

LIGHT HOUSE PROJECT: LIVE LABORATORIES

WEBINAR SERIES: e-learning & webcasting of LHPs for TECHNOGRAHIS March – November 2022

An 'e-Learning series and webcasting of LHP's construction process' to widespread the knowledge about the technology, construction process, sustainability, and mass cum fast construction to TECHNOGRAHIs.

Webinar Session #07 at Light House Project Rajkot, Gujarat

Date: 04.05.2022, Wednesday | Time: 16:00 – 17:30





*Light House Projects : Live Laboratories
Webinar Series*

Emerging Construction Systems for Mass Housing

Overall Sanctions for 1.23 crore Houses



Construction of Houses (Nos in lakh)

Demand	Sanctioned	Grounded	Completed/ Delivered
112.24	122.69	98.36	58.68



Financial Progress (₹ in Cr)

Committed	Released	Expenditure	UC Received
203,427	118,020	110,481	109,974

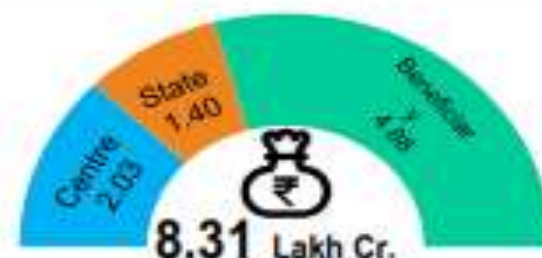


Houses in verticals (Nos in Lakh)

S- Sanctioned G- Grounded C- Completed



Beneficiaries under CLSS (in lakh)



Investment Approved (Rs in Lakh Cr.)



Interest Subsidy under CLSS (Rs in Cr.)

PMAY (U) Achievement (provisional)

[as on 2nd May, 2022]

16 lakh houses are being constructed using New Technologies



Generation of Employment

Details	Direct	Indirect	Total
Person days (Nos in Cr.)	212	474	686
Jobs (in lakh)	76	169	245



* includes incomplete works of earlier NURM.

Global Housing Technology Challenge - India (GHTC-I)

<https://ghtc-india.gov.in>



Ministry of Housing and Urban Affairs
Government of India



गोबल होउसिंग
टेक्नोलॉजी चैलेंज - इंडिया
Global Housing Technology Challenge - India



"To promote the use of new technologies in the housing sector, we have initiated the Global Housing Technology Challenge-India, so that new emerging technologies could be used for low cost housing."





GLOBAL
HOUSING
TECHNOLOGY
CHALLENGE INDIA

The Government of India,
Ministry of Housing and Urban
Affairs, invites established
international construction
technology providers, start ups,
and various other stakeholders to
help transform the country's
construction industry



150
YEARS OF
CELEBRATING
THE MAHATMA



स्वच्छ
भारत
एक कदम स्वच्छता की ओर



GLOBAL
HOUSING
TECHNOLOGY
CHALLENGE INDIA

CTI 2019

GUIDE TO GHTC-INDIA

SIGN-UP

TEC

NEWS

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<https://ghtc-india.gov.in/>

Global Housing Technology Challenge - India (GHTC-I)

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





Light House Projects



**Hon'ble Prime Minister laid the foundation stone of
six LHPs on 01.01.2021**

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.



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

Emerging construction systems help to build

SAFER structures

Sustainable Buildings

- ❖ 30%-50% reduction in energy use
- ❖ 40% reduction in water use
- ❖ 35% reduction in GHG emission
- ❖ 75% reduction in waste

E

Economical - low life cycle cost, better quality

R

Resilient - disaster-resistant, structurally superior

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 :

SALMON
India Leap

holmifactor
Mission
Networks All

OMIPIC

1

Precast Concrete Construction System – 3D Volumetric

1	Pre-cast concrete system with columns, beams, walls, slabs, hollow core slabs & also 3D Volumetric components	Katerra
2	Vertical structural modules cast in Plant/Casting yard are assembled together through casting of floor panel. The unit is transported & installed at site.	Moducast Pvt. Ltd
3	3D Modular casting using steel mould and high performance concrete of building modules in factory. These pods are transported to the construction site & assembled	Magicrete Building Solutions,
4	Modules with 3D Volumetric Precast concrete unit, various units make on house	Ultratech Cement Ltd,



