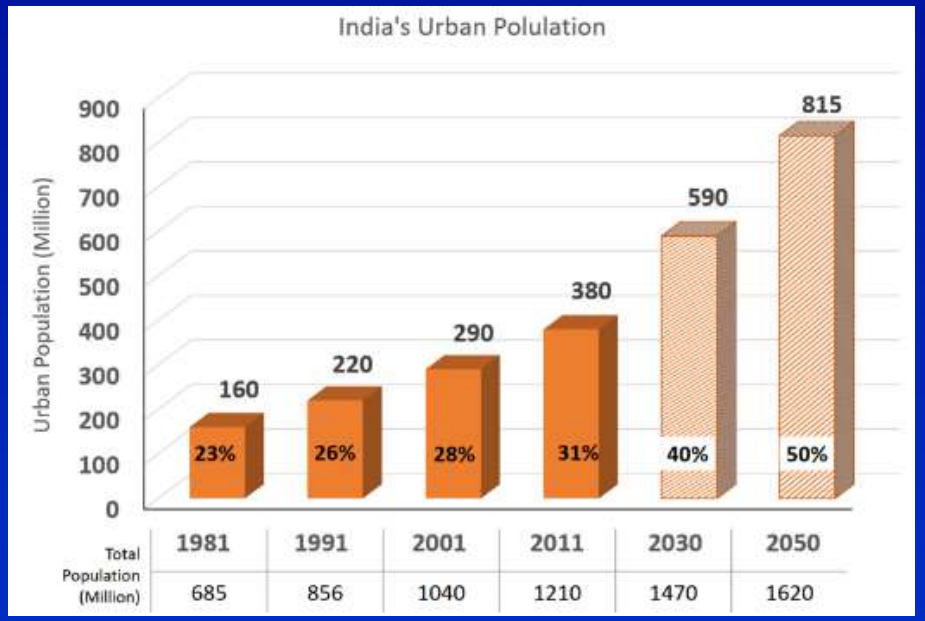
Emerging Construction Systems for Mass Housing

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

Growing Opportunities with Rapid Urbanization



Source: *UN report on World Urbanisation Prospects (2014 revision)*

To cater to this growing population, India has to build 600-800 million m² urban space every year till 2030 i.e. a new Chicago every year.

- With US $3.7 trillion GDP, India is one of the largest (fifth) and fastest growing economies in the world. It is witnessing massive public investment, robust private consumption, and structural reforms leading to rapid growth (> 7%).
- India is poised to become $7.3 trillion economy by 2030 & aspiring to become a $30 trillion economy by 2047.
- Construction in India is emerging as the third largest sector globally; it may reach US $1.4 trillion by 2025.
- Construction sector is second largest employment generator and as of 2023, 71 million workforce is to be employed which will go to 100 million.
- Cities, which will contribute over 80% to GDP by 2050, need to be Receptive, Innovative and Productive to foster sustainable growth and ensure better quality of living.
- Hence, a comprehensive strategy of 3-S Mantra has been adopted: **Skill, Scale** and **Speed.**

PMAY (U) Achievement (provisional)

[as on 25th November, 2024]

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

आज़ादी का अमृत महोत्सव

G20

Overall Sanctions for 1.19 crore Houses

Construction of Houses (Nos in lakh)

Demand	Sanctioned	Grounded*	Completed*
112.24	118.64	114.22	88.22

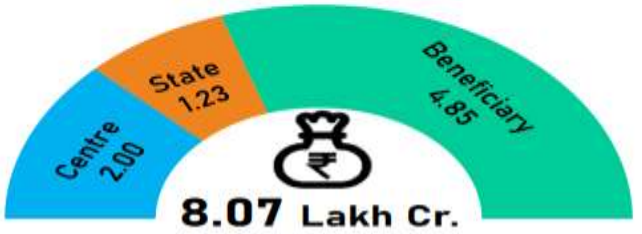
Financial Progress (₹ in Cr)

Committed	Released	Expenditure	UC Received
1,99,652	1,66,256	1,57,935	1,57,685

Houses in verticals (Nos in Lakh)

S- Sanctioned G- Grounded C- Completed

Beneficiaries under CLSS (in lakh)



Investment Approved (₹ in Lakh Cr.)

Interest Subsidy under CLSS (₹ in Cr.)

16 lakh houses are being constructed using New Technologies

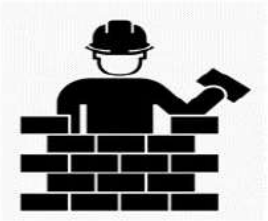
प्रधान मंत्री आवास योजना-शहरी
Pradhan Mantri Awas Yojana-Urban

PMAY (U) Achievement (provisional)

[as on 25th November, 2024]

