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

GLOBAL HOUSING TECHNOLOGY CHALLENGE INDIA

Ministry of Housing and Urban Affairs
Government of India

आज़ादी का अमृत महोत्सव

bmtpc

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

RACHNA 2.0

RESILIENT, AFFORDABLE AND COMFORTABLE HOUSING THROUGH NATIONAL ACTION

VOCATIONAL TRAINING

Training C at Indore – 01, 02 March 2023

PRE-FABRICATED EPS SANDWICH PANEL SYSTEM

Climate Smart Buildings (CSB)

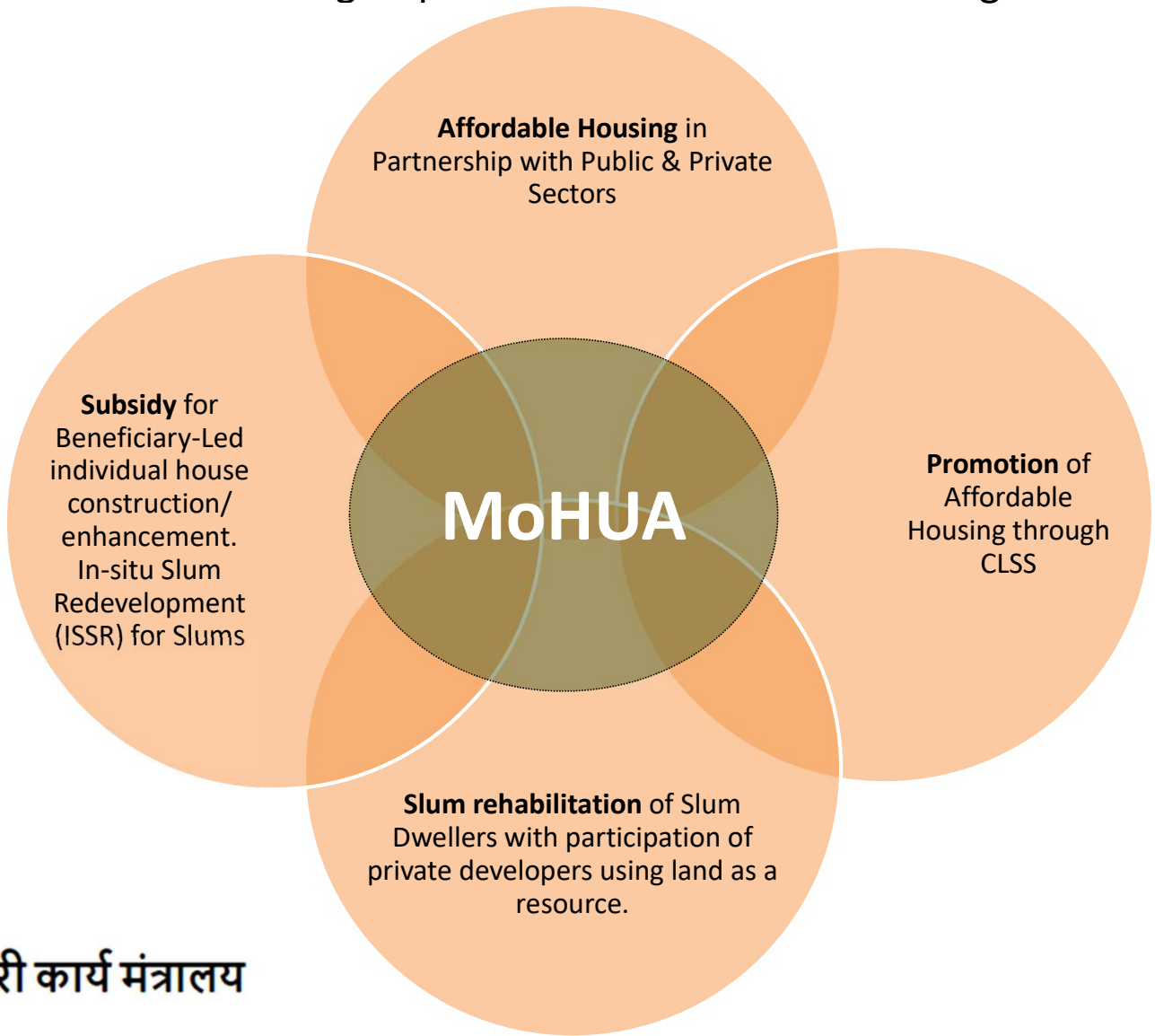
Cluster cell Indore, Madhya Pradesh under Global Housing Technology Challenge - India (GHTC-India)

INTRODUCTION - MoHUA

'Housing for All' by 2022.

Under the Mission, Ministry of Housing and Urban Affairs (MoHUA), provides Central Assistance to implementing agencies through States and Union Territories for providing houses to all eligible families/beneficiaries by 2022.

Addressing the affordable housing requirement in urban areas through:



सत्यमेव जयते

भारत सरकार

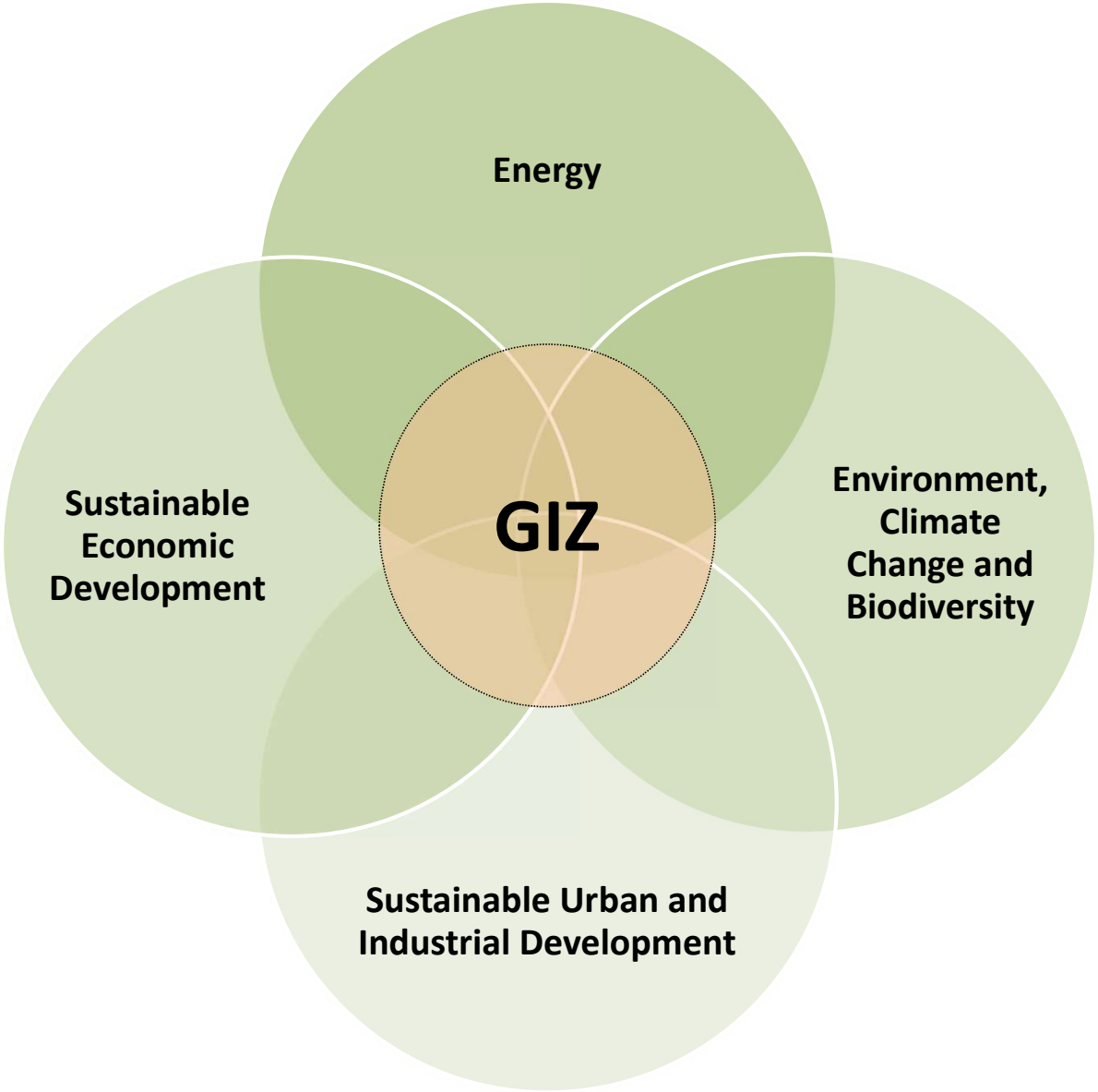
आवासन और शहरी कार्य मंत्रालय

INTRODUCTION - GIZ

- GIZ is an international cooperation enterprise for sustainable development which operates worldwide, on a public benefit basis.

- GIZ is fully owned by the German Federal Government, GIZ implement development programs in partner country on behalf of the German Government in achieving its development policy objectives.