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



Wall Panels



Spandrel



Solid Slab Panels



Staircase

2

Precast Concrete Construction System – Precast components assembled at site

1	Precast Large Concrete Panel (PLCP) System with structural members (wall, slab etc.) cast in a factory/ casting yard and brought to the building site for erection & assembling	Larsen & Toubro
2	Pre-cast Concrete Structural system comprising of pre-cast column, beam, precast concrete / light weight slab, AAC blocks/ infill concrete walls.	B.G. Shirke Construction Technology Pvt. Ltd
3	Optimal Pre-cast concrete System through structural Analysis, design & equipment support	Elematic India,
4	Precast concrete construction system using precast walls with precast plank floor	PG Setty Construction Technology Pvt Ltd,
5	Precast components comprising of beams, columns, staircase, slab, hollow core slab etc. manufactured in plant & erected on site	Teemage
6	Pre-cast sandwich panel system & Light weight Pre cast Light Weight concrete slab	Nordicflex
7	Prefabricated Interlocking Technology (without mortar) with Roofing as Mechanized Precast R.C. Plank & Joist system	Adalakha Associates Pvt. Ltd
8	Large Hollow wall prefab concrete Panel (lightweight, interlocking, concrete panel) using factory produced large standard hollow interlocking concrete block	William Ling,



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



3

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

1	LGS Framing with various walling & roofing options	Mitsumi Housing Pvt. Ltd,
2	LGS Framing with various walling & roofing options	Everest Industries Ltd,
3	LGS Framing with various walling & roofing options	JSW Steel Ltd.,
4	LGS Framing with various walling & roofing options	Society for Development of Composites
5	LGS Framing with various walling & roofing options	Elemente Designer Homes
6	LGS Framing with various walling & roofing options	MGI Infra Pvt. Ltd.,
7	LGS Framing with various walling & roofing options	RCM Prefab Pvt. Ltd,
8	LGS Framing with various walling & roofing options	Nipani Infra and Industries Pvt. Ltd.,
9	LGS Framing with various walling & roofing options	Strawcture Eco
10	LGS Framing with various walling & roofing actions	Visakha Industries Ltd.
11	Prefabricated steel structural system with Dry wall system as AAC panels, PUF panels etc	RCC Infra Ventures Ltd.
12	Hot rolled steel frame with speed floor	Jindal Steel & Power Ltd.
13	Hot rolled steel section with AAC Panels as floor & slab	HIL Ltd.
14	AAC wall and roof panel system to provide integrated solution. AAC products are reinforced and used in both load and non-load bearing applications	Biltech Building Elements Ltd
15	AAC Panels are Wire mesh/ steel reinforced for use as wall & slab. Appears to be non load bearing panels to be used with structural framing.	SCG International India Pvt Ltd
16	Precast Light Weight Hollow-core wall Panel is a non-structural construction material with framed structures.	Pioneer Precast Solutions Private Limited



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)

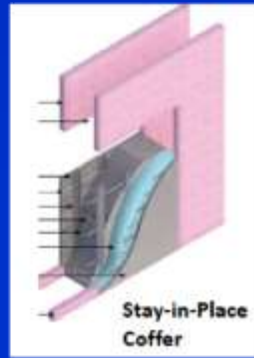
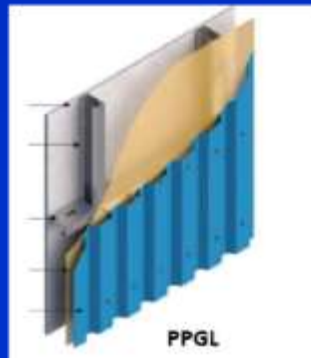
No. of Block / Tower : 7 Blocks

