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

GLOBAL
HOUSING
TECHNOLOGY
CHALLENGE INDIA

आज़ादी का
अमृत महोत्सव

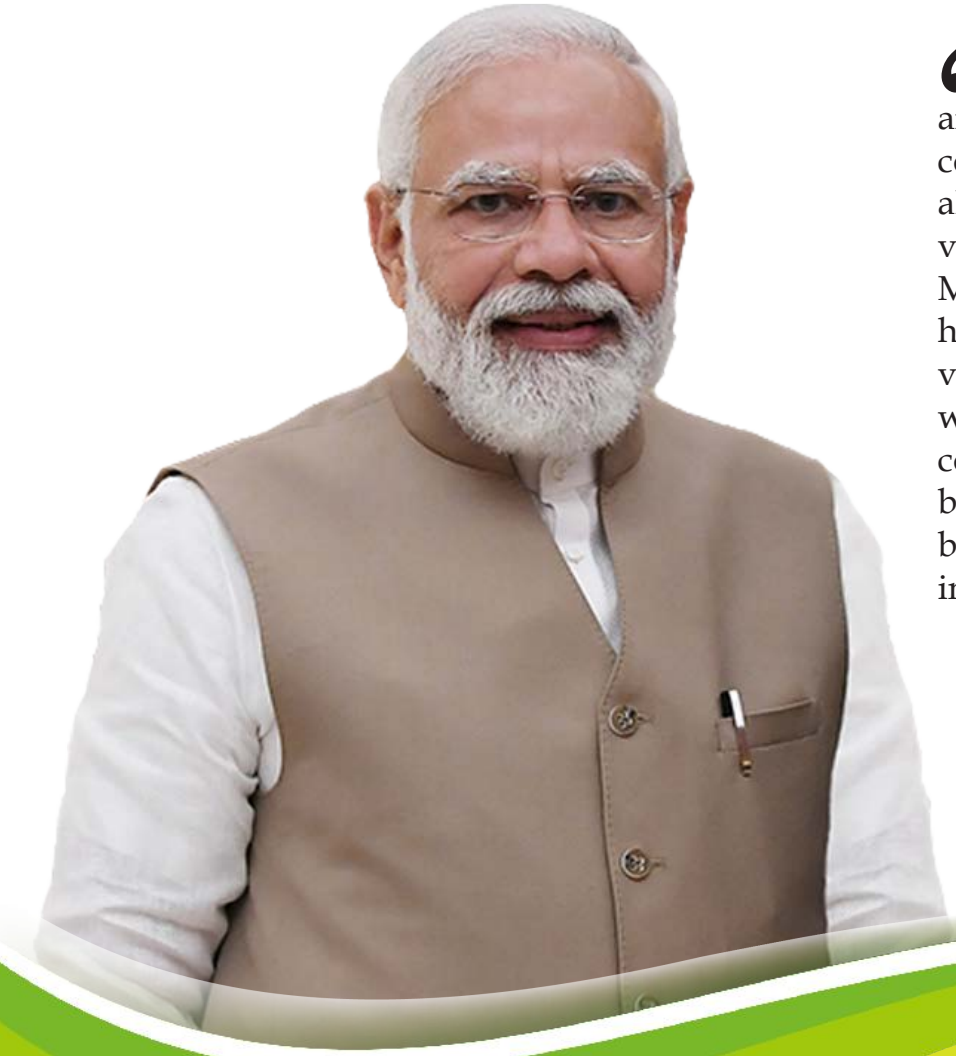
Compendium of Light House Project – Chennai, Tamil Nadu

under Global Housing Technology Challenge-India (GHTC-India)

October 2022

सत्यमेव जयते

Ministry of Housing & Urban Affairs
Government of India



“These Light House Projects are now a perfect example of the country’s working practices. We also have to understand the big vision behind it. Under the Pradhan Mantri Awas Yojana, lakhs of houses have been made in the cities in a very short time. The construction work of lakhs of houses is also continuing. If we look at the houses built under PMAY-U, focus has been given on both innovation and implementation.”

~ Narendra Modi
Hon’ble Prime Minister

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LIGHT HOUSE PROJECT CHENNAI, TAMIL NADU

under Global Housing Technology Challenge - India
(GHTC-India)

सत्यमेव जयते

Minister of Housing & Urban Affairs
Government of India

Ministry of Housing & Urban Affairs, Government of India

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Published: October 2022

हरदीप एस पुरी
HARDEEP S PURI

सत्यमेव जयते
आज़ादी का अमृत महोत्सव

आवासन और शहरी कार्य मंत्री
पेट्रोलियम एवं प्राकृतिक गैस मंत्री
भारत सरकार
Minister of
Housing and Urban Affairs; and
Petroleum and Natural Gas
Government of India

Message

Under the leadership of the Hon'ble Prime Minister, Shri Narendra Modi, Pradhan Mantri Awas Yojana-Urban (PMAY-U) was launched in June 2015 to provide a *pucca* house with basic amenities to all eligible families of urban India. Fulfilling such an ambitious goal was not an easy task and several strategies had to be put into place to make it a reality.

Today, the world is extremely conscious and sensitive to the adverse impact of climate change. The Global Housing Technology Challenge - India (GHTC-India) launched in January, 2019 aimed to identify and mainstream globally best available proven construction technologies that are sustainable, green and disaster resilient through a challenge format.

As a part of GHTC-India, six Light House Projects (LHP) consisting of about 1,000 houses each with physical and social infrastructure facilities are being constructed at six places across the country namely Indore (Madhya Pradesh); Rajkot (Gujarat); Chennai (Tamil Nadu); Ranchi (Jharkhand); Agartala (Tripura) and; Lucknow (Uttar Pradesh). The foundation stone of all 6 LHPs was laid by the Hon'ble Prime Minister on 1 January, 2021.

The LHP at Chennai with 1152 houses using new technology 'Precast Concrete Construction System' has been completed and inaugurated by Hon'ble Prime Minister on 26 May 2022.

This compendium provides details of the journey towards making this happen. I hope this compendium will be helpful to policy makers, public and private construction agencies and other concerned stakeholders for the adoption of such technologies in future housing projects.

(Hardeep S Puri)

New Delhi
12 October, 2022

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M.K.STALIN
CHIEF MINISTER OF TAMIL NADU

SECRETARIAT
CHENNAI - 600 009.

30-9-2022

Message

The Tamil Nadu Slum Clearance Board (now Tamil Nadu Urban Habitat Development Board) was constituted in the early 1970's to provide housing to the urban poor. Since then, Government of Tamil Nadu has provided more than 4.5 lakh tenements / Houses and about 1.31 lakh of developed plots to urban poor. Under Pradhan Mantri Awas Yojana-Urban (PMAY-U) till now 32,499 no. of houses in 78 schemes have been completed under Affordable Housing in Partnership (AHP) and 2,60,565 houses completed under Beneficiary Led Construction (BLC).

Ministry of Housing and Urban Affairs (MoHUA) had conducted a Global Housing Technology Challenge (GHTC) to identify globally the best available proven construction technologies that are sustainable, disaster resilient and green for construction of houses under AHP. Chennai was selected as one of the cities to implement Light House Project (LHP), among the 6 cities throughout India. MoHUA and Government of Tamil Nadu joined hands to complete the first LHP using pre-cast concrete construction system.

Tamil Nadu strongly believes in co-operative federalism, recognizing strong states make a strong nation. The foundation stone for the project was laid on 01.01.2021 by the Hon'ble Prime Minister. The State Government ensured that all the statutory approvals and clearances were given to the project on a fast-track mode; made timely interventions during difficult covid lockdown period for supply of men, materials and equipments, provided the matching grant for the project, ensured social infrastructure and identification of beneficiaries etc. This was the first LHP completed in India and it was inaugurated on 26.05.2022 by Hon'ble Prime Minister.

We have also taken up 30 projects consisting of 23,954 houses using Monolithic RCC concrete construction technology (Mivon Technology) and 3 projects consisting of 2092 houses using pre-fab technology under PMAY-U.

The compendium has elaborate details right from the identification of the land till completion of the project. This will be of great help to the policy makers, Government agencies, private construction companies and all other stakeholders for their future reference.

(M.K. STALIN)

कौशल किशोर
KAUSHAL KISHORE

आवासन और शहरी कार्य राज्य मंत्री
भारत सरकार
Minister of State for Housing & Urban Affairs
Government of India

MESSAGE

India has launched the most comprehensive programmes to revolutionise the country's urban sectors under the direction of India's Hon'ble Prime Minister. The intent is to make our cities affordable for all, resilient and green. The Pradhan Mantri Awas Yojana-Urban (PMAY-U) has radically changed the lives of the urban poor by providing them with all-weather pucca houses equipped with basic utilities as well as the essential physical and social infrastructure. The Ministry of Housing and Urban Affairs has sanctioned more than 1.22 crore houses under PMAY-U, of which more than 1 crore have been grounded. This has set a new milestone for new-age India.

Conventional building methods are frequently labour and energy-intensive, reliant on raw materials and with a high carbon footprint. In new age India, use of innovative building technology has been increasing, but the pace had to be accelerated. It takes a concentrated effort to raise public awareness of the benefits of switching from traditional to new technologies. The Hon. Prime Minister of India has underlined the necessity of accelerating the implementation of advanced construction technologies to increase the speed and calibre of the development, especially in mass housing projects.

With this vision, Hon'ble Prime Minister laid the foundation stones of six Light House Projects (LHPs) on January 1, 2021 consisting of about 1,000 houses each with allied infrastructural facilities at six cities across the country. These LHPs are exhibiting rapid delivery of mass housing that is affordable, sustainable, high quality, and durable. For all the stakeholders, including research and development agencies, these projects are acting as live laboratories, facilitating the effective transfer of technology from the classroom to the field.

I am pleased to announce that LHP Chennai, which includes 1152 homes built with the help of a cutting-edge Precast Concrete Construction System, components constructed on site, has been inaugurated on May 26, 2022, by the Honourable Prime Minister. This will provide cutting-edge, alternative, and innovative technology from around the world, which will lead to a huge transformation in the construction sector for the nation.

This compendium on LHP Chennai captures the journey from its conception to completion including details of the approach used to accomplish this commendable task. I hope this compilation can inspire and aid in the adoption of the technology in upcoming housing projects by policymakers, public and private construction companies, and other key stakeholders.

(KAUSHAL KISHORE)

New Delhi
10th October 2022

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मनोज जोशी
सचिव
Manoj Joshi
Secretary

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आवासन और शहरी कार्य मंत्रालय
निर्माण भवन, नई दिल्ली–110011
Government of India
Ministry of Housing and Urban Affairs
Nirman Bhawan, New Delhi-110011

Message

I am happy to share with you the Compendium of Light House Project- Chennai, Tamil Nadu. It has indeed been an interesting and challenging journey as we crossed various milestones in the making of LHP Chennai and today, we are proudly dedicating the project to the nation. Ministry of Housing and Urban Affairs, (MoHUA) and the State Government of Tamil Nadu successfully partnered to complete the first Light House Project of the country.

As envisioned by Hon'ble Prime Minister to transform housing construction sector, MoHUA initiated a Global Housing Technology Challenge to identify and mainstream the best available construction technologies from across the globe. Out of which 54 technologies were identified and six Light House Projects using six distinct technologies were finalised to showcase use of these technologies for further mainstreaming in the country. Hon'ble Prime Minister laid the foundation stone of Six Light House Projects, including Chennai, on 1st January 2021.

I believe that the Chennai Light House Project will give the experience of technical parlance to not just beneficiaries but to all urban practitioners and stakeholders involved in technology driven construction. This project consists of 1,152 houses in six floors with all basic and social infrastructure facilities such as Anganwadi, milk booth, grocery shops, ATM amongst others. It also features amenities like solar lighting, rainwater harvesting, wastewater recycling, etc. Built using the Precast Concrete Construction System technology the project ensures resource efficiency, speed, quality, durability, dust free construction site and better energy efficiency.

In order to capture the nuances of the technology and document the step-by-step execution of LHP Chennai, MoHUA initiated to make a Compendium. The compendium gives the readers a detailed narrative that captures the nuances of the technology and other aspects of the project.

I am fully confident that this publication will truly serve as reference for field application, such as planning, design, production of components, construction practices, testing etc., for faculty and students, Builders, Professionals of Private and Public sectors and other stakeholders involved in such construction to take a step further in the making of an Aatma Nirbhar Bharat.

Manoj Joshi

(Manoj Joshi)

11th October, 2022
New Delhi.

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कुलदीप नारायण, भा.प्र.से.
संयुक्त सचिव
Kuldip Narayan, IAS
Joint Secretary

आज़ादी का अमृत महोत्सव

सत्यमेव जयते

भारत सरकार
आवासन और शहरी कार्य मंत्रालय

Government of India
Ministry of Housing & Urban Affairs

Message

Under the visionary leadership of Hon'ble Prime Minister, MoHUA initiated Global Housing Technology Challenge-India to identify and mainstream the best available construction technologies from across the globe.

Under GHTC-India, 54 innovative technologies from across the world were identified and six Light House Projects (LHP) using six distinct technologies were initiated to showcase use of these technologies for learning and further mainstreaming in the Country. LHPs are model housing projects with houses built with shortlisted alternate technology suitable to the geo-climatic and hazard conditions of the region.

LHP-Chennai is the first completed project out of total six LHPs across country whose foundations were laid by Hon'ble Prime Minister on 1st January 2021. In LHP Chennai, 1,152 (Ground +5) houses along with physical and social infrastructure facilities have been constructed at Perumbakkam, Chennai. Hon'ble Prime Minister inaugurated the LHP Chennai on 26th May 2022 and dedicated this project to the nation.

The Precast Concrete Construction Technology used in LHP Chennai comprises of manufacturing of precast concrete Columns, Beams and Slabs in steel moulds. Most of the components of building work are manufactured in plant/ casting yard & the jointing of components is done In-situ leading to reduction in construction time and ensuring dust free construction site, resource efficiency, quality, durability and better energy efficiency.

The Compendium on LHP- Chennai, Tamil Nadu captures the whole journey of this project from its inception to completion including specific technical details of the technology used in this project. This compendium also highlights the innovative process of project monitoring and approach adopted to accomplish this commendable task in a specified time period. I am sure that this compendium will enlighten all related stakeholders about details of technology and help in further adoption and mainstreaming the same.

11th October, 2022
New Delhi.

(Kuldip Narayan)

प्रधान मंत्री आवास योजना-शहरी
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स्वच्छ भारत
एक कदम स्वच्छता की ओर

Acknowledgements

Technology Sub mission under PMAY-U has been quite successful in field level implementation of alternate, sustainable building materials such as fly ash bricks, solid, hollow & interlocking blocks along with innovative construction systems other than conventional load bearing masonry/ cast-in-situ RCC framed construction for the houses being built across states. However, the major thrust to the concerted effort came into limelight when Hon'ble PM urged use of globally available best construction practices which can speed up the construction thereby ensuring faster delivery of houses. Accordingly, GHTC-India was organized by MoHUA and 54 emerging construction systems which are superior in terms of structural & functional performance, safe, sustainable & speedier are shortlisted and now being showcased through six Light House Projects (LHPs) using six distinct technologies across six states.

The LHP at Chennai using precast concrete construction technology has been completed within a span of one year & handed over to the beneficiaries by Hon'ble PM on 26th May 2022. Light houses projects are also being projected as live laboratories for learning, adaption & replication of such systems as future construction systems for the county & therefore, it was felt that the LHP should be documented in form of a compendium which will contain all general & technical information about the project, technology being used, construction process, project implementation & management including IEC activities. We are pleased to publish the Compendium of Light House Project – Chennai, Tamil Nadu under GHTC-India to reach out to the stakeholders for further adaption & replication of the technology in the country.

This work would not have been possible without the constant guidance, valuable suggestions & encouragement being provided by Hon'ble Minister Shri Hardeep Singh Puri, Minister of Housing & Urban Affairs, Govt. of India, from time to time for smooth & timely implementation of LHPs at such a scale in the country. Shri Manoj Joshi, Secretary, MoHUA is steering the PMAY-U Mission & providing mentorship & strategic advice for the Light House Projects which is duly acknowledged. Shri Kuldip Narayan, Joint Secretary & Mission Director, Housing for All has led LHPs through timely interventions, interaction with agencies & supervising the entire journey of technology transition. I will be failing in my duty if I do not mention the name of Shri Durga Shanker Mishra, Chief Secretary, Govt. of Uttar Pradesh (erstwhile Secretary, MoHUA) and Shri Amrit Abhijat, Principal Secretary, Urban Development, Govt. of Uttar Pradesh (erstwhile Joint Secretary & Mission Director, HFA, MoHUA), but for them, the entire activities of GHTC, LHPs could not have been conceptualised & translated into the field so successfully. Their handholding & insightful suggestions at each & every step to the entire HFA directorate cannot be expressed in words & is gratefully acknowledged.

Shri R.K. Gautam, Director, HFA, MoHUA who works proactively & tirelessly for the success of mission deserves a special mention for putting all stakeholders together & collecting the information in time. Shri Pankaj Gupta, Dy. Chief, BMTPC has been instrumental in putting up the initial draft of the compendium & his efforts are duly acknowledged.

The most onerous task of final editing, chapterisation & its flow and final design was undertaken by Shri Manish Kumar, Consultant, MoHUA along with final formatting of the publication by Shri Dalip Kumar, BMTPC. They deserve sincere applaud & appreciation for putting scattered pieces together & bringing it in a presentable document form. The untiring efforts put up by Shri J.K. Prasad, Shri Kanha Godha & Shri Abhishek Mishra, PMU Experts for monitoring & review of LHPs and bringing up the document to shape is duly acknowledged.

We appreciate the efforts and support extended by Shri.Vijay Shirke, Chairman and Managing Director of B.G Shirke Construction Technology PVt lTD for successful completion of this Light House Project Chennai. We further acknowledge the dedication of M/s. Shirke team namely Shri R.B.Suryavanshi , Shri YP Kajale , Shri BG Sangale and Shri Yogesh Aychitte, Shri K J Naveen for their dedication and sincere efforts to ensure the successful completion of the work in time.

The chapter on thermal comfort has been the outcome of the study undertaken by Climate Smart Building (CSB) programme of GIZ led by Shri S. Vikash Ranjan and his contributions along with Shri Winfried Dam of GIZ are gratefully acknowledged. I also place on record my sincere thanks & deep appreciation for Shri Sanjay Seth of Team GRIHA for green rating of the project, Prof. Meher Prasad & the team of CUBE at IIT, Madras for TPIMA and & the entire team of executing agency M/s BG Shirke Pvt. Limited for meticulous execution of the project.

I hope the publication will be a trailblazer for concerned stakeholders who intend to use precast concrete construction for their future projects and will go a long way in establishing Precast Concrete Construction as the future technology for the country.

28th Day of September 2022
New Delhi

(Dr. Shailesh Kr. Agrawal)
Executive Director, BMTPC

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ABBREVIATIONS

AAC blocks	Autoclaved Aerated Concrete Block
AHP	Affordable Housing in Partnership
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
ARHCs	Affordable Rental Housing Complexes
ASHA-India	Affordable Sustainable Housing Accelerators- India (ASHA-India)
B2B	Business to Business
B2G	Business to Government
BAU	Business-As-Usual
BEC	Bid Evaluation Committee
BLC	Beneficiary-Led Individual House Construction
BMTPC	Building Materials and Technology Promotion Council
BMZ	German Federal Ministry for Economic Cooperation and Development
CBRI-CSIR	Council Of Scientific And Industrial Research–Central Building Research Institute
CDH	Cooling degree hours
CFCs	chlorofluorocarbons
CLAP	CLSS Awas Portal
CLSS	Credit Linked Subsidy
CNAs	Central Nodal Agencies
CPWD	Central Public Works Department
CSB	Climate Smart Buildings
CSMC	Central Sanctioning and Monitoring Committee
CTI	Construction Testing and Inspections
CUBE	Centre for Urbanization Buildings and Environment
DBT	Dry-bulb temperature
DDH	Degree Discomfort Hours
DPRs	Detailed Project Reports
DUs	Dwelling Units
EKRA	Eliminating Kickbacks in Recovery Act of 2018
ENS	Eco Niwas Samhita
EoI	Expression of Interest
EPC	Engineering, procurement, and construction
EPS	Expanded Polystyrene insulation
EWS	Economically Weaker Section
FSI	Floor Space Index
G2G	Government to Government
GDP	Gross Domestic Product
GGBS	Ground Granulated Blast-furnace Slag
GHG	Greenhouse Gases
GHTC-India	Global Housing Technology Challenge - India
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit

GRIHA	Green Rating for Integrated Habitat Assessment
GST	Goods and Services Tax
HFA	Housing for All
HUDCO	Housing and Urban Development Corporation
IAs	Implementing Agencies
IGEN	Indo-German Energy Programme
IHTM	Indian Housing Technology Mela
IIT	Indian Institute of Technology
IMAC	India Model for Adaptive Comfort
IMAC – R	Indian Model for Adaptive thermal Comfort – Residential
ISSR	In situ Slum Redevelopment
KPI	Key Performance Indicators
LHPs	Light House Projects
LIG	Low-Income Group
MAT	Mean Air Temperature
MIG	Middle Income Group
MoHUA	Ministry of Housing and Urban Affairs
MRT	Mean Radiant Temperature
NABL	National Accreditation Board for Testing and Calibration Laboratories
NAVARITIH	New, Affordable, Validated, Research Innovation Technologies for Indian Housing
NBC	National Building Code of India
NEIST	North East Institute of Science and Technology
NHB	National Housing Bank
NITs	National Institutes of Technologies
NULM	National Urban Livelihood Mission
OBC	Other Backward Class
OPC	Ordinary Portland Cement
PCC	Plain Cement Concrete
PEB	Pre-Engineered Buildings
PMAY-G	Pradhan Mantri Awas Yojana – Gramin
PMAY-U	Pradhan Mantri Awas Yojana – Urban
PMV	Predicted Mean Vote
PPD	Predicted Percentage Dissatisfied
PRAGATI	Pro-Active Governance and Timely Implementation
PSUs	Public Sector Undertaking
PWDs	Public Works Departments
R&D	Research and Development
RACHNA	Rational Admirable Cheerful Heartening Neat Adorable
RCC	Reinforced Cement Concrete
RETV	Residential Envelope Transmittance Value
RFP	Request for Proposal
SBI	State Bank of India
SC	Scheduled Castes

SCC	Self-compacting concrete
SDG	Sustainable Development Goals
SGU	Steel framed Single Glazing Unit
SHGC	Solar Heat Gain Coefficient
SLNAs	State Level Nodal Agencies
SoRs	Schedule of Rates
SPA	School of Planning and Architecture
SRI Paints	Solar Reflective Index
ST	Scheduled Tribes
TCPI	Thermal Comfort Performance Indicator
TDR	Transferable Development Rights
TEC	Technical Evaluation Committee
TIG	Technology Innovation Grant
ToR	Terms of Reference
TPQA	Third Party Quality Assurance
TSM	Technology Sub-Mission
UDI	Useful Daylight illuminance
ULBs	Urban Local Bodies
UN	United Nations
UNEP	United Nations Environment Programme
UPVC	Unplasticized Polyvinyl Chloride
UT	Union Territory
VLT	Visible Light Transmittance
WMM	Wet Mix Macadam
ZOT	Zone Operative Temperature

Chapter 1:
Background

1.1 Background

MoHUA is implementing Pradhan Mantri Awas Yojana-Urban (PMAY-U) which aims to provide all weather pucca houses to all eligible beneficiaries in urban areas within the stipulated timeline. PMAY(U) targets the provision of pucca houses to about 11.20 million household in the country.

Pradhan Mantri Awas Yojana – Urban (PMAY-U), a flagship Mission of Government of India being implemented by Ministry of Housing and Urban Affairs (MoHUA), was launched on 25th June 2015. PMAY-U Mission aims to provide all weather pucca houses to all eligible beneficiaries in urban areas within the stipulated timeline. PMAY(U) targets the provision of pucca houses to about 11.20 million household in the country.

Through PMAY-U, a basket of options is offered to ensure inclusion of a greater number of people depending on their income, finance and availability of land through four Verticals i.e. In Situ Slum Redevelopment (ISSR), Affordable Housing in Partnership (AHP), Beneficiary Led Construction (BLC) and Credit Linked Subsidy Scheme (CLSS).

Under this scheme, against the 122.69 Lakh sanctioned houses by MoHUA, about 103.60 Lakh houses have been grounded for construction, of which 62.79 Lakh houses have been completed and delivered to the beneficiaries as on 22 September 2022.

A PMAY-U house ensures dignified living along with sense of security and pride of ownership to the beneficiaries. PMAY-U adopts a cafeteria approach to suit the needs of individuals based on the geographical conditions, topography, economic conditions, availability of land, infrastructure etc.

During the implementation of the Mission, it has been observed that depending on the natural resources of the region, socio-economic conditions, living preferences and climatic and hazard conditions of the region, use of locally available materials and time-tested indigenous, traditional and local construction practices are undertaken.

Construction of houses at the scale of PMAY(U) offers an opportunity for inviting alternative technologies from both within the country and across the globe, which may trigger a major transition through introduction of cutting-edge building materials, technologies and processes.

Conventionally, houses are built in-situ with traditional materials, i.e., burnt clay bricks, cement, sand, aggregates, stones, timber & steel. Sand and aggregates are already in short supply and due to irrational mining, it is banned in number of States in India. Burnt clay bricks use top fertile soil as raw material and also, its production makes use of coal, a fossil fuel and add to environment pollution. Cement and steel are also energy intensive materials and produced from natural resource, i.e., limestone rock and iron ores respectively, which are not infinite and last forever. Further, the conventional construction requires plenty of potable water which is already in short supply even for drinking. The way out, therefore, is:

- To make use of alternate materials which are based on renewable resources & energy.
- Optimize the use of conventional materials by bringing mechanization in the construction.
- Utilize agricultural & industrials waste in producing building materials.
- Adopt construction technologies and processes which bring speed, quality, durability,

better finish, dust free environment, resource efficiency,

In conventional method, the materials are brought and collected at the site and then construction takes place by laying bricks layer by layer to construct walls and pouring concrete over steel cages (reinforcement) to make floors, vertical members, i.e., columns and horizontal members i.e. beams through a labour intensive process with little control on quality of finished product. Also, this construction process is slow paced. Further, in being cast in situ construction, there is ample wastage of materials and precious natural resources and at the same time, there is enormous dust generated polluting the air surrounding the construction site. Due to number of factors influencing the quality of the work, the overall quality of building is often gets compromised. Bad weathers also affect the construction leading to time over run in most of the projects. Therefore, there is need to bring construction methodologies which impart speed to the construction, bring in optimum use of materials, cut down wastages and produce quality and durable product. Further, disasters due to natural hazards i.e. earthquakes, cyclones, floods, tsunamis and landslides have been happening with ascending frequency and effects. Every year, due to faulty construction practices and bad performance of built environment during disasters, there are not only heavy economic losses but also losses of precious lives of humans, leaving irrevocable impact on human settlements making disaster resilience in construction a prime requirement.

1.2 Role of New Technologies under PMAY-U

In order to have an integrated approach for comprehensive technical & financial evaluation of emerging and proven building materials & technologies, their standardization, developing specifications and code of practices, evolving necessary tendering process, capacity building and creating appropriate delivery mechanism, MoHUA set up a Technology Sub-Mission (TSM) under PMAY-U with the Mission statement as 'Sustainable Technological Solutions for Faster and Cost Effective Construction of Houses suiting to Geo-Climatic and Hazard Conditions of the Country'.

It is obvious that construction sector requires a paradigm shift from traditional construction systems by bringing innovative construction systems which are resource-efficient, environmentally responsible, climate responsive, sustainable, disaster-resilient, faster, structurally & functionally superior. These kinds of systems are being practiced world over successfully and have shown their versatility through the passage of time.

In the PRAGATI[1] meeting held on 12th July 2017, Hon'ble Prime Minister emphasized and exhorted the States/UTs to accelerate adoption of innovative and alternative construction technologies to improve the pace and quality of work under PMAY-U and address the challenges of rapid urban growth and its attendant requirements.

1.3 Global Housing Technology Challenge – India (GHTC-India)

The Hon'ble Prime Minister envisaged the importance of the adoption of new and innovative construction technologies to improve the pace and quality of work under PMAY-U to address the challenges of rapid urban growth and its attendant requirements. MoHUA has, therefore, conceptualized a Global Housing Technology Challenge-India (GHTC- India) to enable a paradigm shift in the construction sector.

1 PRAGATI (Pro-Active Governance And Timely Implementation) is a multi-purpose and multi-modal platform chaired by Hon'ble Prime Minister, aimed at addressing common man's grievances, and simultaneously monitoring and reviewing important programmes and projects of the Government of India as well as projects flagged by State Governments.

To ensure a robust process, MoHUA conducted a series of consultations with range of stakeholders to identify broad reasons for the slow and limited adoption of innovative and alternative construction technologies for affordable housing. Based on the feedback received and subsequent deliberations, the issues identified includes, ensuring the suitability of foreign technologies for Indian conditions, certification and standardization including the requirement of proper specifications and codes, challenges in the procurement process, and the necessary policy support to synergize both demand and supply.

1.3.1 Launch of GHTC-India

Shri Hardeep S. Puri, Hon'ble Minister, Housing and Urban Affairs launched "Global Housing Technology Challenge-India" (GHTC- India) on 14th January 2019. GHTC-India intends to bring paradigm shift in technology transition using large scale construction under PMAY (U) as an opportunity to get the best available construction technologies across the globe.

Shri Amitabh Kant, the then CEO NITI Aayog, Shri Durga Shanker Mishra, the then Secretary, Housing & Urban Affairs, Shri Amrit Abhijat, Joint Secretary & Mission Director (HFA), MoHUA, senior officers of the Ministry, besides various stakeholders in the construction industry were also present at the launch.

Launch of GHTC-India on 14th January 2019

1.3.2 Objectives of GHTC-India

MoHUA has initiated the Global Housing Technology Challenge- India (GHTC-India) under larger umbrella of Technology Sub-Mission of PMAY- U which aims to identify and mainstream a basket of innovative construction technologies from across the globe for housing construction sector that are sustainable, eco-friendly, and disaster-resilient. They are to be cost effective and speedier while enabling the quality construction of houses, meeting diverse Geo-climatic conditions and desired functional needs. Future technologies will also be supported to foster an environment of research and development in the country. GHTC- India aspires to develop an eco-system to deliver on the technological challenges of the housing construction sector in a holistic manner.

GHTC-India intends to get the best globally available innovative construction technologies through a challenge process. It aims to demonstrate and deliver ready to live-in houses in minimum time and minimum cost with high-quality of construction in a sustainable manner. This challenge seeks to promote future potential technologies through Incubation support and accelerator workshops, in order to foster an environment of research and development in the country.

1.3.3 Components of GHTC – India

The challenge has the following three components:

Component-1: Construction Technology India – 2019: Expo-cum- Conference

As part of GHTC-India, an Expo-cum-Conference named Construction Technology India - 2019 (CTI-2019) was organized on 2 to 3 March, 2019 at Vigyan Bhawan, New Delhi. The Expo was inaugurated by Hon'ble Prime Minister of India and brought together multiple stakeholders involved in innovative and alternative housing technologies, for exchange of knowledge and business opportunities through an exhibition, thematic sessions, panel discussions and master classes.

Hon'ble PM visiting GHTC-India pavilion with Hon'ble Union Minister & Secretary, MoHUA

Hon'ble Prime Minister addressing the gathering

Proven Demonstrable Technology providers from across the globe and domestic Potential Future Technologies were invited to the Expo through a simple online screening process and a Technical Evaluation Committee (TEC) constituted for GHTC-India to evaluate and assess the range of technologies available.

Stakeholders such as R&D Institutes, academia, students of technical institutes, engineers, architects, government agencies including State Public Works Departments (PWDs) and Housing Boards, developers, entrepreneurs etc. were invited to participate as delegates.

Overall CTI-2019 had participation of about 2,500 delegates from 32 countries and more than 3,500 visitors at the exhibition. 54 exhibitors with 32 innovative technologies from 25 countries were in display with 166 stalls. **54 Proven Technology Providers** with 32 new technologies from 25 countries including technologies from USA, Finland, Australia, Spain, France, South Korea and Italy were evaluated by the Technical Evaluation Committee (TEC).

A total of **78 Potential Technology Providers** from across the country, with 55 post-prototype and 23 pre-prototype made their presentations to the expert jury during the event.

The two-day Expo-cum-Conference consisted of 4 Plenary and 4 Parallel Sessions, 3 Master classes, 4 Panel Discussion and a World Cafe. There were 8 different parallel interactive sessions between Proven Technology Providers, Technical Evaluation Committee and Expert Jury to shortlist the best technology.

Component-2: Proven Demonstrable Technologies for the Construction of Light House Projects (LHPs)

Proven Demonstrable Technologies were invited through an Expression of Interest (EoI) from across the world which are suitable for use in the Indian context for construction of six Light House Projects in the country. The applications initially were screened to participate in the CTI-2019 Expo-Conference, where the applicants interacted with the TEC.

Post the expo, the TEC through rigorous assessments shortlisted and empanelled a basket of technologies that could be considered for demonstration through actual on ground implementation of six lighthouse projects, located in six sites across of the country. Criterion such as scalability, adaptability, sustainability, and safety were used for evaluating the proven technologies.

Component-3: Potential Future Technologies for Incubation and Acceleration Support

Affordable Sustainable Housing Accelerator (ASHA)-INDIA

"To nurture upcoming Indian individuals or technology ventures in the field of construction technology in housing sector in their start-up phase by providing all the support necessary to help entrepreneurs establish themselves before they scale up their ventures and to support entrepreneurs translating innovations into products and services that are commercially viable."

Under Accelerator Affordable Sustainable Housing Accelerators- India (ASHA-India) initiative, incubation and acceleration support are being provided to potential future technologies that are not yet market ready (pre-prototype applicants) or to the technologies that are market ready (post prototype applicants) respectively. Five ASHA-India Centres at Indian Institute of Technologies of Bombay, Kharagpur, Madras, Roorkee and CSIR-Jorhat have been set up for developing design guidelines, construction manuals and other necessary guidelines, relevant for effective use of such technologies in the region.

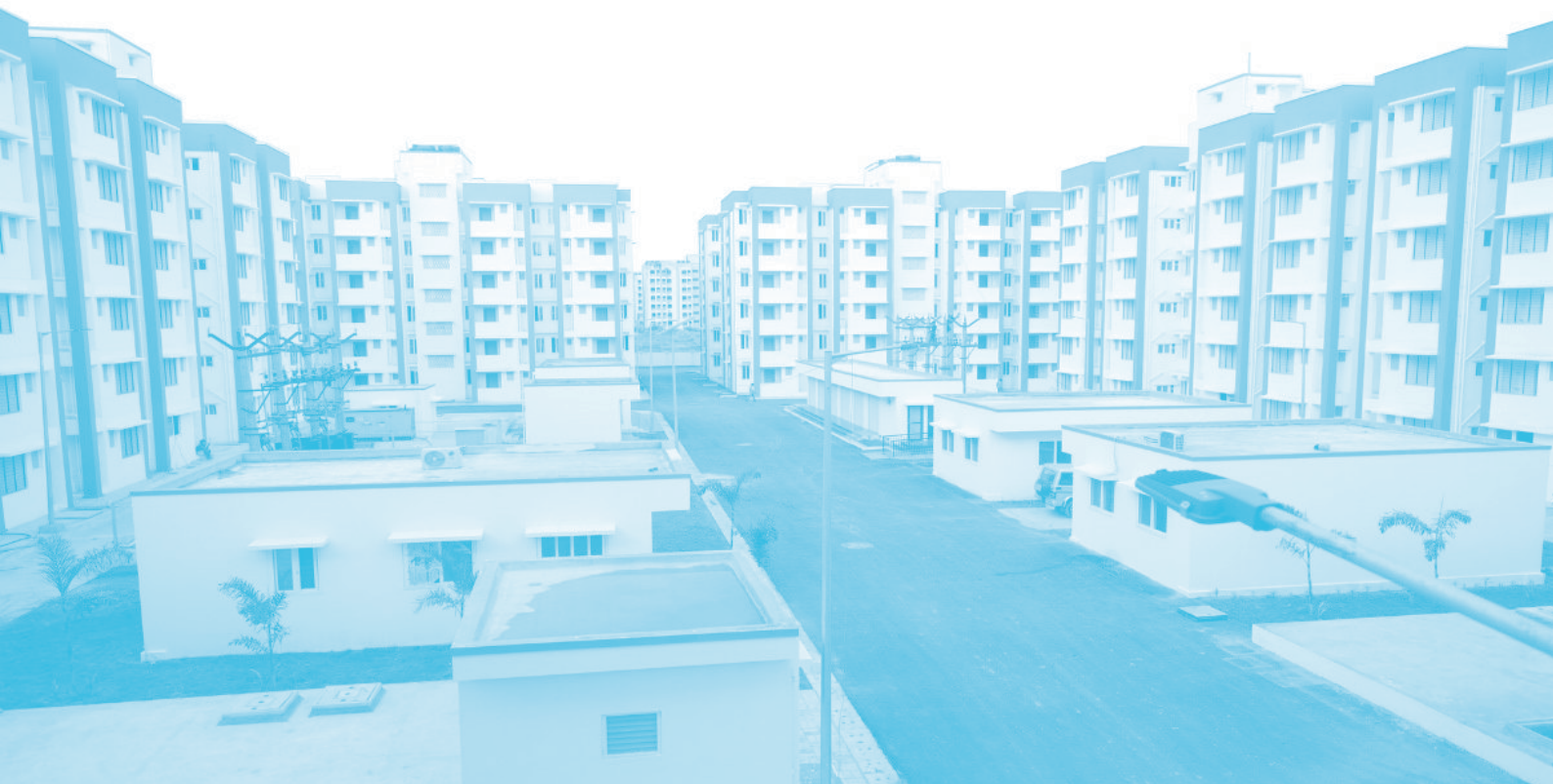
1.4 About Light House Projects

Light House Projects (LHPs) are being implemented in six States, selected through a challenge process viz: Gujarat, Jharkhand, Madhya Pradesh, Tamil Nadu, Tripura and Uttar Pradesh to demonstrate the six distinct innovative technologies identified under the GHTC-India and deliver disaster resilient, climate friendly and cost-effective houses expeditiously compared to conventional construction methods.

These LHPs are demonstrating delivery ready to live mass housing at an expedited pace as compared to conventional brick and mortar construction and will be more economical, sustainable, of high quality and durability. These projects are serving as Live laboratories for all stakeholders including Research & Development leading to the successful transfer of technologies from the lab to the field.

This Compendium documents the whole process of implementation of Light House Project at Chennai, Tamil Nadu including the planning, construction, monitoring and handing over to the beneficiaries in a record 12 months' time.

Chapter 2:
Light House Projects- Implementation Methodology



2.1 Shortlisting of Innovative Proven Technologies

Under GHTC-India, a total 54 Innovative Construction Technologies were shortlisted as per their suitability of construction in different geo-climatic regions of the country and grouped into six broad categories namely (i) Precast Concrete Construction System - 3D Precast volumetric (ii) Precast Concrete Construction System - Precast components assembled at site (iii) Light Gauge Steel Structural System & Pre-engineered Steel Structural System (iv) Prefabricated Sandwich Panel System (v) Monolithic Concrete Construction, and (vi) Stay in Place Formwork System.

2.2 Implementation Methodology

2.2.1 State Challenge for Selection of sites

It was decided that the LHPs using shortlisted technology providers would be undertaken each at the six PMAY (U) regions of the country viz. Northern, Central, Eastern, Western, Southern and North-Eastern parts of the Country.

Selection of sites in different States spread over different regions of the country was initiated through a Challenge process for all States/UTs. The Ministry invited proposals from States to participate in the challenge process for implementation of LHPs. The States/UTs were offered to participate in the Challenge process by providing suitable encumbrance free site of minimum 2 hectare keeping following other criteria into consideration including Number of Dwelling Units buildable, Distance from City centre, Connectivity of site to water supply, sewerage network, electricity and public transport, Additional financial commitment, Commitment for additional finance and land parcel for production of building components with minimum/ no requirements of development work.

All six LHPs are linked to the overall objective of the PMAY-U Mission, accordingly it was planned that the projects would be located in urban areas identified by only those States/ UTs, which participated in the Challenge process and were qualified by MoHUA based on the pre-defined parameters.

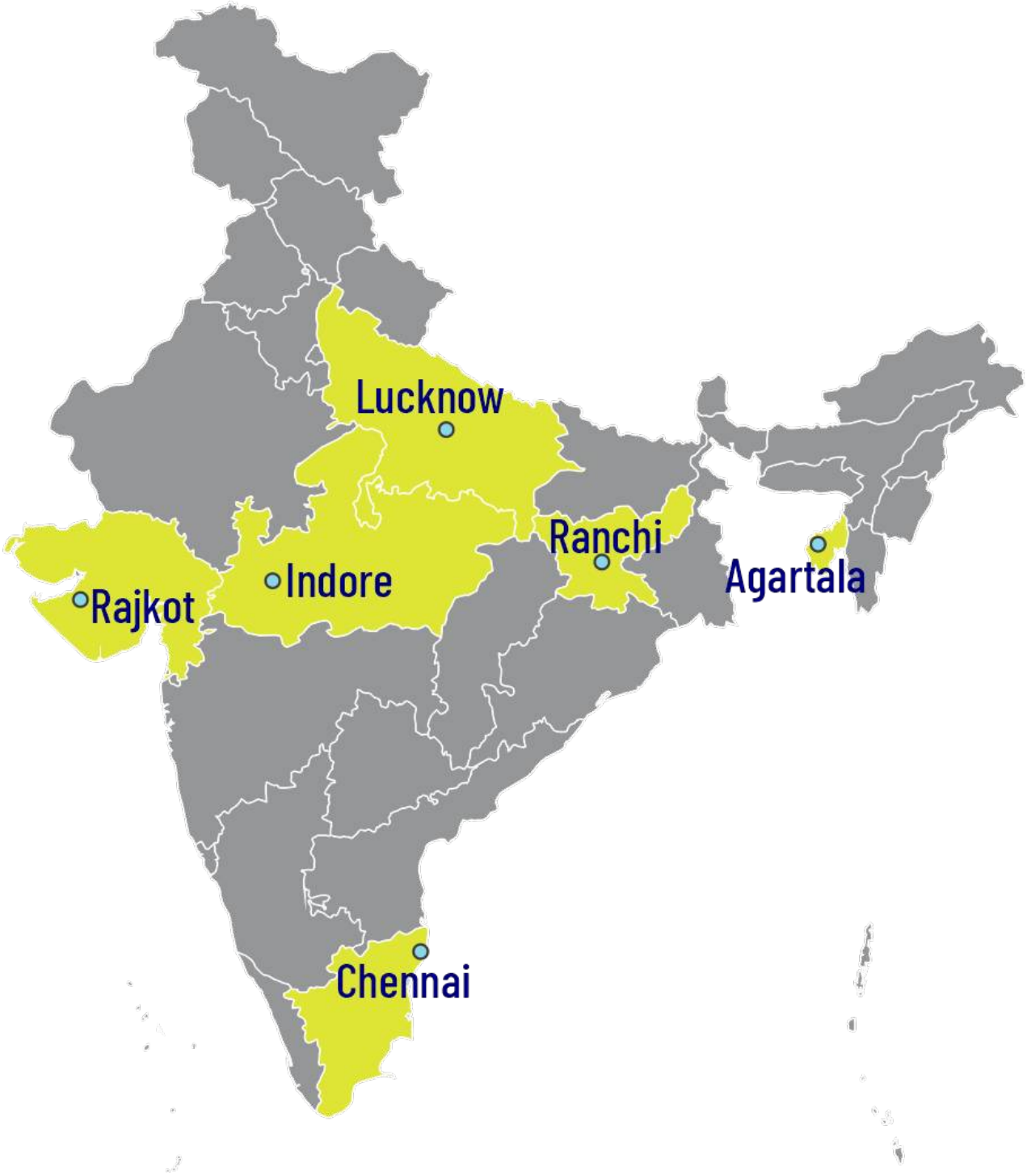
Against the State Challenge, 17 proposals from 14 states namely Andhra Pradesh (Vishakhapatnam), Chhattisgarh (Raipur), Gujarat (Rajkot), Haryana (Hisar), Himachal (Mandi), Jammu & Kashmir (Jammu), Jharkhand (Ranchi), Madhya Pradesh (Indore), Tamil Nadu (Chennai), Uttar Pradesh (Lucknow), Kanpur (Ghaziabad), Tripura (Agartala), Odisha (Bhubaneswar), Rajasthan (Alwar/Kota) and Uttarakhand (Roorkee) were received.

Based on the final score calculated on the merit of each proposal, the Technical Evaluation Committee (TEC) constituted by the MoHUA selected six sites namely Agartala (Tripura), Ranchi (Jharkhand), Lucknow (Uttar Pradesh), Indore (Madhya Pradesh), Rajkot (Gujarat) and Chennai (Tamil Nadu) for the purpose of LHP projects using shortlisted emerging technologies. The technologies as submitted through on-line application & shortlisted by TEC in the form of basket of technologies & recommended for the specific location, were considered for the construction of LHP in the above selected States.

2.2.2 Memorandum of Understanding with selected States

In order to implement the LHPs, Memorandum of Understanding (MOU) was signed between Ministry of Housing and Urban Affairs, Govt. of India and six selected States of Tamil Nadu, Gujarat, Madhya Pradesh, Uttar Pradesh, Jharkhand and Tripura.

Through the MOU, respective States were committed to provide encumbrance free land for construction of LHP as well as for production of building components as required and to comply with the various provisions of Operational Guidelines of LHP in conformity with local regulations and byelaws and related provision of "Scheme Guidelines of PMAY (U) till the completion of the project. For LHP Chennai, the MOU was signed by The State Government of Tamil Nadu through Tamil Nadu Slum Clearance Board, having its office at No.5, Kamarajar Salai, Chepauk, Chennai.



2.2.3 Roles and Responsibilities of Multistakeholders

The broad roles & responsibilities of various Stakeholders for implementation of LHPs have been as under:

Sl No	Agency	Responsibilities
1	Ministry of Housing and Urban Affairs (MoHUA), Government of India	▪ Overall implementation, review & monitoring of LHPs Process and release the Central assistance and Technology Innovation Grant (TIG). ▪ Issue the RFP for LHPs and finalize the bids through constitution of a Bid Evaluation Committee (BEC). ▪ Open an Escrow Account at BMTPC for overall fund disbursal and management ▪ Constitute a Project Monitoring Committee (PMC) at Central level for regular review of the LHPs.
2	State Governments	▪ State Government through State Level Appraisal Committee (SLAC) and State Level Sanctioning and Monitoring Committee (SLSMC) to approve the Light House Projects (LHPs) as done for PMAY (U) projects under PMAY (U) Guidelines. ▪ Nominating member from the State Government for Bid Evaluation Committee (BEC) constituted at MoHUA. ▪ Ensure all approvals for LHPs in fast-track mode. ▪ Ensure release of the matching State, ULB & Beneficiary share in the same pattern that of MoHUA to the designated Agency of MoHUA. Any increase in project cost shall be borne by State Government. ▪ On behalf of the State, State Level Nodal Agency (SLNA) to coordinate with MoHUA and Urban Local Bodies (ULBs)/ Development Agency (DA) till the completion & handing over of the LHPs. ▪ Registration of LHP project under the provisions of RERA Act.
3	Urban Local Body (ULB) / Development Authority (DA)	▪ ULB/DA to hand over encumbrance free land to the selected technology provider/ developer. ▪ Provide water supply, sewage treatment and electricity connection. ▪ ULB/DA to facilitate for necessary statutory approvals for the project to the developer on fast-track mode. ▪ ULB/DA to identify the beneficiaries and responsible for collection of beneficiary share in line with the funding pattern of Central Government and State Government. ▪ Facilitate logistics support to selected technology provider/ developer during construction of LHP.
4	Construction Agencies	▪ To complete the building & all internal infrastructure works including the lifts as per prescribed specifications, terms & conditions of the contract within the specified timeframe while strictly adhering to quality control norms and maintaining them during the defect liability period. ▪ Facilitate propagation of the project through webcasting, visit of various teams, conduction of training programmes etc. ▪ Provide necessary data & technical details for preparation of SOR & standard specifications for the Technology.

2.2.4 Preparation of DPRs by selected States

It was envisaged that the proposed structure of LHPs should not preferably be less than G+3. The suitability of site was assessed by designated Central agency of MoHUA. The Detailed Project Reports (DPRs) under LHPs were submitted by six State which was examined/ approved by the Central Sanctioning States/ UTs.

As per the requirement, the six State/ UT provided preliminary layout of site, architectural drawing of proposed buildings as per applicable Building Bye- laws and Development Control Regulations, soil investigation report, specification for finishing items etc.

These LHPs at different places were envisioned to serve as open live laboratories for different aspects of transfer of technologies to field application, such as planning, design, production of components, construction practices, testing etc. for both faculty and students of IITs/ NITs/ Engineering colleges/ Planning and Architecture colleges, Builders, Professionals of Private and Public sectors and other stakeholders involved in such constructions. For this purpose, a sustained Information Education and Communication (IEC) activities was planned for Awareness and Promotion of new technologies through Multi-layered event publicity and web updates. IEC activities to be fully funded by MoHUA.

Capacity building activities like trainings, workshops, thematic interactions, study, exposure visits, technological meetings etc. were planned to be organized for enhancing the capacities of various stakeholders in implementation of the LHPs.

After completion of the project, houses constructed under LHP are to be allotted to PMAY-U eligible beneficiaries only in accordance with the PMAY-U guideline.

2.2.5 Tendering Process & Selection of Technologies for six LHPs

Based on the DPRs submitted by States and upon approval of the same from MoHUA, a Request for Proposal (RFP) for construction of houses under LHPs at six places were issued by MoHUA in EPC Mode.

It was pre decided that different sites would have different and exclusive technologies for construction of LHPs. It was envisaged that distinct technologies may be showcased for construction of LHPs so that unique learnings may be demonstrated during the construction process. The proven innovative technologies as submitted through on-line application & shortlisted by TEC under GHTC-India in the form of basket of technologies & recommended for the specific location was considered for the construction of LHP in particular State/UT.

A Bid Evaluation Committee at MoHUA was formed which included officials of MoHUA along with a member from the concerned State implementing LHP. Evaluation of bids received for construction of LHPs in all six regions were done centrally by the Bid Evaluation Committee (BEC).

For promoting the emerging Technology from other countries Participating Agencies were allowed to participate as single business Entity shortlisted through GHTC India process or as Joint Venture/ Consortium of business partner with one shortlisted agency from GHTC-India.