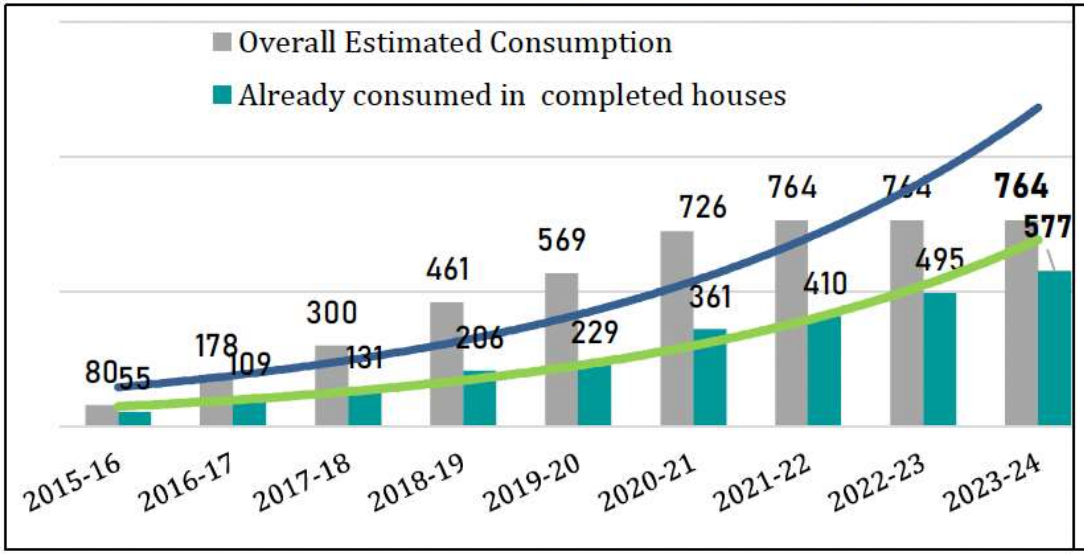
आज़ादी का अमृत महोत्सव | G20

Generation of Employment

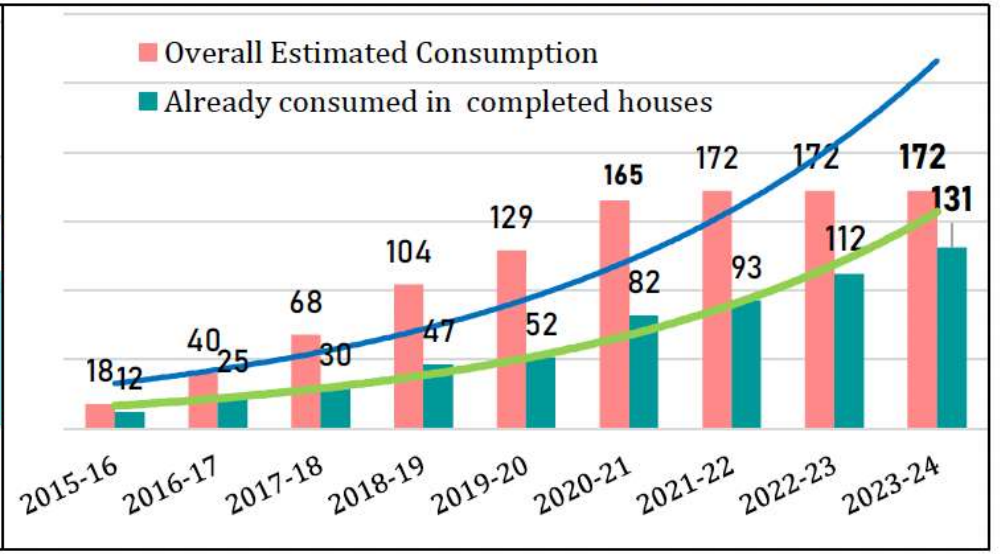


Details	Direct	Indirect	Total
Person days (Nos in Cr.)	289	638	927
Jobs (in lakh)	103	228	331

Cement Consumption (Lakh MT)



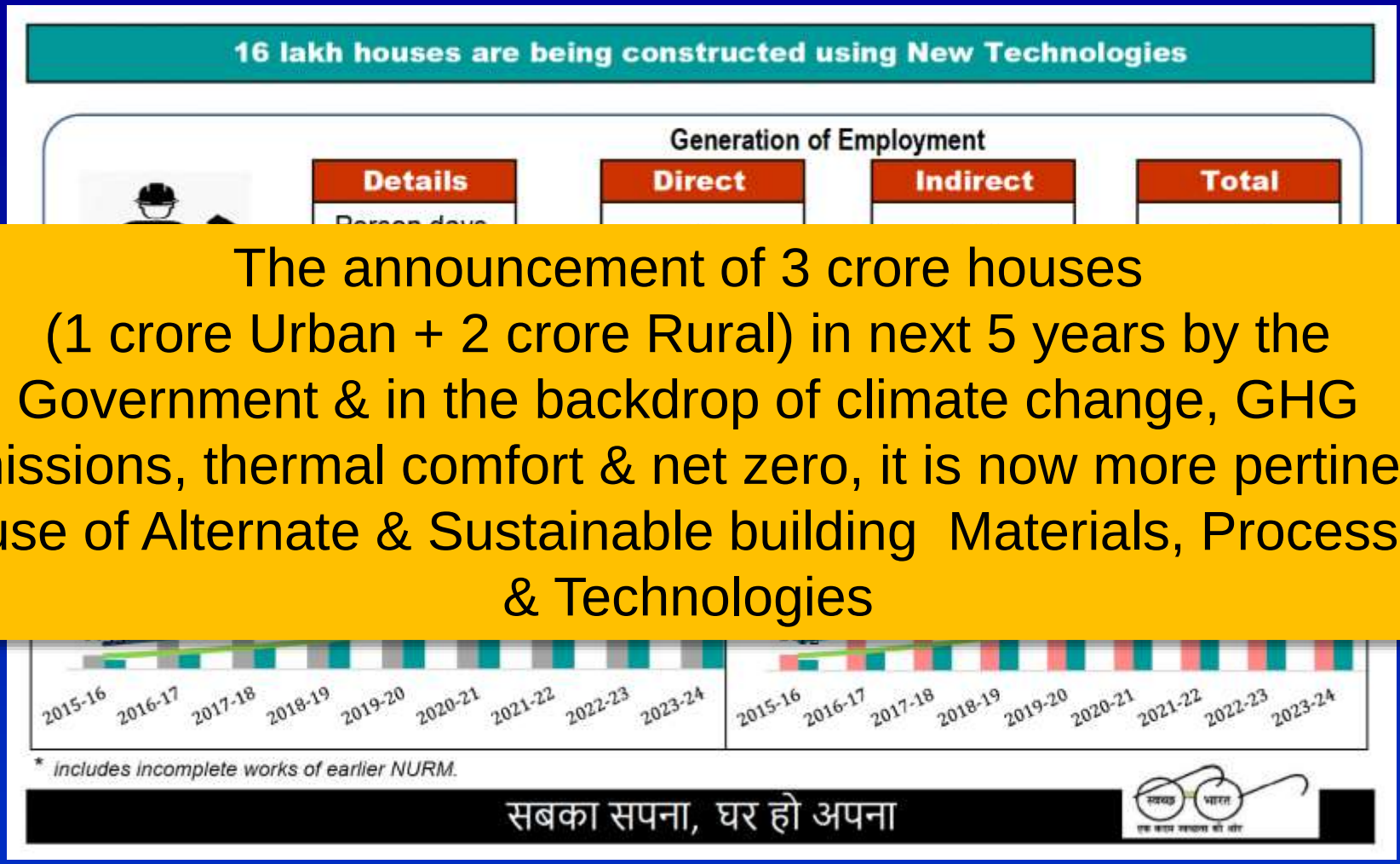
Steel Consumption (Lakh MT)



