





Compendium of Light House Project – Rajkot, Gujarat

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

October 2022



Ministry of Housing & Urban Affairs Government of India



66 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. **99**

> ~ Narendra Modi Hon'ble Prime Minister







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Minister of Housing & Urban Affairs Government of India



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Government of Gujarat



Technical Support



Building Materials & Technology Promotion Council Core-5A, 1st Floor, India Habitat Centre, Lodhi Road, New Delhi - 110 003

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Published: October 2022

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हरदीप एस पुरी HARDEEP S PURI



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

The Pradhan Mantri Awas Yojana – Urban (PMAY-U) was launched in June 2015 to provide all eligible families residing in urban India with an all-weather *pucca* house under the vision of 'Housing for All'.

As we continue on the path of development, India must balance its economic and urban needs with that of the environment. The urban population in cities will exponentially increase, with more than 50% of the country residing in these urban areas by 2050. To make our cities habitable for the future, infrastructure and housing needs will need to be scaled up.

The Ministry of Housing and Urban Affairs launched a Global Housing Technology Challenge - India (GHTC-India) in January 2019, which aimed to identify and mainstream the best available proven construction technologies that are sustainable, green, and disaster-resilient. As a part of GHTC-India, six Light House Projects (LHP) consisting of about 1,000 houses each with physical and social infrastructure facilities at six places across the country namely Indore (Madhya Pradesh); Rajkot (Gujarat); Chennai (Tamil Nadu); Ranchi (Jharkhand); Agartala (Tripura) and; Lucknow (Uttar Pradesh) were initiated to serve as live laboratories for learning by all stakeholders about various aspects of the use of the shortlisted globally best technologies in real housing projects. The foundation stone of all 6 LHPs was laid by the Honourable Prime Minister on 1 January 2021.

I am happy to note that the LHP at Rajkot with 1,144 houses using 'Monolithic Concrete Construction using Tunnel Formwork'– a system developed in France, has also been completed. I am hopeful that this compendium will encourage all relevant stakeholders to adopt sustainable technologies for all their future housing projects.

(Hardeep S Puri)

New Delhi 12 October, 2022

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Bhupendra Patel Chief Minister, Gujarat State





Message

Gujarat is the fastest growing and most urbanized state in India with **42.60%** urban population as compared to **31.14%** urban population of India. During the decade **2001-2011**, the state of Gujarat has seen a growth rate of **36%** in urbanization as compared to **31%** in India. By the year 2030, Gujarat is projected to have **66%** urbanization.

Affordable Housing Mission has been set up as a State-Level Nodal Agency in the field of housing in urban areas of the state and also for implementation of the Prime Minister's Housing Scheme -Urban (PMAY-U). Gujarat State is at the forefront of other states in implementing the Prime Minister's Housing Scheme. Under PMAY-U, so far 7.18 lakh houses have been completed and delivered to the beneficiaries of Gujarat. It is a matter of pride for the State of Gujarat that Gujarat is ranked number one by the Central Government compared to other States under the Credit Link subsidy component and the Central Government has awarded first place certification.

Global Housing Technology Challenge- India (GHTC-India) initiated by Ministry of Housing & Urban Affairs (MoHUA) has been one of the most ambitious initiatives for identification of world's best innovative technologies for promotion and mainstreaming in the country. Light House Project under GHTC-India is an example for technology transformation in construction sector and we feel privileged that Rajkot, Gujarat was selected as one of the six cities to implement LHPs in the country.

The foundation of LHP Rajkot along with other LHPs were laid by Hon'ble Prime Minister on 01 January 2021. MoHUA and Government of Gujarat joined hands to complete this unique project of 1,144 houses along with physical and social infrastructure facilities on time with Monolithic Concrete Construction using Tunnel Formwork system. This project has total 11 blocks of P+13 floors each. Each unit has two bedrooms, kitchen, toilet, bathroom and a lift in each tower. In addition, a community center and a health center have also been constructed. The project has provision of solar lighting, rainwater harvesting and wastewater recycling.

The State of Gujarat ensured that all statutory clearances/ approvals were given to LHP Rajkot on fast-track mode, timely provision of the State matching share for project construction and identification of eligible beneficiaries. The project has been successfully completed in all respect. Through this project, 1144 families will get safe, comfortable, durable and disaster resilient houses made of innovative houses in healthy and green environment.

This compendium captures the details of the complete journey of the project since its inception to completion which will be of great help to the policy makers, public & private construction agencies and other concerned stakeholders for learning and adoption of the technology in future projects.

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(Bhupendra Patel)

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कौशल किशोर KAUSHAL KISHORE





भारत सरकार

Minister of State for Housing & Urban Affairs Government of India



MESSAGE

India has launched the most comprehensive programs to revolutionize 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 1.23 crore houses under PMAY-U, of which about 64 crore have been completed and delivered to the beneficiaries. This has set a new milestone for new-age India.

Conventional construction systems used so far for construction of houses/ buildings have now lost relevance due to their over dependency on natural resources, slow speed, high energy consumption and greenhouse gas emission, non-availability of some basic materials etc. Introduction of cost-effective alternate building materials and construction practices which are fast track, energy efficient, bring better quality and durability are required. Our visionary Hon'ble Prime Minister of India has underlined the necessity of identifying such technologies from across the Globe and create an Eco system to facilitate their use in future projects, especially in mass housing projects.

With this vision, Hon'ble Prime Minister laid the foundation stones of six Light House Projects (LHPs) on 1st January 2021 consisting of about 1,000 houses each with allied infrastructural facilities at six cities across the country planned to be constructed with six distinct globally proven shortlisted technologies. 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.

After the inauguration of Completed LHP Chennai project in May 2022, LHP- Gujarat is the second project successfully completed with another cutting-edge technology of Monolithic concrete construction using Tunnel form system of France. Success of threes LHPs will lead to a huge transformation in the construction sector for the nation and encourage States and other agencies to use such technologies with confidence in their upcoming projects.

This Compendium on LHP Gujarat, 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.

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(KAUSHAL KISHORE)

New Delhi 10th October 2022

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Message

I am happy to share with you the Compendium of Light House Project-Rajkot, Gujarat. This is the second completed LHP project out of six LHPs initiated to showcase shortlisted Global Housing Technologies. It has indeed been an interesting and challenging journey as we crossed various milestones in the making of LHP Rajkot and today, we are proudly dedicating the project to the nation. Ministry of Housing and Urban Affairs, (MoHUA) and the State Government of Gujarat successfully partnered to complete this 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 serve as live laboratories for all stakeholders to learn various aspects of use of these technologies for further mainstreaming in the country. Hon'ble Prime Minister laid the foundation stone of Six Light House Projects on 1st January 2021.

I believe that the Rajkot 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 1,144 houses in stilt plus thirteen floors with all basic and social infrastructure facilities of community hall, anganwadi and shops. It also features amenities like solar lighting, rainwater harvesting, wastewater recycling, etc. Built as Monolithic Concrete structure using Tunnel form System from France, 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 Rajkot, MoHUA initiated to make Compendium of all LHP Projects as they complete. 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 AatmaNirbhar Bharat.

Mang Juh. (Manoj Joshi)

11th October, 2022 New Delhi.

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भारत सरकार आवासन और शहरी कार्य मंत्रालय

Government of India Ministry of Housing & Urban Affairs



Message

Witnessing the inauguration of Light Housing Project (LHP)-Gujarat is yet another historical day of our journey of GHTC-India, after inauguration of LHP-Chennai on 26 May 2022. This is the second successfully completed project out of total 6 LHPs across country, whose foundation were laid by Hon'ble Prime Minister on 1st January 2021.

Under the visionary leadership of Hon'ble Prime Minister, MoHUA has initiated a Global Housing Technology Challenge (GHTC-India) to identify and mainstream the best available construction technologies from across the globe. Out of which 54 technologies were identified in six broad categories and 6 Light House Projects using six distinct technologies-one from each of the six broad group were finalised to showcase use of these technologies on ground for further learning and 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. These projects are demonstrating and delivering ready to live houses with speed, economy and with better quality of construction compared to conventional system in a sustainable manner.

In LHP Rajkot, 1,144 houses with basic and social infrastructure have been successfully constructed with globally proven Monolithic concrete construction using Tunnel Form system of France, now being manufactured in Pune under Make in India initiative, along with environment friendly Autoclave Aerated Concrete block masonry. Besides being a fast-track construction, the use of this technology brings resource efficiency, improved quality & durability, thermal comfort and cost effectiveness.

This Compendium on LHP-Rajkot, Gujarat covering various details of the entire journey of planning and execution of the project will enlighten the stakeholders about the various aspects of planning and construction of buildings using the technology.

Initiation of LHPs is beginning of a new era in Indian housing technologies with an aim to bring awareness and confidence in the mind of all stakeholders including the beneficiaries about construction of houses constructed with such emerging technologies. I hope this will trigger State Government and other agencies to start introducing these technologies in their future projects with confidence.

11th October, 2022 New Delhi.

(Kuldip Narayan)



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Acknowledgements

Technology Sub mission under PMAY-U has been instrumental in field level application 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 Rajkot using Modular Tunnel Form system, a French technology started on 1st January 2021, when Hon'ble PM laid the foundation stone of all LHPs virtually and completed in all respects by September 2022 despite of inclement weather, frequent high wind speeds & heavy downpour. 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. On the occasion of handing over the LHP at Rajkot to the beneficiaries, Hon'ble PM is releasing this Compendium of Light House Project - Rajkot, Gujarat under GHTC-India for wider dissemination of the innovative technology & further adaption & replication in the country. The speed of the technology can be ascertained with the fact that two towers of Stilt+13 each using two Tunnel Forms sets comprising of 208 DUs (39.77 sq.mt. each) were completed in 45 days at LHP Rajkot. In addition, being monolithic concrete construction, its structural performance w.r.t. earthquakes, cyclones including service loads is far superior than conventional RCC framed & brick-mortar construction.

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, PMAY-U 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 & collating the information in time. Shri C. N. Jha & Shri Pankaj Gupta, Dy. Chiefs, BMTPC has been instrumental in putting up the initial draft of the compendium & their efforts are duly acknowledged. The untiring efforts put up by Shri J.K. Prasad and Shri Kanha Godha, Consultants, HFA, MoHUA for monitoring and bringing up the document to shape is duly acknowledged.

The tedious task of final editing, chapterization & its flow and final design was undertaken by Shri Manish Kumar, Consultant, HFA-PMU 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 thermal comfort study for the LHP has been undertaken by Climate Smart Building (CSB) programme of GIZ led by Shri S. Vikash Ranjan and his contributions 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 led by Mr. Manoj Malani of M/s Malani Construction Company & Mr. Jignasu Mehta, CEO, M/s Outinord Formworks Pvt. Ltd., technology provider for timely & quality execution of the project.

I hope the publication will be a useful resource for concerned stakeholders who intend to use monolithic concrete construction in their future endeavours and will go a long way in establishing various customised formwork systems including Tunnel Form as the future technology for the country.

7th Day of October 2022 New Delhi

dutyramal

(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
Eol	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
lAs	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 PRAGATI¹ 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 Rajkot, Gujarat including its planning, technology being used, construction methodology, monitoring and handing over to the beneficiaries.

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 Rajkot, the MOU was signed by The State Government of Gujarat through Affordable Housing Mission (AHM), Urban Development & Urban Housing Department, having its office at Block No. 2, 2nd Floor, Dr. Jivraj Mehta Bhavan, Sector-10, Gandhinagar – 382010 Gujarat.



2.2.3 Roles and Responsibilities of Multistakeholders

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

Ministry of Housing and Urban Affairs (MoHUA):

- Overall implementation, review & monitoring of LHPs Process and release the Central assistance and TIG.
- Issue the RFP for LHPs and finalize the bids through constitution of a Bid Evaluation Committee.
- 3. Open an Escrow Account at BMTPC for overall fund disbursal and management

4. Constitute a PMC at Central level for regular review of the LHPs.

State Governments:

- State Government through SLAC and SLSMC to approve the LHPs as dane for PMAY (U) projects.
- 2. Nominating member from the State Government for BEC constituted at MoHUA.

3. Ensure all approvals for LHPs in fast-track mode.

 Ensure release of the matching State, ULB & Beneficiary share to the designated Agency of MoHUA. Any increase in project cost shall be borne by State.

5. On behalf of the State, SLNA to coordinate with MoHUA and ULBs/ DAs till the completion & handing over of the LHPs.

6. Registration of LHP project under the provisions of RERA Act.

Urban Local Body (ULB) / Development Authority (DA):

- 1. 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.
 - 5. Facilitate logistics support to selected technology provider/ developer during construction of LHP.

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 States 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:

SI. 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

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



5. Monolithic Concrete Construction

4. Prefabricated Sandwich Panel 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 Rajkot.

The project cost of LHP Rajkot is Rs. 118.90 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.

SI. 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	₹1.50 lakh per dwelling unit	Government of Gujarat
(iv)	Beneficiary Share	₹3.39 lakh per dwelling unit	Beneficiary
	Total	₹10.39 Lakh per dwelling unit	

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

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)	
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	1.0%
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%
21	Installation of Lifts and machine room	2.5%
2J	Fire Fighting System	3.0%
2К	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 laiddown 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 Affordable Housing Mission (AHM) and Rajkot Municipal Corporation (RMC) 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	Rajkot Municipal Corporation	
2	Commencement Certificate	Rajkot Municipal Corporation	
3	Fire & Emergency Services	Rajkot Municipal Corporation	
4	Environment Impact Assess Clearance	State Level Environment Impact Assessment Authority, Gujarat	
5	RERA Registration of	Gujarat Real Estate Regulatory Authority, Government of Gujarat	
6	Labour License	Deputy Commissioner of Labour, Rajkot, Govt. of Gujarat.	
7	Height Clearance	Airport Authority of India	
8	STP Water Permission	Rajkot Municipal Corporation	
9	Police Department	Police Commissionerate, Rajkot	

After obtaining all the Statutory Approvals from the respective ULBs/ Parastatal Agencies, the LHP construction agency of LHP Rajkot M/s Malani Construction Co 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 Rajkot

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 Gujarat 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 Rajkot will be built through the Tunnel Form System of France, 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 Rajkot is a model housing project comprising of 1,144 houses with Monolithic concrete construction using Modular Tunnel Form 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. Since its inception in January 2021, the project was completed in July 2022 which includes COVID-19 disruptions and other weather related hazards such as high wind speed and heavy rainfall.



Foundation Laying of LHP Rajkot by Hon'ble Prime Minister



Foundation Laying of LHP Rajkot by Hon'ble Prime Minister

Project Brief		
Project Brief		
Location of Project	Raiya Smart City Area, TPS No-32, FP63/10	
No. of DUs	1,144 (S+13)	
Plot area 39,599sq.mt.		
Carpet area of each DU	39.77 sq.mt.	
Total built up area	62,369sq.mt.	
Technology being used	Monolithic Concrete Construction using Tunnel	
	Formwork	
Other provisions Community Centre and Health Centre		
Broad Specifications		
Foundation	RCC raft foundation	
Walling	Monolithic RCC walls cast through tunnel formwork &	
	AAC Block Masonry in Partition Walls	
Floor Slobs/Poofing	Manalithic PCC Slahs/Poofing cast through tunnel	
FIOUR Stabs/ Rooming	formwork	
Door Frame/ Shutters	Pressed steel door frame with 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 fleering in Peems & Kitchen	
riooning		
	 Anti-skid ceramic tiles in bath & WC 	
	Kota stone Flooring in Common area.	
	Kota stone on Staircase steps.	
Wall Finishes	Weather-proof acrylic emulsion paint on external	
	walls	
	Oil Bound distemper over POP on internal walls	
Infrastructure	Internal Water Supply, Laying of Sewerage Pipe Line, RCC	
	storm water drain, Provisions for Fire Fighting, Internal	
	Electrification, Internal Road & Pathway (CC Road),	
	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, Solid Waste	
	Management.	

3.2 Project Location

The State Government of Gujarat allocated the site for the project in the Smart City area of Rajkot which is located on Raiya Road, opposite RMC Drainage Pumping Station (F.P 63/10). The Smart City area is presently under development along with Atal Sarovar which is about 1.5 kms from the Site.

A total of 39,599 sqm. land area was provided by Rajkot Municipal Corporation for Light house Project. Project Location in Google map is as under:



3.3 Site Conditions

Based on contour maps and total station survey, it was found that there is a level difference of 7meters within the site allocated for LHP with high undulations. The soil strata comprises of highly weathered fractured small angular rock pieces mixed with sand and pebbles.





Initial site photographs before construction

3.4 Geo-Technical Investigation of the Site

The first and foremost requirement to carry out construction is to undertake detailed geo-technical investigation of the project site. The geo-technical investigation was carried out by M/s NKPC Boring House, Rajkot based on prevailing Indian Standards with the approval of MoHUA. The typical geo-technical investigation helps in ascertaining soil strata, bearing capacity, water table and other sub-surface features which help in design of sub-structure.



Geo Technical Investigation of the Site

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

- i. 22 numbers of bore holes were made for which Standard Penetration Values (SPT) were arrived. Bore hole log details were also included in the Report. Bore holes were made upto total depth of 10 meters.
- ii. In some cases, highly weathered basalt rock pieces were recovered as murram upto 1.3 meters of depth, in other cases highly weathered basalt fractured angular rock pieces mixed with sand & pebble were found as first layer upto a depth of 3 meters. Beyond which highly to moderately weathered greenish/greyish/ brownish color basalt rock core were found.
- iii. Based on the geo technical investigations & other details, the SBC for 4 Number of towers has been taken as 35t/m2 at 2.5 m from EGL and for 7 numbers of towers, SBC taken is 25 t/m2 at 2.5 m from EGL.

Based on the Geo-Technical Investigations (Summary of the Report is 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 to 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 LHP projects are essentially fall under Affordable Housing in Partnership (AHP) vertical of PMAY-U and therefore, the architectural design including layout was proposed by the State Government as per their prevailing byelaws and Town & Country Planning Act. Being turnkey project, the agency was permitted to make minor changes in consultation with State Government in the architectural design and layout based on the technology proposed. After finalization of the architectural design, the design basis report is prepared on the basis of which detailed structural analysis & design was carried out.

M/s Malani Construction Co., the Construction Agency of the project, prepared the architectural & structural design with help of its Consultant namely M/s L J Purani and Associates. The structural design for the project is proof checked by Sardar Vallabhbhai National Institute of Technology (SVNIT), Surat. M/s Outinord Formworks Pvt. Ltd, Pune, the technology provider for the project, manufactured, supplied the tunnel formwork, which is a French technology. The technology provider also provided requisite technical support at site for training the workforce for handling and installation of tunnel formwork and the construction thereon.

As part of design philosophy, the project includes various green & sustainable features as per the details below:

- Climate responsive architecture to maximize the use of daylight with adequate size windows primarily opening to outer open to sky areas, ensuring thermal comfort through use of Autoclaved Aerated Concrete (AAC) Block masonry on outer exposed walls and natural ventilation through adequate number of shafts in the building blocks.
- Optimum utilization of renewable energy sources in terms of roof top solar panels in the overall energy system design, for common area (passage, staircase etc.) electricity requirements. Solar street lights have also been installed in lawn/ park areas. A part of building envelope with AAC Block masonry brings the passive aspects of thermal performance in the building.
- The design and construction consider the requirements of Rating 4 of GRIHA Affordable Housing Standards.
- The provision for STP with wastewater recycling for horticulture purpose has been made. The water conservation has been ensured through the provision of 6 numbers rain water harvesting Pits for recharging the ground water table in the entire layout.
- Based on the contour survey, layout has been prepared based on natural profile considering rain water disposal and drainage disposal.
- A provision for large central space with 2500 Sqm. has been kept, catering to the human spaces with large outdoor barrier free landscape area, as integral part of the built environment.

The project of LHP Rajkot is proposed as EWS II Type Housing (as per State nomenclature) located opposite to Rajkot Municipal Corporation Drainage Pumping Station, Raiya Road, Rajkot.

4.2 Architectural and layout planning

The project is designed as a multi-storey residential complex with 11 blocks in Slilt+13 configurations to house a total of 1,144 Dwelling Units. Each block serves a total of 104 DUs summing up to 1,144

DUs in all 11 building blocks. These residential DUs are provided with additional social infrastructure namely: Shops, Anganwadi, Community Centre, and health centre, with a total built up area of 2297.33 Sqm. Each dwelling unit is planning and designed to serve as a very comfortable residential unit as per NBC standards, with carpet area for one residential unit in the complex is 39.77 Sqm.

Total plot area for the project is 39,599.00 Sqm with permissible FSI as 2.70. For the construction of the said complex, the FSI for residential built-up space achieved was 1.575 (62368.82 Sqm).

Social Infra at site:			
S. No.	Social Infrastructure Item	Nos	Plinth Area (in Sqm)
1	Aanganwadi	04	1025.76
2	Shop	14	
3	Health Centre	02	
4	Community Centre	01	1271.57

The details of social infrastructure provided at site are as follows:











4.3 Social Infrastructure



i. Community Center: 1 No. Built up Area – 1271.57sqmt





Section and Elevation of Anganwadi





4.4 Site services

4.4.1 External Sewerage layout

For the project 230 KLD STP plant is installed operating on the Alfa MBBR Technology. The site sewerage is carried through a well-connected sewerage network as per approved plans of Rajkot Municipal Corporation. Through the sewerage network, the sewage is taken to STP where it is converted into water which is being used for secondary purposes such as gardening. STP is one of sustainable practice for waste water recycling.



4.4.2 External Water supply Layout

Water supply is provided by the Water Supply Department of the RMC to the LHP project site. The project has 11 Underground (UG) tanks of 52,000 KL capacity for each block to store water. This stored water is pumped to overhead tanks through pumping for supplying water to individual DUs and blocks. Four overhead tanks of 5KL capacity are provided per block. Further to meet firefighting requirements one additional overhead Tank of same capacity is provided for water requirements during fire. Besides, two additional underground tanks of 52,000 KL capacity each are provided as fire tanks as per firefighting norms.



4.4.3 External Storm water drainage layout

A network of covered storm water drains with natural slope has been provided to collect and dispose of rain water from surfaces, roads, paved areas and further connected to rain water harvesting recharge wells/ pits.



Internal Plumbing for Dwelling Units

Internal Electrical Layout for Dwelling Units





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 (being a project with new technology) by Third party which is SVNIT, Surat in the present case.

These design basis report and structural design & drawings were further submitted to MoHUA for final approval & construction.