19 agencies with 41 proposals participated in the Bid either as single business Entity or

as Joint Venture/ Consortium. Bids for LHPs were opened in descending order as per the land area of the project. In order to propagate the use of different technologies across the regions, one shortlisted technology provider was allotted work in one region only. Though the technology providers were free to participate in the bidding process for more than one location, once a particular technology (as distinct from technology provider) was selected as winner for one location, bids using the same technology for other locations were not opened. This ensured that different locations had separate technologies.

Prospective Contractors/ Builders / Technology Providers participating in pre-bid meeting

The details of selection of technologies and Construction Agencies for construction of six Light House Projects are as follows:

Sl. No.	LHP Site	Technology Selected	No of Houses	Project cost	Construction Agency
1	Chennai	Precast Concrete Construction System- Precast Components Assembled at Site	1,152	₹ 116.27 Cr.	M/s B.G. Shirke Constriction Private Ltd.
2	Rajkot	Monolithic Concrete Construction using Tunnel Formwork	1,144	₹ 118.90 Cr.	M/s Malani Construction Co.
3	Indore	Prefabricated Sandwich Panel System with Pre-engineered Steel Structural System	1,024	₹ 128.00 Cr.	M/s KPR Projectcon Pvt. Ltd.
4	Lucknow	Stay In Place PVC Formwork with Pre-Engineered Steel Structural System	1,040	₹ 130.90 Cr.	M/s Jam Sustainable LLP
5	Ranchi	Precast Concrete Construction System – 3D Volumetric	1,008	₹ 134.00 Cr.	M/s SGC Magicrete LLP
6	Agartala	Light Gauge Steel Framed (LGSF) System with Pre-engineered Steel Structural System	1,000	₹ 162.50 Cr.	M/s Mitsumi Housing Pvt. Ltd

The technology pictures of all six LHPs are as under:

1. Precast Concrete Construction System - 3D Precast volumetric

2.Precast Concrete Construction System - Precast components assembled at site

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

4.Prefabricated Sandwich Panel System

5.Monolithic Concrete Construction

6.Stay In Place Formwork System

The details of the shortlisted 54 technologies are available at https://ghtc-india.gov.in.

The selected bidder submitted vetted structural design and other requisite details within three weeks of Letter of Intent (LoI) issued to it. Bidder submitted detailed drawings to the concerned authority of State/UT with changes in architectural drawing, if any, (owing to specific nature of the technology and/or towards improvement in original drawing) in agreement with State/UT.

2.2.6 Handover of sites to construction Agencies

Once the Construction Agencies and LHP specific technologies were shortlisted through the tendering process, the representatives of State governments handed over the encroachment free land to the BMTPC in a specified format which was then transferred to the selected construction agencies by the BMTPC.

2.2.7 Funding Mechanism of LHPs

The funding for the Light House Projects (LHPs) constructed under GHTC-India was done as per the Operational Guidelines of PMAY-U and Guidelines of LHPs. A Technology Sub-Mission (TSM) formed under the PMAY-U Mission facilitates adoption of modern, innovative and green technologies and building materials for faster and quality construction of houses. The activities proposed under LHPs were financed under the Capacity Building allocation of PMAY-U Mission.

Application of innovative and alternate construction technologies at limited scale has large implication but has significant opportunity cost. Technology Innovation Grant (TIG) was provisioned to offset this impact and absorb the issues related to economies of scale and other related factors. TIG was provisioned as a financial grant and is in addition to the existing funding under PMAY(U). The MoHUA for the purpose of LHPs provisioned for an amount of Rs. 4.00 lakh per DU for the project to BMTPC as TIG for LHP Chennai.

The project cost of LHP Chennai is Rs. 116.27 Cr. The project cost viz. the cost of Civil works along with internal infrastructure includes planning and design charges, preparation of Detailed Project Report (hereinafter referred to as DPR) including Architectural and working drawings which are suitable for Construction, preparation of structural design, vetting of structural design from reputed institutions like IITs, material testing from NABL accredited labs, contingency charges etc. Project cost also includes internal infrastructure developments such as internal roads, pathways, common green area, boundary wall, water supply, water tank, site development, internal electrification, sewerage, drainage, firefighting system, lift shafts and machine room, lifts for multistorey blocks, transformers along with HT/LT panel, sewage treatment plant and Diesel Generator (DG) set for emergency backup power for lift operation, etc.

Funding for LHPs was managed by BMTPC and a dedicated Escrow Account was opened at BMTPC for this purpose. Central Assistance for LHPs was released to BMTPC by MoHUA. Simultaneously, for effective implementation of LHPs, the State matching share along with beneficiary share for LHPs was released by the concerned State Govt./ ULB/ Development Authority in advance to the BMTPC as per funding pattern of PMAY (U). Further, BMTPC with the approval of MoHUA released the funds as per payment terms of contract to the selected developer as per the stages and progress of work of LHPs, based on the recommendations of the Project Monitoring Committee to be constituted by MoHUA.

The Finance of LHPs includes the contribution from Central Government share including Technology Innovation Grant (TIG), State Government share and Beneficiaries Share as

applicable. The State kept its entire share of the project including beneficiary share ready in advance so that the fund flow to the project is not delayed. The State was required to allot the houses to the eligible beneficiaries during the initial stage of construction of houses (before the release of second instalment), so that State/UT can deposit the beneficiary share in Escrow Account of BMTPC on time

The details of the funding pattern for LHP Chennai are as follow:

Sl. No	Share	Amount	Agency
(i)	Central Assistance	₹1.50 lakh per dwelling unit	MoHUA
(ii)	Technology Innovation Grant	₹4.00 lakh per dwelling unit	MoHUA
(iii)	State Share	₹3.09 lakh per dwelling unit	Government of Tamil Nadu
(iv)	Beneficiary Share	₹1.50 lakh per dwelling unit	Beneficiary
Total		**₹ 10.09 Lakh per dwelling unit**	

The LHP Construction agency raised the monthly bill on "monthly Pro rata basis". The running bill is worked out on the percentage of work done out of total scope of work. The running bill with supporting documents was sent to the BMTPC, technical Partner of GHTC-India for review and their recommendations for further processing of the running bill as per payment terms of contract and the progress of work of LHP. BMTPC with the approval of MoHUA released the funds to the Construction Agency as per the stages of the payment schedule as follow:

S. No	Activities	Payment Schedule
1	Investigation, planning, Designing and obtaining approvals (1% of total quoted rate)	1.0%
1A	Submission of Inception Report, detailed survey, Architectural drawings ready for submission for approval of local bodies	
1B	On approval of local bodies, EIA clearances and other statutory approvals of local bodies, final Architectural drawing showing electrical and sanitary layout plan and drawings and its submission	
1C	On submission and approval of Vetted structural design by Competent Authority On completion of above	
2	**On completion of following:**	
2A	Completion of excavation work, laying of foundation and reaching plinth level of all towers	10.0%
2B	Completion of Super Structure-Structural skeleton of external walls, slabs and other structural members, lift shaft and staircase well, etc. of residential and non-residential buildings/ towers	40.0%
2C	Internal work of residential and non-residential units with all Civil including flooring and skirting, dado work, Electrical, Mechanical services, Plumbing	10.0%
2D	Finishing of Doors, Windows and woodwork in wardrobes and complete kitchen work including all fittings and painting etc.	2.5%
2E	Internal Finishing and painting inside residential and non-residential buildings	2.5%

2F	External Finish and painting outside residential and non-residential buildings	2.5%
2G	Over Head tanks, chinaware and sanitary fittings including testing	2.5%
2H	Electrical Installation including external electrification, installation of distribution boards, laying off cables, installation of electric sub-station and other associated electrical works etc.	2.5%
2I	Installation of Lifts and machine room	2.5%
2J	Fire Fighting System	3.0%
2K	External Infrastructure outside residential buildings and within boundary wall including water supply, sewerage including STP/ septic tank, sewer line, inspection chambers, electricity lines, storm water drainage, rainwater harvesting, solid waste management, signages, installation of solar streetlights and other associated works etc.	9.0%
2L	Site Development works including Horticulture Services, development of parks and green areas, Totlots, street furniture, construction of boundary wall and installation of gates, internal roads, Street lighting, other amenities etc.	7.0%
2M	On issuing of Completion Certificate by competent authority and after taking all statutory approvals from local authorities	5.0%
	Total	100%

2.2.8 Project Monitoring

A Project Monitoring Committee (PMC) was set up at MoHUA to oversee the entire progress of construction of LHPs at six locations. The PMC comprised of Representative of CPWD, Member from MoHUA-HFA Directorate, Representative of BMTPC, Representative of concerned State, Representative of concerned ULB/DA and Expert from IIT/ NIT which regularly reviewed the progress, resolving any important issues related to project both technical and administrative and guided the Project team and agencies for timely completion of the project.

2.2.9 Third Party Quality Monitoring

In order to do the independent assessment of quality of materials and construction, Third Party Quality Assurance (TPQA) Agencies for all 6 LHPs were initiated. In order to do so, bids from Govt Institutions/Organizations/ Central PSUs were invited by the Ministry. The main responsibilities of the TPQA Agency included:

- Checking and reporting, whether work was being executed according to the designs and specifications of the contract agreement and in accordance with the approved drawings,
- Ascertaining the quality of materials & components through test results, and reporting any instances of deviations from accepted quality of construction materials, workmanship and general quality of works at appropriate stages of construction
- Submission of report on Quality Control Aspects on Monthly basis.

2.2.10 Salient features of LHPs

Light House Projects: Salient Features
LHPs are model housing project with approximately 1,000 houses built at each location with shortlisted alternate technology suitable to the geo-climatic and hazard conditions of the region.
Constructed houses under LHPs includes on-site infrastructure development such as internal roads, pathways, common green area, boundary wall, water supply, sewerage, drainage, rainwater harvesting, solar lighting, external electrification, etc.
Houses under LHPs were designed keeping in view the dimensional requirements laid down in National Building Code (NBC) 2016 with good aesthetics, proper ventilation, orientation, as required to suit the climatic conditions of the location and adequate storage space, etc.
Convergence with other existing Centrally sponsored Schemes and Missions such as Smart Cities, Atal Mission for Rejuvenation and Urban Transformation (AMRUT), Swachh Bharat (Urban), National Urban Livelihood Mission (NULM), Ujjwala, Ujala, Make in India were ensured during the designing of LHPs at each site.
The structural details were designed to meet the durability and safety requirements of applicable loads including earthquakes, cyclone, and flood as applicable in accordance with the applicable Indian/International standards.
Cluster design may include innovative system of water supply, drainage and rainwater harvesting, renewable energy sources with special focus on solar energy.
The period of construction will be maximum 12 months. Approvals were accorded through a fast-track process by the concerned State/UT Government.
For the subsequent allotment of constructed houses under LHPs to the eligible beneficiaries in States/ UTs, procedures of existing guidelines of PMAY-U will be followed.

2.2.11 Statutory Approvals

The Statutory Approvals are all those approvals/ No Objection Certificates (NoCs) which needs to be obtained by the respective construction agencies to commencement of the construction activities at the project site. To obtain the NoCs/ approvals from the concerned Department, the Construction Agency have to prepare the detailed architectural drawings, layout plan for the site accommodating specified numbers of houses and related infrastructure facilities and reports as per prevailing local building byelaws and development control norms in the area of concerned State.

The Construction Agency in coordination with the Tamil Nadu Urban Habitat Development Board (TNUHBD) had obtained all the required Statutory Approvals before commencement of the actual construction. All the Statutory approvals were taken in a fast-track mode with full cooperation from the concerned Departments/ Agencies of the State Government. The

details of the Statutory Approvals obtained and approving authority are as below:

S. N	Statutory Approvals	Approving Authority
1	Building Planning Permit	Chennai Metropolitan Development Authority (CMDA), Chennai, Tamil Nadu
2	Building Permission	Perumbakkam Town Panchayat, Tamil Nadu
3	Environment Impact Assess Clearance	State Environment Impact Assessment Authority, (SEIAA) Tamil Nadu
4	RERA Registration of	Tamil Nadu Real Estate Regulatory Authority (TNRERA)
5	Labour License	Labour Welfare Department, Govt. of Tamil Nadu

After obtaining all the Statutory Approvals from the respective ULBs/ Parastatal Agencies, the LHP construction agency of LHP Chennai M/S B. G. Shirke Construction Technology Pvt. Ltd. has submitted these NOcs/Approvals to Ministry of Housing and Urban Affairs (MoHUA) to grant the permission of commencement of the work at the site.

The above-mentioned Statutory approvals and NOCs are attached at **Annexure 1.**

Chapter 3:
Project Details & Site Location

3.1 Foundation Laying of LHP Chennai

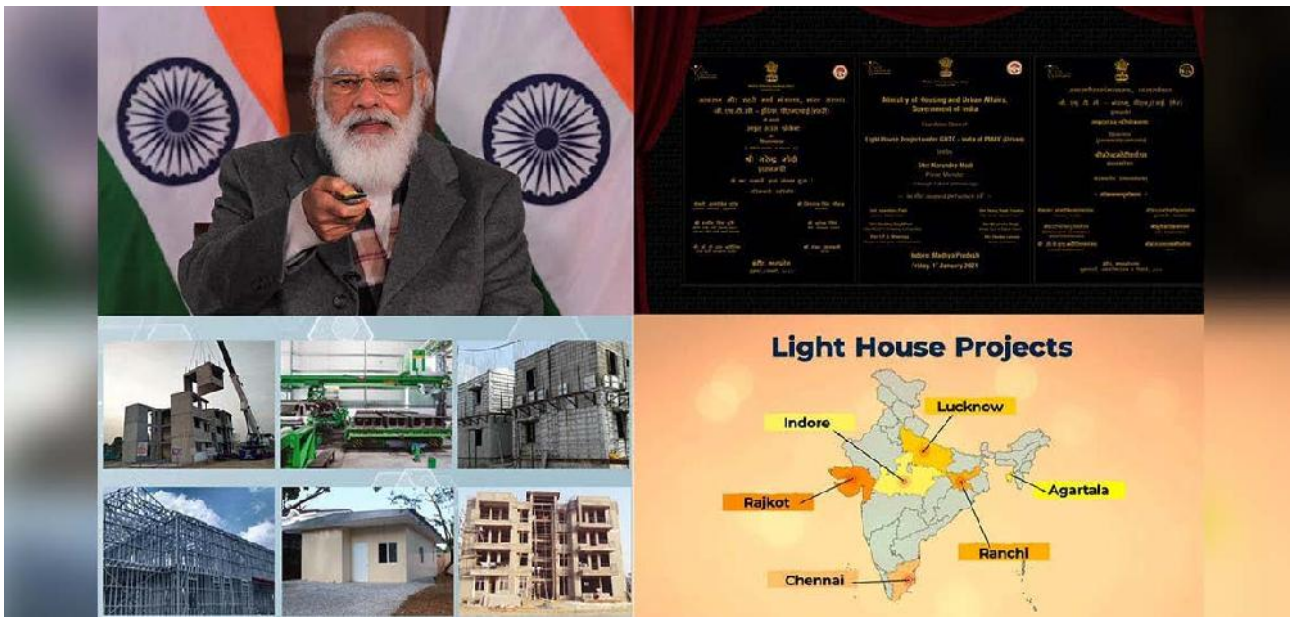
Hon'ble Prime Minister Shri Narendra Modi laid the foundation stone of LHP Chennai, Tamil Nadu along with other five LHPs on 01 January 2021 via virtual mode. The event was anchored by Joint Secretary and Mission Director (HFA), Ministry of Housing and Urban Affairs (MoHUA). Hon'ble Union Minister for Housing & Urban Affairs, Shri Hardeep S Puri; Secretary, MoHUA and officials of MoHUA were present on the occasion. Hon'ble Governor, Hon'ble Chief Minister of Tamil Nadu State along with the state minister joined the event from the LHP site through video conference.

Speaking on the occasion, the Prime Minister said that "The houses in Chennai will be built through the precast concrete technology of the US and Finland, which will help build houses faster and cheaper. These Light House projects are now a perfect example of the country's working practices. We also have to understand the big vision behind it. At one time, housing schemes were not as much in the priority of the central governments as it should be. The governments did not go on the nuances and quality of house construction. But we know how difficult it would have been if these changes were not made in the expansion of work. Today, the country has chosen a different approach and adopted a different path".

Hon'ble Prime Minister further added that today is the day to move forward with new energy, to prove new resolutions and today the country is getting new technology to build houses for the poor, middle class. Hon'ble PM also said that the houses are called light house projects in technical language, but these 6 projects are really like lighthouses showing a new direction to the housing sector in the country.

The LHP Chennai is a model housing project comprising of 1,152 houses with Precast Concrete Construction System for showcasing use of the best proven new-age technology, materials and processes in the construction sector. The technology being used is one of the 54 innovative technologies shortlisted under GHTC-India suitable to the geo-climatic and hazard conditions of the region. The project has been completed within stipulated time of one year.

Foundation Laying of LHP Chennai by Hon'ble Prime Minister



Foundation Laying of LHP Chennai by Hon'ble Prime Minister

Project Brief of LHP Chennai, Tamil Nadu	
Location of Project	Nukkampal Road, Chennai, Tamil Nadu
No. of DUs	1,152 (G+5)
Plot area	29,222 sq.m.
Carpet area (per DU)	26.78 sq.m.
Total built up area	43439.76 sq.m.
Technology used	Precast Concrete Construction System - 3S System
Other provisions	Anganwadi, shops, milk booth, library and ration shop
Broad Specifications	
Foundation	RCC isolated/Combined footing
Structural Frame	RCC precast beam/columns
Walling	AAC Blocks
Floor Slabs/ Roofing	RCC precast slab
Joinery & Finishing	
Door Frame / Shutters:	• Pressed steel door frame with GI sheet flush shutters • PVC door frame with PVC shutters in toilets.
Window Frame/ Shutter:	• uPVC frame with glazed panel and wire mesh shutters.
Flooring	• Vitrified tile flooring in Rooms & Kitchen • Anti-skid ceramic tiles in bath & WC • Anti-Skid tile flooring in Common area. • Kota stone on Staircase steps.
Wall Finishes	• Weatherproof Acrylic Emulsion paint on external walls • Oil Bound distemper over putty on internal walls

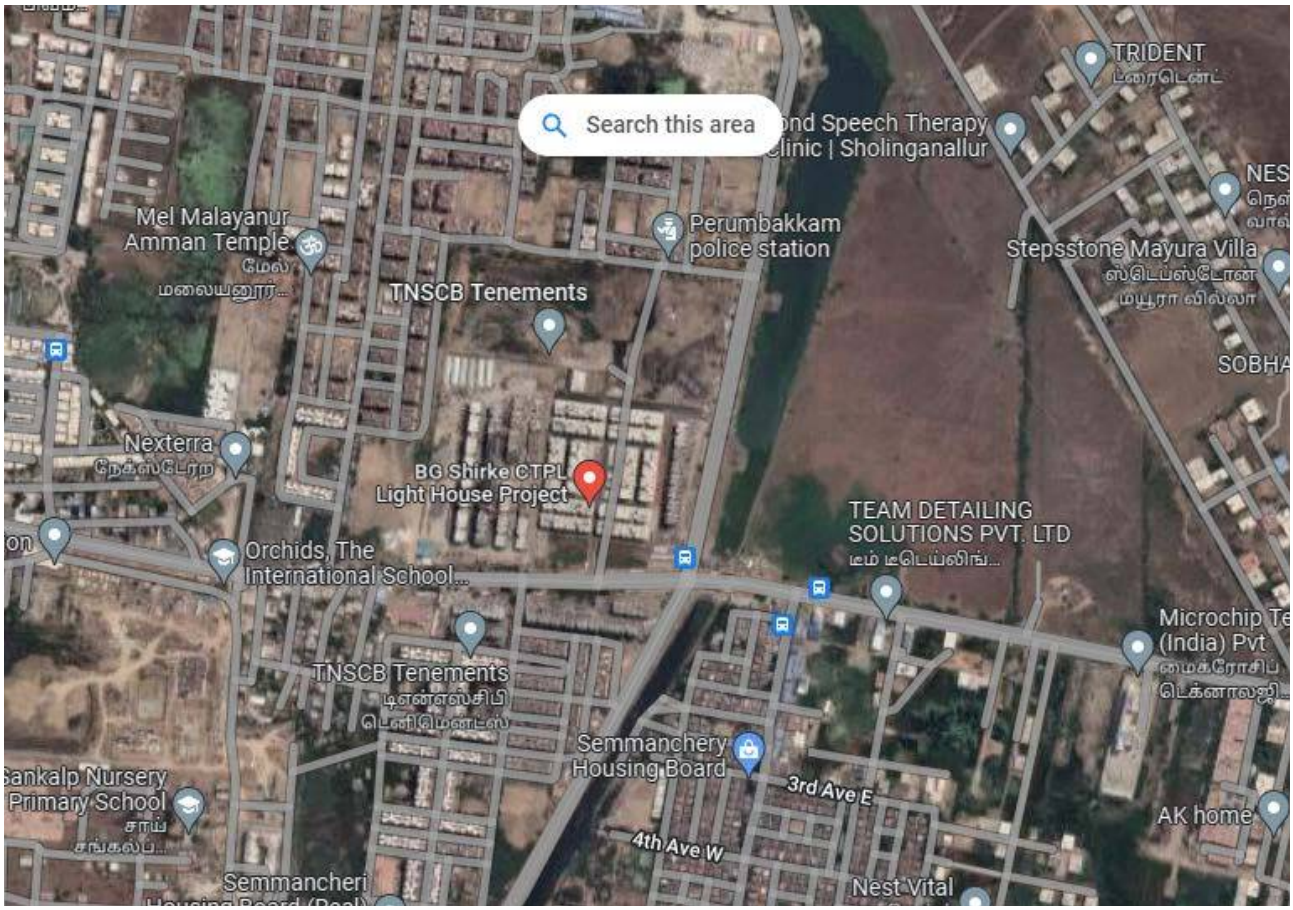
Infrastructure	Internal Water Supply, Laying of Sewerage Pipe Line, RCC storm water drain, Provisions for Fire Fighting, Internal Electrification, Bituminous/CC Internal Road & Paver blocks for Pathway, Providing Lifts in building blocks, Landscaping of site, Street light with LED lights, Solar Street Light System, Sewerage Treatment Plant, External Electrification, Water Supply System including underground water reservoir, Compound wall with Boundary Gates, Horticulture facilities, Rain Water Harvesting etc.

3.2 Project Location

The State Government of Tamil Nadu was asked to give the site for the project and the site allocated for LHP is in Perumbakkam area which is adjacent to the sites where number of affordable housing projects under PMAY(U) are being constructed and existing.

The site of the LHP Chennai is located in a well-developed area with infrastructure facilities such as 18 m wide approach road, ration shops, milk booth, primary health centre, community hall, Government primary school, ICDS bus Terminus cum depot, water supply, underground drainage, treatment plant, parks etc. The Perumbakkam land has been alienated with an extent of 81.20 hectare (200.65 acre) classified as 'Tharisu' in favour of construction of multi storied buildings for Tsunami affected people by the State Government. Out of the land under the possession of Tamil Nadu Slum Clearance Board (Now TNUHDB), land parcel of 29,222 sq.m. was allocated for Lighthouse Project.

Project Location in google map is as under:



3.3 Site Conditions

The land earmarked for LHP was falling under low-lying area having frequent heavy water logging. Initially, there have been temporary encroachments also, which were subsequently removed by TNSCB (now TNUHDB). Heavy duty pumps were deployed to drain out the water from site for conducting soil testing, during heavy rains and subsequently during laying of foundation.

Initial site photograph before construction

3.4 Geo Technical Investigation of the Site

Geo technical investigations of the whole area covering many other projects have been done at different times for different projects. These reports available at the time of proposal from Tamil Nadu Slum Clearance Board were as per investigation done by Anna University in 2013-14.

For the LHP project, the agency (M/s B. G. Shirke Construction Technology Pvt. Ltd.) got the geo technical investigations done by M/s Geo-marine Consultants Pvt. Ltd., Chennai with the approval of MoHUA.

Geo Technical Investigation of the Site

The salient observations from the Geo Technical Investigations are as follows:

i. The ground level of the project site was found to be lower as compared to ground level of neighbouring areas. The area was found to be prone to water logging.

ii. The topsoil up to a depth of 3.5m is predominantly clay with shrinking and swelling property making it unsuitable for any construction and backfilling of basement and foundation. Thereafter, up to 8.00m is weathered rock of different grades i.e., from Grade III to Grade VI. *N* value suggested the deposits can be considered as medium dense state.

iii. The ground water was found to be contaminated with chloride and sulphate, making it unsuitable for construction, presence of Chloride and Sulphate in water and soil makes the environment conditions aggressive. Therefore, special treatment is called for use of cement and steel to take care of any adverse effect due to aggressive environment.

iv. Based on the geo technical investigations and other reports, bearing Capacity of 25KN/m^2 was considered for design of foundation.

v. Geo-Investigation Report suggested the foundation types namely (a) shallow raft foundation with minimum depth of 2.7m excavation or (b) shallow under reamed piles. The isolated/combined RCC footings were finally adopted for the LHP project based on design considerations.

vi. The LHP project site falls in Seismic Zone III as per IS 1893 (Pt I) and based on liquefaction analysis, it was concluded that the sub soil formation exists at site is non liquefiable considering the Zone III seismic intensity.

vii. The chloride content in the ground water were found to be more than the stipulated permissible limit of 500 mg/l as per IS 456 (Table 1.0). Therefore, it is suggested that proper cover to the reinforcement shall have to be provided and anti-corrosive coating shall be adopted.

viii. Corresponding to the sulphate content, it is recommended that the provisions of Table 4 of IS 456:2000 for type of cement, minimum cement content, water- cement ratio were made applicable.

Based on the Geo-Technical Investigations (summary annexed as Annexure-2), total station survey, site contour maps, and considering geo-climatic conditions of the region, the detailed architectural plan, layout and infrastructure facilities were planned and subsequently design basis report was prepared by the agency out carry out structural analysis and design which is being explained in next chapter.

Chapter 4:
Design & Layout

4.1 Design Philosophy and Green initiatives:

The architectural design including layout was proposed by the State Government. Being turnkey project, the agency was asked to make minor changes in consultation with State Government in the architectural design and layout and subsequently carried out the structural design.

Both architectural and structural design were done by the technical team of M/s B. G. Shirke Construction Technology Pvt. Ltd and subsequently was vetted by IIT Mumbai which is the pre-requisite for the project. In addition, inclusion of green and sustainable practices are part and parcel of all LHP projects. Accordingly, the design philosophy adopted for the LHP project has following significant features:

i. Climate responsive architecture to maximize the use of daylight, ensure thermal comfort, and natural ventilation, shielding, window area disposition, and day lighting to be supplemented with an integrated design of artificial lighting.

ii. To cater to the different functional requirements of users including their cultural and occupational preferences, through creatively designed indoor spaces, common areas and circulation. Safe pedestrian spaces between community areas, courtyards, and spaces between buildings in a barrier free built environment to encourage community formation.

iii. Optimum utilization of renewable energy sources to be duly integrated in the overall energy system design; with consideration of active and passive aspects in building design including thermal performance of building envelope.

iv. Design also incorporates renewable resources for power generation (Solar) for consumption in common areas, provision for installation of solar street lights, solar lighting for common areas, etc.

v. Integrated designs of electrical, mechanical and other services with structural system planned with optimum cost, low maintenance and lowest consumption of energy and water.

vi. The design and construction considers the requirements of Rating 4 of GRIHA Affordable Housing Standards.

vii. Integrated water and solid waste management with waste water recycling, water conservation and modular rain water harvesting as per CPWD norms is adopted.

4.2 Architectural and layout Planning

The project is designed as a multi-storey residential complex with 12 blocks in G+5 configuration to house a total of 1152 dwelling units. Each block serves for total 96 tenants. These residential DUs are provided with additional social infrastructure namely: Shops, Aanganwadis, milk booth, library and ration shop. The total built up area of the project is 43,439.76 Sqm. Each dwelling unit is planned and designed to serve as a comfortable residential unit as per space norms of NBC. In line with PMAY(U) guidelines each unit is having two habitable rooms, kitchen, separate bath and WC with a carpet area of 26.78 Sqm.

Total plot area for the project is 29,222.49 Sqm with permissible FSI as 2.00. However, in the LHP project total FSI for residential achieved was 1.487 (15005.22 Sqm). The site land use break up provides Residential Area as 7372.08 Sqm., Planned Open Area as 3360.59 Sqm and area used for Public purpose is 1786.30 Sqm. Further, in the site hardscape (Paved Area) is 4225.71 sqm and 11063.99 sqm. is covered by internal roads. Apart from all the above, a total area of about 1950 sqm.is left as green belt.

The details of social infrastructure provided at site is given in the table below:

Social Infra at site:			
S.No.	**Social Infrastructure Item**	**Nos**	**Plinth Area** (in Sqm)
1	Aanganwadi	2	49.72 (each)
2	Ration Shop	1	46.56
3	Commercial Shops	6	10.36 (each)
4	Milk Booth	1	16.48
5	Library	1	49.23

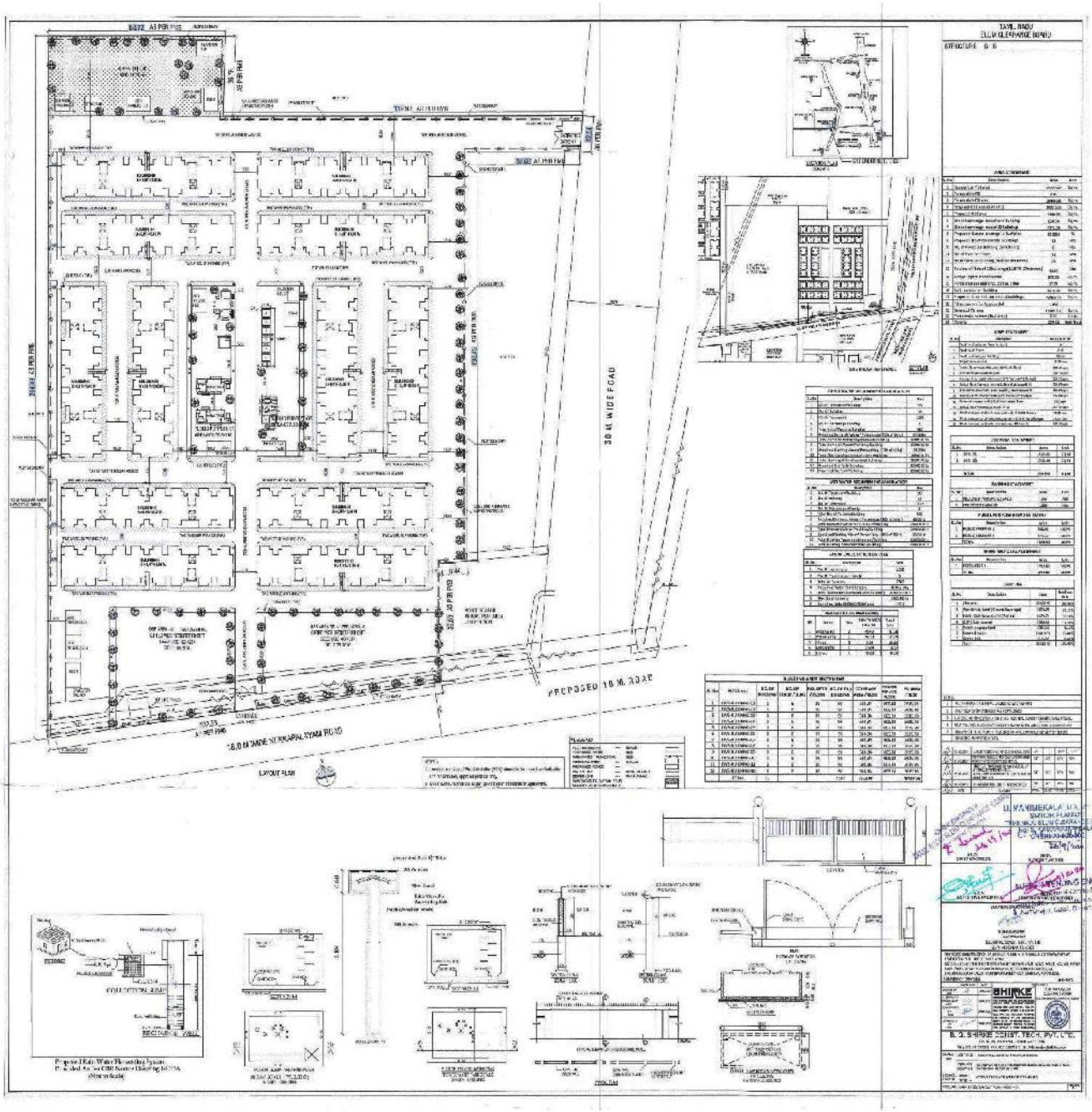
The architectural drawings including layouts, DU plan, sections and elevations are presented in the figures below.

Layout Plan

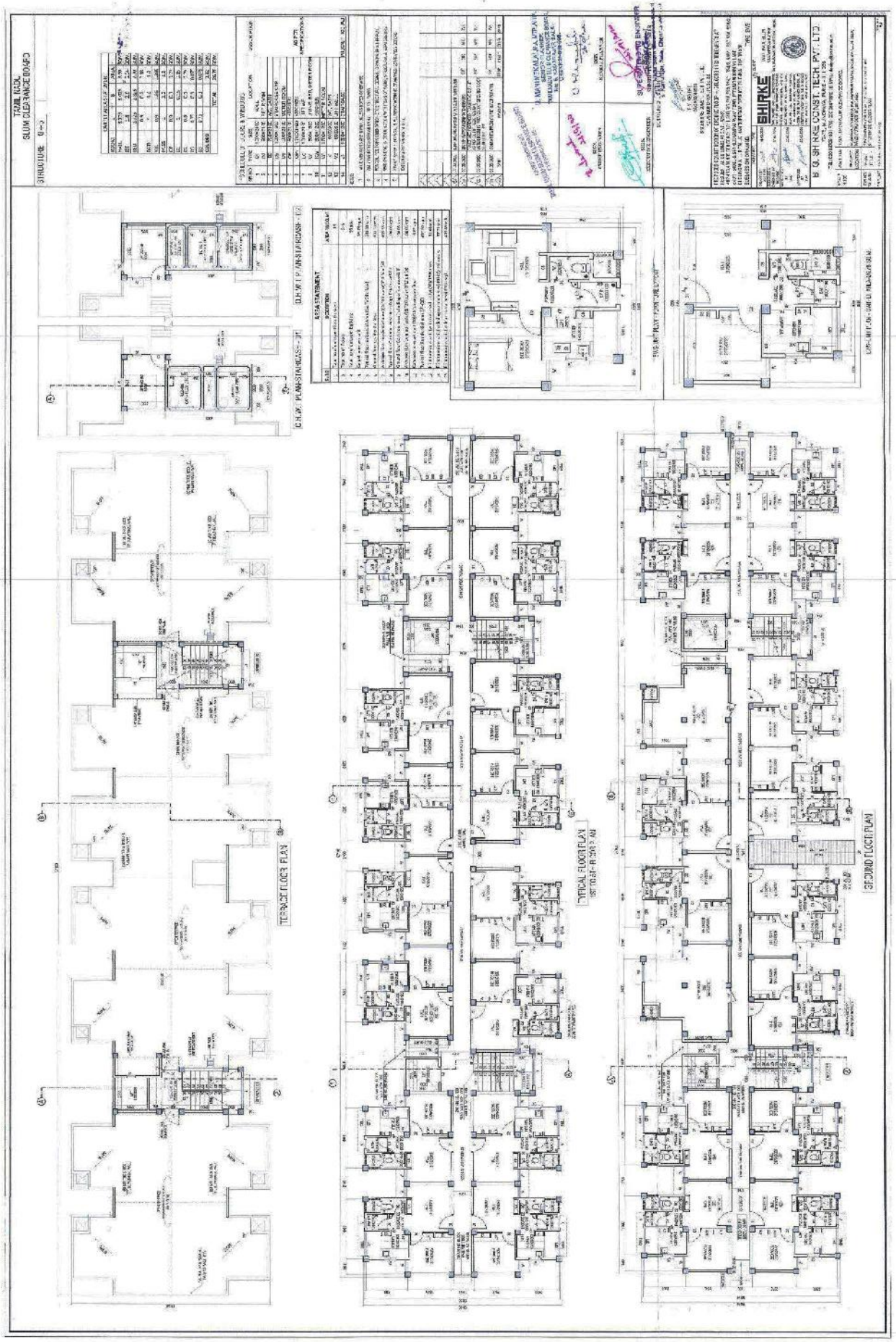
Dwelling Unit Plan

3D of Dwelling Unit

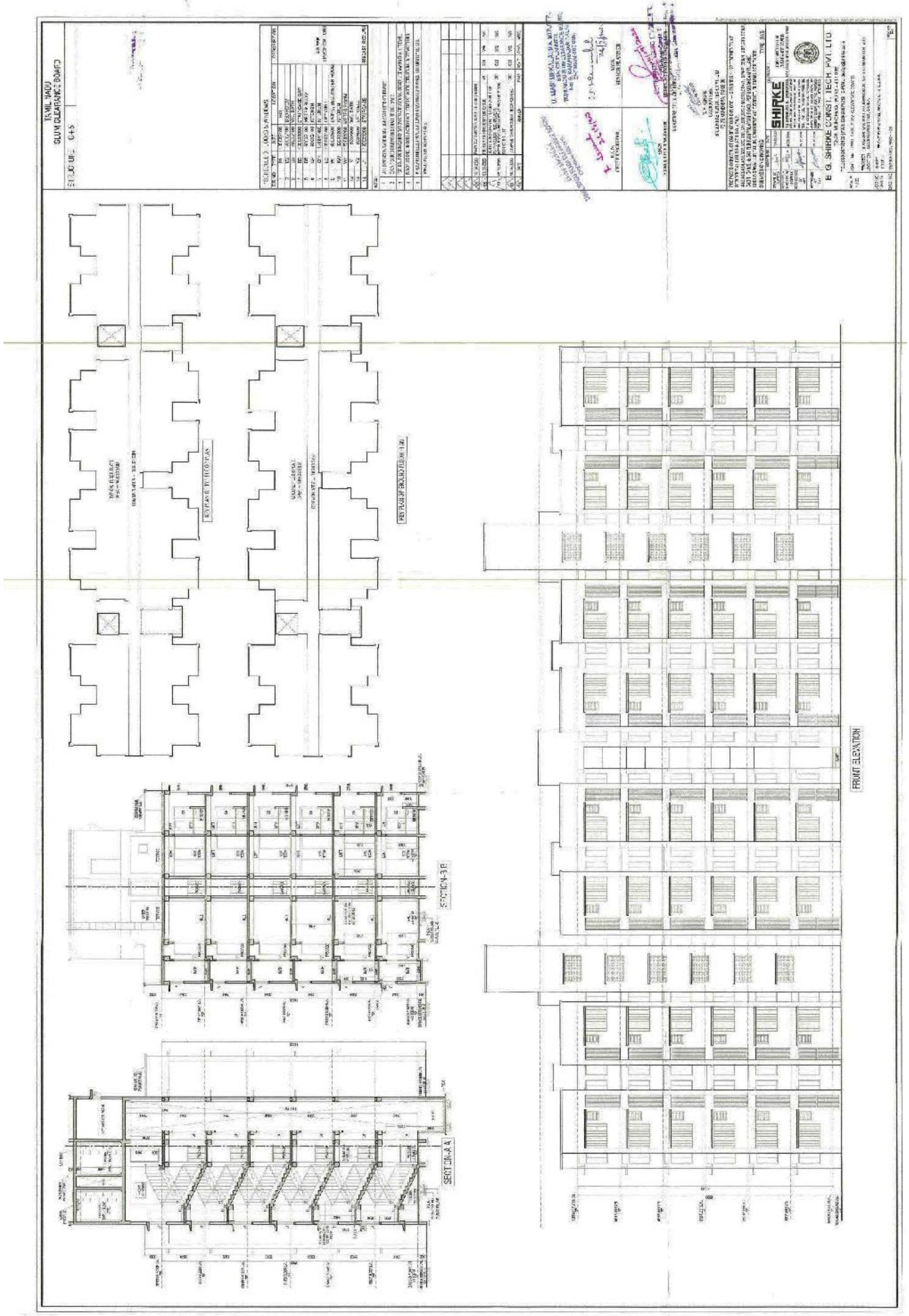
Typical Floor Plan



Site Layout Plan



Floor Level Plan

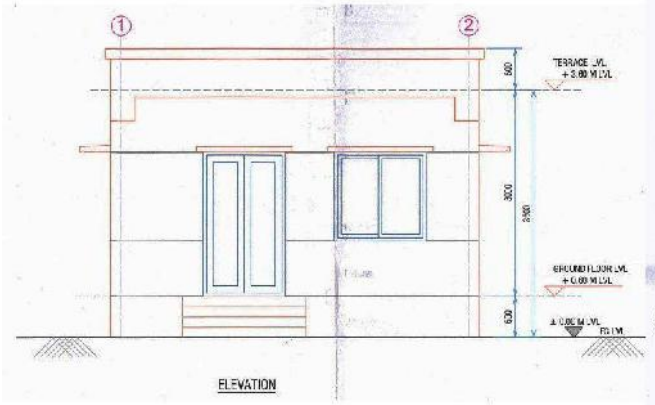


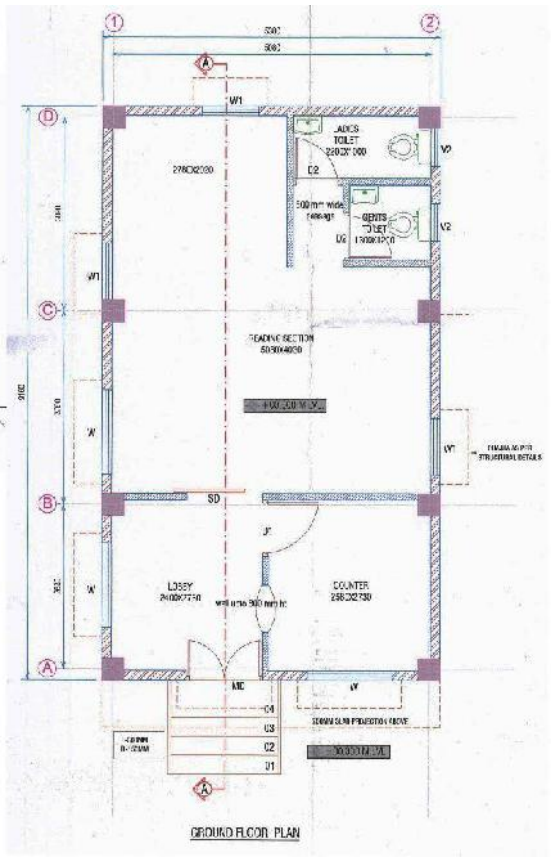
Elevation and Section

4.3 Social Infrastructure

The architectural drawings of social infrastructure which is also constructed using precast concrete construction technology as used for residential complex are presented here.

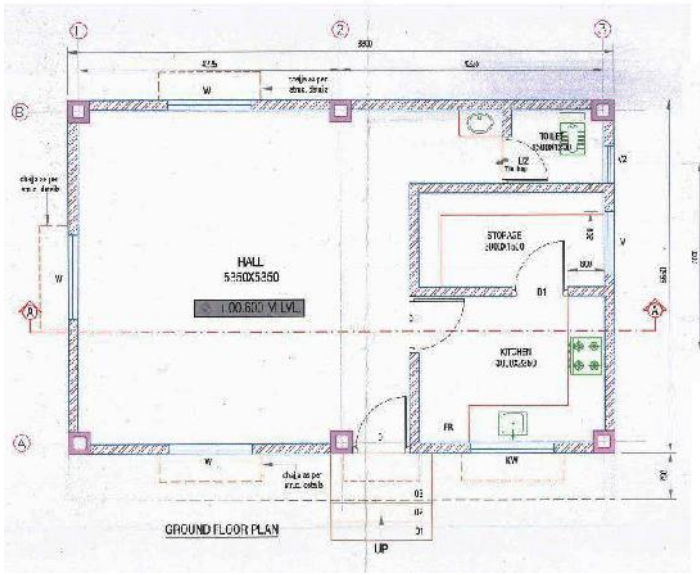
i. Library Building: 1 No. Built up Area 49.23 sqm.

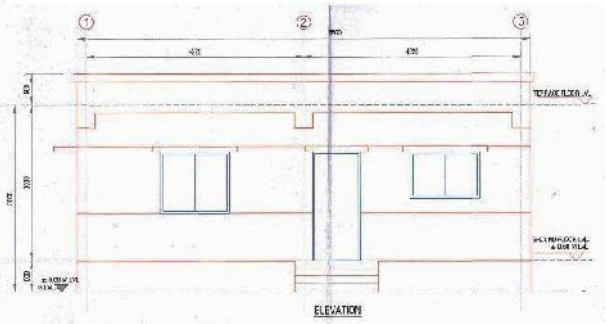




LIBRARY PLAN AND ELEVATION

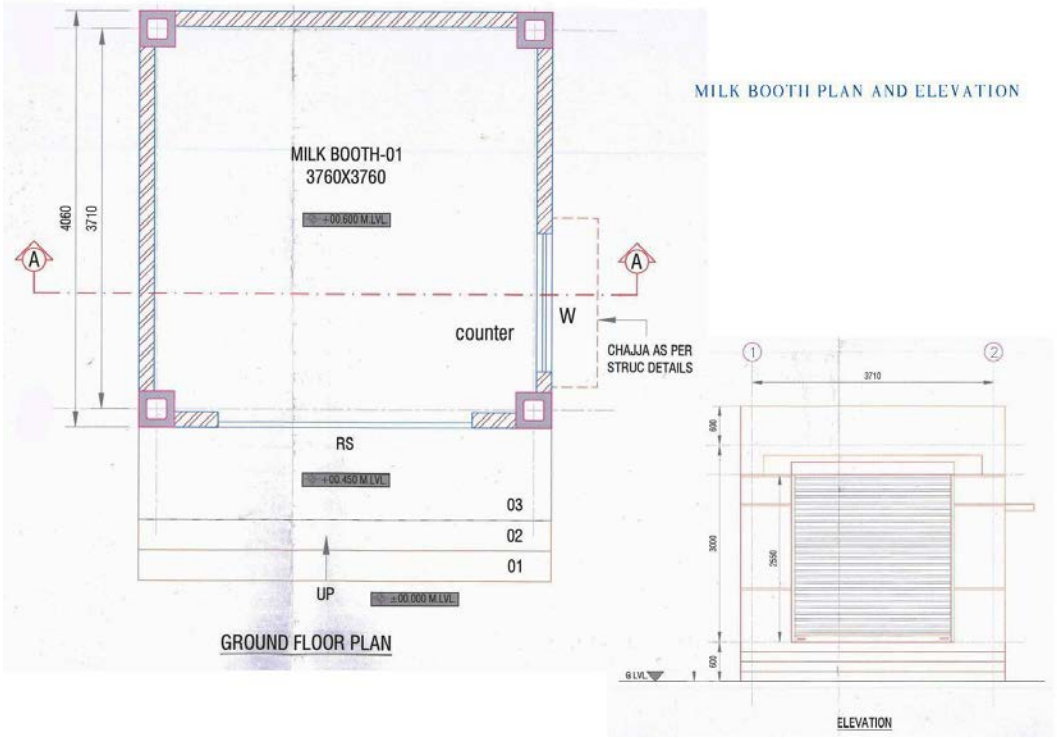
ii. Anganwadi: 2 No. Built up Area 99.44 sqm.