- For over **60 years**, the GIZ has been working jointly with partners in India for **sustainable economic, ecological, and social development.**

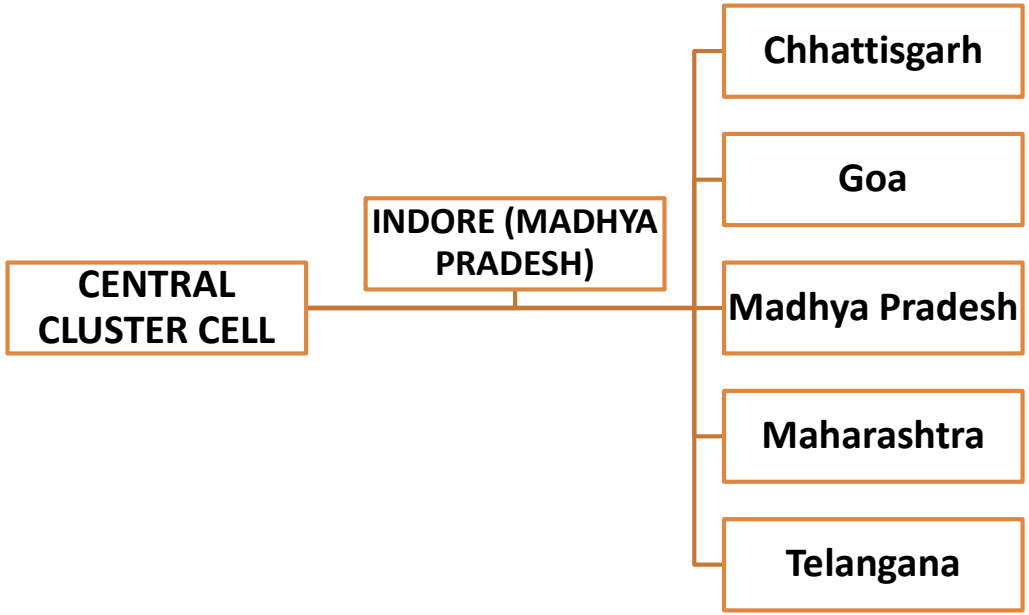


TASKS PLANNED WITH MoHUA

CLIMATE SMART BUILDING

- Technical assistance in developing thermal comfort action plan for climate resilience building for mass scale application in selected states for Affordable Housing
- Technical support in implementation of Global Housing Technology Challenge-India (GHTC-India)

States and UT's under central cluster cell established at Indore



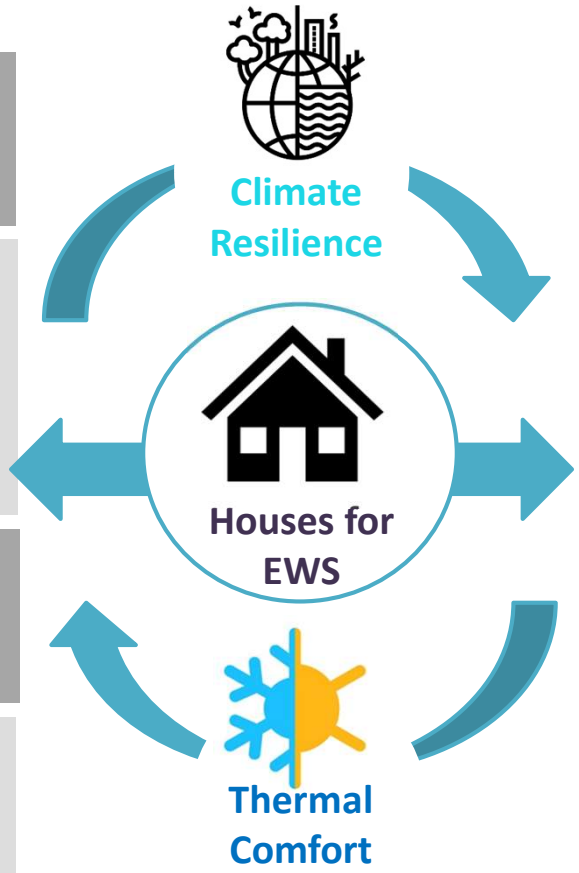
AIM & CONCEPT

7 AFFORDABLE AND CLEAN ENERGY
Ensure access to affordable, reliable, sustainable, and modern energy for all

9.INDUSTRY, INNOVATION AND INFRASTRUCTURE
Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation

11.SUSTAINABLE CITIES AND COMMUNITIES
Make cities and human settlements inclusive, safe, resilient, and sustainable

13. PROTECT THE PLANET
Take urgent action to combat climate change and its impacts



DESIGN

↓

CONSTRUCTION

↓

POST OCCUPANCY (O & M)

INTEGRATION IN BY-LAWS

AIM & CONCEPT

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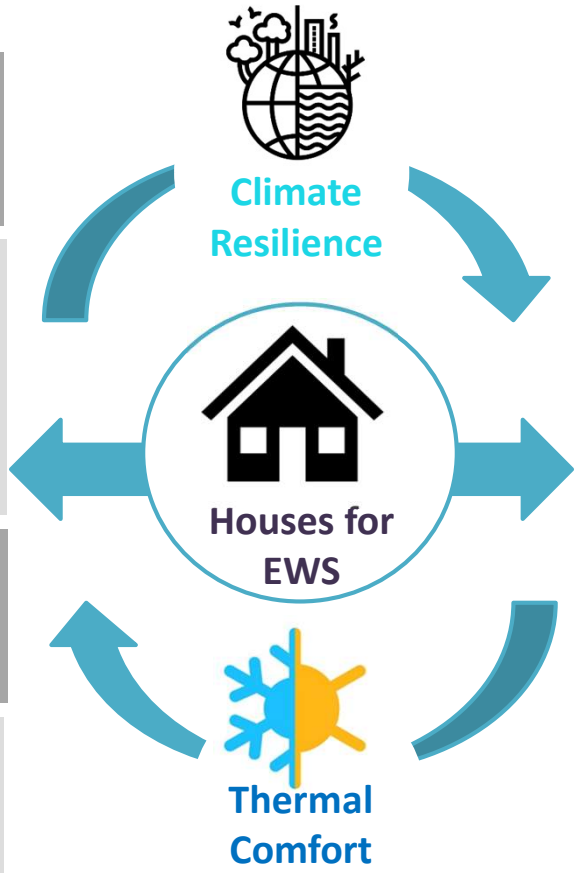
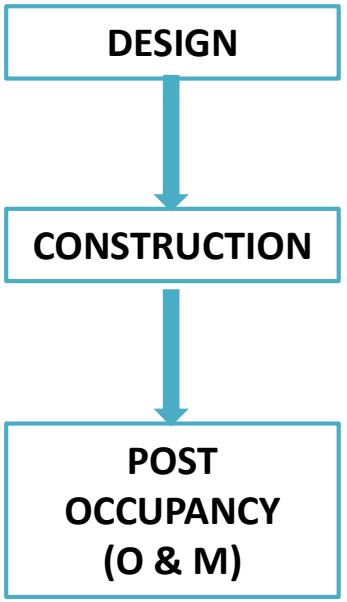




INTEGRATION IN BY-LAWS

LHP INTRODUCTION

6 LHP ACROSS INDIA

Map showing six different LHP Locations

LHPs shall serve **as LIVE Laboratories** for different aspects of **Transfer of technologies**

