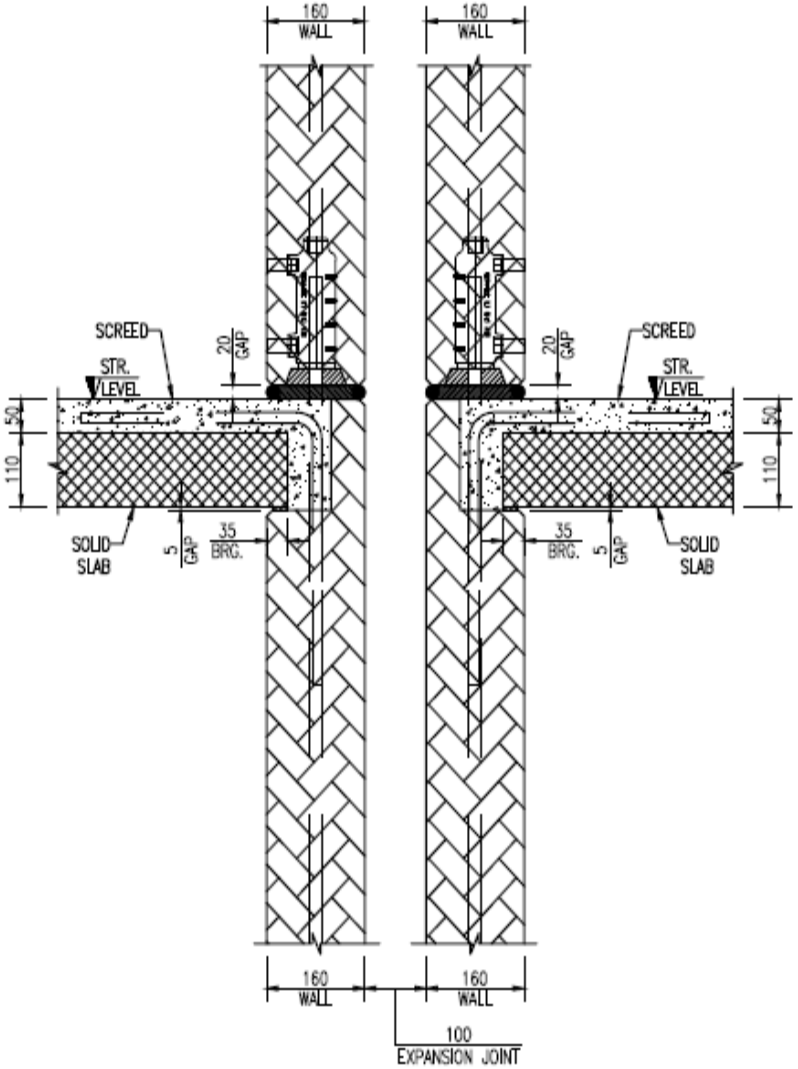
- Typical Connection Details



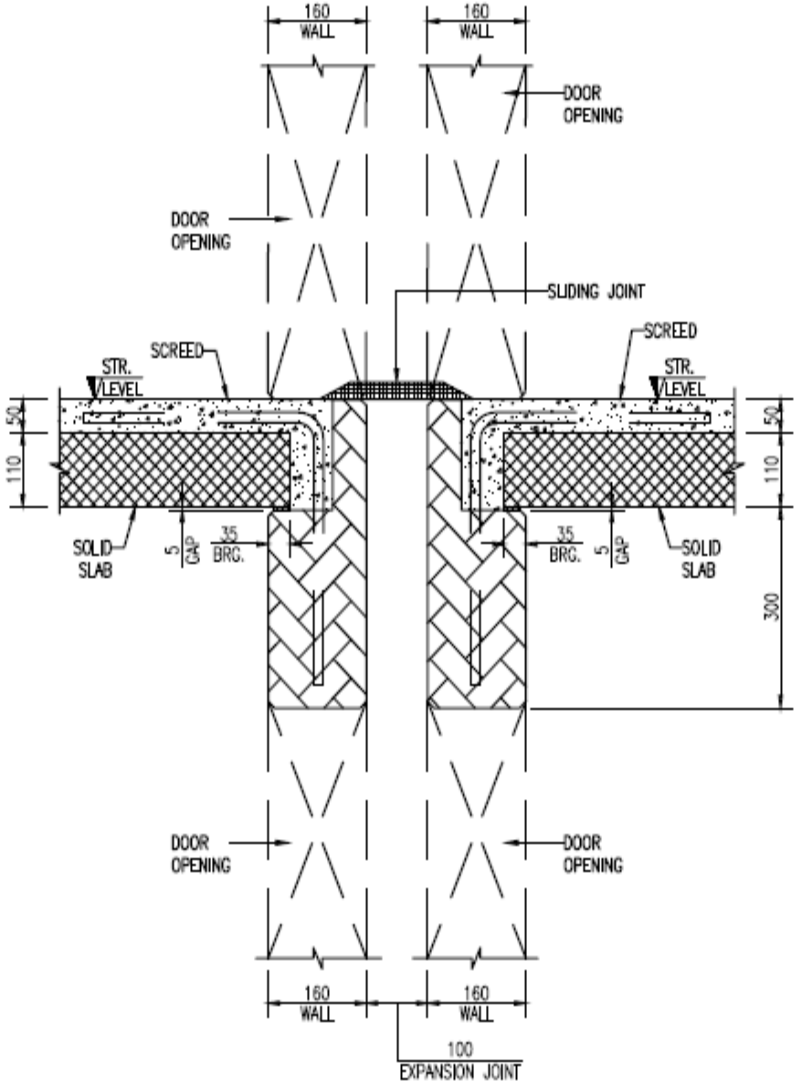



# STRUCTURAL SYSTEM

- Typical Connection Details



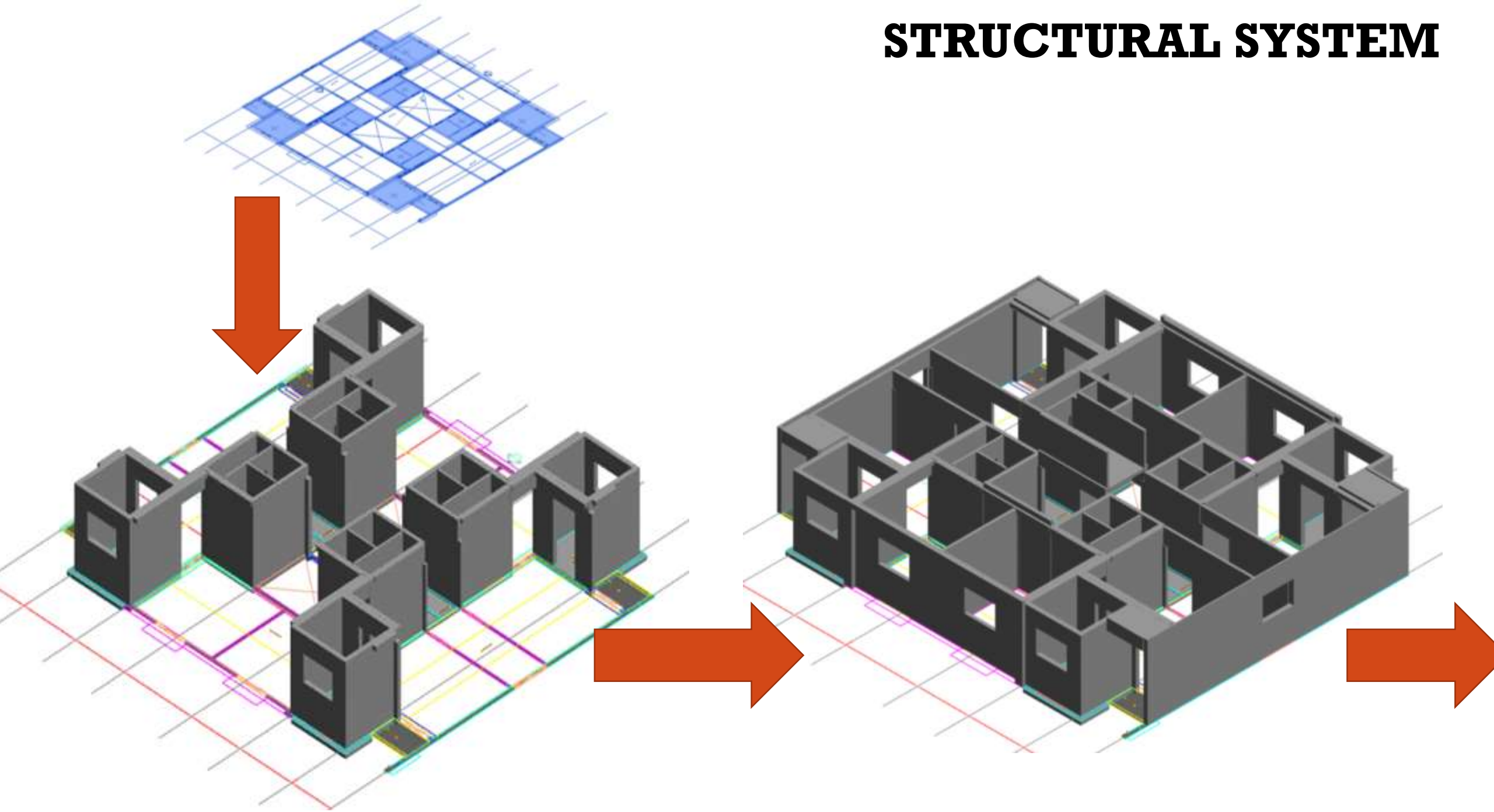

SECTION-T14
SCALE 1:10



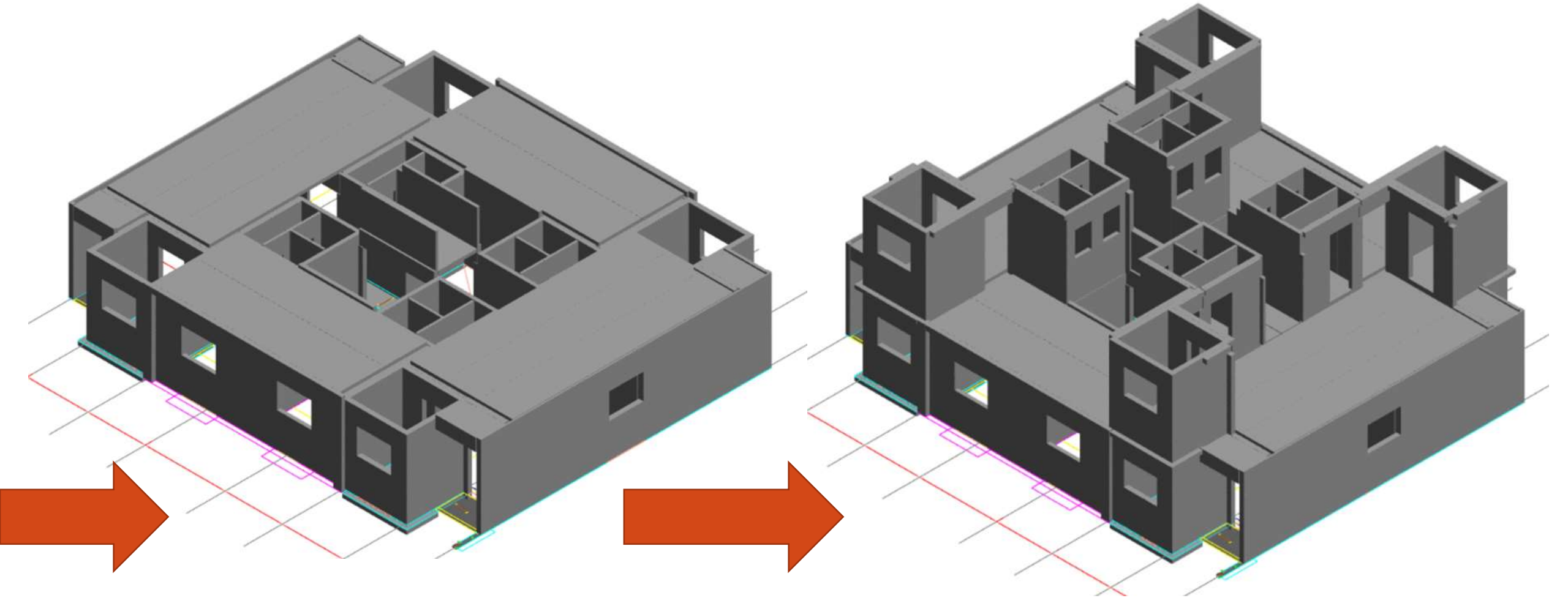

SECTION-T15
SCALE 1:10

Groutec
Coupler

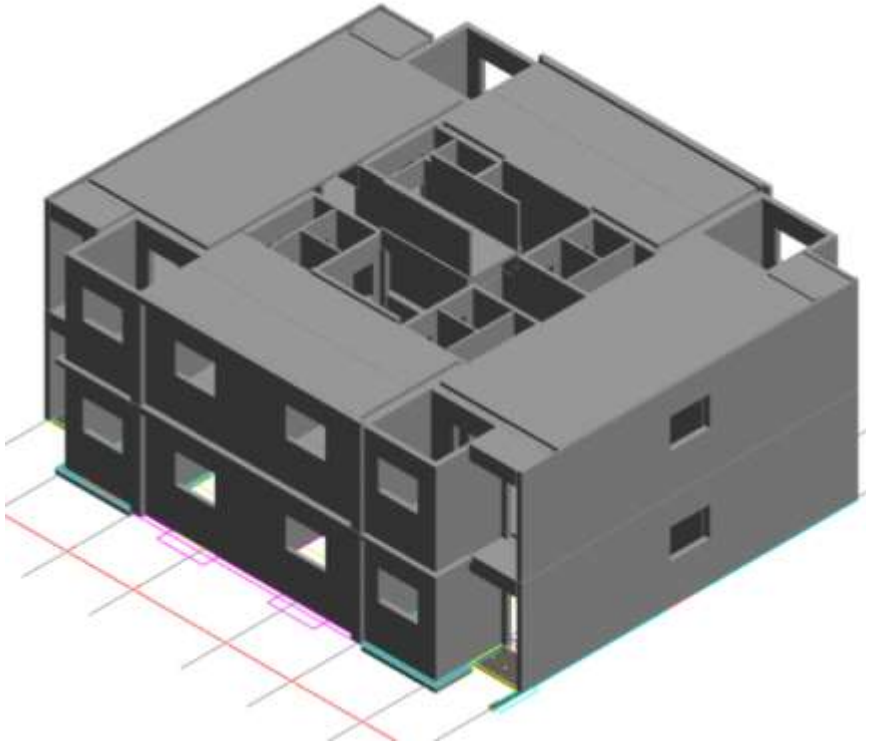
# STRUCTURAL SYSTEM

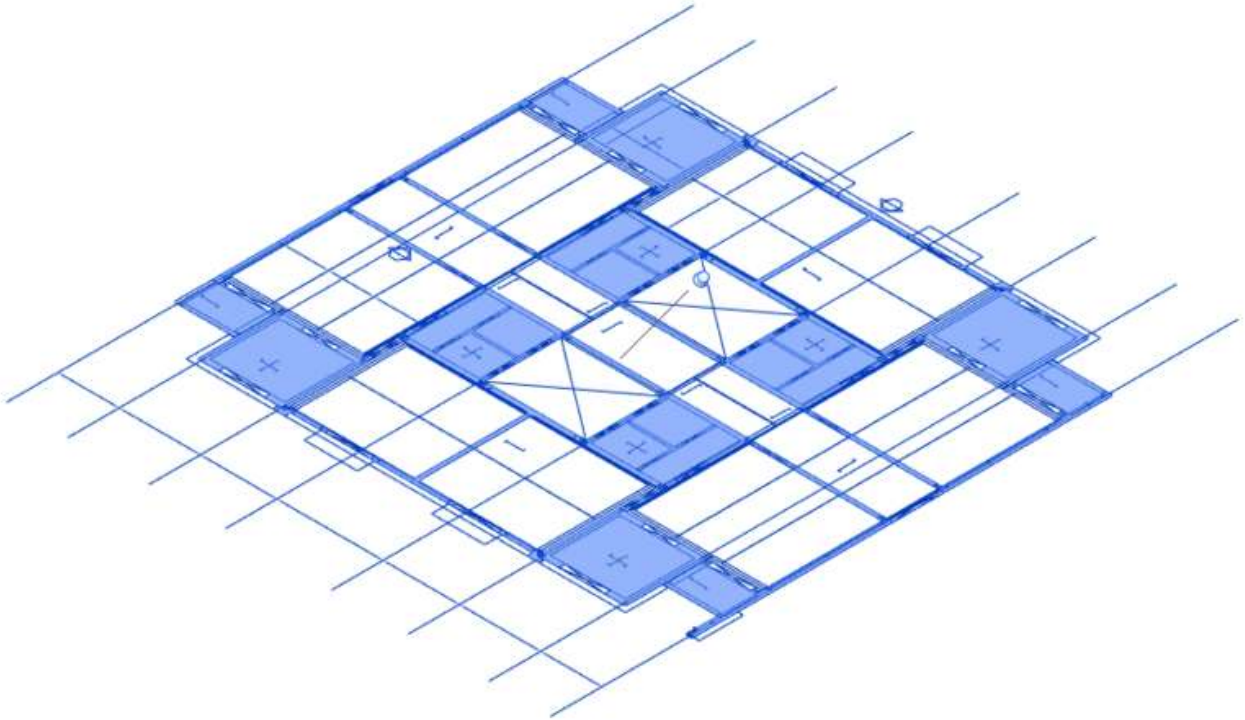