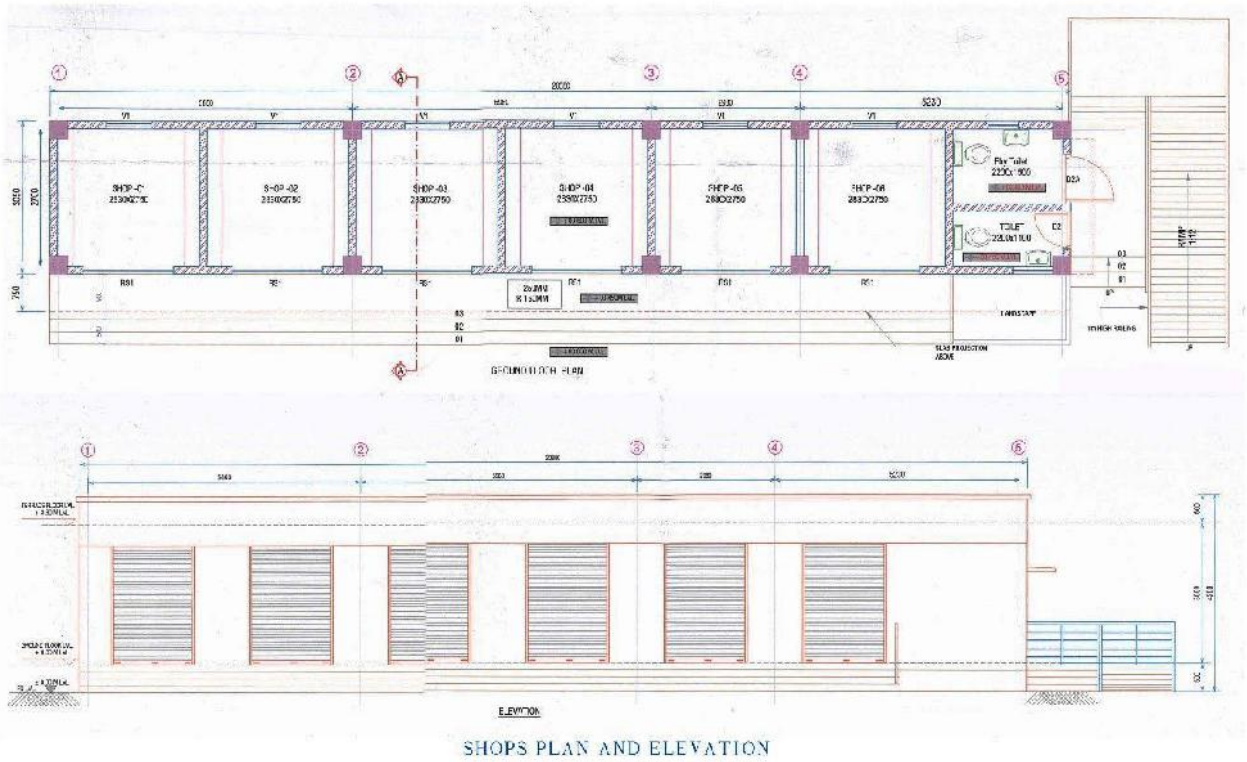


ANGANWADI PLAN AND ELEVATION

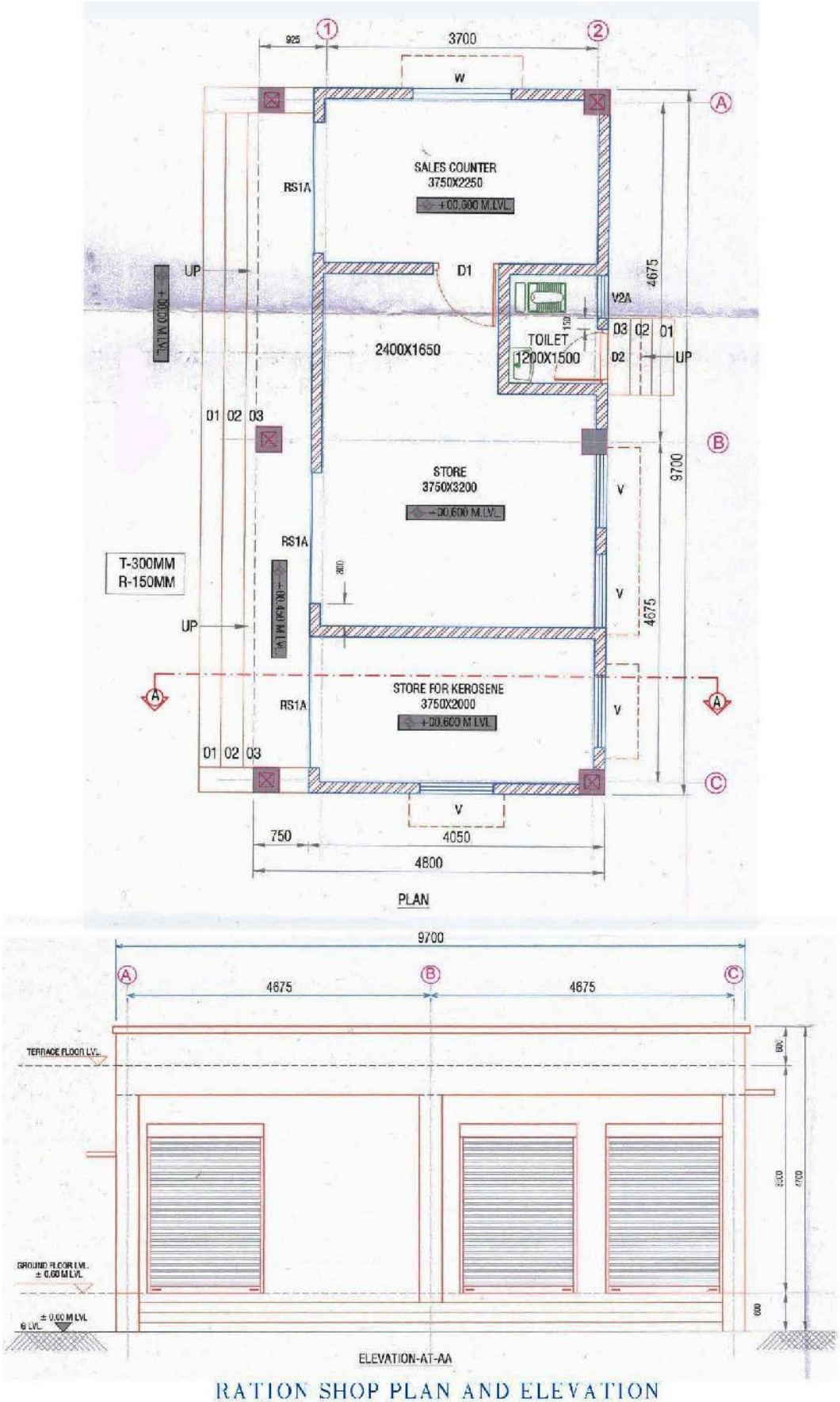
iii. Milk Booth: 1 No. Built up Area 16.48 sqm.



iv. Commercial shop: 6 No. Built up Area 62.16. sqm.



v. Ration shop: 1 No. Built up Area 46.56 sqm.



RATION SHOP PLAN AND ELEVATION

4.4 Site services

The basic services for the project namely water supply, sewerage, storm water drainage are being discussed in this section.

External Sewerage layout

For the project 550 KLD STP plant operating on the SBR (Sequencing Batch Reactor) Technology is installed. The site sewerage is carried via a well-established sewage network. The Pipes laid out are

1. 160mm Ø Sewage Pipe at slope 1:100.
2. 250mm Ø Sewage Pipe slope 1:190.
3. 315mm Ø Sewage Pipe slope 1:245

MANHOLE SIZES AND DIMENSIONS	
RECTANGULAR MANHOLES	
FOR DEPTH LESS THAN 0.90m	900mm x 800 mm
FOR DEPTHS FROM 0.90m AND UPTO 2.5m	1200mm x 900 mm
CIRCULAR MANHOLES	
FOR DEPTHS ABOVE 0.90m AND UPTO 1.65m	900 mm Diameter
FOR DEPTHS ABOVE 1.65m AND UPTO 2.30m	1200 mm Diameter
FOR DEPTHS ABOVE 2.30m AND UPTO 9.00m	1500 mm Diameter

All sewerage is carried to the on-site STP where all sewerage is treated and the treated wastewater is to be used for secondary purposes such as gardening and/or flushing (waste water recycling).

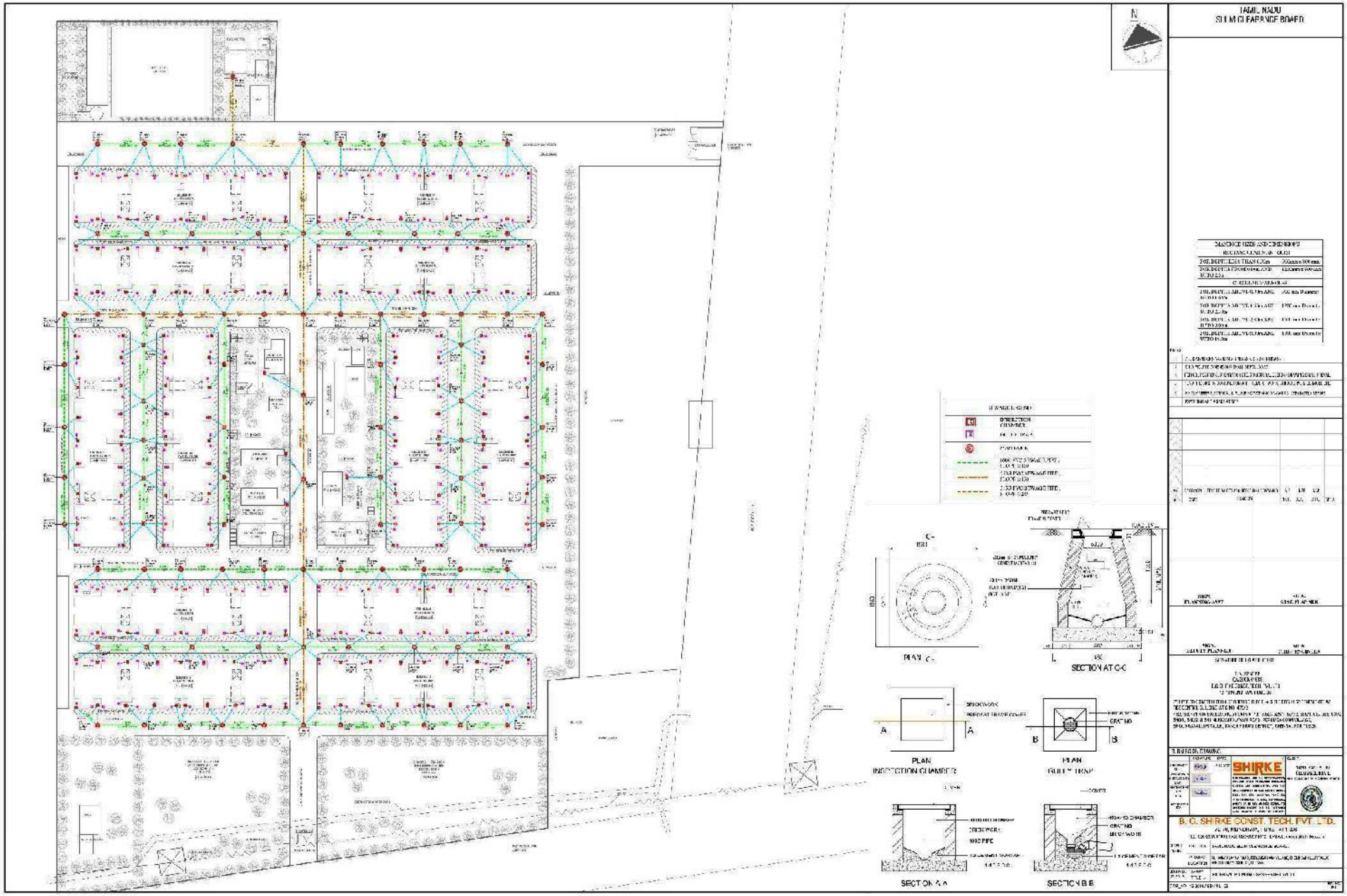
External Water supply Layout

Water supply is provided by the water department of the ULB to the LHP project site. The project has three Underground (UG) tanks to store water from where supply to overhead tanks is done through pumping. Six tanks are provided per block, five tanks of 5000 *litre* and one of 3000 *litre*. Out of which, two tanks of 5000 *litre* are used for flushing purpose.

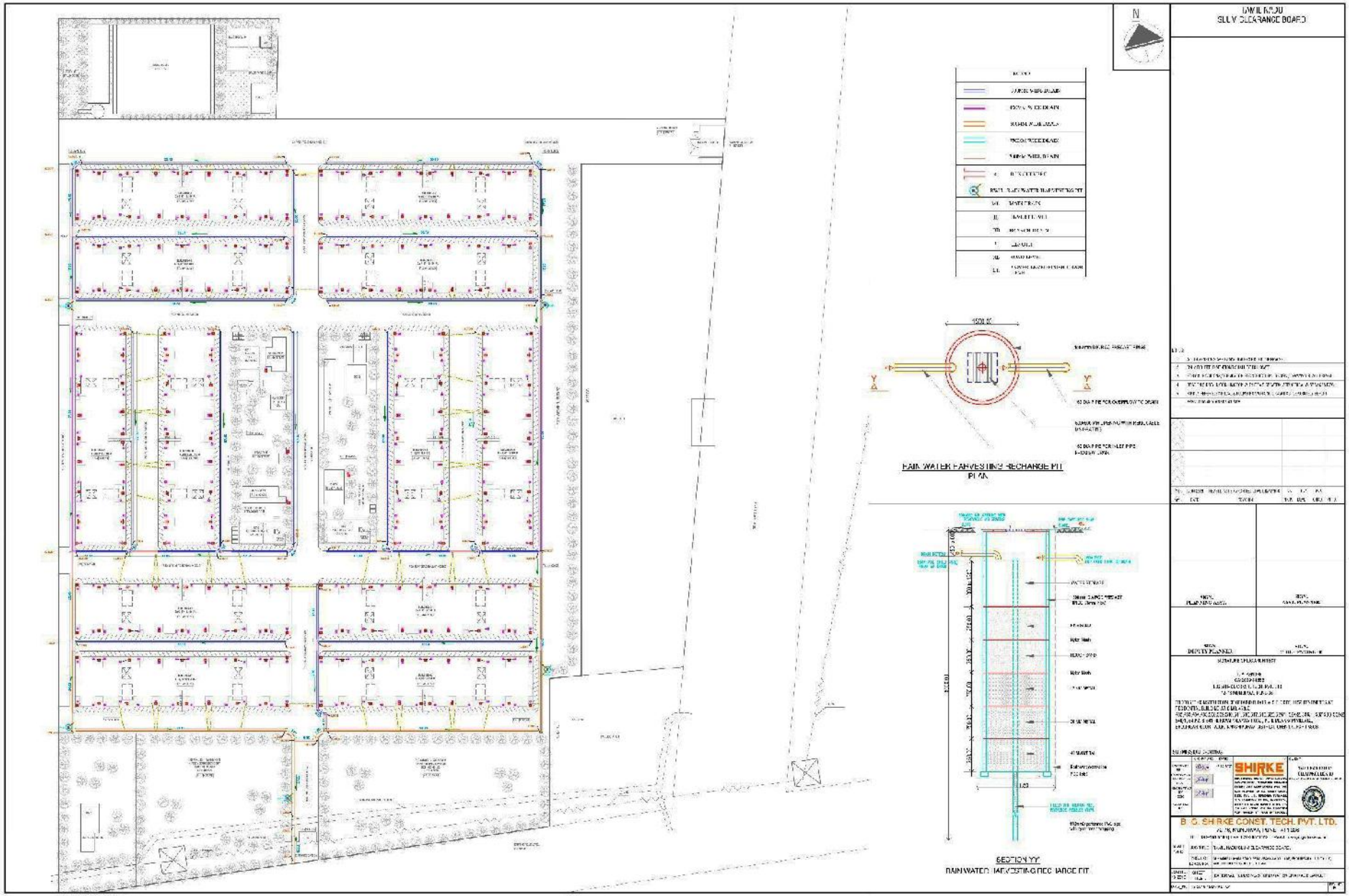
External Storm Water Drainage layout

A network of storm water drains of width 900mm, 750mm, 600mm, 450mm, and 300mm of various lengths has been provided to collect and dispose rain water from surfaces, roads, paved areas.

The layout drawings of basic services are present here below.

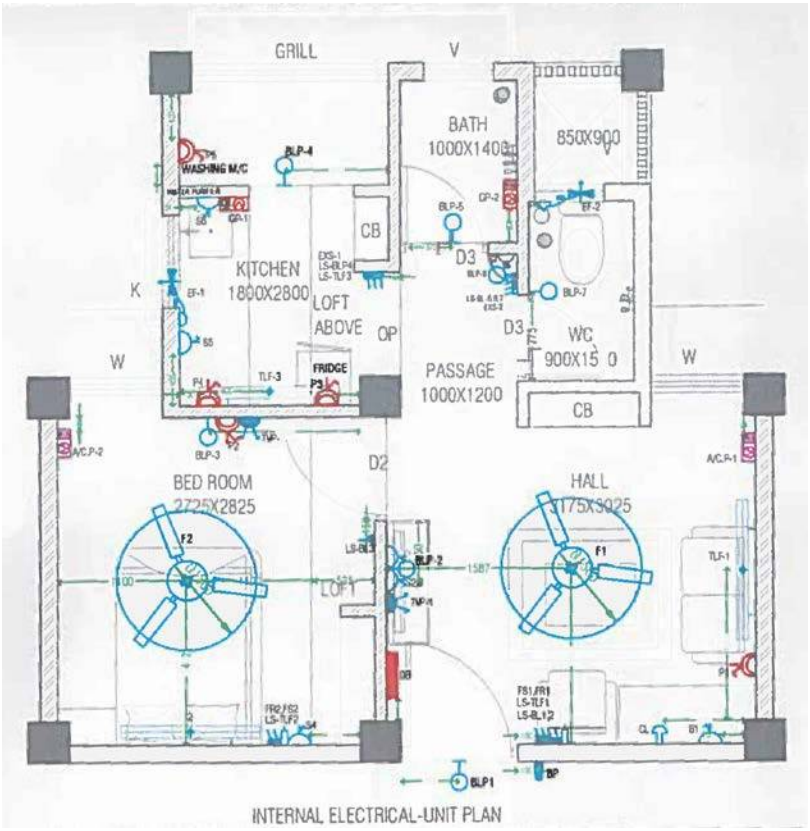

TAMIL NADU
SLUM CLEARANCE BOARD
PLAN C-C
SECTION AT C-C
PLAN
INSPECTION CHAMBER
PLAN
GULLY TRAP
SECTION A-A
SECTION B-B
B. G. SHIRKE CONST. TECH. PVT. LTD.


DAY LIMOU
SLUM CLEARANCE BOARD
B. G. SHIRKE CONST. TECH. PVT. LTD.


N
RAIN WATER HARVESTING RECHARGE PIT
PLAN
SECTION YY
RAINWATER HARVESTING RECHARGE PIT
B. G. SHIRKE CONST. TECH. PVT. LTD.

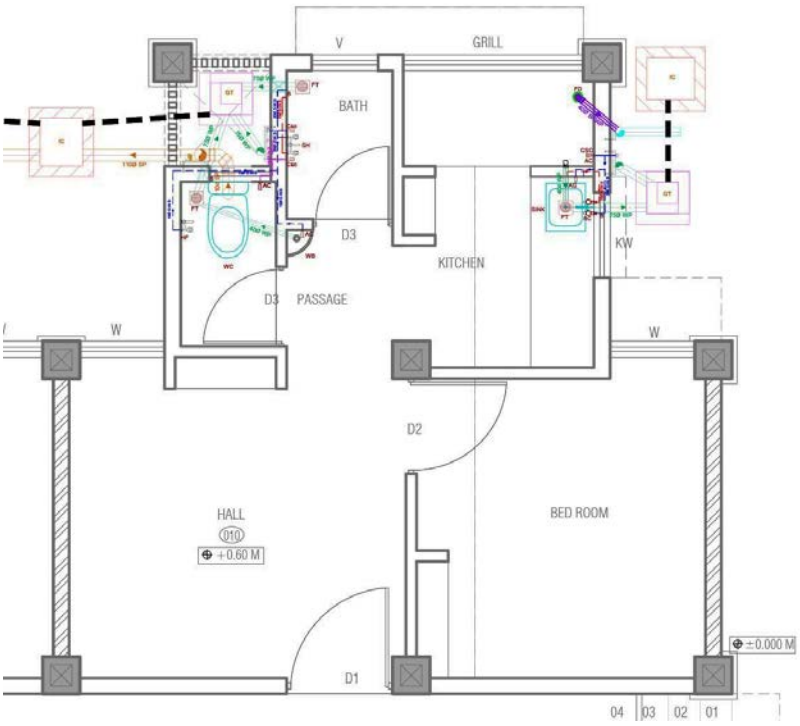
Internal Electrical Layout for Dwelling Units –
The internal and external electrification as per State norms have been provided for the LHP and is being presented here.

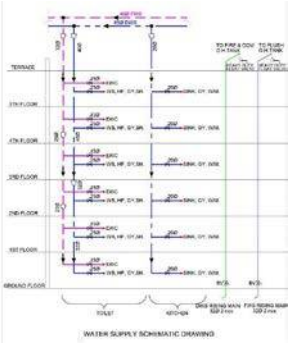
Electrical fittings and arrangements



LEGEND		
SYMBOL	DESCRIPTION	HEIGHTS@FFL
	1200mm FAN CEILING POINT	CEILLING
	SINGLE WAY SWITCH	750/1200mm
	TWO WAY SWITCH	750/1200mm
	TV SOCKET OUTLET	750mm
	FAN REGULATOR	750/1200mm
	BELL PUSH BUTTON	1200mm
	CALL BELL BUZZER	2100mm
	6A 5 PIN SOCKET NEXT TO BED/TV	900MM
	6A 5PIN SWITCHED SOCKET IN KITCHEN	300MM Above platform
	IN HALL FOR MOBILE CHARGE	1200mm
	IN KITCHEN WATER PURIFIER	1800mm
	15A 6 PIN SOCKET WITH SWITCH -HALL A/C	2400mm
	IN BEDROOM FOR TV	750mm
	REFRIGERATOR	1200mm
	IN KITCHEN	300MM Above platform
	FOR WASHING MACHINE	1250mm
	MCB CONNECTED SOCKET FOR A/C	2400mm
	For GEYSER Point(supply not to be provided)	2100mm
	EXHAUST FAN POINT	2400mm
	Bracket Light Point (Excluding lamp)	2400mm
	LED tube light fittings (Excluding tube)	2400mm
	LED Bulk Head fitting	2400mm
	FLAT DISTRIBUTION BOARD	2100mm
	COMMON AREA DISTRIBUTION BOARD	2100mm

Internal Plumbing for Dwelling Units-
As regards internal plumbing, single stack piping system has been used and the same is shown here.





LEGEND	
	DOMESTIC WATER SUPPLY (DWS)
	FLUSH WATER SUPPLY (FWS)
	HOT WATER SUPPLY (HWS)
	SOIL PIPE (SP)
	WASTE PIPE (WP)
	ANTI SIPHONAGE PIPE (ASP)
	RAIN WATER PIPE (RWP)
EWC	EWC FLOOR MOUNTED WITH 'P' TRAP
WB	WASH BASIN (CORNER)
SH	2 IN 1 MIXER
BC	BIB-COCK
SINK	S.S.SINK WITHOUT DRAIN BOARD
HF	HEALTH FAUCET
FT	FLOOR TRAP
AC	ANGLE COCK
CSC	CONCEALED STOP COCK
BV	BALL VALVE

4.5 Structural Design:

The design basis report which essentially comprises of design philosophy, load calculations, hazard profile and codal requirements forms the basis of structural design and preparation of working drawings to achieve desired structural and functional requirements during the service life of building. It is pertinent to mention here that design basis report along with detailed structural design and working drawings need to be vetted by third party which is IIT Mumbai in the present case. Further, these vetted design basis report and design are approved by the MoHUA.

4.5.1 Structural Design Philosophy

The essential components of design basis report considered in the present project are as follows:

- The aim of structural design is to achieve an acceptable probability that structures being designed will perform satisfactorily during their intended life as per the guidelines provided under IS 456:2000.
- The limit state method of design is adopted. The design of various members is carried out in accordance with the provisions, laid down in IS 456, IS 16700 and IS 13920.
- To meet the durability & serviceability requirements, various provisions as regards to maximum w/c ratio, minimum cement content, minimum percentage of steel, detailing of reinforcement, curtailment of reinforcement etc., as laid down in IS 456 and other applicable national / international codes are complied with.
- The RC moment resisting frames are detailed as per '3-S' system and relevant applicable BIS/International standards' provisions are complied with to meet the design ductility level.

Standards/Guidelines referred

Structural System	Industrialized 3s system for RCC precast column, beams and slab with/ without precast RCC shear walls
Occupancy use	Residential building- dwelling units
Design consideration and service life	In compliance with IS:1893(Part-1)-2016, IS:875(Part-3)-2015, IS:13920-2016, IS:456-2000 and National Building code of India NBC-2016
Structure is designed for	Limit state of collapse as per IS:456-2000 and NBC-2016 Limit state od serviceability as per IS: 456:2000 and NBC-2016 Durability consideration as per IS: 456:2000 Lateral sway under transient wind loading: ≤ h/500 Storey drift under design seismic loading: ≤ 0.4percent of storey height Final deflection of horizontal RCC members: Due to all loads: Not exceeding span/250 After erection of participation and application of finishes: Lesser of span /350 or 20mm.
Design loads	Dead loads as per IS: 875(part 1) Live loads as per IS:875(part 2) Wind loads as per IS:875(part 3) Basic wind speed; 50m/sec Wind terrain: category –II Seismic loads as per IS: 1893(part-1)2016 for seismic zone-III Importance factor: 1.2 Response reduction factor;5 Fundamental natural period as per cl.7.6.2 of IS:1893(part 1)

Imposed loads	All rooms including toilet, bath& w/c =2.0 kN/Sqm UDL Corridors, balcony, passages, staircases =3.0 kN/Sqm UDL Lift machine room = 10.0 kN/Sqm UDL
Fire resistance	As per IS: 456:2000
Partition masonry	100mm thk. AAC Gr-2 block of 451-550 kg/m3 density in oven dry condition as per IS: 2185(part-3) for internal and 150mm thk. AAC GR-2 2185(part-3) for other walls
Floor and roof slabs	Precast RCC composite slab with embedded lattice grinder having in-situ RCC topping of 55mm thickness for typical floor and 75mm thickness at roof floor – Min. Overall thickness of 130mm

4.5.2 Design Basis for Sub-Structure

- Safe Bearing capacity: 25 T/m^2, depth of foundation varying from 2.5m to 3.5 m
- Shallow Foundation as per IS-1080:1985 and IS-1904:1986. Minimum M35 grade of concrete is proposed for RCC structural elements in sub-structure.

4.5.3 Structural Frame

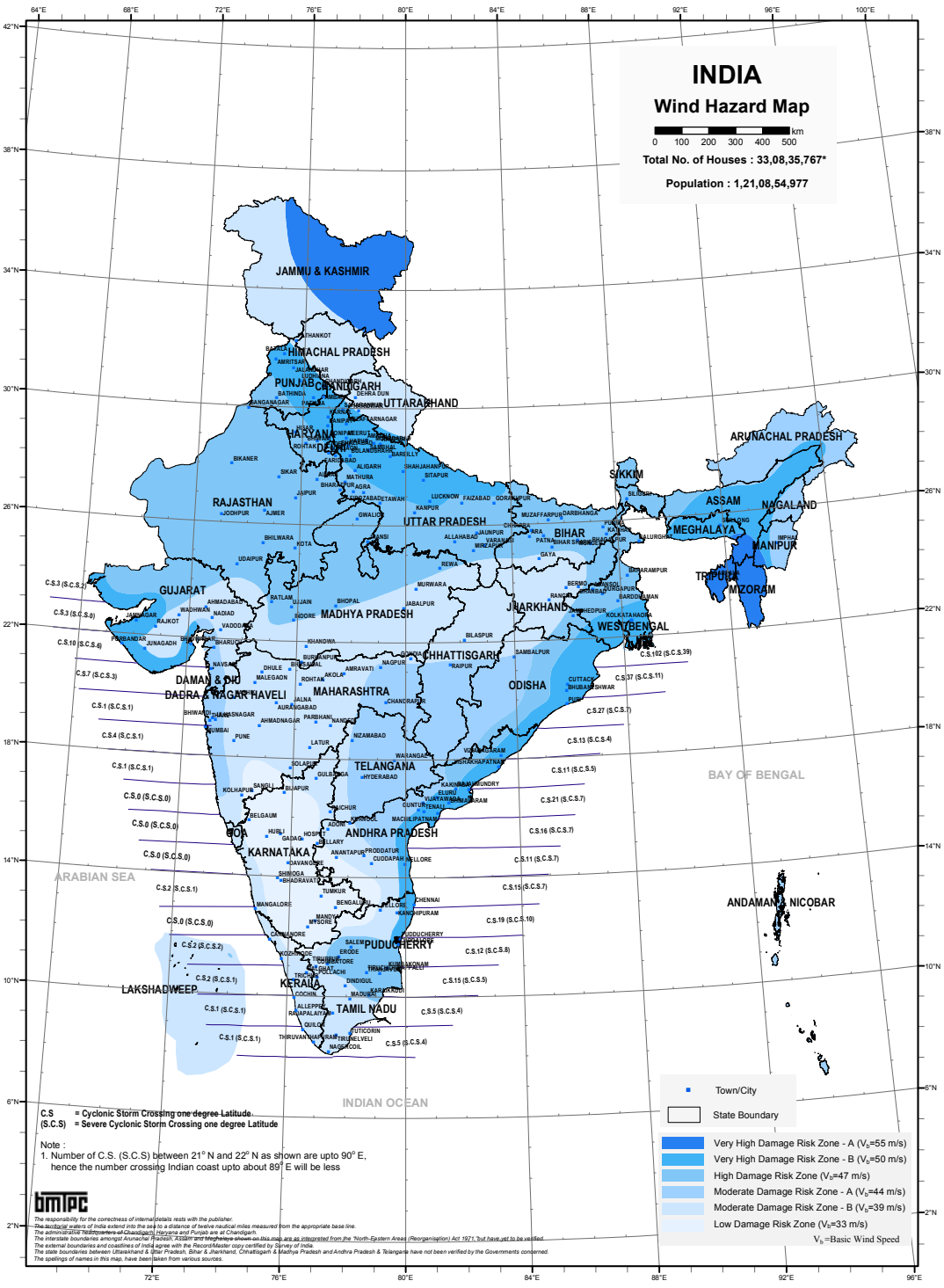
- Composite precast RCC solid slabs, precast RCC solid beams (T shape / L shape / rectangular) and precast dense concrete reinforced hollow core columns shells (core of which is concreted after erection using self-compacting concrete with the provision for suitable reinforcement for effective jointing), are manufactured in special steel moulds at site factory under stringent quality control and ISO / OSHAS quality norms.
- The jointing of various precast RCC elements is proposed as 'Wet Jointing' i.e. concreting with self-compacting concrete for achieving required rigid joints.
- Wind speed: High damage risk zone with basic wind speed (Vb=50m/sec) as per IS875(Part-3) (Refer Wind Hazard Map of India)
- 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.
- Earthquake: Zone-III as per Seismic Zoning Map of India IS: 1893 (Part-1):2016 (Refer Earthquake Hazard Map of India)
- Designed as dual system with ductile RC structural walls and few special moment frames in structural steel in both direction, Response Reduction Factor=5 (Table-9 iv of IS: 1893 (Part-1):2016), Z=0.16, I=1.2, R=5, Damping Ratio=5percent.
- 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

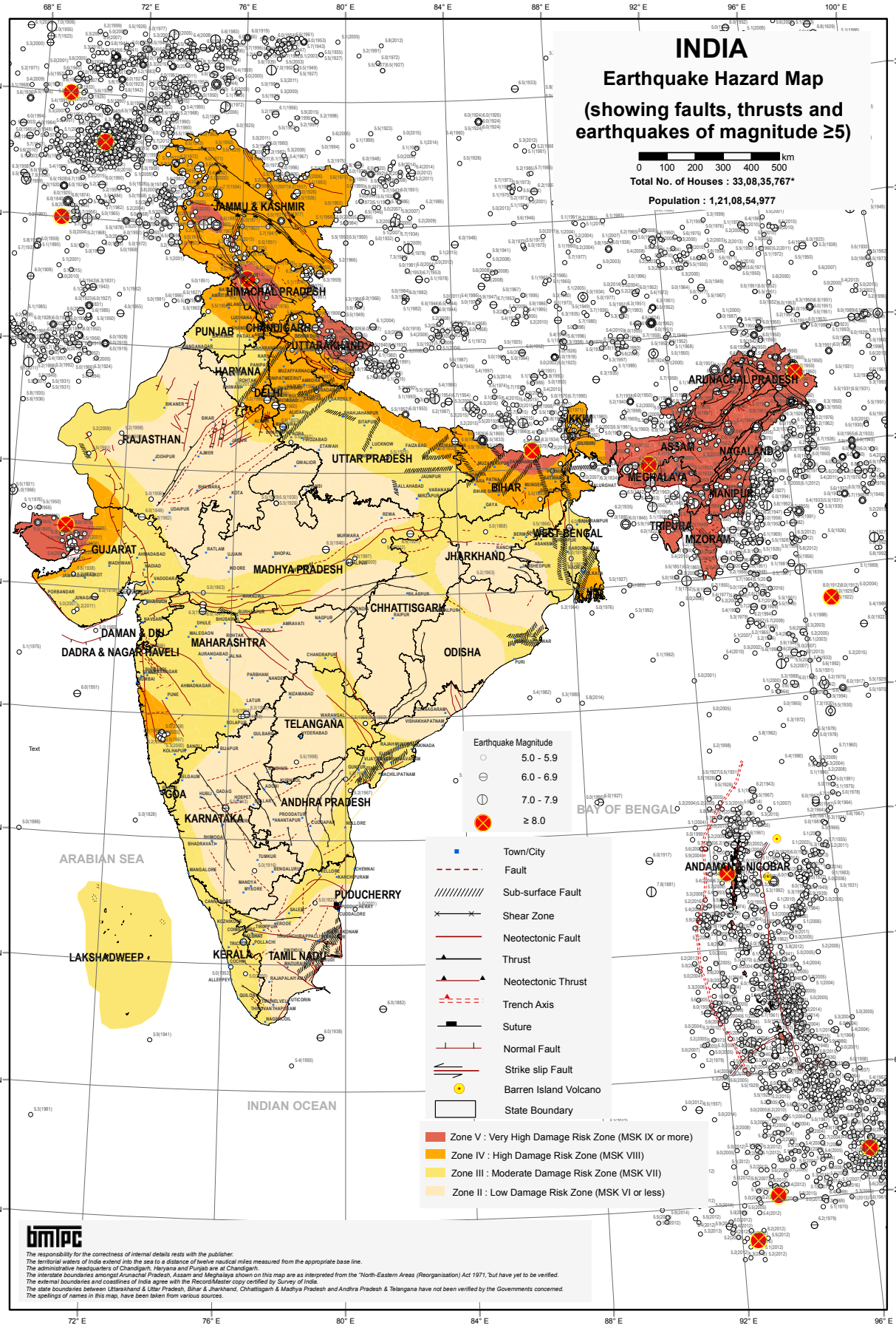
- Design Lateral Force (VB)
- VB=Ah.W
- W is seismic weight of building
- 3D dynamic analysis using response spectrum method using ETABS.
- Moment resisting forces are designed to resist the total design force in proportion to their lateral stiffness.

- 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.
- Reinforced cement concrete used for floor elements are minimum M35 Grade and minimum M40 Grade for vertical load bearing elements.
- Thermal comfort levels are ensured as per IS: 3792 by selecting walling material having thermal transmittance well within 2.56 W/m2K.



BMTPC : Vulnerability Atlas- 3rd Edition; Peer Group, MoHUA; Map is Based on digitised data of SOI, GOI; Basic Wind Speed Map National Building Code: 2016; Cyclone Data, 1891-2015, IMD, GOI. Houses/Population as per Census 2011; *Houses including vacant & locked houses. Disclaimer: The maps are solely for thematic presentation.

Wind Hazard Map of India



BMTPC : Vulnerability Atlas - 3rd Edition : Peer Group, MoHUA, GOI; Map is Based on digitised data of SOI; Seismic Zones of India Map IS 1893 (Part I): 2002, BIS; Earthquake Epicentre from IMD; Seismotectonic Atlas of India and its Environs, GSI; Houses/Population as per Census 2011; *Houses including vacant & locked houses. Disclaimer: The maps are solely for thematic presentation.

Earthquake Hazard Map of India

4.3.4 Structural Design & Detailing

In order to carry out detailed structural analysis and design the following design inputs have been considered:

Sub-Structure

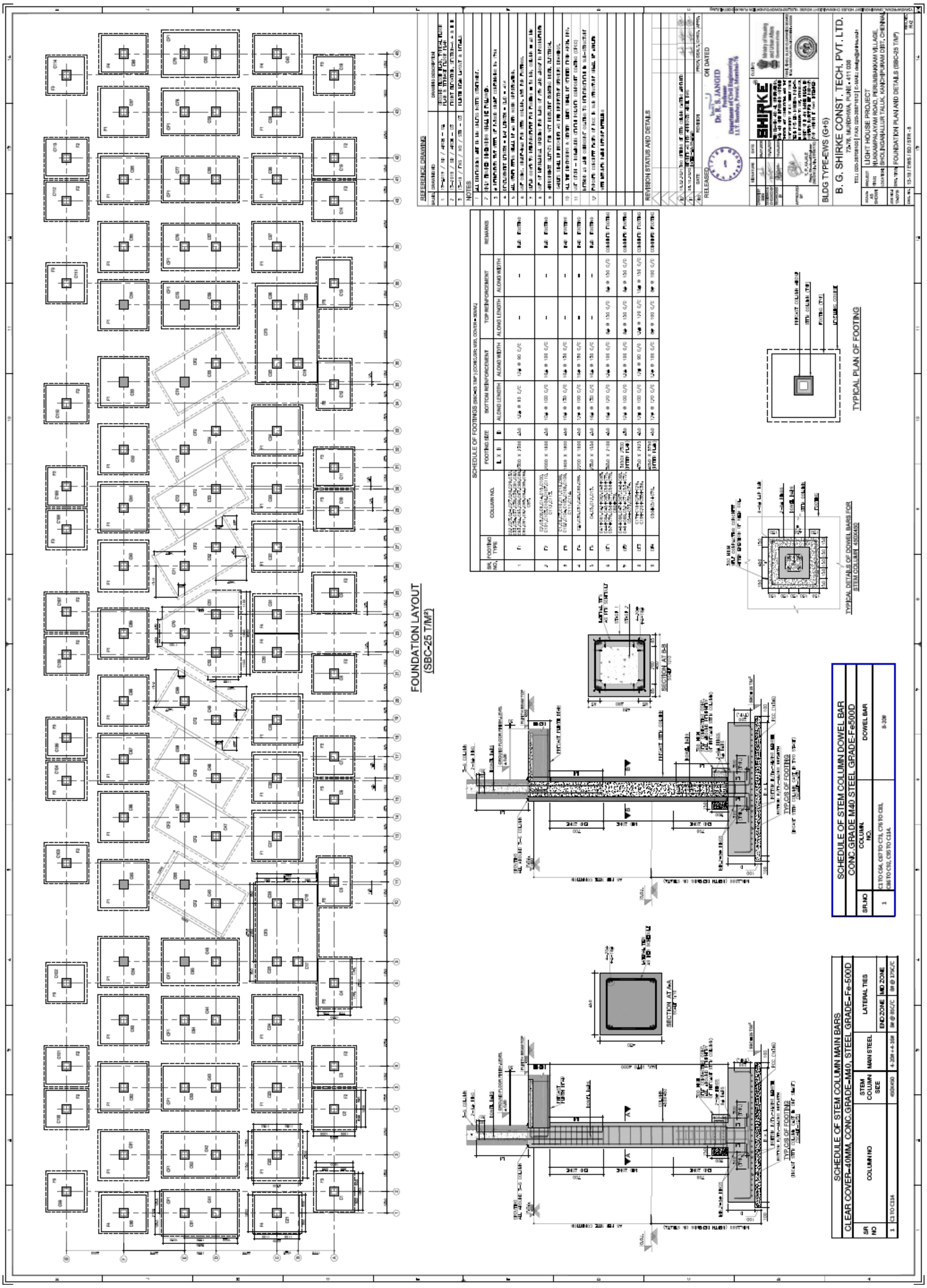
a) Bearing capacity of the founding strata and type of foundation for various buildings & structures shall be based on actual geotechnical investigations conducted at respective sites. Accordingly, "Shallow Foundation" with safe bearing capacity as recommended in Geotechnical Investigation reports was adopted.

b) For seismic forces and wind loading, 25% permissible increase in the allowable bearing pressure is considered while working out foundation sizes as per IS: 1893 and IS: 875 respectively.

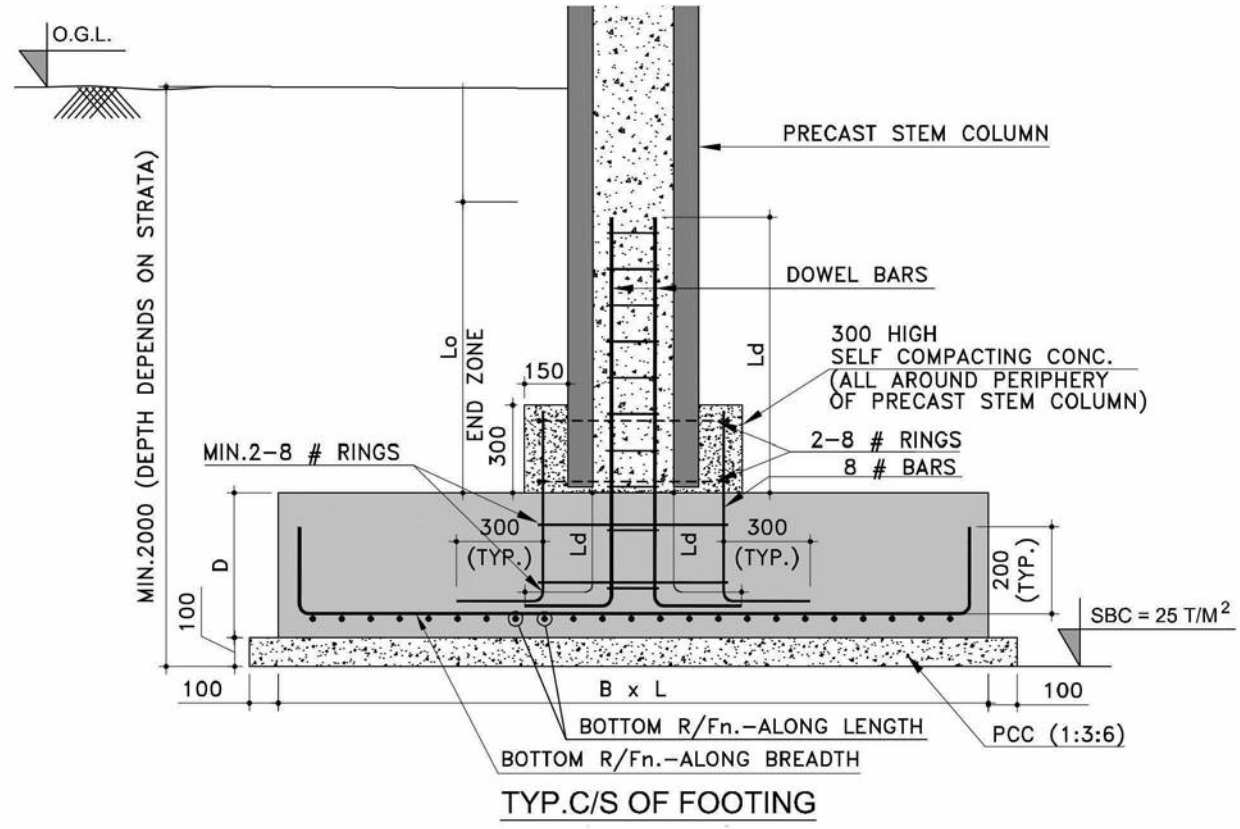
c) The thickness of shallow foundations was deep enough to allow for necessary anchorage (straight length for bars in compression & length including bend for bars in tension) of column reinforcement.

d) Severe exposure condition is considered for the foundations/ substructure as per tender stipulations and accordingly appropriate provisions as specified in IS: 456-2000 as regards to clear cover, grade of concrete, cement content, water-cement ratio etc. are complied with.

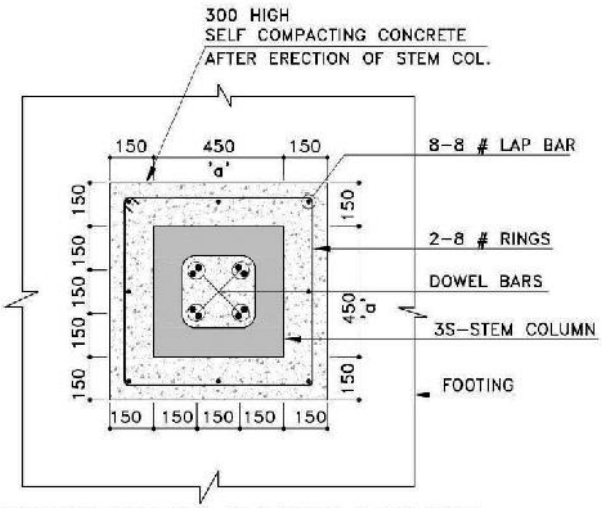
e) Minimum M35 grade of concrete has been used for RCC structural elements in sub-structure.


FOUNDATION LAYOUT
(SBC-25 T/M²)
SCHEDULE OF FOOTINGS
REFERENCE DRAWING
NOTES
REVISION STATUS AND DETAILS
RELEASED
Dr. K. S. JANGID
SHIRKE
BLDG TYPE-EWS (G+5)
B. G. SHIRKE CONST. TECH. PVT. LTD.
LIGHT HOUSE PROJECT
FOUNDATION PLAN AND DETAILS (SBC-25 T/M²)
TYPICAL PLAN OF FOOTING
TYPICAL DETAILS OF DOWEL BARS FOR STEM COLUMN 450X450
SECTION AT B-B
SECTION AT A-A
TYP.C/S OF FOOTING
SCHEDULE OF STEM COLUMN DOWEL BAR
CONC.GRADE M40 STEEL GRADE-Fe500D
SCHEDULE OF STEM COLUMN MAIN BARS
CLEAR COVER-40MM, CONC.GRADE-M40, STEEL GRADE-Fe-500D

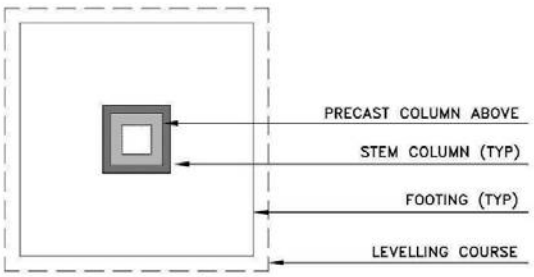
RCC Footing



TYP.C/S OF FOOTING



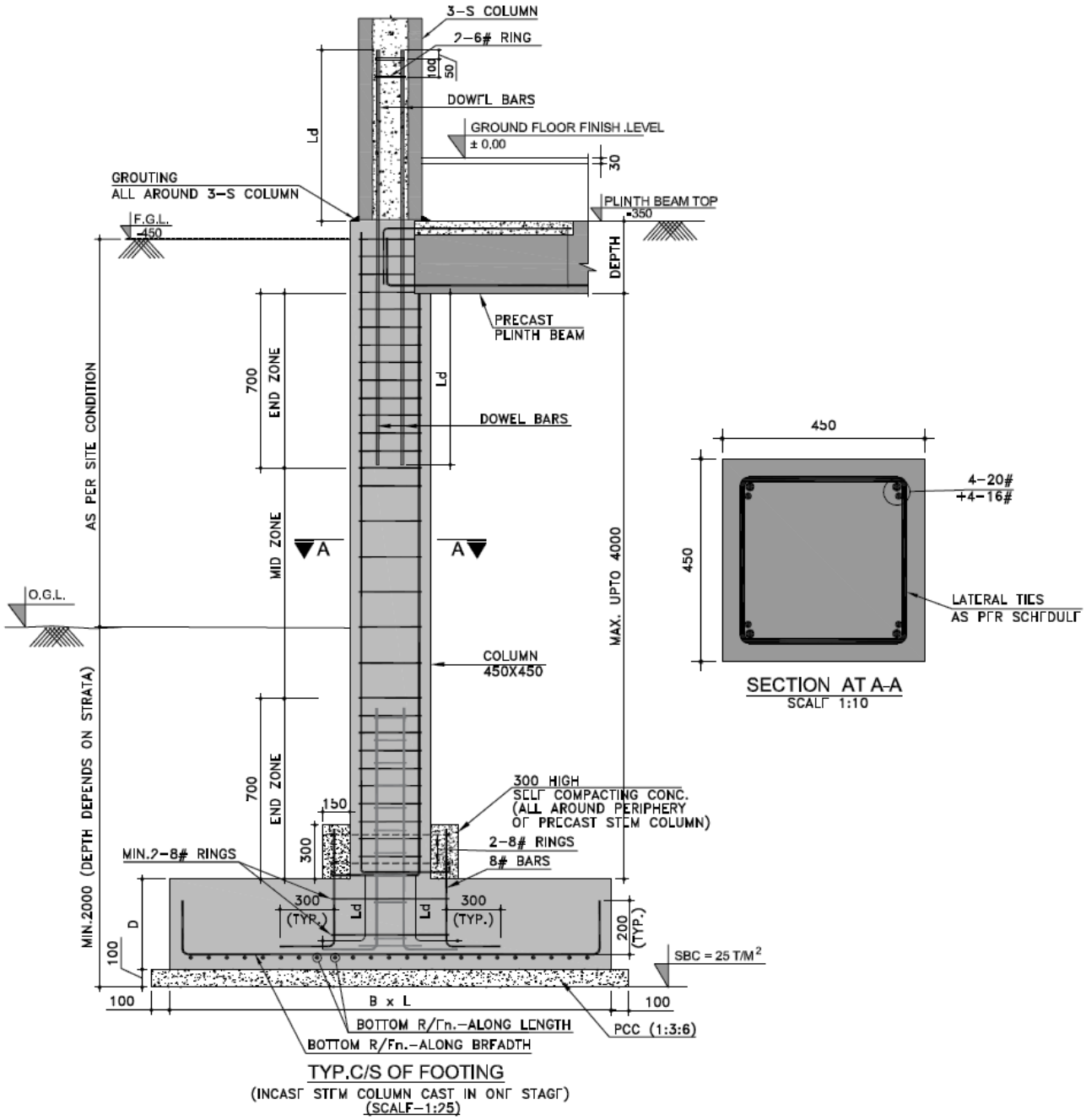
TYPICAL DETAILS OF DOWEL BARS FOR
PRECAST STEM COLUMN 450X450



TYPICAL PLAN OF FOOTING

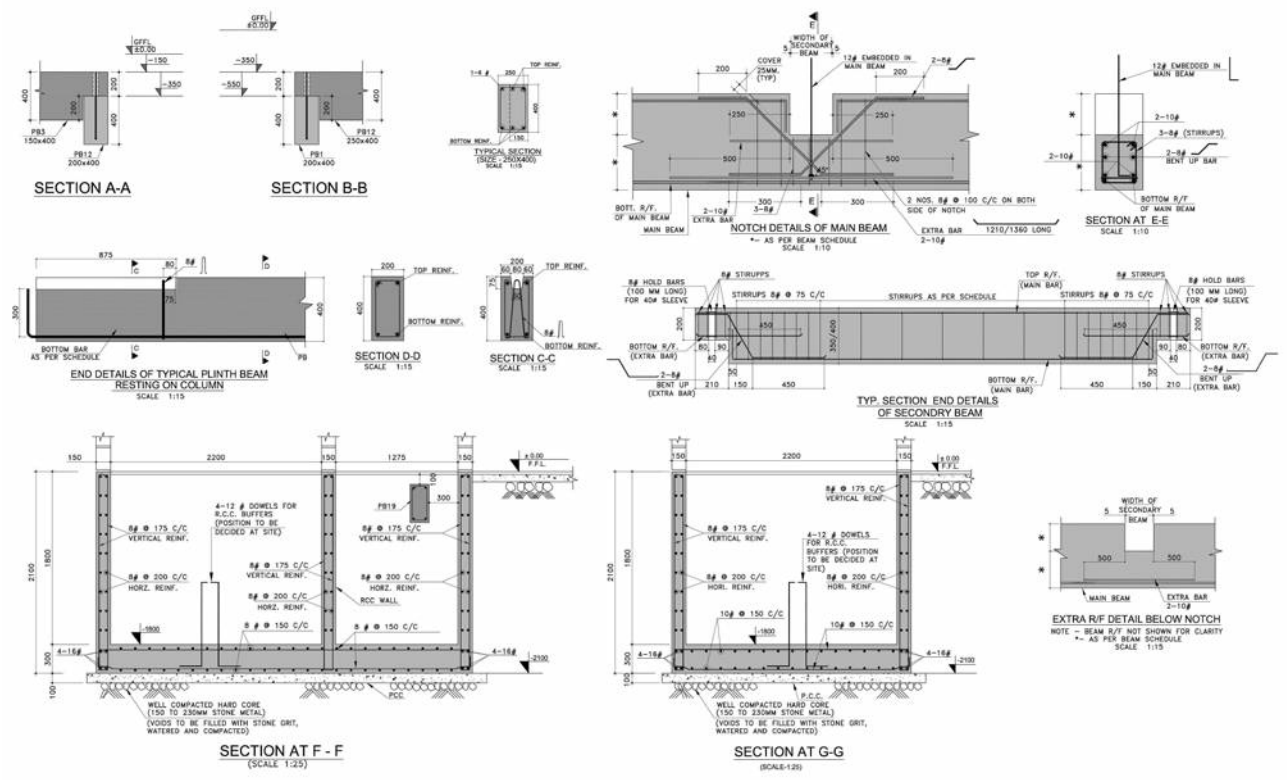
Stem Column

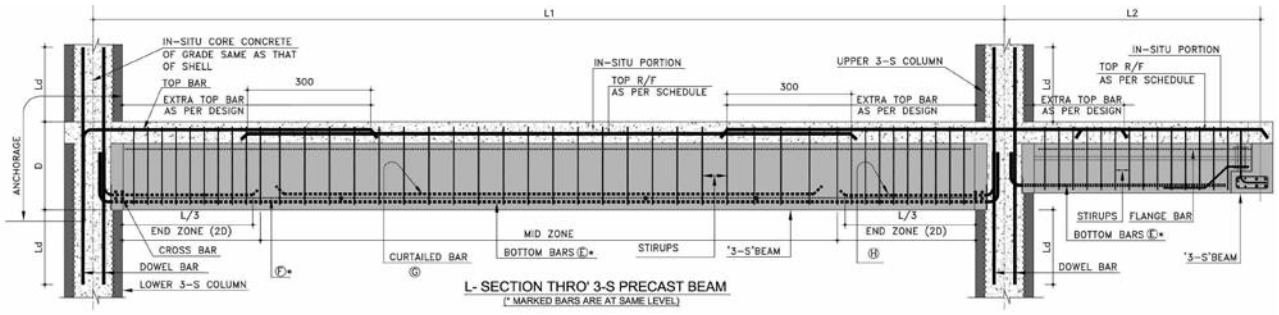
The typical stem column is of 450mmX450mm size and its' height is upto the plinth beam. Main bars consist of 4No 20 dia and 4 no. 16 dia. The grade of concrete used is M40. Column core is formed by using EXPAMESH which acts as a sacrificial formwork to maintain the dimensional accuracy. Clear cover to reinforcement is kept at 40mm. OPC cement of grade 53 with C3A content (5% to 8%) has been used below ground level due to high chloride content in the soil as recommended in soil investigation report.