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, NBC-2016 & other applicable national / international codes.
- 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 monolithic shear wall construction as per relevant applicable BIS/International standards provisions are complied with to meet the design ductility level.

Standards/Guidelines referred:

Structural System	RCC Shear wall Monolithic structure (outer shell) using Modular tunnel formwork
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 etc.

Structure is designed for	Limit State of collapse as per IS:456-2000 and NBC-2016 Limit State of serviceability as per IS: 456:2000 and NBC-2016 Durability consideration as per IS: 456:2000
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; Vb 39 m/sec Wind terrain: category 4 Seismic loads as per IS: 1893 (part-1) 2016, for seismic zone-III Importance factor: 1.2 Response reduction factor;4 Fundamental natural period as per cl.7.6.2 of IS:1893 (part 1)
Imposed loads	All rooms including toilet, bath & Toilet =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	100 & 150 mm thick AAC Gr-2 block of 551-650 kg/m3 density in oven dry condition as per IS: 2185(part-3) for internal/ partition & 200 mm thick AAC GR-2 2185(part-3) for outer walls
Walls and roof slabs	Shear walls and RCC floor and roof slab are provided with M40 grade of design mix concrete for all building blocks.

4.5.2 Design Basis for Sub-Structure

- Safe Bearing capacity: 25 T/m², depth of foundation varying from 2m to 2.5 m
- Raft Foundation as per IS:2950 (Part-1)-1981 (reaffirmed 2008), has been provided. The minimum M25 grade of concrete is used for RCC structural elements in sub-structure.

4.5.3 Structural Frame

Based on design basis report, the details of structural frame are as follows:

The entire building in constructed with Monolithic RCC Shear wall in the form of tunnel, using prefabricated tunnel formwork. The frame structure of monolithic construction consists of walls and slabs casted monolithically, where the concrete in poured in one go. The slab of story just below where the casting is being done, bears the load of upper story and also serves as the floor of the above story. The walls of the structure are designed as shear walls for applicable loads. The vertical reinforcement in form of steel bars as per design are first properly erected and placed. The tunnel formwork is then installed and horizontal reinforcement is placed. The concrete is then poured as per the mix design for forming dense concrete structure which is in form of a tunnel.

Wind loads:

Wind speed: High damage risk zone with basic wind speed (V_b =39m/sec) as per IS875(Part-3).

Design wind speed: $V_z = V_b \cdot k_1 \cdot k_2 \cdot k_3 \cdot k_4$

 k_1 (Risk Coefficient) =1

- k_2 (Size factor) = category 4
- k_{3} (topography factor) =1
- k_4 (importance factor) =1
- Wind Pressure (P_z) = 0.6.Vz²
- Wind pressure is converted into design wind pressure and then distributed at each storey as wind force.



Wind Hazard Map of India

- 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_b)

 $A_{h} = (Z/2).(S_{a}/g).(I/R)$

 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.
- Reinforced cement concrete used for floor elements are minimum 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.



Earthquake Hazard Map of India

4.5.4 Sub Structure

The sub structure essentially comprises of foundation and structure upto plinth level. The following design input is considered for carrying out detailed structural analysis and design;

- a) Bearing capacity of the founding strata and type of foundation for various buildings & structures shall be based on actual Geo-technical investigations conducted at respective sites. Accordingly, Raft Foundation as recommended in Geo-technical Investigation report, was adopted.
- b) For seismic forces and wind loading, 25 percent permissible increase in the allowable bearing pressure is considered while working out foundation sizes as per IS: 1893 and IS: 875 respectively.
- c) 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.
- d) Minimum M25 Grade of concrete has been used for RCC structural elements in substructure.

RCC Raft Foundation

The raft foundation is designed for SBC of 25, 35 T/m² as calculated in soil investigation report. The details of RCC raft foundation are as follows:

- 150 mm thick PCC is placed as levelling course
- depth of the raft footing 750 to 900mm.
- M25 grade of design mix concrete
- cover of 50mm to reinforcement.



STRUCTURAL LAYOUT AT POUNCATION LEVEL 7 AL ODTE: JRC & DREDKIN NEED AS TEL ACH DAG TRIS BARRED AS THE GAP ADDVC RAFT [COOD] - TRIS BARRED AS THE GAP ADDVC RAFT

Shear Wall over Raft Foundation

Above raft footing, shear wall of 200mm thickness is designed up to Plinth level and the section of the same shown below. The grade of concrete used for shear walls is M40.



Structural Layout at Plinth Beam Level

At the plinth level, all the shear wall are connected with linth beam of 230 x 600 mm, with M25 grade of concrete.


Structural Layout for super structure

As explained earlier, it is monolithic shear wall system comprising of slab and walls above ground. The walls and slabs are 160mm thick. M40 Grade of Concrete have been used in all wall & slabs, beam in the superstructure. Grade of Steel used is Fe-500. The structural drawings of same are shown below.

Slab







Wall

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Chapter 5: Description of Technology



5.1 Monolithic Concrete Construction using tunnel form System

The Construction system used in LHP Rajkot is Monolithic Concrete Construction using tunnel form system, is from one of the broad categories namely "Monolithic Concrete Construction" shortlisted under GHTC-India.

Monolithic Concrete Construction technology intends to replace the conventional steel/plywood shuttering (formwork) system with customised engineering formwork which is fabricated in the factory under controlled conditions. In this system, in place of traditional RCC framed construction of columns and beams and infill walls; all walls, floors, slabs, stairs, including columns and beams (as per design requirement) together with door and window openings are cast monolithically using appropriate grade of concrete required as per exposure condition of the site in one operation. Being modular formwork system, it enables fast construction of multiple/mass modular units.

The formwork system used for monolithic concrete construction may be one of the following:

- i) The Modular Aluminium Formwork Systems are made of lightweight Aluminium using robotics welding system. The fixing of formwork is done using, pin & wedges system without requirement of very skilled labour to do the job.
- ii) Customized Engineered Tunnel form system consists of two half shells made of steel which are placed together to form a room or cell. Several such cells make an apartment.
- iii) There are other customised formwork system such as jump formwork, table formwork, climbing formwork, slip formwork made of steel are being used for high rise structures.

In LHP Rajkot, Tunnel Formwork system developed in France has been used. Under "Make in India" this Tunnel Formwork is produced in Pune by M/s Outinord Formwork Private Ltd. and being used in the present project.

5.2 Advantages and Limitations of Tunnel Formwork System

Tunnel form technology offers many advantages over conventional beam-column-slab construction. Major Advantages of Tunnel Form System are:

- The formwork is specially adapted for each project. The repetitive nature of the system and the use of prefabricated forms and reinforcing mats/cages simplify the whole construction process, producing a smooth and fast operation.
- Quality is enhanced despite the speed of construction. The precise, even steel face of the formwork creates a smooth, high-quality finish capable of receiving direct painting/decoration with the minimum of preparation (a skim coat may only be required). Plastering need is eliminated.
- High resistance against horizontal forces of earthquakes and wind due to monolithic slab & walls construction
- Monolithic structure reduces number of joints and improves water tightness
- Tunnel form has integral working platforms and edge protection systems. In addition, the repetitive, predictable nature of the tasks involved encourages familiarity with operations,

and, once training is complete, productivity improves as construction progresses.

• The insitu casting of units on site and the local availability of ready-mixed concrete supplies reduce transportation impacts.

With so many advantages, the Tunnel form system has certain limitations also. Following are some of the limitations of the system:

- Not suitable for small projects, and if there are many variations in design
- High initial investment of formwork and other machineries.
- A lead time of about 3 months is required for initiation of work, as the formwork are custom designed, manufactured and prototype approved before manufacturing required number of sets of formworks
- Dependence on formwork supplier for amendments in form work and accessories.
- Need to design building suitable for system.
- Due to speedy construction, high cash flow management required.
- Basement storey cannot be constructed by using tunnel formwork system, as removal of formwork is not feasible.
- Various geometrical forms and angles are difficult for which special formwork is to be designed, which will be very expensive
- Due to high production speed management-related functions are vital. Proper coordination of all stakeholders are essential.
- Skilled labor force is needed compared to traditional systems.

5.3 Description of Monolithic Concrete Construction using Tunnel formwork

Tunnel formwork, a customized engineered formwork made of high carbon steel, is a mechanized system for cellular structures. It is based on two half shells which are placed together to form a room or cell. With tunnel forms, walls and slab are cast in a single day. The structure is divided into phases. Each phase consists of a section of the structure that will be cast in one day. The phasing is determined by the program and the amount of floor area that can be poured in one day. The formwork is set up for the day's pour in the morning. The reinforcement and services are positioned and concrete is poured in the afternoon. Once reinforcement is placed, concrete for walls and slabs shall be poured in one single operation. The formwork is stripped the early morning next day and positioned for the subsequent phases.



The on-site implementation of 24-hour cycle involves the following operations:



A typical 24 h cycle staring from 7.00 am shown below:

THE 24 HOUR CYCLE







Engineer completes a concrete test to ensure that the previous day's pour has achieved the required strength.









With the engineer's permission the Tunnelform is struck, cleaned, olled and repositioned.









Once all of the packages are in position slab reinforcement and insertion of conduits can begin.







Concrete pouring commences. This usually takes between 2 and 3 hours.





After pouring, when temperature is above 20C wait for 12-14 hours and check cube strength. As per structural engineer suggestion check the strength of the same. START REMOVAL OF FORMWORK.

- First half portion deshutter and remove.
- Reprop as per structural engineer guideline.
- Remove another half of tunnel formwork.
- At no point of time slab should be unsupported.

Typical 24 hour Cycle

5.4 Formwork system

The formwork system used in the project typically consist of inverted L shaped half tunnels and wallforms as per the project requirements so as to complete one modular unit. The salient features of both are explained below.

5.4.1 Modular Tunnel form

Tunnel forms are room size formworks that allow walls and floors to be cast in a single pour. With multiple forms, the entire floor of a building can be done in a single pour. Tunnel forms require sufficient space exterior to the building for the entire form to be stripped out and lifted up to the next level.

This Tunnel form consists of inverted L-shaped half tunnels (one vertical panel and one horizontal panel) joined together to create a tunnel. Articulated struts brace the horizontal and vertical panels. These struts enable the adjustment of the horizontal level of the slab and simplify the stripping of the formwork. The vertical panel is equipped with adjustable jacking devices and a triangular stability system. Both devices are on wheels.

A range of spans is possible by altering the additional horizontal infill panel's dimensions. Due to the distribution of the horizontal beams on the vertical plank, the formwork also cast staggers and offsets in the layout of the walls as well as differing wall thicknesses. The half-tunnels shall be equipped with back panels to cast perpendicular shear walls or corridor walls. Assembly and levelling devices ensure that the formwork surfaces are completely plumbed and levelled.



Figure 1 Modular Tunnel Form

Standard Characteristics

Standard dimensions:				
Unit width:	2.40 m to 6.00 m			
Type 1 horizontal panel:	1.20 m to 1.60 m			
Type 2 horizontal panel:	1.80 m to 2.40 m			
Type 3 horizontal panel:	2.40 m to 3.00 m			

The span can be adjusted by fitting an additional panel measuring between 0.05 and 0.60 m.

Package length:	Up to 12.50 m in length as a function of the hoisting facilities and availability
Basic length:	1.25 m
Average weight:	110 Kg/m ²
Handling:	Lifting triangle or sling
Transportation:	180 m ² per truckload.

In LHP Gujarat the modular formwork, each half tunnel consisting of a horizontal panel and a vertical panel are fixed by two triangular bracings to guarantee its stability. Mounted on wheels, it can be easily moved by using a pusher system.

Retractable jacks optimize the settings on site. BAAM© is a flush locking system patented by M/s Outinord, which ensures a perfect link between 2 half tunnel forms.



Photographs: Typical Tunnel Form from M/s Outinord



The main elements in such structure are wall elements, as primary load carrying elements, and slabs which are almost the same thickness as the walls (160 mm). This type of structure reduces the number of joints. Steel forms composed of vertical and horizontal panels are set at right angles. Nonstructural walls/components such as facade walls, partition walls, stairs, etc. may be prefabricated elements or block masonry. The doors/windows may also be formed by leaving openings in the formwork during the primary casting.

The factory-made steel formwork can be reused more than 500 times and it can suit a variety of module sizes. This makes the method of construction very versatile and extremely economical. With 24-hour construction, the build ability of in-situ concrete is improved by choosing this type of formwork. In practice, when the two halves are bolted together, the tunnel formwork will appear like the Fig 1.

5.5 Comparison of Conventional / Aluform / Tunnel Form

The most prevalent customised formwork system being used in our country is aluminium formwork also known as Aluform. Tunnel formwork is an innovative system and its comparison with conventional framed construction and aluminium formwork is tabulated below:

Activity	For	For Aluform Shuttering	For Tunnel Formwork	
	Conventional			
Capital Cost	Less	Cost of shuttering	Cost of shuttering	
			machinery is very high	
Casting System	RCC Frame structure of beam, slab, column etc. casted separately	Monolithic structure of walls and ceiling casted together	Monolithic structure of main walls and ceiling casted together. Internal portion walls build afterwards.	
Accuracy and	Less	Good accuracy but with	Good accuracy	
Quality of construction		proper care		
Internal/external	Required	Not required if good	Not required if good	
Plastering required		precaution taken.	precaution taken.	
Design Changes	Flexibility in	Used for Repetitive	Used for Repetitive	
	design to	design/mass construction.	design/ mass	
	incorporate any	Changes in design are	construction. Changes	
	changes before	difficult to incorporate.	in design are difficult to	
Speed of work	Slow	Moderate to Fast	Fast	
Cycle time for RCC work	20 days	3 -5 days	1-2 days repeat cycle possible with proper infrastructure and other ancillary machineries	
No. of repetition of shuttering material	12 to 15	100 to 200	500 +	
Advantages	Low cost easy to	High cost but more	Long lifespan, low	
	operate,	effective to operate with	manpower, speedy	
		low manpower, moderate	construction, high	
		to fast construction, with	reusability, with	
		modification can be used	modification can be used	
		In other project, most	in other project, most	
		mass housing	mass bousing	
Limitations	Short lifespan	Moderate lifespan &	High investment Work	
	Slow speed poor	manpower required.	only with tower crane	
	quality	moderately high speed of construction, moderately high investment	Need well experienced skilled people. Need many other ancillary machineries to achieve 1 day repeat cycle	

5.6 Use of light Weight Autoclaved Aerated Concrete (AAC) block Masonry for outer and partition walls

AAC Block masonry has been used for outer and partition walls in the building. AAC blocks are 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.

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 /m³	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)	-	

Physical Properties of AAC Blocks as compared to Clay Bricks

5.7 Concrete & its Mix Design

Depending upon the exposure condition of construction site, the grade of concrete is selected. The Concrete Mix Design for Superstructure (monolithic concrete shear walls & slabs) was carried out with M40 Grade of Concrete. One of the important criteria was early strength of the concrete (which was minimum 8 MPa after 10-12 hrs), for allowing early de-shuttering of Tunnel form.

The concrete mix, comprising of Ground Granulated Blast furnace Slag (GGBS) & alco fine powder, w/c ratio of 0.33, along with admixture resulted in high early strength, high workability (180 mm after 1 hr). Use of GGBS as 30% of the cementitious mix, results in lower Carbon emissions, proportionate conservation of limestone reserves, high durability & impermeability of concrete structure. The substructure was designed with M25 Grade concrete with similar mixes.

Concrete Mix Design for M40 Grade by National Council of Cement & Building Materials (NCCBM), Ahmedabad.



3.0 CONCRETE MIX DESIGN TRIALS

Grade of Concrete	Standard Deviation	Target Mean Strength
Recommended	(N/mm ²)	(N/mm ²)
M40	5.0	48.25

FINAL RECOMMENDATIONS FOR THE CONCRETE MIX DESIGN 3.1

3.1.1 M40 (MSA20) Grade, Workability: 180 mm (After 60 Minutes), Exposure Condition:

As per IS:456-2000, Minimum Cement Content: As per IS:456-2000Kg/m3.

The recommendations for M40 MSA20 grade of concrete on the basis of data generated from Table1 and for the target average 28-day compressive strength of 48.25 N/mm²are as follows:

Mix Constituents (kg)	For One Cubic Metre	
Cement	325 Kg	
GGBS	150 Kg	
Alco fine	25 Kg	
Water	165 Kg	-
Fine Aggregate Mix Material Sand (75 %) Stone Dust (25 %)	731 Kg 548.2 Kg 182.8 Kg	
Coarse Aggregate 10-20mm (50 %) <10mm (50 %)	563 Kg 563 Kg	
Admixture @ 0.9 % by wt. of (Cementitious Material Content)	4.50 Kg	
Water - Cement Ratio	0.33	

NOTES:

- 1) The mix design is based on saturated surface dry condition of coarse and fine aggregate . If dry aggregates are used, the amount of mixing water should be increased by an amount equal to the moisture likely to be absorbed by the aggregates. If wet aggregates are used ,necessary adjustment should be made on the mixing water and aggregate depending upon the amount of free (surface) moisture present.
- It will be advisible to check the silt content of sand at frequent intervals during the supply ,if the silt 2) content in sand is higher than the permissible limit as per IS:383, the sand may require washing.
- Results given above refer only to the samples supplied. 3)
- The above mix design can be adopted at site after carrying out trials as usual. 4) 5)
- This report is being issued on the specific understanding that NCB will not in any way be involved in any action following the interpretation of the above results.

Lab Incharge

Amit Gandhi

Group Manager

TSA 18134

5.8 Other Salient Aspects of the System & Limitations

Establishment of batching plant of suitable capacity is necessary to achieve the desired cycle. Concrete can be designed as green concrete using industrial wastes like flyash and thus contributing towards reduction of greenhouse emissions.

Following machineries help in achieving the desired cycle of 24-48 h.

- Batching Plant
- Tower Crane of 10-ton capacity
- Welded Wire mesh machine
- Concrete Distributor
- Gas heaters (for cold climate)

5.9 Functional Parameters

In addition to structural performance, the functional parameters with regard to innovative technology are also important and need to be ascertained which are as follows:

Durability

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

Fire Resistance Property Concrete Wall, Slab & AAC Block Masonry

Concrete Wall / Slabs, AAC Block masonry used will have fire rating as per the NBC norms for dwelling units.

Thermal Behavior

Concrete walls & Slabs are 160 mm thick. AAC blocks has Kvalue - 0.122 k cal/h/m°c .

Chapter 6: Construction Process



6. Preparatory Activities at site

The LHP at Rajkot makes use of prefabricated tunnel formwork system which is tailor made for the project and therefore, at the inception of the project, it is important to plan & mobilise resources and manpower for successful execution of the project. It includes requirement of Tunnelform system, its fabrication & Procurement, deployment of essential Plant and Machineries at the site, skill training, handling & erection procedures, site laboratory for Quality Assurance and multi-disciplinary manpower.

6.1 Mobilization of Plant and Machineries:

Being a Stilt+13 building structure constructed using Tunnel formwork, heavy equipment, machineries & associated paraphernalia are required for proper execution of project. Accordingly, the list of the Plant and Machinery deployed at the LHP Rajkot by the agency is given below for reference:

S. No	Particulars	Quantity Available
1	Batching Plant	01
2	Transit Mixer	06
3	Concrete Pump	03
4	Tower Crane	02
5	Backhoe loader	02
6	Hydra	03
7	Total Station	01
8	Needle Vibrator	25
9	Bar Cutting Machine	10
10	Bar Bending Machine	06
11	Stirrup Making Machine	06
12	Welding Equipment	07
13	Frequency converter	00
14	Plate Compactor	06
15	Tipper	04
16	Tractor	02
17	Open Truck	02
18	Auto Level	02
19	Weight Bridge	01
20	Pick up	01
21	Mud Pump	06
22	Water Pump	05
23	Submersible Pump	08
24	Ambulance	01
25	D. G Set 125 KVA	04
26	D. G Set 62.5 KVA	01
27	QTK Crane	00
28	Skid Steer Loader	00
29	Winger	00
30	Front Loader	00
31	Winch Machine	10

Table: Plant and Machinery used at Site

6.2 Laboratory Setup

As per the requirement in case of project of such size, it is essential to establish QC/QA laboratory at site for periodic testing. Accordingly, a laboratory was set up at the site and the list of testing equipment is given below:

S. No.	Equipment's Details	Quantity available at site laboratory (Nos)
1	2000KN compression testing machine	01
2	Vicat apparatus with Desk pot	01
3	Weighing scale 100kg capacity	01
4	Slump Cone set	02
5	Cube mould 150X150X150 mm	100
6	Hot air oven 300-degree celcius	01
7	Electronic balance 10 kg -50kg	01
8	Digital thermometer up to150-degreecelcius	01
9	Set of GI sieves 4.75mm to 45mm	01
10	Set of Brass sieves 75 micron to 4.75mm	01
11	Measuring jars 100ml,200ml, 500ml	01
12	Gauging Trowels 100mm & 200mm with wooden Handle	01
13	Vernier calipers 12" & 6" size (Normal)	01
14	Digital PH meter least count 0.01mm	01
15	GI tray 450X300X40mm, 300X250X40mm, 600X450X50mm	01
16	Mortar Cube vibrator	02
17	Hammer 11b & 21b with chisel	01
18	Le-Chatlier Apparatus+Water Bath	01
19	Flakiness and Elongation Index	01
20	Spirit Level	01

Table: List of Testing Equipment



Photographs: Testing equipment installed at laboratory of LHP Site

6.3 Placement of Manpower Resources

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 right from the beginning of the project. The project being on EPC Mode with 1,144 DUs & comprising of primarily all standalone physical infrastructure facilities, a multi-disciplinary team was specified as requirement in the contract. The list of various professionals deployed by the construction agency as per the requirement of the contract agreement is given below:

	Malani Construction Company								
	Construction of 1,144 EWS (G+13) units at LHP site at Rajkot.								
			List of Tee	chnical Repres	entative at site				
SI. No.		Requirement of Tech as per Contract	inical Staff	Minimum Experience	Required Designation	Designation of Technical	Total Experience		
		Qualification	Strength (No)	(years)	staff	deployed at site	(jeuis)		
1		Graduate Engineer	1	20	Project Manager	Project Manager	40		
2	а	Graduate (Civil/ Billing Engineer)	1	12	Deputy Project Manager	Deputy Project Manager	35		
	b	Graduate (MEP) Engineer	1	12	Deputy Project Manager	Deputy Project Manager	23		
3	а	Civil Graduate Engineer or Diploma Engineer	2	5 to 10	Project	Project	22		
	b	Civil Graduate Engineer or Diploma Engineer	1	5 to 10	Quality Control Engineer	Quality Control Engineer	12		
	С	Electrical Graduate Engineer or Diploma Engineer	1	5 to 10	Project/site Engineer	Deputy control engineer	10		
	d	Graduate Engineer/ MBA in project Management	1	5	Planning Engineer	Planning Engineer	5		
4	а	Civil Diploma Engineer	4	5	Supervisors	Supervisors (4 Nos.)	6-8		
	b	Electrical Diploma Engineer	2	3	Supervisors	Supervisors (2 Nos.)	8		
	С	Mechanical and Plumbing Engineer	2	5	Supervisors	Supervisors (2 Nos.)	12& 7		
	d	IT/Communication / MCA	1	5	IT Engineer	IT Engineer	11		

6.4 Mobilization of Tunnel Form work at Site:

Once the architectural & structural drawings were approved by MoHUA, the same were forwarded by the Agency to Technology Provider M/s Outinord Formworks Pvt. Ltd., Pune for fabrication and preparation of Tunnel formwork. While the foundation work was being carried out at site, the preparation of Tunnel forms were taking place in the factory of technology provider at Pune, Maharashtra.