6 LHPs

1.Indore,Madhya Pradesh

- Prefabricated Sandwich Panel System

2.Rajkot,Gujarat

- Monolithic Concrete Construction using Tunnel Formwork

3.Chennai,Tamil Nadu

- Precast Concrete Construction System – Precast Components Assembled at Site

4.Ranchi,Jharkhand

- Precast Concrete Construction System – 3D Volumetric

5.Agartala,Tripura

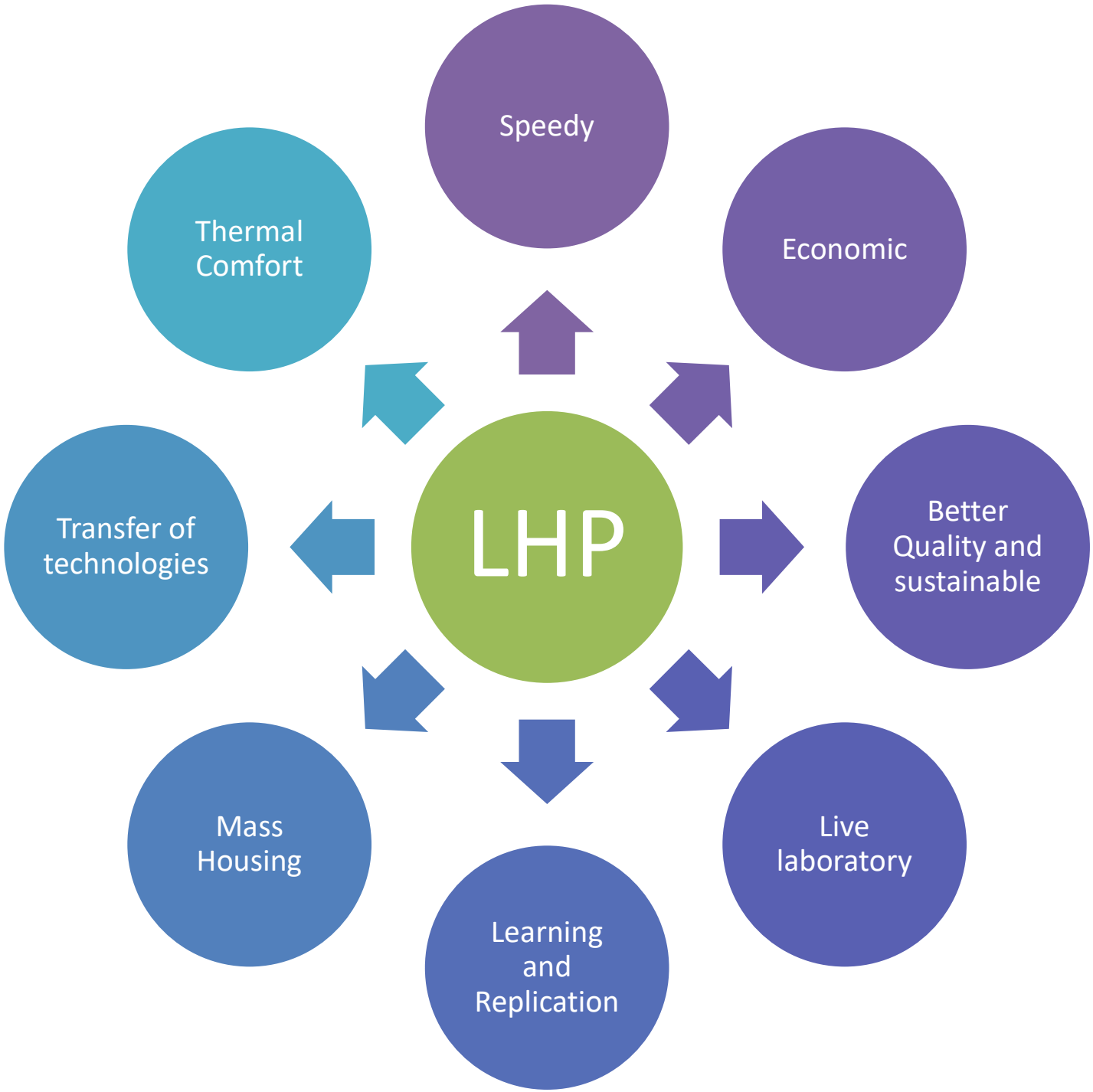
- Light Gauge Steel Structural System & Pre-engineered Steel Structural System

6.Lucknow,Uttar Pradesh

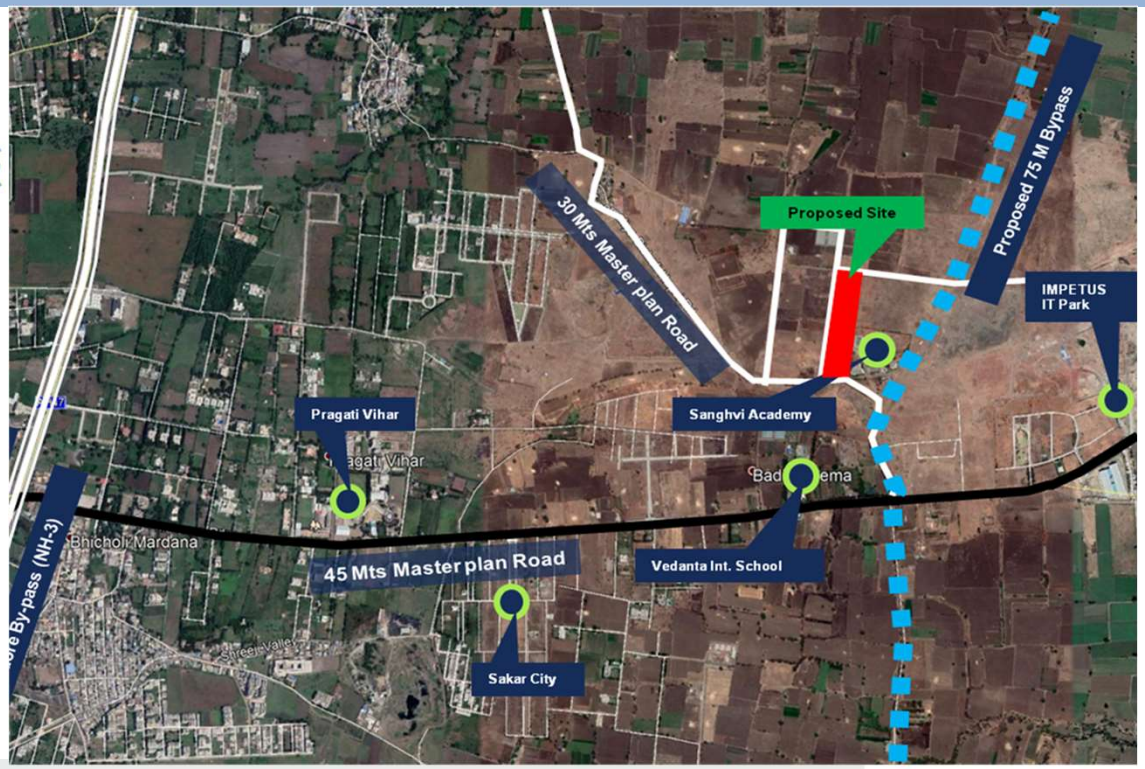
- PVC Stay In Place Formwork System

6 LHPs Explained Via Video

6 LHPs – FOCUSES ON



LHP INDORE



Description	Unit	Length	Width	Area
Living Room	Sqmt	3.12	3.08	9.61
Bed Room	Sqmt	3.12	2.99	9.33
Kitchen	Sqmt	2.1	1.81	3.80
Toilet	Sqmt	2.1	1.2	2.52
Balcony	Sqmt	2.07	1.06	2.19
Circulation Area	Sqmt	2.19	0.9	1.97
Thresold Area	Sqmt			0.50
Total Carpet Area	Sqmt			29.92

LHP INDORE

Project Details

Land Area – 41920 sqm
Net Plot Area – 34276 sqm
No's of Dwelling Unit – 1024
No's of Tower – 08
No's of Floor – *SF* + 08
No's of DU / Tower – 128
Community Hall – 169.5 sqm

Key Highlights

Technology – Pre-Fabricated Sandwich Panel & PEB Structure
Project Start Date – 01-01-2021
Amenities –
Rain Water Harvesting, Rooftop Solar Power System
Fire Equipment (s), Elevator / Lift
Emergency Power Back-up, Sewage Treatment Plant
Central Waste Collection Plant

LHP INDORE - TECHNOLOGY

Structural System – *Pre Engineering Building* ***Slab-*** *Deck Sheet Slab*

Walling System - *Pre fabricated sandwich panel system*

PEB STRUCTURE

DECK SHEET SLAB

PREFABRICATED SANDWICH PANEL WALLING

SITE PREPARATIONS

SITE EXACAVATION

LABOUR HUTMENT

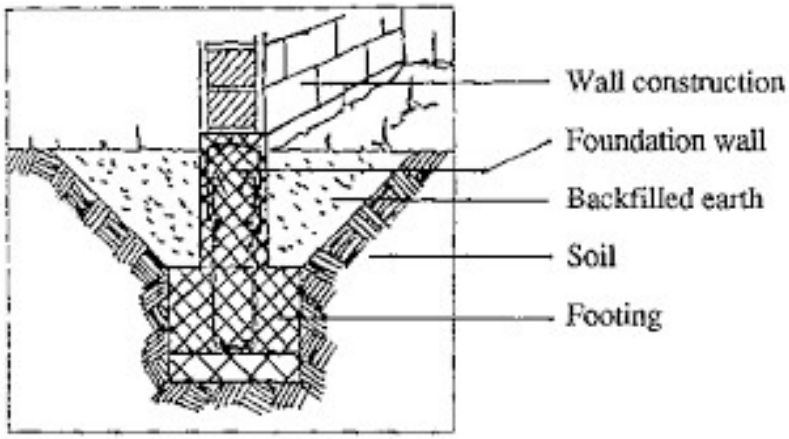
SITE OFFICE, STORE AND FRONT SIDE BARRICADING

LABOUR HUTMENT

FOOTING MARKING

FOOTING MARKING

PCC FOR FOOTING



Footing section with soil layering

FOOTING DESIGN & SECTION

Types of Footing In The Project

- Straight isolated footing
- Inclined isolated footing
- Combined footing
- Raft footing