Precast Beams

As per the requirement of the building the various types of beam such as roof beam, floor beam, plinth beam, and lintel beam were manufactured in the casting yard.



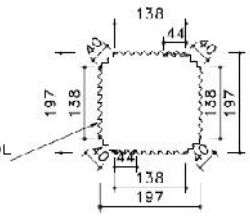


Precast Column

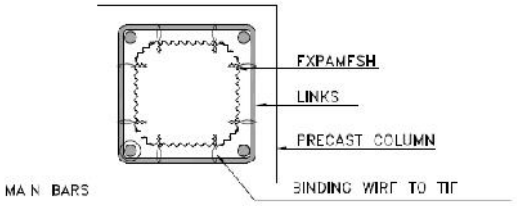
Typical size of the precast column in ground floor and upper floors is 350mm by 350mm having varying height depending upon the architectural requirement. Grade of concrete used is M40 and clear cover to reinforcement is 40 mm demolding of side shutter is done after 12 hours of concreting and 18 hours for bottom shuttering. Column core is formed by using EXPAMESH which acts as a sacrificial formwork to maintain the dimensional accuracy.

IMAGE OF EXPAMESH

200 X 200 X COLUMN HEIGHT BOX TO BE MADE USING TWO 400 MM WIDE X 0.4MM THK. MS EXPAMESH (Wt. = 1.40 KG/M^2) OF 6MM X 12MM APERTURE SIZE



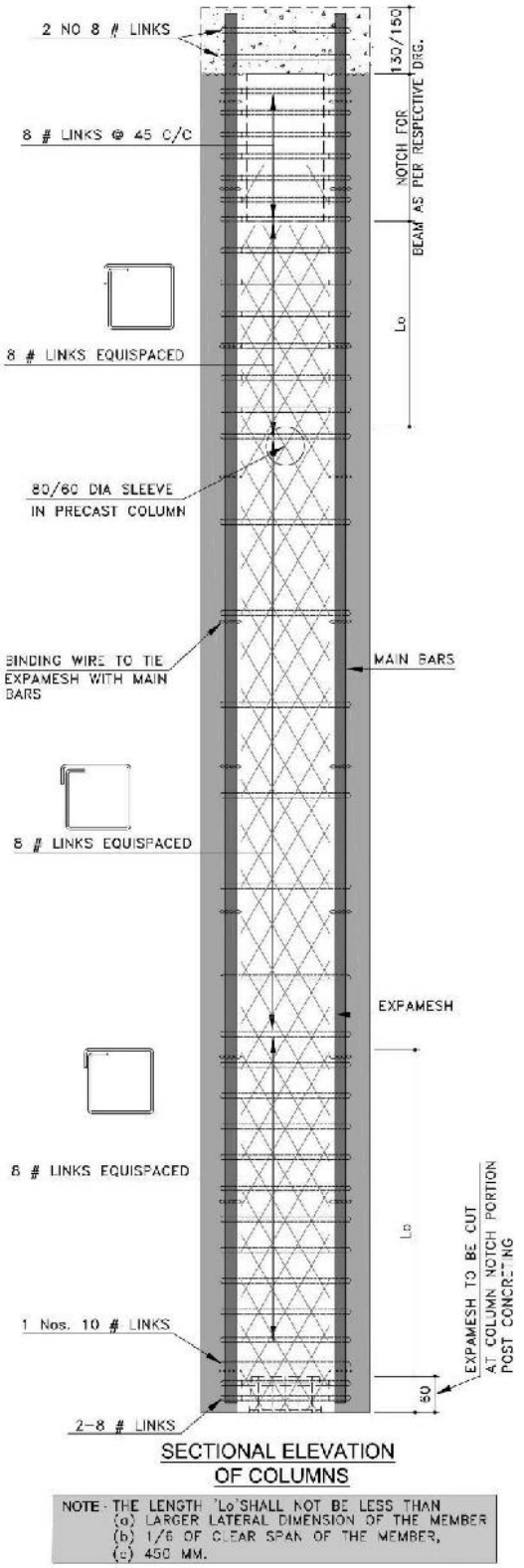
EXPAMESH DETAILS



DETAILS OF EXPAMESH

SCALE 1:10

COLUMN CORE FORMED USING EXPAMESH AS SACRIFICIAL FORMWORK

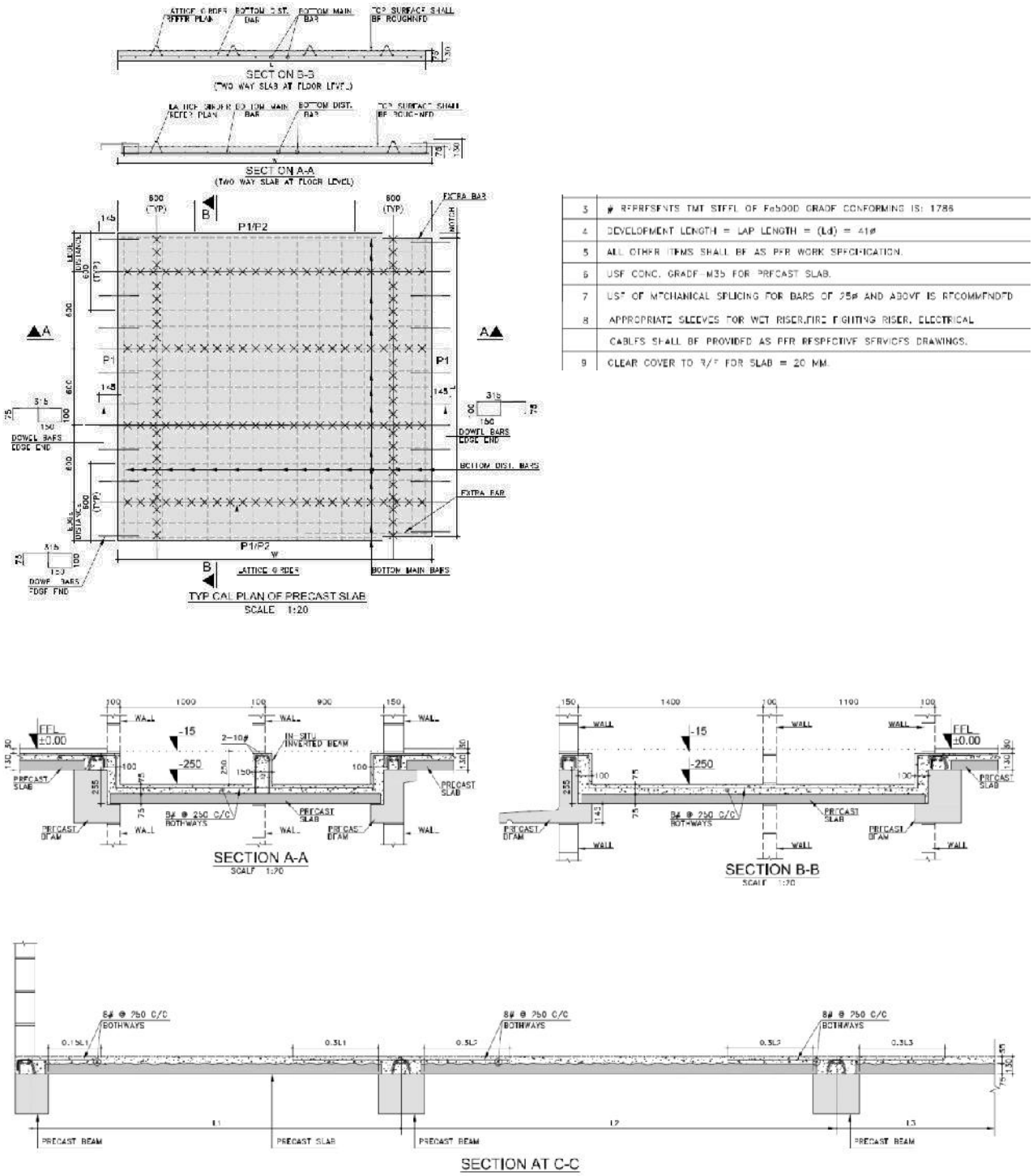


SECTIONAL ELEVATION OF COLUMNS

NOTE : THE LENGTH 'Lo' SHALL NOT BE LESS THAN
(a) LARGER LATERAL DIMENSION OF THE MEMBER
(b) 1/6 OF CLEAR SPAN OF THE MEMBER,
(c) 450 MM.

Precast Slab

Floor/Roof slabs shall be composite Precast Reinforced Cement Concrete Solid Slab. Precast slabs shall have rebar lattice girders projecting above precast surface. Whenever, two or more panels are forming one slab of a room, such panels shall have in-situ topping of reinforced concrete laid over slab after erection and the thickness of such screed shall be as recommended in IS: 1893/ IS: 13920 there by making them "composite". Stair flight shall also be precast RCC. Reinforced cement concrete used for floor elements shall be minimum M35 Grade and minimum M40 Grade for vertical load bearing elements.



4.3.5 Concrete & Reinforcement Steel Specifications:

The following specifications of concrete and steel have been used:

- Isolated footing / combined footing have been used of varying size depending on the load.
- The footing is designed for SBC of 25 T/m^2 as calculated in soil investigation report.
- After leveling off the ground 100 mm thick PCC is placed and depth of the footing is 450mm.
- M35 grade of concrete has been used with cover of 50mm. reinforcement has been placed as per the drawings.
- Dowels are left in place to place the precast stem column self-compacting concrete is placed around the stem column for its alignment.
- Anti-corrosive coating is applied on reinforcement in such sub-structure due high chloride content in the sub soil.
- Exposed surfaces of RCC in sub-structure have been applied with bitumen paint before refilling.

Chapter 5:
Description of Technology

5.1 Details of Construction System

The construction system used in LHP at Chennai is one of the technologies from the broad group of Precast Concrete- Concrete Components Assembled at Site. It is also popularly known as 3S system, 3S stands for Strength, Speed and Safety including sustainability. 3S system incorporates precast dense reinforced cement concrete hollow core columns, AAC blocks for masonry (outer and partition walls), T/L/Rectangular shaped beams, stairs, floor/roof solid Precast RCC slabs, lintels, parapets and chajjas.

Precast structural components are mostly casted in casting yard/factory. The units are responsible for manufacturing of components, their designing, cutting and transportation to the site. Casting yards /factory use predesigned steel moulds based on requirement of the project.

Comparison with the Conventional Construction:

The prevalent conventional construction system in India are Load Bearing Structure and Reinforced Cement Concrete (RCC) Structure which are primarily on-site construction using raw materials like cement, sand, aggregates, bricks etc.

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 the foundation 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 beams and columns to the foundation.

5.2 Advantages of Precast Construction over Conventional Construction

The Precast concrete Technology has a number of advantages over conventional construction. Some of the important advantages are listed below:

- Precast construction use causes reduction in construction time.
- The controlled factory environment brings resource optimization, and improved quality, precision & finish.
- Using industrial waste such as fly ash, GGBS etc., conserves natural resources.
- Increased safety on site
- Reduced wastage and non-generation of construction debris
- Minimizing air, water and noise pollution at work site.
- Minimal requirement of water for construction
- Elimination of use of timber / wooden scaffolding/ Shuttering.
- All weather site execution
- Cost saving due to compressed completion time and rental cost reduction
- Mechanized and standardized prefab products assure perfect and accurate shape/ size of entire structure, uniform cover, dense concrete, correct placement of reinforcement, high strength etc.

5.3 Precast Structural Components Used

Columns: Columns are most important structural member as it transfers loads from beam to foundation. Columns are casted in square, rectangular or circular in shape. These are initially casted in the form of hollow section with arrangements of dowelled connections.

Beams: Beams are the horizontal components which transfers loads from slabs to the columns. The sizes of the beam are designed to satisfy the structural requirement and according to the sizes and shapes of the column provided. Typical depth of beam is 16 inch to 40 inch and typical width is 12 inch to 24 inch. Prefab beams and columns provide flexibility in design, shape and application.

Beams and columns are produced with high strength concrete. It provides clean, finished surface for structural aesthetic of the building.

Slabs- The prefabricated slabs are manufactured or casted in factory and transported to the site by means of trucks etc. While erecting the slabs, silicon oil is spread over to its surface and metal mesh is placed over it which is covered by the layer of 40 mm thick slurry concrete of M25-30 grade (depending upon the requirements). Mesh and concrete layer give strength to type prefab slabs.

Staircase- The pre-cast staircase consists of two flights which includes floor landing to mid landing and mid landing to floor landing. According to design the reinforcements are arranged and while placing the reinforcements the moulds are oiled. The mould is designed in such a way that two flights staircase are cast at a time.

The basic materials used for making precast structural components are:
Concrete Conforming to appropriate grade based on environmental and structural requirements condition as per IS 456:2000
Reinforcement Conforming to Fe 415 Grade or Fe 500 Grade as per IS 1786:2008
Concrete Mix is designed based on the requirements and available materials. For LHP Chennai, Concrete of Grade M10, M15, M35 and M40 were designed keeping quality and durability requirements into consideration by IIT Madras.
As the natural river sand and Aggregate are not available in Chennai, the design mix was done using M sand and crushed aggregates.

Ground Granulated Blast Furnace Slag (GGBS) – an industrial waste from Steel industry was used to the tune of 15% to 25%. Use of GGBS allows replacement of Ordinary Portland cement, which in turn helps reducing CO_2 emission. Use of GGBS further improves the durability of concrete in aggressive environment. A typical Mix Design of M35 grade concrete using GGBS is given below:

4. Mix Design for M35 (OPC 43) Grade Concrete

1. Grade of Concrete	= M35
2. Grade of cement	= OPC 43 (ACC Cement)
3. Maximum Size of Aggregate	= 20 mm
4. Characteristic Strength, f_{ck}	= 35 N/mm^2
5. Target Mean Strength	= 43.25 N/mm^2

Basic Data

1. Specific Gravity of Cement	= 3.15
2. Type of Fine Aggregate	= M-Sand
3. Specific Gravity of Sand	= 2.59
4. Sand in Total Aggregate	= 44.5%
5. Type of Coarse Aggregate	= Crushed Rock
6. Specific Gravity of Coarse Aggregate	= 2.75
7. Coarse Aggregate (20 mm) in Total Aggregate	= 33.3%
8. Coarse Aggregate (12.5 mm) in Total Aggregate	= 22.2%

Materials for 1 cu.m of Concrete

✓ Cement (75%)		= 300 kg
✓ G.G.B.S – JSW (25%)		= 100 kg
✓ Water		= 164 lit
✓ Admixture content (Fosroc Conplast SP430)		= 2.80 lit
✓ Sand (M-Sand)		= 820 kg
✓ Coarse Aggregate:	20mm nominal size	= 408 kg
	12.5mm nominal size	= 612 kg

Mix Proportions:

C	:	W	:	FA	:	CA*
1.0	:	0.40	:	2.050	:	2.550

Result

Workability (Slump) = 120 mm

Compressive strength @

a. **7 days = 35.98 N/mm^2**

b. **28days = 49.34 N/mm^2**

11/02/2021

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Professor
Department of Civil Engineering
Indian Institute of Technology Madras
Chennai - 600 036, India

5.4 **Transportation of Components**:

The precast components manufactured in factory/ casting yard are transported through trailer trucks. The handling and transport of precast concrete elements are consistent with their shape and design to avoid stresses which could cause cracking or other damages.

- The components are transported on trailers and once the elements are lifted to load on the trailer or unload on the site, it is lifted at the support points as specified in the shop drawings.

- During loading and storage, the precast concrete element is protected from staining by using spacers of even thickness between each element

- The precast concrete element is unloaded in designated storage area. The identification marks on the panels are clear and visible.

- The precast elements will be loaded and delivered on trailer with proper supports, blocking, cushioning, etc. to minimize or prevent damage during transit.

- Precast elements are stacked on trailers based on their geometry and are separated and supported by dunnage aligned across the full width of each bearing location. The transported elements are securely tied down to prevent overturning or sliding

- The precast elements and their respective supports are positioned on the trailer so as to ensure optimum orientation and installation, and avoid any unnecessary off loading and double handling, whilst allowing for efficient and safe erection.

- Upon arrival at site a visual inspection of the elements is made by the site supervisors prior to unloading, to detect any defects that have occurred during shipping. A check is also made to ensure that the name and identification of each unit match the delivery note.

- In the case of any defect, the site supervisor refers the unit to the assigned QC personnel on site who will decide whether the unit is to be offloaded or sent back to the precast plant / casting yard.

- Prior to unloading the unit from the trailer, all the straps, chains, belts and bracings shall be completely removed in a safe way to ensure the stability of the remaining load.

- After unloading, the belts, chains, bracings shall be properly secured in the trailer chain tray and the trailer is then sent off the site.

- In the event where unloading is not possible upon arrival, then the trailer is positioned in a safe and secure location, parked, jacked and unhooked from the tractor unit. The tractor unit is then sent off the site to collect the next delivery trailer.

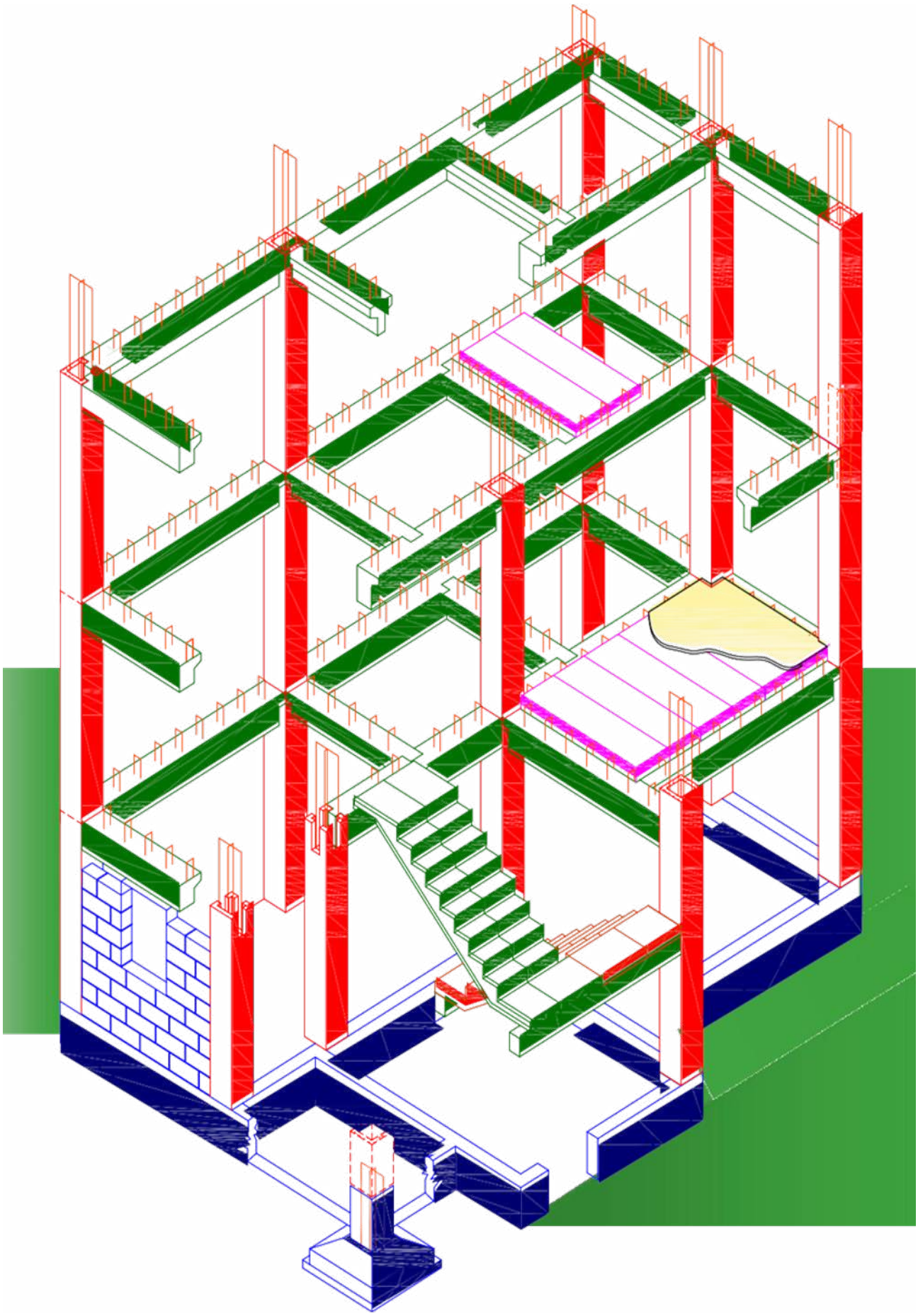
Precast components being received in truck at site

5.5. Installation of Components

Foundation is designed based on the prevailing soil condition and findings of geotechnical investigation It is constructed using conventional cast-in-situ method. The precast plinth beam is placed, and erection of prefabricated hollow core column is done.

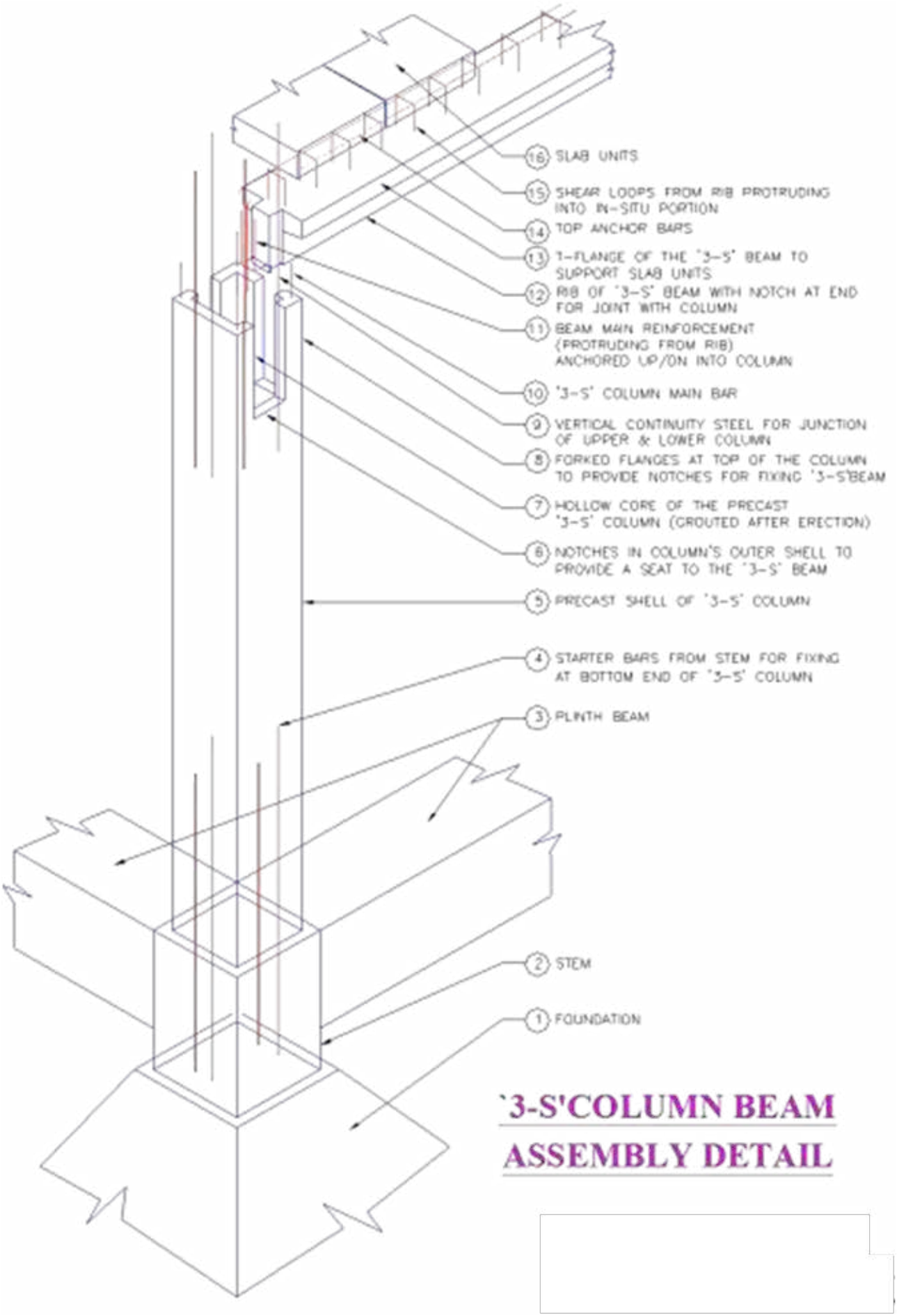
Hollow core columns are erected with the help of power crane above substructure, over which beams are integrated in the column notches followed by erection of slabs. Structural continuity and robustness is achieved through wet jointing using Dowel bars/ continuity reinforcement placed at connections and filling the in-situ self-compacting concrete in hollow cores of columns. All the connections and jointing of various structural framing components is accomplished through in situ self-compacting concrete/ micro concrete/ non-shrink grout as per design demand along with secured embedded reinforcement of appropriate diameter, length and configuration to ensure monolithic, continuous, resilient, ductile and durable behavior.

In order to get no eccentricity in columns, these are temporarily attached to the slab below with the help of wire rope arrangement. Then the dowel bars are inserted in these columns and grouting is done until the column is half filled with high strength self-compacting concrete. Primary beams are then allowed to rest on these columns at the notches as shown below. In order to check the level of beam, level flushing is done in which, the floor-to-floor height is measured. If the level of beam is lower by significant amount, then steel pads is used. After proper alignment, further four 20mm diameter steel bars are passed through the stirrups of beam with the required lap length placed inside the core of the column. Secondary beams are then placed keeping in view the location of notches. Similarly, alignment is checked, and then further reinforcements are tied. Then the prefabricated slabs are allowed to rest on the beams. Props are placed beneath to avoid formation of cracks due to self-weight. Further, reinforcements are provided which connects slab, beam, and columns together providing a stable and monolithic structure. This is followed by constructing shuttering for the entire floor and screeding is done in which the partially cast component attains their final dimensions. For the installation or erection of staircase, notches are made in the columns while casting in which the beams are allowed to rest. These beams are provided for supporting the mid-landing of the staircase. The beam should be arranged properly so that the level of mid landing is exactly at a distance equal the half of floor-to-floor height. After this the mid landing is allowed to rest on these beams and reinforcements are then provided. Then the prefabricated staircase is placed between floor landing to mid landing and then mid landing to floor landing.



Structural Configuration of the system

Beam – Column jointing



`3-S'COLUMN BEAM ASSEMBLY DETAIL

Prefab technology used in the LHP provides with crucial factors such as stability of the structure incorporating earthquake resistance, safety, adaptability to various climatic conditions, thermal insulation, acoustic insulation and conformity to the codal provisions. All the structural components are pre-engineered and manufactured in factories / site factories with objective quality control resulting into dimensional accuracy, correctness in spacing of reinforcement, uniform protective cover, full maturity of components and assurance on design strength due to use of design mix concrete having minimal water-cement ratio which ultimately results into durable structure.

5.6 Walling – Precast concrete structure is filled with AAC block masonry to complete the superstructure

AAC Blocks: AAC blocks used for walling are light weight Aerated Autoclave Concrete Block. It is manufactured through a reaction of aluminium powder and a proportionate blend of lime, cement, and fly ash or sand. It is a green product with high thermal insulation and sound reduction property.

Physical Properties of AAC Blocks as compared to Clay Bricks

Property	Units	AAC Block	Clay Brick
Size	mm	600 x 200 x (75 to 300),	230 x 75 x 115
Size Tolerance	mm	± 1.5	± 05 to 15
Compressive Strength	N/mm^2	3 – 4.5 (IS 2185 part 3)	2.5 to 3.5
Normal Dry Density	Kg/m^3	550 – 650	1800
Sound Reduction Index	Db	45 for 200 mm Thick Wall	50 for 230 mm Thick Wall
Fire Resistance	Hrs.	2 to 6 (Depending on Thickness)	2
Thermal Conductivity "K"	W / m-k	0.16 – 0.18	0.81
Drying Shrinkage	percent	0.04percent (Size of block)	-

AAC Blocks has following advantages over Clay Bricks

Parameter	AAC Block	Clay Bricks
Structural Cost	Steel Saving Upto 15percent	No Saving
Cement Mortar for Plaster & Masonry	Requires less due to flat, even surfaces & less number of joints	Requires more due to irregular surface and a greater number of joints.
Construction speed	Speedy construction due to its big size, lightweight & ease to cut in any size or shape	Comparatively slow
Quality	Uniform & Consistent	Normally varies
Fitting & Chasing	All kind of fitting and chasing possible	All kind of fitting and chasing possible
Availability	Anytime	Shortage in monsoon
Operational Energy Saving	Approx. 30percent reduction in air-conditioned load	No such saving

5.7 Functional Parameters of the technology Used

Durability
Concrete and cover requirement are as per durability clause of IS 456: 2000, to ensure adequate durability.

Fire Resistance Property of Block / Slab as Dwelling Unit
AAC blocks / Slabs used will have fire rating as per the NBC norms for dwelling units.

Thermal Behavior
Kvalue – 0.122 k cal/h/m^{o}c of AAC blocks.

Acoustic Comfort Test
For 150/100 mm ACC Wall, Sound absorption is 38 – 40 db

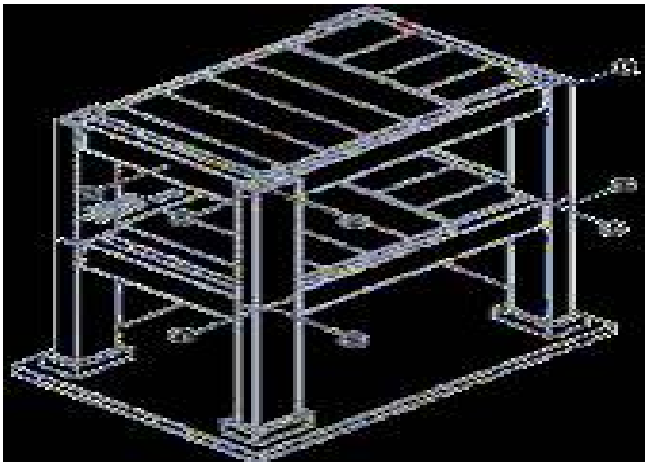
5.8 Structural Safety of the System

The Prefab construction system used in LHP Chennai conforms to relevant provisions of Indian Standard Code related to prefabricated construction and National Building Code (NBC) of India. It has successfully undergone testing/evaluation for different projects from time to time for structural safety of the joints against vertical and lateral loads.

Evaluation of Structural Requirement of Joints

Against vertical load Full Scale load test on assembly of precast elements by ToR Steel Research Foundation in India, Bangalore found it safe. Structural Design evaluation for HIG – II Buildings at Powai by Shri H.P. Shah; Stanford University found that based on the design concept, design calculation and detailing; the structure is safe against vertical loads, seismic loads and the wind loads. Scrutiny of design for S+24 type buildings by IIT Mumbai found it safe. Scrutiny of design details for Delhi project by IIT Roorkee found jointing & connections ensuring monolithic, durable & ductile behavior.

Full Scale Testing against seismic and wind load - A Test was performed by Central Building Research Institute, Roorkee BRI on full-scale building to establish behavior of various joints under all design loads including seismic Zone IV. The experimental results on Full Scale Building Structure demonstrated the desired performance and behavior of the 3S system under all loading condition as envisaged. When designed for use in Zone V, independent verification may be needed.



Full Scale testing

Full scale testing at CBRI, Roorkee

Services:

It is important to preplan the plumbing and electrical services. No special requirement for fixing of Services are needed. Services are fixed in similar way as is done.

Chapter 6:
Construction Process

6. Preparatory Activities at site

6.1 Mobilization of Plant and Machineries:

Being industrialised precast technology, heavy equipment and machineries are required for proper execution of work. Necessary machineries/ equipment was mobilised by the agency as required. The list of the Plant and Machinery deployed at the LHP Chennai is given below:

Table: Plant and Machinery used at Site

Sl. No	Particulars	Quantity Available
1	Tower Crane	05
2	Backhoe loader	02
3	Total Station	02
4	Auto Level	02
5	Tipper	01
6	Soil Compactor -12T	01
7	Needle Vibrator	06
8	Bar Cutting Machine	03
9	Bar Bending Machine	04
10	Stirrup Making Machine	02
11	Welding Equipment	07
12	Frequency converter	02
13	Plate Compactor	01
14	Transit Mixer	06
15	Concrete Pump	01
16	Hydra	05
17	Tractor	01
18	Open Truck	07
19	Batching Plant	01
20	Weight Bridge	01
21	Pick up	01
22	Mud Pump	06
23	Water Pump	04
24	Submersible Pump	11
25	Ambulance	01
26	D. G Set 125 KVA	05
27	D. G Set 62.5 KVA	01
28	QTK Crane	02
29	Skid Steer Loader	01
30	Winger	01
31	Front Loader	01
32	Winch Machine	04

6.2 Laboratory Setup

It is mandatory to set up quality control laboratory at the site. Accordingly, a site lab consisting of testing equipment was set up and periodic testing was done as required. The list of testing equipment in the site lab is given below:

Table: List of Testing Equipment

Sr. No	Equipment's Details	Quantity available at site laboratory (Nos)
1	2000KN compression testing machine	01
2	Slump Cone set	02
3	Vicat apparatus with Desk pot	02
4	Weighing scale 100kg capacity	01
5	Set of GI sieves 4.75mm to 45mm	01
6	Set of Brass sieves 75 micro to 4.75mm	01
7	Cube mould 70X70X70 mm	09
8	Cube mould 150X150X150 mm	36
9	Hot air oven 300-degreecelcius	01
10	Electronic balance 10 kg -50kg	01
11	Digital thermometer up to150-degreecelcius	01
12	Measuring jars 100ml,200ml, 500ml	01
13	Gauging Trowels 100mm & 200mm with wooden Handle	01
14	Verniercalipers 12" & 6" size (Normal)	01
15	Digital PH meter least count 0.01mm	01
16	GI tray 450X300X40MM, 300X250X40MM, 600X450X50MM	02
17	Mortar Cube vibrator	01
18	Hammer 1Ib & 2Ib with chisel	01
19	Le-Chatlier Apparatus+ Water Bath	01
20	Pressure Grouting Machine with accessories	01
21	Hot Pan with Tava	01
22	Flakiness and Elongation Index	01
23	Spirit Level	01

Laboratory for testing of materials at the site

6.3 Placement of Manpower Resources

Being EPC project, it was tender requirement that a multi-disciplinary project team of professionals including civil engineers, electrical engineers, mechanical engineers, management and IT was deployed for smooth operation of the various activities involved in the execution of the project from the start of the project.

The list of various professionals deployed by the construction agency as per the requirement of the contract agreement is given below:

B G SHIRKE CONSTRUCTION TECHNOLOGY PVT. LTD.							
Construction of 1152 EWS (G+5) units at LHP site at Chennai							
List of Technical Representative at site							
Sl.No		**Requirement of Technical Staff**		**Minimum Experience (years)**	**Required Designation of Technical staff**	**Designation of Technical Staff deployed at site**	**Total Experience (years)**
		Qualification	**Strength (No)**				
1		Graduate	1	20	Project Manager	Sr. DGM	31
2	a	Graduate (Civil/ Billing Engineer)	1	12	Deputy Project Manager	Construction Manager	22
	b	Graduate (MEP) Engineer	1	12	Deputy Project Manager	Sr. Engineer	12
3	a	Civil Graduate Engineer or Diploma Engineer	2	5 to 10	Project	Dy. Construction Manager	22
					site Engineer	Asst. Engineer	9
	b	Civil Graduate Engineer or Diploma Engineer	1	5 to 10	Quality Control Engineer	Sr. Engineer	23
	C	Electrical Graduate Engineer or Diploma Engineer	1	5 to 10	Project/site Engineer	Asst. Engineer	10
	d	Graduate Engineer/ MBA in project Management	1	5	Planning Engineer	Jr. Engineer	5
4	a	Civil Diploma Engineer	4	5	Supervisors	Asst. Engineer	10
						Jr. Engineer	10
						Jr. Engineer	7
						Jr. Engineer	5
	b	Electrical Diploma Engineer	2	3	Supervisors	Asst. Engineer	8
					Supervisors	Jr. Engineer	8
	C	Mechanical and Plumbing Engineer	2	5	Supervisors	Asst. Manager	23
						Asst. Engineer	7
	d	IT/ Communication / MCA	1	5	IT Engineer	IT Manager	26

6.4 Setting up of casting yard:

The technology used in the project requires casting of various components like columns, beams, slabs, staircase, sunshades and some other small components.

A casting yard was set up by the agency near the project site (within 0.5 km) for casting of columns, beams, staircase, sunshades etc. Partially precast slabs were produced in another precast yard few kilometres away from the site. All the precast components were transported to site as per the erection schedule.

Manufacturing of column

One Tower crane was provided at Pre-casting yard for Shifting of PRECAST Components. There were 32688 number of Precast components in Superstructure of the project which took about 127 days (from February 2021- July 2021) to construct. There was 318 Moulds deployed at site. A total of 6 pallets used for Slab Casting. On an average 260 components were casted on a daily basis in the casting yard. About 5 Tower cranes were erected near the buildings for erection of pre-casting Components constructed in the casting yard. The Prefab components were erected, aligned and connected using SCC i.e. Self-Compacting Concrete of appropriate grade along with secured embedded reinforcement.

6.5 Casting of Structural Components

Each building in the LHP Chennai project consists of prefabricated components like beams, columns, slab, staircase etc as per design. The requirement of these precast as assessed from the structural drawings were sent to the factory for the fabrication of the required component.

Moulds were fabricated with precision as per the required specifications. There was perfect coordination between site engineers and casting yard for production of components. As per prepared schedule and specification, the components were manufactured using designed reinforcement, concrete and curing and transported to the construction site.

6.5.1 Precast Beams

As per the requirement of the building the various types of beams such as roof beam, floor beam, plinth beam, and lintel beam were manufactured in the casting yard. A total of 2724 Plinth beam and 13260 Typical floor beams were casted. The production process involved placement of reinforcement, pouring of designed concrete, curing, and testing.

Curing on Manufactured Precast Beams

6.5.2 Precast Columns

The columns are as per the design requirements and include single core and multi-core hollow columns. A total 1272 Stem Column and 8208 Typical floor columns were casted for the project.

The construction of the columns is initiated by arranging the reinforcements as per the design. Before placing the reinforcement, the pallet should be oiled properly. These columns reinforcement is placed on the pallet along with the plates at the end to provide opening for the notches. After this, the pallet is moved forward with the help of lorry. The core is then inserted hydraulically. This is followed by pouring of concrete in the pallet with the help of bucket. The concrete in bucket is poured from the batching plant. After pouring, uniform spreading of concrete is done manually. For removing the voids, hydraulic vibrators are provided below the pallet. Core is taken out after the setting of the concrete. Proper surface finish is achieved with the help of floater machine. Further, the pallet is moved forward, and the entire pallet is covered with the plastic, so as to use the moisture generated by the heat of concrete is for curing.

Manufacturing of Precast Columns

6.5.3 Precast Slab

As per the requirement of the structural design, 8064 slabs were cast. Before placing the reinforcement, the pallet should be oiled properly. The reinforcement of the slab consists of a mesh and lattice girder. The mesh and the lattice girder are fabricated with the help of machines. These are the tied manually.

After this, the cover blocks are provided, and electrical conduits are placed. These reinforcements are placed on the pallet and moved forward with the help of lorry. The concrete is poured with the help of bucket having capacity of 3 cubic meters. The required slump of concrete is maintained to ensure proper casting and smooth finish.

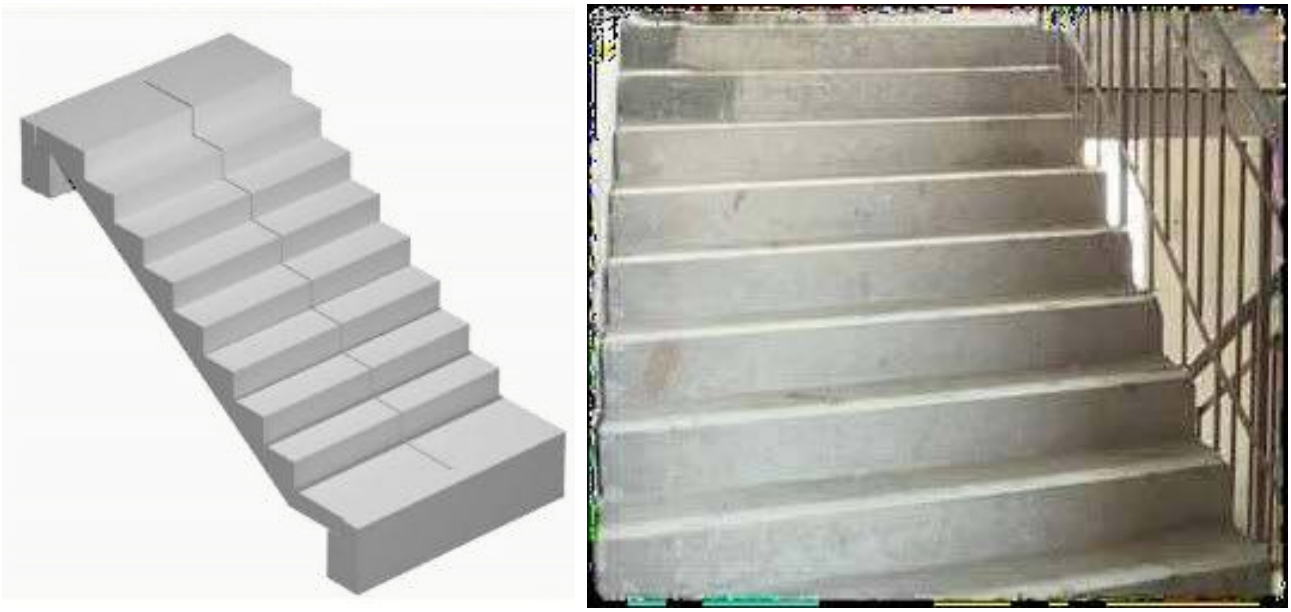
For removing the voids hydraulic vibrators are provided below the pallet. After pouring, uniform spreading of concrete is done manually. Thereafter the concrete is compacted the pallet is moved forward in the curing chamber or taken to stack yard for water curing as the case may be.

For identification purpose the slabs are marked and then moved further for curing in the stacking yard. Before dispatching the concrete 7-day curing is done.

Manufacturing of Precast Slab

6.5.4 Precast Staircase

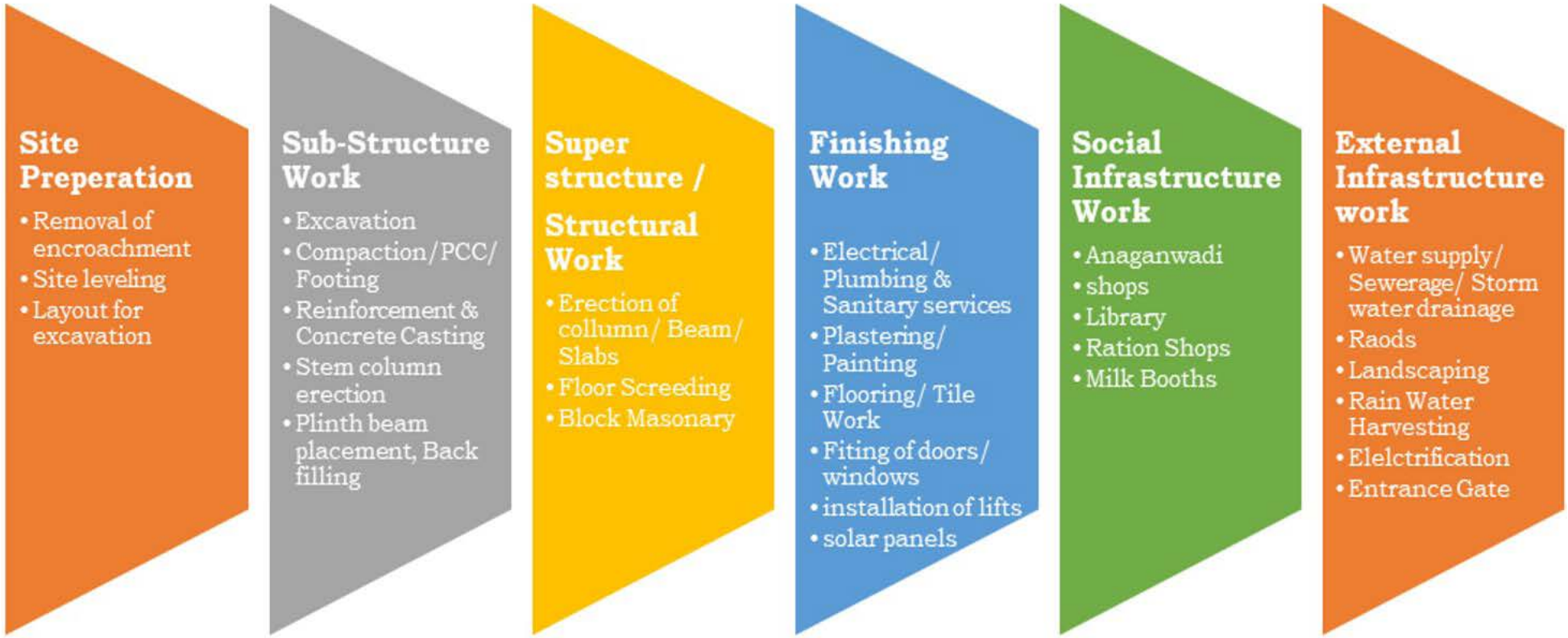
The pre-cast staircase consists of two flights which includes floor landing to mid landing and mid landing to floor landing. According to design the reinforcements are arranged and while placing the reinforcements the molds are oiled. The mold is designed in such a way that two flights staircase are cast at a time. The reinforcements are inserted in the mold manually. After this concrete is poured from the bucket with the help of remote-control cranes. After 24 hours the molds are removed and then lifted with the help of cranes and placed in the stacking yard. Curing is done for 7 days for dispatching the batch for erection to site. The prefabricated components after the curing are dispatched with proper inspection and registration along with its date and time. These components are then transported to the specified building site for erection purpose. The erection and construction of the buildings are done according to the design.



Precast Staircase

6.6 Construction Activities at Site:

Construction activities were as per Flow diagram given below:



6.6.1 Site Preparation

Removal of Encroachment

The Site earmarked for LHP had some encroachment. During the site visit, it was observed that there were 5-6 scattered houses on the project site. TNSCB got the site cleared before the start of construction.

Proposed site of LHP Chennai, Tamil Nadu

Clearing of site

Site clearing is normally the first operation to be done before the layout to be set out. It was observed that there was waterlogging of around 1.0m depth in approx. one acre area of the site. The contractor dewatered and started preparing the site for construction. Geotechnical investigation was started on the available land and was continued on the remaining land after dewatering was finished and encroachment was removed.

Clearing of LHP Site

Layout for excavation

After the site was cleared with the removal and disposal of all bushes, shrubs, fences and loose boulders etc from the topsoil, the levelling was done for preparation of site for setting out and excavation. After design and mobilisation are completed, the site was ready for marking / setting out and excavation.

Layout marking for excavation

6.6.2 Sub-Structure Work

Excavation

Due to incessant rains, the low-lying areas were waterlogged frequently during rainy season requiring use of heavy pumps for dewatering. As the local soil was expansive and not good for filling, it was brought from outside for filling.

Excavation of work at the LHP Site

Foundation work:

Plate Load Test

- Safe bearing capacity of 25t/m^2 has been considered for design of isolated and combined footing based on the soil investigation done at site by the construction agency.
- The construction agency also conducted plate load test to verify the SBC at representative locations.
- The plate load test was conducted at a depth of 3.0 m from ground level.
- Plate used for test was 0.3mX0.3m having area of 0.09sqm. Capacity of the jack 200KN.
- Least count of settlement gauge was 0.01mm and hydraulic pressure gauge of 10 kg/ sq.cm.
- Load increment was done for 24 hrs. Maximum load applied was 576KN. The gross settlement was 4.04mm which was well within the acceptable limit.

Plate Load Test at the LHP Site

RCC footing:

As per geo-technical investigations, bearing capacity, soil strata, water table, etc. Typical isolated footings along with some combined footings of varying sizes depending on the load are provided.

RCC footing work

Stem Column:

- Precast stem columns are placed on the RCC footing.
- Exposed surfaces of RCC in sub-structure have been applied with bitumen paint before refilling.
- Precast RCC Stem columns upto plinth level and connected with precast plinth beam.
- The stem columns have notches in which precast beams are placed.