* *includes incomplete works of earlier NURM.*

सबका सपना, घर हो अपना

स्वच्छ भारत
एक कदम स्वच्छता की ओर



The announcement of 3 crore houses (1 crore Urban + 2 crore Rural) in next 5 years by the Government & in the backdrop of climate change, GHG emissions, thermal comfort & net zero, it is now more pertinent to use of Alternate & Sustainable building Materials, Processes & Technologies

PMAY-U 2.0

Sl. No	States/UTs	PMAY-U 2.0 Verticals		
		BLC & AHP	ARH	ISS
1	Assam, Arunachal Pradesh, Meghalaya, Manipur, Mizoram, Nagaland, Tripura, Sikkim, Himachal Pradesh, Uttarakhand, Jammu and Kashmir, Puducherry and Delhi	Central Govt.- ₹2.25 lakh/Unit State Govt.- Min. ₹0.25 lakh/Unit	Technology Innovation Grant GoI: ₹3,000/sqm per unit State Share: ₹2,000/sqm per unit	Home Loan Subsidy – up to ₹1.80 lakh (Actual Release) per unit by Government of India as Central Sector Scheme
2	Andaman & Nicobar Islands, Chandigarh, Dadra Nagar Haveli & Daman and Diu, Ladakh, Lakshadweep	Central Govt. - ₹2.50 lakh/Unit		
3	Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Goa, Haryana, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Telangana, Uttar Pradesh, West Bengal	Central Govt. - ₹1.5 lakh/Unit State Govt.- Min. ₹1.00 lakh/Unit		

Notes:
i.State/UT share shall be mandatory under PMAY-U 2.0. Apart from the minimum State Share, the State Governments may also provide additional top-up share to increase affordability.
ii.In addition to Central Assistance, MoHUA will provide Technology Innovation Grant (TIG) only to the projects using innovative building materials, technologies & processes @ ₹1,000 per sqm on built up area (including internal infrastructure) for 30 sqm per unit to the implementing agencies to offset the impact of any additional cost implication under AHP projects.

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.

Steel framed Structure

Here RCC beam and columns are replaced by hot rolled steel sections.

CONVENTIONAL CONSTRCTION SYSTEMS

business as usual approach

- There is too much of dependency on **cement**, **aggregates** and **water** in these traditional constructions. In particular, the **fine aggregate** (sand) and water to-day are quite scarce.
- It is also seen that, on account of shortage of **skilled labour**, these constructions today, in general, are not upto the mark in terms of quality.
- In addition, traditional construction cannot be **green buildings** normally. But green buildings are the order of the day, in view of energy scarcity and, fast depletion of precious natural materials.

SLOW TRACK CONSTRUCTION

- **Buildings consume**
  - **40% of energy**
  - **25% of water**
  - **40% of resource**

As per UNEP, GHG emissions will double by 2050 as compared to 30% as of today on a business as usual scenario

- **Buildings activities contribute**
  - **50% of air pollution**
  - **42% of GHG emission**
  - **50% of water pollution**
  - **48% of solid wastes**

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

Looking Back / Rear view

Levels of Construction Technology

Level 0	Level 1	Level 2	Level 3	Level 4
				
MATERIAL	COMPONENTS	ELEMENTAL OR PLANAR SYSTEMS	VOLUMETRIC SYSTEM	COMPLETE BUILDING SYSTEMS
Basic materials for site-intensive construction ✓ Involves more Labour ✓ Time consuming	Manufactured components ✓ Fabricated in Factory ✓ Can't be build On-site ✓ Assist in construction speed & quality	Linear or 2D components ✓ Series of Pre fabricated elements assembled to form the shell ✓ Requires on-site work	3D components in the form of modules ✓ Volumetric, forms a completed part of the building ✓ Involves more than one trade in the factory	Modular components - fully finished and delivered to site ✓ Finished interior & exterior surfaces ✓ Less on-site work

Courtesy :

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

DfMA

Design for Manufacture & Assembly

Design for Manufacture
Design for Assembly

Manufacturing of Buildings

Prefabricated Prefinished Volumetric Construction

BUILDING INFORMATION MODELLING

bimtpc

3D Printed House at Kanchipurum by L & T


The
NEWS
Minute

3D Printing - Chandigarh

CIDCO L&T Mission 96

DRDO - Flight Control System Complex in 45 days

Teemage - Largest Hospital Constructed by Precast Concrete Technology in 45 days

Emerging Trends in Housing construction

- **Engineered Formwork Systems**
- **Stay-in-Place Formwork Systems**
  - ✓ *Insulating Concrete Formwork Systems*
  - ✓ *Structural stay-in-place Formwork Systems*
- **Precast Sandwich Panel Systems**
  - ✓ *EPS Panel Systems*
  - ✓ *GFRG panel Systems, Cement Panel Systems*
- **Light Gauge Steel Structural Systems**
- **Steel Structural Systems**
- **Precast Concrete Construction Systems**
  - ✓ *3D volumetric construction*
  - ✓ *2D large panel systems*
  - ✓ *Beam, column, components based systems*