Footing calculations is done as per live load , dead load and wind load

PLINTH

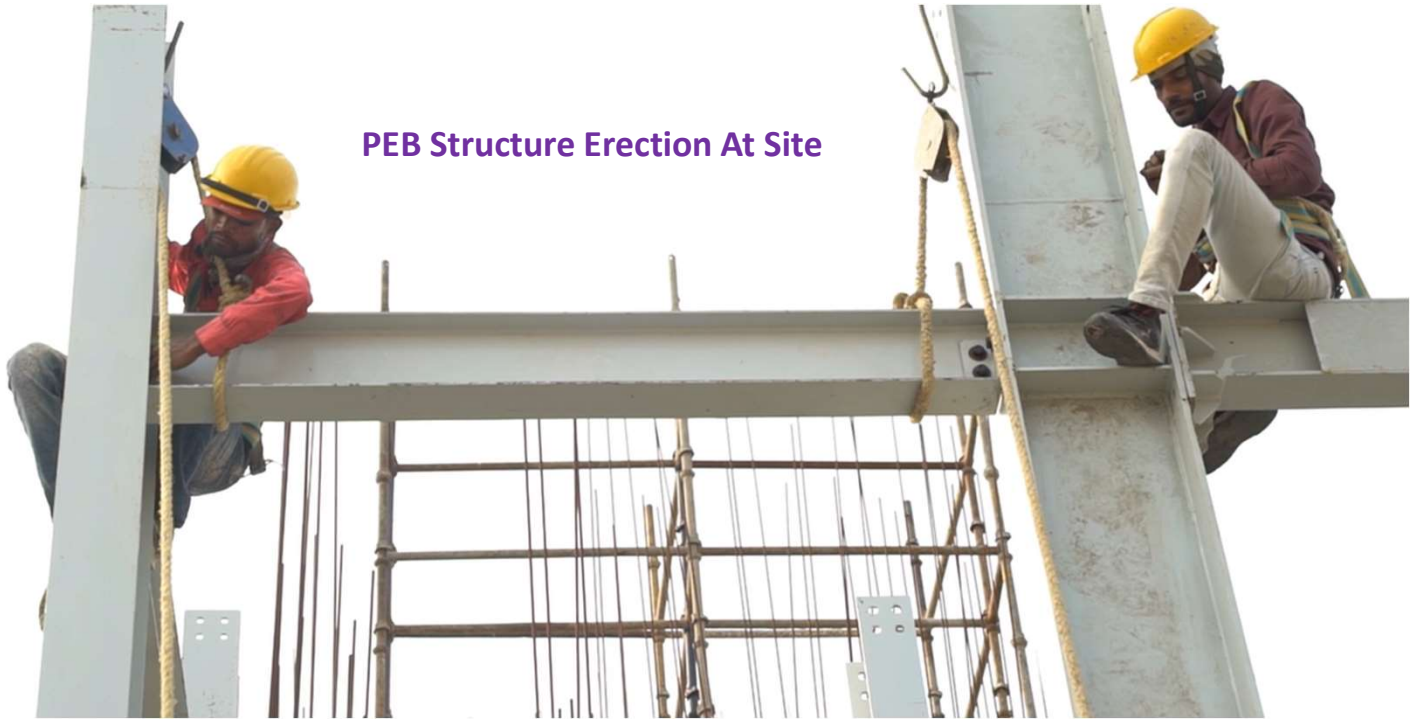
RCC COLUMN UP TO PLINTH LEVEL

PLINTH BEAM

PEB ERRECTION

PEB Material Stacking At Site

PEB Material Lifting At Floors Via Crane



PEB Structure Erection At Site

PEB ERRECTION Explained Via Video

LHP INDORE - TECHNOLOGY

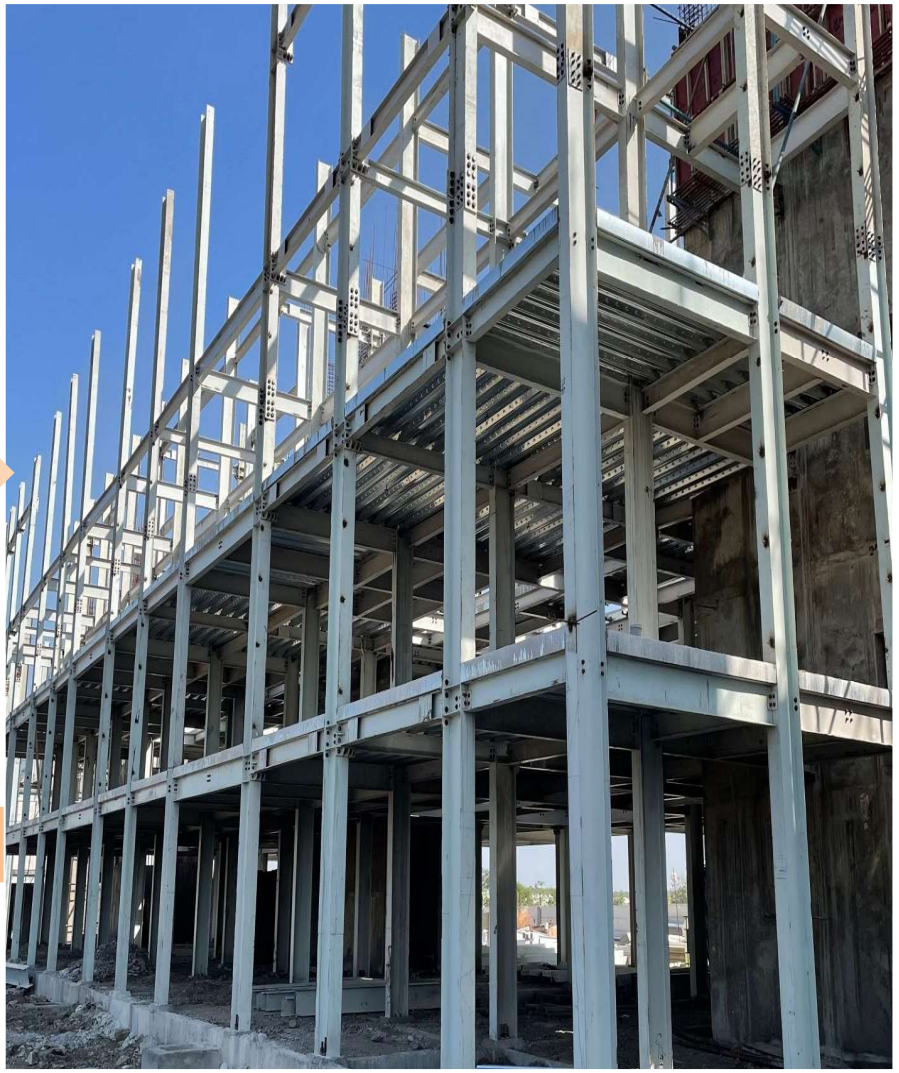
PEB STRUCTURE

- With **Pre-engineered steel building** systems, multi-stories can now be scripted in the shortest "set-up" time
- Speed in Construction

Lifting

Floor Structure

Bolting

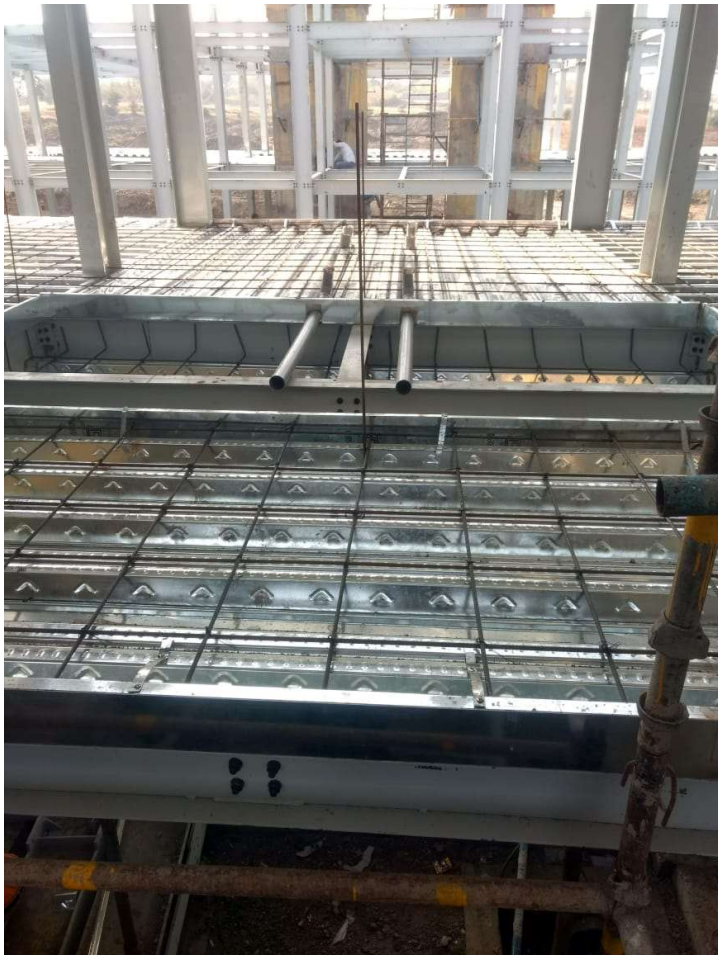


LHP INDORE - TECHNOLOGY

DECK SLAB

Deck Sheet Laying

Services & Reinforcement Laying



Concreting

CONSTRUCTION METHODOLOGY

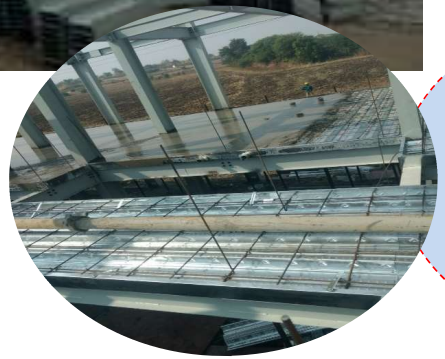
6. Staircase –
Fabricated MS sections are being welded at site for staircase frame preparation