Stem Column erection

6.6.3 Super Structure:

a) Industrialized 3-S (Strength, Safety, Speed) prefab method of construction is based on mass produced precast structural components (columns, beams, shear walls, slabs, stairs etc.) onsite or offsite.

b) The methodology of construction includes assembly of precast RCC hollow columns, beams and partially precast RCC solid slabs at site. The slabs shall have in-situ reinforced concrete laid on top after erection thereby making them monolithic.

c) The filler walls are of AAC blocks

d) Composite precast RCC solid slabs, precast RCC solid beams (T shape/ L shape/ rectangular) and precast dense concrete reinforced hollow core columns shells ***(core of which is concreted after erection using self-compacting concrete with the provision for suitable reinforcement for effective jointing),*** are manufactured in special steel moulds at site factory under stringent quality control and ISO/ OSHAS quality norms are proposed for frame structure.

e) The jointing of various precast RCC elements was done as **'Wet Jointing'** i.e. concreting with self-compacting concrete for achieving required rigid joints.

f) Moderate exposure condition is considered for elements in super structure.

g) Floor/Roof slabs shall be composite Precast Reinforced Cement Concrete Solid Slab.

h) Precast slabs shall have rebar lattice girders projecting above precast surface. Whenever, two or more panels are forming one slab of a room, such panels shall have in-situ topping of reinforced concrete laid over slab after erection and the thickness of such screed shall be as recommended in IS: 1893/ IS: 13920 there by making them "composite". Stair flight shall also be precast RCC.

i) Reinforced cement concrete used for floor elements shall be minimum M35 Grade and minimum M40 Grade for vertical load bearing elements.

j) Thermal comfort levels are ensured as per IS: 3792 by selecting walling material having thermal transmittance well within 2.56 W/m^2K.

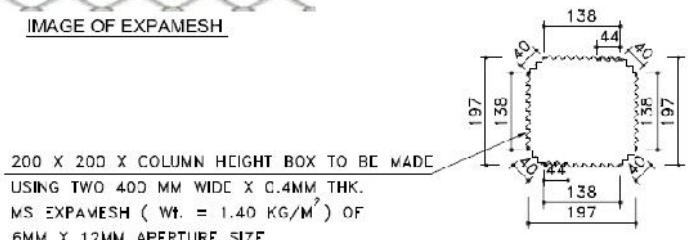
Super structure works of towers

Precast Column in Superstructure

- Hollow core precast columns are used which are filled with the self-compacting concrete after placement of precast beams for monolithic joint.
- A sleeve 60mm dia. is created in the column at the time of casting to insert a steel rode with hook to lift the column.
- A mesh of mild steel is placed in the hollow core column which acts as sacrificial form work.

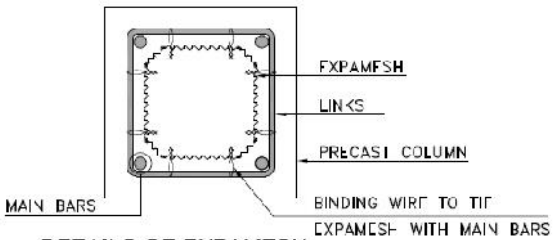
Assembly of precast columns and beam

IMAGE OF EXPAMESH



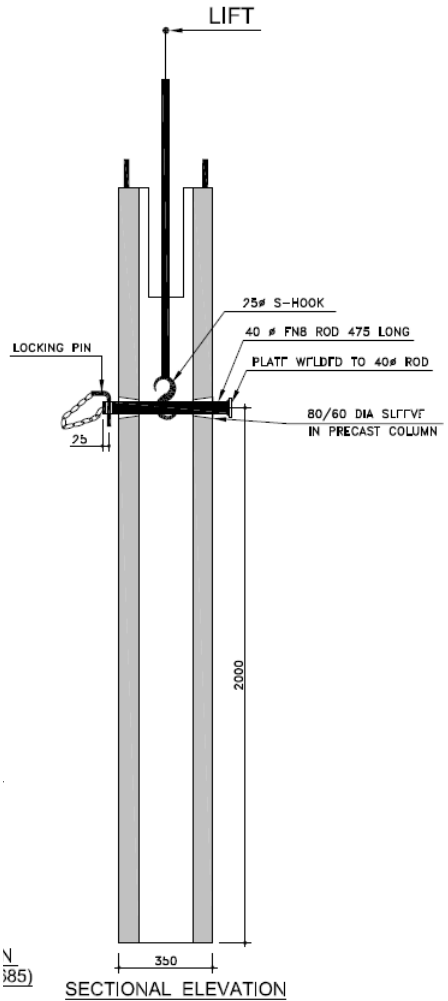
200 X 200 X COLUMN HEIGHT BOX TO BE MADE
USING TWO 400 MM WIDE X 0.4MM THK.
MS EXPAMESH (Wt. = 1.40 KG/M^2) OF
6MM X 12MM APERTURE SIZE

EXPAMESH DETAILS

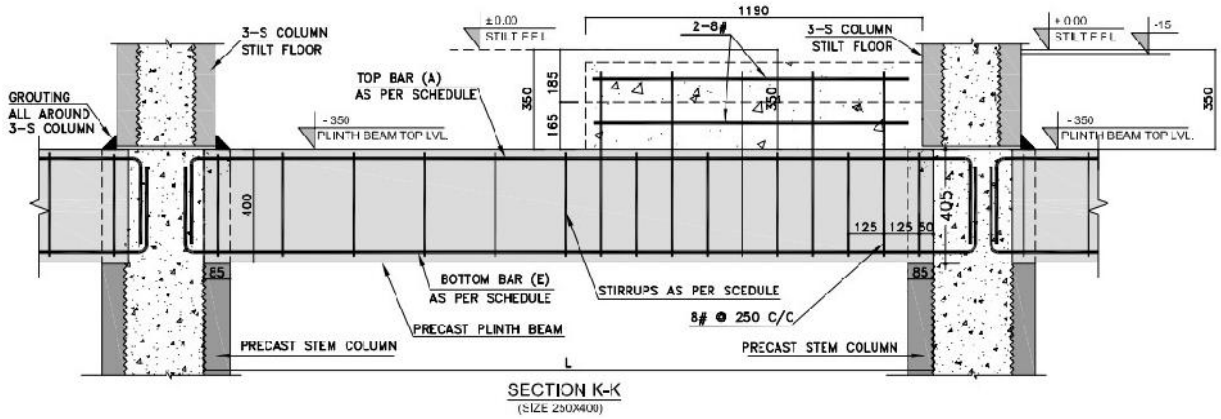


DETAILS OF EXPAMESH
SCALE 1:10

COLUMN CORE FORMED USING EXPAMESH
AS SACRIFICIAL FORMWORK



SECTIONAL ELEVATION
LIFTING COLUMN DETAIL



SECTION K-K
(SIZE 250X400)

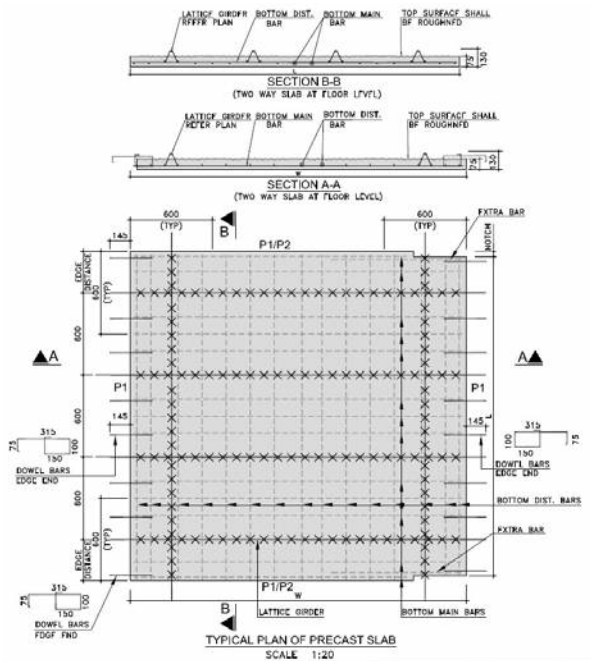
Precast RCC solid beams

- Composite precast RCC solid slabs, precast RCC solid beams (T shape / L shape / rectangular) and precast dense concrete reinforced hollow core columns shells (core of which is concreted after erection using self-compacting concrete with the provision for suitable reinforcement for effective jointing), are manufactured in special steel moulds at site factory under stringent quality control and ISO / OSHAS quality norms.
- The jointing of various precast RCC elements is done as 'Wet Jointing' i.e. concreting with self-compacting concrete for achieving required rigid joints.
- The production process involved placement of reinforcement, pouring of designed concrete, curing and testing.
- Plinth beam – 2724 numbers and Typical floor beam – 13260 Nos were casted

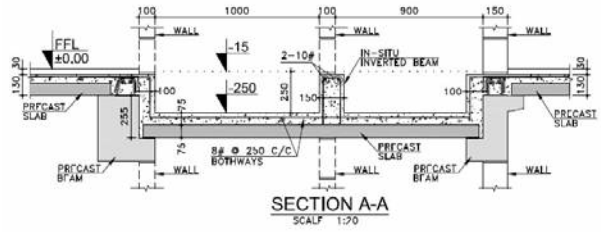
Precast RCC solid beams at site

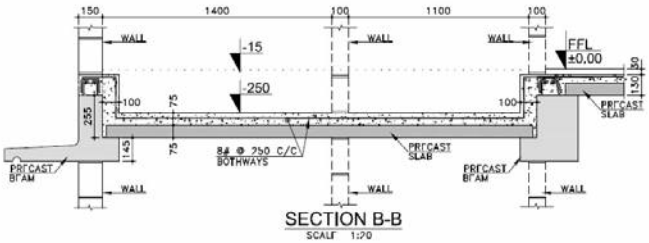
Floors/ Slab:

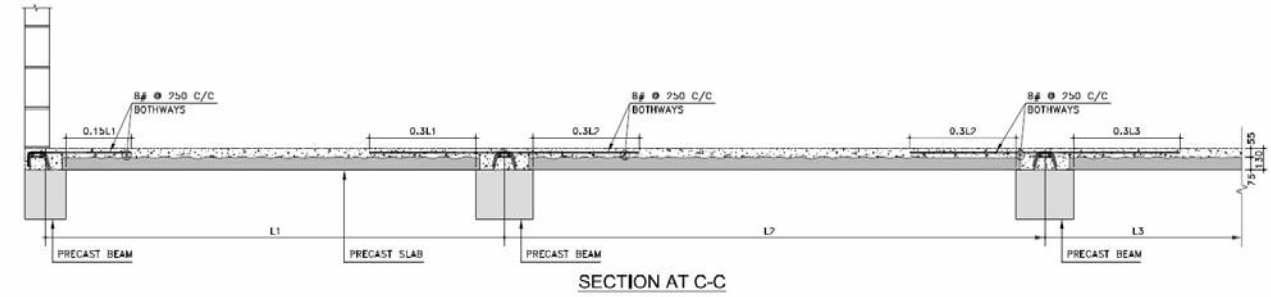
- After erection of beams and column, partially precast slabs are placed with required bearing on the beams.
- Finally the screed concrete (55mm thickness) is poured over the partially precast slab to ensure monolithic continuous action and ductile behavior of the structure.
- Structural integrity and 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.



3	# REPRESENTS TMT STEEL OF Fe500D GRADE CONFORMING IS: 1786
4	DEVELOPMENT LENGTH = LAP LENGTH = (Ld) = 41ø
5	ALL OTHER ITEMS SHALL BE AS PER WORK SPECIFICATION.
6	USE CONC. GRADE–M35 FOR PRECAST SLAB.
7	USE OF MECHANICAL SPLICING FOR BARS OF 25ø AND ABOVE IS RECOMMENDED
8	APPROPRIATE SLEEVES FOR WET RISER,FIRE FIGHTING RISER, ELECTRICAL
	CABLES SHALL BE PROVIDED AS PER RESPECTIVE SERVICES DRAWINGS.
9	CLEAR COVER TO R/F FOR SLAB = 20 MM.







Erection of Floor/Slab

Autoclaved Aerated Concrete (AAC) Blocks for Wall

After construction of frame with precast beam column and slab, internal walls are constructed using Autoclaved aerated concrete (AAC) blocks having density 451-550 kg/ m3 as per IS 2185 (Part-3).

Erection of wall by Autoclaved Aerated Concrete (AAC) Blocks

6.6.4 Finishing Work

Internal Finishes

This contains flooring, door & window work and painting works in residential as well as in social buildings. The finishing items used are as follows:

Sl. No	Materials	Approved make
1	Doors	Pressed steel door frame with flush shutters and PVC doors in toilets.
2	Windows	UPVC frame with glazed panel and wire mesh shutter are used in windows.
3	Floor Tiles	Vitrified tiles are used in flooring in rooms and kitchen.
4	Bath/Toilet Tiles	Anti-skid ceramic tiles are used in bath & WC.
5	Common Area Flooring	Kota stone flooring is used in Staircase steps.
6	Painting(External walls)	External surface made smooth with coarse putty before painting work. Painted with paints of approved make.
7	Painting (Internal walls)	Surface made smooth with putty before painting work if required. Walls painted with paints of approved make.

Wall Finishes

Living Room/ Bedrooms/ Ceiling	Low VOC Acrylic washable distemper
Kitchen	Low VOC Acrylic washable distemper
	Ceramic Tiles on all walls except inside the built-in cupboard
Toilets/ Bath	Ceramic tiles on all walls upto 1800 mm height.
External Finishes	As per the architectural design

Flooring

Living room, Bedroom, and Kitchen	Vitrified (600mmx600mm) laid as per CPWD specifications.
Toilets/ Bath/ Balcony	Anti-skid ceramic tiles 300mm x 300mm laid as per CPWD specifications.
Staircase	Pre-Polished Kota Stone in single length of treads & riser
Skirting / Dado / Wall Cladding	Skirting / Dado / Wall Cladding shall be matching with the floor with adhesive, as given below (i)100 mm high skirting matching the floor material (ii) 100mm of tile skirting & 800mm of oil paint in line with industry practice

Electrical and Plumbing services:

The plumbing and electrical services were incorporated as done in conventional method of construction i.e., chasing and filling. Details of fixture items included in the project are as follows:

Internal Electrical Fittings in each Dwelling Unit		
S.No.	**Description**	**Nos.**
1	Tube Light Point	3
2	Bracket Light Point	7
3	Ceiling Fan Point	2
4	Exhaust Fan Point	2
5	6Amps Socket Point	7
6	16Amps Socket Point	5
7	AC Point	2
8	Geyser Point	2
9	Fan Regulator	2
10	Ceiling Rose	5
11	TV Point	2
12	Bell Push	1
13	Buzzer	1
14	SPN DB	1

Internal Plumbing Fittings in each Dwelling Unit		
Sl.No.	**Description**	**Nos.**
1	EWC with PVC Flush Tank	1
2	Wsash Basin	1
3	CP Piller Cock	1
4	CP Waste Coupling 32 mm dia	1
5	CP Angular Cock	2
6	15mm dia PVC Connection Pipe	2
7	32mm dia flexible waste pipe	1
8	SS Sink	1
9	SS sink waste pipe 32 mm	1
10	CP grating plain	2
11	CP grating with pocket	1
12	20mm dia concealed stop cock	2
13	wall mixer	1
14	Two-way Bib cock	1
15	Health Faucet with 1mtr hose	1
16	Bib cock (long Body)	2
17	Soap dish holder	1
18	Towel rod 450mm long	1
19	Bib cock (Short)	1

6.6.5 Social Infrastructure

Following amenity buildings were also constructed using Precast system:

Anganwadi: 2 No. Built up Area 99.44 sqmt
Ration shop: 1 No. Built up Area 46.56 sqmt
Milk Booth: 1 No. Built up Area 16.48 sqmt
Library Building: 1 No. Built up Area 49.23 sqmt
Commercial shop: 6 No. Built up Area 62.16. sqmt

6.6.6 On Site Infrastructure and Site Development Works

i) **Water supply:** 3 underground tanks (capacity 1,36,000 litre each). There is automatic system for pumping of water to overhead tanks on building roof top. If required, pumping will be done two times during the day.

ii) **Sewerage system:** 1 STP (SBR technology) capacity (550 KLD). Provision of wastewater recycling is also done by providing two tanks of 5000 litre capacity each on roof top of the building for flushing purpose.

iii) **External Electrification:** Following Street lights, solar lights, Bollard Lights. Have been provided
   a) Astronomical timer control has been installed to control 100% of outdoor lighting.
   b) 68 numbers of LED Street Light of 90W with luminous efficacy of 120 lm/W.
   c) 10 no of LED bollard Light of 20W with luminous efficacy of 100 lm/W
   d) 04 no of solar street lights of 60W with luminous efficacy of 140 lm/w.

iv) **PV Solar System:** 3KWP X 12 Buildings = 36KWP capacity solar panels provided for lighting of common areas.

v) **Storm Water drains:** RCC drains with perforated covers.

vi) **Roads and Pathways:** Bituminous, CC roads and pavers for pathways / Parking.

vii) **Landscaping:** As per the drawing landscaping covered 6781.75 Sqm. area

viii) **Provision for Fire Fighting:** As the building height is less than 18.3 m, there is no requirement of NOC from local fire department. However, fire extinguishers (2 no. in each block) have been provided. In addition, water from the underground tanks will be available at the time of exigency.

ix) **Provision of lifts:** Two lifts (one 8 passengers and one 13 passengers) have been provided in each block. Total 24 lifts have been provided as per the requirement.

x) **Provision of Rainwater harvesting:** Provision of 4 no. rainwater harvesting pits has been made as per site area. The water table in the site area is already high and soil condition is clayey, therefore extensive arrangement of rainwater harvesting is not necessary.

xi) **Provision of solid waste management:** At the time of handing over, no provision of solid waste collection and disposal is made at site. The agency is advised to provided one bin (big size as per requirement) for each block. The disposal will be done by the Municipal staff on daily basis.

xii) **Compound wall:** precast RCC wall with fencing at top and entry gates (2 no.) provided.

Construction sequence of LHP Chennai through photographs

Excavation work for foundation

PCC and Shuttering for footings

Shuttering and reinforcement work for footings

Casting of footings

Erection of precast stem columns from footings

Precast plinth beam connection with stem columns

Placement of ground floor beam on columns

Placement of partially precast slab

Reinforcement for screed concrete on partially precast slab

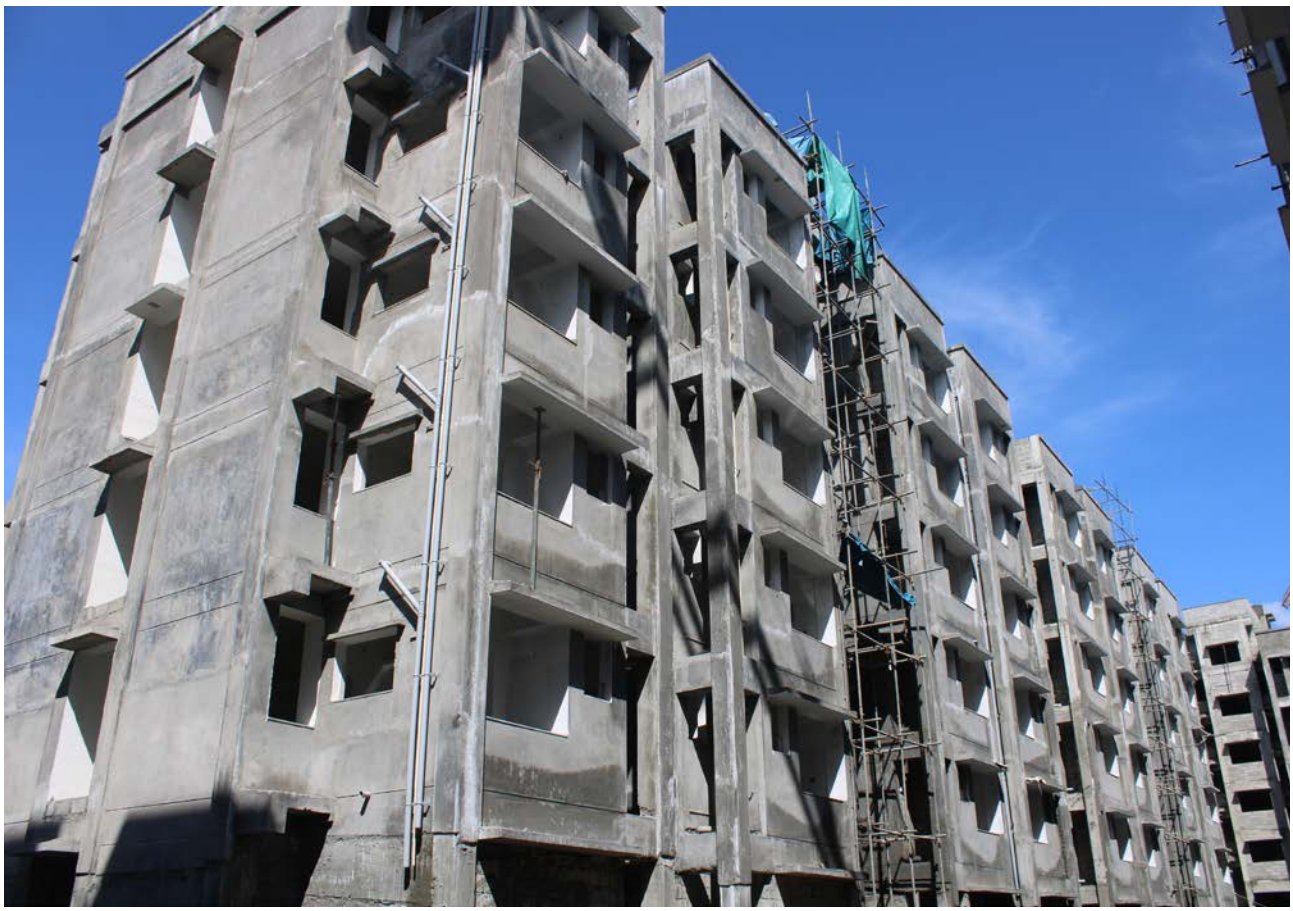
Monolithic RCC frame after screed concrete and wet jointing of beam, column and slab

Erection of beams, columns and slab in upper floors

AAC block masonry work

Externl plastering

External plastering



Building after external plastering

External painting

External painting

External painting

Horticulture & landscapping work

Horticulture & landscapping work

Horticulture & landscapping work

Horticulture & landscapping work

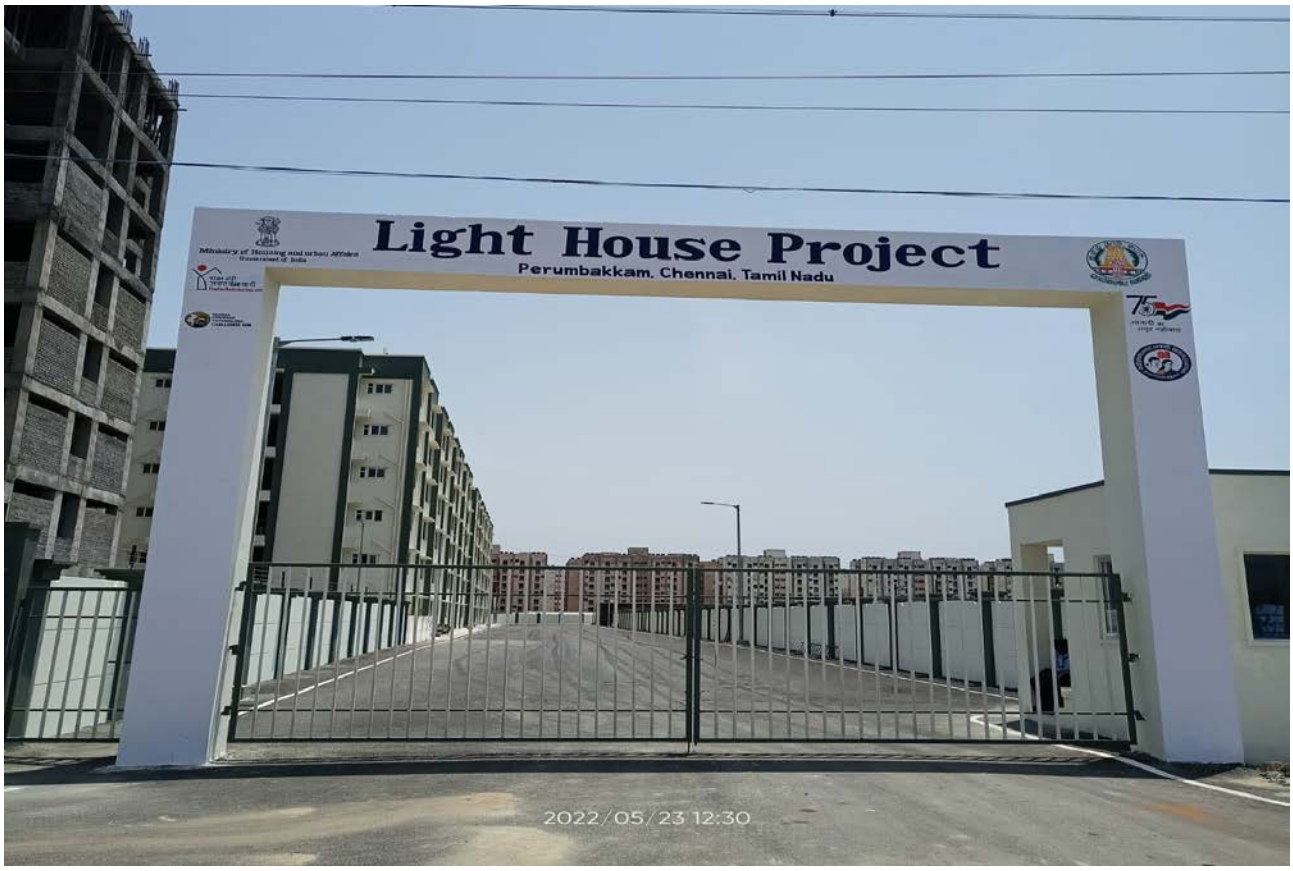
Sewer Treatment Plant Building

Roof top solar panels

Overview of project under completion

Overview of project under completion

Completed Project Photographs



Completed Project Photographs

Completed Project Photographs

Completed Project Photographs

Bedroom

Living Room

Completed Project Photographs

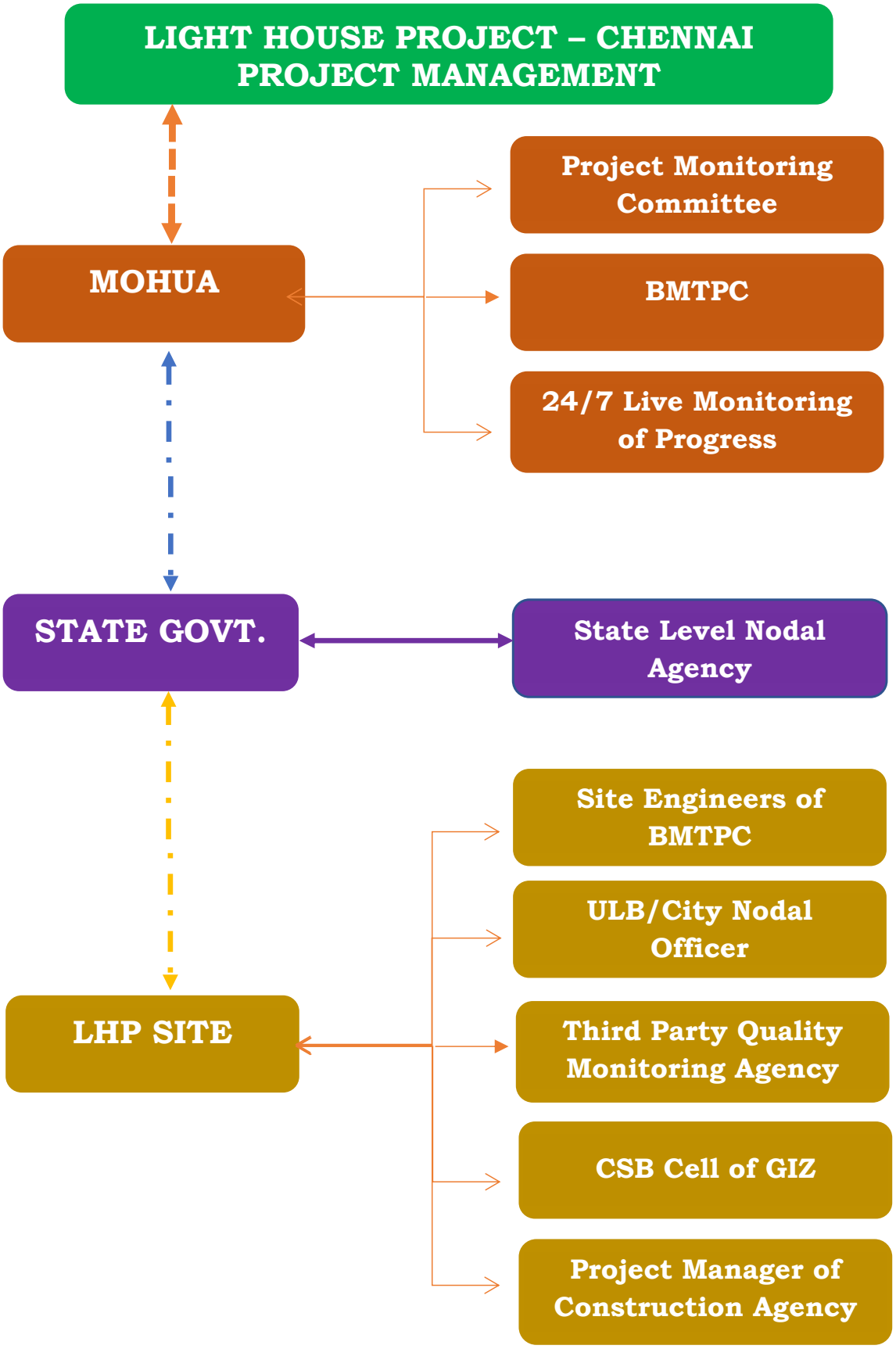
Kitchen

Bathroom and WC

Chapter 7:
Project Management

7.1 Project Management

Multi-tier monitoring mechanism was adopted to maintain quality and timely completion of the project as per approved Specifications and design. The arrangement is as shown below:

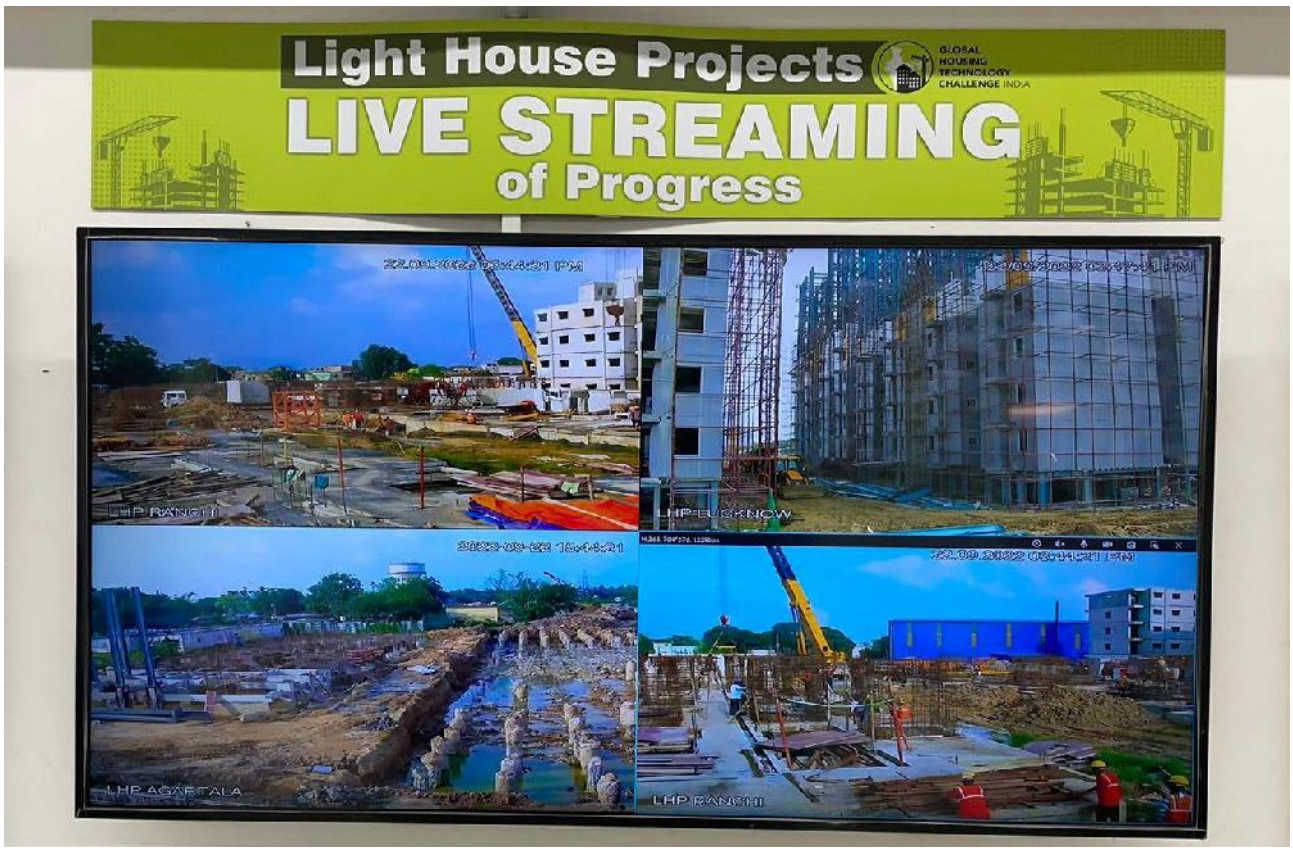


At the Ministry level, a Project Monitoring Committee under the Chairmanship of Secretary, Housing and Urban Affairs and Joint secretary & Mission Director, Housing for All along with representatives from BMTPC, CPWD, Resource Institutions (IITs and CBRI), IIT Chennai, TNUHDB was set up which periodically reviewed the progress of the work, resolving any important issues related to project both technical and administrative and guiding the Project team and agencies for timely completion of the project.

Building Materials and Technology Promotion Council (BMTPC) as a Technical Partner for GHTC-India, provided the necessary technical inputs as per the project requirements. An experienced Civil engineer from BMTPC was deployed full time at LHP Chennai site for day-to-day supervision and monitoring of the project.

Review of LHPs by PMC Members

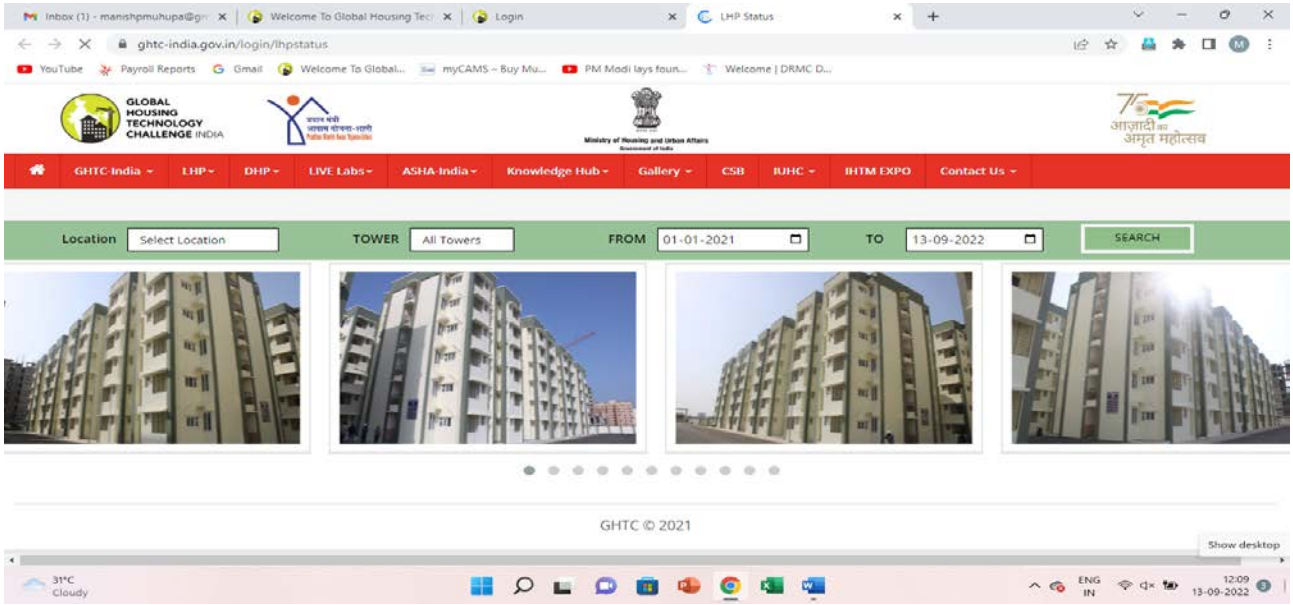
Further, the Ministry through its already identified event management agency i.e., Wizcraft International set up the high-resolution CCTV and HD cameras at the site. Through these cameras, high resolution live feed of the work on going at site was sent to Ministry for live viewing. Two large screens were set up at the Ministry wherein live feed of groundwork was available for the officials to view and take corrective action if needed. The 24/7 live telecast of work at live site in the Ministry was a unique experiment which helped the officials see the live work ongoing at the site, strength of labour at site, block wise progress and other details. Also, weekly videos and photographs of the work was sent to the Ministry for further dissemination.

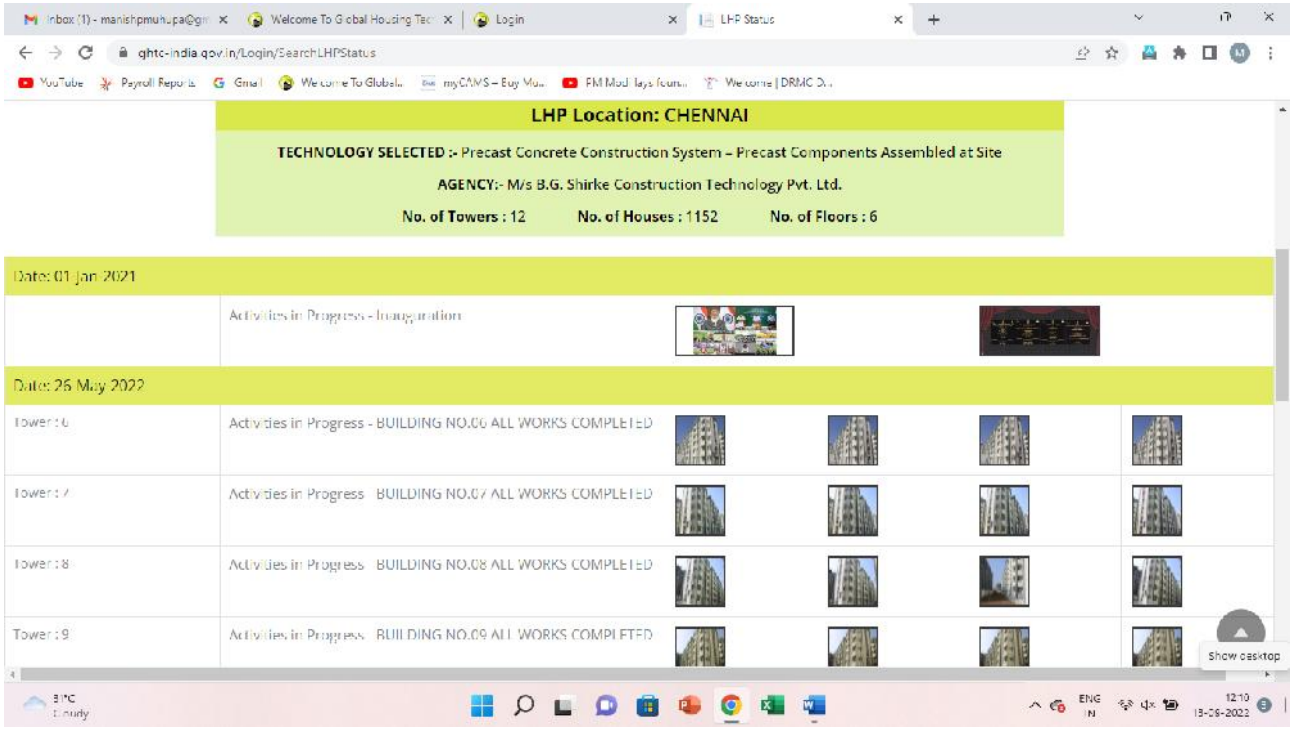


Live streaming of LHPs

The responsibility of the Project Team of the Agency (See), inter- alia, included preparation of phase wise (monthly) resource chart (materials, manpower and machinery), quality control and assurance, execution and supervision of work based on the project execution schedule as mentioned in contract conditions.

The Ministry on the GHTC-India website designed a module for the construction agencies of LHPs to upload daily pictures of work in each site. The Agencies were required to upload 10 pictures out of which the central team would monitor and approve at least 4 for final uploading. For this, the LHP construction agencies were given login IDs and passwords. Through this, pictures of daily work progress could be uploaded on the website for the general public to view especially on a particular date or period and in specific tower also.





Further, at the State level, the State Government of Tamil Nadu nominated one officer for entire implementation, monitoring of LHP. The nodal officer along with the technical team visited the project site on a periodic basis and the briefing was sent to the Ministry for corrective steps. For LHP Chennai, the State level Nodal Agency was Tamil Nadu Urban Habitat Development Board (TNUHBD) and Mr. A. Selvamani, Superintending Engineer; TNUHBD was nominated as Nodal Officer R. Sethupathy, Chief Engineer, TNUHDB for State representative for Project Management Committee and G. Sekar, Executive Engineer, Chennai Special Division I, for Program Engineer at LHP Project Site.

GIZ, which is a partner of MoHUA for Climate Change Programme also posted their Engineer/ architect fulltime for monitoring the progress and submitting independent report. These weekly ground reports included qualitative and quantitative issues of each tower of the project and were directly sent to MoHUA for independent analysis.

7.2 Quality Assurance

As per Contract Agreement, a “Quality Assurance” plan having Lot-size, number of required tests and frequency of testing were finalized for day to day quality control and assurance.

At the construction site testing lab for testing of compressive strength of concrete, setting time, workability of concrete, sieving of sand etc. were functional for day-to-day Quality Control and assurance.

Based on Quality assurance Plan testing were carried out and record maintained. At least 25percent of samples of materials including cement concrete cubes were sampled jointly by construction Agency and Third-Party Quality Assurance (TPQA) Agency for testing either in the site lab or NABL accredited laboratory.

Testing of strength of concrete

For independent assessment of Quality of materials and construction, as per the contract of Light House Projects, the bid for Third Party Quality Assurance (TPQA) for all 6 LHPs were invited from Govt Institutions/Organizations/ Central PSUs. A total 16 Institutions/ Organizations participated in the process & IIT, Madras (CUBE) being lowest bidder was awarded the TPQA work for all 6 LHPs including LHP at Chennai.

The main responsibilities of the TPQA Agency included:

- Checking and reporting, whether work was being executed according to the designs and specifications of the contract agreement and in accordance with the approved drawings,
- Ascertaining the quality of materials & components through test results, and reporting any instances of deviations from accepted quality of construction materials, workmanship and general quality of works at appropriate stages of construction
- Submission of report on Quality Control Aspects on Monthly basis

For the entire duration of the project, the Monthly Reports were submitted on regular basis including general observations on ongoing work & quality related issues. The quality issues/ reports were forwarded to Construction agency for its compliance. The compliance submitted by the construction agency on the issues were again checked & confirmed by TPQA Agency, for its closure. IIT Madras (CUBE) has completed the Quality assurance work of the project with the help of one of its Engineers regularly posted at site, intermediate visit of experts, and a team at its Centre guiding and supervising all activities.

7.3 Review by the Hon'ble Prime Minister

The LHPs are ambitious projects of Government, and the progress was monitored by the highest level. A mid-term review of the Light House Projects including that of Chennai was taken by Hon'ble Prime Minister on 03rd July 2021 where the progress of the projects was shown through Ariel survey by drone. The construction agency briefed the Hon'ble Prime Minister about the features of the project and showed the progress of the projects including specific work in each block through live drone.

Review of LHPs by Hon'ble Prime Minister

7.4 Site Visit to LHPs

The project has been visited by the officials of the Ministry of Housing and Urban Affairs, Govt. of India, Engineers of project Management Unit placed at HFA Directorate in the Ministry regularly to review the progress. On many occasions, the Secretary, MoHUA and other officials of MoHUA visited the site for reviewing the progress of the work. In March 2022, Shri Manoj Joshi, Secretary, MoHUA, had inspected and reviewed progress of LHP Chennai. Shri Joshi had chaired a meeting with concerned officials and other stakeholders and also visited the sample flats.

Visit of Sh. Manoj Joshi, Secretary, HUA, Govt. of India




Visit of Sh. Durgra Shanker Mishra, Former Secretary, HUA, Govt. of India

Visit of Sh. R. K. Gautam, Director (HFA-V), MoHUA, Govt. of India


Visit of Sh. Hitesh Kumar, Principal Secretary, (Housing and Urban Development Department), Govt. of Tamil Nadu


Visit of Sh. Govind Rao, Managing Director (TNUHBD), Govt. of Tamil Nadu


Govt. of Uttar Pradesh Task force visit to LHP Chennai

7.5 Safety Management

The Construction Agency ensured adequate safety measures at sites with necessary signages during construction and pre-casting which included Precautionary Signs for Working on Machinery. Maintaining Hoists and Lifts, Lifting Machines, Chains, Ropes, and other lifting tackles in good condition. Safety belts, protective equipment, helmet and other protective equipment were provided to construction workers. Adequate measures to prevent fires were also taken. Fire extinguishers and buckets of sand were provided in the fire-prone area and elsewhere.

The workers and other site staff were trained by the trainers on the health and safety measure to be followed while working for the project. Harness was mandatorily worn by workers while working on height.

Health and safety training conducted by trained by the trainers

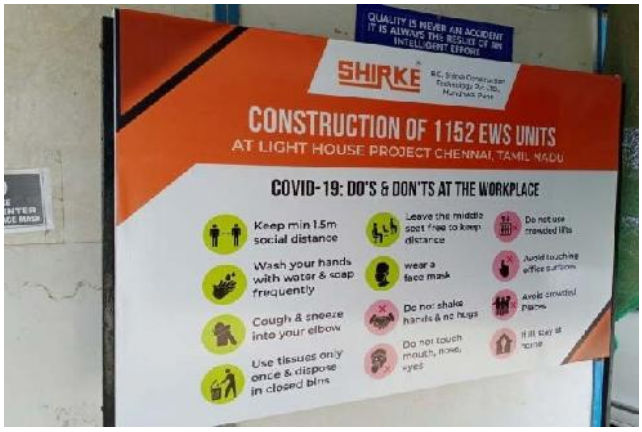
A safety park displaying safety equipment were set up at the construction site for bringing awareness on safety tools and instructions.

Health and safety training conducted by trained by the trainers

7.6 Signages

Health and safety signages help educating the construction workers in preventing injury and keeping themselves aware of health hazards while working. The construction agency had placed different signages as shown below across the site. They also conducted training and awareness program for the labour and staff on health and safety periodically.

Health and safety signages at the LHP site



Health and safety signages at the LHP site

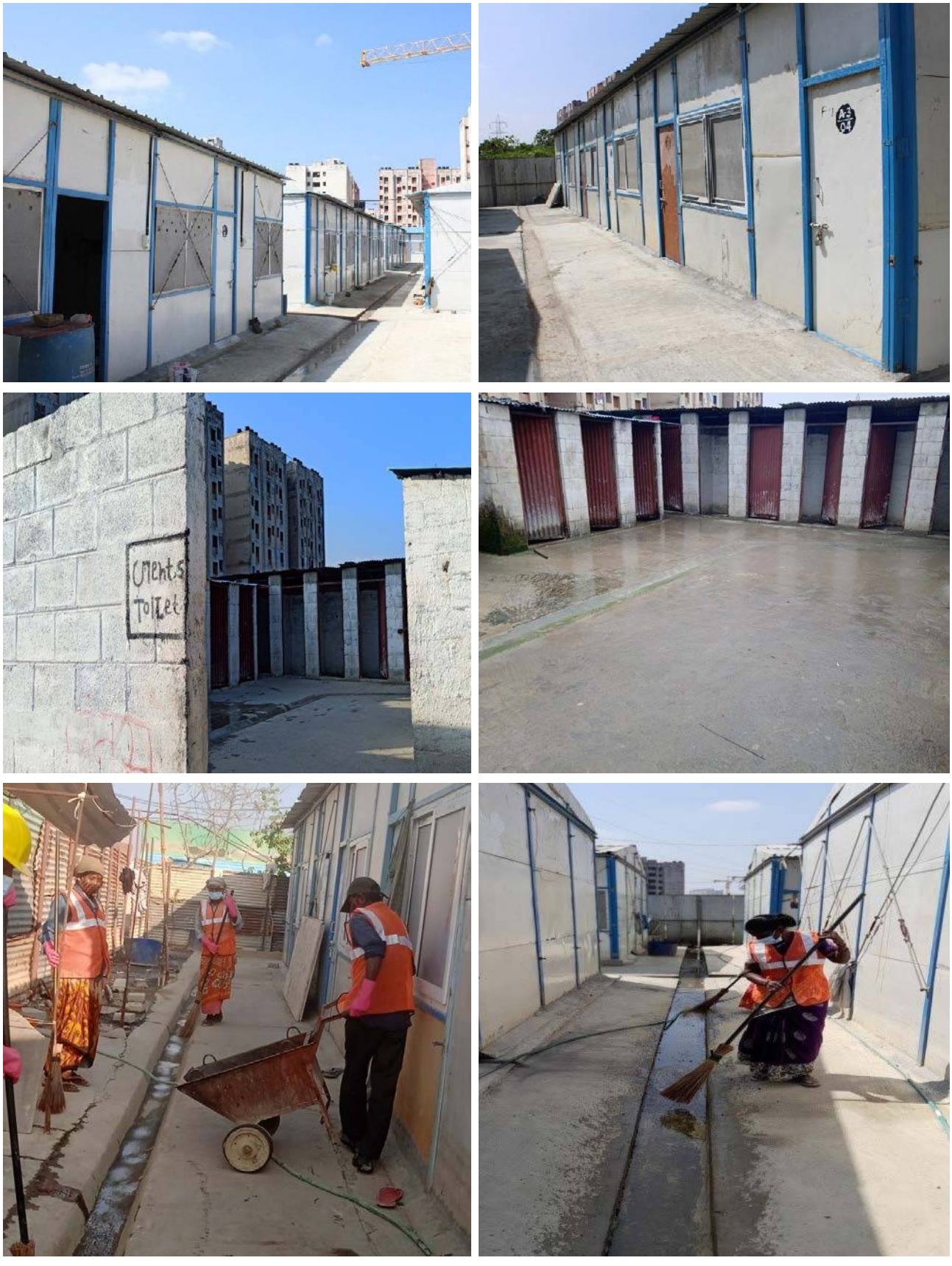
7.7 Labour welfare facilities

The Construction Agency had taken care of Welfare measures for construction workers during the entire period of the project. Welfare measures/ facilities provided include the following:

- Awareness training for housekeeping workers
- First Aid facility At the LHP Site
- Neat and clean Labour colony at the site
- 14 Male Toilets and 8 open Shower area.
- 09 Female Toilets and 5 Bathrooms.
- Drinking water facilities
- Regular medical camp conducted for COVID 19 for vaccination and testing at site.
- Thermal screening of staff and labour at main entrance of site.
- All working platform of top mast painted with red colour to indicate the level and to avoid over run of working platform.