ENGINEERED FORMWORK SYSTEM

- 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

A typical plan of one of the mass housing projects

Monolithic Concrete Construction

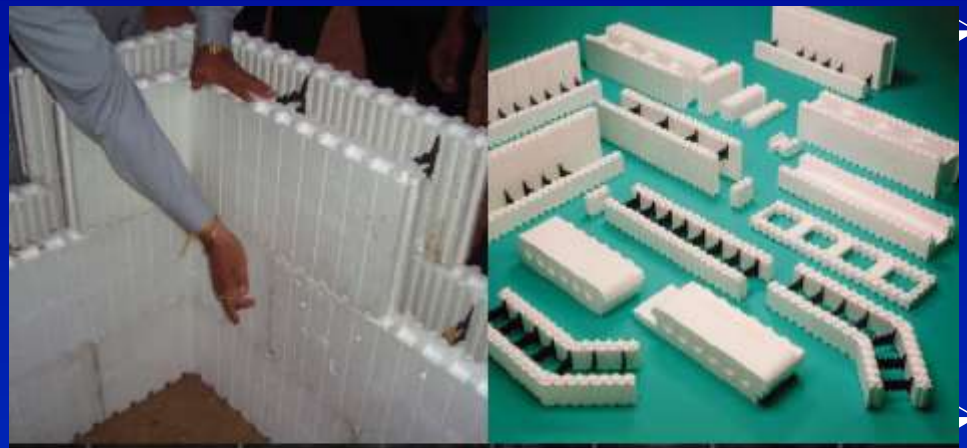
Modular Tunnel form

- 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 – Insulated Concrete Forms

- 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 layer

Monolithic Insulated Concrete System (MICS)



Monolithic Insulated Concrete System (MICS) is a patented system of M/s Maiwir Ecotech Pvt. Ltd.. It is a formwork system for reinforced concrete made with a rigid thermal insulation that stays in place as a permanent interior and exterior substrate for walls, floors and roofs.

This system consists of two layers of modules i.e. Expandable Polystyrene (EPS) separated by hard plastic ties. The modules are interlocking modular units that are dry stacked (without mortar) and filled with cast-in-place concrete. The units lock together and create a form for the structural walls or floors of a building. When cured, the wall supports the structural loads from floors and roofs, and the shuttering provides thermal insulation. Reinforcing steel shall be as required from design.

Structural Stay-in-Place Formwork System (Coffor)

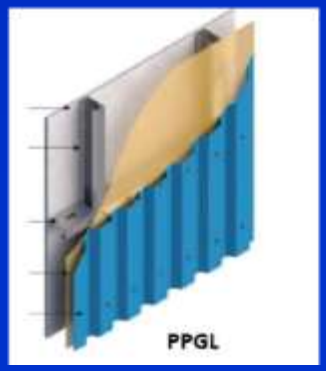
- Replacing cast-in-situ Formwork with factory made formwork systems
- It is sacrificial formwork or lost formwork means formwork is left in the structural system to later act as reinforcement (shear/flexure)

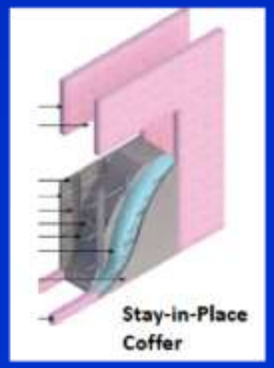
Stay-In-Place PVC Wall Forms

- 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.

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

Prefabricated Fibre Reinforced Sandwich Panels

- The Prefabricated Fibre Reinforced Sandwich Panels known as Aerocon Panels are patented panels of M/s HIL Ltd. These are sandwich panels, made of two fibre reinforced cement facing sheets, on either sides of a lightweight concrete core.
- These panels have a unique tongue and groove jointing system that facilitates rapid construction and are fully cured at the factory itself. These panels are manufactured by using Flexo Board (FOB)/ Fibre Cement Board (NT).
- These panels can be used for variety of applications such as for partitions, cladding, mezzanine floors, boundary walls, etc.

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 shortly a plant will be installed in India.

STEEL STRUCTURAL SYSTEMS

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

Steel skeleton with Aerocon panel infills

Continuous Sandwich (PUF) Panels with Steel Structure

- Continuous sandwich panels are single piece, prefabricated, modular, factory made units which consist of an insulating layer of rigid polyurethane foam between two layers of metal sheets.
- The panels comprise of PUF bonded between two sheets of Pre-coated GI sheets of 0.5 mm thick to produce straight-to-finish panels. Insulation core provides effective insulation and strong bonding for better structural stability to facilitate higher loading and wider spans. These panels are available for both wall and roof.
- The system can incorporate all types of architectural features like coving, boxes, cantilevers, projections, infill walls, mezzanine floors etc. This system can also incorporate all types of services viz. electrical, gas and plumbing etc.

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

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

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 :

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**

Global Housing Technology Challenge - India (GHTC-I)

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,

Global Housing Technology Challenge - India (GHTC-I)

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, coloumns, 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 Mechnized 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,

Global Housing Technology Challenge - India (GHTC-I)

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

Global Housing Technology Challenge - India (GHTC-I)

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

Global Housing Technology Challenge - India (GHTC-I)

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

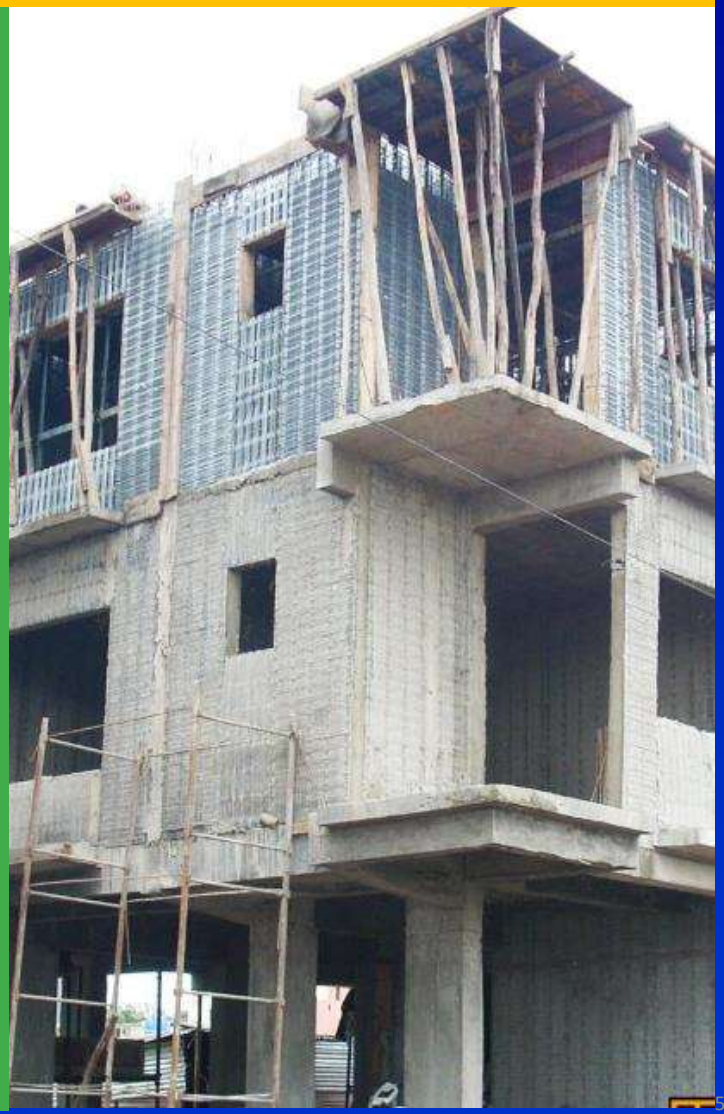
Global Housing Technology Challenge - India (GHTC-I)