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**

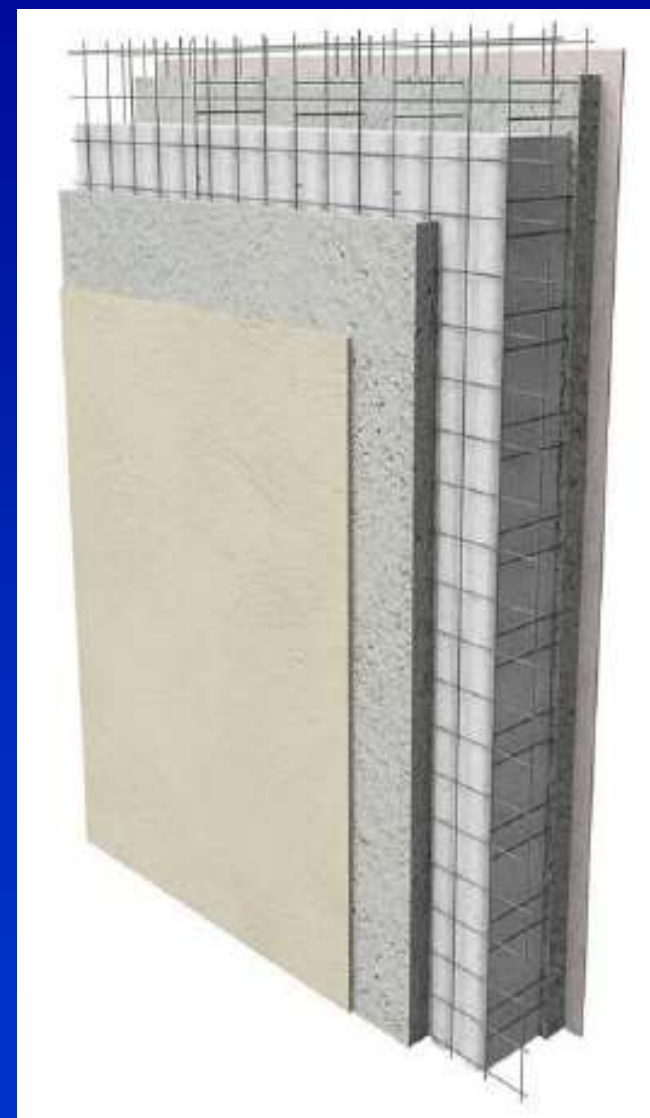




SINGLE



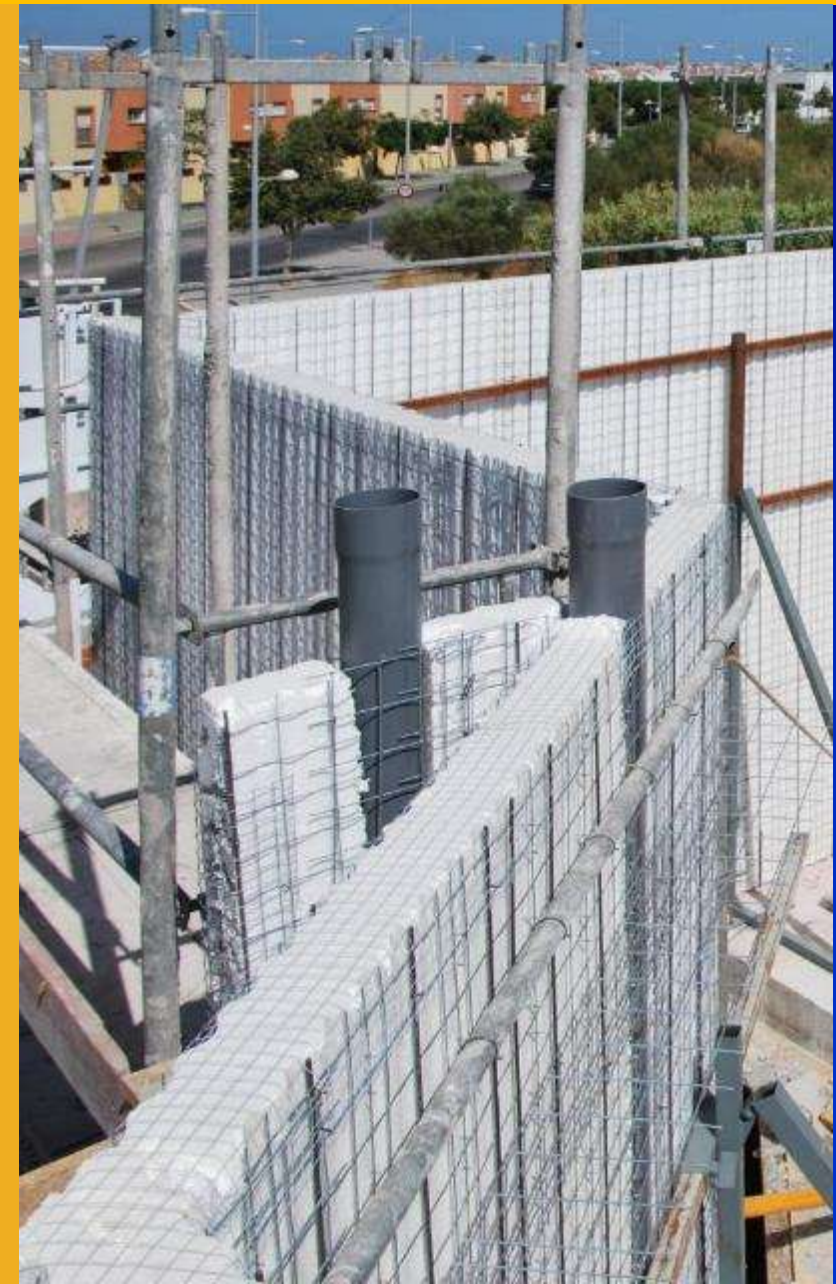
DOUBLE



4

Prefabricated Sandwich Panel System

1	Reinforced Expanded Polystyrene sheet core Panel with sprayed concrete as wall & slab	Worldhaus
2	EPS Cement sandwich Panel: wall & slab with EPS Cement sandwich Panel to be used with RCC or Steel structural frame. Load bearing upto G+1 storey	Bhargav Infrastructure Pvt.Ltd
3	EPS Cement sandwich Panel: wall & slab with EPS Cement sandwich Panel to be used with RCC or Steel structural frame. Load bearing upto G+1 storey	Rising Japan Infra Private Limited
4	Reinforced Expanded Polystyrene sheet core Panel with sprayed concrete as wall & slab	Bau Panel Systems India Pvt Ltd,
5	Reinforced Expanded Polystyrene sheet core Panel with sprayed concrete as wall & slab	BK Chemtech Engineering
6	Reinforced Expanded Polystyrene sheet core Panel with sprayed concrete as wall & slab	MSN Construction
7	Reinforced Expanded Polystyrene sheet core Panel with sprayed concrete as wall & slab	Beardshell Ltd.
8	Pre-fab PIR (Poly-isocyanurate) based Dry Wall Panel System" as non-load bearing wall	Covestro India Pvt. Ltd.,
9	Sandwich panels as wall & slab	Project Etopia Group



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.



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 were manufactured by the firm in China and now two plants at Nagpur & Pune are operational in India.

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



5

Monolithic Concrete Construction

1	Aluminium formwork system for Monolithic Concrete construction	Maini Scaffold Systems