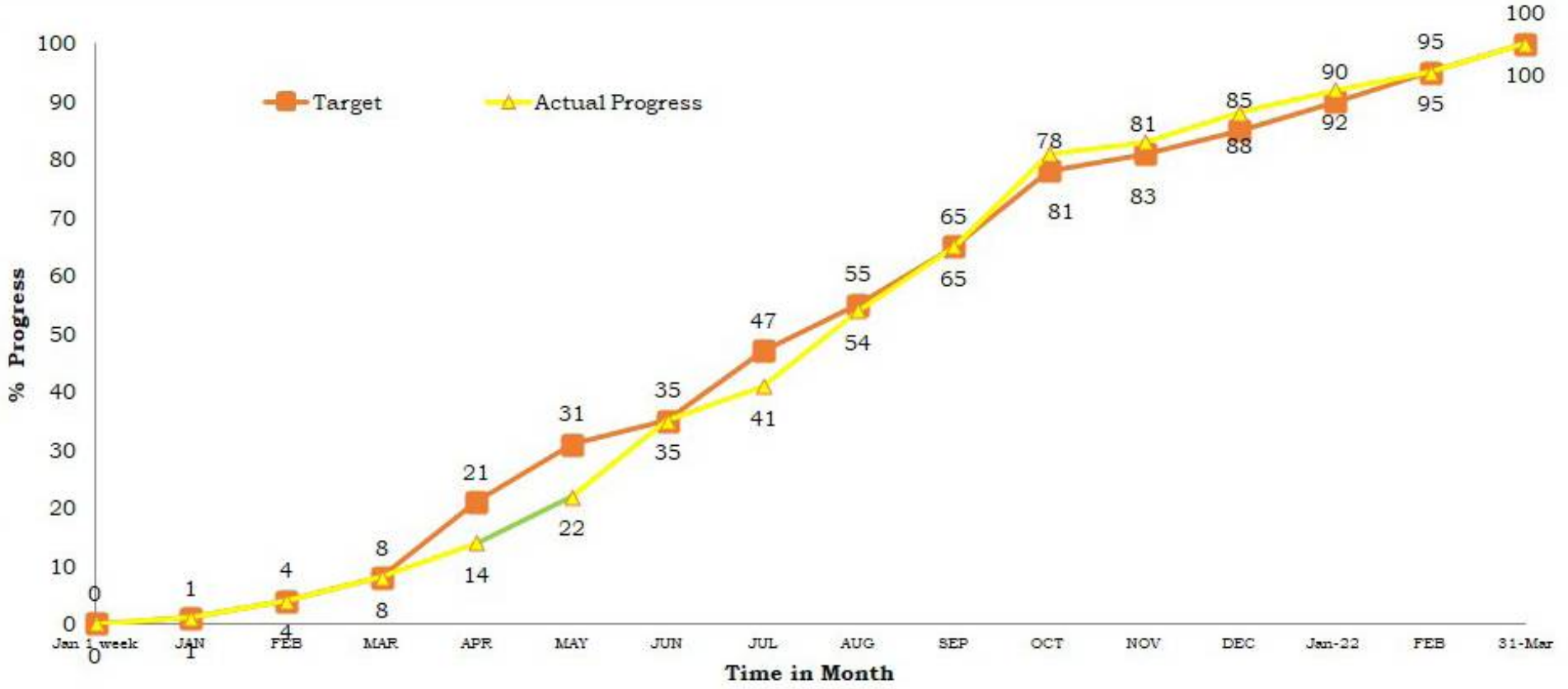
Covid-19 vaccination of labours

M/s B.G.Shirke, had provided accommodation facilities/shelter, adequate number of separate toilets facilities for male and female, washing facilities, creche/daycare centre for children's of labour, a place to warm up and eat the food, drinking water facilities etc. at the site as basic facilities for construction workers and their families.



Facilities for labour at the LHP Site

7.8 Timeline of the Project



7.8 Identification of Beneficiaries

The beneficiaries for Light House Project, Chennai have been identified by the State Government of Tamil Nadu as the operational guidelines of Pradhan Mantri Awas Yojana –Urban.

The beneficiaries of LHP Chennai are belonging to the Economically Weaker Section (EWS) and have paid Rs. 1.5 Lakh for house. The allotments of these houses are on the name of the female households of the family.

Beneficiaries of LHP Chennai

7.9 Post Construction Operation and Maintenance

After completion of the project in all respect, a Completion Certificate was obtained by the Construction Agency from Chennai Metropolitan Development Authority. The project was handed over to Tamil Nadu Urban Habitat Development Board (TNUHDB) with all documents and inventory list of all works.

A Resident Welfare Association has been formed by the Resident Beneficiaries for managing the maintenance and operational activities. Normal routine maintenance of the LHP will be the responsibility TNUHDB). However, for any remedial measures pertaining to structural issues/ major distress occurring in the LHP will be taken up by the agency at their own cost for a period of five years from the date of completion of project. A team of Civil, Electrical and Plumbing Engineers gas been deployed by the agency for one year to take care of routine maintenance and operation of building and infrastructure works

The agency has also provided the required maintenance Manuals and will be providing necessary training to officials of TNUHDB regarding relevant measures required.

Chapter 8:
GRIHA & Aspects of Thermal Comfort

8.1 Thermal Comfort:

The LHP Chennai is well planned with more than 11% green area keeping functional needs of prospective occupants in mind. Dimensions of habitable rooms, Kitchen, bathroom, toilet conform to the requirements of National Building Code. Planning takes care of requirements of proper orientation, air circulation, accessibility and thermal comfort. Thermal Comfort Housing for families belonging to low- and medium-income group is focused for urban households in India. The design of the new affordable housing must ensure acceptable level of thermal comfort for the occupants without the use of air-conditioning, which majority of the occupants are unable to afford. A proper design of building envelops to generate the required thermal comfort in affordable housing is a critically important.

The LHP in Chennai with Precast Concrete Technologies – Components assembled at site has been planned and constructed with such specification and layout which would give better thermal comfort compared to conventional construction. GIZ was assigned the task of studying aspect of thermal comfort in LHP project.

The term 'thermal performance' generally relates to the efficiency with which something retains or prevents the passage of heat. Typically, this is in relation to the thermal conductivity of materials or assemblies of materials. Materials which are regarded as having a good thermal performance are those which also tend to be good insulators, i.e., they do not readily transmit heat. In contrast, materials with poor thermal performance tend to be better conductors of heat and therefore will allow heat to transmit more quickly.

In summer when external temperatures can be much hotter outside than inside a building with poor thermal performance overall, will allow more heat to pass through and so will be hotter inside – than one with a good thermal performance. The thermal behaviour of a building's fabric is also affected by conditions such as seasonal and temperature changes; daily diurnals (i.e., the difference between highest and lowest temperatures in 24 hours), the amount of solar gain and shading, incoming and outgoing heat radiation, water and moisture absorption, air movement, infiltration, pressure differences and so on. Thermal performance has become a critical consideration in the design of buildings.

Exact prediction of performance requires a complete understanding of material properties, the processes involved in the interaction of the material with external environment, and the environmental factors to which it will be subjected. Test methods can be used to supplement knowledge and experience in predicting performance.

8.2 Thermal performance of LHP Chennai vs Conventional Construction

Energy codes for new buildings are an important regulatory measure for ushering energy efficiency in the building sector. Eco Niwas Samhita 2018 (Part-I: Building Envelope) was launched in 2018 to set minimum building envelope performance requirements to limit heat gains (for cooling dominated climates) and to limit heat loss (for heating dominated climates), as well as for ensuring adequate natural ventilation and day lighting potential.

The code provides design flexibility to innovate and vary important envelope components such as wall type, window size, and type of glazing, and external shading to windows to meet the compliance. LHP Chennai was evaluated on the parameters of ENS compliance based on the building material and configuration adopted in the project.

A Simulation approach was made to showcase the benefits of thermal performance of LHP

Chennai's specifications to the conventional construction method. Based on Simulation results, there is a temperature difference of 2.60 Celsius in the indoor temperature (@3pm of a typical day in summer month) of the bedroom between LHP Chennai specifications & Conventional method. Also, the annual discomfort hours are lesser in LHP Chennai than in the conventional method.

Some of the key features of LHP Chennai observed are as follows:

- Residential Envelop Transmission Value (RETV) is 25% better than the conventional case making it 15% more energy efficient.
- Embodied energy is reduced by 20% due to use of GGBS in cement concrete mix
- Electricity saving due to less construction time is estimated to 6 Lakh kWh.
- This is led to a total carbon mitigation of 4000 tons of CO2 emissions.
- The results clearly shows that the thermal performance of LHP Chennai is better than a conventional building

The Table 1 & 2 below includes the comparison of the building envelope components for a conventional construction versus the specifications of the LHP Chennai.

Table 1: Envelope Components – Conventional & LHP

Components	Conventional Building (Conventional Case)	LHP Chennai (LHP Case)
Wall material	Burnt Red clay brick wall	150 mm Autoclaved Aerated Concrete (AAC) block
Roof material	Reinforced Cement Concrete (RCC) Slab	RCC precast slab with Brickbat Koba
Window Glass & frame	Steel frame with 5mm clear glass	Unplasticized Polyvinyl Chloride (uPVC) frame with 5mm clear glass

Table 2-a: Conventional Construction Envelope Details

Envelope Type	Conventional Case - Construction Configuration	Section	U Value*
Wall	Interior Surface Film resistance + Internal Cement Mortar (12 mm) + Brick Wall (230mm) + External Cement Mortar (12 mm) + Exterior Surface film resistance		3.75 W/ m2K
Roof	Interior Surface Film resistance + External Cement Mortar (18mm) + RCC slab (150mm) + Internal Cement Mortar (12mm) + Exterior Surface film resistance		2.8 W/ m2K
Fenestration & Glazing	Steel framed Single Glazing Unit (SGU) with 5mm glass, SHGC = 0.84, VLT = 0.89		6.2 W/ m2K
Void	Assumed SHGC = 1, VLT = 1		7 W/ m2K
RETV	Residential Envelope Transmittance Value (North-South Blocks)		15.1 W/ m2

Table 2-b: LHP Chennai Construction Envelope Details

Envelope Type	LHP Case - Construction Configuration	Section	U Value*
Wall	Interior Surface Film resistance + Internal Cement Mortar (12 mm) + AAC Block (150mm) + External Cement Mortar (20 mm) + Exterior Surface film resistance		0.97 W/m2K
Roof	Interior Surface Film resistance + Precast slab (75 mm) + screeding (55 mm) + Brick Bat (100 mm) + External Cement Mortar (75mm) + Exterior Surface film resistance		1.79 W/m2K
Fenestration & Glazing	UPVC framed SGU with 5mm glass thickness, SHGC = 0.84, VLT = 0.89		5.8 W/ m2K
Void	Assumed SHGC = 1, VLT = 1		7 W/ m2K
RETV	Residential Envelope Transmittance Value (North-South Blocks)		11.8 W/m2

* *Thermal transmittance (U-value) of materials is referred from Eco-Niwas Samhita 2018 (Energy Conservation Building Code for Residential Buildings), Part I: Building Envelope.*

LHP Chennai is constructed with AAC blocks for the wall and, Brickbat Koba, Precast slab, concrete flooring is used for the Roof and UPVC frames are used for the windows.

8.3 Embodied Energy and Carbon Mitigation

Embodied Energy is the sum of all energy used in the construction process from the extraction of raw material, manufacture of material, fabrication of product to their transportation and installation of buildings. Cement and steel are the major contributors of embodied energy in building construction in LHP Chennai.

The construction in LHP, Chennai is having a lower embodied energy as compared to the conventional building, which is built primarily with brick, mortar, concrete and steel. Ground granulated blast-furnace slag (GGBS) Cement has been used in the construction of

LHP Chennai, which has many advantages including improvement of workability, durability and strength of concrete. In the construction of LHP, there is a direct replacement of 25% of cement has been done by GGBS, which reduces the overall embodied energy by a minimum of 20%.

Sustainable intervention like cement usage reduction through GGBS, electricity usage reduction during construction time has led to significant carbon mitigation as well from the construction of LHP Chennai. It has been estimated that the total carbon mitigation is around 4,000 Tonnes of CO2.

8.4 Electricity usage reduction during construction

Bad construction practices cost energy at the construction site. This was avoided in two ways 1) Better Layout planning and less movement of fluids 2) Less construction time due to its innovative 3S Prefab technology. Overall, the construction time with new technology in LHP Chennai is shortened by typically from 18 to 24 months due to use of innovative technology, thus saving due to lower construction time reflects in avoidance of temporary construction electricity billing to the tune of 30,000 kWH per month making it a total saving of more than 6 Lakh Units in LHP Chennai.

8.5 Inferences

A temperature difference of 2.6 degree Celsius in bedroom space between conventional & LHP site configurations. It is inferred that the LHP Chennai construction provides better thermal comfort compared to a Conventional construction, due to the selection of materials with better thermal performance and prefab construction technique with dimensional accuracy, correctness in the spacing of reinforcement, uniform protective cover, and assurance of design strength due to the use of design mix concrete having minimal water-cement ratio which ultimately results into the durable structure.

8.6 GRIHA Affordable Housing (GRIHAAH) Rating

Light House Project in Chennai aimed for 4-star GRIHA Affordable Housing rating. The rating mainly focuses on sustainability in the affordable housing segment. The rating process was coordinated & documented by Green Consultant M/s PEC Greening India, Pune on behalf of Contractor M/s BG Shirke.

Three site visits by the GRIHA officials for monitoring the implementation of the claimed green measures were undertaken on the site. GRIHA (Green Rating for Integrated Habitat) is country's own green building rating system and significant strategy in the National Mission of Enhanced Energy Efficiency to reduce emission intensity of its Gross Domestic Product (GDP) and is an integrate part of our nation's mitigation strategy for combating global warming and climate change.

The rating variant called 'GRIHA for Affordable Housing) 'is aligned to PMAY-U. The rating evaluates the environmental performance of residences holistically over its entire life cycle. The rating thus provides a definitive standard for what constitutes a 'green building' as it is a dedicated assessment cum rating tool, and pre –fed calculator system.

GRIHA Affordable Housing (GRIHA AH) system is a 100-points system consisting of 30 criteria. The criterions are divided into 6 broad sub-groups of site planning, Energy

Occupant Comfort, water saving, wastes Management, Sustainable Building Materials and social aspects.

Different levels of rating (1 star to 5 stars) are awarded based on the number of points earned. The minimum requirement of points is 25. The Rating threshold is as given below:

Sl. No	Points	GRIHA AH Ratings
1	25-40	1 Star *
2	41-55	2 Stars **
3	56-70	3 Stars ***
4	71-85	4 Stars ****
5	>86	5 Stars *****

LHP Chennai project was evaluated for GRIHA rating and was awarded ** rating with overall 73% points.**

Highlight of Findings:

Some of the important findings of GRIHA is given below:

1) **Site selection** - Environment clearance, drawing approval from the Authority,
2) **Availability of Water-** provision of potable water supply and electrification made.
3) **Low Impact Design**
   - ***a) Light coloured external surfaces to reflect solar radiations-*** Light coloured Scheme has been used in all the external facades to in order to reduce the heat gain through walls.
   - ***b) Buffer spaces in unfavourable orientation-*** All the service area are located in unfavourable orientation
   - ***c) Shadow Analysis****-Building does not obstruct solar access of the neighbouring building*
   - ***d) Massing of the building***-20 % of radiation has been achieved by massing
4) **Reduction in air and Soil Pollution During Construction**

   To minimize air and water pollution following measures taken

   i) Provision of 3 m high barricading along the periphery of site.

   ii) Provision of gravel bed on the vehicular entry /exit.

   iii) Stack height of DG above the breathing level.
5) **Envelop of Thermal Performance**

   a) Peak heat gain of building is 13.54 W/$m^{2,}$ which is less than the threshold of 40 W/m^2 for compliance zone.

   b) Peak cooling load is 290.25 W/m^2, less than the threshold of 350 W/m^2 for composite climate zone.
6) **Occupant Visual comfort (day light)**

   a) 6mm single glazing unit with U value- 5.7 W /m^2 K, VLT 9 Visual Light. Transmittance) =0.89 and Solar Factor= 0.82 is installed in building.

   b) 83 % of total living area meets the UDI requirements as per the criterion.

7) Efficient Lighting

a) Astronomical timer control has been installed to control 100% of outdoor lighting.

b) 68 numbers of LED Street Light of 90W with luminous efficacy of 120 lm/W.

c) 10 no of LED bollard Light of 20W with luminous efficacy of 100 lm/W

d) 04 no of solar streetlights of 60W with luminous efficacy of 140 lm/w.

8) Energy Efficient Equipment

Star BEE rated Transformer and motor has been used

9) Renewable Energy-

Solar PV panel of capacity 36 kWp has been installed.

10) Energy Metering-

Dedicated energy meters have been installed at outdoor spaces and indoor common area and for renewable energy system.

11) Efficient Use of Water during Construction: To reduce consumption of potable water during construction:

- Use of gunny bags/hessian cloth and ponding technique for curing.
- Use of additives to reduce water requirements during curing.

12) Optimization of building & landscape water demand: low flow fixtures with following flow rates have been installed:

- Flow rates of WC: 6/3 lpf
- Flow rates of kitchen faucets: 6 lpm
- Flow rates of lavatory faucets: 6 1pm
- Flow rates of showers: 6 1pm

As per calculation, annual base case landscape water consumption has been be 16,533.92 kl and annual design case has been be 11,047.90 kl. Thus, project demonstrates reduction of 33.18% in the annual landscape water consumption against GRIHA AH base case.

13) Water Reuse

SBR based STP capacity 550kld has been installed on site.

14) Water Metring-

water meters have been installed at eater supply and STP.

15) Construction Waste Management -construction waste has been segregated and sold to the recyclers.

16) Post Construction Waste Management

multi-colored bins has been provided at each floor and at site level for segregation, storage and disposal of wastes.

17) Reduction In Environmental Impact of construction

a) Batch mix of M-35 and M40 grade of concrete indicates that more than 15% of OPC was replaced with GGBS.

b) Autoclaved Aerated Concrete blocks which uses fly ash and is environment friendly material has been used.

18) Use Of Low-Environmental Impact Materials In Building Interiors 84.91 % of material are low environmental impact material.

19) Use of Recycled Content in Roads and Pavements-18% of fly ash is used in construction of pavements by volume for 100% of the pavements used on site.

20) Facilities for Construction Workers

- The project has demonstrate compliance with NBC (2016) safety norms for providing the necessary safety equipment and measures for construction workers.
- There has been for provisions for drinking water, hygienic working & living conditions and sanitation facilities for the workers.
- Cretch facility has been provided for children of construction workers.

21) Universal Accessibility

- Lift: Braille button and handrail has been installed.
- Ramps: Ramps has been installed at the entrance of each block
- Toilets: DA toilet as per NBC norms has been provided near the commercial block.

22) Proximity to Transport and Basic Services

The threshold for average distance of basic services from the main entrance of project has been met with 76.67% as compared to the pre-defined base case. Following basic facilities are located near the project site.

- School - 220 m
- Parks- 300 m
- Pharmacy - 600 m
- Hospital - 700 m
- Restaurant - 350m
- Vegetable store - 350 m

Market has been designed within the site with following facilities:

- Market space
- Drinking water facility
- Toilet facility
- Waste management

23) Additional Measures

Following strategies has been adopted on site:

- Pre-cast slab: Pre-cast slab has been used to reduce embodied energy of structure application
- Charging Point: E-vehicular charging point was provided in the project.
- Heritage conservation: Photographs of the local heritage monuments and culture has been displayed in the common areas of the project.
- Gender neutral toilets: Gender neutral toilet was provided in the commercial area.

Chapter 9:
Project Inauguration

9.1 Inauguration by the Hon'ble Prime Minister on 26th May 2022

Hon'ble Prime Minister Shri Narendra Modi inaugurated Light House Project (LHP) in Chennai, Tamil Nadu on Thursday (26 May 2022), constructed under Global Housing Technology Challenge-India (GHTC-India). The event was held at JLN Indoor Stadium in Chennai, wherein Hon'ble Prime Minister dedicated the LHP Chennai to the nation. Hon'ble Governor of Tamil Nadu Shri RN Ravi and Hon'ble Chief Minister of Tamil Nadu Shri MK Stalin were present on the occasion. Secretary, Ministry of Housing and Urban Affairs (MoHUA), other officials of the Ministry and BMTPC also attended the event.

While inaugurating the LHP, Hon'ble Prime Minister said, ***"I congratulate all those getting a house under the historic Light House Project at Chennai under the Pradhan Mantri Awas Yojana. It was a very satisfying project for us. We had started a global challenge to get the best practices involved in making homes that are affordable, durable and environmentally friendly. In record time, the first such LHP has been realised and I am glad it is in Chennai."***

Some beneficiaries of LHP Chennai were also present on the occasion and five among them were given the keys to their houses by Hon'ble Prime Minister.

LHP Chennai is the first one to be completed among the other LHPs located at Indore, Rajkot, Ranchi, Agartala and Lucknow. The 1,152 houses at LHP Chennai are spread across 12 towers and 6 floors with basic infrastructure such as internal water supply, sewer lines, internal electrification, internal roads, lifts, LED Street lights, solar streetlight system, sewerage treatment plant, rainwater harvesting, etc., in place. It also comprises of anganwadi, shops, milk booth and library for the ease of families living inside the premises. The Completion Certificate of LHP Chennai is at Annexure 3.

Hon'ble Prime Minister during the inauguration of LHP Channai

Ministry officials during the inauguration of LHP Channai

Completed Light House Project (LHP) Channai

LIGHT HOUSE PROJECT CHENNAI, TAMIL NADU

GLOBAL HOUSING TECHNOLOGY CHALLENGE INDIA

"Literally, dreams do come true. I realised it when I got my own house."
- Smt Malliga, Flat No - 308

"Thanks to PMAY-U, I am now living in a gated society and not in a slum area, where we earlier used to reside."
- Smt Vallamma, Flat No - 314

"Feeling so happy to be here. I hope PMAY-U continues so that more and more people are able to get a home like me."
- Smt Jayaseeli, Flat No - 514

"We suffered a lot in our previous house when it came to paying rent due to our financial situation. Today, we feel blessed to have our own house."
- Smt R. Manimegalai, Flat No - 210

"Feeling proud to be a house owner."
- Smt Ambika, Flat No - 301

"With my kid, I am really enjoying the amenities provided inside this gated premises of LHP Chennai. I can drop my daughter to the anganwadi & I also don't have to walk much for a ration shop or a milk booth."
- Smt Uthiriya Mary, Flat No - 503

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Beneficiary Testimonial

Beneficiaries of Light House Project (LHP) Channai

9.2 Challenges And Opportunities, Learnings from The Ground

There has been a lot of challenges from very start of the project. Initially there were few encroachments in the site which were removed by the authority.

- Being low lying area, the site encountered **frequent flooding** due to heavy rains in Chennai. On regular basis heavy pumps had to be deployed to drain out the water to perform the bplatre load testing and subsequent foundation work.
- The land required filling upto 2.5 m. Suitable filling materials were not available locally and it had to be brought from outside for filing. Due to filled up land and high-water table (at 2m depth), excavation and foundation work faced great challenge.
- **Concrete making** also faced challenge as water available from bore hole was not potable and suitable for concrete. Precast Concrete slab had to be brought from factory located at about 40 km from the site. **Transportation of the elements** was also a big challenge.
- As the work progressed the **cost of Steel cement and other materials** gone very high making the components costlier than anticipated. Above all the restriction imposed due to first and **second wave of COVID-19 Pandemic** made movement of materials/ components difficult and keeping the labours intact.

Despite various constrains, due to better Project Management and Planning the work was carried out as planned. Precast system, being a mechanized industrialized system with production of components in a controlled condition could face the adverse weather condition without affecting the progress at site.

The success of the project in time may be attributed to the following

- Code of practice of the precast system used is well defined by the agency.
- Good Project Management.
- Deployment of material, equipment, and human resources as per need.
- Good planning of supply chain of precast components and other materials.
- Well trained artisans executing the erection and other works with focus on safety.
- Regular flow of finance from the MoHUA commensurate with the physical progress.
- Good quality Assurance plan with timely intervention and solutions in case of any technical or administrative issues.
- Overall Good coordination of MoHUA, state Government, BMTPC, Construction agency, and TPQA agency

The success of LHP at Chennai, Tamil Nadu was achieved with proper project planning including financial planning with regular flow of funds. There had been smooth flow of funds commensurate to the physical progress of the project with all necessary approvals as per Contract Agreement. The State Government of Tamil Nadu also released the State and beneficiaries share in time to the Escrow Account of BMTPC and at no time work was affected for want of release of funds from MoHUA.

Chapter 10:
Live Laboratories: Knowledge Dissemination

Live Laboratories

To facilitate mass replication of these new-age innovative technologies, Ministry of Housing and Urban Affairs (MoHUA) has started nationwide trainings and pool of experts' initiatives.

The Light House Projects (LHPs) are being promoted as **Live Laboratories** for different aspects of transfer of technology to the field which includes planning, design, production of components, construction practices and testing. These six 'light house projects' are serving as live laboratories for evaluation, assessment, certification, standardization, skill development leading to adapting and mainstreaming these technologies in India.

The primary goal of making these LHPs as **Live Laboratories** is to encourage large scale citizen participation and create technical awareness for on-site learning, multi-stakeholder consultation, find ideas for solutions, learning by doing, experimentation and encouraging innovation, thereby mainstreaming the globally identified proven innovative technologies under GHTC-India in Indian context.

10.1 The Technograhi Initiative

MoHUA launched an Online Enrolment Module for all stakeholders to register themselves to visit these pilot projects to learn the use of latest innovative technologies, innovate and adapt as per their local needs and contexts as **TECHNOGRAHIS** of new construction technologies.

To facilitate mass replication of these new-age innovative technologies, MoHUA started a nationwide trainings and pool of experts' initiatives – TECHNOGRAHIs. It includes faculty and research students, technical professionals, Central/States/ULB officials, construction agencies, builders/ developers, start-ups/ entrepreneurs/ innovators, and other concerned stakeholders. So far, close to 36,000 stakeholders have enrolled themselves and have visited the LHP sites or have received training through different mediums. They are being exposed to the innovative construction technologies through onsite activities as well as through offsite Workshops/ Webinars, Webcasting, Mentoring on Technical know-how/ Module etc.

Technograhis are Change Agents of innovative and sustainable technologies who will bring about technology transition in the construction sector for its adoption & replication in the country. They will act as catalysts to transform the Urban Landscape for New Urban India to fulfil the vision of AatmaNirbhar Bharat. Concerned stakeholders can enrol themselves as TECHNOGRAHIS through a simple online procedure available at https://ghtc-india.gov.in/.

10.2 LHP E-Newsletter

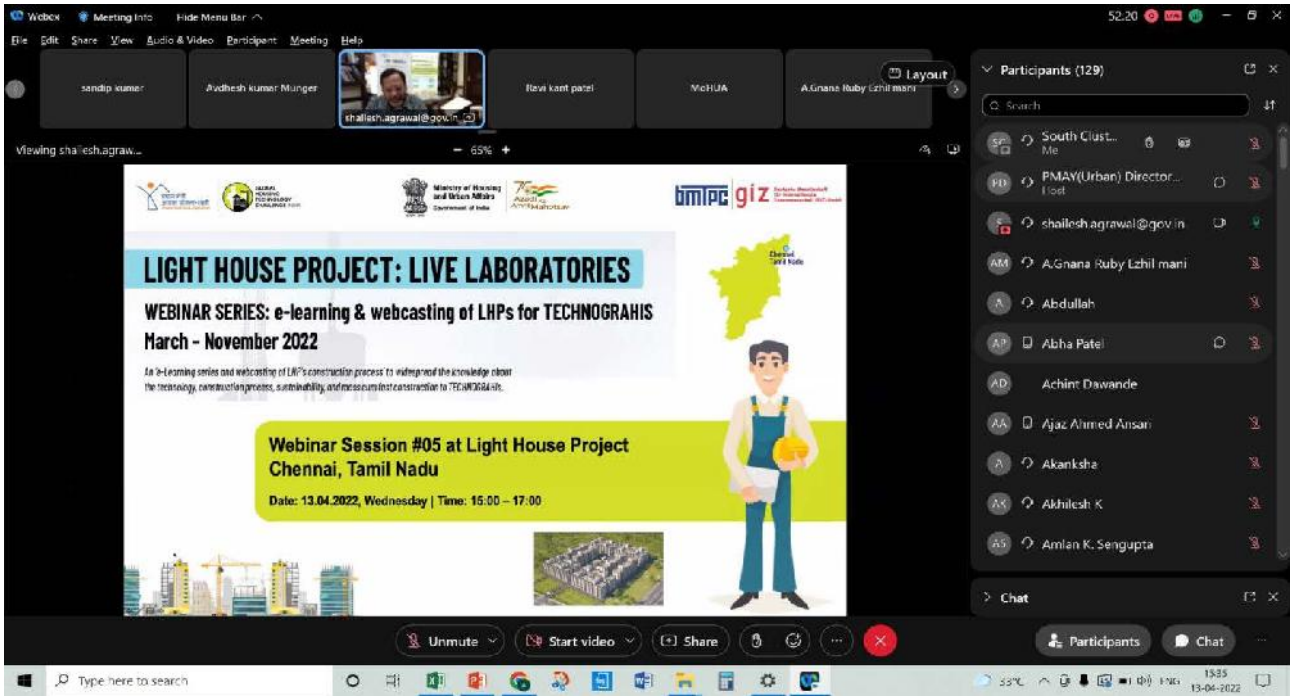
The monthly E-Newsletter of LHPs captures the progress of the projects at each LHP location. Technograhis and other stakeholders get updates about the sites through the write-ups, photographs which subsequently helps in knowledge dissemination. The Newsletter also promotes a healthy competition among the six states regarding the progress of each state as it specifically covers the progress made at the LHP locations with photographs and a detailed summary of the work being done. The Newsletters can be downloaded from https://ghtc-india.gov.in/Content/eNewsletter.html.

10.3 GHTC-India website

MoHUA through BMTPC has made available a vast collection of knowledge material and engaging learning content for the Technograhis on GHTC-India website. The six LHP State-specific e-booklets have also been uploaded for structured information about each site. They give an idea about the technical specifications, an insight into each technology and other details. These booklets are one-stop guide for technocrats for information exchange. The Technograhis e-learning modules which have detailed videos on description of technologies and the construction process. These are also supported by FAQs and inputs from various experts in this field. Compendiums on indigenous building materials, innovative technologies and prospective emerging technologies are also available on the web.

10.4 Webinars & e-courses for Technograhis

Technograhis are exposed to the innovative construction technologies through onsite activities to learn different phases of use of innovative technologies in LHPs as well as through offsite Workshops/ Webinars, Webcasting, Mentoring on Technical know-how/ Module etc. To further foster an environment of research and development in the country, MoHUA initiated **'e-Learning sessions and webcasting of LHP's construction process'** to widespread the knowledge about the technology, construction process, sustainability, and mass-cum-fast construction to TECHNOGRAHIs. The main purpose of conducting these webinars/training sessions was to create awareness of the different technologies used in the construction of Light House Projects through technical session and webcasting of work at site. Series of webinars on LHPs including of Chennai created awareness of the different technologies used in the construction of LHPs through technical session by domain experts and live webcasting of work at site.



Webcasting on LHP Chennai in progress

10.5 RACHNA-Resilient, Affordable and Comfortable Housing Through National Action

MoHUA in partnership with GIZ and BMTPC conducted 75 trainings and capacity buildings events under the name RACHNA under Azadi Ka Amrit Mahotsava. These RACHNA trainings were attended by over **5,000** participants across **30** cities. The focus of these trainings is on creating awareness among stakeholders on thermal comfort, its necessity in the affordable housing sector and ways to achieve it. The training programs delivered in-depth knowledge on thermal comfort, material influences, and its relationship with building physics.

Particularly on LHP Chennai and the innovative technologies being used, series of trainings were conducted with multi-stakeholders with an aim to spread the technical awareness on the use of technology and the process of construction. The details are as follows:

No	Training	Completed Date	Venue	Location
1	Awareness Training	07.12.2021	Puducherry Smart City Development Limited	Puducherry
2	Awareness Training	17.12.2021	LHP	Chennai
3	Vocational Training for Construction Labour	3rd & 4th March 2022	LHP	Chennai
4	Awareness drive in architectural colleges	10.03.2022	Chettinad Architectural College	Chennai
5	Technograhi Webinar	13.04.2022	LHP	Chennai
6	Awareness drive in architectural colleges	16.05.2022	Reva University	Bengaluru
7	Vocational Training for Construction Labour	19.05.2022	SPR	Chennai
8	Vocational Training for Construction Labour	9th & 10th June 2022	Renaissance Reserva	Bengaluru
9	Training for Professionals/ Practitioners	16th & 17th June 2022	Simsan hotel	Chennai
10	Awareness drive in architectural colleges	17th & 18th June 2022	BMS College	Bengaluru
11	Training for Govt Officials	30.06.2022	PWD	Bengaluru
12	Training for Govt Officials	05.07.2022	Karnataka Housing Board	Bengaluru
13	Technograhi Webinar	14.07.2022	LHP	Chennai
14	Training for Govt Officials	15.07.2022	Hotel Bhimas	Chennai
15	Training for Professionals/ Practitioners	29.07.2022	Hotel Aditya	Hyderabad
16	Awareness drive in architectural colleges	2nd & 3rd August 2022	SPA College	Vijayawada

Glimpses of trainings and Capacity Building Sessions

Glimpses of trainings and Capacity Building Sessions

Glimpses of trainings and Capacity Building Sessions

Glimpses of trainings and Capacity Building Sessions

Glimpses of visits at LHP sites by Officials/Technograhis

Glimpses of visits at LHP sites by Officials/Technograhis

Glimpses of visits at LHP sites by Officials/Technograhis

Task force of Govt of UP at LHP Chennai on 8 March 2022

Social Media and other Outreach activities

The online enrolment module for Technograhis for site visits has evinced enthusiastic participation from across India, especially from several institutions and organisations. The initiative has created a platform for students, professionals, practitioners, construction sector stakeholders and others to enable them to learn about government scheme, implementation process, construction activities and other frameworks for future application and implementation of housing programmes.

Details about the programme particulars, workshops, LHP site visits by Hon'ble Ministers, Government Officials, Technograhis and other stakeholders have been extensively shared on social media platforms for wider outreach and dissemination. They have been documented on social media handles such as Twitter, Facebook (English & Hindi) and Instagram of Housing for All Division. The posts are simultaneously shared on GHTC-India handles, operated by the HFA division.

The YouTube channel has videos of progress of the housing project and other related clips. Moreover, the same videos and progress made at the sites are shared simultaneously in the form of creatives and live photos on social media accounts.

Details about RACHNA initiative of MoHUA, LHP webinars have also been shared extensively with participating links. The LHP webinars are hosted live on YouTube channel for outreach activities. Major milestones related to all the activities on sites have been shared online.

The details of IEC campaign and social media activities including on Twitter, Facebook, Instagram etc has been documented as Annexure-4.

References

1. Global Housing Technology Challenge Website https://ghtc-india.gov.in/
2. https://ghtc-india.gov.in/Content/pdf/16022021/02_LHP_Chennai_Booklet_15Feb2021_final.pdf
3. Eco Niwas Samhita – Part I: Building Envelope standard, Bureau of Energy Efficiency
4. Centre for Advanced Research in Building Science & Energy - CARBSE https://carbse.org/
5. National Building Code 2016

Annexures

Statutory Approvals and NOCs

Chennai Metropolitan Development Authority
PLANNING PERMIT
(Sec 49 of T & C. P. Act 1971)

PERMIT No. 13576 Date of Permit 17.07.2020.

B/NHRB/207 A&B/2020. Tamil Nadu Slum clearance Board.

File No. AP/NHRB/SLB(1)/1022/2019 No.5, Kamarajar Salai,

Name of Applicant with Address... Chennai-05.

Date of Application 22.10.2019

Nature of Development : ~~Layout/Sub-division of Land~~/Building construction/~~Charge in use of Land~~/Building

Site Address PP for the proposed construction of Group Development comprising of 12 Blocks; Typical Block 1 to 12 consisting of Ground floor + 5 floors residential building with 1128 dwelling units (94 dwelling units in each Block) at Nukkarampalayam Road and TNSCB Road, Perumbakkam, Chennai in S.No.537(part), 539/2(part), 540/1(part) & 540/2 of Perumbakkam village.

Division No.

Development Charge paid Rs. 5,68,000/- Challan No. B0016417 Date. 28.05.2020

PERMISSION is granted to the ~~layout/sub-division of lar d~~/building construction/~~change in use of land~~/building according to the authorised copy of the plan attached hereto and subject to the condition overleaf.

3. The permit expires on 16-07-2025

the building construction work should be completed as per plan before the expiry date. If it is not possible to Complete the construction, request for renewing the planning permit should be submitted to Chennai Metropolitan Development Authority before the expiry date. If it is not renewed before the said date fresh. Planning Permission application/has to be submitted for continuing the construction work when the Development Control Rules that may be currently in force at that time will be applicable. If the construction already put up is in deviation to the approved plan and in violation of rules. Planning permit will not be renewed.

17/7/2020

For MEMBER SECRETARY

17/07/2020

CONDITIONS

Note : 1. According to Section 79 of the T. & C. P. Act 1971 (Act 35 of 1972) as amended by Act 22 of 1974 any person aggrieved by any decision of order of the Planning Authority Under section 49 or sub section (1) of section 54 may appeal to the Government within Two months from the date on which the decision or order was communicated

2. The Member Secretary, Chennai Metropolitan Development Authority reserves the right to revoke or modify the planning permission in the event of planning permit having been granted based either on wrong information furnished by the applicant or by misrepresentation of the facts or by any lapse of procedural formalities to be followed or permit having been obtained by any fraudulent manner.

BY REGISTERED POST WITH ACK.DUE

CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
Thalamuthu Natarajan Building, No.1, Gandhi Irwin Road, Egmore,
Chennai - 600 008
Phone : 28414855 Fax: 91-044-28548416
E-mail: mscmda@tn.gov.in, Web site: www.cmdachennai.gov.in

Letter No.PP/NHRB/S(B1)/1022/2019, Dated: 17. 07.2020

To

The Commissioner,
St.Thomas Mount Panchayat Union,
Chitlapakkam, Chennai.

Sir,

Sub: CMDA – Area Plans Unit - 'B' Channel (South) - Planning Permission for the proposed construction of Group Development comprising of 12 Blocks; Typical Block 1 to 12 consisting of Ground floor + 5 floors residential building with 1128 dwelling units (94 dwelling units in each Block) at Nukkampalayam Road and TNSCB Road, Perumbakkam, Chennai in S.Nos.537 (part), 539/2 (part), 540/1 (part) & 540/2 of Perumbakkam Village within the limit of St.Thomas Mount Panchayat Union- Approved and forwarded to Local Body for issue of Building Permit – Reg.

SP
17/07/2020

Ref:
1. Planning Permission Application received in SBC No.CMDA/PP/NHRB/S/1022/2019, dated.22.10.2019
2. G.O.Ms.No.86, H&UD Department dated 28.03.2012
3. G.O.Ms.No.85, H&UD Department dated 16.5.2017.
4. Govt. letter No.6188/UD4(3)/2017-8 received from H&UD Dept. dated 13.6.2017.
5. G.O.(Ms).No.18 MAWS (MA-I) Department, dated 04.02.2019.
6. This office DC letter even No. dated.14.05.2020
7. Letter dated. 13.05.2020 & 01.07.2020 received from the applicant.

******

The Planning Permission Application for the proposed construction of Group Development comprising of 12 Blocks; Typical Block 1 to 12 consisting of Ground floor + 5 floors residential building with 1128 dwelling units (94 dwelling units in each Block) at Nukkampalayam Road and TNSCB Road, Perumbakkam, Chennai in S.Nos.537 (part), 539/2 (part), 540/1 (part) & 540/2 of Perumbakkam village within the limit of St.Thomas Mount

Panchayat Union received in the reference 1st cited has been examined and Planning Permission is issued subject to the conditions put forth by CMDA in the reference 6th cited.

2.The applicant has remitted the following charges in the reference 7th cited.

i)	Development charges	**₹ 5,68,000/-**	**Receipt No.B0016417, Dated. 28.05.2020.**
ii)	Scrutiny Fee	Nil	
iii)	Regularization charges	Nil	
iv)	Open space & reservation charges	Nil	
v)	Security Deposit for Building	Nil	
vi)	Security Deposit for Display Board	Nil	
vii)	Security Deposit for STP	Nil	
viii)	Infrastructure & Amenities Charges	Nil	
ix)	Premium FSI Charges	Nil	
x)	Shelter charges	Nil	
xi)	MIDC Charges	Nil	

3. Two sets of approved Plans are numbered as **B/NHRB/ 207A & B/2020, dated. 17.07.2020, Planning Permit No.13576** are sent herewith. The Planning Permit is valid for the period from**17.07.2020 to16.07.2025.**

4. The Localbody is requested to ensure water supply and sewerage disposal facility for the proposal before issuing building Permit. It shall be ensured that all wells, overhead tanks are hermitically sealed with properly protected vents to avoid mosquito menace. Non provision of rain water harvesting structures shown in the approved plan to the satisfaction of the Authority will also be considered as a deviation to the approved plan and violation of Tamil Nadu Combined Development Building Rule 2019 and enforcement action will be taken against such development.

5. The Planning Permission for buildings is issued in accordance with the provisions of the Town & Country Planning Act, 1971 and the rules made there under. All other statutory clearance as applicable to this project shall be obtained by the project proponent from the competent Authority. The Town & Country Planning Act provision does not cover the Structural Stability aspect of the building including the safety during the construction. However, these aspects are covered under the provisions of the Local Bodies Act.

6. As far as, the Structural Stability aspect of the building is concerned, it falls within the jurisdiction of the Local Body concerned as stated in the Building Rules under the respective Local Body Act 1920, such as Madras City Municipal Corporation Act 1919, Tamil Nadu District Municipality Act, 1924, Tamil Nadu Panchayat Act, 1994. The

Planning Permission issued under the provision of Tamil Nadu Town & Country Planning Act 1971, does not cover the Structural Stability aspect. However, it is the sole responsibility of the applicant / developer /Power Agent and the Structural Engineers / License Surveyor / Architects who has signed in the plan to ensure the safety during construction and after construction and also for the continued structural stability of the buildings. In this regard, applicant along with the Architect and Structural Engineer and Construction Engineer has furnished necessary undertakings for Structural Design Sufficiency as well as for supervision in the prescribed formats.

7. Issuance of Planning Permission by CMDA under the statutory provisions does not confirm any ownership or title over the property, in favour of the applicant. Before issuing Planning Permission for any development, CMDA in this regard, checks only the aspect of applicant's right over the site under reference to make the development thereon based on the copies of the documents (such as Sale Deed, Patta, Lease Deed, Gift Deed etc., and GPA) furnished by the applicant along with his /her application to prove the same. Thus, CMDA primarily considers only the aspect whether the applicant prima facie has a right to carry out development on the site under reference.

Any person who acquires interest in the property shall ensure independently about the ownership and the applicant's right before acquiring the same. Further, if any individual claim right (or) title over the property he / she / they shall have to prove it before the appropriate / competent Court to decide on the ownership or get the matter settled in the Court of Law and CMDA is not the competent authority to decide on this matter.

8. As approved by Tamil Nadu Government in G.O.M.s.No.112 H & UD Department dated 22.06.2017 to carry out the provisions of Real Estate (Regulation & Development) Act 2016, the promoter has to advertise, Market, Book, sell or offer for sale, or invite persons to purchase in any manner any plot, apartment or building, as the case may be, in any Real Estate project or part of it, only after registering the Real Estate project with the Real Estate Regulatory Authority.

9.This Planning Permission is not final. The applicant has to approach the Commissioner, St.Thomas Mount Panchayat Union for issue of Building Permit under the Local Body Act.

10.Applicant shall not commence construction without building approval from the St.Thomas Mount Panchayat Union

11.The Planning Permission issued under New Rule TNCDBR, 2019 is subject to final outcome of the W.P.(MD) No.8948 of 2019 and WMP (MD) Nos.6912 & 6913 of 2019.

Yours faithfully,

For Member Secretary 17/07/2020

17/7

Encl:

1. Two sets of approved Plans
2. Two copies of Planning Permit

Copy to:

1. **Tamil Nadu Slum Clearance Board,**
   Represented by Thiru.P.P.Elangovan,
   No.5, Kamarajar Salai, Chennai 600005.
2. **The Deputy Planner**
   Enforcement Cell (South), CMDA, Chennai – 8.
   (With one set of approved plans)
3. **The Commissioner of Income Tax**
   No.108, Mahatma Gandhi Road, Nungambakkam, Chennai-34.
4. **The Member**
   Appropriate Authority
   No.108, Mahatma Gandhi Road, Nungambakkam,
   Chennai-34.

வெங்கம்பாக்கம்...கிராம ஊராட்சியின் தனி அலுவலர் மற்றும் வட்டார வளர்ச்சி அலுவலர் (கி.ஊ)
புனிததோமையார்மலை அவர்களின் நடவடிக்கைகள்

முன்னிலை : S. பஞ்சு அவர்கள்

க.ஊ.எண்........................

மு.மு.எண்...6/2020-2021

நாள் : 27-07-2020

பொருள் : கட்டிட வரைப்பட அனுமதி...வெங்கம்பாக்கம்...ஊராட்சி
தமிழ்நாடு இசை மற்றும் வாரியம்...தெரு/ரோடு
புல எண். 537/pt, 539/2pt, 540/1pt, 540/2 மனை எண்.
..........—..........ஆகியவற்றில் கட்டிடம் / சுற்றுச்சுவர் / கிணறு
முதலியன கட்டுவதற்கு அனுமதி வழங்கப்பட்டது.

பார்வை : 1. திரு./திருமதி...P. P. இளங்கோவன், TNSCB.....அவர்களின்
மனு நாள் 24-07-2020

2. ஆணையாளர், புனிததோமையார்மலை ஊராட்சி ஒன்றியம்
அவர்களின் ப.மு.எண். 2758/20/A4 Dt. 24.07.20

உத்திரவு :

திரு./திருமதி...P.P. இளங்கோவன், TNSCB...என்பவருக்கு
...வெங்கம்பாக்கம்...கிராமம்...தமிழ்நாடு இசை மற்றும் வாரியம்...தெரு
புல எண்...537/pt, 539/2pt, மனை எண்...540/1pt, 540/2...ஊராட்சி ஆகிய பகுதிகளில்

கட்டிடம் / சுற்றுச்சுவர் / கிணறு / கழிப்பிடம் / குளியலறை / கடைகள் முதல் தளம் / இரண்டாம் தளம் பேருந்து வண்டிகள் நிறுத்துமிடம் ஆகியவைகள் கட்டுவதற்கு கீழ்கண்ட நிபந்தனைகளுக்கு உட்பட்டு அனுமதி அளிக்கப்பட்டது.

இந்த அனுமதியானது...27-07-2023...ம் தேதி வரை ~~ஒரு~~ 3 ஆண்டுக்கு செல்லுபடியாகும் அனுமதி கட்டணம் ரூ...46,89,700/-...(ரூபாய்...நாற்பத்து ஆறு லட்சத்து எண்பத்து ஒன்பது ஆயிரத்து எழுநூறு மட்டும்...) செலுத்தியமைக்கான பல வகை ரசீது எண்...16312...நாள்...27-07-2020...மற்றும் அங்கீகரிக்கப்பட்ட வரைப்படங்கள இத்துடன் இணைக்கப்பட்டுள்ளன.

நிபந்தனைகள்

1. கட்டிடத்தின் முன் பக்கத்தில் 3.5 மீட்டருக்கு குறையாமலும், பின்பகுதியில் 3.5 மீட்டருக்கு குறையாமலும் இரு பக்கங்களிலும் 1.5 மீட்டருக்கு குறையாமலும் இடைபெறி விடப்பட்டிருக்க வேண்டும்.
2. தமிழ்நாடு ஊராட்சியின் 1995-ம் ஆண்டு திருத்தப்பட்ட சட்டத்தின்படி சென்னை பெருநகர் வளர்ச்சிக் குழும விதிகளில் ஏற்படுத்தப்பட்டுள்ள எல்லா கட்டுப்பாடுகளுக்கும் உட்பட்டிருத்தல் வேண்டும்.
3. அரசாங்கத்திற்கு சொந்தமான இடங்களிலோ அல்லது இம்மனுதாரருக்கு சம்பந்தமில்லாத வேறு இடங்களிலோ ஆக்கிரமனம் செய்வது கூடாது.

4. கட்டிட வேலைகள் நடக்கும்பொழுதோ அல்லது வேறு எந்த நேரங்களிலோ ஊராட்சியிலிருந்து ஆய்வு செய்ய வரும் அதிகாரிகளுக்கு அங்கீகரிக்கப்பட்ட வரைப்படங்களை காண்பிக்க வசதியாக வேலை நடக்குமிடங்களில் மேற்படி வரைப்படங்களை வைத்திருத்தல் வேண்டும்.

5. இந்த உத்திரவில் அனுமதிக்கப்பட்ட கால வரையரைக்குள் கட்டிடம் கட்டி முடிக்காவிடில் அனுமதியை மீண்டும் புதிதாக மன கொடுத்து அனுமதி பெற வேண்டும்.

6. அனுமதிக்கப்பட்ட வரைப்பட்டத்தில் கூடுதலோ அல்லது மாறுதல் ஏதேனும் செய்து கட்ட வேண்டுமானால் அதற்குரிய திருத்தப்பட்ட வரைப்படங்களுடன் தலைவர் / நிர்வாக அதிகாரிக்கு விண்ணப்பம் செய்து உத்தரவு பெற்ற பிறகுதான் மாறுதல் கட்டிடம் கட்ட வேண்டும்.

7. கட்டிடம் கட்ட உத்திரவு பொய்பதிவுகள் மூலம் பெற்றதாகவோ அல்லது ஏதேனும் கட்டிட விதிகளுக்கு புறம்பாகவோ பெற்றதாயிருந்தால் மேற்படி உத்திரவை ரத்து செய்ய தனி அலுவருக்கு உரிமை உண்டு.