GLOBAL HOUSING TECHNOLOGY CHALLENGE INDIA

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



bmtpc

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

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

Ministry of Housing and Urban Affairs
Government of India

GLOBAL HOUSING TECHNOLOGY CHALLENGE INC

स्वच्छ भारत
एक कदम स्वच्छता की ओर

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

bmtpc

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.

Light House Project: Chennai, Tamil Nadu

Construction Agency	M/s B.G. Shirke Constriction Private Ltd.
Technology Used	Precast Concrete Construction System - Precast Components Assembled at Site
No. of Houses	1,152
No. of Towers	12 (G+5)
Technology Brief	• Individual **precast building components** (columns & beams, slabs, stairs etc.) are manufactured in the **casting yard** under controlled conditions. • Finished components are then transported to site, erected & assembled through in-situ concreting **(wet jointing).**

Construction Process

1 **Manufacturing** of Pre-cast building components (columns & beams, slabs, stairs etc.) in casting yard

2 **Transportation & Erection** of Pre- cast beams & columns at site

3 **Placement** of pre-cast slabs & **Assembly** through in-situ concreting (wet jointing) with beam and columns

4 **Infill walls** constructed using Autoclaved Aerated Concrete (AAC) Block masonry along with **services** (electricity, plumbing) followed by plastering

Hon'ble Prime Minister inaugurates Light House Project Chennai, dedicates 1,152 houses to beneficiaries

26th May, 2022, Chennai

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.

Light House Project: Rajkot, Gujarat

Construction Agency	M/s Malani Construction Co.
Technology Used	Monolithic Concrete Construction using Tunnel Formwork
No. of Houses	1,144
No. of Towers	11 (S+13)
Technology brief	• **Reinforced Concrete walls and slabs** are cast monolithically in single pour (one go) using Tunnel Form work. • It is a 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 a house.

Construction Process

1 **Customised Tunnel Formwork** (mould) of steel manufactured in the factory

2 **Placement of Tunnel formwork** in already erected reinforcement cage for walls at site

3 **Placement of slab reinforcement & Concreting** of walls & slabs together in one go along with **services** (electricity,

4 **Infill walls** constructed using Autoclaved Aerated Concrete (AAC) Block followed by plastering

Hon’ble Prime Minister inaugurates Light House Project Rajkot, Dedicates 1,144 houses to beneficiaries

19th October, 2022, Rajkot

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.

Light House Project: Indore, Madhya Pradesh

Construction Agency	M/s KPR Construction Pvt. Ltd
Technology Used	Prefabricated Sandwich Panel System with Pre-Engineered Steel Structural System
No. of Houses	1,024
No of Towers	08 (S+8)
Technology brief	• The **factory-made Prefabricated Sandwich Panel System** comprises of core cement mortar with EPS granules balls sandwiched between calcium silicate boards on both sides. • These panels are being used in combination with **pre-engineered steel structural system as a dry wall construction** in this project.

Construction Process

1 **Customised steel columns & beams** manufactured in the factory are erected at site

2 **Deck slab installation in already erected steel structure**

3 **Concreting** of deck slabs with reinforcement along with **services**

4 **Factory made Prefabricated sandwich panels** are installed as infilled walls along with services