1. Substructure
RCC Isolated column footing

5. Lift Wall –
RCC structure is being prepared for lift walls. Onsite RMC plant for RCC material preparation

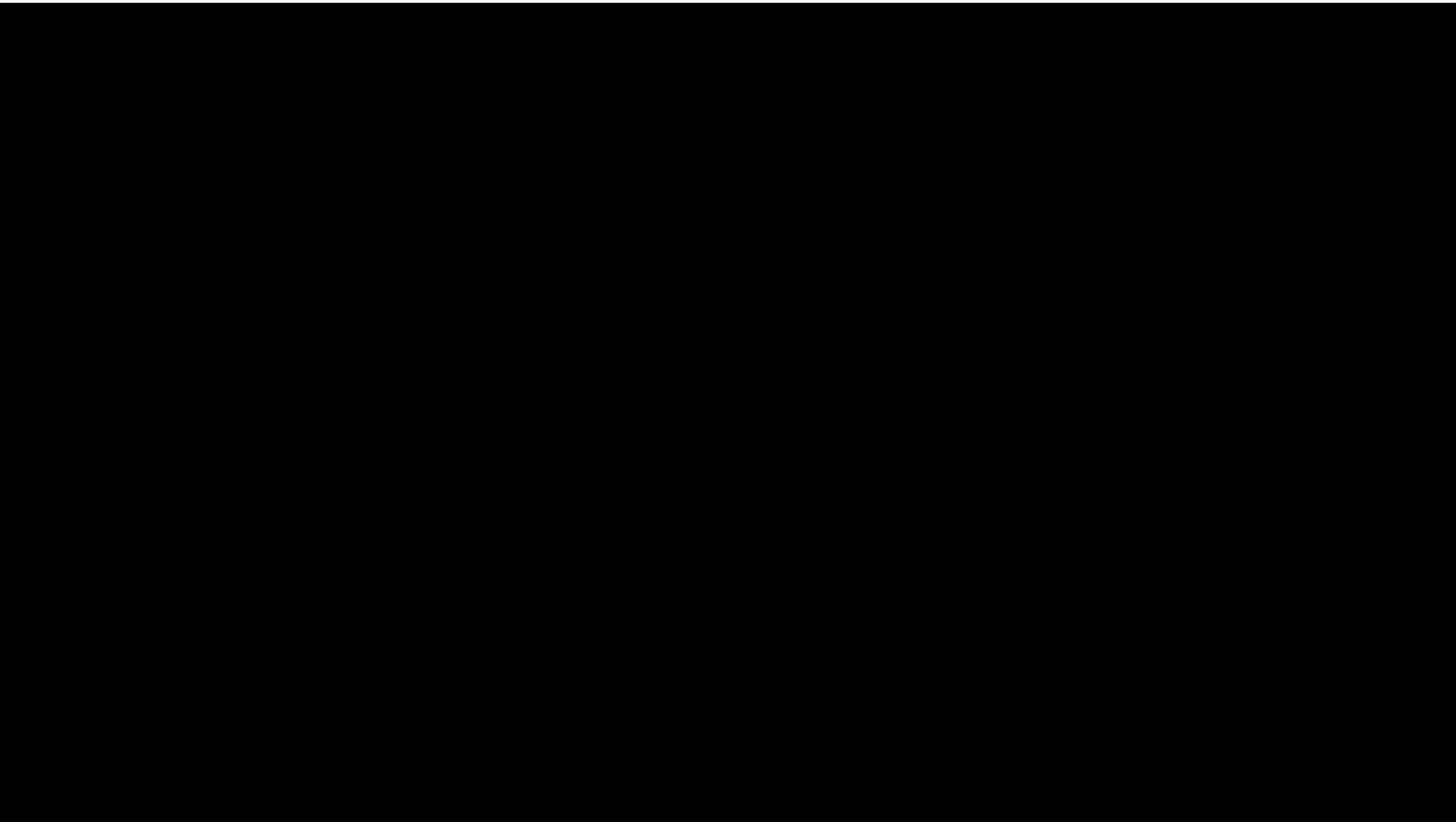
2. Structural System
Pre Engineered structure consists of factory manufactured steel column and beam erected on site.

4. Walling System
Factory made Prefabricated sandwich panels are being used for wall preparation



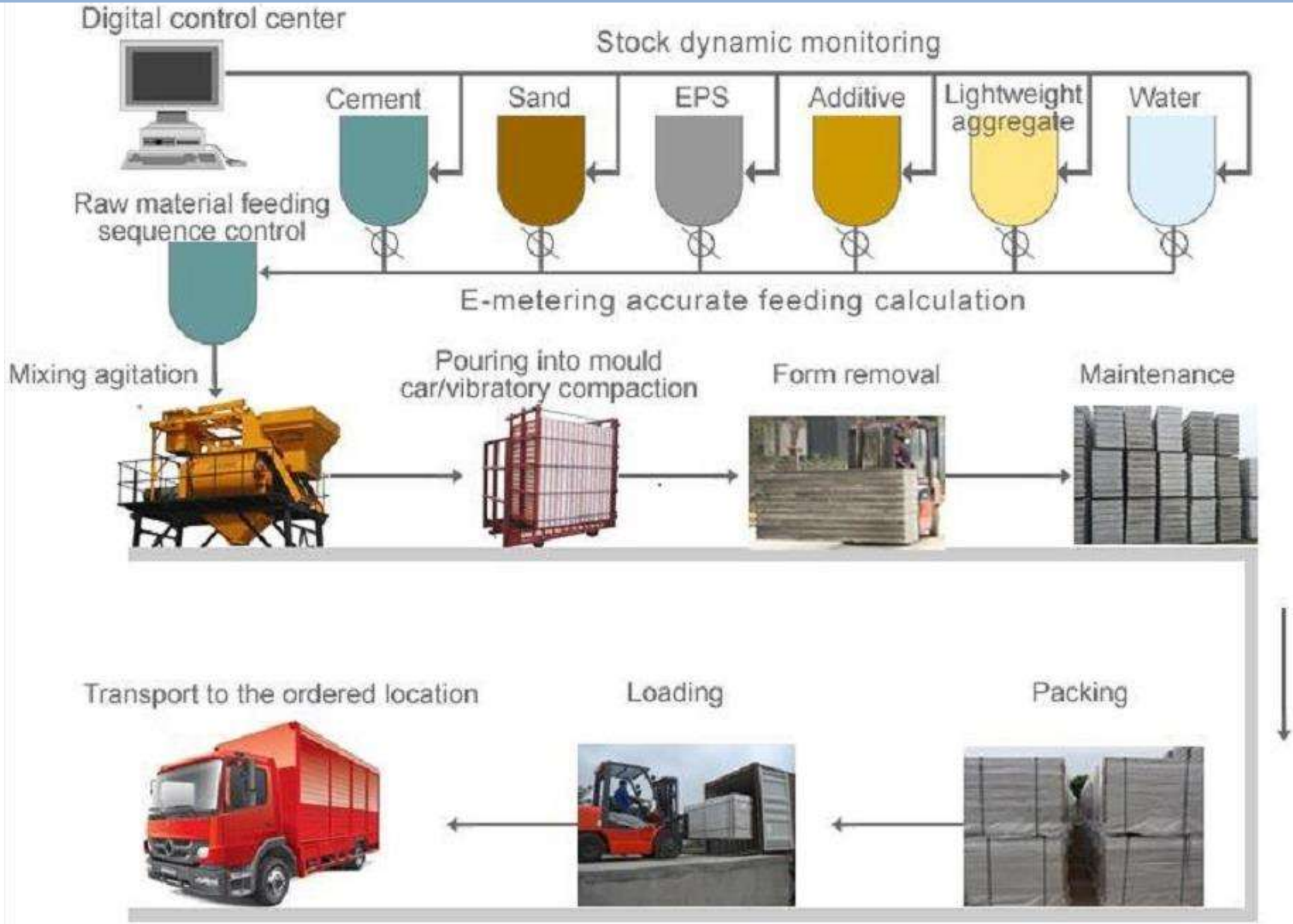
3. Slab –
Deck sheet is placed on structure. over it, slab casting is done