Photographs: Fabrication of Tunnel formwork





Two set of Tunnel formworks each of 4 Dwelling Units were mobilized at Site. The details of walls casted using the tunnel wallform is marked as Red in the typical Floor Plan of the Building as given below:



6.5 Assembly & Functioning of Tunnel Form work at Site:

As per the report by agency, the Tunnel formwork was supplied to the project site and subsequently installed and erected starting from the month of June 2021. The pictures of the same are given below:



Photographs: Transportation & placement of Tunnel form

Two tower cranes with capacity of 6T load each were installed at the project site for placing two sets of Tunnel form (each for four DUs) separately on two towers. The installation adopted at site was putting a set of formwork for 4 Units on one side of Staircase/ lift well, and after casting of the units, it was shifted to its other side. After completion of the opposite side, it was again brought to upper side of already cast Units. The average time taken for casting of two Towers of 208 DUs (Each Tower with 104 DUs) was 45 Days with two sets of Tunnel forms. Accordingly, 8 DUs were constructed in about 1.75 Days & an average Cycle time of 1.75 Days (for 8 DUs) was achieved in the project. In few instances, particularly in summer days when concrete gained initial strength fast (allowing early deshuttering) a Cycle time of less than 36Hrs (1.5 Days) was also achieved.

A typical cycle time achieved at site using this particular formwork system comprise of following:

- (i) de-shuttering of Tunnel form & placing it inside portion/ upper storey Time taken about 4-6 hrs,
- (ii) putting of reinforcement cage in wall & slab portion along with electrical & plumbing conduits Time taken about 6-8 hrs,
- (iii) pouring of concrete in the slab & wall portion Time taken 4-6hrs, and
- (iv) de-shuttering (after 16-20 hrs).
 (Before de-shuttering of tunnel form, it was ensured that strength of casted cube in the mould, while pouring the concrete in that portion, achieved a minimum strength of 8 N/mm².)

The completion of all 11 building blocks took one year (June 2021 to June 2022), despite of temporary stoppage of the work due to COVID-19 disruptions, high wind affecting the operation of Tower Cranes with Tunnel form (during July to August, 2021), inclement weather leading to heavy rainfalls, batching plant O&M issues, disruption of supply of aggregates in the State for few weeks in the month of May, 2022, etc.

A total of 143 repetitions of Tunnel form (Set of 8 DUs) were achieved in the project for construction of entire 1144 DUs. The agency claims that this high carbon tunnel formwork can be used for more than 500 repetitions.

6.6 Construction Activities at Site:

A typical sequence of construction activities are as shown in the flow diagram below and being explained subsequently:



6.6.1 Site Preparation

Clearing of site

Site clearing operations include removal and disposal of all bushes, shrubs etc. followed by geotechnical investigation of the project site.



Photographs: Cleaning of site

Layout for Foundation:

After clearing of site through Total Station Survey, it was observed that there is a level difference within the site was of 7 m, which was brought to 3 m through cutting & filling. After the same, the levelling was done for preparation of site for setting out and excavation.

Photographs: Layout for excavation



As the soil was rocky after a depth of 1 m below ground level, mechanical excavator was used for the excavation. After excavation, levelling, dressing and compaction of bottom base was done before laying of P.C.C.

6.6.2 Sub Structure Work

Excavation

Highly weathered fractured small angular rock pieces mixed with sand and pebbles were observed upto 1m depth & high to moderately weathered blast rock after 1m of depth. Due to hard rock, it was tough to excavate upto 2.5m depth which affected the speed of excavation. Three JCBs with Hitachi breaker were mobilised to break the boulders and prepare the surface for foundation.

Photographs: Excavation work



Foundation and Plinth Beam

As per structural drawings, layout as per foundation plan was carried out and raft foundations were cast in conventional manner using concrete of M25 grade prepared in the batching plant with Boom Placer Machine.

Backfilling was done in layers with compaction before levelling and marking for plinth beam. After plinth beams are cast, base concrete of M15 grade was placed on compacted soil base for installation and fixing of kicker/starter for tunnelform at ground floor.

Photographs: Foundation and Plinth Beam





Construction of Shear Walls and Slab of Super Structure

After placing and binding of reinforcement in shear wall, tunnel form was placed with help of tower crane. Levelling, tightening, fixing of stoppers etc was done with inclined jack and tie rod respectively. Concrete of M40 grade was placed in walls and slab with Boom Placing Machine after placing and binding of reinforcement for slab.



Photographs: Tunnel Form placing for Shear Walls and Slab

Photographs: Tunnel Form placing and casting of concrete



Photographs: Super structure work in progress



Photographs: Building tower near completion


AAC Masonry Wall for Non-load bearing External and Internal Walls

AAC Blocks of thickness 200mm, 150mm and 100mm were used for external and internal walls. The AAC wall masonry was laid as per laid down procedures in Indian Standards.



Photographs: Autoclaved Aerated Concrete (AAC) Blocks for Wall

6.7 Internal Finishes

This contains flooring, door & window work and painting works in residential building complexes as well as social infrastructure such as community centre, anganwadi, etc. The finishing items are as follows:

SI. No	Materials	Approved make	
1	Doors	Pressed steel/MS angle iron 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. Mat vitrified tiles are used in Corridor passage.	
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)	Plaster and texture on AAC masonry face before painting work 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

SI. No	Materials	Approved make	
1	Living Room/ Bedrooms/ Ceiling	Low VOC Acrylic washable distemper	
2	Kitchen	Low VOC Acrylic washable distemper	
		Ceramic Tiles on all walls except inside the built-in cupboard	
3	Toilets/ Bath	Ceramic tiles on all walls upto 1800 mm height.	
4	External Finishes	As per the architectural design	

Flooring

SI. No	Materials	Approved make		
1	Living room, Bedroom, and	Vitrified (600mmx600mm) laid as per CPWD		
	Kitchen	specifications.		
2	Toilets/ Bath/ Balcony	Anti-skid ceramic tiles 300mm x 300mm laid as per		
		CPWD specifications.		
3	Staircase	Pre-Polished Kota Stone in treads & riser		
4	Skirting / Dado / Wall	Skirting / Dado / Wall Cladding shall be matching with		
	Cladding	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		

Photographs: Internal Wall and Flooring Finishes



6.8 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.	Descriptions	Nos		
1	Tube Light Point	03		
2	Bracket Light Point	07		
3	Ceiling Fan Point	03		
4	Exhaust Fan Point	02		
5	6Amps Socket Point	09		
6	16Amps Socket Point	02		
7	AC Point	01		
8	Geyser Point	01		
9	Fan Regulator	03		
10	Ceiling Rose	03		
11	TV Point	01		
12	Bell Push	01		
13	Buzzer	01		
14	SPN DB	01		

Internal Plumbing Fittings in each Dwelling Unit

SI.No.	Description			
1	EWC with PVC Flush Tank	02		
2	Wash Basin	02		
3	CP Piller Cock	02		
4	CP Waste Coupling 32 mm dia	02		
5	CP Angular Cock	05		
6	15mm dia PVC Connection Pipe	04		
7	32mm dia flexible waste pipe	02		
8	SS Sink	01		
9	SS sink waste pipe 32 mm	01		
10	CP grating plain	03		
11	CP grating with pocket	-		
12	20mm dia concealed stop cock	01		
13	wall mixer	-		
14	Two way Bib cock	02		
15	Health Faucet with 1mtr hose	02		
16	Bib cock (long Body)	01		
17	Soap dish holder	01		
18	Towel rod 450mm long	01		
19	Bib cock (Short)	03		

6.9 On Site Infrastructure and Site Development Works

- **i. Water supply** The underground tanks of capacity 52,000 litre for each block had been provided.4 numbers of Overhead water tanks of 5,000 litres capacity & one additional fire tank of 5,000 litre capacity are provided on roof top. There is automatic system for pumping of water to overhead tanks on building roof top. Depending on the requirement, pumping can be done three times during a day.
- **ii. Sewerage system:** 1 STP (ALFA MBBR technology) capacity (230 KLD) had been provided with provision of wastewater recycling for horticulture 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) 140 numbers of LED Street Light of 45W.
 - c) 10 nos of solar streetlights of 60W with luminous efficacy of 140 lm/w.
- iv. Storm Water drains: Closed channel drain with inspection chamber and perforated cover.
- v. Roads and Pathways: RCC roads and pavers for pathways / Parking.
- vi. Landscaping: As per scope of work landscaping covered 2850 Sqm. area
- vii. **Provision for Fire Fighting:** As per NBC 2016 and Local Byelaws, provision of firefighting system has been made.

- viii. **Provision of lifts:** Three lifts (two passenger lifts of capacity 6 people and one service lift of capacity 8 people) have been provided in each block. Total 33 lifts have been provided as per the requirement.
 - **ix. Provision of Rainwater harvesting:** Provision of 6 no. rainwater harvesting pits have 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.
 - **x. Provision of solid waste management:** The provision for two bins (big size as per requirement) for each block has been made.
 - **xi. Compound wall:** precast RCC wall with M.S railing at top and entry gate (1 no.) has been provided.



Photographs: Community Centre



Photographs: Landscaping of the Project



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 (Government Engineering College, Rajkot and Lalbhai Dalpatbhai (L.D.) College of Engineering, Ahmedabad), SVNIT Surat & CEPT Ahmedabad, Affordable Housing Mission (AHM), Gujarat 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 Rajkot site for day-to-day supervision and monitoring of the project.



Photographs: Review of LHPs by PMC Members

Further, the Ministry through its already identified event management agency i.e., Wizcraft International Entertainment Pvt. Ltd. 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.

Photographs: 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 Gujarat 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 Rajkot, the State level Nodal Agency was Gujarat Urban Development Mission (GUDM) Mr. Bhavin Patel, Project Specialist, Affordable Housing Mission was nominated as Nodal Officer and representative for Project Management Committee.

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.



Photographs: Laboratory testing equipments

Based on Quality assurance Plan testing were carried out and record maintained. At least 25 percent 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.

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 Rajkot.

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 Rajkot was taken by Hon'ble Prime Minister on 03rd July 2021 and on 20 July 2022 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.



Photographs: Review of LHPs by Hon'ble Prime Minister on 03 July 2021

Photographs: Review of LHPs by Hon'ble Prime Minister on 20 July 2022



7.4 Site Visit to LHP

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 December 2021, Shri Bhupendra Rajnikant Patel, Hon'ble Chief Minister of Gujarat had inspected and reviewed progress of LHP Rajkot. Shri Patel had interacted with the Technograhis, concerned officials and other stakeholders and also visited the sample flats.



Photographs: Visit of Hon'ble Chief Minister of Gujarat, Sh. Bhupendra Rajnikant Patel



Photographs: Visit of Hon'ble Chief Minister of Gujarat, Sh. Bhupendra Rajnikant Patel

Photographs: Visit of Sh. Durgra Shanker Mishra, Former Secretary, HUA



Photographs: Visit of Sh. Kuldip Narayan, Joint Secretary & Mission Director (HFA), MoHUA, Govt. of India



Photographs: Visit of Sh. Mangesh Ghildiyal, Deputy Secretary, PMO, Govt. of India



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



7.5 Safety Management

The Construction Agency ensured adequate safety measures at sites with necessary signages during construction 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.



Photographs: Health and safety at the LHP Rajkot Site

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.



Photographs: 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
- 06 Male Toilets and 05 Bathrooms.
- 06 Female Toilets and 05 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.

Photographs: Covid-19 vaccination of labours

M/s Malani Construction Co, 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.

Photographs: Facilities for labour at the LHP Site





7.9 Identification of Beneficiaries

The beneficiaries for Light House Project, Rajkot have been identified by the Rajkot Municipal Corporation as per 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. 3.39 Lakh for house. The allotments of these houses are on the name of the female households of the family.



Photograph: Beneficiaries of LHP Rajkot

7.10 Post Construction Operation and Maintenance

After completion of the project in all respect, a Completion Certificate was obtained by the Construction Agency from Rajkot Municipal Corporation (RMC). The project was handed over to RMC 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 RMC. 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 has 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 RMC regarding relevant measures required.

7.11 Challenges and Learnings from The Ground

Being large project with innovative tunnel formwork system, a few challenges, learnings faced by project team are presented here

- Due to COVID 19 pandemic and its recurrence from time to time, it posed extreme challenges on movement of materials/ components, keeping the workforce healthy, intact & isolated.
- As the work progressed, there have been steep and continuous rise in the cost of raw materials mainly steel, cement and other materials.

Despite of challenges, the project could be completed in time due to efficient project monitoring, uninterrupted fund flow and payment to the agencies, quick query resolution and good project management at all levels i.e. agency, state and centre. Success of the project can be attributed to the following:

- Efficient Project Management.
- Timely approvals of statutory requirements by State Government including release of state and beneficiary shares.
- Timely mobilisation and deployment of material, equipment, and human resources.
- Ensuring uninterrupted supply chain of building materials /components used in the project.
- Trained workforce at site for fixing/removal of the tunnel form and placement of concrete with due safety measures.
- Regular flow of funds from the MoHUA commensurate with the physical progress.
- Third party inspection & monitoring with timely intervention and solutions in case of any technical or administrative issues.
- Proper coordination of MoHUA, State Government, BMTPC, Construction agency, and TPQA agency

Chapter 8: GRIHA & Aspects of Thermal Comfort



8.1 Thermal Comfort

The LHP Rajkot is well planned with 6.3% green area keeping functional needs of prospective occupants in mind. Dimensions of habitable rooms, Kitchen, bathroom, toilet conforms 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 Rajkot constructed with Monolithic Tunnel formwork technology (Figure 1) 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.



Figure 1 Tunnel formwork at LHP, Rajkot

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 Rajkot 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 Rajkot was evaluated on the parameters of ENS compliance based on the building material and configuration adopted in the project. The Residential Envelope Thermal Transmittance Value (RETV), as defined in ENS 2018, for LHP Rajkot has been calculated as 14.32 W/m²K, which is complying with the minimum RETV value requirement of 15 W/m²K as per ENS 2018.

8.2.1 Methodology for monitoring and evaluation of Thermal Comfort at LHP

On-site spot measurements, dataloggers, comparative graphs, and a comfort chart of 'Phase 1' was used to access the impact of the building envelope of LHP, Rajkot on the thermal comfort performance of the dwelling units (Figure 2). Based on on-site measurement results, there is a temperature difference (Δ T) of 4 - 5 Celsius in the indoor temperature (During noon time of a typical day in monsoon month) of the dwelling unit in comparison to the outdoor temperatures (Figure 3). Also, the dataloggers study of a corner dwelling unit for a typical monsoon week shows that the drybulb temperature (DBT) of all rooms fall inside the Indian Model of Adaptive Comfort (IMAC comfort) (Figure 3). This showcases that the envelope of the LHP, Rajkot is thermally efficient when compared to conventional buildings. Broadly the construction technology is 3 - 4% more comfortable than the conventional building.


Figure 2 Thermal comfort analysis methodology



Figure 3 On-site spot measurements and dataloggers study showing indoor temperatures falling under IMAC band



Figure 4 On-site spot measurements and dataloggers study showing indoor temperatures falling under IMAC band

8.3 Key performance features of LHP, Rajkot

Following points highlights upon some of the key features of LHP Rajkot:

- Residential Envelop Transmission Value (RETV) is around 14% better than the conventional case making it 16.67% more energy efficient.
- Embodied energy is reduced by 25% due to use of GGBS in cement concrete mix.
- Percentage (%) reduction in water use:
 - o for Concrete- 26.67%
 - for Brick Masonry- approx. 70%
- In comparison to a typical building built in Rajkot, the estimated electricity saving in LHP Rajkot due to less construction time and advance technology used is estimated to be 2.15 Lacs kWh. This accounts to INR 15 Lacs savings in terms of cost¹. Typical saving is 4.72 kWh/ Sqm compared to building construction using conventional method.
- This translates into a total carbon mitigation of 6.97 metric tonnes of CO2 emissions.

The real time monitoring results clearly shows that the thermal performance of LHP Rajkot is better than a conventional building.

8.4 Comparative analysis of building envelope between conventional building vs LHP, Rajkot

This section highlights upon the building envelope comparison between a conventional building and the Light House project in Rajkot.

¹ Price of INR 7 per unit is considered

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

Components	Conventional Building (Conventional Case)	LHP Rajkot (LHP Case)
Wall material	230 mm Burnt Red clay brick wall	200 mm Autoclaved Aerated Concrete (AAC) block
Roof material	150mm Reinforced Cement Concrete (RCC) Slab and China mosaic	160mm Monolithic RCC slab with water proofing and China mosaic
Window Glass & frame	Steel frame with 5mm clear glass	Unplasticized Polyvinyl Chloride (uPVC) frame with 5mm clear glass

Table 1 Envelope Components – Conventional & LHP

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		1.97 W/ m2K
Roof	Interior Surface Film resistance + External Cement Mortar (18mm) + RCC slab (150mm) + Internal Cement Mortar (12mm) + Exterior Surface film resistance		2.78 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		7W/m2K
RETV	Residential Envelope Transmittance Value (North-South Blocks)		16.64 W/ m2

Envelope Type	LHP Case - Construction Configuration	Section	U Value*
Wall	Interior Surface Film resistance + Internal Cement Mortar (10 mm) + AAC Block (200mm) + External Cement Mortar (30 mm) + Exterior Surface film resistance		0.68 W/ m2K
Roof	Interior Surface Film resistance + RCC slab (160 mm) + screeding (55 mm) + External Cement Mortar (50mm) + China mosaic + Exterior Surface film resistance		2.74 W/ m2K
Fenestration & Glazing	uPVC framed SGU with 5mm glass thickness, SHGC = 0.83, VLT = 0.89		5.9 W/ m2K
Void	Assumed SHGC = 1, VLT = 1		7W/m2K
RFTV	Residential Envelope Transmittance		14.32 W/
	Value (North-South Blocks)		m2

Table 3 (b) LHP Rajkot Construction Envelope Details

* 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 Rajkot is constructed with AAC blocks for the wall and RCC slab, concrete flooring is used for the Roof and UPVC frames are used for the windows.



Figure 5 UPVC windows and AAC blocks used in LHP Rajkot

8.5 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 Rajkot.

The construction in LHP, Rajkot 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 Rajkot, which has many advantages including improvement of workability, durability and strength of concrete. In the construction of LHP, there is a direct replacement of 30% of cement has been done by GGBS, which reduces the overall embodied energy by a minimum of 25%.

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 Rajkot. It has been estimated that the total carbon mitigation is around 6.97 metric Tonnes of CO₂.

8.6 Electricity demand reduction during construction

Advance construction technique is vital for new age India and if not practiced properly leads to higher energy use at the construction site. In LHP Rajkot, the same was avoided in two ways:

- 1) Better Layout planning and less movement of fluids,
- 2) Less construction time due to faster crane operated tunnel formwork technology.
- 3) Optimized resource planning and utilization.

Overall estimated savings achieved using the monolithic tunnel formwork technology in LHP Rajkot are:

6 to 10 months less construction time 2.15 lacs kWh savings of construction electricity at LHP Rajkot when compared to a coventional muiti storey building in Rajkot

8.7 Inferences

The Light House Project at Rajkot was monitored for thermal comfort for a week in monsoon month. During this period the spaces were thermally comfortable according to the India model for Adaptive Comfort (IMAC) model. A temperature difference of 4 - 5 degree Celsius in the dwelling units was observed during on-site spot measurements study indicating better thermal performance of building unit when compared to outside temperature.

Additionally, the construction technology used in the project showcased 25% reduction in Embodied Energy by using GGBS in the concrete design mix. Further, shorter construction time leads to 2.15 lacs kWh energy savings and 6.97 metric Tonnes of CO₂ emissions.

It is inferred with the real time performance monitoring, that the LHP Rajkot construction provides better thermal comfort compared to a conventional construction, due to the selection of materials with better thermal performance and monolithic tunnel formwork 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.

8.8 GRIHA Affordable Housing (GRIHAAH) Rating

Light House Project Rajkot aimed for GRIHA Affordable Housing rating. The rating mainly focuses on sustainability in the affordable housing segment.

The 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. The 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, while emphasizing on the following aspects:

Low Impact Design

(Light coloured external surfaces to reflect solar radiations- Buffer spaces in unfavourable orientation, Shadow Analysis, massing of the building)

- Reduction in air and Soil Pollution during Construction
- Envelop of Thermal Performance
- Occupant Visual comfort (day light)
- Efficient Lighting
- Energy Efficient Equipment
- Renewable Energy
- Energy Metering
- > Efficient Use of Water during Construction:
- > Optimization of building & landscape water demand:
- Water Reuse
- Water Metring-
- Construction Waste Management

- Post Construction Waste Management
- > Reduction In Environmental Impact of construction
- Use of Low-Environmental Impact Materials
- > Use of Recycled Content in Roads and Pavements-
- Facilities for Construction Workers
- Universal Accessibility
- Proximity to Transport and Basic Services
- Additional Measures, if any

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:

SI. 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 *****

The above framework is being used for evaluation of LHP Rajkot for GRIHA rating. Based on monitoring, data collection, visits & interaction at the site by the GRIHA team, report submitted by the agency, LHP Rajkot project was evaluated for GRIHA rating and was awarded **** rating.

Chapter 9: Live Laboratories: Knowledge Dissemination



9. 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.



9.1 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/.

9.2 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.

9.3 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.