2	Aluminium formwork system for Monolithic Concrete construction	KumkangKind India Pvt. Ltd
3	Aluminium formwork system for Monolithic Concrete construction	S-form India Pvt. Ltd.,
4	Aluminium formwork system for Monolithic Concrete construction	ATS Infrastructure Ltd.
5	Aluminium formwork system for Monolithic Concrete construction	Innovative housing & Infrastructure Pvt. Ltd
6	Aluminium formwork system for Monolithic Concrete construction	MFS formwork Systems Pvt. Ltd.
7	Aluminium formwork system for Monolithic Concrete construction	Knest Manufacturers LLP
8	'Tunnel form' construction technology, an cast in situ RCC system, based on the use of high-precision, re- usable, room-sized, steel forms or moulds for monolithic concrete construction	Outinord Formworks Pvt. Ltd.
9	Aluminium formwork system for Monolithic Concrete construction	Brilliant Etoile



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.



Modular Tunnel form



- Tunnel formwork is a mechanized system for cellular structures. It is based on two half shells which are placed together to form a room or cell. Several cells make an apartment. With tunnel forms, walls and slab are cast in a single day.
- The formwork is set up for the day's pour in the morning. The reinforcement and services are positioned and concrete is poured in the afternoon. Once reinforcement is placed, concrete for walls and Slabs shall be poured in one single operation. The formwork is stripped the early morning and positioned for the subsequent phase.
- Here the walls and slabs are cast in a form of a tunnel leaving two sides open whereas in monolithic concrete construction the entire room is cast in a single pour..