LHP INDORE - TECHNOLOGY

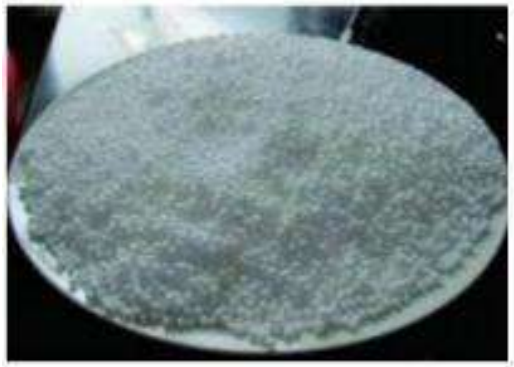


Technology information being explained via Video

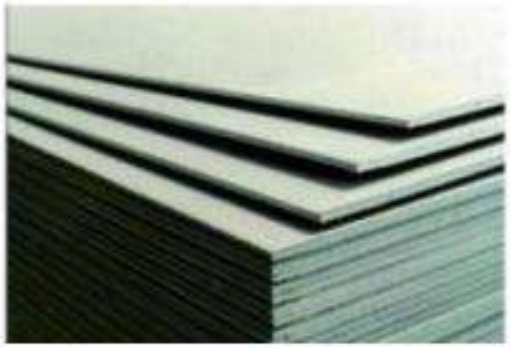
EPS SANDWICH PANEL MANUFACTORING PROCESS



EPS SANDWICH PANEL RAW MATERIALS



EPS



Calcium silicate board

Fly ash

Cement

EPS SANDWICH PANEL- FIXING TOOLS

No.	Name	Picture	Function	Picture
1	Cement adhesive		Special cement adhesive for EPS cement sandwich panel connection	
2	Triangle wood		Support, ensure the panel be sticked firmly	
3	Steel bar		Reinforce the connection of the EPS cement sandwich panels	
4	PU foam		Filling the gaps between panel and structure, door, window.	
Decoration remark: if you choose painting for the decoration, you need to put fiber mesh cloth on the wall or fiber mesh tape at the joint before painting, if you decorate the wall by wallpaper, wall tile or other covered materials, no need for the following materials, can put the wallpaper, wall tile on the wall directly.				
5	Fiber mesh cloth		For whole wall anti-crack	
6	Fiber mesh tape		Between panels connection for anti-crack	
7	Anti-crack mortar		Stick (cover) the fiber mesh cloth/fiber mesh tape on the panel	

EPS SANDWICH PANEL FIXING

Technology information being explained via Video

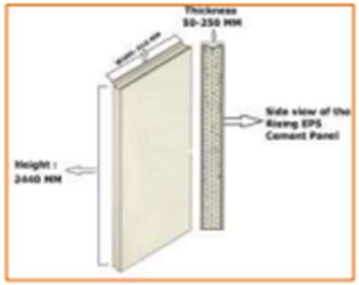
EPS PANEL PERFORMANCE APPRAISAL CERTIFICATE

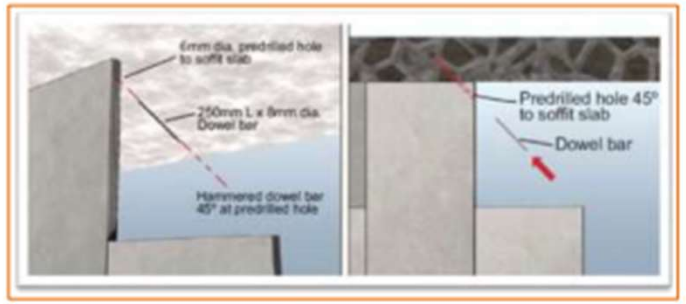
BMTPC PACS
PERFORMANCE APPRAISAL CERTIFICATION

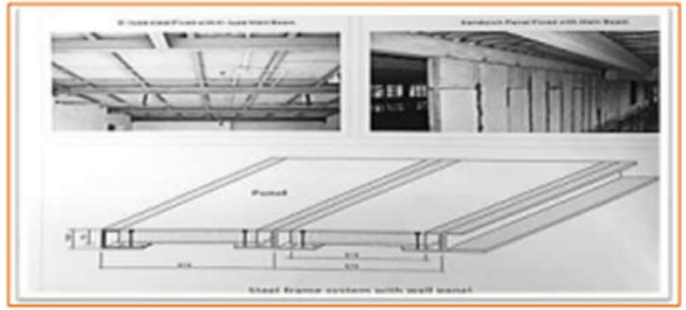
Rising EPS (Beads) Cement Panels

User should check the validity of the Certificate by contacting Member Secretary, BMBA at BMTPC or the Holder of this Certificate.

Name and Address of Certificate Holder:	Performance Appraisal Certificate No.
M/s Rising Japan Infra Pvt. Ltd., **I-203,Som Vihar, R K Puram** **New Delhi -- 110022** **Tel: 08826195032** **E-mail:rpg@rijapaninfra.com**	PAC No.:**1032-S/2017** Issue No. **01** Date of Issue: **04.07.2017**







bmtpc

Building Materials & Technology Promotion Council
Ministry of Housing & Urban Poverty Alleviation
Government of India
Core 5A, First Floor, India Habitat Centre,
Lodhi Road, New Delhi – 110 003

Tel: +91-11-2463 8096, 2463 8097; Fax: +91-11-2464 2849
E-mail: bmtpc@del2.vsnl.net.in Web Site: http://www.bmtpc.org

Rising EPS Cement Panels

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE
(A Grant-in-aid Autonomous Institute under R.G.P.V. Bhopal, (MP)
Race Course Road, Gwalior (M.P.) 474 005
Phone: +91-751-2409300 Fax: +91-751-2664684 Email: infomitsgwl@gmail.com website: www.mitsgwl.ac.in

Ref: Civil/AT/Material Testing /886 **Date:** 04/04/17

To
The Director
Rising Japan Infra Private Limited
i-203, Som Vihar, R K Puram
New Delhi-110022

Subject: Testing of Rising EPS Cement Sandwich Panels of 90mm Thickness samples
Ref: ***Your letter No. NIL dated 28.02.2017***

Dear Sir,

Please find herewith a consolidated test report of 90mm thickness Rising EPS Cement sandwich panels samples sent by you vide above mentioned reference and subject: This table of results is a summary of the detailed individual tests conducted on the panel samples as per listed tests.

Report of the results of the Tests

Sl No.	Test conducted	Standards Applied	Lab Results	Remarks
1.	Density & Flammability of EPS	ASTM 7309–07	780 kgs/ M³ (Flammability)	Qualified
2.	Axial compression	EN520:2004+ A1:2009	4.27 MPa	Qualified
3.	Resistance to continuous heating	ASTM F 1939	80°c	Qualified
4.	Flexural Strength	ASTM 293	1.53 MPa	Qualified
5.	Acoustic Performance	IS 9901-1981	40 dB	Qualified
6.	Thermal conductivity	IS 3346 1980	0.22 W/ mk	Qualified
7.	Thermal Resistance	IS 3346 1980	0.42 mk/W	Qualified
8.	Water penetration	EN1609	No dampness or leakage	Pass
9.	Fire rating of the panels	BS 478 part 20/ 22	Grade –1 / 3 Hrs.	Pass
10.	Resistance to structural damage from a large light body	BS5234: Part2: 1992, Annex E	No collapse or dislocation	Pass
11.	Anti-bending damage load	BS 5234: Part 2	3 Times of its weight	Qualified
12.	Non-combustibility	GB8624-1994	A Level	Qualified
13.	Water tightness	ASTM C1185	No droplets observed behind panels after 24 Hrs.at 250mm Water head	Qualified
14.	Drying Shrinkage value	IS 2185 Part 1-0C	0.083 %	Pass
15.	Single point hanging strength	BS 5234: Part 2	1300 N	Pass

Remarks: "Qualified" with regards to relevant tests.
The above tests results are only for the information to the referred agency / client. The institute does not take any responsibility of these tests results for any other purpose, legal or otherwise.