8. புதியதாக கட்டப்படும் கட்டிட இடங்கள் எந்த நேரத்திலும் சுத்தமாக பொதுச் சுகாதாரக்கேடு விளைவிக்காத வகையில் வைத்து இருத்தல் அவசியம்.

9. மனுதாரர் கட்டிடத்தை கட்டி முடித்த பின்பு இவ்அலுவலகத்திலிருந்து சான்றிதழ் பெற்ற பின்பே குடிபுக வேண்டும்.

10. கட்டிடத்திலிருந்து வெளிவரும் கழிவுநீரை மனுதாரர் தன் சொந்த இடத்திற்குள்ளேயே நிறுத்தி வைத்து அவைகளை அப்புறப்படுத்தும் வகையில் வடிகால்களும், கழிவுநீர்த் தொட்டிகளும் அமைத்துக்கொள்ள வேண்டும்.

11. கட்டிடம் தொழிலகங்களுக்காகவோ அல்லது வேறு தொழிலாளர்கள் வேலை செய்ய வேண்டிய இடங்களுக்காகவோ கட்டப்படவிருந்தால் அவைகளுக்கு மாவட்ட சுகாதார அலுவலரிடமிருந்து தொழிலகங்களின் ஆய்வாளரிடமிருந்து மற்றும் உறுப்பினர், செயலர், சென்னை பெருநகர், வளர்ச்சிக் குழுமம் ஆகியோரிடமிருந்து அனுமதி பெற்றிட வேண்டும்.

12. அங்கீகரிக்கப்பட்ட வரைப்படங்களின்படியே கட்டிடம் கட்டி முடிக்கப்பட்ட பின்பு இவ்வூராட்சியிலிருந்து சான்றிதழ் பெற்றுக்கொள்ள வேண்டும்.

13. கட்டிட வேலை முடிந்த பின்போ அல்லது குடியேறிய பின்னரோ 15 தினங்களுக்குள்ளாக தலைவர் அவர்களுக்கு எழுத்து மூலமாக தெரிவிக்க வேண்டும்.

14. கட்டிடத்தில் மழைநீர் சேகரிப்பு கட்டமைப்பு கண்டிப்பாக அமைக்கபட வேண்டும்.

தனி அலுவலர்,
பெரும்பாக்கம் ஊராட்சி

தனி அலுவலர்,
....கிராம ஊராட்சி
புனிததோமையார்மலை ஊராட்சி ஒன்றியம்

பெறுநர்.

திரு./திருமதி...... தமிழ்நாடு மின்சார வாரியம்
.... திரு. P.P. இளங்கோவன்
.... எண்: 5, காமராஜர் சாலை
.... சென்னை – 600005

அனுப்புநர்

திரு.மு.சிவகலைச்செல்வன்,
ஆணையாளர்
புனிததோமையார்மலை ஊராட்சி ஒன்றியம்
(இ) சிட்லப்பாக்கம்

பெறுநர்

தனி அலுவலர் / பெரும்பாக்கம்
வட்டார வளாச்சி அலுவலர் (கி.ஊ)

ப.மு.எண்.2758 /2020 /அ4, நாள். 24/07/2020

அய்யா,

பொருள் - திட்ட அனுமதி - புனிததோமையார்மலை ஊராட்சி ஒன்றியம் - பெரும்பாக்கம் ஊராட்சி - சர்வே எண். 537 Pt, 539/2 Pt, 540/1 Pt & 540/2 மனை எண். — திட்ட அனுமதி அளிக்கப்பட்டது - கட்டிட அனுமதி மற்றும் ~~மனை உட்~~பிரிவு அளிக்கும் பொருட்டு அனுப்புதல் - சார்ந்து.

பார்வை -

1. வீட்டு வசதி மற்றும் நகர்புற வளர்ச்சித் துறை செயலர் கடித எண்.15029/ந.ச.1/98. நாள்.23.06.1999.
2. காஞ்சிபுரம் மாவட்ட ஆட்சித் தலைவர் அவர்கிள்ன கடித ந.க.எண்.28784/99/பிசி2. நாள்.05.07.1999.
3. சென்னை பெருநகர வளர்ச்சி குழுமம் அவர்களின் கடிதம் ந.க.எண்.ஆர்.டி.1/23815/97. நாள்.08/99.
4. உறுப்பினர் செயலர், சென்னை பெருநகர வளர்ச்சி குழுமம் அவர்களின் கடிதம் ந.க.எண். S(B1)/1022/2019 நாள். 17.07.2020
5. மனுதாரர் திரு / ~~திருமதி~~. தமிழ்நாடு குதிரை மாற்று வாரியம் திரு P.P. இளங்கோவன்

****

பார்வை 4ல் காணும் மனுதாரருக்கு பெரும்பாக்கம் ஊராட்சியில் சர்வே எண். 537 Pt, 539/2 Pt, 540/1 Pt & 540/2 மனை எண். — ல் கட்டிடம் கட்ட திட்ட அனுமதி / ~~மனை உட்~~பிரிவு அனுமதி அளிக்கப்பட்டுள்ளது.

திட்ட அனுமதி அளிக்கப்பட்ட வரைபடம் மற்றும் பெர்மிட் இத்துடன் இணைத்து அனுப்பப்படுகிறது. மேற்படி மனுதாரரிடம் கட்டிட அனுமதி / ~~மனை உட்~~பிரிவு அனுமதிக்கான கட்டணங்களை வசூலித்து கட்டிட அனுமதி அளிக்குமாறு கேட்டுக் கொள்ளப்படுகிறது.

Approved plan No. B/NHRB/207A&B/2020
planning permit No: 13576/17.7.2020

MWF Charges Remitted
Rs 1,16,26,969/-
D.D.No: 011520, dated 24.07.2020

ஆணையாளர்
புனிததோமையார்மலை ஊராட்சி ஒன்றியம்
(இ) சிட்லப்பாக்கம்

இணைப்பு - திட்ட அனுமதி / ~~மனை உட்~~பிரிவு அனுமதி அளிக்கப்பட்ட வரைபடங்கள், திட்ட அனுமதி மற்றும் பெர்மிட்

நகல் - திரு / திருமதி தமிழ்நாடு குதிரை மாற்று வாரியம்
Rep by திரு P.P. இளங்கோவன்
எண்.5, காமராஜர் சாலை,
சென்னை - 600005

(தங்கள் கட்டிட / ~~மனை உட்~~பிரிவு அனுமதி பெற தனி அலுவலர் / வட்டார வளாச்சி அலுவலர் (கி.ஊ) பெரும்பாக்கம் ஊராட்சி அவர்களை அணுகுமாறு கேட்டுக் கொள்ளப்படுகிறது.

सत्यमेव जयते

Dr. JAYANTHI. M, I.F.S
MEMBER SECRETARY

STATE LEVEL ENVIRONMENT IMPACT
ASSESSMENT AUTHORITY – TAMIL NADU
3rd Floor, Panagal Maaligai,
No.1 Jeenis Road, Saidapet,
Chennai-15.
Phone No.044-24359973

ENVIRONMENTAL CLEARANCE (EC)

Letter No. SEIAA-TN/F. 7148/EC/ 8(a)/ 686/2019 dated: 19 .12.2019

To

The Executive Engineer
M/s. Tamil Nadu Slum Clearance Board
Chennai Special Division - I
Semmencherry
Chennai – 600 119

Sir,

Sub: SEIAA, TN - Environmental Clearance – Proposed construction of residential building by M/s. Tamil Nadu Slum Clearance Board in S.F No. 537 pt, 539/2 pt, 540/1pt, 540/2 in Perumbakkam Village, Tambaram Taluk, Kancheepuram District, Tamil Nadu - Issued – Regarding.

Ref: 1. Your application for Environmental Clearance dated: 26.09.2019
2. Minutes of the 138th SEAC Meeting held on 08.11.2019
3. Minutes of the 364th SEIAA Meeting held on 19.12.2019

*****

This has reference to your application 1st cited, the proposal is for obtaining Environmental Clearance to establish a construction project under Category B2 and Schedule S.No. 8(a) under the Environment Impact Assessment Notification, 2006, as amended.

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The Competent Authority and Authorized signatory furnished detailed information in Form 1 and Form 1A and liquidate enclosures are as Annexures:

Annexure 1

PROJECT DETAILS		
SL No	**Description**	**Details**
1)	Name of the Project proponent and address	The Executive Engineer M/s. Tamil Nadu Slum Clearance Board Chennai Special Division - I Semmencherry Chennai – 600 119
2)	Proposed Activity	Proposed construction of residential building
3)	Schedule No.	8(a)
4)	**Project Location**	
	i)Survey No	537 pt, 539/2 pt, 540/1pt, 540/2
	ii)Revenue Village	Perumbakkam
	iii)Taluk	Tambaram
	iv)District	Kanchipuram
5)	Area of the Land	33595.98 Sq.m
6)	Built up Area	43475.04 Sq.m
7)	Brief description of the project	Proposed construction of multistoried group development residential building comprises of 12 Blocks each with Ground floor + 5 floors totally 1152 Dwelling Units.
8)	Expected Occupancies (including Visitors)	6163 Nos
9)	Green Belt	5048.50 Sqm
10)	Parking facilities	2221.2 Sq.m
11)	**UTILITIES-WATER**	
	Total Fresh Requirements	521 KLD

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	a)Source from where the water is proposed to be drawn	CMWSSB
	i)Domestic Purposes	521KLD
	ii) Toilet Flushing(Recycled Water)	264 KLD
	iii) Green belt development/gardening (Recycled Water)	18 KLD
	iv) OSR(Recycled Water)	12 KLD
	v) road side avenue plantation (Recycled Water)	423 KLD
12)	Waste Water	
	i)Sewage	sewage water generated – 310 KLD
	ii) Details of Treatment	STP: 330KLD(Proposed) Components:- i) Bar Screen Chamber ii) Equalization tank iii) Aeration tank iv) Secondary settling tank v) Clarified water tank vi) Sludge holding tank vii) UF Feed Tank viii) UF treated water tank ix) Pressure Sand Filter x) Activated Carbon Filter xi) UV Disinfection system xii) Dewatering system – filter press with screw pumps
	iii) Mode of Disposal with quantity	Treated sewage: 294KLD Flushing - 264 KLD Green belt – 18 KLD OSR Maintenance – 12 KLD untreated water to roadside trees &

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		avenue plantation– 423 KLD
13)	**SOLID WASTE**	
	I) Municipal solid Waste	3525 kg/day
	i) Bio degradable – 2115 Kg /day	Bio mehtanation plant
	ii) Non Bio degradable – 1410 Kg /day	Disposed to Authorized Recyclers
	iii) STP Sludge – 30 kg/day	Manure for gardening
14)	**POWER REQUIREMENT**	
	i) Electricity Board	2354 KVA from TANGEDCO
	ii) D.G. Set	There is no power back up
	iii) Height of Stack above the tallest Building	-
15)	Project Cost	Rs. 121.20 Crores
16)	EMP Cost	For Construction: Operation cost- 28 Lakhs For Operation Phase: Capital Cost –122.5 Lakhs, Operation cost- 42 Lakhs

Annexure 2- Affidavit

The Proponent has furnished affidavit in hundred Rupees stamp paper attested by the Notary stating that

1. We commit to SEIAA that the total fresh water requirement for our residential development is 522 KLD. The required water will be met through CMWSSB. We assure that the required permission from the competent Authority for supply of fresh water for entire period of operation will be obtained before obtaining completion certificate from the competent authority.
2. We commit to SEIAA that the Total quantity of sewage generated from the residential development is 733 KLD including 264 KLD of recycled flush water, out of which 423 KLD will be collected in sewage collection sump and pumped to Sholinganallur STP & remaining 310 KLD will be treated in the STP of 330

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KLD capacity & the treated sewage of 294 KLD will be recycled and 264 KLD will be used for toilet flushing, 18 KLD will be used for Greenbelt & 12 KLD for OSR.

3. We commit to SEIAA that the Total Municipal Solid waste generated from the development will be 3525 Kg/day in which 2115 Kg/day is Biodegradable waste, which will be treated in Bio methanation plant within the project site mixed with 30 Kg/day STP sludge and then used as manure for landscaping purpose within project site and 1410 Kg/day is Non Biodegradable waste will be sold to recyclers.
4. We assure that we are liable for the operation and maintenance of STP for a period of 10 years from the date of operation of the project.
5. We also assure that the storm water drain would not carry any untreated or treated sewage.
6. We also assure that our project site does not encroach any water bodies such as rivers, canals, nallas, lakes, ponds, tanks, etc., from its original boundary.
7. We also assure that no litigations are pending against the project.

I am aware that I can be prosecuted under relevant Act and Rules, if I am not ensuring the adherence of the above commitment.

The project activity is covered in 8(a) of the Schedule and is of B2 category. It does not require Public Consultation as per Para 7 III Stage (3) (i) (d) of EIA Notification, 2006.

The Authority after consideration all the requisite documents with status and data and based on SEAC appraisal and recommendations for issue of Environmental Clearance in its 138th meeting held on 08.11.2019, SEIAA placed the proposal in the 364th SEIAA meeting held on 19.12.2019 hereby conveyed Environmental Clearance along with the conditions containing four parts namely

Part - A –Common conditions applicable for Pre-construction, Construction and Operational Phases

Part - B –Specific Conditions – Pre construction phase

Part - C - Specific Conditions – Construction phase

Part – D - Specific Conditions – Operational Phase/Post constructional Phase / Entire life of the project.

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Validity:

The SEIAA hereby accords Environmental Clearance to the above project under the provisions of EIA Notification dated 14th September, 2006 as amended, with validity for Seven years from the date of issue of EC, subject to the compliance of the terms and conditions stipulated below:

Part - A – Common conditions applicable for Pre-construction, Construction and Operational Phases:

1. Any appeal against this environmental clearance shall lie with the Hon'ble National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.
2. The construction of STP, Solid Waste Management facility, E-waste management facility, DG sets, etc., should be made in the earmarked area only. In any case, the location of these utilities should not be changed later on.
3. The Environmental safeguards contained in the application of the proponent /mentioned during the presentation before the State Level Environment Impact Assessment Authority / State Level Expert Appraisal Committee should be implemented in the letter and spirit.
4. All other statutory clearances such as the approvals for storage of diesel from Chief Controller of Explosives, Fire and Rescue Services Department, Civil Aviation Department, Forest Conservation Act, 1980 and Wild Life (Protection) Act, 1972, State / Central Ground Water Authority, Coastal Regulatory Zone Authority, other statutory and other authorities as applicable to the project shall be obtained by project proponent from the concerned competent authorities.
5. The SEIAA reserves the right to add additional safeguard measures subsequently, if non-compliance of any of the EC conditions is found and to take action, including revoking of this Environmental Clearance as the case may be.
6. A proper record showing compliance of all the conditions of Environmental Clearance shall be maintained and made available at all the times.
7. The environmental statement for each financial year ending 31st March in Form-V as is mandated to be submitted by the project proponent to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules,

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(ambient levels as well as stack emissions) or critical sectoral parameters, indicated for the project shall be monitored.

15. The SEIAA, TN may cancel the environmental clearance granted to this project under the provisions of EIA Notification, 2006, if, at any stage of the validity of this environmental clearance, if it is found or if it comes to the knowledge of this SEIAA, TN that the project proponent has deliberately concealed and/or submitted false or misleading information or inadequate data for obtaining the environmental clearance.
16. The Environmental Clearance does not imply that the other statutory / administrative clearances shall be granted to the project by the concerned authorities. Such authorities would be considering the project on merits and be taking decisions independently of the Environmental Clearance.
17. The SEIAA, TN may alter/modify the above conditions or stipulate any further condition in the interest of environment protection, even during the subsequent period.
18. The Environmental Clearance does not absolve the applicant/proponent of his obligation/requirement to obtain other statutory and administrative clearances from other statutory and administrative authorities.
19. Where the trees need to be cut, compensation plantation in the ratio of 1:10 (i.e. planting of 10 trees for every one tree that is cut) should be done with the obligation to continue maintenance.
20. A separate environmental management cell with suitable qualified personnel should be set-up under the control of a Senior Executive who will report directly to the Head of the Organization and the shortfall shall be strictly reviewed and addressed.
21. The EMP cost of Rs. 164.5 Lakhs shall be deposited in a nationalized bank by opening separate account and the head wise expenses statement shall be submitted to TNPCB with a copy to SEIAA annually.
22. The Project Proponent has to provide rain water harvesting 44 pits and the rainwater collection sump of capacity 250 cu.m in order to recover and reuse the rain water during normal rains as reported.

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1986, as amended subsequently, shall also be put on the website of the company. The status of compliance of environmental clearance conditions and shall also be sent to the Regional Office of the Ministry of Environment and Forests, Chennai by e-mail.

8. The Regional Office of the Ministry located at Chennai shall monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the officer (s) of the Regional Office by furnishing the requisite data / information / monitoring reports.
9. "Consent for Establishment" shall be obtained from the Tamil Nadu Pollution Control Board and a copy shall be submitted to the SEIAA, Tamil Nadu.
10. In the case of any change(s) in the scope of the project, a fresh appraisal by the SEAC/SEIAA shall be obtained before implementation.
11. The conditions will be enforced inter-alia, under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986, the Public Liability Insurance Act, 1991, along with their amendments ,draft Minor Mineral Conservation & Development Rules , 2010 framed under MMDR Act 1957,National Commission for protection of Child Right Rules ,2006 and rules made there under and also any other orders passed by the Hon'ble Supreme Court of India/Hon'ble High Court of Madras and any other Courts of Law, including the Hon'ble National Green Tribunal relating to the subject matter.
12. The Environmental Clearance shall not be cited for relaxing the other applicable rules to this project.
13. Failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract action under the provisions of the Environment (Protection) Act, 1986.
14. The proponent shall upload the status of compliance of the stipulated EC conditions, including results of monitored data on their website and shall update the same periodically. It shall simultaneously be sent to the Regional Office of MoEF, Chennai, the respective Zonal Office of CPCB, Bengaluru and the TNPCB. The criteria pollutant levels namely; PM10, PM2.5, SO2, NOx

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23. The project activity should not cause any disturbance & deterioration of the local bio diversity.
24. The project activity should not impact the water bodies. A detailed inventory of the water bodies and forest should be evaluated and fact reported to the Forest Department & PWD for monitoring.
25. All the assessed flora & fauna should be conserved and protected.
26. The proponent should strictly comply with, Tamil Nadu Government Order (Ms) No.84 Environment and forests (EC.2) Department dated 25.06.2018 regarding ban on one time use and throwaway plastics irrespective of thickness with effect from 01.01.2019 under Environment (Protection) Act, 1986.
27. The proponent shall furnish the permission/ NOC of water supply from the CMWSSB before obtaining CTO from TNPCB.
28. Traffic congestion near the entry and exit points from the roads adjoining the proposed project site must be avoided.
29. The safety measures proposed in the report should be strictly followed.
30. The proponent shall obtain the necessary permission or NOC from the competent authority for the utilization of untreated sewage of 423 KLD for road side trees & avenue plantation before obtaining CTE from TNPCB.
31. As per MoEF & CC, GoI, Office Memorandum dated 30.03.2015, prior clearance from Forestry & Wildlife angle including clearance from obtaining committee of the National Board for Wildlife as applicable shall be obtained before starting the quarrying operation, if the project site is located within 10KM from National Park and Sanctuaries.
32. Environment Clearances is subject to the outcome of the Hon'ble High Court in the W.P.(C) 12517/2018 & CM APPL. 48579/2018 and W.P.(C) 12570/2018 & CM Appl. 48897/2018.

Part - B – Specific Conditions – Pre construction phase:

1. The project authorities should advertise with basic details at least in two local newspapers widely circulated, one of which shall be in the vernacular language of the locality concerned, within 7 days of the issue of clearance. The press releases also mention that a copy of the clearance letter is available with the State

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Pollution Control Board and also at website of SEIAA, TN. The copy of the press release should be forwarded to the Regional Office of the Ministry of Environment and Forests located at Chennai and SEIAA-TN.

2. In the case of any change(s) in the scope of the project, a fresh appraisal by the SEAC/SEIAA shall be obtained before implementation.
3. A copy of the clearance letter shall be sent by the proponent to the Local Body. The clearance letter shall also be put on the website of the Proponent.
4. The approval of the competent authority shall be obtained for structural safety of the buildings during earthquake, adequacy of fire fighting equipments, etc as per National Building Code including protection measures from lightning etc before commencement of the work.
5. All required sanitary and hygienic measures for the workers should be in place before starting construction activities and they have to be maintained throughout the construction phase.
6. Design of buildings should be in conformity with the Seismic Zone Classifications.
7. The Construction of the structures should be undertaken as per the plans approved by the concerned local authorities/local administration.
8. No construction activity of any kind shall be taken up in the OSR area.
9. Consent of the local body concerned should be obtained for using the treated sewage in the OSR area for gardening purpose. The quality of treated sewage shall satisfy the bathing quality prescribed by the CPCB.
10. The height and coverage of the constructions shall be in accordance with the existing FSI/FAR norms as per Coastal Regulation Zone Notification, 2011.
11. The Project Proponent shall provide car parking exclusively for the visiting guest in the proposed residential apartments as per CMDA norms.
12. The project proponent shall ensure the entry of basement shall be above maximum flood level.
13. The proponent shall prepare completion plans showing Separate pipelines marked with different colours with the following details

    i. Location of STP, compost system, underground sewer line.

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ii. Pipe Line conveying the treated effluent for green belt development.
iii. Pipe Line conveying the treated effluent for toilet flushing
iv. Water supply pipeline
v. Gas supply pipe line, if proposed
vi. Telephone cable
vii. Power cable
viii. Strom water drains, and
ix. Rain water harvesting system, etc.,. and it shall be made available to the owners

14. A First Aid Room shall be provided in the project site during the entire construction and operation phases of the project.
15. The present land use surrounding the project site shall not be disturbed at any point of time.
16. The green belt area shall be planted with indigenous native trees.
17. Natural vegetation listed particularly the trees shall not be removed during the construction/operation phase. In case any trees are likely to be disturbed, shall be replanted.
18. During the construction and operation phase, there should be no disturbance to the aquatic eco-system within and outside the area.
19. The Provisions of Forest conservation Act 1980, Wild Life Protection Act 1972 & Bio diversity Act 2002 should not be violated.
20. There should be Fire fighting plan and all required safety plan.
21. Regular fire drills should be held to create awareness among owners/ residents.

Part - C - Specific Conditions – Construction phase:

1. **Construction Schedule:**
   i) The Project proponent shall have to furnish the probable date of commissioning of the project supported with necessary bar charts to SEIAA-TN.

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2. **Labour Welfare:**

i) All the labourers to be engaged for construction should be screened for health and adequately treated before and during their employment on the work at the site.

ii) Personnel working in dusty areas should wear protective respiratory devices and they should also be provided with adequate training and information on safety and health aspects. Occupational health surveillance program of the workers should be undertaken periodically to observe any contradictions due to exposure to dust and take corrective measures, if needed.

iii) Periodical medical examination of the workers engaged in the project shall be carried out and records maintained. For the purpose, schedule of health examination of the workers should be drawn and followed accordingly. The workers shall be provided with personnel protective measures such as masks, gloves, boots etc.

3. **Water Supply:**

i) The entire water requirement during construction phase may be met from ground water source from the source with approval of the PWD Department of water resources/ may be out sourced.

ii) Provision shall be made for the housing labour within the site with all necessary infrastructures and facilities such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, crèche etc. The housing may be in the form of temporary structures to be removed after the completion of the project.

iii) Adequate drinking water and sanitary facilities should be provided for construction workers at the site. The treatment and disposal of waste water shall be through dispersion trench after treatment through septic tank. The MSW generated shall be disposed through Local Body and the identified dumpsite only.

iv) Water demand during construction should be reduced by use of pre-mixed concrete, curing agents and other best practices prevalent.

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v) Fixtures for showers, toilet flushing and drinking water should be of low flow type by adopting the use of aerators / pressure reducing devises / sensor based control.

4. Solid Waste Management:

i) In the solid waste management plan, the STP sludge management plan for direct use as manure for gardens is not acceptable; it must be co-composted with biodegradables.

ii) House hold hazardous waste such as batteries, small electronics, CFL bulbs, expired medicines and used cleaning solvent bottles should be segregated at source, collected once in a month from residences and disposed as per the SWM rules 2016.

iii) Domestic solid wastes to be regularly collected in bins or waste handling receptacles and disposed as per the solid waste management rules 2016.

iv) No waste of any type to be disposed of in any watercourse including drains, canals and the surrounding environment.

v) E-waste shall be disposed through Authorized vendor as per E-waste (Management and Handling) Rules, 2016 and subsequent amendment.

5. Top Soil Management:

i) All the top soil excavated during construction activities should be stored for use in horticulture/ landscape development within the project site.

6. Construction Debris disposal:

i) Disposal of construction debris during construction phase should not create any adverse effect on the neighboring communities and be disposed off only in approved sites, with the approval of Competent Authority with necessary precautions for general safety and health aspects of the people. The construction and demolition waste shall be managed as per Construction & Demolition Waste Management Rules, 2016.

ii) Construction spoils, including bituminous materials and other hazardous materials, must not be allowed to contaminate watercourses. The dump

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sites for such materials must be secured so that they should not leach into the adjacent land/ lake/ stream etc.

7. **Diesel Generator sets:**

i) Low Sulphur Diesel shall be used for operating diesel generator sets to be used during construction phase. The air and noise emission shall conform to the standards prescribed in the Rules under the Environment (Protection) Act, 1986, and the Rules framed thereon.

ii) The diesel required for operating stand by DG sets shall be stored in underground tanks fulfilling the safety norms and if required, clearance from Chief Controller of Explosives shall be taken.

iii) The acoustic enclosures shall be installed at all noise generating equipments such as DG sets, air conditioning systems, cooling water tower etc.

8. **Air & Noise Pollution Control:**

i) Vehicles hired for bringing construction materials to the site should be in good condition and should conform to air and noise emission standards, prescribed by TNPCB/CPCB. The vehicles should be operated only during non-peak hours.

ii) Ambient air and noise levels should conform to residential standards prescribed by the TNPCB, both during day and night. Incremental pollution loads on the ambient air and noise quality should be closely monitored during the construction phase. The pollution abatement measures shall be strictly implemented.

iii) Traffic congestion near the entry and exit points from the roads adjoining the proposed project site shall be avoided. Parking shall be fully internalized and no public space should be utilized. Parking plan to be as per CMDA norms. The traffic department shall be consulted and any cost effective traffic regulative facility shall be met before commissioning.

iv) The buildings should have adequate distance between them to allow free movement of fresh air and passage of natural light, air and ventilation.

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v) The project proponent should ensure that adequate Air Pollution Control measures shall be provided from buses and other vehicles, which will be entering the bus terminal. Further, water sprinkling system shall be provided and same shall be used at regular interval to control the dust emission within the project site.

9. Building material:

i) Fly-ash blocks should be used as building material in the construction as per the provision of Fly ash Notification of September, 1999 and amended as on 27th August, 2003 and Notification No. S.O. 2807 (E) dated: 03.11.2009.

ii) Ready-mix concrete shall alone be used in building construction and necessary cube-tests should be conducted to ascertain their quality.

iii) Use of glass shall be reduced up to 40% to reduce the electricity consumption and load on air conditioning. If necessary, high quality double glass with special reflecting coating shall be used in windows.

10. Storm Water Drainage:

i) Storm water management around the site and on site shall be established by following the guidelines laid down by the storm water manual.

ii) Storm water management plan shall be obtained by engaging the services of Anna University/IIT.

11. Energy Conservation Measures:

i) Roof should meet prescriptive requirement as per Energy Conservation Building Code by using appropriate thermal insulation material, to fulfill the requirement.

ii) Opaque wall should meet prescribed requirement as per Energy Conservation Building Code which is mandatory for all air conditioned spaces by use of appropriate thermal insulation material to fulfill the requirement.

iii) All norms of Energy Conservation Building Code (ECBC) and National Building Code, 2005 as energy conservation have to be adopted Solar lights shall be provided for illumination of common areas.

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iv) Application of solar energy should be incorporated for illumination of common areas, lighting for gardens and street lighting. A hybrids system or fully solar system for a portion of the apartments shall be provided.

v) A report on the energy conservation measures conforming to energy conservation norms prescribed by the Bureau of Energy Efficiency shall be prepared incorporating details about building materials & technology; R & U factors etc and submitted to the SEIAA in three month's time.

vi) Energy conservation measures like installation of CFLs/TFLs for lighting the areas outside the building should be integral part of the project design and should be in place before project commissioning.

12. Fire Safety:

i) Adequate fire protection equipments and rescue arrangements should be made as per the prescribed standards.

ii) Proper and free approach road for fire-fighting vehicles up to the buildings and for rescue operations in the event of emergency shall be made.

13. Green Belt Development:

i) The Project Proponent shall plant tree species with large potential for carbon capture in the proposed green belt area based on the recommendation of the Forest department well before the project is completed.

ii) The purpose of Green belt around the project is to capture the fugitive emissions and to attenuate the noise generated, in addition to the improvement in the aesthetics. A wide range of indigenous plants species should be planted in and around the premise in consultation with the DFO, Kanchipuram District / State Agriculture University. The plants species should have thick canopy cover, perennial green nature, native origin and large leaf areas. Medium size trees and small trees alternating with shrubs shall be planted. If possible Miyawaki method of planting i.e planting different types of trees at very close intervals may be tried which will give a good green cover. A total of 15% of the plot area should be

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designated for green belt which should be raised along the boundaries of the plot and in between blocks in an organized manner.

iii) The proponent shall develop the green belt as per the plan furnished and area earmarked for the greenbelt shall not be alter at any point of time for any other purpose.

iv) The proponent has to earmark the greenbelt area with dimension and GPS coordinates for the green belt area and the same shall be included in the layout out plan to be submitted for CMDA/DTCP approval.

14. Sewage Treatment Plant:

i) The Sewage Treatment Plant (STP) installed should be certified by an independent expert/ reputed Academic institutions for its adequacy and a report in this regard should be submitted to the SEIAA, TN before the project is commissioned for operation. Explore the less power consuming systems viz baffle reactor, etc., for the treatment of sewage.

ii) The Proponent shall install STP as furnished. Any alteration to satisfy the bathing quality shall be informed to SEIAA-TN.

iii) The project proponent shall operate and maintain the Sewage treatment Plant effectively to meet out the standards prescribed by the CPCB.

iv) The project proponent shall continuously operate and maintain the Sewage treatment plant to achieve the standards prescribed by the CPCB.

v) The project proponent has to ensure the complete recycling of treated sewage after achieving the standards prescribed by the CPCB.

vi) The project proponent has to provide separate standby D.G set for the STP for the continuous operation of the STP in case of power failure.

vii) The proponent shall obtain the necessary permission to utilize the treated sewage/ grey water for avenue plantation and green belt development in the OSR area after achieved the standards prescribed for the treated sewage by TNPCB.

15. Rain Water Harvesting:

i) The proponent/ Owner of the Flats shall ensure that roof rain water collected from the covered roof of the buildings, etc shall be harvested so

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as to ensure the maximum beneficiation of rain water harvesting by constructing adequate sumps so that 100% of the harvested water shall be reused.

ii) Rain water harvesting for surface run-off, as per plan submitted should be implemented. Before recharging the surface run off, pre-treatment with screens, settlers etc. must be done to remove suspended matter, oil and grease, etc.

iii) The Project Proponent has to provide rain water harvesting collection tank to the capacity of 250KLD in order to recover and reuse the rain water during normal rains.

iv) The project activity should not cause any disturbance & deterioration of the local bio diversity.

16. Building Safety:

Lightning arrester shall be properly designed and installed at top of the building and where ever is necessary.

Part – D - Specific Conditions – Operational Phase/Post constructional phase/Entire life of the project:

1. There should be Fire fighting plan and all required safety plan.
2. Regular fire drills should be held to create awareness among owners/ residents.
3. House hold hazardous waste such as batteries, small electronics, CFL bulbs, expired medicines and used cleaning solvent bottles should be segregated at source, collected once in a month from residences and disposed as per the SWM rules 2016.
4. The building should not spoil the green views and aesthetics of surroundings and should provide enough clean air space.
5. The project proponent has to furnish the certificate stating that the proposed site had not encroached any water body (rivers, canals, lakes, ponds, tanks, etc) from its original boundary shall be obtained from the competent authority before obtaining CTE from TNPCB.
6. The project proponent shall furnish the permission flood NOC from the PWD before obtaining CTO from TNPCB.

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agreements for compliance of all conditions furnished in Environment Clearance (EC) order issued by the SEIAA-TN or the Proponent himself shall maintain all the above facilities for the entire period. The copy of MOU between the buyers Association and proponent shall be communicated to SEIAA-TN.

18. The ground water level and its quality should be monitored and recorded regularly in consultation with Ground Water Authority.
19. Treated effluent emanating from STP shall be recycled / reused to the maximum extent possible. The treated sewage shall conform to the norms and standards for bathing quality laid down by CPCB irrespective of any use. Necessary measures should be made to mitigate the odour and mosquito problem from STP.
20. The Proponent shall operate STP continuously by providing stand by DG set in case of power failure.
21. It is the sole responsibility of the proponent that the treated sewage water disposed for green belt development/ avenue plantation should not pollute the soil/ ground water/ adjacent canals/ lakes/ ponds, etc
22. Adequate measures should be taken to prevent odour emanating from solid waste processing plant and STP.
23. The e - waste generated should be collected and disposed to a nearby authorized e-waste centre as per E- waste (Management & Handling), Rules 2016 as amended.
24. Diesel power generating sets proposed as source of back-up power during operation phase should be of enclosed type and conform to rules made under the Environment (Protection) Act, 1986. The height of stack of DG sets should be equal to the height needed for the combined capacity of all proposed DG sets.
25. The noise level shall be maintained as per MoEF/CPCB/TNPCB guidelines/norms both during day and night time.
26. Spent oil from D.G sets should be stored in HDPE drums in an isolated covered facility and disposed as per the Hazardous & other Wastes (Management & Transboundary Movement) Rules 2016. Spent oil from D.G sets should be disposed off through registered recyclers.
27. The proponent is required to provide a house hold hazardous waste / E-waste collection and disposal mechanism.

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7. Solar energy saving shall be increased to atleast10% of total energy utilization.
8. The Project proponent has to spend the CER amount of Rs. 181Lakhs shall be paid in the form of DD favoring Environmental Management Authority of Tamil Nadu" (EMAT) and the said amount shall be utilized for the de-silting and beautification of water bodies in and around project site before applying for CTO from TNPCB.
9. The EMP cost of Rs. 164.5 Lakhs shall be deposited in a nationalized bank by opening separate account and the head wise expenses statement shall be submitted to TNPCB with a copy to SEIAA annually.
10. The EMP cost shall be printed in the Brochure / Pamphlet for the preparation of the sale of the property and should also mention the component involved.
11. The Project proponent shall get due permission from the wetland Authority before the commencement of the work, if applicable.
12. The Project proponent should discuss with the wet land Authority, Tamil Nadu Forest Department, PWD and support lake restoration cum improvement, awareness and conservation programs.
13. The project activities should in no way disturb the manmade structures.
14. The Proponent shall do afforestation/ restoration programme contemplated to strengthen the open spaces shall preferably include native species along with the financial forecast for planting and maintenance for 5 years.
15. "Consent to Operate" should be obtained from the Tamil Nadu pollution Control Board before the start of the operation of the project and copy shall be submitted to the SEIAA-TN.
16. Raw water quality to be checked for portability and if necessary RO plant shall be provided.
17. The Proponent should be responsible for the maintenance of common facilities including greening, rain water harvesting, sewage treatment and disposal, solid waste disposal and environmental monitoring including terrace gardening for a period of 3 years. Within one year after handing over the flats to all allottees a viable society or an association among the allottees shall be formed to take responsibility of continuous maintenance of all facilities with required

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28. The proponent/ Owner of the Flats shall ensure that storm water drain provided at the project site shall be maintained without choking or without causing stagnation and should also ensure that the storm water shall be properly disposed off in the natural drainage / channels without disrupting the adjacent public. Adequate harvesting of the storm water should also be ensured.
29. Used CFLs and TFLs should be properly collected and disposed off/sent for recycling as per the prevailing guidelines/rules of the regulatory authority to avoid mercury contamination.
30. A copy of the Environmental clearance (EC) letter shall be made available to all the allottees along with the allotment order / sale deed.
31. Failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract action under the provisions of the Environment (Protection) Act, 1986.

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Copy to:

1. The Principal Secretary to Government, Environment & Forests Dept, Govt. of Tamil Nadu, Fort St. George, Chennai - 9.
2. The Chairman, Central Pollution Control Board, Parivesh Bhavan, CBD Cum-Office Complex, East Arjun Nagar, New Delhi 110032.
3. The Member Secretary, Tamil Nadu Pollution Control Board, 76, Mount Salai, Guindy, Chennai-600 032.
4. The APCCF (C), Regional Office, Ministry of Environment & Forest (SZ), 34, HEPC Building, 1st & 2nd Floor, Cathedral Garden Road, Nungambakkam, Chennai - 34.
5. Monitoring Cell, I A Division, Ministry of Environment & Forests, Paryavaran Bhavan, CGO Complex, New Delhi 110003.
6. The Commissioner, Greater Chennai Corporation, Rippon Building, Chennai District
7. Stock File.

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File No: TNRERA/2962/2020

TAMIL NADU REAL ESTATE REGULATORY AUTHORITY
REGISTRATION CERTIFICATE OF PROJECT
FORM 'C'
[See rule 6(1)]

This registration is granted under section 5 of The Real Estate (Regulation and Development) Act, 2016 to the following project under project registration number

TN /01/ Building /0302/2020, Dated 21.08.2020
Project Name : "—"

Project Details & Address :

Block - 1 to 12 of Ground Floor + 5 Floors with 94 tenements in each block and by totalling altogether 1128 tenements, Comprised in S. Nos. 537 Part, 539/2 Part, 540/1 Part, 540/2 of Perumbakkam Village, Tambaram Taluk, Kancheepuram District. Planning Permission was issued by the Member-Secretary, CMDA, Chennai, Vide Letter No. PP/NHRB/S(B1)/1022/2019, dated 17.07.2020 and the Building Permission was issued by the Special Officer/Perumbakkam Panchayat & BDO(VP)/Punitha Thomaiyar Malai Panchayat Union, Vide Letter No. 6/2020-2021, dated 27.07.2020.

Applicant :

The Executive Engineer,
Tamil Nadu Slum Clearance Board,
Chenni Special Division – 1,
Semmanchery, **Chennai - 600 119**.

2.This registration is granted subject to the following conditions, namely:-

(i) The promoter shall enter into an agreement for sale and construction agreement with the allottees as provided in 'Annexure A' of Rule 9

(ii) The promoter shall execute and register a conveyance deed and construction agreement in favour of the allottee or the association of the allottees, as the case may be, of the apartment or the common areas as per section 17 of the Act;

(iii) The promoter shall deposit seventy percent of the amounts realized by the promoter in a separate account to be maintained in a schedule bank to cover the cost of construction and the land cost to be used only for that purpose as per sub-clause (D) of clause (*I*) of sub-section (2) of section 4 of the Act;

(iv) The registration shall be valid till **NOVEMBER'2021** unless renewed by the Real Estate Regulatory Authority in accordance with section 6 read with rule 7 of the Act;

(v) The promoter shall comply with the provisions of the Act and the rules and regulations made there under;

(vi) The promoter shall not contravene the provisions of any other law for the time being in force in the area where the project is being developed.

(vii) The Registration is given based on the declaration given by you. The Registration of the Project does not amount to regularization of any violation of rules. If there is any violation/ deviation to the approved plan, it is the responsibility of the Promoter to get it regularized from the competent Authority and inform this Authority.

P.T.O.

3. If the above mentioned conditions are not fulfilled by the promoter, the regulatory authority may take necessary action against the promoter including revoking the registration granted herein, as per the Act and the rules and regulations made there under.

Project Bank Details:

Bank Name & Branch : **HDFC Bank Ltd.,**
Kelambakkam Branch,
CHENNAI - 603 103.

Account Number : **5020 0050 5624 12**

Dated : 21.08.2020
Place : Chennai-08.

Signature and seal of the Authorized Officer
Tamil Nadu Real Estate Regulatory Authority

Additional Director
(Operation),
TNRERA, Chennai-8.

21/8/2020

Prj/

ADVERTISEMENT IN ANY FORM SHOULD CONTAIN RERA REGISTRATION NUMBER AND WEBSITE ADDRESS OF THIS AUTHORITY (www.tnrera.in)

Contract Labour (Regulation and Abolition) Act,1970

FORM VI

(See Rule 25 (1))

Government of Tamil Nadu

Office of licensing officer

Application No : A/614/2020

Licence. No. **73/2020** Dated:**08/12/2020** Fee paid **Rs.10,000 /-**
(Chalan no:46,Dt:07.12.2020)

LICENCE

1. Licence is hereby granted to **M/s.B.G.Shirke Construction Technology Pvt Ltd., No72-76, Mundhwa, Pune – 411 036.** Under section 1 of 12 of the **Contract Labour (Regulation and Abolition) Act, 1970**, subject to the conditions specified in Annexure.

2. This Licence is for doing the work of **(Nature of work) " Construction – EWS Building "** in the Establishment of (Name of the principal employer) **M/s. Superintending Engineer., Tamilnadu Slum Clearance Board, No.5, Kamarajar Salai, Chennai – 600 005.** (Place of work) **Tamilnadu Slum Clearance Board., Light House Project, Global Technology Challenge(India), Perumbakkam Village, Tambaram Taluk, Chengalpattu – 600 119.**

3. This License shall remain in force till **31.12.2021**

Date: 08/12/2020

08/12/2020

Signature and seal of the Licensing Officer

Deputy Director (BOCW) Kanchipuram
Industrial Safety and Health,
Guindy, Chennai-600 032

AMENDMENT
(Rule 28)

No. of Workers (1)	Fee and Licence Fees (2)	Date of amendment (3)	Signature of the Licensing Officer (4)

RENEWAL
(Rule 29)

Date of renewal	Fee paid for renewal	Date of expiry	Signature of the Licensing Officer.

ANNEXURE

The Licence is subject to the following conditions:

1. The Licence shall be non – transferable.
2. The number of workmen employed as contract labour in the establishment shall not, on any day, exceed **100 (One Hundred Workers only)**
3. Except as provided in the rules the fees paid for the grant or, as the case may be, for renewal of the licence shall be non-refundable.
4. The rates of wages payable to the workmen by the contractor shall not be less than the rates prescribed for the Schedule of employment under the Minimum Wages Act, 1948, where applicable, and where the rates have been fixed by agreement, settlement or award, not less than the rates fixed.
5. In cases where the workmen employed by the contractor perform the same or similar kind of work as the workmen directly employed by the Principal Employer of the establishment, the rates of wages, holidays, the hours of work and other conditions of service of the workmen of the contractor shall be the same as applicable to the workmen directly employed by the principal employer of the establishment. In the case of any disagreement with regard to the same or similar kind of work the same shall be decided by the Registering Officer having t jurisdiction over the area. Any person aggrieved by the decision of the Registering Officer may prefer an appeal to the Commissioner of Labour within thirty days from the date of receipt of such decision and his decision shall be final.
6. In other cases the wage rates, holidays, hours of work and conditions of service of the workmen of the contractor shall be such as may be specified in this behalf by the Commissioner of Labour.
7. In every establishment where 20 or more women are ordinarily employed as contract labour, there shall be provided 2 rooms of reasonable dimensions for the use of their children under the age of six years. One of such rooms would be used as a play room for the children and the other as bed room for the children. For this purpose the contractor shall supply adequate number of toys and games in the play room and sufficient number of cots and beddings in the sleeping room. The standard of construction and maintenance of the crèches may be such as may be specified in this behalf by the Commissioner of Labour.
8. The Licensee shall notify any change in the number of workmen or the conditions of work to the Licensing Officer.
9. A copy of the Licence shall be displayed prominently at the premises where the contract work is being carried on.
10. The License shall within fifteen days of commencement and completion of each contract work submit a return to the Inspector appointed under Sec.28 of act intimating the date of the commencement or, as the case may be completion of such contract work in form VI-A)

Security Deposit through NSC Bond A/C No:49727 49974 (Date:02/12/2020) Rs.50,000 /-

08/12/2020

Deputy Director (BOCW)
Industrial Safety & Health,Kancheepuram

Deputy Director (BOCW) Kanchipuram
Industrial Safety and Health,
@ Guindy, Chennai-600 032

The Interstate Migrant Workmen ACT, 1979

FORM VIII

(See Rule 11 (1))

GOVERNMENT OF TAMIL NADU

Office of the licensing officer

Application No : A/615/2020

Licence. **No.69/2020**

Dated :**08/12/2020**

Fee paid :**Rs 2500 /-**
(Challan no:47,Dt:07.12.2020)

LICENCE

1. Licence is hereby granted **M/s. B.G.Shirke Construction Technology Pvt Ltd., No72-76, Mundhwa, Pune – 411 036.** Under sub-section (1) of section 8 of the **Inter-State Migrant Workmen (Regulation of Employment and Conditions of Service) Act, 1979** subject to the conditions specified in Annexure.

2. This Licence is for doing the work of **(Nature of work) " Construction – EWS Building "** in the Establishment of (Name of the principal employer) at **M/s. Superintending Engineer., Tamilnadu Slum Clearance Board, No.5, Kamarajar Salai, Chennai – 600 005.** (Place of work) **Tamilnadu Slum Clearance Board., Light House Project, Global Technology Challenge(India), Perumbakkam Village, Tambaram Taluk, Chengalpattu – 600 119.**

3. This Licence shall remain in force till **31.12.2020**

08/12/2020

Signature and Seal of Licensing Officer
Deputy Director (BOCW) Kanchipuram
Industrial Safety and Health,
@ Guindy, Chennai-600 032

RENEWAL (Rule 14)

Date of Renewal	Fee paid for renewal	Date of expiry	Signature and Seal of Licensing Officer.

ANNEXURE

The Licence is subject to the following conditions:

1. The Licence shall be non – transferable.

2. The number of workmen employed as Inter-state migrant workmen in the establishment shall not, on any day, exceed **50 (Fifty Workers only)**

3. Except as provided in the rules the fees paid for the grant or, as the case may be, for renewal of the licence shall be non-refundable.

4. The rates of wages payable to the workmen by the contractor shall not be less than the rates prescribed for the Schedule of employment under the Minimum Wages Act, 1948, Where applicable, and where the rates have been fixed by agreement, settlement or award, not less than the rates fixed.

5. a) In cases where the workmen employed by the contractor perform the same or similar kind of work as the workmen directly employed by the Principal Employer of the establishment, the rates of wages, holidays, the hours of work and other conditions of service of the workmen of the contractor shall be the same as applicable to the workmen directly employed by the principal employer of the establishment. In the case of any disagreement with regard to the same or similar kind of work the same shall be decided by the Registering Officer having jurisdiction over the area. Any person aggrieved by the decision of the Registering Officer may prefer an appeal to the Commissioner of Labour within thirty days from the date of receipt of such decision and his decision shall be final.

   b)In other cases the wage rates, holidays, hours of work and conditions of service of the workmen of the contractor shall be such as may be specified in this behalf by the Commissioner of Labour.

6. Every migrant workman shall be entitled to allowances benefits, facilities, etc, as prescribed in the Act and these rules.

7. No Female migrant workman shall be employed by any contractor before 6 am or after 7 pm. Provided that this clause shall not apply to the employment of female migrant workmen in pit head baths, Creches and canteens and as midwives and nurses in hospitals and dispensaries.p

8. The Contractor shall notify any change in the number of migrant workmen or the conditions of work to the Licensing Officer.

9. The Contractor shall comply with all the provisions of the Act and these Rules.

10. The Copy of license shall be displayed prominently at the premises where the migrant workmen are employed.

Security Deposit through NSC Bond A/C No:49727 65622 (Date:02/12/2020) Rs.50,000 /-

08/12/2020

Deputy Director (BOCW)
Industrial Safety & Health, Kancheepuram

Deputy Director (BOCW) Kanchipuram
Industrial Safety and Health,
@ Guindy, Chennai-600 032

Annexure - 2

Geotechnical Investigation Report – Lighthouse Project at Chennai

Summary:

Nature of Project : 1052 EWS HOUSES (Ground + 5 Floors)

Owner : MINISTRY OF HOUSING AND URBAN AFFAIRS

Contractor : B G SHIRKE CONSTRUCTION TECHNOLOGY PVT LTD

Geotechnical Investigation Agency: GEO MARINE CONSULTANTS (P) LTD., CHENNAI

Project Location : SEMMANCHERI, PERUMBAKKAM CHENNAI

Scope of Work

Field Work

- Conducting twenty four soil investigation bore holes of 150 mm diameter in overburden soil & NX diameter in rock formation.
- The depth of investigation varies from 8.0m to 13.0m with respect to the borehole location and the termination is as per the direction of client incharge.
- Conducting Standard Penetration Test (SPT) within the borehole in overburden and grade-VI & V weathering rock formation followed by rock core drilling upto the termination depth.
- Collection of disturbed soil sample (Split Spoon Sample) and rock core sample.
- Collection of water samples if groundwater table met within the investigation depth
- Conducting six dynamic cone penetration test IS 4968 (part-I):1976
- Conducting three electrical resistivity survey (ERT) at the client designated locations as per IS 3043-1987

Laboratory Work

- Natural Moisture Content
- Atterberg limits, Grain Size Analysis
- Chemical Analysis test on soil and water samples to give pH, Chlorides and Sulphates
- Strength test on rock core.

Methodology of Field Work

Equipment Used and Method of Drilling:

Twenty four soil investigation boreholes were put as per the planning . All the boreholes were sunk by conventional rotary drilling rigs. For borehole Methodology followed for boring conformed to IS1892:2000. Boring was progressed by the cutting action of rotating bit with water circulation and stabilizing the side of the boreholes by using casing pipes/bentonite slurry up to required depth to prevent collapse of sidewall.

Standard Penetration Tests (SPT):

This is a field test to determine "Penetration Resistance of Stratum at the Test Depth". This has been conducted in the boreholes generally up to refusal depth using procedures described in IS 2131:2002. The tests were conducted at the depth intervals specified. The SPT-samples collected were used as disturbed soil samples. These samples were used for visual and physical identification and for conducting laboratory classification tests as per IS1498:1970.

Collection of Ground Water Samples:

One representative water sample from each borehole was collected after 24 hours of completing the borehole if water table met within the investigated depth.

Laboratory Testing

On Coarse Grained Soil

On the representative samples, sieve analysis tests were conducted to arrive at grain size distribution. These tests were conducted as per IS 2720 (part 4):1985 and the results are presented in Tabular form and the graphical representation of grain size distribution curve for the representative samples in each bore is presented in the report.