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







6

Stay In Place Formwork System

1	Expanded-Steel Panel reinforced with all- galvanised Steel Wire-Struts serving both as the load- bearing steel structure and as the stay-in-place steel formwork filled with EPS- alleviated concrete	JK Structure
2	Factory made prefab Glass fibre reinforced Gypsum cage panels suitable for wall & slab with reinforcement & concrete as infill as per the requirement	FACT-RCF Building Products Limited
3	Structural Stay In Place Galvanized Steel formwork system for walling with the same bottom single layer formwork for slabs/ in-situ slab	Coffor Construction Technology Pvt.Ltd
4	Factory produced PVC Stay in place formwork with concrete & reinforcement in walling units with cast insitu RCC Slab	Joseph Jebastin (Novel Assembler)
5	Fully load bearing walls with 150 mm monolithic concrete core sandwiched inside two layers of EPS as walling The forms are open ended hollow polystyrene interlocking blocks which fits together to form shuttering system	Reliable Insupack
6	Ready to use Stay in place polymer formwork, light weight, with flooring slab (combination of ferro cement and natural stone) placed on RCC precast joists)	Kalzen Realty Pvt. Ltd
7	Fast Bloc, Insulated Concrete Form (ICF), acts as formwork for concrete and rebar, Co1oumn/post and beam construction, creating an strong skeleton in the walls.	Fastbloc Building Systems
8	Formwork system "Plaswall with Two fibre cement boards (FCB) & HIMI (High Impact Molded Inserts) bonded between two sheets of FCB in situ and erected to produce a straight-to finish wall with in-situ concrete	FTS Buildtech Pvt.Ltd



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)



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.



Adoption of New Technologies by States



AHP houses in Pune, Maharashtra using Precast Construction Technology

- Around **16 Lakh houses** are being built using innovative technologies under PMAY(U) & other state schemes.

State	Technology
Andhra Pradesh	EPS, Monolithic and Steel Technology
Chhattisgarh	Monolithic and Precast Technology
Gujarat	Monolithic, Precast (Waffle-crete)
Kerala	Glass Fibre Reinforced Gypsum (GFRG)
Maharashtra	Precast (3S) & Monolithic Technology
Odisha	Precast concrete construction
Jharkhand	Global Tender floated
Tamil Nadu	Precast Concrete Technology
States like Assam, Karnataka, Madhya Pradesh, Telangana & Uttarakhand have also expressed interest in Technology neutral bidding process	