Prof I/C Material Testing — H.C.E.D 04/04/17 — Forwarded by: DIRECTOR 4.4.17

Council of Architecture · IITBombayX · IEEE · The Institution of Engineering and Technology · ASCE

EPS SANDWICH PANEL- PANEL SIZES

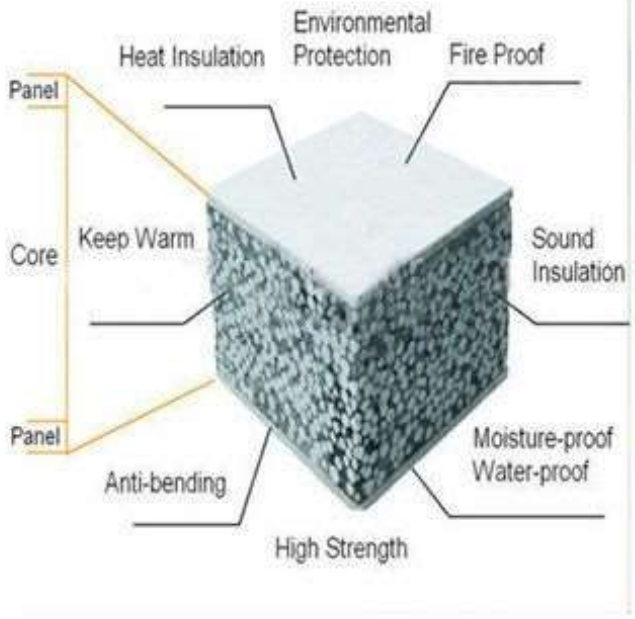
EPS Cement Sandwich Panel			
Specification L*W*T (mm)	Weight (kg/m2)	Packing (pcs/m2 per 20′ GP / 40′ HQ)	Application
2270 / 2440 x 610 x 60	45-48	315pcs*436m2/ 384pcs*572m2	Interior wall/ Roof system
2270 / 2440 x 610 x 75	50-53 / 55-58	252pcs*349m2/ 312pcs*464m2	Interior wall
2270 / 2440 x 610 x 90	55-58 / 69-72	207pcs*287m2/ 251pcs*375m2	Interior/ Exterior wall
2270 / 2440 x 610 x 100	60-65 / 72-75	189pcs*262m2/ 240pcs*357m2	Interior/ Exterior wall
2270 / 2440 x 610 x 120	65-75 / 90-93	153pcs*212m2/ 192pcs*286m2	Exterior wall
2270 / 2440 x 610 x 150	80-90 / 111-114	126pcs*175m2/ 156pcs*232m2	Exterior wall

PANEL TECHNICAL SPECIFICATION

Items	National Standards					Testing Indexes				
Thickness	60mm	90mm	100mm	120mm	150mm	60mm	90mm	100mm	120mm	150mm
Anti-impact performance/ times	≥5	≥5	≥5	≥5	≥5	≥8	≥10	≥15	≥18	≥22
Anti-bending damage load/ times over dead-weight	≥1.5	≥1.5	≥1.5	≥1.5	≥1.5	≥3	≥4	≥5	≥6	≥7
Anti-pressure strength/ Mpa	≥3.5	≥3.5	≥3.5	≥3.5	≥3.5	≥3.5	≥3.5	≥3.5	≥3.5	≥3.5
Surface density/ kg/㎡	≤70	≤90	≤110	--	--	≤45	≤55	≤65	≤75	≤85
Single point hanging strength/ N	≥1000	≥1000	≥1000	≥1000	≥1000	≥1000	≥1200	≥1300	≥1400	≥1500
Fire proof limit/ h	≥1	≥1	≥1	≥1	≥1	≥3	≥3	≥4	≥4	≥4
Sound insulation capacity in the air/ db	≥30	≥35	≥40	≥45	≥50	≥35	≥40	≥45	≥50	≥55
Soften coefficient	≥0.8	≥0.8	≥0.8	≥0.8	≥0.8	≥1	≥1	≥1	≥1	≥1
Moisture coefficient/ a%	≤12	≤10	≤10	≤8	≤8	≤10	≤9	≤7	≤6	≤6
Heat transfer coefficient/ B/W/M2.K	≤2.0	≤2.0	≤2.0	≤2.0	≤1.0	≤0.4	≤0.25	≤0.2	≤0.18	≤0.15
Drying shrinkage/ mm/m	≤0.6	≤0.6	≤0.6	≤0.6	≤0.6	≤0.4	≤0.5	≤0.5	≤0.5	≤0.5
Inner radiation index	≤1	≤1	≤1	≤1	≤1	≤1	≤1	≤1	≤1	≤1
Outer radiation index	≤1	≤1	≤1	≤1	≤1	≤1	≤1	≤1	≤1	≤1
Radioactivity limit	≤1	≤1	≤1	≤1	≤1	≤1	≤1	≤1	≤1	≤1

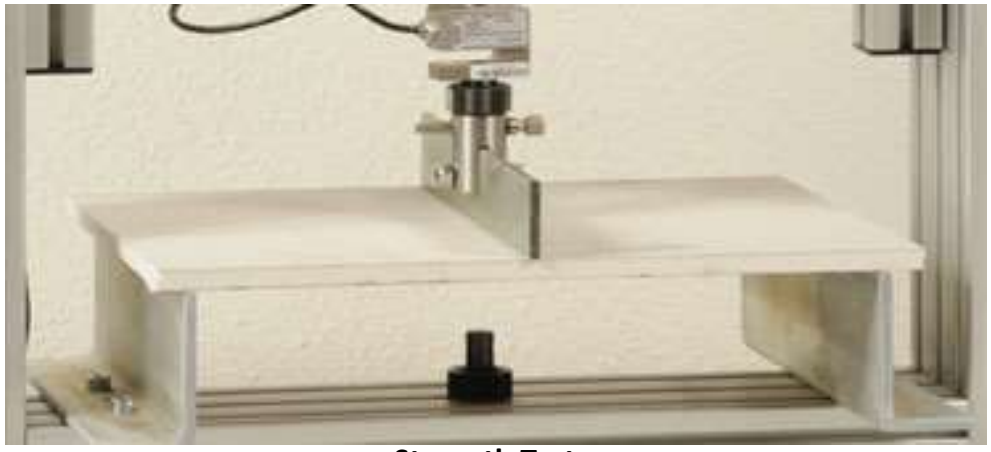
EPS PANEL INSTALLATION Via Video

LHP INDORE – TECHNOLOGY ADVANTAGES



- ✓ Speed in Construction
- ✓ No use of water in curing
- ✓ Panels bring resource efficiency, better thermal insulation, acoustics & energy efficiency