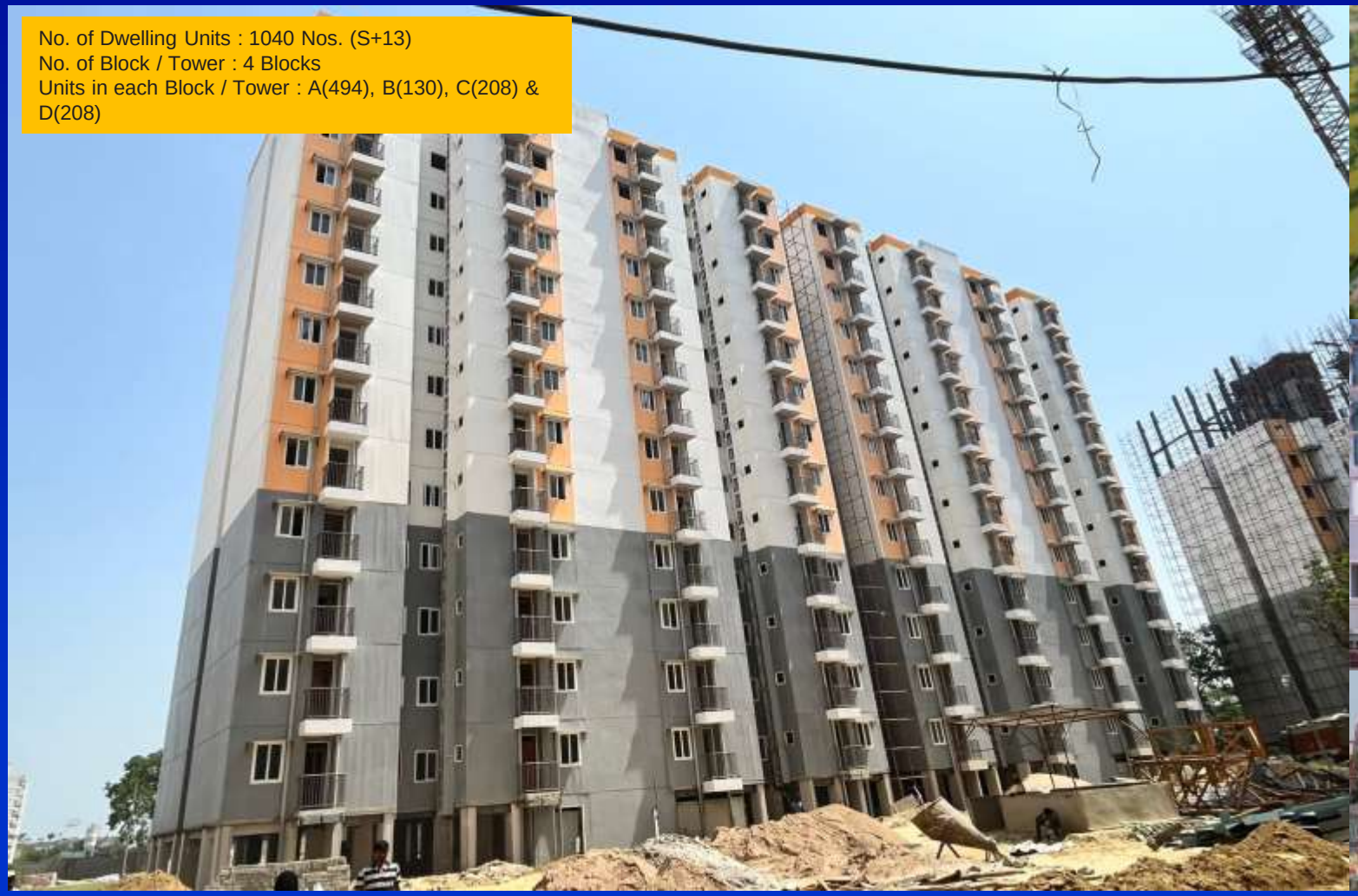
Hon’ble Prime Minister inaugurates Light House Project Indore, Dedicates 1,024 houses to beneficiaries

5th October, 2023

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)



Light House Project: Lucknow, Uttar Pradesh

Construction Agency	M/s Jam Sustainable LLP
Technology Used	Stay in Place PVC Formwork with Pre-Engineered Steel Structural System
No. of Houses	1,040
No. of Towers	04 (S+13)
Technology brief	• Poly-vinyl Chloride (PVC) based permanent stay-in-place form work acting as pre finished walls filled with concrete which requires no plaster and paint • These pre finished walls are used in combination with Pre-Engineered Steel Structural System

Construction Process

1 **Customised steel columns & beams** manufactured in the factory are erected at site

2 **Deck slab installation** in already erected steel structure & **Concreting with services**

3 **Factory made prefinished PVC Wall forms** are installed as infilled walls along with services

4 **Filling of infill walls with concrete**

Hon’ble Prime Minister inaugurates Light House Project Lucknow, Dedicates 1,040 houses to beneficiaries

10th March, 2024

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.

Light House Project: Ranchi, Jharkhand

Construction Agency	M/s SGC Magicrete LLP
Technology Used	Precast Concrete Construction System – 3D Volumetric
No. of Houses	1,008
No. of Towers	07 (G+8)
Technology brief	• A latest technology where precast concrete **structural modules** like room, toilet, kitchen, bathroom, stairs etc. & any combination of these are cast monolithically in casting yard under controlled condition. • These Modules are **transported and installed** using cranes & push-pull jacks and integrated together at site to form a complete building unit.