# STRUCTURAL SYSTEM



# STRUCTURAL SYSTEM





Animation

# Erection


- Erection of Components

# Erection

# Erection

# Erection

## H Pod

# Erection


# Erection


# Erection

# Sequence of Erection

## Sequence of erection of Pre-fabricated Components;

- Lifting the precast element and placing it on its designated location.
- Adjust the panel to position and secure it with diagonal props.
- Check the alignment and verticality of the panel. If necessary, adjust the temporary propping to achieve the level and position of the precast element.
- Check the stability of the erected props before releasing the hoisting cable.
- Carry out stage passing QC Inspection after the erection of Element and before grouting.
- Check that the joint width between panels is within design allowances before grouting.
- Prepare and apply non-shrink mortar to seal all the gaps.
- Check that all joints are properly sealed.
- Installation of subsequent precast panels above the erected precast wall panels.
- Repeat step 1 for further erection

# Erection

# Finishing in Progress

# Finishing in Progress

# Present Status of the project (03rd October, 2023)

| Activities | | Progress |
|---|---|---|
| **Casting Yard (Production of Components)** | : | Production of all required 10,784 components completed |
| **Super Structure work** | : | 6 Blocks (1,2,3,5,6&7) – Completed.<br>Block 4– 8th Floor is nearly complete & Parapet wall is in progress.<br>Finishing work is in progress in all the blocks. |
| **Infrastructure work** | : | Pre-cast boundary wall- About 56% of total length completed.<br>STP & UG Water Tank – All civil works are nearly completed.<br>Road & External Electrification- In progress |

Live status of LHP site can be accessed at

https://ghtc-india.gov.in

# Thank You

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