LHP INDORE – TECHNOLOGY ADVANTAGES



Strength Test

Fast and Easy Construction

Fire Resistance Test

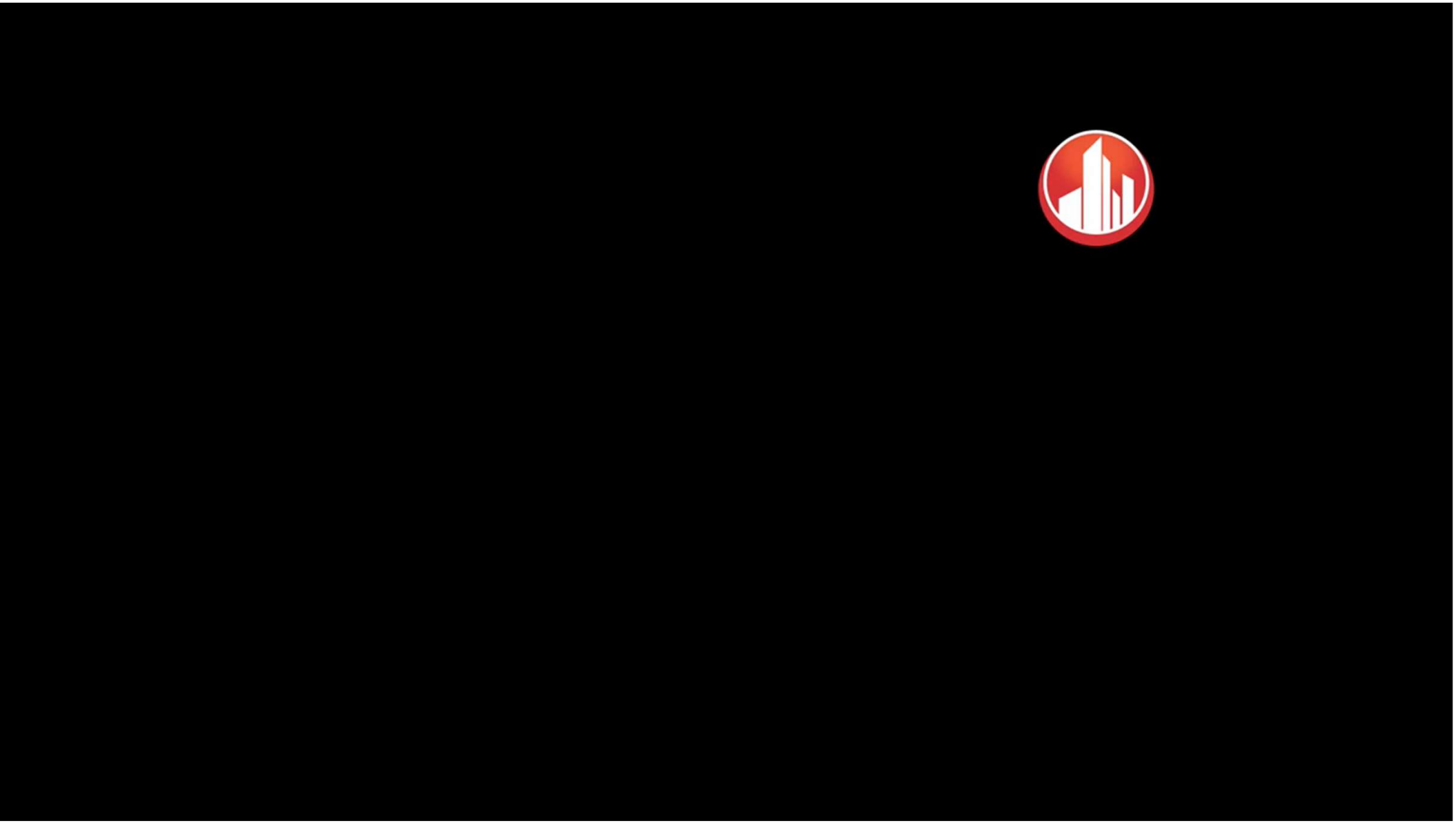
Energy saving by thermal resistance

Recyclable

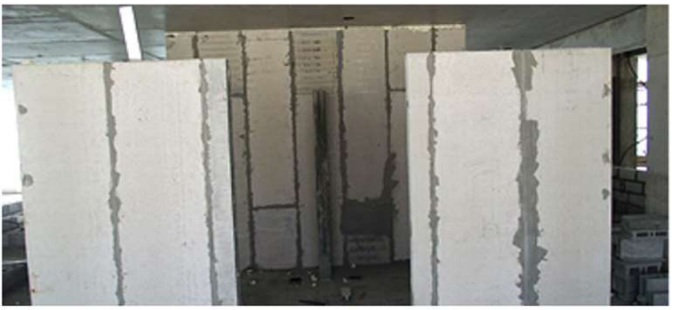
Eco friendly dry construction

- ✓ Light weight and cost effective
- ✓ Easy and faster construction
- ✓ Fireproof
- ✓ Water proof and damp proof
- ✓ Non-toxic & environment-friendly
- ✓ Energy saving & environment-friendly
- ✓ Water saving due to dry construction
- ✓ Smooth and flat surface, thus no plastering needed
- ✓ High sound insulation
- ✓ Cost effective
- ✓ Ground staff optimization
- ✓ Increase in carpet area up to 15% which saves money

LHP INDORE – TECHNOLOGY ADVANTAGES Via Video



CASE STUDY – India - Hotel Projects









CASE STUDY – Iran - High Rise Construction









CASE STUDY

PRACTICAL CHALLENGES WITH SOLUTIONS

Challenge: raw material transportation

Solution: can be solved if having multiple projects

Challenge: panel cutting disposal

Solution : can be used in the sunk filling as this is light weight material

Challenge: panel lifting on floors

Solution : if the site scale is large , it can be done via crane

Challenge: Panel fixing with PEB structure

Solution : panel fixing can be done by welding steel bars and adding an adhesive (S- Bond) for further strengthening the joinery

Challenge: safety measures while dealing with wall preparation

Solution : while working on height, working staff should have proper safety measures (helmet, shoes, mask, safety glasses)

PLANNING ASPECTS

WALL CONSTRUCTED BRICK BY BRICK / LAYER BY LAYER
- LABOUR INTENSIVE
- REQUIRE CURING

DESIGN PROCESS
SELECTION OF TECHNOLOGIES

FACTORY MADE EPS PANELS ARE PRE FINISHED
- REQUIRES NO CURING,
- NO PLASTERING

Sandwich Panel System Replaces Brick-mortar With Dry Wall

The cast-in-situ conventional construction systems need to be replaced by industrialized systems which

- ❑ Reduce the construction time
- ❑ Produce quality,
- ❑ Resilient and
- ❑ Sustainable structures.

These panels are

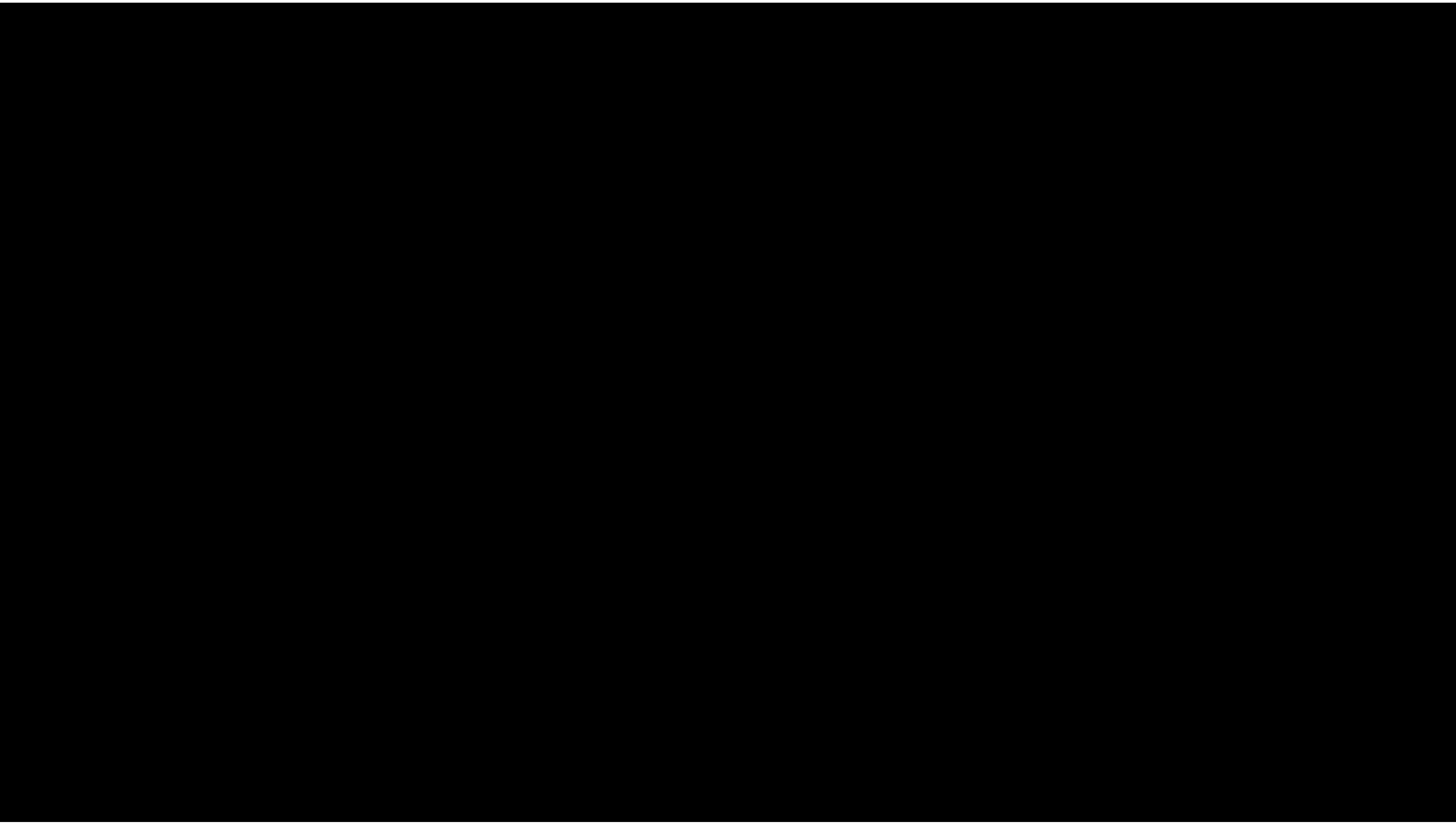
- ❑ Stronger,
- ❑ Durable with better quality control.
- ❑ Their functional performance in terms of acoustics, thermal, fire, rain water penetration, termite is much superior than cast-in-situ walls.
- ❑ These panels can be used as load bearing structural panels to build single to three storey houses or as non-load bearing infill walls to replace brick masonry walls between RCC frame.
- ❑ These panels can be cut to suitable sizes, made hollow so as to minimize wastages & accommodate services.

COST COMPARISION

Considering 10 Sq. M. Wall										
S.no.	EPS WALL 120MM					BRICKWORK 230MM				
	Description	Area		Rate	Total	Description	Area		Rate	Total
1	EPS PANEL	10	Nos	1440	14400	Bricks	1065	Nos	7	7455
2	Tape	20	m	5	100	Mortar	0.46	Cu m	1850	851
2	Mortar	10	Kg	12	120	Plaster	20	sq m	530	10600
4	Labour	10	Sq M	190	1900	Labour	2.3	Cu m	700	1610
					16520					**20516**
				Per Sq M	**1652**				**Per Sq M**	**2051.6**
	Carpet Area - Increased by 1.1 SQ M									

Tentative Saving Analysis				
Particulars	**Brick Work**	**EPS Work**	**Saves**	**% Saves**
Material (EPS)	18133113	17033872.1	1099241	**6%**
Water	1947600	1175400	772200	**40%**
Resources	12646778	6546507.01	6100270	**48%**
			Values in INR	

SHORT FILM ON LHP, INDORE



Query Session

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

GLOBAL HOUSING TECHNOLOGY CHALLENGE INDIA

Ministry of Housing and Urban Affairs
Government of India

आज़ादी का अमृत महोत्सव

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"भारत में कंस्ट्रक्शन की अप्रोच में हमने एक और बदलाव किया है। अब चाहे सड़कें हों, रेज़िडेंशियल अपार्टमेंट्स हों या फिर कमर्शियल बिल्डिंग्स, इको फ्रेंडली, डिजास्टर रेजिसटेंट, और एनर्जी एफ़िशिएन्ट निर्माण को प्रोत्साहन दिया जा रहा है..."

– नरेन्द्र मोदी

Thank you.