Construction Process

1 **Casting of structural modules & slabs in the casting yard**

2 **Placement of modules at site** using cranes

3 **Placement of pre cast floors on already erected structured modules**

4 **Step 2 & 3 are repeated like Lego Blocks to complete a Tower**

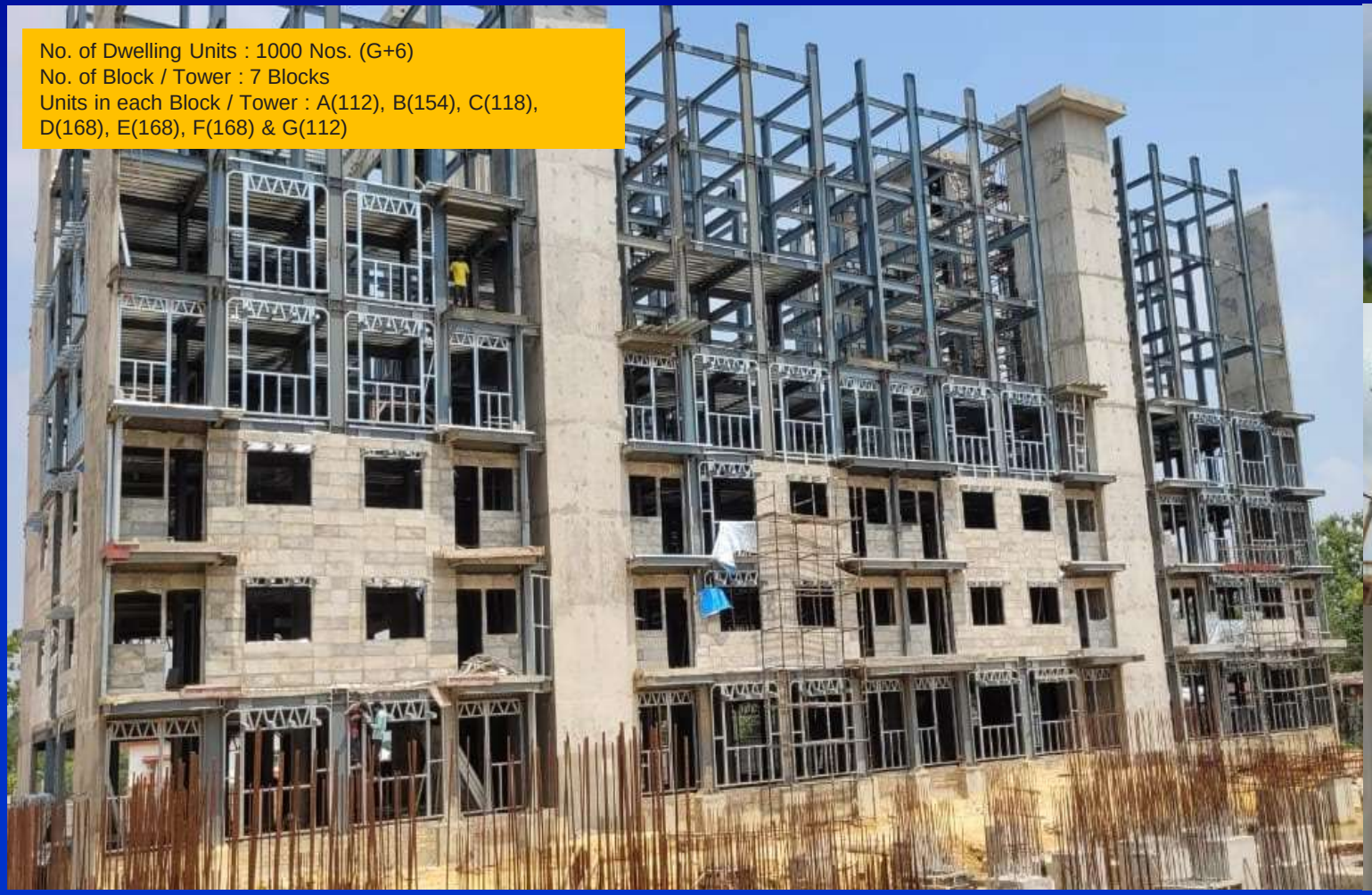
Hon’ble Prime Minister inaugurates Light House Project Ranchi, Dedicates 1,008 houses to beneficiaries

10th March, 2024

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)



Light House Project: Agartala, Tripura

Construction Agency	M/s Mitsumi Housing Pvt. Ltd
Technology Used	Light Gauge Steel Framed (LGSF) System with Pre-engineered Steel Structural System
No. of Houses	1,000
No. of Towers	07 (G+6)
Technology brief	• This system uses factory made galvanized **Light Gauge Steel** wall components in combination with pre-engineered steel structural system for structure • The light gauge steel wall sections are **assembled at site** which are then cladded with concrete panels on both sides and filled with light weight concrete.

Construction Process

1 **Customised steel columns & beams** manufactured in the factory are erected at site

2 **Erection** of factory made **LGSF panels** and **Fixing** of Precast concrete panels for walling

3 **Filling of light weight concrete** between the wall panels

4 **Deck slab installation** in already erected steel structure & **Concreting with services**


GLOBAL
HOUSING
TECHNOLOGY
CHALLENGE INDIA
TECHNOGRAHIS
Change Agents of Innovative and
Sustainable Construction Technologies
Scan and enrol:
Target Group :-
Faculty & Research Students
Technical Professionals
Central/States/ULB Officials
Construction Agencies
Builders/ Developers
Startup/Innovators/Enterpreneurs
Other Concerned Stakeholders
https://ghtc-india.gov.in/userhome/index

Demonstration Housing Projects (DHPs)

Completed

- **Bhubaneshwar, Odisha**
  (PMAY(U) Beneficiaries)
- **Bihar shariff, Bihar**
  (Sports Hostel & other social welfare activities)
- **Lucknow, UP**
  (Rental basis to Hospital patients & their attendees)
- **Nellore, Andhra Pradesh**
  (Social welfare activities)
- **Hyderabad, Telangana**
  (Training Hostel)
- **Panchkula, Haryana**
  (Working women hostel)
- **Agartala, Tripura**
  (Old Age Home)
- **Hathijan, Ahmedabad, Gujarat**
  (PMAY (U) Beneficiaries)
- **Bhouri, Bhopal, Madhya Pradesh**
  (Sports Hostel)
- **Tiruppur, Tamil Nadu**
  (Working Women's Hostel and Widow Home)
- **Ayodhya, UP**
  (Destitute Widow Ashram and Orphanage)

Ongoing

- **Dimapur, Nagaland**
  (Working Women Hostel)
- **Jammu, J&K**
  (Sports Hostel)
- **Guwahati, Assam**
  (Contractual Safai Karamcharis)