9.4 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

9.5 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 Rajkot 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	Location
1	Training on emerging construction technologies for thermal comfort for officers	10 May 2022	Ahmedabad
2	Training on emerging construction technologies for thermal comfort	12 May 2022	Rajkot
3	Vocational Training	17 & 18 May 022	Rajkot
4	Vocational Training	02 & 03 June 2022	Ahmedabad
5	Awareness drive in architectural college	09 & 10 June 2022	Vadodara
6	Training on emerging construction technologies for thermal comfort	22 June 2022	Ahmedabad
7	Vocational Training	30 June & 01 July 2022	Ahmedabad
8	Vocational Training	07 & 08 July 2022	Rajkot

Photographs: Glimpses of Trainings and Capacity Building Sessions



Photographs: Glimpses of Trainings and Capacity Building Sessions









Photographs: Glimpses of Trainings and Capacity Building Sessions



Photographs: Glimpses of visits at LHP sites by Officials/Technograhis



Photographs: Glimpses of visits at LHP sites by Officials/Technograhis



Photographs: Glimpses of visits at LHP sites by Officials/Technograhis





Photographs: Glimpses of visits at LHP sites by Officials/Technograhis



9.6 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-3.

Annexures



Statutory Approvals and NOCs



Rajkot Municipal Corporation Krishna nagar Civik Center, Guruprasad Chowk, Nr. Doshi Hospital, Gonadal road, Rajkot-360004 (Gujarat) Ph : 0281 2966248

No. : RMC/Awas/Tech-577

Date : 22-08-2020

To, Executive Director Building Materials & Technology Promotion Council Core 5A, 1st floor India Habitat Center, Lodhi road New Delhi 110003

> Sub : Construction of 1144 EWS Units at Light House Project (LHP) site at Rajkot, Gujarat under Global Housing Technology Challenge = India (GHTC-India) Ref : Your Letter No : BMT/LHP/Rajkot/2020, Dated 18-08-2020

Dear Sir,

In reply to your letter subject and ref above, we have incorporated all observation as per local norms of GDCR 2017. GDCR has all provisions required fire system which fulfill requirements during fire and emergency. It is confirmed that there is no need to provide gurbage shaft type solid waste management system in highrise apartment. Rajkot Municipal Corporation has been providing door to door service of collection of garbage. It is also confirmed that the fire hydrant provided at mid landing of staircase and the same is sanctioned by Town Planning Department of Rajkot Municipal Corporation as per GDCR Norms. GDCR does not ask for separate provision of shaft for fire. We are hereby submitting approved drawings showing all the required and admissible modifications, made by agency under intimation of Rajkot Municipal Corporation. Submitted for further necessary procedure.

Thanking You,

City Engineer (Sp.) Rajkot Municipal Corporation

Copy respectfully submitted to : Y. Project Specialist, Affordable Housing Mission



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મુ⁵¹ દુ: શેલ, ક્ષયર લાક્ર્ટ, દેરેમ, જેન્ટ્રસ દોયલેટમાં માંય Wit, અને ૭ જીવિનલ લેડીજ દોયલેટમાં ૭ માદ, છે સ્વડી તથા મેસેજ્ય હોલ હામ, shopping center

સા. રુ. : અમ)ગામમાંગ ૧ તથા ન સાત શોમ, રેલ્ય સેન્ટર, અોય, ઓમન સોક્રા બે ચોયલેટ રેન્ડ્રી કેમ ઘેયલેટ , છે પેન્સી , છેન્ટરન દોયબેટમાં છે ખ.લ., છે જીવિનાલ, ઉક્રીઝ્જ રોયલેટમાં છે ખ.લ. તથા છે સાડી, ખેસેજનુ બોલકામ ૯

2⁵⁴ કરે મનોગાળવાડી હતથા છે, સાત શોમ, દેલ્ય સેન્ટર, હવા મોત્ર, સાથા શેમછેટ. હે બેબ્દી, જેન્ટસ રોયલેટમાં છે ખ.૮., છે જીવિનલ, લેગઝ રોમલેટમાં હેને ખ.૮. તથા a ansi, maron બોલઠામ

Residential Tower (11-Unit)

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ઘી ગુજરાત પ્લા. એન્ડ અર્બન ડેવ. એકટ ૧૯૭૬ તથા બોમ્બે પ્રો. મ્યુનિ. કોર્પોરેશન એક્ટ ૧૯૪૯ અન્વયે ઈમારત બાંધવા સંબંધી કોર્પોરેશનના પેટા કાયદા તથા વખતો વખત કોર્પોરેશન જે કાંઈ અધિનિયમો (રેગ્યુલેશન) અમલમાં મુકશે તેને આધીન રહીને બાંધકામ કરવાનું છે અને બાંધકામ પુરૂં થયે મકાન વપરાશ માટે દાખલો કે ભોગવટા પરવાનગી સર્ટીફીકેટ આ મથવા નથી આપ વધા આવે ! મેળવવાનું રહેશે.

આ પરવાનગી અનુસાર બાંધકામ કરવાથી કોઈના હકકને બાધ આવશે અથવા સરકારી કે કોર્પોરેશનમાં કોઈ પેટા કાયદા અધિનિયમો, કે નિયમોનું ઉલ્લંધન થશે તો તે માટે તમારી જવાબદારી રહેશે. 👘 👘 👘 👘

શ્રી કમિશ્નર સાહેબનાં હુકમનાં R.M.C./G.A.D./No. 488 Dt. 07-02-2009 થી મળેલ રાત્તોના આધારે પરવાનગી આપવામાં આવે છે. તેના મનાવના પ્રતિવર્ધ અન્ય 31

5 17 R-166 કેવ. સા. ઈ. નં. ૭૧-૨ ડવ. સા. 8. ન. ૭૪.~ રાજકોટ, તા. લગ્ન (ગ્રેન્સ્ટ્રિક્સ અને ત્રોન્સ્ટ્રેન્સ્ટ્રેન્સ્ટ્રિક્સ સ્ટ્રોન્સ્ટ્રેન્સ્ટ્રિક્સ્ટ્રેન્સ્ટ્રિક્સ્ટ્રેન્સ્ટ્

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૧) મકલ રવાના ર= વેરા વસુલાત શાખો, રાજકોટ મેહાનગરપાલિકાં આવ્યું લિયાળાંક લાખ હેઠક joppare છે. પરવાનગી ફીના રા. ૨૫/- પહોંચ નંજે ૬૧૧૦.. તા ટકા૦.....તેજી બોલેલ છે.

ખાસ શરતો ઃઃ–

વિકાસ પરવાનગી મેળવ્યા બાદ સ્થળ ઉપર વિકાસ શરૂ કરતા પહેલા સાત દિવસ અગાઉ ફોર્મનં.૨(ડી) નું એનેક્ષર, સ્ટ્રક્ચરલ ડ્રોઈરસ, વર્કી ગ ડ્રોઈરસ ۹. તથા સોઈલ ઈન્વેસ્ટીગેશન રીપોર્ટસ નિયામાનુસાર રજુ કરવાના રહેશે. વર્ડ છે. બાંધેકાંસનો દેરેક તબકકે કોર્મ નં. જ (એ) થી ક (ડી) માં દર્શાવ્યા મુજબનું પ્રોગ્રેસ સર્ટીફીકેટ રજુ કરવાનું રહેશે.

ઙ. ુ જી.કી.સી.ઓરુ.તી જોગવાઈ તથા સરકારશીના તા.૨૯−૫–૨૦૦૧ ના સ્ટ્રકચર સેકટી અંગેના હુકમના વિનિયમ નં. ૩ અનુસાર બાંધકામના સ્થળ ની જરૂરીયાનોની જોગવાઈઓનું પાલન થયેથી જે સ્થળ ઉપર બૉલકામ શરૂ કરવાનું રહેશે.

- સેપ્ટી ટેંક તથા સોકવેલની સાઈઝ તથા સંખ્યા નેશનલ બિલ્ડીંગ કોંડ (આઈ.એસ.૨૪૭૦) તથા સિવિલ એન્જીનીયરીગ હેન્ડ બુક બાય ખગ્ના મુજબ ડ્રેનેજ ۲, કો-આઉટમાં દર્શાવવાના રહેશે. તે અનુસારની જોગવાઈ કરવાંની જવાબદારી આર્ક્રીટેકટ/ઈજનેર/સ્ટ્રકચરલ એન્જીનીયર/કલાર્ક ઓક વર્કસ / સાઈટ (A_i) સુપરવાઇઝર/ડેવેલપર્સ/જમીનના માલિકની રહેશે.
- ્ર પિટી સે વિકાર્સપરવેનોથી પંત્ર તથા મહુદ થયેલ નકશાંથીની એક સેટ સાંબે ઉપર પ્રસિદ્ધ કરવાનો રહેશે. વિકાર્સ જ જ જે છે કે જિલ્લ
- ⊊. (ં બોધકામ પૂર્વ થયા બાદ બોધકામનો ઉપયોગવાટ કરતા પહેલા વિયમાનુસાર અર્ગથીઓધકામનું વપરાક્ષ સંગ્રેનું પ્રધાક્ષપત્ર ભોળવ્યા બાદ જ વપરાક્ષ શરૂ કરવાનો રહેશે. 843 812d) ::-

તામ આવશે તે મહાનગી પત્રમાં દર્શવિધ શરતોમાંથી કોઈપલ શરતોનો ભંગ કરવામાં આવશે તો મહાનગરપાલિકા તે શરતોનો અમલ જવાબદાર ઈસમના/સંસ્થાના ખર્ચ અને જોખે કેરાવી શકશે એને મહાનગર પાલિકાના તેવા કુત્યને લીવે જે નુકર્યાન, ખોટ કે હરકત થાય તે બદલ કોઈ પણ વળ AZ 3 USA HUR HUR LAND RANDER INSTITUTE IN THE AND THE PARTY AND THE PART

આ પરવાનગીના કારણે અરજદારને માલિકી, જમીનની હદ તથા જમીનના વિસ્તાર / સંગ્રેફળ અંગેની પંજુરી મળતી નથી પરંતુ બાંધકામ ₹. અંગેની મંજૂરી આપવામાં આવે છે. મુસદારૂપ નગર રચના યોજનામાં આવેલ અંતિમળેડની હદ, માૃપ્ શેરકળે તથા કાળવાલી ટાઉન પ્લાનીએ ઑક્સિરેશી દારે ફેરફારને પાસ છે 15/105- ...

з. Χ.

- વખતો વખત શહેરી વિકાસ સતામંડળ તરફથી વિકાસ માટેના જે નિયમો તથા જાહેરાત કરાય તે જમીન મોલિક, હિતસંબંધ ધરાવતી વ્યક્તિ / સંસ્થા 1 તેમજ અરજદારને લંઘનકર્તા રહેશે 🖉 🖓
- સદર વિકાસ પરવાનથી અન્વયે જામીન માલિકીમાં કેરકાર થાય અથવા આ પરવાનગી સાંઘે સંકળાયેલ રજીસ્ટ્રેશન ધરાવતી કોઈ વ્યક્તિ બદલાય તો, નવા જમીન માલિકી અંગેના પુરાવા રજુ કરે ત્યાં સુધી તથા રજીસ્ટ્રેશન ધરાવતી નવી વ્યક્તિની નિમસુંક ન થાયત્વાં સુધી જીડી સી.આર. ના વિદિ પ.ર મુજબ વિકાસ પરવાનગી નિલંબીત ગણાશે. સદરહુ સંમયે દરમ્યાન થયેલ બોલકામ બીનંઝવિફત ગણાશે.
- ાં દા કા સરકારશીના તા રહ-પ-૨૦૦૧ ના સ્ટ્રેક્ચરલ લોકટી અંગેના એનેસરના વિનિયમ ૧૩,૧૪,૧૫ ની જોગવાઈ અનુસાર ભૂઇપ અંગેની સુરવા,

🚈 😳 🕖 ચારવાત અંગેમી સુરક્ષા, બાંધકામ તથા બાંધકામમાં વપરાતા ઈમારતી પાલ સામાનની ગુજાવતાં અને તેની ચકારણી, બાંધકામની ફિયરતા તથા આંગ અંગેની સલામતી તેમજ અન્ય ભયજનક ભાગતો અંગે નિષ્ક્રાંતોની સલાહ સૂચન મુજબ પણલાં લેવાની તમામ જવાબદારી આર્કિટેકટ/ઈજૂતેર/સ્ટ્રકચરલ . ં/ ં એન્જીનીપર #કલાર્ક ઓફ વર્ડસ / સુપરવાઈઝર / દેવલપર્સ / જમીન માલીકની સુદેશે.

ં છે. ં આ વિકાસ પરવાનગી પત્ર મંજુરી આપ્યા તારીખથી બાર માસ સુધી જ અમલમાં રહેશે. ત્યારબાદ અધિનિયમની કલેમ–ઉર મુજબ વિકાસ પરવાનગીની મુદત વધારવાની પૂર્વ મંજૂરી મેળવી લેવાની રહેશે.

ગુજરાત નગર રચના અને શહેરી વિકાસ અધિનિયમ-૧૯૭૮ ની કલમ - ૩૩ મુજબ વિકાસ પોજનામાં જો કોઈ ફેરફોર થાય તો મહાનગરપાલિકા ٤. આપેલ વિકાસ પરવાનગીમાં કેરકાર કરી શકશે અથવા વિકાસ પરવાનગીરંદ કરી શકશે. આપેલ વિકાસ પરવાનગીમાં કેરકાર કરી શકશે અથવા વિકાસ પરવાનગીરંદ કરી શકશે. છે.ડી.સી.આરંગો વિગિયમ છે.૮ મુજબ એરંજદારશીએ ખોટી સ્જુઆત અથવા ખોટા દસ્તાવેજી પુરાવા રજુ કરેલે હશેનો ઓપેલવિકાસ પરવાનગી દેવી બી આપેલીપે કેદ શહેલ અલગ

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٩." કવર્ડ/ઓપન પાર્કિંગ તથા માર્જીનલસ્પેશ ગ્રાઉન્ડ લેવલ (+0.0) રાખવાના રહેશે. તથા તેમાં અત્રેથી પૂર્વમંજુરી મેળવ્યો સિવાય કોઈપણ પ્રકારનો કેરકાર કે બાંધકામ કરી શકાશે નહિ તથા તેનો ઉપયોગ સંયુક્ત <u>રીતે કરવી</u>ની રહેશે.

- જે હેતુ માટે પર્વાનગી આપવામાં આવેલ છે તે હેતુ માટે જ ઉપયોગ કરવાનો રહેશે અન્ય હેતુ માટે ઉપયોગ કરવામાં આવશે તો ۹. પરવાનગી આપોઆપ રદ ગણાશે. H-≦. 18843
- з. સેલરનું ખોદકામ કરતા સમયે આજુબાજુની મિલ્કતને નુકશાન ન થાય તે સંપૂર્ણ ધ્યાન રાખવાનું રહેશે.
- વરસાદી પાણીના ભૂંગળા તેમજ ખાળ મોળીનાં પાણીના ભૂંગળા જમીન સુધી ઉતારવાના રહેશે. ۲.
- પ. મકાનના દરવાજા, શટર્સ, રસ્તા તરક ખુલ્લે તે પ્રમાણે રાખવાના નથી.
- આ પરવાનગીથી ફક્ત ચણતર કરવાની પરવાનગી મળે છે. કારખાના અથવા મકાનમાં બીજા વિશિષ્ટ હેતુ માટે ઉપયોગ કરતાં મહાનગરપાલિકાની અલગ મંજુરી મેળવવાની રહેશે.
- ાર્ગ 🔆 આ પરવાનગીથી જે કામની પરવાનગી મળે છે તે કામે જો બીજા કોઈ ખાતાની પરવાનગી લેવી જરૂરી હશે તો તે મેળવી લેવાની શરતે આ પરવાનગી આપવામાં આવે છે.
- આ પરવાનગીથી પોતાની માલીકીની જ જગ્યામાં બાંધકામની મંજુરી મળે છે. આજુબાજુના કોઈ હકક હિતને બાંધ આવેશે તો તેની ٤., જવાબદારી અરજાદરની રહેશે.
- આ બાંધકામ પરવાનગી તથા મંજુર થયેલ પ્લાન મહાનગરપાલિકાના ટાઉન પ્લાનીંગ શાખાના અધિકૃત ઓફીસરથી/કર્મચારીને e. સ્થાનિકે ચેક કરવા બતાવવાના રહેશે. z∉≓
- ૧૦. દરેક ક્રિયન દીઠ એક વૃક્ષ વાવવાનું રહેશે.
- ૧૧. બાંધકામ શરૂ કરવાની સાથે પરવાનગી નંબર તારીખ તથા આર્કીકેટશ્રીનાં નામ નિર્દેશવાળું સ્પષ્ટ મોટા અક્ષરથી બોર્ડ બનાવી કરજીયાત સ્થળ પર રાખવાનું રહેશે. 292
- ૧૨. તમારા પ્લોટમાં બોર બનાવીને તેને રીચાર્જ કરવાની સીસ્ટમ કરવાની રહેશે. ૧૩. એરજદાર સ્થળ ઉપર વિસ્તારના સર્વે નંબર, સીટી સર્વે નંબર, બ્લોક નંબર, સૂબે પ્લોટ નંબર, વિસ્તાર, માધિક, માર્કિટકટ, ાર બેન્જીનીયર, ડેવલપર વિ. નું નામ, બાંધકામ પરવાનગી નંબર, તારીખ, પ્રોજેકટનું નામ તથા તેને સંલગ્ન વિગતો દર્શાવતું બોર્ડ સ્પષ્ટ અને સુવાચ્ય ગુજરાતી ભાષામાં કરજયાત પદ્મે મુકવાનું રહેશે.
- સ્માર્ટ સીટી અંતર્ગત બાંધકાય શરૂ કરતા પહેલાં સ્થાનીકે કામ કરતા મજુરો માટે હંગામી ટોયલેટ (સાત મજુર દીઠ એક) મોલીકીની ٩X હદમાં બનાવવાનું રહેશે, તથા રોગચાળો કેલાય નહીં તે અન્વયે તકેદારી રાખવાની રહેશે, અન્યથા બાંધકામ પરવાનગી રદ ગણાશે.
- ___ટીયલ એસ્ટેટ (રેગ્યુલાઇઝેશન એન્ડ ડેવલપમેન્ટ) એક્ટ, ૨૦૧૬ની કલસ,- ૭ની બેગવાઈ મુજબ, રાજ્યમાં કોઈપણ વિકાસકાર (પ્રમોટર) રીયલ 94 એસ્ટેટ પ્રોજેક્ટ જેવા કે, પ્લોટ, એપાર્ટમેન્ટ અથવા બિલ્ડીંગ અથવા તેના ભાગના વેચાણ માટે જાહેરાત, માર્કેટીંગ, બુઠીંગ અથવા ઓફર માટેની કાર્યવાદી, રાજય સરકાર દારા રચાયેલ રીયલ એસ્ટેટ રેગ્યુલેટરી ઓયરીટી (રેરા)ની કચેરીમાં રજીસ્ટ્રેશન કરાવ્યા સિવાય કરી શકશે નહી.''



No.

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રાજકોટ મહાનગરપાલિકો (બાંધકામ પરવાનગી)

(ध्रूर डोल, सेन्ट्रल डोल, वेस्ट डोल) काही सिल्ट मेन्ट्र गौडल मोड, भारकोट શીસાદી શ્વેપિજલિયર (સ્પે.) રાજ્યોટ સંયુનગર નાઉમમ ટે તમોને કોર્પોરેશનની હદમાં મેમા- 32 C] . TP- 33, PP- 93/20 (842) . 93/4-121 25, 200 . ટ્રેનેજ

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વોર્ડ નં. :- ...ં?.....

ર. ગેમમ અનેસ્ટેટ (રેગ્રહ્મગાઇસ્ટ્ર)ન અને ઉમ્લામેન્ટ) અનેટર ૨૦૨૬ત્રી હલન- ક રી સેગાયા ઇ

8 શ્વરત્રથા નકી એ નવા જારે લોર વિચાર્વ દસ્યાનો વટેશે લયા સબાદો કેર દ્વાળમાં દર્શાળમાં ક્રાઉભા મુકલ અપરજ્યરકી જો જીમાદ સામયાં સ્વાનવાનું વહેરો.

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- 9. 821) 821 832 801121 -21) diadiz (121) auguarabit diasin मन्द्रभी लेगकी संरको.
- C. 2A कडीमने 32- देमा (442) व्यक्तिम यथे सावकरकी आया केया? अपन्त्र अंधनवनी वहेशे.

થી ગુજરાત પ્લા. એન્ડ અર્બન ડેવ. એક્ટ ૧૯૭૮ તથા બોમ્બે પ્રો. મ્યુનિ. કોર્પોરેશન એક્ટ ૧૯૪૯ અન્વયે ઈમારત બાંધવા સંબંધી કોર્પોરેશનના પેટા કાયદા તથા વખતો વખત કોર્પોરેશન જે કાંઈ અધિનિયમો (રેગ્યલેશન) અમલમાં મકશે તેને આધીન રહીને બાંધકામ કરવાનું છે અને બાંધકામ પુરૂં થયે મકાન વપરાશ માટે દાખલો કે ભોગવટા પરવાનગી સર્ટીફીકેટ મેળવવાનું રહેશે.

આ પરવાનગી અનુસાર બાંધકામ કરવાથી કોઈના હકકને બાધ આવશે અથવા સરકારી કે કોર્પોરેશનમાં કોઈ પેટા કાયદા અધિનિયમો, કે નિયમોનું ઉલ્લંધન થશે તો તે માટે તમારી જવાબદારી રહેશે.

શ્રી કમિશ્નર સાહેબનાં હુકમનાં R.M.C./G.A.D./No. 488 Dt. 07-02-2009 થી મળેલ સત્તાના આધારે પરવાનગી આપવામાં આવે છે. Course of Almahan -

કેવ. સા. ઈ. નં. 99-2	Kent
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તકતાબગી વ્રજ્ઞાક સ્કલ્પક સક્વેથ	งราว หลายการการเปลือเ
ભાવેશ છે. અપેલળ (શરતો માટે પાછળ જુઓ)	na an a
૧) નકલ રવાના :- વેરા વસલાત શાખા. રાજકોટ મહાનગરપાલિકા	and dense son der eine Fölgt i Kreaktingen

પરવાનગી કીના રૂા. ૨૫/- પહોંચ નં. .. ઉ. મ્પુ ભ. તા. ૧૮ / / શા ભરેલ છે.