54

Alternate technologies Identified

54

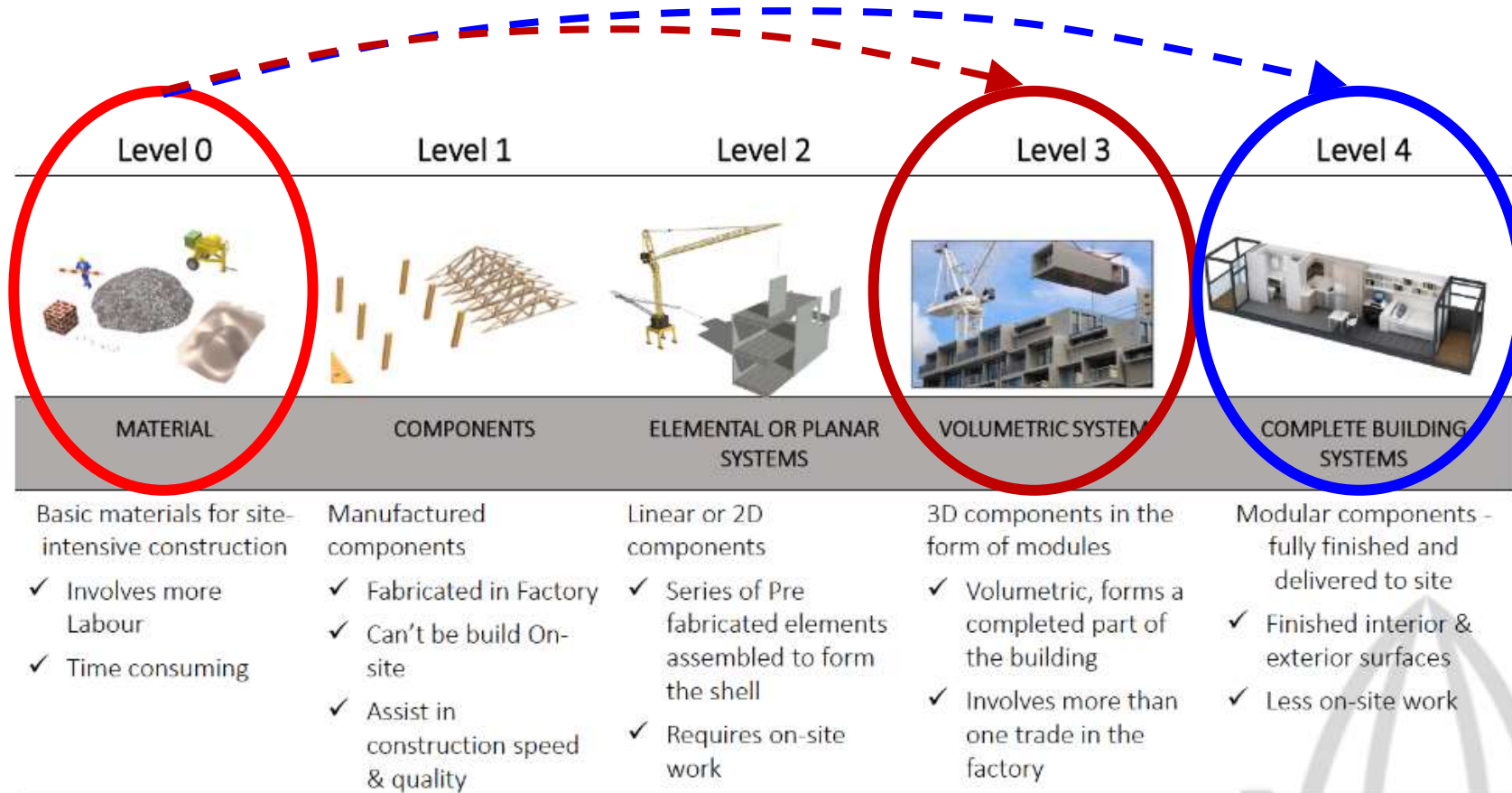
technologies approved by CPWD

29

SoRs issued for alternate technologies by CPWD (22+7)

Looking Back / Rear view

Levels of Construction Technology



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

Courtesy : **hmv** **vision**
Abode All



Light House Project at RAJKOT

GHTC-I Category:

Monolithic Concrete Construction System

Technology:

Monolithic Concrete Construction using Tunnel Formwork

Typical Dwelling Unit Plan



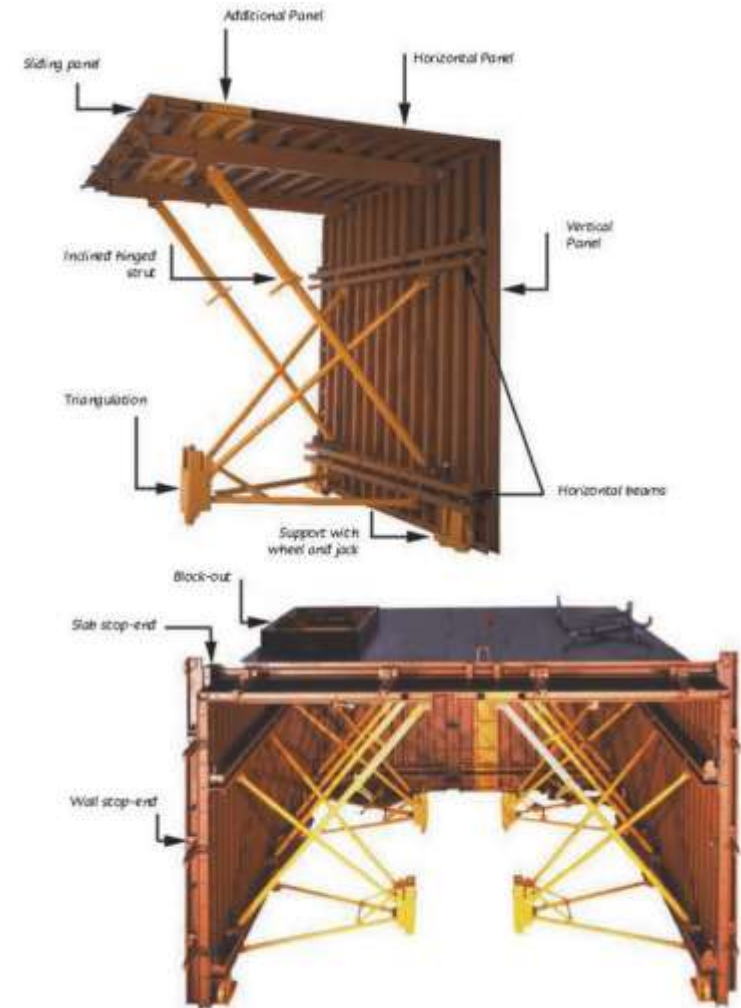
Unit Plan

- Each dwelling unit comprises of one living room, one Bedroom, one study room, Kitchen and two toilets.
- The carpet area of each unit is 39.77 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
 - Solid waste management
 - STP with recycling of waste water