On Fine Grained Soil

On the SPT sample index property tests were conducted to estimate consistency. These test results and the graphical representation of hydrometer analyses curve for the representative samples in each bore is presented in the report.

Chemical Analysis Tests

On representative soil and water samples, chemical analysis tests were conducted to estimate pH, Chloride and Sulphates and these results are presented in the report.

FOUNDATION SYSTEM

Proposed Structures

An understanding of the proposed construction and the order of loads on the foundation was done for choosing the appropriate foundation system. In the present case, the proposed structure is configured with ground and five upper floors, and is meant for residential use. For this kind of structure, the column loads could vary between 1500 kN to 2000 kN. The above mentioned loads have no bearing on the design of either sub or super structures and are mentioned just to provide an insight to choose an appropriate foundation system with respect to subsoil conditions.

Sub Surface Characteristics

The general sub soil stratification in the project site consists of the following two layers of formation:

Layer-I	0.0m to 2.0m/ 3.0m	Very Soft, Medium Stiff to Hard, Silty Clay
Layer-II	Beyond 2.0m/3.0m	Rock Formation of different degree of weathering

Foundation System - Option-I (Shallow Foundation System)

In the present project site there is variation in the shear strength characteristics of the soil formation exits in the top 3.0m depth below the natural ground level. Hence for adopting shallow foundation system the minimum depth of excavation is 2.75m with a 100mm thickness of soil replacement with sand-gravel (1:1) mix or quarry dust. Thus the overall depth of minimum foundation excavation can be 2.85m below the natural ground level. The isolated footing or strip raft shall be designed for a recommended allowable bearing pressure of 400kPa. Since the formation beyond the bearing stratum is rock formation with varying grade of weathering, only elastic settlement will takes place. *In case raft is adopted it can be designed for the reaction pressure due to the super structural load.*

Foundation System - Option-II (Pile foundation system)

In case of shallow foundation system doesn't meet the requirement alternatively pile foundation can be adopted. The piles can be installed by drilling with direct mud circulation technique. Since the degree of weathering is not only varying with depth but also vary over the entire investigation area hence it is ideal to model the rock formation as "very dense sand". The recommended safe load carrying capacity of bored cast insitu piles in compression, tension and lateral for different diameters located at a depth of 6.0m below the ***natural ground level*** have also been worked out as per IS 2911Part-I-Section-2.

RECOMMENDATIONS

Recommendation for shallow foundation system:

- In case of shallow foundation is adopted, the minimum depth of excavation below the natural ground level is 2.75m with a 100mm thickness of soil replacement with sand-gravel mix or quarry dust.
- The isolated footing or strip raft shall be designed for a recommended allowable bearing pressure of 400 kPa.
- In case raft is adopted it can be designed for the reaction pressure due to the super structural load.
- Since the formation beyond the founding depth being rock formation of varying grade of weathering, only immediate or elastic settlement will takes place (Consolidation settlement criteria is not applicable in the present project site)
- Excavated earth is not suitable for backfilling the foundation trenches
- Foundation excavation can be carried out with mechanical excavator.
- During the time of excavation any variation in the sub soil formation is encountered at the founding level the same may be bring to the notice of geotechnical consultants to confirm the stratum and bearing capacity.

Recommendation for pile foundation system

- In case of shallow foundation system discussed above is not adopted, alternatively shallow bored cast insitu piles can be adopted.
- The allowable safe load carrying capacities of different diameters of piles can be adopted as theoretical design loads.

- The theoretical load carrying estimates of piles shall be confirmed by conducting pile loads tests as per the guide lines laid down in IS: 2911-Part-IV.
- The boring shall be carried out using direct mud circulation prepared out of sodium bentonite.
- After reaching the borehole termination depth, the borehole shall be cleaned using mud circulation for a minimum period of 30min or till the return mud is relatively clear of soil particles.
- After ensuring the borehole is clean, the tremie pipe shall be lowered and concreting can be done.

Construction method statement of pile foundation:

- The mud used shall be made out of sodium bentonite with minimum free swell index of more than 300% and liquid limit more than 100%. The silt content in bentonite shall not be more than 5%.
- The mud should be prepared using sodium bentonite with a density of 1.10 to 1.15 g/cc.
- The guide casing shall be upto the top of hard stratum as the formation overlain the weathered rock is very soft/ very loose and collapsible formation.

General Recommendation

- The present project site fall in seismic zone-III as per IS 1893-P-I and based on the liquefaction analysis the sub soil formation exists at site is non-liquefiable considering the zone-III seismic intensity.
- The chlorides content in ground water are more than the permissible limit of 500 mg/l as per IS 456 Table 1.0. Hence proper cover to the reinforcement shall be provided or anti corrosive coating shall be adopted.
- Corresponding to the sulphate content in 2:1 Water-Soil extract and ground water use Table 4.0 IS 456 Clause 2.0 for minimum cement content and maximum water cement ratio.

Completion Certificate of LHP Chennai

CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
Thalamuthu Natarajan Building
No.1, Gandhi Irwin Road, Egmore, Chennai - 600 008.

BY RPAD

COMPLETION CERTIFICATE

From	To
The Member-Secretary Chennai Metropolitan Development Authority "Thalamuthu-Natarajan Building" No.1, Gandhi-Irwin Road, Egmore, Chennai-600 008	1) The Chairman, TANGEDCO, Anna Salai, Chennai-600 002. 2) The Managing Director, CMWSSB, No.75, Santhome High Road MRC Nagar, R.A.Puram, Chennai-600 028.

Letter No. CMDA/CC/NHRB/S/0188/2022 **Dated:20.05.2022**

Sir / Madam,

Sub: CMDA – Enforcement Cell (South-II) – Completed Construction of Group Development comprising of 12 Blocks; Typical Block 1 to 12 consisting of Ground Floor + 5 Floors Residential Building with 1128 Dwelling Units (94 dwelling units in each Block) at Nukkampayalam Road and TNSCB Road, Perumbakkam, Chennai in S.No.537 (Part), 539/2 (Part), 540/1 (Part) & 540/2 of Perumbakkam Village, within the Limits of St.Thomas Mount Panchayat Union – Completion Certificate – Issued – Reg.

Ref: 1. W.P(MD) No.8948 of 2019 & W.M.P.(MD) Nos.6912 & 6913/2019 dated 12.04.2019.

2. CMDA Planning Permission No.B/NHRB/207 A to B/2020 dated 17.07.2020 in Planning Permit No.13576 in letter No. PP/NHRB/S(B1)/1022/2019 dated 17.07.2020.

3. Completion Certificate Application received from Tamil Nadu Slum Clearance Board (Now Tamil Nadu Urban Habitat Development Board) Represented by Thiru.P.P.Elangovan.

4. This office D.C. Letter even No. dated 19.045.2022.

5. Additional Development Charges & Infrastructure and Amenities Charges remitted vide CMDA Receipt No.B0021436 dated 20.05.2022.

*****

This is to certify that Tamil Nadu Urban Habitat Development Board (then Tamil Nadu Slum Clearance Board) Represented by Thiru.P.P.Elangovan has Completed the Construction of Group Development comprising of 12 Blocks; Typical Block 1 to 12 consisting of Ground Floor + 5 Floors Residential Building with 1128 Dwelling Units (94 dwelling units in each Block) at Nukkampayalam Road and TNSCB Road, Perumbakkam, Chennai in S.No.537 (Part), 539/2 (Part), 540/1 (Part) & 540/2 of Perumbakkam Village, within the Limits of St.Thomas Mount

Panchayat Union vide CMDA' Planning Permission issued in the reference 2nd cited. It was inspected and observed that the building has been completed as per approved plan and satisfies the Norms for issue of Completion Certificate approved by the Monitoring Committee.

2. Accordingly Completion Certificate is issued for the above construction in **C.C.No.EC/South-II/ 144 /2022 dated 20.05.2022.**

3. In accordance with the Provisions of the Town & Country Planning Act, 1971 and the Rules made there under. This Provision does not cover the Structural Stability aspect of the building. As far as the Structural Stability aspect of the building is concerned, it falls within the jurisdiction of the Local Body concerned as stated in the connected Building Rules under the respective Local Body Act, 1920, such as Madras City Municipal Corporation Act, 1919, Tamil Nadu District Municipality Act, Tamil Nadu Panchayat Act. The Completion Certificate issued under Development Regulations 4(5) does not cover the Structural Stability aspect. It is the sole responsibility of the Applicant/Developer/ Power Agent and the Structural Engineers/ Licensed Surveyor/Architects, who has signed in the Plan to ensure the safety after construction and also for its continued Structural Stability of the buildings.

4. Further, the Completion Certificate issued is subject to outcome of the Hon'ble High Court order in the reference 1st cited (Also indicated in the Planning Permission approval letter in Serial No.11).

Yours faithfully,

20/05/2022

for MEMBER-SECRETARY

20/5/2022

Copy to:

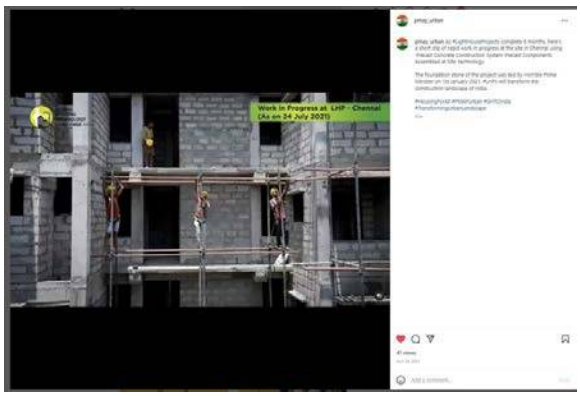
1. Tamil Nadu Urban Habitat
   Development Board
   Represented by Thiru.P.P.Elangovan,
   No.5, Kamarajar Salai,
   Chennai - 600 089.

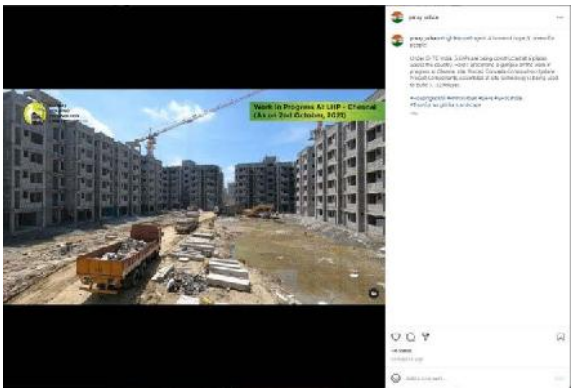
2. The Chairperson, (TNRERA/9333/2021,dt.18.05.2022)
   TNRERA,
   CMDA Tower-II, 1st Floor, Egmore,
   Chennai – 600 008.

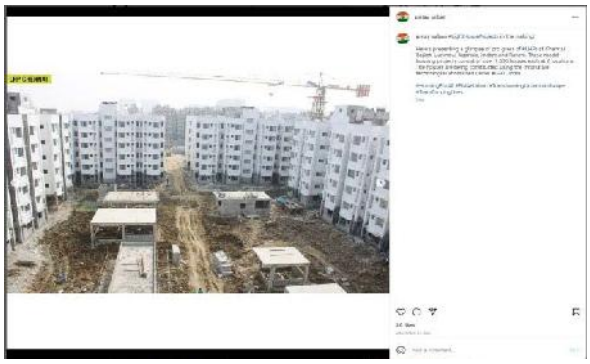
3. The System Analyst, Computer Cell, CMDA
   (to update Webpage).

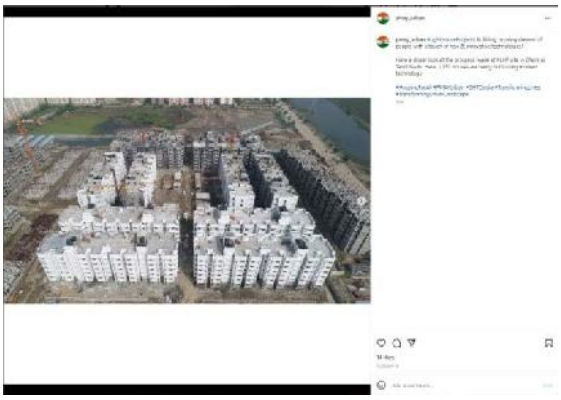
Annexure - 4

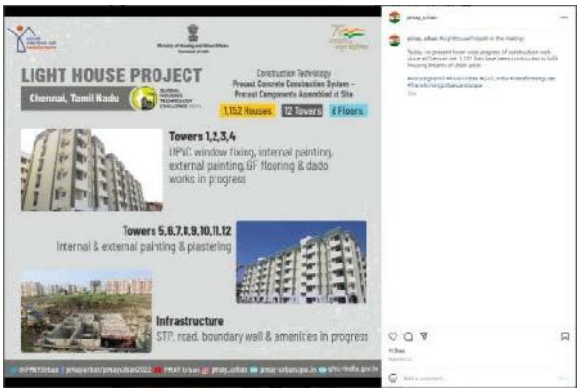
IEC campaign and social media activities on LHP Chennai











Housing For All ✓
@PMAYUrban

#LightHouseProject in Chennai will soon be ready to welcome 1,152 families. A home well-equipped with all basic/civic amenities which the family can proudly say its “ours”. Over 98% work has been completed here & the external finishing work is in full swing. Here’s an overview.

11:48 AM · Apr 28, 2022 · Twitter Web App

3 Retweets **14** Likes

Housing For All ✓
@PMAYUrban

Presenting glimpse of the rapid progress made at #LightHouseProject Chennai site in Tamil Nadu, where 1,152 houses have been built to fulfil housing dreams of people. Over 95% work has been completed here.

To know more about the project, visit: ghtc-india.gov.in.

10:16 AM · Apr 9, 2022 · Twitter Web App

6 Retweets **1** Quote Tweet **16** Likes

Housing For All
@PMAYUrban

A housing project for thousands of smiles!

A glimpse into #LHP Chennai, which is complete with all infrastructure in place. The site will soon be inaugurated by Hon'ble Prime Minister & subsequently, 1,152 flats will be handed over to beneficiaries.

#HousingForAll

4:10 PM · May 19, 2022 · Twitter for Android

9 Retweets 1 Quote Tweet 14 Likes

Housing For All
@PMAYUrban

#ConstructionTechnology revolution in India has taken a concrete shape with completion of #LightHouseProject in Chennai.

Take a look at some glimpses from on site.

#HousingForAll #PMAYUrban #GHTCIndia #LHPs #TransformingLives #TransformingUrbanLandscape #AffordableHousing

Hardeep Singh Puri and 3 others

11:01 AM · May 14, 2022 · Twitter Web App

6 Retweets 25 Likes

Housing For All
@PMAYUrban

#LightHouseProject Chennai has been completed in 12 months & is ready to be inaugurated. The project consists of 1,152 flats, spread across 12 towers with 6 floors each.

#HousingForAll #PMAYUrban #GHTCIndia #ConstructionTechnology #AffordableHousing #TransformingUrbanLandscape

Hardeep Singh Puri and 4 others

1:31 PM · May 23, 2022 · Twitter Web App

8 Retweets 26 Likes

Housing For All
@PMAYUrban

#LightHouseProjects: Dedicating innovative housing technology to the nation!

A beautiful overview of #LightHouseProject Chennai built with Precast Concrete Construction System-Precast Components Assembled at Site technology. Have a look here.

#HousingForAll

Hardeep Singh Puri and 5 others

9:53 AM · May 20, 2022 · Twitter Web App

10 Retweets 1 Quote Tweet 25 Likes

Housing For All
@PMAYUrban

Here's #LightHouseProject Chennai at a glance – Right from the buildings, towers and infrastructure in place.

#HousingForAll #PMAYUrban #GHTCIndia #LHPs #ConstructionTechnology #AffordableHousing #TransformingUrbanLandscape #TransformingLives

Hardeep Singh Puri and 4 others

8:05 PM · May 24, 2022 · Twitter Web App

11 Retweets 26 Likes

Housing For All
@PMAYUrban

Bird's-eye view of #LightHouseProject Chennai. Catch a glimpse of the housing project more closely.

#HousingForAll #PMAYUrban #GHTCIndia #LHPs #ConstructionTechnology #AffordableHousing #TransformingUrbanLandscape #TransformingLives

10:42 AM · May 24, 2022 · Twitter Web App

9 Retweets 18 Likes

Housing For All
@PMAYUrban

The soon-to-be inaugurated #LightHouseProject in Chennai raced ahead of 5 other #LHP projects & completed the construction work with all infrastructure in place within just 12 months.

#HousingForAll #PMAYUrban #GHTCIndia #TransformingLives #TransformingUrbanLandscape

5:46 PM · May 25, 2022 · Twitter Web App

8 Retweets 13 Likes

Narendra Modi
@narendramodi

In Chennai, development works worth over Rs. 31,000 crore would either be inaugurated or their foundation stones would be laid. These projects cover key infra sectors such as railways, petroleum, housing and roads. Commerce and connectivity would be boosted by these works.

7:57 PM · May 25, 2022 · Twitter for iPhone

7,160 Retweets 404 Quote Tweets 36.5K Likes

Housing For All
@PMAYUrban

#LightHouseProject Chennai is ready to be inaugurated by Hon'ble Prime Minister. The housing project will fulfil #affordablehousing dreams of 1,152 families.

#HousingForAll #PMAYUrban #GHTCIndia #TransformingLives #TransformingUrbanLandscape #DeliveringSmiles #DeliveringHomes

Hardeep Singh Puri and 4 others

11:06 AM · May 26, 2022 · Twitter Web App

Housing For All
@PMAYUrban

Hon'ble Prime Minister will inaugurate #LightHouseProject in Chennai tomorrow, built at a cost of Rs 116 crore under Pradhan Mantri Awas Yojana-Urban.

timesofindia.indiatimes.com/india/pm-modi-...

#HousingForAll #GHTCIndia #TransformingLives #TransformingUrbanLandscape #ConstructionTechnology

12:32 PM · May 25, 2022 · Twitter Web App

7 Retweets 1 Quote Tweet 18 Likes

Housing For All
@PMAYUrban

It's time to welcome #LightHouseProjects!

#LightHouseProject in Chennai is ready for inauguration. The housing project which comprises of 1,152 flats will be dedicated to the Nation by Hon'ble Prime Minister on 26th May 2022. Here are few glimpses from on-site.

Hardeep Singh Puri and 4 others

9:00 PM · May 25, 2022 · Twitter for Android

61 Retweets 2 Quote Tweets 200 Likes

Narendra Modi
@narendramodi

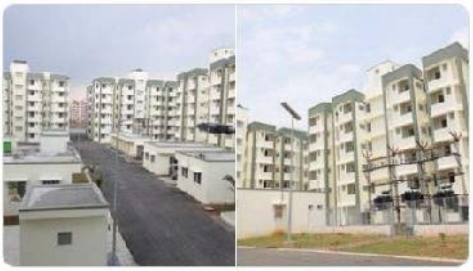
The projects being inaugurated include:

Madurai-Theni railway gauge conversion project.

Third railway line between Tambaram-Chengalpattu.

2 natural gas pipelines.

Houses constructed as part of Light House Project, Chennai.



7:57 PM · May 25, 2022 · Twitter for iPhone

3,764 Retweets 102 Quote Tweets 13.3K Likes

Housing For All
@PMAYUrban

Inauguration of first #LightHouseProject will be done by Hon'ble Prime Minister in Chennai, Tamil Nadu. The event will begin from 5 pm onwards.

Watch live on: webcast.gov.in
YouTube Live: youtube.com/watch?v=BdodjT...

#HousingForAll

4:01 PM · May 26, 2022 · Twitter Web App

5 Retweets 15 Likes

Housing For All
@PMAYUrban

With inauguration of #LHP Chennai, housing dreams of more than 1,000 families was fulfilled. A group of beneficiaries were present at the venue from where Hon'ble Prime Minister inaugurated the project. Keys of houses were also handed over to 5 beneficiaries by Hon'ble PM.

Hardeep Singh Puri and 4 others

8:21 PM · May 26, 2022 · Twitter for Android

10 Retweets 33 Likes

Housing For All
@PMAYUrban

There is no greater feeling than living in your own house & beneficiaries of #LightHouseProject Chennai are now living this dream!
After inauguration of the project this May, grih pravesh ceremonies are being held by beneficiaries as they enter their own pucca house with smiles.

2:15 PM · Jul 11, 2022 · Twitter Web App

25 Retweets 1 Quote Tweet 93 Likes

Housing For All
@PMAYUrban

A walkthrough #LightHouseProject Chennai, showcasing a glimpse of how the model housing project looks like. #LHP Chennai comprises of 1,152 Dwelling Units, spread across 12 towers & 6 floors.

#HousingForAll #PMAYUrban #TransformingLives #TransformingUrbanLandscape

1:13 PM · May 26, 2022 · Twitter Web App

5 Retweets 12 Likes

Housing For All
@PMAYUrban

Hon'ble Prime Minister Shri Narendra Modi dedicates #LightHouseProject in Chennai, Tamil Nadu, to the nation. The housing project will now be home to 1,152 families.

#HousingForAll #GHTCIndia #TransformingUrbanLandscape #TransformingLives #AffordableHousing

Hardeep Singh Puri and 4 others

7:11 PM · May 26, 2022 · Twitter Web App

10 Retweets 33 Likes

Narendra Modi
@narendramodi

Chennai's Light House project is special for numerous reasons. It illustrates our commitment to delivering the best possible infrastructure for the poor.

9:28 PM · May 26, 2022 · Twitter Media Studio

2,368 Retweets 23 Quote Tweets 6,176 Likes

Manoj Joshi
@Secretary_MoHUA

Here's a quick look at the #Chennai #LightHouse Project under the #PMAY (Urban). The project contains 12 towers with six floors, offering 1,152 model infrastructured houses.

3:59 PM · May 26, 2022 · Twitter Web App

17 Retweets 1 Quote Tweet 38 Likes

Manoj Joshi
@Secretary_MoHUA

The #Chennai #LightHouseProject is the first project completed among the six LHPs under the ambit of #PMAYUrban. Hon'ble PM @narendramodi inaugurated 1152 houses constructed with a project cost of ₹116 cr.

10:01 PM · May 26, 2022 · Twitter Web App

19 Retweets 63 Likes

Hardeep Singh Puri
@HardeepSPuri

The new technologies identified as an outcome of the Global Housing Technology Challenge launched by @MoHUA_India are bringing about a revolutionary change in the speed & scale of building construction projects in the country.

8:43 PM · May 26, 2022 · Twitter for iPhone

20 Retweets 106 Likes

Hardeep Singh Puri
@HardeepSPuri

In a major boost to Pradhan Mantri Awas Yojana-Urban @PMAYUrban PM @narendramodi Ji inaugurates 1152 houses constructed at a cost of ₹116 crore as part of the Chennai Light House Project.

8:42 PM · May 26, 2022 · Twitter for iPhone

63 Retweets 358 Likes

Housing For All
@PMAYUrban

On 26th May 2022, #LightHouseProject in Chennai was inaugurated by Hon'ble Prime Minister. Highlights from the speech here.

#HousingForAll #GHTCIndia
#TransformingUrbanLandscape #TransformingLives
#ConstructionTechnology #AffordableHousing

12:47 PM · May 27, 2022 · Twitter Web App

5 Retweets 13 Likes

Housing For All
@PMAYUrban

LHP Chennai, equipped with all modern & basic infrastructure facilities, comprises of 1,152 houses.

#HousingForAll #PMAYUrban #GHTCIndia
#TransformingLives #TransformingUrbanLandscape
#AffordableHousing #ConstructionTechnology

2:15 PM · Jul 11, 2022 · Twitter Web App

9 Retweets 23 Likes


Pradhan Mantri Awas Yojana - Urban, Government of India
Pradhan Mantri Awas Yojana (Urban)
LIGHT HOUSE PROJECTS
LHP CHENNAI
LHP RAJKOT
LHP INDORE
LHP LUCKNOW
LHP RANCHI
LHP AGARTALA


Housing For All
@PMAYUrban
Terming #LightHouseProject 'historic', Hon'ble Prime Minister dedicated the housing project to the Nation in Chennai.
Read event details: pib.gov.in/PressReleasePa...
#HousingForAll #GHTCIndia
#TransformingUrbanLandscape #TransformingLives
#ConstructionTechnology #AffordableHousing
Hardeep Singh Puri
12:45 PM · May 27, 2022 · Twitter Web App
3 Retweets 7 Likes

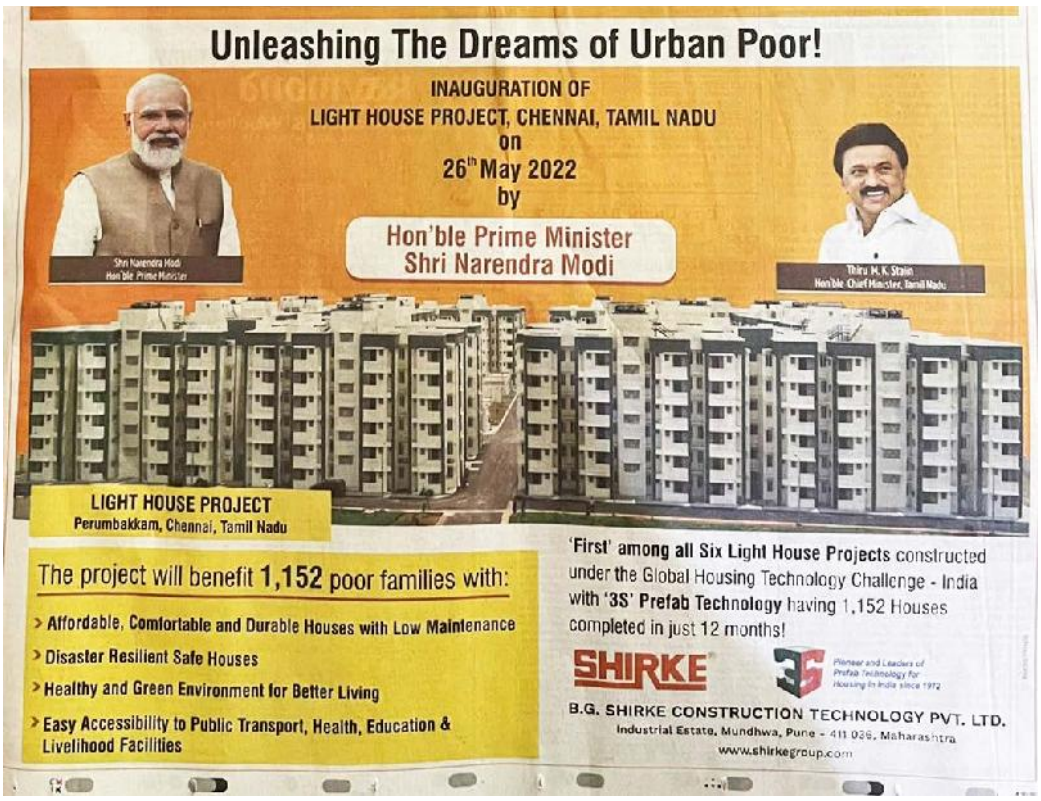

Housing For All
@PMAYUrban
#LightHouseProjects brought a new era in building construction sector & completion of #LHP Chennai was a milestone. The project, fully equipped with all basic & civic infrastructure, got completed in 12 months' time. A look at how beautifully #LHPChennai has been developed.
LIGHT HOUSE PROJECT
Chennai, Tamil Nadu
GLOBAL HOUSING TECHNOLOGY CHALLENGE
Technology
Precast Concrete Construction System - Precast Components Assembled at Site
No. of Houses : 1,152
Inaugurated by Hon'ble Prime Minister on 29th May 2022
No. of Floors : G+5
Country of Origin : Finland/ USA
12:01 PM · Jul 30, 2022 · Twitter Web App
10 Retweets 1 Quote Tweet 31 Likes

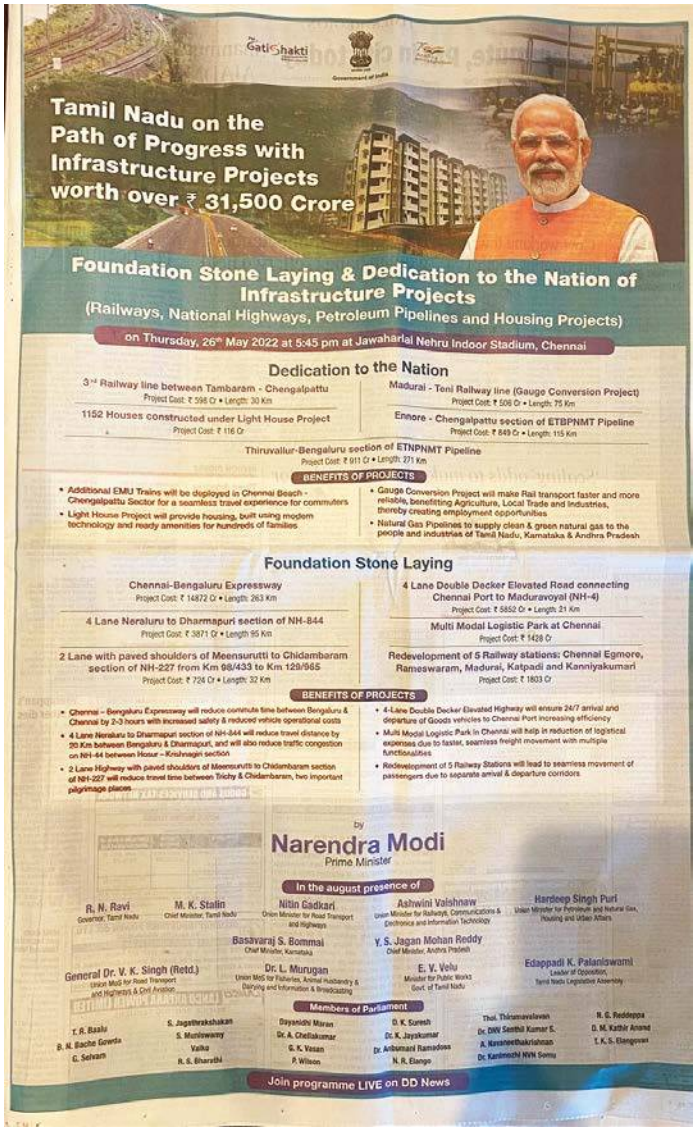

9:10
Chrome
Thread
ANI
@ANI
Prime Minister Narendra Modi will inaugurate 1152 houses constructed as part of the Light House Project in Chennai tomorrow, built at a cost of Rs 116 cr under PM Awas Yojana-Urban. It uses the best of new-age global technologies, materials & processes in the construction sector.
3:27 PM · 25/05/22 · Twitter Web App
1,081 Retweets 63 Quote Tweets 7,761 Likes
Tweet your reply


8:00
Thread
Narendra Modi
@narendramodi
The projects being inaugurated include:
Madurai-Theni railway gauge conversion project.
Third railway line between Tambaram-Chengalpattu.
2 natural gas pipelines.
Houses constructed as part of Light House Project, Chennai.
Tweet your reply


10:52
Tweet
GHTC INDIA Retweeted
Narendra Modi
@narendramodi
Chennai's Light House project is special for numerous reasons. It illustrates our commitment to delivering the best possible infrastructure for the poor.
16.7K views
9:28 PM · 26/05/22 · Twitter Media Studio


8:52
Chrome
Tweet
PMO India
@PMOIndia
I would like to congratulate all those who will be getting houses as a part of the historic Chennai Light House project under the PM-Awas Yojana.
This has been a very satisfying project for us: PM @narendramodi
7:14 PM · 26/05/22 · Twitter Web App
254 Retweets 10 Quote Tweets 1,027 Likes


Unleashing The Dreams of Urban Poor!
INAUGURATION OF
LIGHT HOUSE PROJECT, CHENNAI, TAMIL NADU
on
26th May 2022
by
Hon'ble Prime Minister
Shri Narendra Modi
Shri Narendra Modi
Hon'ble Prime Minister
Thiru M. K. Stalin
Hon'ble Chief Minister, Tamil Nadu
LIGHT HOUSE PROJECT
Perumbakkam, Chennai, Tamil Nadu
The project will benefit 1,152 poor families with:
> Affordable, Comfortable and Durable Houses with Low Maintenance
> Disaster Resilient Safe Houses
> Healthy and Green Environment for Better Living
> Easy Accessibility to Public Transport, Health, Education & Livelihood Facilities
'First' among all Six Light House Projects constructed under the Global Housing Technology Challenge - India with '3S' Prefab Technology having 1,152 Houses completed in just 12 months!
SHIRKE
Pioneer and Leaders of Prefab Technology for Housing in India since 1972
B.G. SHIRKE CONSTRUCTION TECHNOLOGY PVT. LTD.
Industrial Estate, Mundhwa, Pune - 411 036, Maharashtra
www.shirkegroup.com


PM GatiShakti
Government of India
Tamil Nadu on the Path of Progress with Infrastructure Projects worth over ₹ 31,500 Crore
Foundation Stone Laying & Dedication to the Nation of Infrastructure Projects
(Railways, National Highways, Petroleum Pipelines and Housing Projects)
on Thursday, 26th May 2022 at 5:45 pm at Jawaharlal Nehru Indoor Stadium, Chennai
Dedication to the Nation
3rd Railway line between Tambaram - Chengalpattu
Project Cost: ₹ 598 Cr • Length: 30 Km
Madurai - Teni Railway line (Gauge Conversion Project)
Project Cost: ₹ 508 Cr • Length: 75 Km
1152 Houses constructed under Light House Project
Project Cost: ₹ 116 Cr
Ennore - Chengalpattu section of ETBPNMT Pipeline
Project Cost: ₹ 849 Cr • Length: 115 Km
Thiruvallur-Bengaluru section of ETNPNMT Pipeline
Project Cost: ₹ 911 Cr • Length: 271 Km
BENEFITS OF PROJECTS
• Additional EMU Trains will be deployed in Chennai Beach - Chengalpattu Sector for a seamless travel experience for commuters
• Light House Project will provide housing, built using modern technology and ready amenities for hundreds of families
• Gauge Conversion Project will make Rail transport faster and more reliable, benefiting Agriculture, Local Trade and Industries, thereby creating employment opportunities
• Natural Gas Pipelines to supply clean & green natural gas to the people and industries of Tamil Nadu, Karnataka & Andhra Pradesh
Foundation Stone Laying
Chennai-Bengaluru Expressway
Project Cost: ₹ 14872 Cr • Length: 263 Km
4 Lane Double Decker Elevated Road connecting Chennai Port to Maduravoyal (NH-4)
Project Cost: ₹ 5852 Cr • Length: 21 Km
4 Lane Neraluru to Dharmapuri section of NH-844
Project Cost: ₹ 3871 Cr • Length: 95 Km
Multi Modal Logistic Park at Chennai
Project Cost: ₹ 1428 Cr
2 Lane with paved shoulders of Meensurutti to Chidambaram section of NH-227 from Km 98/433 to Km 129/965
Project Cost: ₹ 724 Cr • Length: 32 Km
Redevelopment of 5 Railway stations: Chennai Egmore, Rameswaram, Madurai, Katpadi and Kanniyakumari
Project Cost: ₹ 1803 Cr
BENEFITS OF PROJECTS
• Chennai – Bengaluru Expressway will reduce commute time between Bengaluru & Chennai by 2-3 hours with increased safety & reduced vehicle operational costs
• 4 Lane Neraluru to Dharmapuri section of NH-844 will reduce travel distance by 20 Km between Bengaluru & Dharmapuri, and will also reduce traffic congestion on NH-44 between Hosur – Krishnagiri section
• 2 Lane Highway with paved shoulders of Meensurutti to Chidambaram section of NH-227 will reduce travel time between Trichy & Chidambaram, two important pilgrimage places
• 4-Lane Double Decker Elevated Highway will ensure 24/7 arrival and departure of Goods vehicles to Chennai Port increasing efficiency
• Multi Modal Logistic Park in Chennai will help in reduction of logistical expenses due to faster, seamless freight movement with multiple functionalities
• Redevelopment of 5 Railway Stations will lead to seamless movement of passengers due to separate arrival & departure corridors
by
Narendra Modi
Prime Minister
In the august presence of
R. N. Ravi
Governor, Tamil Nadu
M. K. Stalin
Chief Minister, Tamil Nadu
Nitin Gadkari
Union Minister for Road Transport and Highways
Ashwini Vaishnaw
Union Minister for Railways, Communications & Electronics and Information Technology
Hardeep Singh Puri
Union Minister for Petroleum and Natural Gas, Housing and Urban Affairs
Basavaraj S. Bommai
Chief Minister, Karnataka
Y. S. Jagan Mohan Reddy
Chief Minister, Andhra Pradesh
General Dr. V. K. Singh (Retd.)
Union MoS for Road Transport and Highways & Civil Aviation
Dr. L. Murugan
Union MoS for Fisheries, Animal Husbandry & Dairying and Information & Broadcasting
E. V. Velu
Minister for Public Works Govt. of Tamil Nadu
Edappadi K. Palaniswami
Leader of Opposition, Tamil Nadu Legislative Assembly
Members of Parliament
T. R. Baalu
B. N. Bache Gowda
C. Selvam
S. Jagathrakshakan
S. Muniswamy
Valka
R. S. Bharathi
Dayanidhi Maran
Dr. A. Chellakumar
G. K. Vasan
P. Wilson
D. K. Suresh
Dr. K. Jayakumar
Dr. Anbumani Ramadoss
N. R. Elango
Thol. Thirumavalavan
Dr. DNV Senthil Kumar S.
A. Navaneethakrishnan
Dr. Kanimozhi NVN Somu
R. G. Reddeppa
D. M. Kathir Anand
T. K. S. Elangovan
Join programme LIVE on DD News

- சென்னை, மதுரை, திருச்சி, கோவை, சேலம், நெல்லை, வேலூர், கடலூர், ஈரோடு, நாகர்கோவில், தஞ்சை, திண்டுக்கல், திருப்பூர், புதுச்சேரி, பெங்களூரு, மும்பை, துபாய், கொழும்பு நகரங்களில் அச்சாகிறது -

தினத் தந்தி

DAILY THANTHI
வெல்க தமிழ்
சென்னை (27-5-2022) வெள்ளிக்கிழமை CHENNAI | மலர் 80 இதழ் 206 | VOL 80 ISSUE 206
சுபகிருது ஹூ வைகாசி மீ 13 உ ஹிஜிரி 1443 ஷவ்வால் 25

ரூ.31,500 கோடி திட்டங்களை தொடங்கிவைத்தார்

நெருக்கடியில் சிக்கி தவிக்கும் இலங்கைக்கு

இந்தியா அனைத்து வகையிலும் உதவும்

சென்னையில் நேற்று நடந்த விழாவில் பிரதமர் வீட்டுவசதி திட்டத்தின்கீழ் கட்டப்பட்ட குடியிருப்பை பிரதமர் நரேந்திரமோடி திறந்து வைத்தார். பின்னர் ஒரு பெண்ணுக்கு வீட்டுச்சாவியை அவர் வழங்கிய காட்சி. அருகில் கவர்னர் ஆர்.என்.ரவி, முதல்–அமைச்சர் மு.க.ஸ்டாலின், மத்திய மந்திரி எல்.முருகன் ஆகியோர் உள்ளனர்.

சென்னை விழாவில் பிரதமர் மோடி பேச்சு

நெருக்கடியில் சிக்கி தவிக்கும் இலங்கைக்கு இந்தியா அனைத்து வகையிலும் உதவும் என்று சென்னையில் நடைபெற்ற விழாவில் பிரதமர் மோடி தெரிவித்தார்.

சென்னை, மே.27-

மத்திய அரசின் பல்வேறு திட்ட பணிகள் தொடக்க விழா சென்னையில் நேற்று நடைபெற்றது.

இந்த விழாவில் பங்கேற்க பிரதமர் மோடி நேற்று விமானம்மூலம் சென்னை வந்தார்.

வரவேற்பு

ஐதராபாத்தில் இருந்து தனி விமானத்தில் சென்னை வந்த பிரதமரை கவர்னர் ஆர்.என்.ரவி, மத்திய மந்திரி எல்.முருகன் மற்றும் தமிழக அமைச்சர்கள், அதிகாரிகள் வரவேற்றனர்.

பின்னர் விமானநிலையத்தில் இருந்து ஹெலிகாப்டரில் ஐ.என்.எஸ். அடையாறுக்கு வந்தார். அங்கு அவரை முதல்-அமைச்சர் மு.க.ஸ்டாலின் மற்றும் அமைச்சர்கள் வரவேற்றனர்.

பின்னர் அங்கிருந்து புறப்பட்டு பிரதமர் நரேந்திர மோடி சாலை மார்க்கமாக நேரு உள்விளையாட்டு அரங்கத்துக்கு வந்தார். அவருடன் கவர்னர் ஆர்.என்.ரவி, முதல்-அமைச்சர் மு.க.ஸ்டாலின், மத்திய மந்திரி எல்.முருகன் ஆகியோர் வந்தனர்.

வாழ்த்து கோஷம்

அப்போது அரங்கத்தில் இருந்த தி.மு.க. மற்றும் பா.ஜ.க. கட்சியினர் மிகுந்த சத்தத்துடன் வாழ்த்து கோஷம் எழுப்பி அவர்களை வரவேற்றனர். பிரதமர் நரேந்திர மோடி அனைவரையும் நோக்கி கையசைத்தும், தலை வணங்கியும் வாழ்த்துகளை ஏற்றுக்கொண்டார். பின்னர் தமிழ்த்தாய் வாழ்த்துடன் நிகழ்ச்சி தொடங்கியது. மத்திய இணை மந்திரி எல்.முருகன் அனைவரையும் வரவேற்றுப் பேசினார்.

தமிழகத்தின் பங்களிப்பு

அதைத்தொடர்ந்து முதல்-அமைச்சர் மு.க.ஸ்டாலின் உரையாற்றினார். அவர் பேசியதாவது:-

தமிழ்நாட்டில் மக்களின் பேராதரவோடு தி.மு.க. ஆட்சிப்பொறுப்பேற்ற பிறகு இங்கு பிரதமர் நரேந்திர மோடி பங்கேற்கும் முதல் அரசு விழா இதுவாகும். தமிழ்நாட்டின் வளர்ச்சிக்குத் தேவையான திட்டங்களைத் தொடங்கி வைப்பதற்காக வருகை தந்ததற்கு நன்றி. தமிழ்நாட்டில் 5 நெடுஞ்சாலைத் துறை திட்டங்களுக்கும், ஒரு ரெயில்வே திட்டத்திற்கும் அடிக்கல் நாட்டப்பட்டுள்ளது.

3 ரெயில்வே திட்டங்களும், பைப்லைன் திட்டம் மற்றும் நகர்ப்புற வீட்டுவசதி திட்டத்தின் கீழ் 1,152 வீடுகளின் திறப்பு விழாவும் நடைபெறுகிறது. இவை அனைத்தும் தமிழ்நாட்டின் வளர்ச்சிக்கு மிகமிக முக்கியமான திட்டங்களாகும்.

தமிழ்நாடு பல்வேறு வகையிலும் இந்தியாவின் முன்னணி மாநிலமாக திகழ்ந்து வருகிறது. கல்வி, பொருளாதாரம், மருத்துவம், வேளாண்மை, ஏற்றுமதி, திறன்மிகு மனித ஆற்றல் எனப் பல்வேறு வகையிலும் தமிழ்நாடு ஒரு சிறப்பான பங்களிப்பை இந்திய நாட்டின் ஒட்டுமொத்த வளர்ச்சிக்கும் அளித்து வருகிறது. இந்தியாவின் வளர்ச்சியில் தமிழ்நாட்டு மக்களின் பங்களிப்பு என்பது மிக மிக

(2–ம் பக்கம் பார்க்க)

வரி விளம்பரங்கள் படியுங்கள். அதில் நல்ல செய்திகள் உள்ளன 11–ம் பக்கம்

உள்ளே...

மகிந்த ராஜபக்சேவிடம் போலீசார் விசாரணை

செய்தி 9–ம் பக்கம்

The Indian Express (27/5/22)

THE NEW INDIAN EXPRESS | TAMIL NADU
04 CHENNAI | FRIDAY 27.05.2022

MP BOYCOTTS PM'S EVENT

PM opens 'game-changer' housing project

Under Light House Project, 1,152 tenements have been built at Perumbakkam using prefab technology at a cost of ₹116 crore in 17 months

Housing units inaugurated by Prime Minister Narendra Modi in Perumbakkam | Express

Various construction technologies used in the project

Prefab tech: Columns, beams, lintels with sunshade and other slabs are manufactured to prefixed dimension in factories or precast yards and brought to the project site

Projects being implemented in TN: Moorthingnagar Street in North Chennai, Sholinganallur, Royapuram, Ambattur and Erode

Monolithic Concrete Construction: Under this modular formwork made out of aluminium plastic composite are used for walls, floors, slabs, stairs, and window openings

GFRG technology: It consists of building panel products made of calcined gypsum and plaster reinforced with glass fibre for mass scale building construction. A pilot G+2 project is being implemented at Thailavaram in Maraimalai Nagar

Pre-engineered Building System: The entire structure is pre-designed, pre-punched, pre-drilled, pre-welded and pre-formed in factories before being shipped to erection sites

C SHIVAKUMAR @Chennai

TAMIL Nadu's Light House Project to provide homes to 1,152 families could be a game-changer in building affordable houses at competitive costs as the project has been completed within 17 months of its foundation stone being laid by Prime Minister Narendra Modi last year.

The prefab technology — where structures like columns, beams, lintels with sunshade and other slabs are manufactured in factories and brought to project site — has been used in four other projects in the State.

Tamil Nadu Urban Habitat Development Board (TNUHDB) managing director Govinda Rao told TNIE that TNUHDB has already constructed 960 tenements (10 blocks) using this technology at Moorthingar Street in North Chennai at a cost of ₹112.80 crore in 2017. The project was inaugurated on February 2, 2018. Similarly, Tamil Nadu Housing Board constructed Middle-Income Group houses at Sholinganallur using the technology. Similarly, TNUHDB has constructed houses using this technology in Ambattur, Royapuram and Erode.

Interestingly, the Perumbakkam project is the first among six Light House Projects, constructed under Global Housing Technology Challenge by DG Shirke Construction Technology Private Limited at a cost of ₹116.37 crore. The other five projects, built under Pradhan Mantri Awas Yojana (PMAY), are being implemented in Gujarat, Jharkhand, Madhya Pradesh, Uttar Pradesh and Tripura.

According to Rao, the share of Union government per flat is ₹1.5 lakh. An additional grant of ₹4 lakh per unit is provided under Technology Innovation Grant (TIG) apart from the State's share of ₹3 lakh per unit. Beneficiaries' contribution for each house is ₹1.5 lakh.

The 12-block, G+5 project in Perumbakkam will have 96 units in each block. Each of these units, which have a plinth area of 406 sqft, will have hall, bedroom, kitchen, bathroom and a toilet. Two lifts have been provided for each block. The work was supervised by the BMTPC (Building Materials and Technology Promotion Council) and Tamil Nadu Urban Habitat Development Board (TNUHDB) provided assistance, the officer said.

Precast concrete system saves construction time, improves quality of construction and is cost-effective. A Memorandum of Agreement (MoA) was signed between MoHUA and Tamil Nadu government on November 26, 2019 for the project.

First of 6 projects

The project in Perumbakkam is the first among six Light House Projects constructed under Global housing Technology Challenge. The other five projects are being implemented in Gujarat, Jharkhand, Madhya Pradesh, Uttar Pradesh and Tripura

World-class infra for seamless freight transport

A quick look at the Mappedu multi-modal logistic park

An MoU was signed on October 12, 2021 by Chennai Port Trust (ChPT), National Highway Authority of India (NHAI) and Government of TN (GoTN/TIDCO) to develop a state-of-the-art multi-modal logistic park (MMLP) at Mappedu

MMLP will be world-class logistic aggregation/disaggregation point for various forms of cargo across different transportation modes

₹1,045 CRORE Estimated cost of MMLP which will be developed over 158 acres of land in Mappedu village of Tiruvallur district. It will have road and rail connectivity

MMLP WILL BE AN ONE-STOP SOLUTION FOR ALL SERVICES RELATED TO CARGO MOVEMENT VIZ. CROSS-DOCKING, CONTAINER STACKYARD, CUSTOM CLEARANCE, TESTING FACILITIES, DOCUMENTATION, WEIGHBRIDGES, ETC.

Amenities to include truck parking, truck repair, lodging for drivers, eating joints, etc. A road over-bridge is planned near MMLP to ensure seamless movement of traffic

This is among the first projects to be chosen for implementation under the Centre's grand 'Bharatmala Pariyojna' scheme. Under this, 35 such multi-modal logistic parks are planned across the country

To develop this MMLP, a Special Purpose Vehicle (SPV) will be formed with all 3 stakeholders — ChPT, NHAI and TIDCO

Chennai Port will hand over 121.34 acres of 'Port Trust Land' to the SPV, GoTN will contribute ₹50 crore while additional area of 56.23 acres adjacent to 'Port Trust Land' will be acquired by NHAI

A new railway siding will be developed at MMLP to provide rail connectivity from the nearest rail head near Kadambattur for length of about 12 km

CBRE, an Indian consulting firm, has been appointed as advisor for the project

PM to give keys to 1st batch of Light House beneficiaries

Times News Network

Chennai: The first batch of beneficiaries of housing units constructed under the Global Housing Technology Challenge (GHTC) at Perumbakkam will receive keys from Prime Minister Narendra Modi in the city next week. The Light House Project, under GHTC, provides the poor houses built using technology suitable for the geo-climatic conditions of the region.

As part of the joint initiative of the Union ministry of housing and urban affairs and the Tamil Nadu Urban Habitat Development Board (TNUHDB), 1,152 tenements at a cost of ₹116.3 crore were built in 15 months. Each unit costs ₹10 lakh, of which ₹1.5 lakh is borne by the beneficiary. While the Centre provides ₹5.5 lakh, the state government contributes ₹3 lakh for each unit.

The Perumbakkam project includes 12 blocks, each with G+5 storey comprising 96 tenements and an elevator. The plinth area of a unit is 406 sqft with each tenement consisting of a hall, a bedroom, a kitchen and a toilet.

TOI

PERUMBAKKAM TENEMENTS

Official inspects PMAY scheme

Pudukkottai: Director of State institute of rural development and panchayat raj S Samuel Inbadurai inspected construction of houses under PMAY in Avudaiyarkovil union here on Tuesday. The inspection follows district collector issuing showcause notice to 25 DRDA officers for not constructing 435 houses. TNN

GRIHA

GREEN RATING FOR INTEGRATED HABITAT ASSESSMENT

Light House Project, Chennai, 1152 EWS (G+5) Units with" 3S Prefab Technology" under Global Housing Technology Challenge Constructed by BGSCTPL, Pune

has been certified with a

'Four Star'

rating under

GRIHA Affordable Housing Category

Chief Executive Officer
GRIHA Council

Date of Issue: 6th June 2022

सत्यमेव जयते

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