100 ખાસ શરતો ઃઃ– વિક્રીસે પરવાનગી મેળવ્યા બાદ સ્થળ ઉપર વિકાસ શરૂ કરતા પહેલા સાત દિવસ અગાઉ કોર્મનં.ર(ડી) નું એનેક્ષર, સ્ટ્રક્ષ્યરલ ડ્રોઈટ્સ, વર્કીંગ ડ્રોઈટ્સ ۹. તથા સોઈલ ઈન્વેસ્ટીગેશન રીપોર્ટસ નિયામાનુસાર રજુ કરવાના રહેશે. 👘 આંધકામના દરેક તખકડે શેમ ને કે (એ) થી કે (ડી) માં દર્શાવ્યા મુજબનું પ્રોગેસ સર્ટીક્રેકેટ રજુ કરવાનું રહેશે. ₹. છ.ડી.ચી.આર. ની જોગવાઈ તથા સરકારશ્રીના તો કુલ-૫-૨૦૦૧ ના સ્ટ્રકચર સેકટી અંગ્રેના હુકમના વિનિયમ નં. ૩ અનુસાર બાંધકામના સ્થળ з. ની જરૂરીયાતોની જોગવાઈઓનું પાલન થયેથી જ સ્થળ ઉપર બાંધકામ શરૂ કરવાનું રહેશે. સેપ્ટી ટેક તથા સોક્વેલની સાઈઝ તથા સંખ્યા નેશનલ બિદ્ધીંગ કોર્ડ (ઓઈ.એસ.૨૪૭૦) તથા સિવિલ એન્જીનીયરીંગ હેન્ડ બુક બાય – ખલા મુજબ ડ્રેનેજ γ. 🚍 ાલે–આઇટમાં દર્શાવવાના રહેશે. તે અનુસાર્ગની જોગવાઈ કરવાની જવાબદારી આર્કીટેકટીઈજનેરોસ્ટ્રેકેયરલ એન્જીનીયર/કલાર્ક ઓફ વર્કસ / સાઈટ સુપરવાઈઝર/ડેવલપસંજીમીનના માલિકની રહેશે. વિકાસ પરવનાગી પત્ર તથા મંજુર થયેલ નકશાઓનો એક સેટ સ્થળ ઉપર પ્રસિધ્ધ કરવાનો રહેશે. 92° ° ° ા ' 😴 🦢 બાંધકાય પૂર્ણ થયા બાદ બાંધકામનો ઉપયોગ જારૂ કરતા પ્રદેશ નિયમાનુસાર અનેથી બાંધકાયનું વપરાસ એંગે નું પ્રમાણપત્ર મેળવ્યો બાદ જ વપરાય શરૂ કરવાનો સ્કેશે. 'ં 'ં ' શરતો ં' ઘ−ુ ે યુ. વિકાસ પરવાનગી પત્રમાં દર્શાવેલ શરતોમાંથી કોઈપણ શરતોનો ભંગ કરવામાં આવશે તો મહાનગરપાલિકા તે શરતોનો અમલ જવાબદાર ઈસમના/સંસ્થાના ખર્ચે અને જોખમે કરાવી શકશે અને મહાનગરપાલિકાના તેવા કુટ્યને ધીધે જે નુકશાન, ખોટ કે હરકત થાય તે બદલ કોઈપછ વળ b_{2M} તર કે બદલો મળશે નહિ. . રં. 🗥 આ પરવાનગીના કારણે અરજદારને મોલિકી, જમીનની હદ તથા જમીનના વિસ્તાર / ક્ષેત્રકળ અંગેની મંજૂરી મળતી નથી પરંતુ બાંધકામ િત્ર અંગેની પંજરી આવેવામાં આવે છે. $\{c\}$ કે: મુસદાઇ પ નગર રચનાં યોજનામાં ફાળવવોમાં આવેલ અંતિમખેડની શદ, માપ, લેત્રકળ તેવા ફાળવણી સંઉન પ્લાનીગ ઓફીસરશી દ્વરા કેરફોરને પાત્ર છે. વખતો વખત શહેરી વિકાસ સતામંડળ તરકથી વિકાસ માટેના જે નિયમો તથા જોહેરાત કરાય તે જમીન માલિક, હિતસંબંધ ધરાવતી વ્યકિત / સંસ્થા તેમજે અરજકારને બંધનકતા વહેશે. x ીર્ક ં ં ં તેમજ અરજદારમેં બંધનક્તી રહેશે. સદર વિકાસ પરવાનગી અન્વયે જમીન માસિકીમાં કેરકાર થાય અથવા આ પરવાનગી સાથે સંકળાયેલ રજીસ્ટ્રેશન ધરાવતી કોઈ વ્યક્તિ બદલોય 🖑 ч. મવા જમીન માલિકી અંગેના પરાંતા રેજ કરે ત્યાં સુધી તથા રજીસ્ટ્રેશન ઘરાવતી નવી વ્યક્તિની નિર્માણક નું થોય તેવાં સુધી જી.ડી.સી.આર. ના વિનિધ 🦯 પ.ર મુજબ વિકાસ પરવાનગી નિલંબીત ગણાશે. સંદેરહુ સમય દેરમ્યાન થયેલ બધિકામ બીનઅંધિદ્વતં ગણાશે. 👘 👘 👘 1.2 8 સરકારેશ્રીનો તો ૨૯≟ચે≟૨૦૦૧ ના સ્ટ્રેકચરલ સેકટી અંગેના'એનેક્ષરના વિનિયમ ૧૩,૧૪,૧૫ ની જોગવાઈ અનુસાર ભૂકંપ અંગેની સુરક્ષા, ∷િ ς. ચકવાત અંગેની સુરક્ષા, બાંધકામ તથા બાંધકામમાં વપરાતા ઈમારતી માલ સામાનની શુણવતા અને તેની ચકાસણી, બાંધકામની સ્થિરતા તથા આગ અંગેની સલાખતી તેમજ અંને ભયજનક બાબતો અંગે મિષ્ણાંતોની સલાહ સુરાન મુજબ પગલાં લેવાની તમામ જવાબદારી આર્કિટેક્ટ/ઈજનેર સ્ટ્રક્ર્ચરલ 🕧 એન્જીનીયર / કલાર્ક ઓફ વર્કસ / સુપરવાઈઝર / ડેવલપર્સ / જમીન માલીકની રહેશે. 👘 🖓 🖓 🖓 છે. 👘 ગેટ ગેર્ફો 🖓 છે. 👘 ગેટ ગેર્ફો 🖓 છે. આ વિકાસડપરવાનગી પણ મંજુરી સામ્યાં તારીખંધી બાર મૉસ સુધી જ અમલમાં રહેશે. ત્યારબાદ અધિનિયમની કલમ-૩૨ મુજબ વિકાસ 🖉 а. પરવાનગીની મુદત વધારવાની પૂર્વ મંજુરી સેળવી લેવાની રહેશે. ગુજરાત નગર રચના અને શહેરી વિકાસ અધિનિયમ-૧૯૭૬ ની કુલમ – ૩૩ મુજબ વિકાસ યોજનામાં જો કોઈ કેરસર થાય તો મહાનબરપાલિકા ٤. આપેલ વિકાસ પરવામગીમાં કેરકાર કરી શકેશે અથવા વિકાસ પરવાનગી રદ કરી શકશેક ના કલ્પાંગ માટે છે. ગુજરાત વાર્ગ જે ગુજ જી.ડી.સી.આર. ના વિનિયમ ૩.૮ મુજબ અરજદારશ્રીએ ખોટી રજુઆત અથવા ખોટા જસ્તાવેજી પુરાવા રજી કરેલ હશે તો આ પેલ વિકાસ પરવાનગી e. આમોઆપ રદ થયેલ ગણાશે. કવર્ડ/ઓપન પાર્કિંગ તથા માર્જીનલસ્પેશ ગ્રાઉન્ડ લેવલ(+0.0) રાખવાના રહેશે. તથા તેમાં અત્રેથી પૂર્વમંજુરી મેળવ્યા સિવાય કોઈપલ ۹. પ્રકારનો કેરકાર કે બાંધકામ કરી શકાશે નહિ તથા તેનો ઉપયોગ સંયુક્ત રીતે કરવાનો રહેશે. જે હેતુ માટે પરવાનગી આપવામાં આવેલ છે તે હેતુ માટે જ ઉપયોગ કરવાનો રહેશે અન્ય હેતુ માટે ઉપયોગ કરવામાં આવશે તો ર. પરવાનગી આપોઆપ રદ ગણાશે. સેલરનું ખોદકામ કરતા સમયે આજુબાજુની મિલ્કતને નુકશાન ન થાય તે સંપૂર્ણ ધ્યાન રાખવાનું રહેશે. З. વરસાદી પાણીના ભૂંગળા તેમજ ખાળ મોળીનાં પાણીના ભૂંગળા જમીન સુધી ઉતારવાના રહેશે. Χ. પ્ર ું ભકાનના દરવાજા, શટર્સ, રસ્તા તરક ખુલ્લે તે પ્રમાણે રાખવાના નથી. 🐲 👘 👾 👘 化化化化物 标 આ પરવાનગીથી ફક્ત ચલતર કરવાની પરવાનગી મળે છે. કારખાના અથવા મકાનમાં બીજા વિશિષ્ટ હેતુ માટે ઉપયોગ કરતાં **1** મહાનગરપાલિકાની અલગ મંજૂરી મેળવવાની રહેશે. છું આ પરવાનગીથી જે કામની પરવાનગી મળે છે તે કામે જો બીજા કોઈ ખાતાની પરવાનગી લેવી જરૂરી હશે તો તે મેળવી લેવાની શરત આ પરવાનગી આપવામાં આવે છે. આ પરવાનગીથી પોતાની માલીકીની જ જગ્યામાં બાંધકામની મંજુરી મળે છે. આજુબાજુના કોઈ હકક હિતને બાધ આવશે તો તેની 6.ju જવાબદારી અરજાદરની રહેશે. આ બાંધકામ પરવાનગી તથા મંજુર થયેલ પ્લાન મહાનગરપાલિકાના ટાઉન પ્લાનીગ શાખાના અધિકૃત ઓફીસરઝી/કર્મથારીને e. કે હાલુક **સ્થાનિકે સેક કરવા બેતાવવામાં રહેશ**ાળે પર્સ છે છે. આ ગામ છે ને પ્રેસ્ટ જેવા પણ બેમના આ વિદ્યાર્થમાં જે અમેરિક જિ ૧૦. 🐘 દરેક ક્રિયન દીઠ એક વૃક્ષ વાવવાનું રહેશે. ૧૧. બાંધકામ શરૂ કરવાની સાથે પરવાનગી નંબર તારીખ તથા આર્કીકેટલ્રીનાં નામ નિર્દેશવાળું સ્પષ્ટ મોટા અક્ષરથી બોર્ડ બનાવી કરજીયાત 54 W. S. S. M. 42 2 સ્થળ પર રાખવાનું રહેશે. ૧૨ ______પારા પ્લોટમાં બોર બનાવીને તેને રીચાર્જ કરવાની સીસ્ટમ કરવાની રહેશે. ૧૩. અરજદારે સ્થળ ઉપર વિસ્તારના સર્વે નંબર, સીટી સર્વે નંબર, બ્લોક નંબર, સબ પ્લોટ નંબર, વિસ્તાર, માલિક, ઑક્ટિકેટ, એન્જીનીઘર, ઉવલપર વિ. નું નામ, બાંધકામ પરવાનગી નંબર, તારીખ, પ્રોજેકટનું નામ તથા સેને સંલગ્ન વિગંતો દર્શાવતું બોર્ડ સ્પષ્ટ અને સુવાચ્ય ગુજરાતી ભાષામાં કરજીયાત પણે મુકવાનું રહેશે. ૧૪ સ્માર્ટ સીટી અંતર્ગત બાંધકામ શરૂ કરતા પહેલાં સ્થાનીકે કામ કરતાં મજુરો માટે હંગામી ટોયલેટ (સાત મજુર દીઠ એક) માલીકીની હદમાં બનાવવાનું રહેશે, તથા રોગચાળો ફેલાય નહીં તે અન્વયે તકેદારી રાખવાની રહેશે, અન્પથા બાંધકામ પરવાનગી રદ ગણાશે. ''રીયલ એસ્ટેટ (રેગ્યુલાઈઝેશન એન્ડ ડેવલપપેન્ટ) એક્ટ, ૨૦૧૬ની કલમન રની બેગવાઈ મુજબ, રાજ્યમાં કોઈપણ વિકાસકાર (પ્રમોટર) રીયલ ૧૫ એસ્ટેટ પ્રોજેક્ટ જેવા કે, પ્લોટ, એપાર્ટમેન્ટ અથવા બિલ્ડીંગ અથવા તેના ભાગના વૈચાણ માટે જાહેરાત, માર્કેટીંગ, બુકીંગ અથવા ઓફર માટેની કોર્યવાહી, રાજ્ય સરકાર હોશ રચાયેલ રીયલ એસ્ટેટ રેમ્યુલેટરી આથરીટી (રેશ)ની કચેરીમાં રછેસ્ટ્રેશન કરાવ્યા સિવાય કરી શકશે નહી."



રાજકોટ મહાનગરપાલિકા ડેવલપમેન્ટ શાખા

(Commencement Certificate) આરંભ પ્રમાણપત્ર વિક્રસ કામની પરવાનગી (વયનો નિયમ ૧૦)

વોર્ડનં. – ૧

*હે*નીટ) રહેવાસીઃ-alomoleur ansiz PRIMORN પાલીક્રા

2 661 401 9 સવિવ્ર લ્ય, ગોંડલ શેક, સાજકોટ aid રેવન્યુ ગામઃ- શુક્રકોટ/રેવા/મનની/નાનમળ/વાનરી/કોકારીયા, સર્વે નં. 32 r /પેકી) ના પ્લોટ નં. _ ના સભ-પ્લોટનં. _ માં નગર રચના યોજના નંભર 3 ((સ્ટિંગ) કા. પ્લોટ નં. કુકોગ્ટ (સુરિટેસ્ટ સ્થળઃ -નીરે જણાવ્યા પ્રમાણેનું વિકાસ કામ તેમના મકાનમાં/ જમીન અંદર આ પોછળ જણાવ્યા પ્રમાણેની શરતોએ કરવા દેવા ગુજરાત ટા. પ્લાનીન એન્ડ અ. કે. એકટ ૧૯૭૬ રેવન્યુ ગામઃ-- ગુજકોટ/રેયા/મવતી/નાનમવ,/વાન

કલમ ૨૯--૧ અનુસાર આથી પરવાનથી આપવામાં આવે છે.

વિકાસ કામનું વર્ણનઃ--

-: વાલીજય + રહેલાંક + કોમ્પુનીટી હોલ હેતુ (EWS-II) પ્લાન:-સામેલ પ્લાનમાં લાલ રંગ રેખાથી દર્શાવ્યા મુજબનું બાંધકામ.

Floor	Detail
	Community Hall
Ground	હોલ, કિંચન, સ્ટોર, વોશ, લેડીઝ ગ્રીન રૂમ, જેન્ટસ ગ્રીન રૂમ, કાયર લીક્ટ, અડેશ, હેન્કીક્રેપ ટોયલેટ, જેન્ટસ ટોયલેટમાં ત્રણ W.C. અને ૭ યુરીનલ, લેડીઝ ટોયલેટમાં ૭ W.C., બે સીડી તથા પેસેજન બાંધકામ
1 st Floor	હોલ, કાયર લીક્ટ, ટેરેસ, જેન્ટસ ટોયલેટમાં પાંચ W.C. અને ૭ યુરીનલ, લેડીઝ ટોયલેટમાં ૭ W.C., બે સીડી તથા પેસેજનું બાંધકામ
	Shopping Center
Ground	આંગણવાડી ૧ તથા ર, સાત શોપ, કેલ્લ સેન્ટર, ઓટા, ઓપન ચોક, બે ટોયલેટ, કેન્ડીકેપ ટોયલેટ, બે પેન્ટ્રી, જેન્ટસ ટોયલેટમાં બે W.C., બે યુરીનલ, લેડીઝ ટોયલેટમાં બે W.C. તથા બે સીડી, પેસેજનં બાંધકામ
1 st Floor	આંગલવાડી ૩ તથા ૪, સાત શોપ, હેલ્ય સેન્ટર, કવર્ડ પોર્ચ, ત્રલ ટોયહેટ, બે પેન્ટ્રી, જેન્ટસ ટોયલેટમાં બે W.C., બે યુરીનલ, લેડીઝ ટોયલેટમાં બે W.C. તથા બે સીડી, પેસેજનું બાંધકામ
	Residential Tower (11-Unit)
Ground	કવર્ડ પાર્કિંગ, બે લોકર, એક સયર લીકટ, પેસેજ તથા સીડીને બોધકાસ
1 st To 13 th	લીવીંગ રૂમ, બેડરૂમ, સ્ટડી રૂમ, કિંચન, લોકા, બે ટોયલેટ એવા આંક થનીટ તથા બે સીકર, એક કાયર લીકર, પેગ્રેજ તવા ગીરીને
Floor	બાંધકામ
	General
Ground	પંપ રૂપ તથા ઈલેકટીક રૂમને બાંધકામ

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	—: શરતો :—
4	રીયલ એસ્ટેટ (રેગ્યુલરાઈઝેશન એન્ડ ડેવલપયેન્ટ) એક્ટ, ૨૦૧૬ ની કલમ–૩ ની જોગવાઈ મુજબ, રાજયમાં કોઈપણ વિકાસકાર (પ્રમોટર) રીયલ એસ્ટેટ પ્રોજેક્ટ જેવા કે, પ્લોટ, એપાર્ટયેન્ટ અથવા બિલ્ડીગ અથવા તેના ભાગના વેચાય માટે જાહેરાત, માર્કેટીગ, બુકીગ અથવા ઓફર માટેની કાર્યવાહી, રાજય સરકાર ઠારા રચાયેલ રીયલ એસ્ટેટ રેગ્યુલેટરી ઓયોરીટી (રેસ)ની કચેરીમાં ર સ્ટશન કરાવ્યા બિલાય કરી શકશે નહી
ş	પોલીસ કમિશ્વન શાખાના કર્માકઃ નં.રાજ/સીપી/એલબી–૨/કોમ્પનીટી હોલ/એન.ઓ.સી./૭૧૯/૨૦૨૦. તા.૦૭/૦૮/૨૦૨૦ની શરતોને આદિન
3	અરજદારશીએ સ્થાનિકે બોર રીચાર્જ કરવાનો રહેશે તથા ટ્રાન્સ્ફોમર્સ પ્લાનમાં દર્શાવ્યા મજબ અરજદારશ્રીની પ્રીમાઇસીસમાં સ્થાપવાનં રહેશે.
8	લાયર બ્રીગેડ શાખાના એન.ઓ.સી.નં R.M.C.F.E.S.No.NOC.181, Date.02/07/2020 ની શરતોને આધિન
4	એનવાયરમેન્ટ કલીયરન્સ સર્ટી નં. SEIAA/GUJ/EC/8(a)/171/2020, Date 18/02/2020 ને આવિન
۶	એરપોર્ટ ઓથોરીટી એન.એ.સી. આઈ.ડી. RAJK/WEST/B/090219/427340, Date 27/09/2019 ને આદિન સ્ટીને
9	જ્યાં જયાં જરૂર જણાય ત્યાં સરકારી તથા અર્ધસરકારી સંસ્થાની મંજરી મેળવી લેવાની રહેશે
6	ટી.પી. સ્ક્રીમ નં. ૩૨ - રૈયા(ડાકટ) અંતીમ થયે સરકારથી દારા થતા દેરકાર સરકારને તંત્ર ત્વન કરો છે.

ર.થી.નં. કારુ 225 ÷1. 2317/2026 2015/2020

આસીન્ટઉંન પ્લાનર રાજકોટ મહાનગરપાલિકા

રેવ.સ.ઈ.નં.

ett.

<u>શરતો ઃ–</u>

- (૧) બો.પ્રો.કોર્પો એકટ ૧૯૪૯ તથા મહાનગરપાલિકાના નિયમો અને પેટા કાયદા અનુસાર મકાનનું બાંધકામ શરૂ કરતા પહેલ અગર સદરહુ એકટની કલમ રપઉ તથા રપ૪ માં જવાવ્યા પ્રમાવ્યેનું કામ કરતાં પહેલા ધોરલસર મહાનગરપાલિકાની મંજુરી લેવી પડશે.
- (૨) 🐘 લેન્ડ રેવન્યુ કોડની કલમ ૮૫ પ્રમાશે જમીનનો બીનખેતી ઉપયોગ શરૂ કરતા પહેલા ક્રલેકટરની જરૂરી પરવાનગી મેળવવી પડશે.
- (૩) મકાન અગર તેનો ભાગ ઉપયોગમાં લેતા પહેલા બો.પ્રો.મ્યુ.કોર્પો. એક્ટ ૧૯૪૯ ની કલમ ૨૬૩ પ્રમાણે ધોરણસરની મહાનગરપાલિકાની જરૂરી પરવાનગી લેવી પડશે.
- .(૪) બો.પ્રો.કોર્પો. એકટની ૧૯૪૯ ની ક્લમ હ૧૭ માં નિર્દેશ કર્યા પ્રમાણેના ઘંધા અગર ઉપયોગ માટે કોઈપણ માટે કોઈપણ જગ્યાનો ઉપયોગ કરતા પહેલા મહાનગરપાલિકાના પેટા કાયદા મુજબ જરૂરી વેપાર અગર બીજા પરવાના મેળેવવા પઠશે.