Unit 3D View

Assembly of Tunnel Formwork

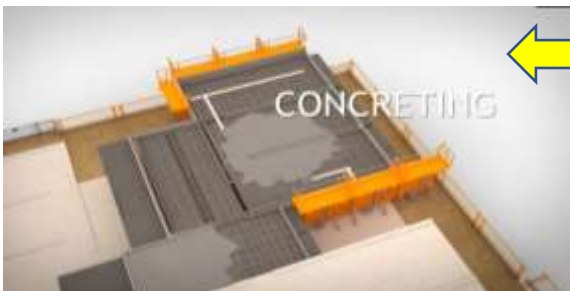
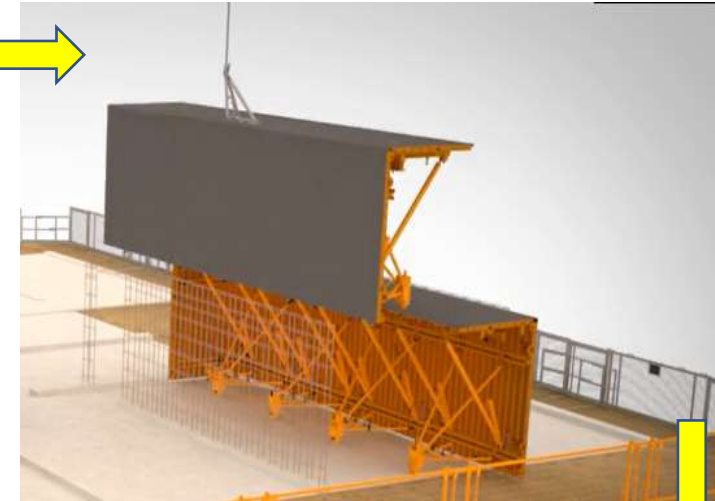


Structural Elements

Work Cycle with Tunnel Formwork

The on-site implementation of 24 hour cycle is divided into following operations.

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





In Shear walls, the plumbing and electrical services are incorporated before casting.
In AAC Block walls, the plumbing and electrical services are incorporated as done in conventional method of construction i.e. chasing and filling

Structural Elements

Structural System



- Placement of tunnel formwork for slab and wall



- Concreting after placement of reinforcement on slab and wall.

Present Stage of Work (As on May 02, 2022)

Activities	Progress	
Foundation work	:	Completed in all 11 blocks.
Superstructure work	:	8 Blocks completed (Block no.1,2,3,4,7,8,9,10 & 11) Block No. 5- Ground +10 work is completed Block No. 6- Ground +7 work is completed
Sample Unit	:	Completed
Masonry work	:	Completed – 7 blocks In progress – 4 blocks
Internal Building work	:	Internal plaster is completed in 6 blocks & in-progress in 4 blocks. Kitchen slab, tile work and plumbing are in progress. Installation of lifts is also in progress.
Internal (electrical work)	:	In progress – 10 blocks
Social & Physical Infrastructure works	:	After completion of Structure work, the Internal finishing is in progress in Anganwadi cum Shopping Complex and community centre both. Plaster work both internal and external completed.
External Infrastructure	:	Infrastructure works including Sewer line, storm water drains, water supply works, boundary wall, fire fighting etc. are in progress.

Towers in Progress Photographs



Onsite Photographs



Tower 1



Tower 2

Onsite Photographs



Tower 3



Tower 4

Onsite Photographs



Tower 5



Tower 6

Onsite Photographs



Tower 7



Tower 8

Onsite Photographs



Tower 9



Tower 10

Onsite Photographs



Tower 11

Onsite Photographs



Anganwadi cum shopping centre



Community Centre

Overall Project as on May 04, 2022





You can reach us at ska@bmtpc.org; info@bmtpc.org;



@bmtpcdelhi



bmtpc.mhwa

“Creating Enabling Environment for Affordable Housing for All”