Adoption of New Technologies by States

AHP houses in Pune, Maharashtra using Precast Construction Technology

- More then **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	

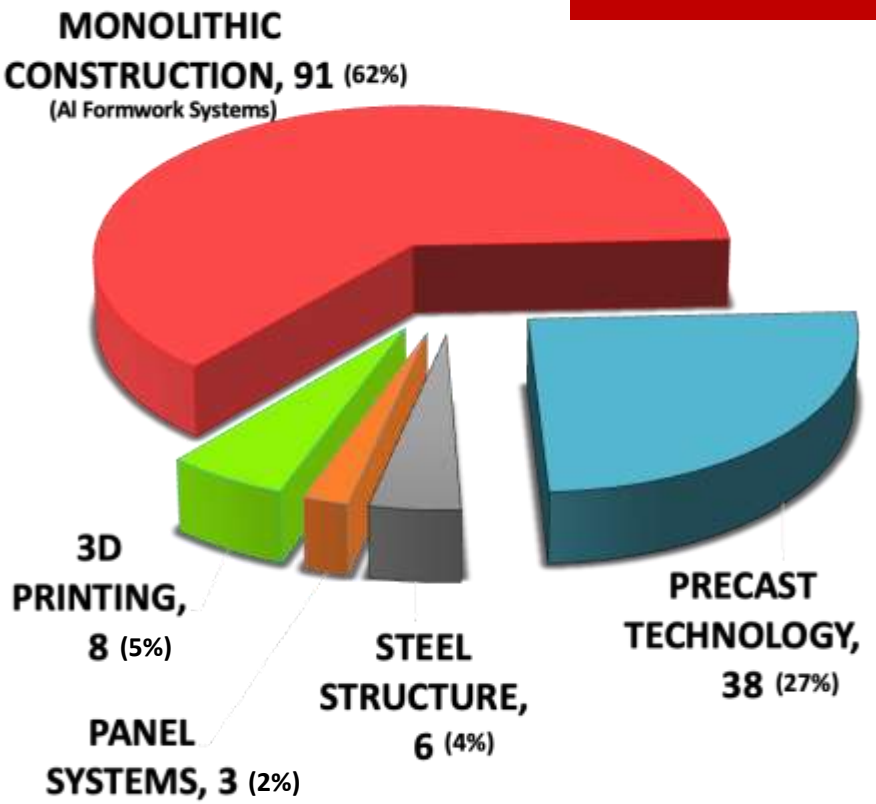
54
Alternate technologies Identified

54
technologies approved by CPWD

34
SoRs issued for alternate technologies by CPWD (27+7)

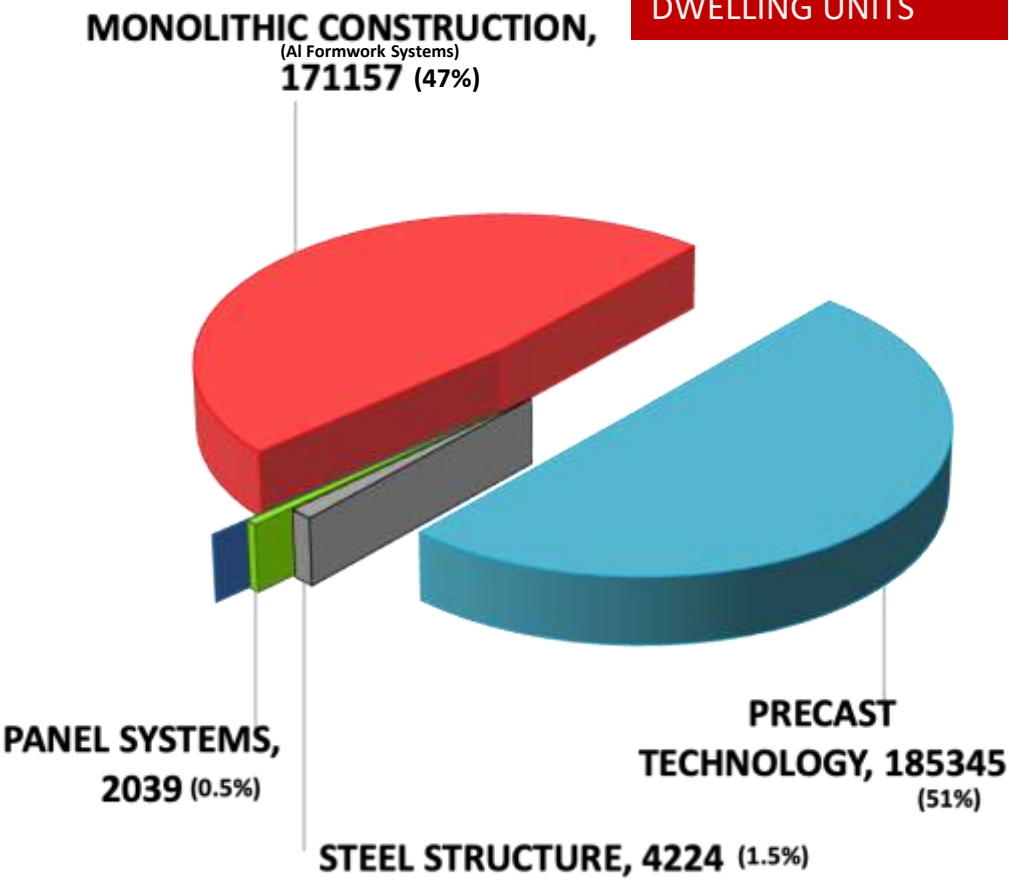
DISTRIBUTION OF USE OF INNOVATIVE TECHNOLOGIES

BY NUMBER OF PROJECTS



Total Projects: 146

BY NUMBER OF DWELLING UNITS



Total Units: 3,62,765

नवरीतिः (NAVARITIH)

(New, Affordable, Validated, Research Innovation Technologies for Indian Housing)

Certificate Course on Innovative Construction Technologies

Hon'ble Prime Minister of India launched NAVARITIH

during Foundation Stone Laying ceremony of six Light House Projects (LHPs) on 1.1.2021

Ministry of Housing and Urban Affairs
Government of India

GLOBAL HOUSING TECHNOLOGY CHALLENGE INDIA

School of Planning and Architecture, New Delhi

Building Materials & Technology Promotion Council, New Delhi

नवरीतिः (NAVARITIH)

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an initiative of Ministry of Housing & Urban Affairs, Govt. of India
in collaboration with SPA, New Delhi & BMTPC

Online Classes of 20th Batch will start from January 17, 2025

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Impediments & Actions Required for using Emerging Construction Systems

Impediment	Action
Misconceptions about new systems	Develop a knowledge base on new technologies
Risk avoidance by policy makers and Technocrats	Policy level interventions through a committee of experts representing technical and financial departments.
Apathy at Implementation level	Incentivize innovation in construction
User Acceptability	Awareness creation and construction of some public buildings to build confidence in public
Inadequate Capacities at Professional level	Create a pool of specialists
Paucity of Contractors	Build a platform for technology providers & contractors
High Initial cost & Economies of Scale	Digress from initial cost to life-cycle cost
Do away with item rate business and adopt EPC contract system	Bring new Procurement Policy
Conventional pre-qualification criteria	Modify and relax existing pre-qualification criteria in tender documents.
Lack of modular/standardized planning & design	Prepare modular plans & design for different geo-climatic regions of India.
Absence of Demonstration at grass-root level	Demonstration Construction with new technologies
Skill Development	Capacity Building & Skill Development

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"Creating Enabling Environment for Affordable Housing for All"