<u>ખાસ શરતો :–</u>

- (૧) વિકાસ પરવાનગી મેળવ્યા બાદ સ્થળ ઉપર વિકાસ શરૂ કરતા પહેલા સાત દિવસ અગાઉ કોર્મ નં.૨(ડી)નું એનેક્ષર, સ્ટ્રકચરલ ડ્રોઈંગ્સ, વર્ડીંગ ડ્રોઈંગ્સ તથા સોઈલ ઈન્વેસ્ટીંગેશન રીપોર્ટસ નિયમાનુંસાર રજુ કરવાના રહેશે.
- (૨) બાંધકામના દરેક તબક્કે ફોર્મ નં. ૬(એ) થી ૬(ડી) માં દર્શાવ્યા મુજબનું પ્રોગ્રેસ સર્ટાફિકેટ રજૂ કરવાના રહેશે.
- (3) જી.ડી.સી.આર.ની જોગવાઈ તથા સરકારશીના તા.૨૯–૫–૨૦૦૧ ના સ્ટ્રકગર સેફટી અંગેના હુકમના વિનિયમ નં.૩ અનુસાર બાંધકામના રથળની જરૂરીયાતોની જોગવાઈઓનું પાલન થયેથી જ સ્થળ ઉપર બાંધકામ શરૂ કરવાનું રહેશે.
- (૪) સેપ્ટીક ટેંક તથા સોકવેલની સાઈઝ તથા સંખ્યા નેશનલ બિલ્ડીંગ કોડ(આઈ એસ ૨૪૭૦) તથા સિવિલ એન્જીનીયરીંગ હૅન્ડ બુક બાય-ખન્ના મુજબ ડ્રેનેજ લે-આઉટમાં દર્શાવવાના રહેશે. તે અનુસારની જોગવાઈ કરવાની જવાબદારી આર્કિટેક્ટ/ ઈજનેર/ સ્ટ્રક્ચરલ એન્જીનીયર/ કલાર્ક ઓફ વર્કસ/ સાઈટ સુપરવાઈઝર/ ડેવલપર/ જમીન માલિકની રહેશે.
- (પ) વિકાસ પરવાનગી પત્ર તથા મંજુર થયેલો નકશાઓનો એક સેટ સ્થળ ઉપર પ્રસ્થિક કરવાનો રહેશે.
- (۶) બાંધકામ પૂર્ણ થયા બાદ બાંધકામનો ઉપયોગ શરૂ કરતા પહેલાં નિયમાનુસાર અત્રેથી બાંધકામનું વપરાશ અંગેની પ્રમાણપત્ર મેળવ્યા બાદ વપરાશ શરૂ કરવાનો રહેશ.

<u>શરતોઃ-</u>

- (૧) વિકાસ પરવાનગી પત્રમાં દર્શાવેલ શરતોમાંથી કોઈપક્ષ શરતોનો ભંગ કરવામાં આવશે તો મહાનગરપાલિકા સત્તામંડળને તે શરતોનો અમલ જવાબદાર ઈસપના/ સંસ્થાના ખર્ચે અને જોખમે કરાવી શકશે અને મહાનગરપાલિકા સત્તામંડળના તેવા કૃત્યને કીધે જે નુકશાન, ખોટ કે હરકત થાય તે બદલ કોઈપક્ષ વળતર કે બદલો મળશે નહીં.
- (૨) આ પરવાનગીના કારણે અરજદારને માલિકી, જમીનની હઠ તથા જમીનના વિસ્તાર/ ઢેત્રફળ અંગેની મંજુરી મળતી નથી પરંતુ બાંધકામ અંગેની મંજુરી આપવામાં આવે છે.
- (3) મુસદારૂપ નગર રચના યોજનામાં ફાળવવામાં આવેલ અંતિમ ખંડની હદ, માપ, ક્ષેત્રહજ્ તથા ફાળવલી ટાઉન પ્લાનીંગ ઓફિસરશ્રી દારા ફેરકારને પાત્ર છે.
- (૪) વખતો વખત મહાનગરપાલિકા શહેરી વિકાસ સત્તામંડળ તરફથી વિકાસ માટેના જે નિયમો તથા જાહેરાત કરાય તે જમીન માલિક, હિતસંબંધ ધરાવતી વ્યક્તિ/ સંસ્થા તેમજ અરજદારને બંધનકર્તા રહેશે.
- (૫) સદર વિકાસ પરવાનગી અન્વયે જમીન માલિકીમાં ફેકાર થાય અથવા આ પરવાનગી સાથે સંકળાયેલ રજીસ્ટ્રેશન ધરાવતી કોઈ વ્યકિત બદલાય તો નવા જમીન માલિકી અંગેના પુરાલા રજુ કરે ત્યાં સુધી તથા રજીસ્ટ્રશન ધરાવતી નવી વ્યક્તિની નિમલુંક ન ઘાય ત્યાં સુધી જી.ડી.સી.આર.પત વિનિયમ પાર મુજબ વિકાસ પરવાનગી નિલંબીત ગણારો. સદરહ સમય દરમ્યાન થયેલ બાંધકામ બિનઅધિકૃત ગણાશે.
- (5) સરકારશ્રીના તા.૨૯-૫-૨૦૦૧ ના સ્ટ્રેક્કચરલ સેકટી અંગેના એનેલર શયના વિનિયમ ૧૩,૧૪,૧૫ ની જોગવાઈ અનુસાર ભુકંપ અગેની સુરક્ષા, ચકવાત અંગેની સુરક્ષા, બાંધકામ તથા બાંધકામમાં વપરાતા ઈમારતી માલ સામાનની ગુજ્ઞવતા અને તેની ચકાસજ્ઞી, બાંધકામ સ્થિરતા તથા આગળ અંગેની સલામતી તેમજ અન્ય ભયજનક બાબતો અંગે નિષ્ણાંતોની સલાહ, સુચન મુજબ પગલા લેવાની તમામ જવાબદારી આર્ડિટેકટ/ ઈજનેર/ સ્ટ્રકચરલ એન્નીયર/ કલાર્ડ ઓફ વર્ડસ/ સાઈટ સુપરવાઈઝર/ ઠેવલપજ્ઞ જમીન માલિકની રહેશે.
- (૭) આ વિકાસ પરવાનગી પત્ર મંજૂરી આપ્યા તારીખધી બાર માસ સુધી જ અમલમાં રહેશે. ત્યારબાદ અધિનિયમની કલચ–૩૨ મુજબ વિકાસ પરવાનગીની મુદત વધારવાની મંજુરી મેળવી લેવાની રહેશે.
- (૮) ગુજરાત નગર રચના યોજના અને શહેરી વિકાસ અધિનિયમ–૧૯૭૬ ની કલમ–૩૩ મુજબ વિકાસ યોજનામાં જો કોઈ દેરફર થાય તો મહાનગરપાલિકા સત્તામંડળ આપેલ વિકાસ પરવાનગીમાં દેરકાર કરી શકશે અથવા વિકાસ પરવાનગી રદ કરી શકશે.
- (૯) જી.ડી.સી.આર. ના વિનિયમ ૩.૮ મુજબ અરજદારક્ષીએ ખોટી રજુઆત અથવા ખોટા દસ્તાવેજી પુરાવા રજુ કરેલ હશે તો આપેલ વિકાસ પરવાનગી આપોઆપ રદ થયેલ ગણાશે.
- (10) સ્માર્ટ સીટી અંતર્ગત બાંધકાય શરૂ કરતા પહેલા સ્થાનિકે કામ કરતા મજુરો માટે હંગામી ટોયલેટ (સાત મજુર દિઠ એક) માલિકીની હદમાં બનાવવાનું સ્હેશે તથા રોગચાળો દેલાય નહી તે અન્વયે તકેદારી રાખવાની રહેશે. અન્યથા બાંધકામ પરવાનગી રદ ગણાશે.
- (૧૧) ીયલ એસ્ટેટ (રેગ્યુલરાઈઝેશન એન્ડ કેવલપમેન્ટ) એક્ટ, ૨૦૧૬ ની કલમ–૩ ની જોગવાઈ મુજબ, રાજયમાં કોઈપણ વિકાસકાર (પ્રમોટર) રીયલ એસ્ટેટ પ્રોજેક્ટ જેવા કે, પ્લોટ, એપાર્ટમેન્ટ અથવા બિલ્ડીગ અથવા તેના ભાગના વેલાબ્ર માટે જાહેરાત, માર્કેટીગ, બુકીગ અથવા ઓશ્ર માટેની કાર્યવાહી, રાજય સરકાર દ્વારા રચાયેલ રીયલ એસ્ટેટ વેગ્યુલેટરી ઓથોરીટી (રેશ) ની કચેરીમાં રજીસ્ટ્રેશન કરાવ્યા સિવાય કરી શકશે નહી.



RAJKOT MUNICIPAL CORPORATION

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Dr. Ambedkar Bhavan, Dhebar Road Fire & Emergency Service RAJKOT – 360 001.

R.M.C.F.E.S.No.NOC.181.

Date:-02-07-2020.

Smart Cit

TO,

Name of Work: - Proposed Construction of EWS – II Houses Under Light House Projects (LHPS) At Rajkot, Owner: - Rajkot Municipal Corporation, Nodal Agency: - AHM Gujarat, 1144 EWS Units Building Wing: - 1 To 11, Location: - Opp. RMC Drainage Pumping Station, Raiya Road, Rajkot.

-:: PROPOSED FIRE NOC ::-Reference No.1.RMC/F.B/NOC/E.No.47, Date:-02-06-2020.

Name of Work :- Proposed Construction of EWS - II Houses Under Light House Projects (LHPS) At Rajkot, Owner: - Rajkot Municipal Corporation, Nodal Agency: - AHM Gujarat, 1144 - EWS Units Building Wing: - 1 To 11, Location: -Opp. RMC Drainage Pumping Station, Raiya Road, Rajkot, Use of Building :-Residence, Commercial, Community Hall, Rev.Sr.No.318/P (Raiya), Ward No.01, T.P.S.No.32 (Raiya) - Draft, O.P.No.61, F.P.No.63/10 - Old (As Per Draft TP Skim), Building Floor:- G.F. + 1st Floor To 13th Floor, Stair Room, All Wing Height of Building :- 41.90 M. Area Table :- Net Plot Area = 18184.76 sq.mt. F.S.I. Used = 62368.82 sq.mt. / 39599.00 sq.mt. = 1.575 < 2.70.

Note: - Fire & Safety measures plan must be submitted before staring the construction work general guidelines are as under.

The proposed building is proposed to be provided with fire protection arrangements such as hose reel House, wet riser, yard hydrant, automatic sprinkler system in basement and manual call point provision at upper floors of each building block, Separate Underground water storage tank 1,00,000 For the Building & Overhead tank 20,000 for the building. Fire Pump 3200 LPM, and head of 50 miters. in each Building ISI standard Silent D.G. set must be incet with requirement of occupier consumptions & Connection of DG should be given to fire fighting pump & ALARM SYSTEM & LIFT of the Building of each block, portable fire Extinguishers installation as per req. Emergency Exit Glow sing, Fire lift Provision etc.

There is no objection to this department for the construction of the said High rise building subject to the compliance of the following fire safety condition.

Main entrance shall be adequate width to allow easy access to the fire fighting appliance and in no case it shall measure less than 6.0 m. The

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Entrance gates shall fold back against the compound wall of the Promises thus leaving the exterior access way within the plot free for Movement of fire service vehicles. If archway is provided over the main entrance than the height of the archway shall not be less than 4.5m., Access way of 6 m. wide all around high rise block shall be of hard surface capable of taking the weight of the fire engine up to 45 tones and always shall be free from every hindrance parking etc. for easy movement of fire/emergency vehicles.

- EXIT REOUIREMENTS:- Exit requirements shall meet in accordance with provision as per building bye laws clause 16. Width of the main staircase in building shall not be less than 1.25 m. The treads shall be of non slip type.
- 3. <u>MEANS OF ESCAPE</u>:- Means of escape / exit shall be a continuous and unobstructed way of exit travel from and shall open towards means of escape which is away from but shall not obstruct the travel along any exit. No door when opened shall reduce the required width of staircase / corridor / passage way. The width of fire escape staircase shall not be less than 100 cms.
- 4. All exit and exit way marking signs shall be illuminated and wired to independent circuit supplied by alternate source of power supply. Wiring for the illuminated signs must be laid and protected so that it cannot get involved in fire.
- <u>VENTILATION:</u>- The building shall be provided with adequate ventilation. The provision of lighting and ventilation shall be strictly in accordance with part-VIII Section-I or National building code of India
- 6. <u>EMERGENCY POWER SUPPLY</u>:- The stand by electric generator shall be installed of adequate cap. to supply power co staircase and corridor lighting circuits, exit signs and fire pump in case of failure of normal electric supply. The generator shall be capable of taking starting current of all the machines and circuit stated above simultaneously and generator must be automatic in action.
- Non Combustible material shall be used for construction of the building. Raised floors and false ceiling shall also be of non combustible material including structural support members.
- <u>ELECTRIC WIRING</u>:- The electrical wiring shall be provided in metal conducts. Miniature circuit breaker and earth leakage circuit breaker shall also be installed.
- 9. <u>STATIC WATER TANK</u>:- An underground static water tank of fighting in the complex as marked on the plans. The replenishment through tube well or from the town main shall be ensured 3200 LPM/ to avoid stagnation of water in static tank the fire tank and passes to a domestic tank. This shall conform part-IV. An additional water storage tank of cap. Shall also be provided on the terrace.
- 10. <u>STATIONARY FIRE PUMP</u>:- One no. of electrical driven pumping act automatic in operation of LPM cap. Shall be provided at the farthest point. The standby dicsel driven pumping set positive suction. The electric connection for fire pump shall be direct from the meter board it shall have no on/off switch in between. The pressure should be maintaining 3.5 k.g. at Top most hydrant's connections.

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11. <u>WET RISER</u>:- All Units Wet riser shall be provided in the bldg. which shall extend from the basement to the terrace floor. The internal hydrants.

The wet riser system and landing valves shall conform to is: code of practice.

- 12. 11 Way fire brigade inlets shall be provided in the block wet riser.
- <u>HOSE BOX</u>: A hose box near each internal hydrant shall be provided comprising of 2 x 15m. Length of 63 mm. rubber lined hose conforming to JS: 903-1984.
- 14. HOSE REEL:- A hose reel near each internal hydrants containing 30 m. of length of 25 mm. bore terminating into shut off nozzle of 08 mm. Outlet connected directly to down comer shall be provided. This should conform to As per Latest Is:
- 15. PORTABLE FIRE EXTINGUISHERS: The portable fire extinguishers of 4kg ABC/DCP and Coz 4.5 kg type shall be provided and marked on the plans. The number of the fire extinguishers may have to be increased later when the layout of the partition etc. in and maintained in accordance with IS: 15683
- 16. All vertical cable ducts/shafts and electrical niches on various floors of the building must be continuously monitored by fixed temperature heat detectors conforming to BIS Code of practice.
- 17. <u>AUTOMATIC ALARM SMOKE DETECTOR HEAT DETECTOR</u> <u>GAS DETECTOR</u>:-Should be fixed installation system should be reception to basement, theater banquet area, lobby area of all floor, all Room's per requirement for risk area (i.e.NBC code).
- <u>SMOKE VENTING SYSTEM</u>:-The system shall be provided in the upper floors of Telephone Exchange building as per relevant code of practice.
- YARD HYDRANTS: The yard hydrants shall be provided as proposed in the complex as per specified BIS code of Practice.
- 20. SPRINKLER INSTALLLATIONS:-Automatic sprinklers shall be installed in the basement building area. Flow alarm switch/gong shall be incorporated in the installation for giving provided near the testing facility. The entire system including pump capacity and head size of pipe net work, office size, source of water supply, provided in accordance to relevant code of practice/relevant rules (i.e. as TAC Rules / NFPA Code). Fire Services inlet shall also be provided at ground floor level.
- MANUAL CALL POINTS:- Manual electrical call points at suitable locations on each floor of building shall be installed conforming to K-II.1. Of the unified building bye laws.
- AIR CONDITIONING SYSTEM:- Following points must be ensured in respect of the air conditioning system :
- (A) The ceiling and all its fixtures must be combustible material.
- (B) Wherever the ducts pass through walls of floors the opening around the ducts must be sealed with fire resisting material. Air ducts must not pass through the staircase enclosures.

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- (C) The air filters of the air handing units must be of non combustible material. Air handling units must not be used for storage of any handling material.
- (D) Fire dampers shall be provided in the ducts.
- (E) Escape routes like staircase, corridors must not be used as return air passage.
- LIGHTING PROTECTION:-The lighting protection system is conforming to IS: 2309 shall be provided in the building.
- 24. LIFT GROUNDING SWITCH:-The lifts must be equipped with fireman switch so that it is possible to ground all lifts during a fire emergency. In case of failure of normal supply it shall automatically trip over to the Alternate supply. Suitable arrangements such as providing slope in the floor of lift lobby shall be made to prevent water during fire fighting etc. at any landing room entering into the lift shaft. All other conditions as laid down in NBC Part - IV (D-1.5) shall also be followed.
- 25. <u>CONTROL ROOM/SECURITIY ROOM</u>:- The control room / security room on the entrance of ground level with communication system to all floors and facilitate for receiving messages from different floors. Details of all floor plans along with the detail of firefighting equipment and installations shall be maintained in the control room.
- 26. <u>HOUSE KEEPING</u>:- To prevent the fire hazard, good housekeeping both inside and outside the building shall be strictly maintenance by MTNL authorities. The periodic inspection and maintenance of under floor space and false ceiling shall also be carried out to eliminate the fire risk.
- 27. <u>GENERAL</u>:- The fire prevention/fire safety measures recommended above cannot be effective unless these are backed by the administrative measures and the building, including the maintained in the top condition at times.

The building or part there of shall not be occupied unless compliance is ensured.

- All the fire fighting system should be in accordance with the provision of Bombay provincial municipal corporation Act. 1949 and National Building code Act.
- Note:- (1)After completion of above fire fighting system installation work and On The basis of Inspection of Chief Fire Officer NOC will be issued.

April 258 March 261 Date (1014)-252 Tool 10-342 Photon of Building Fox 500 262 26113 In 11 Nov Inc. Top 500 262 10:57 Date - 11 House Kate 2020



I/C Chief Fire Officer Fire & Emergency Services Rajkot Municipal Corporation

Copy to :-1. T.P.O. S. M. SAIYAD, IFS MEMBER SECRETARY SEIAA (GUJARAT)



STATE LEVEL ENVIRONMENT IMPACT ASSESSMENT AUTHORITY GUJARAT

Government of Gujarat

No. SEIAA/GUJ/EC/8(a)/ゴデエ/2020

Date: 18 FEB 2020

BY R.P.A.D Time Limit

Sub: Environment Clearance for the Building Construction Project under Pradhan Mantri Aavas Yojana at F.P. No. 63/10, T.P.S. No. 32, Raiya, Rajkot proposed by Rajkot Municipal Corporation. Construction project in Category 8 (a) of Schedule annexed with EIA Notification dated 14/09/2006.

Ref: Your Proposal No. SIA/GJ/MIS/111747/2019.

Dear Sir,

This has reference to your application along with Form-1, Form-1 A dated 22/10/2019, seeking Environmental Clearance under Environment Impact Assessment Notification, 2006. The project was scheduled for hearing in the SEAC meeting held on 26/11/2019. The project proponent submitted additional information / documents vide letter dated 23/01/2020 to the SEAC.

The proposal is for Environmental Clearance for the Building Construction Project under Pradhan Mantri Aavas Yojana at F.P. No. 63/10, T.P.S. No. 32, Raiya, Rajkot proposed by Rajkot Municipal Corporation. This is a proposed building construction project having plot area of 39,599.0 m² and the proposed FSI area of the project is $60,583.10 \text{ m}^2$ with proposed built up area of 77,244.75 m². As the built up area is >20,000 m² and <1,50,000 m², it falls in the category 8(a) of the Schedule of EIA Notification, 2006.

The project will comprise of 13 numbers of buildings. No. of Blocks: 13. Scope of buildings/blocks are: 11 buildings: ground floor + 13 floors; 2 buildings: ground floor + 1 floor and No.& size of Residential Units are: 1,144 units and No.& size of Commercial Units are: 14 units.

The project activity is covered in 8(a) and falls in Category 'B'. Since the proposed project is in item no.8 of the EtA notification, 2006, it does not need Public Consultation as per Para 7(i) III. Stage (3) (d) – Public Consultation of EtA Notification, 2006.

The SEAC, Gujarat had recommended the project vide their letter dated 01/02/2020 to grant Environmental Ctearance to the SEIAA, Gujarat based on the decision taken during SEAC meeting held on 28/01/2020. The proposal was considered by SEIAA, Gujarat in its meeting held on 04/02/2020 at Gandhinagar. After careful consideration, the SEIAA hereby accords Environmental Clearance to above project under the provisions of EIA Notification dated 14th September, 2006 subject to the compliance of the following conditions.

A. PROJECT SPECIFIC CONDITIONS: A.1 CONSTRUCTION PHASE: A.1.1 WATER:

 Fresh water requirement during the construction phase shall be 15.0 KL/day and it shall be met from the water supply system of Rajkot Municipal Corporation (RMC). No ground water shall be tapped during the construction phase.

Sewage generated during the construction phase shall be disposed off through drainage line of RMC.

2 OPERATION PHASE:

WATER Total water requirement during the operation phase shall be 870. 0 KL/day, out of which fresh requirement of 640.0 KL/day shall be met through water supply system of Rajkot Municipal Corporation (RMC) and the remaining 234.65 KL/day of water requirement shall be met through treated sewage from Common STP of

Page 1 of 6

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ent impace

Rajkot Municipal Corporation. No ground water shall be tapped during the operation phase. Metering of the water shall be done and its records shall be maintained.

- Sewage generation during the operation phase shall be 692.28 KL/day and it shall be send to the Common STP of Rejkot Municipal Corporation for Ireatment.
- Treated sewage, from the common STP of RMC, conforming to GPCB norms shall be utilized within premises for gardening & flushing purpose at the maximum extent possible.
- A proper logbook showing the treated sewage utilization within premises shall be maintained and furnished to the GPCB from time to time.
- Dual plumbing system with separate tanks and fines shall be provided for utilization of treated sewage for flushing.
- No bore well shall be constructed and existing bore well/s, if any, shall be either sealed or converted into the recharge well.
- Rain water harvesting from rootcop and paved areas and ground water recharge through 10 nos. of percotation
 wells shall be carried out as per the details submitted. Before recharging the run off, pre-treatment must be done
 to remove suspended matter.

A.2.2 AIR:

- A D. G. set (1 x 250 KVA) proposed as backup power shall be of enclosed type and confirm to prescribe standards under EPA rules. Necessary acoustic enclosures shall be provided at diesel generator set to mitigate the impact of noise.
- 11. The exhaust of the D. G. Set shall be at least 3 m above roof top.
- 12. The gaseous emissions from the D.G. Sets shall conform to the standards prescribed under EPA rules as amended from time to time. At no time, the emission levels shall go beyond the stipulated standards.

A 2.3 SOLID WASTE:

13. The solid waste generated shall be properly collected and segregated at source. The biodegradable waste shall be converted into useful end product by treating it into the proposed onsite Organic Waste Convertor and the recyclable waste shall be sold to vendors whereas the other garbage shall be disposed off properly as per the other provisions made by the Rajkot Municipal Corporation (RMC).

A 2.4 SAFETY :

- 14. Fire fighting facilities like fire extinguishers, hose reel, wet riser, manually operated electric fire alarm System, smoke detectors, underground water storage tanks 3 x 100 KL capacity etc. shall be installed, etc. shall be provided as proposed.
- 15. All the staircases and lifts shall open out at ground level from the highest point of building (with access from)^{*} each floor) for emergency evacuation. Two staircases shall be provided in each building having floor area more than 500 m² on each floor.
- 16. Clear peripheral margin space of atleast 6 m, excluding the width for tree plantation, shall be provided for unobstructed & easy movement of vehicles in case of emergency.

A2.5 PARKING / TRAFFIC CONGESTION:

Minimum parking space of 9,460.07 m² [5,431.84 m² in hollow plinth + 4,028.23 m² as open surface parking] shall be provided as proposed.

A 2.6 ENERGY CONSERVATION:

18. Energy conservation measures viz maximum use of natural lighting through architectural design, energy efficient motors & pumps, solar lights in open & landscape areas - 50 solar street lights, use of aerated blocks & RMC, use of LED lighting fixtures and low voltage lighting, roof top solar panels of capacity 411 KW etc. shall be implemented as proposed.

A 2.7 GREEN BELT :

19. Green belt area of 4,515.27 m² comprising of 3,176.40 m² tree covered area with 620 trees within premises shall be developed as proposed. The other open spaces inside the plot shall be suitably landscaped and covered with vegetation of indigenous tree species.

Page 2 of 6

B. GENERAL CONDITIONS :

B1. PRE-CONSTRUCTION AND CONSTRUCTION PHASE:

- 20. Environment Management Cell shall be formed, which shall supervise and monitor the environment related aspects of the project during construction and operational phases in addition to observance of Gujarat Building and other Construction Workers' (Regulation of Employment & Conditions of Service) Rules 2003.
- Prior permission from the competent authority shall be obtained for cutting of the existing trees before site preparation work is commenced.
- Water demand during construction shall be reduced by use of curing agents, super plasticizers and other best construction practices.
- 23. Temporary wind shield shall be done to prevent dust emission spreading outside the project premises. Barricade of adequate height shall be provided on the periphery of the construction site with adequate signages. Individual building within the project site shall also be provided with barricades.
- 24. Regular water sprinkling shall be done in vulnerable areas for controlling fugitive emission,
- 25. Material shall be covered during transportation to avoid the fugitive emission.
- 26. Uniform piling and proper storage of sand to avoid fugitive emissions shall be ensured.
- Structural design of the project shall strictly adhere to the seismic zone norms for earthquake resistant structures.
- 28. The planning, designs and construction of all buildings shall be such as to ensure safety from fire.
- 29. The project proponent shall ensure maximum employment to the local people.
- 30. All required sanitary and hygienic measures shall be provided before starting the construction activities and to be maintained throughout the construction phase.
- 31. Provision shall be made for housing of construction labor within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical healthcare, crèches, electricity & ventilation, canteen, rest rooms, safe disposal system for garbage, first aid, medical and emergency facilities etc. to ensure that they do no ruin the existing environmental condition. The housing may be in the form of temporary structures to be removed after completion of the project.
- 32. Adequate personal protective equipments shall be provided to the construction workers to ensure their safety and the project proponent shall ensure its usage by the labours.
 - . First Aid Box shall be made readily available in adequate quantity at all the times.
 - Training shall be given to all workers on construction safety aspects.
 - The project proponent shall strictly comply with the Building and other Construction Workers' (Regulation of Employment & Conditions of Service) Act 1996 and Gujarat rules made there under and their subsequent amendments.
- 36. The overall noise level in and around the project area shall be kept well within the prescribed standards by providing noise control measures including acoustic insulation, hoods, silencers, enclosures vibration dampers etc. on all sources of noise generation.
- 37. Ambient noise levels shall conform to residential standards both during day and night. Incremental pollution load on the ambient air and noise quality shall be closely monitored during construction phase
- 38. The noise generating equipments, machinery and vehicles shall not be operated during the night hours and shall be maintained properly to avoid generation of high noise due to wear and tear.
- 39. Use of diesel generator sets during construction phase shall be strictly with acoustic enclosure and shall conform to the EPA Rules for air and noise emission standards.
- Safe disposal of wastewater and municipal solid wastes generated during the construction phase shall be ensured.
- All topsoil excavated during construction activity shall be used in horticultural / landscape development within the project site.
- 42. Construction materials and debris shall be properly stored and handled to avoid negative impacts such as air pollution and public nuisances by blocking the roads and public passages.
- 43. Construction debris shall be reused in construction of roads, levelling the site etc. Waste packaging material (like used cement bags, waste paper, cardboard packing material), metal scraps etc. shall be sold to recyclers or shall be sent to the nearest municipal solid waste landfill site.
- 44. Excavated earth to be generated during the construction phase shall be utilized within the premises to the maximum extent possible and balance quantity of excavated earth shall be disposed off with the approval of the competent authority after taking the necessary precautions for general safety and health aspects. Disposal of



the excavated earth during construction phase shall not create adverse effect on neighbouring communities.

- Provisions of Construction & Demolition Waste Management Rules-2016 shall be strictly adhered to. 46. Vehicles hired for bringing construction material at the site shall be in good conditions and conform to applicable
- air and noise emission standards and shall be operated only during day time and non-peak hours.
- 47. Project proponent shall ensure use of eco-friendly building materials including fly ash bricks, fly ash paver blocks, Ready Mix Concrete [RMC] and lead free paints in the project.
- 48. Fly ash shall be used in construction wherever applicable as per provisions of Fly Ash Notification under the E.P. Act, 1986 and its subsequent amendments from time to time.
- 49. Use of glass shall be minimal and only low emissive glass shall be used in the project to reduce the electricity consumption and load on air conditioning.

B2. OPERATION PHASE AND LIFE TIME:

- 50. Low water consuming devices shall be provided. Fixtures for showers, tollet, flushing and drinking shall be of low flow either by use of aerators/ diffusers or pressure reducing devices etc.
- 51. A water meter shall be installed on rain water harvesting & ground water recharge well system & compliance report of the same shall be submitted to concerned authorities.
- Used oil shall be sold only to the registered recycler.
- 53. Provisions of Solid Waste Management Rules-2016 shall be strictly adhered to.
- 54. Requisite fire fighting facilities as per the requirement of NBC and Gujarat Fire Prevention and Life Safety. Measures Act-2013 along with the rules & regulations made there under shall be provided.
- 55. Underground fire water storage tanks and terrace water storage tanks of adequate capacity shall be provided as proposed. Adequate provision shall be made to ensure that water from the Fire Water Tank shall not be used for any other purpose.
- 56. Dedicated power back up system shall be provided in the case of power failure & emergency of fire water pumps.
- 57. First Aid Box shall be made readily available in adequate quantity at all the times.
- 58. Main entry and exit shall be separate and clearly marked in the facility
- 59. Necessary emergency lighting system along with emergency power back up system shall be provided. Furth necessary auto glow signage at all appropriate places shall be provided to guide the people towards exit શો assembly points during emergency.
- 60. Sufficient peripheral open passage shall be kept in the margin area for free movement of fire tender/ emergen vehicle around the premises.
- 61. The overall noise level in and around the project area shall be kept well within the prescribed standards by providing noise control measures including acoustic insulation, hoods, silencers, enclosures vibrations dampers etc. on all sources of noise generation including D.G.Sets. The ambient noise levels shall confirm to the standards prescribed under the Environment (Protection) Act and Rules.
- 62. The area earmarked for the parking shall be used for parking only. No other activity shall be permitted in this area.
- 63. Traffic congestion near the entry and exit points from the roads adjoining the proposed project site shall be avoided. No public space including the service road shall be used or blocked for the parking.
- 64. The project proponent shall install energy efficient devices, appliances, motors, and pumps conforming to the Bureau of Energy Efficiency norms.
- The transformers and motors shall have minimum efficiency of 85%.
- Only variable frequency motor drives shall be used in project.
- 67. Application of solar energy shall be incorporated for Illumination of common areas, lighting for gardens and strest lighting. In addition the provision for solar water heating system shall also be provided.
- 68. Use of glass shall be minimal to reduce the heat island effect as well as to reduce the electricity consumption.
- 69. The area earmarked as green area shall be used only for plantation and shall not be altered for any other purpose.
- 70. Drip irrigation/low volume, low angle sprinkler system shall be used for the lawns and other green area including tree plantation.
- 71. The project proponent shall inform to SEAC / SEIAA regarding the transfer of management responsibility to the Society / Association to be formed for the proposed project with all the supporting documents. The Society / Association formed for further management of the proposed project shall be responsible for compliance of all the

conditions stipulated in the Environmental Clearance order.

- 72. Environmental Clearance granted for the project on the basis of documents related to land possession submitted shall become invalid in case the actual land for the project site turns out to be different from the land considered at the time of appraisal of the project and mentioned in the EC.
- 73. All other statutory clearances such as N.A. permission, approvals for storage of diesel from PESO, Fire Department, Airports Authority of India etc., if applicable, shall be obtained by the project proponent from the competent authorities.
- 74. All the conditions as may be stipulated in the N.A. order, Development permission, Building Use permission, NOC obtained from Fire Department etc, shall be strictly complied with.
- 75. The project management shall also comply with all the environment protection measures, risk mitigation measures and safeguards proposed by them.
- 78. All the commitments / undertakings given to the SEAC during the appraisal process for the purpose of environmental protection and management shall be strictly adhered to.
- 77. The project proponent shall also comply with any additional condition that may be imposed by the SEAC or the SEIAA or any other competent authority for the purpose for the environmental protection and management.
- 78. All the terms & conditions prescribed in the amendment of EIA Notification 2006 published by the MoEF&CC vide its Notification No. S.O. 3999(E) dated 9th December, 2016 shall be complied with letter & spirit.
- 79. The project proponent shall strictly comply with the Gujarat Building and other Construction Workers'(Regulation of Employment & Conditions of Service) Rules 2003 as well as Gujarat Lifts & Escalators Rules as amended from time to time.
- 80. No further expansion or modifications in the project likely to cause environmental impacts shall be carried out without obtaining prior Environment Clearance from the concerned authority.
- 81. The above conditions shall be enforced, inter-alia under the provisions of the water (Prevention & Control of Pollution) Act, 1974, Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act 1986 and the Hazardous Wastes (Management Handling and Tran boundary) Rules, 2008, Building and Other Construction Workers' (Regulation of Employment & Conditions of Service) Act-1996, The Gujarat Lifts and Escalators Act-2000 along with their amendments and rules.

B3. OTHER:

space As

2. The project proponent shall allocate separate fund of Rs. 2.25 crores for modification & repair of drainage network at project site of EWS housing facilities under Pradhan Mantri Awas Yojna in accordance to the MoEFCC's Office Memorandum No. F.No.22-65/2017-IA.III dated 01/05/2018. The entire activities proposed under CER shall be monitored and the monitoring report shall be submitted to the regional office of MoEFCC as a part of half-yearly-compliance report and to district collector. The monitoring report shall be posted on the website of the project proponent.

- 83. The project authorities shall earmark adequate funds to implement the conditions stipulated by SEIAA as well as GPCB along with the implementation schedule for all the conditions stipulated herein. The funds so provided shall not be diverted for any other purpose.
- 84. The project proponent shall adhere to provisions made for Corporate Environment Responsibility "CER" in Office Memorandum dated 01/05/2018 by Ministry of Environment, Forests & Climate Change and its amendments from time to time in a letter and spirit.
- 85. The applicant shall inform the public that the project has been accorded environmental clearance by the SEIAA and that the copies of the clearance letter are available with the GPCB and may also be seen at the Website of SEIAA/ SEAC/ GPCB. This shall be advertised within seven days from the date of the clearance letter, in at least two local newspapers that are widely circulated in the region, one of which shall be in the Gujarati language and the other in English. A copy each of the same shall be forwarded to the concerned Regional Office of the Ministry.
- 86. It shall be mandatory for the project management to submit half-yearly compliance report in respect of the stipulated prior environmental clearance terms and conditions in hard and soft copies to the regulatory authority concerned and shall be uploaded on website of Gujarat Real Estate Regulatory Authority, on 1st June and 1st December of each calendar year.
- 87. The project authorities shall also adhere to the stipulations made by the Gujarat Pollution Control Board.
- 88. The project authorities shall inform the GPCB, Regional Office of MoEF&CC and SEIAA about the date of financial closure and final approval of the project by the concerned authorities and the date of start of the project.

- 89. The SEIAA may revoke or suspend the clearance, if implementation of any of the above conditions is not found satisfactory. This environmental clearance is valid for seven years from the date of issue.
- 90. Any appeal against this environmental clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.
- 91. Submission of any false or misleading information or data which is material to screening or scoping or appraisal or decision on the application makes this environment clearance cancelled.

With regards, Yours sincerely,

(S. M. SAIYAD) Member Secretary

Issued to: City Engineer (Sp.) Rajkot Municipal Corporation Dhebar Rd S, Manohar Pura, Rajkot



Page 6 of 6

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Gujarat Real Estate Regulatory Authority (RERA)

Government of Gujarat

Website: gujrera.gujarat.gov.in, Email: inforera@gujarat.gov.in

FORM - C

REGISTRATION CERTIFICATE OF PROJECT

[The Gujarat Real Estate (Regulation and Development) (General) Rules, 2017 See Rule 6(1) "said rules"]

1. This registration is granted under section 5 of the Real Estate (Regulation & Development) Act, 2016 "said act" to

the following Project under project registration number :-

PR/GJ/RAJKOT/RAJKOT/Others/MAA07456/150920

Project Name & Address :-GHTC-I LHP Rajkot Opp Raiyadhar STP, Nr. Parshuram Temple, Raiya road, Rajkot, Rajkot, Gujarat

Remarks:TP/Revenue Village:32 (Raiya), FP/Survey No:- 63/10(As Per Draft), 64(As Per Paramarah) (R.S.No :- 316/P, Moje :- Raiya, Ta & Dist :- Rajkot), SP/Piot no.: -, Block:- A To L .

Promoter Name & Address :-

Rajkot Municipal Corporation Competent Authority Krishna Nagar Civic Center, Guruprasad Chowk, Rajkot, Gujarat-360004

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

- (i) The promoter shall enter into an agreement for sale with the allottees as prescribed in said rules as per "Annexure A" by the Government of Gujarat.
- (ii) The promoter shall execute and register a conveyance deed in favour of the allottee or the association of the allottees, as the case may be, of the apartment, plot or building, as the case may be, or the common areas as per section 17 of the said act.
- (iii) The promoter shall deposit seventy percent of the amounts realised 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 said act.
- (iv) The registration shall be valid till Dt. 01/09/2022 unless renewed by the Real Estate Regulatory Authority in accordance with section 6 of the said act read with rule 7 of the said rules made thereunder.
- (v) The promoter shall comply with the provisions of the said act and the said rules and regulations made thereunder.
- (vi) The promoter shall not contravene the provisions of any other law for the time being in force as applicable to the project.
- (vii) All advertisements for this project must mention RERA registration number and GujRERA website www.gujrera.gujarat.gov.in. The font size for the same should not be less than that of the contact details of the project.

3. If the above mentioned conditions are not fulfilled by the promoter, the Authority may take necessary action against the promoter including revoking the registration granted herein, as per the said act and the said rules and regulations made thereunder.

Date: 15/09/2020 Place: Gandhinagar



Signature Not Verified Digitaly signed by PATEL EHAGVANDAS Date: stord of the Index Set IST Reason: Digity Signed Certificate Location: Sendimage

Signature and Seal of the Secretary Gujarat Real Estate Regulatory Authority

FORM VI	[SEE	RULE-	(25))]
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GOVERNMENT OF GUJARAT

Deputy Commissioner Of Labour - Rajkot

Licence No : CLRA/Licence/CLRA/RJT/2020/CLL/75 Date : 21/10/2020

Amount of Fee Paid

Rs. 142/-

Amount of Security Deposit Paid

Rs. 13,500/-

Date : 16/10/2020

* <u>LICENCE</u> *

Licence is hereby granted to MALANI CONSTRUCTION CO., "MALANI COMPLEX", 58-KOTECHANAGAR,

KALAWAD ROAD, RAJKOT under section 12(1) of the Contract Labour (Regulation and Abolition) Act, 1970 subject to the conditions specified in the annexure.

This licence is for doing the work of CONSTRUCTION WORK in the establishment of Rajkot Municipal Corporation, Dr Ambedkar Bhavan, Dhebar Road,nr Central Bus Starion, rajkol,

The licence shall remaining in force till 18/11/2020.

Date : 21/10/2020

A K Shihora

Asst. Labour Commissioner Licensing officer,

Rajkot

Signature Not Verified Digitally signed by SHIHOFA ANANDKUMAR KANJIBHAI Date: 2020.10.21 11:33:01 +09:30 Reason: Approval Location: Candhinager

RENEWAL [See RULE 29]						
Date of Fee paid for renewal renewal		Date of expiry	Signature of and Seal of the Licenceing Officer And Date			
19/11/2019	Rs. 142/- Date : 17/10/2020	18/11/2020				

Licence No : CLA/License/CLRA/RJT/2020/CLL/75 Date : 21/10/2020

Nature of work: CONSTRUCTION WORK

The licence is subject to the following conditions :

- The licence shall be non-transferable.
- (2) The number of workmen employed as Contract Labour in the establishment Rajkot Municipal Corporation, Dr Ambedkar Bhavan, Dhebar Road, nr Central Bus Starion, rajkot. establishment shall not, on any day, exceed <u>50</u>.
- (3) Except as provided in the rules the fees paid for the grant, or as the case may be, for renewal of the license shall be nonrefundable.
- (4) The rates of wages payable to the workmen by the contractor shall not be less than the rates prescribed for the scheduled 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 so 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 wage rates, holidays, 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 on the same or similar kind of work; provided that in the case of any disagreement with regard to the type of work the same shall be decided by the Labour Commissioner, whose 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 Labour Commissioner.

Signature Not Verified Digitally signed by SHIHORA AMANDKUMAR KANJIBHAL Date: 2020/10.21 11:38:07 -09 30 Reason: Approval Location: Gandhinagar

- establishment where 20 or more women are ordinarily be provided 2 rooms of reasonable (7) every employed as contract labour, there shall be provided dimensions for the use of their children under the age of six years. One of such rooms shall be used as a play-room for the children and the other as bedroom 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 Labour Commissioner.
- (8) The licensee shall notify any change in the number of workmen or the conditions of work to the Licensing Officer;
- (9) Contractor shall employ 85% of the skilled, semiskilled and unskilled contract workmen from the local resident, who are living in Gujarat since last 15 years, and will maintain the 85% strength till the completion of the valid License. If the local residents are not available then the contractor shall employ the remaining more than 15% of the non-local contract workmen after obtaining the prior written permission of the respective Licensing officer appointed under the Act.

Signature Not Verified Digitally signed by SHIHORA AMANDKUMAR KANJIBHAI Date: 2020/10.21 1138:07 -22/30 Reason: Approval Location: Gandhinagar

	FORM VI	[SEE RULE-(25)]	
	GOVERN	MENT OF GUJARAT	and the second of
Deputy Labour Cor	nmissioner Office - Ra	ajkot	
Licence No : CLRA/Li Date : 21/10/2020	cence/CLRA/RJT/2020	/CLL/75	
<u>Amount -</u> Rs.	of Fee Pald 142/-	Amount of Se Licence Security Rs. 13, Renewal Security Rs. 20	curity Deposit Paid 500/- ,250/-
ADDITION) ACC, 1970 SUDJE	or to the conditions specified	neu in the annexure.	
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Licence No : CLRA/License/CLRA/RJT/2020/CLL/75

Nature of work: CONSTRUCTION WORK

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 Rejkot Municipal Corporation, Dr Ambedkar Bhavan, Dhebar Road, nr Central Bus Station, rejkot, establishment shall not, on any day, exceed 125.
- (3) Except as provided in the rules the fees paid for the grant, or as the case may be, for renewal of the license shall be nonrefundable.
- (4) The rates of wages payable to the workmen by the contractor shall not be less than the rates prescribed for the scheduled 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 so 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 wage rates, holidays, 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 on the same or similar kind of work; provided that in the case of any disagreement with regard to the type of work the same shall be decided by the Labour Commissioner, whose 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 Labour Commissioner.

Signature valid Digtally signed by SHIHORA ANDKUMAR KANJIBHAJ Date: 2021.01.06 17:47: Reason: Approval Locotion: Gendhinager

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 shall be (7) every establishment where used as a play-room for the children and the other as bedroom 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 creches may be such as may be specified in this behalf by the Labour Commissioner. (8) The licensee shall notify any change in the number of workmen or the conditions of work to the Licensing Officer; (9) Contractor shall employ 85% of the skilled, semiskilled and unskilled contract workmen from the local resident, who are living in Gujarat since last 15 years, maintain the 85% strength till the completion of the valid License. If and will the local residents are not available then the contractor shall employ the remaining more than 15% of the non-local contract workmen after obtaining the phor written permission of the respective Licensing officer appointed under the Act. Signature valid Digitally signed by SHIHORA AVANDKUMAR KANJIBHAI Date: 2021.01.08 17:47: 049730 Reason: Approval Location: Gandhinagar



भारतीय विमानपत्तन प्राधिकरण AIRPORTS AUTHORITY OF INDIA

CITY ENGINEER SPECIAL RAJKOT MUNICIPAL CORPORATION

KRUSHNANAGAR CITY CIVIC CENTER,NEAR DOSHI HOSPITAL,GONDAL ROAD,RAJKOT. Date: 27-09-2019

Valid Upto: 26-09-2027

No Objection Certificate for Height Clearance

1. This NOC is issued by Airports Authority of India (AAI) in pursuance of responsibility conferred by and as per the provisions of Govt. of India (Ministry of Civil Aviation) order GSR751 (E) dated 30th Sep. 2015 for Safe and Regular Aircraft Operations.

2. This office has no objection to the construction of the proposed structure as per the following details:

NOC ID :	RAJK/WEST/B/090219/427340
Applicant Name*	Dharmesh Gediya
Site Address*	VILLAGE-RAIYA,TALUKA-RAJKOT,DISTRICT-RAJKOT,SR NO-318-P,TPS NO-3 RAIYA,OP NO-61,I'P NO-63-10.,RAIYA,Rajkot,Gujarat
Site Coordinates*	22 18 5.33N 70 44 11.14E, 22 18 10.57N 70 44 15.34E, 22 18 7.71N 70 44 7.21E, 22 18 15.15N 70 44 7.89E
Site Elevation in mtrs AMSL as submitted by Applicant®	123.27 M
Permissible Top Elevation in mtrs Above Menn Sen Level(AMSL)	180 M (Restricted)

*As provided by applicant

3. This NOC is subject to the terms and conditions as given below:

a. Permissible Top elevation has been issued on the basis of Site coordinates and Site Elevation submitted by Applicant. AAI neither owns the responsibility nor authenticates the correctness of the site coordinates & site elevation provided by the applicant. If at any stage it is established that the actual data is different, this NOC will stand null and void and action will be taken as per law. The office in-charge of the concerned aerodrome may initiate action under the Aircraft (Demolition of Obstruction caused by Buildings and Trees etc.) Rules, 1994"

b. The Site coordinates as provided by the applicant in the NOC application has been plotted on the street view map and satellite map as shown in ANNEXURE. Applicant/Owner to ensure that the plotted coordinates corresponds to his/her site.In case of any discrepancy,Designated Officer shall be requested for cancellation of the NOC.

c. Airport operator or his designated representative may visit the site (with prior coordination with applicant or owner) to ensure that NOC terms & conditions are complied with.

d. The Structure height (including any superstructure) shall be calculated by subtracting the Site – elevation in AMSL from the Permissible Top Elevation in AMSL i.e. Maximum Structure Height = Permissible Top Elevation minus (-) Site Elevation.

e. The issue of the 'NOC' is further subject to the provisions of Section 9-A of the Indian Aircraft Act, 1934 and any notifications issued there under from time to time including the Aircraft (Demolition of Obstruction eaused by Buildings and Trees etc.) Rules,1994.

हवाईअड्डा निदेशकसरदार वल्लभ भाई पटेल अंतर्राष्ट्रीय हवाई अड्डा अहमदाबाद - 380 003 दूरभाष संख्या : 91-79-2286 9211 Airport Director, Sardar Vallabhbhai Patel International Airport, Ahmedabad-380 003 (Gujarat), Telephone - 91-79-2286 9211



भारतीय विमानपत्तन प्राधिकरण AIRPORTS AUTHORITY OF INDIA

f. No radio/TV Antenna, lighting arresters, staircase, Mumtee, Overhead water tank and attachments of fixtures of any kind shall project above the Permissible Top Elevation of 180 M (Restricted) (AMSL), as indicated in para 2.

g. Use of oil, electric or any other fuel which does not create smoke hazard for flight operations is obligatory, within 8 KM of the Aerodrome Reference Point.

h. The certificate is valid for a period of 8 years from the date of its issue. One time revalidation without assessment may be allowed, provided construction work has commenced subject to the condition that such request shall be made within the validity period of the NOC and the delay is due to circumstances which are beyond the central of the developer.

i. No light or a combination of lights which by reason of its intensity, configuration or colour may cause confusion with the aeronautical ground lights of the Airport shall be installed at the site at any time, during or after the construction of the building. No activity shall be allowed which may affect the safe operations of flights

j. The applicant will not complain/claim compensation against aircraft noise, vibrations, damages etc. caused by aircraft operations at or in the vicinity of the airport.

k. Day markings & night lighting with secondary power supply shall be provided as per the guidelines specified in chapter 6 and appendix 6 of Civil-Aviation Requirement Series B Part I Section 4, available on DGCA India website: www.dgea.nic.in

I. The applicant is responsible to obtain all other statutory clearances from the concerned authorities including the approval of building plans. This NOC for height clearances is to ensure the safe and regular aircraft operations and shall not be used as document for any other purpose/claim whatsoever, including ownership of land etc.

m. This NOCID has been assessed w.r.t Hirasnr,Rajkot Airport(s). NOC has been issued w.r.t. the AAI aerodromes and other licensed civil aerodromes as listed in Schedule-III, Schedule-IV(Part-1), Schedule-IV(Part-2;RCS Airports Only) and Schedule-VII of GSR751(E).

n. Applicant needs to seek separate NOC from Defence, if the site lies within the jurisdiction of Defence Aerodromes as listed in Schedule-V of GSR751(E). As per Rule 13 of GSR751(E), applicants also need to seek NOC from the concerned State Govt. for sites which lies in the jurisdiction of unlicensed aerodromes as listed in Schedule-IV (Part-2:other than RCS airports) of GSR751(E).

o. In case of any discrepancy/interpretation of NOC letter, English version shall be valid.

p. In case of any dispute w.r.t site elevation and/or AGL height, top elevation in AMSL shall prevail.

Chairman NOC Committee

Region Name: WEST

Address: Jt. General Manager Airports Authority of India, SVP International Airport Ahmedabad-3800003(Gujrat)

Email ID: nocahm@aai.acro Contact No: 079-22863396



Name / Designation / Sign with Date					
Prepared By :					
Verified By :					

हवाईअड्डा निदेशक सरदार वल्लभ भाई पटेल अंतर्राष्ट्रीय हवाई अड्डा अहमदाबाद - 380 003 दूरभाष संख्या : 91-79-2286 9211 Airport Director, Sardar Vallabhbhai Patel International Airport, Ahmedabad-380 003 (Gujarat), Telephone - 91-79-2286 9211

ANNEXURE

Distance From Nearest Airport And Bearing

Airport Name	Distance (Meters) from Nearest ARP	Bearing (Degree) from Nearest ARP	
Hi r asar	33158.35	252.72	
Rajkot	4362.95	259.8	
NOCID	RAJK/WEST/B/090219/42	7340	



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Saptember 2, 2015



રાજકોટ મહાનગરપાલિકા

કૃષ્ણનગર સિટી સિવિક સેન્ટર ગુરૂપ્રસાદ ચોક, દોશી હોસ્પીટલ પાસે, ગોંડલ રોડ, રાજકોટ – ૩૬૦ ૦૦૪ (ગુજરાત)

રા.મ.ન.પા./આવાસ/ટેકનીકલ/જા.નં. ૪૨૫

dl. 95/00/2020

પ્રતિ, શ્રી માલાણી કન્સ્ટ્રકશન કું, માલાણી કોમ્પ્લેક્ષ, ૫૮-કોટેચાનગર, કાલાવડ રોડ, રાજકોટ, ૩૬૦૦૦૧, કો, ૦૨૮૧-૨૪૫૧૩૮૧

> વિષય :- ગ્લોબલ ફાઉસિંગ-લાઈટ ફાઉસ પ્રોજેક્ટ માટે રૈયા STP માંથી ટ્રીટેડ સુએઝ વૉટર મેળવવા બાબત

સંદર્ભ : આપના પત્ર ઈ.નં. ૩૬૨, તા. ૦૧/૦૭/૨૦૨૦

ઉપરોક્ત વિષય અને સંદર્ભ અન્વચે જણાવવાનું કે સિટી એન્જીનીયરશ્રી (ડ્રેનેજ પ્રૉજેક્ટ) ના ફાઈલ પરત્વેની સુચના અનુસાર ચાલુ વર્ષે રૂ. ૧૭.૩૦/૧૦૦૦ લીટર મુજબ ૫૬ MLD STP ખાતેથી ટ્રીટેડ સુએઝ વોટર આપવામાં આવશે. જે મેળવવાની વ્યવસ્થા એજન્સીએ જાતે જ કરવાની રહેશે. આ ઉપરાંત મિકેનીકલ વિભાગ (ડ્રેનેજ પ્રોજેક્ટ) નીડિમાન્ડ નોટ મુજબ રકમ ભરપાઈ કર્ચેથી પાણી આપવાની મંજુરી આપવામાં આવશે. જે ધ્યાને લઇ આ બાબતે ડ્રેનેજ વિભાગ (પ્રોજેક્ટ) નો સંપર્ક કરશો. પ્રથમ ટ્રીટેડ સુએઝ વોટરનું લેબટેસ્ટીંગ કરાવી તે બાંધકામ માટે વપરવા લાયક છે કે કેમ તે બાબતે BMTPC તથા સ્ટ્રક્ચર એન્જીનીયરનો લેખિત અભિપ્રાથ મેળવી લેશો.

વિશેષમાં ટાઉન પ્લાનિંગ શાખામાં GHTC ના પ્લાનની મંજુરી મેળવ્યા બાદ જરૂરી NOC આજદિન સુધી રજુ કરેલ નથી. જે રજુ કરી મંજુર થયેલ પ્લાનની નકલ મેળવી MOHUA તથા અત્રેની શાખામાં રજુ કરશો.

નાયબ કોર્ચેપાલક ઈજનેર રાજકોટ મહાનગરપાલિકા

પોલીસ કમિશનર કચેરી, રાજકોટ શહેર, રાજકોટ. <u>"લાયસન્સ બ્રાન્ચ "</u> રેસકોર્પ રીંગ રોડ, રાજકોટ. ફોન નં. :- ૦૨૮૧ - ૨૪૭૨૪૮૪ ક્રમાંક : રાજ/સીપી/એલબી-૨/કોમ્યુનિટી હોલ/એન.ઓ.સી./૭૧૯/૨૦૨૦ તા.૦૧/૦૮/૨૦૨૦

પતિ, શ્રી માલાણી કન્સ્ટ્રકશન કું., રાજકોટ.

"ના વાંધા પ્રમાશપત્ર"

શ્રી માલાણી કન્સ્ટ્રકશન કું., માલાણી કોમ્પ્લેક્ષ, ૫૮, કોટેચાનગર, કાલાવડ રોડ, રાજકોટ શહેરનાઓએ રૈયાગામ સર્વે નં. ૩૧૮/પી ખાતેની જગ્યામાં કોમ્યુનિટી હોલનું બાંધકામ કરવા અંગે નીચેની શરતોને આધિન "ના વાંધા પ્રમાણપત્ર" આપવામાં આવે છે.

- પાર્કિંગ સિવાયની જગ્યાએ વાહન પાર્ક કરવું નહી.
- વ્યવસ્થાપનના નિયમોનું ચુસ્તપહો પાલન કરવાનું રહેશે.
- સી.સી.ટી.વી. કેમેરા લગાવવાના રહેશે.
- ં ફાયર એન.ઓ.સી. મેળવી લેવાનું ૨હેશે.
- અન્ય સંબંધિત ખાતાઓ પાસેથી બાંધકામ કરતા પહેલા મંજુરી મેળવી લેવાની રહેશે.

ઉપરોક્ત શરતોના ભંગ બદલ આ <u>"ના વાંધા પ્રમાણપત્ર"</u> આપોઆપ રદબાતલ થયેલ ગણાશે.

''પોલીસ કમિશન૨શ્રીના હુકમથી''



(ખુરશીદ એહ્ર્મદ)

(બુરશાદ અહુનદ) સંયુક્ત પોલીસ કમિશન૨ રાજકોટ શહે૨ રાજકોટ

નકલ રવાના :--

- (૧) ટાઉન પ્લાનીંગ ઓફીસર, રાજકોટ મહાનગરપાલિકા
- (૨) પો.ઈન્સ.શ્રી, ગાંધીગ્રામ-૨(યુનિ.) પો.સ્ટે., રાજકોટ શહેર
- (૩) મ.પો.કમિ.શ્રી, પશ્ચિમ વિભાગ, રાજકોટ શહેર
- (૪) મ.પો.કમિ.શ્રી, ટ્રાફીક શાખા, રાજકોટ શહેર

Annexure - 2

Geotechnical Investigation Report – Lighthouse Project at Rajkot

Summary:

Nature of project : 1144 EWS HOUSES (S+13 Floors)

Owner : Ministry of Housing and Urban Affairs, Govt. of India

Contractor : Malani Construction Company

Geotechnical Investigation Agency: M/s NKPC, Rajkot

Project Location : Raiya Road, Rajkot

The geotechnical investigation work for the lighthouse project site was entrusted to M/s NKPC, Rajkot. There are 11 residential blocks in the project. It was decided drill 22 bore holes, 2 at each block location.

Scope of Work

- To determine the Soil Profile of site.
- To know physical properties and strength characteristics of soil at various depth and to find SBC (Safe Bearing Capacity).
- Bore hole 22 No. with depth as mentioned the in log table.
- Collecting disturbed samples.
- Collecting undisturbed samples.
- To find physical properties and strength characteristics of undisturbed samples.
- Strength characteristics for core samples.

Field Investigation

- Drilling Bore hole
- Standard Penetration Tests
- Collection of soil samples (Disturbed & Undisturbed)
- Collection of core samples

Laboratory Investigation

- Bulk density & Moisture content
- Grain size analysis
- Index properties
- Shear Tests

Based on above investigations and the results were obtained. The recommendations for the foundation are based on interpretation of Results, Analysis and computation as per relevant Indian Standards.

Field Investigation:

Drilling

The field work consisted for Twenty Two No. of bore holes. Bore holes were drilled by rotary drilling machine. The depth of test bore and lithology at proposed location are shown in the detailed report.

Sampling:

Disturbed Samples

Disturbed samples were collected during boring and also from the split spoon sampler. The samples were logged, labeled and placed in polythene bags and sent to laboratory for testing.

Undisturbed Samples

Undisturbed Samples were collected in thin walled shelby tubes as per IS: 2132. The samples were sealed with wax, labeled and transported to laboratory at Rajkot for testing.

Standard Penetration Test

The Standard Penetration Test were conducted in accordance with IS: 2131 using Indian Split Spoon Sampler driven by 63.5 kg hammer falling freely from a height for 75 cm through a guide rod. The standard size of spoon sampler is 35 mm internal and 50.8 mm outer diameter. The blow count is made three times for every 15 cm penetration of the spoon. If full penetration is obtained, the number of blows for the first 15 cm of penetration is neglected due to possible caving and disturbance of soil into the hole. The number of blows for next 30 cm (15 cm intervals) penetration are recorded as N values of the soil at the depth of tests.

Laboratory Investigation

The following laboratory tests were conducted on undisturbenand disturbed soil samples collected from various depths to find the physical properties and strength characteristics.

Sr.	Test	Recommended Procedure	Type of samples			
1	Samples Preparation	IS 2720 PtI	DS/UDS			
2	Moisture Content	IS 2720 PtII	DS/UDS			
3	Dry Unit Weight	Lambe	UDS			
4	Specific Gravity	IS 2720 PtIII	DS			
5	Liquid Limit	IS 2720 PtV	DS			
6	Plastic Limit	IS 2720 PtV	DS			
7	Grain Size Analysis	IS 2720 PtIV	DS			
8	Soil Classification	IS 1488				
9	Box Shear Test	IS 2720 PtVI	UDS			
10	Uniaxial Compression		Core/Rock			

Measurement of soil properties in Laboratory

Safe Bearing Capacity based on the test results and analysis of results

Project:	EWS Houses under Light house projects (LHPs) at		Job No	2020 579 07		
Troject.	Raiya T.P.	S 32, F.P. No	o. 63/10		JOD NO.	2020 37 3 07
Sr. No.	BH No.	Lab No.	Depth of footing M	Size of footing	Q kg/ cm ²	(Allowable Bearing Pressure t/m ² as per IS 12070-1987
1	BH1	526.1	2.50	2m wide	51	43
2	BH1	526.2	3.00	2m wide	60	50
3	BH1	526.3	2.50	2.5m wide	51	43
4	BH1	526.4	3.00	2.5m wide	60	50
1	BH2	526.5	2.50	2m wide		24
2	BH2	526.6	3.00	2m wide		29
3	BH2	526.7	2.50	2.5m wide		27
4	BH2	526.8	3.00	2.5m wide		32
1	BH3	526.9	2.50	2m wide		27
2	BH3	526.10	3.00	2m wide	50	42
3	BH3	526.11	2.50	2.5m wide		27
4	BH3	526.12	3.00	2.5m wide	50	42
1	BH4	526.13	2.50	2m wide		24
2	BH4	526.14	3.00	2m wide	49	41
3	BH4	526.15	2.50	2.5m wide		24
4	BH4	526.16	3.00	2.5m wide	49	41
1	BH5	526.17	2.50	2m wide		24
2	BH5	526.18	3.00	2m wide	48	40
3	BH5	526.19	2.50	2.5m wide		24
4	BH5	526.20	3.00	2.5m wide	48	40
1	BH6	526.21	2.50	2m wide		27
2	BH6	526.22	3.00	2m wide	51	43
3	BH6	526.23	2.50	2.5m wide		27
4	BH6	526.24	3.00	2.5m wide	51	43
1	BH7	526.25	2.50	2m wide		27
2	BH7	526.26	3.00	2m wide	50	42
3	BH7	526.27	2.50	2.5m wide		27
4	BH7	526.28	3.00	2.5m wide	50	42
1	BH8	526.29	2.50	2m wide	50	42
2	BH8	526.30	3.00	2m wide	60	50
3	BH8	526.31	2.50	2.5m wide	50	42
4	BH8	526.32	3.00	2.5m wide	60	50
1	BH9	526.33	2.50	2m wide	45	38
2	BH9	526.34	3.00	2m wide	54	45
3	BH9	526.35	2.50	2.5m wide	45	38
4	BH9	526.36	3.00	2.5m wide	54	45

1	BH10	526.37	2.50	2m wide	49	41
2	BH10	526.38	3.00	2m wide	59	49
3	BH10	526.39	2.50	2.5m wide	49	41
4	BH10	526.40	3.00	2 5m wide	59	49
•	DITIO	520.10	3.00	2.511 Wide		15
1	RH11	526.41	2 50	2m wide		24
2	BH11	526.42	3.00	2m wide		29
2		526.42	2.50	2 5m wido		25
3		526.43	2.30	2.5m wide		27
4	DHII	520.44	5.00	2.311 wide		52
1	DU12	E26 4E	2.50	2m wide		27
2		520.45	2.30	2m wide	52	42
2		520.40	3.00	2 Fra wide	52	43
3	BH12	526.47	2.50	2.5m wide	50	27
4	BHIZ	526.48	3.00	2.5m wide	52	43
	DU 40	596.40	0.50			
1	BH13	526.49	2.50	2m wide		27
2	BH13	526.50	3.00	2m wide	53	44
3	BH13	526.51	2.50	2.5m wide		27
4	BH13	526.52	3.00	2.5m wide	53	44
1	BH14	526.53	2.50	2m wide		24
2	BH14	526.54	3.00	2m wide	46	38
3	BH14	526.55	2.50	2.5m wide		24
4	BH14	526.56	3.00	2.5m wide	46	38
1	BH15	526.57	2.50	2m wide	49	41
2	BH15	526.58	3.00	2m wide	57	48
3	BH15	526.59	2.50	2.5m wide	49	41
4	BH15	526.60	3.00	2.5m wide	57	48
1	BH16	526.61	2.50	2m wide	48	40
2	BH16	526.62	3.00	2m wide	56	47
3	BH16	526.63	2.50	2.5m wide	48	40
4	BH16	526.64	3.00	2.5m wide	56	47
1	BH17	526.65	2.50	2m wide		27
2	BH17	526.66	3.00	2m wide	53	44
3	BH17	526.67	2 50	2 5m wide		27
4	BH17	526.68	3.00	2 5m wide	53	44
		520.00	5.00	2.5m wide		
1	BH18	526.69	2 50	2m wide	<u>4</u> 2	35
2	BH18	526.05	3.00	2m wide	52	/3
2		526.70	2.50	2 5m wido	12	25
3		526.71	2.30	2.5m wide	42 52	
4		520.72	3.00	2.511 Wide	52	43
2		520.75	2.50	2m wide	50 61	<u>4</u> 2
2		520.74	3.00	2 Em wide		21
3	BH 19 BU 10	520.75	2.50	2.5m wide	50	42
4	внія	526.76	3.00	2.5m wide	61	51
1	DU IOO	506 77	2.50			27
	BH20	526.77	2.50	2m wide	44	3/
2	BH20	526.78	3.00	2m wide	55	46
3	BH20	526.79	2.50	2.5m wide	44	37

4	BH20	526.80	3.00	2.5m wide	55	46
1	BH21	526.81	2.50	2m wide	42	35
2	BH21	526.82	3.00	2m wide	52	43
3	BH21	526.83	2.50	2.5m wide	42	35
4	BH21	526.84	3.00	2.5m wide	52	43
1	BH22	526.85	2.50	2m wide	43	36
2	BH22	526.86	3.00	2m wide	51	43
3	BH22	526.87	2.50	2.5m wide	43	36
4	BH22	526.88	3.00	2.5m wide	51	43

0.5= Correction factor for Fracture in rock

0.5= Correction factor for fully saturation

3= factor of safety

Q=unconfined compressive strength in kg/cm2

SBC=(Q*10*0.5*0.5)/3

IEC campaign and social media activities on LHP Rajkot

🚭 Footbare Walder (www.Yapano - Univer, Sana maranahad baris 👂 Benary († 221) - @











Protection
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• u 7 k



















#LightHouseProjects: #TransformingUrbanLandscape of India with Touch of New Technologies! Presenting glimpses of #LUP sites from Rajkot, Indore & Lucknow. The housing project is in an advanced stage at the locations & will subsequently fulfil #affordablehousing dreams of people.



10.39 AM - Jun 3, 2022 - Twitter Web App

8 Networks 34 Likes





Detailed discussions were held on construction developments & completion of project. At *fit* HPRajkot. 88% work has been completed & it is in nearing completion stage.

ITTousingForAlt IIPMAYUrban I/GLITCIndia I/ULIPS #TransformingUrbanLandscape #TransformingLives #AffordableHousing



8.02 PM - Jun 8, 2022 - Pwitter Web App

B Retweets 18 Likes



The beneficiaries of #LHPRajkot are proud to be pioneers & first-time owners of technology-driven #affordablehouses, which is not the conventional type & unique in itself.

#PMAYUroan #GHTUIndia #LHPs #ConstructionTechnology #TransformingLives #TransformingUrbanLandscape



h (H = 01 - Nep 8, 2002) - function White App

G Retweets 17 Likes



During *HindlanUtbani* loucing Conclave, ffLightLouseProject Bajket, Guiarat will be Insugurated, after which 1,124 attantishle & technology driven flate will be handed over to pheody identified bondticiary tamilies.

//HousingConclave //UrbanHousingConclave //IUFIC



9 Retweets 21 Dires



Welcome to #LightHouseProject Rajkot, soon-to-be home of 1,144 families!

#LHPRsikot is almost complete with all basic & social infractructure in place. It comprises of S+13 floors, accommodating 1,144 attordable flats. Have a look at how the project has shaped.

#HousingForAll



5.10 PM - Sep 8, 2022 - Twitter Web App

Etildevella" 2 Suctor Incela - 98 Linua



The power of 3S - Skill, Speed & Scale - is what makes #Light-HouseProjects unique. Such confluence of new age innovative construction technologies is being withressed to transform building construction sector of India









Completed Project Photographs







Ministry of Housing & Urban Affairs Government of India

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