## CAMPUS ON THE SABARMATI

IIT GANDHINAGAR


# DESIGN OF HOUSING FOR FACULTY AND STAFF 

## AN OVERVIEW

Rajiv Kathpalia<br>Sönke Hoof<br>Sudhir K. Jain<br>Shobhit Tayal<br>Harish P. M.<br>Marjorie Greene<br>Mouli Kethineedi

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#### Abstract

NOTE: For this publication, most of the drawings and graphic material were prepared by Vastu Shilpa Consultants and presented to IIT Gandhinagar as a Comprehensive Design Report for the Faculty Housing Phase 1A of the new permanent campus. It is hoped that this publication is beneficial in setting selection methodologies and procedures to arrive at competent design solutions for residential requirements of large educational institutions. Hopefully it will be a useful educational tool for students and professionals.


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## LAYOUT

Gaurav Shukla

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Indian Institute of Technology Gandhinagar, 2018
ISBN: 978-81-934412-5-1
Email: director@iitgn.ac.in
Website: www.iitgn.ac.in

## FOREWORD

Once created, universities may last not just decades, but centuries. Hence, it is a rare privilege for any academic to participate in the process of creating a new university. Establishment of the Indian Institute of Technology Gandhinagar (IITGN) has enabled all of us associated with the Institute to innovate in creating curricula, organizing governance, and nurturing a unique culture and ethos of the Institute. The philosophy of education has been to push traditional boundaries with an emphasis on multi-disciplinary approaches and crosscutting thematic areas.

Just as the Institute endeavours to think out of the box for its academic programmes and governance, it has also been doing so for development of its 399 acre campus on the banks of the Sabarmati River. It is our firm belief that the physical environment makes a huge contribution to shape the processes of learning and knowledge creation. The campus has been conceptualized keeping in mind the long-term objectives as well as the present needs and immediate future. The guiding principles of the campus development have been

- An ambience that attracts visitors and conveys to them that they are on a university campus unlike any they have visited before.
- Functional convenience for the academic community for mutual interaction, learning and research.
- Low energy and resource consumption, as well as minimal upkeep and low maintenance costs.

The engagement of a large number of professionals and academics in brainstorming and in executing the design and construction has enabled us to introduce numerous innovations in the development of the campus. The campus development work was split into master planning and architectural design. The Masterplan development was completed by a consortium of architects selected through a competitive process. Another selection process was conducted for the comprehensive architectural design of the student hostels, the faculty and staff housing, and the academic buildings. A landscape architect and member of the master planning team oversaw the landscape design for the overall elements and spaces of the new campus. This landscape architect also peer-reviewed the landscaping developed as part of the hostels, faculty and staff housing, and academic buildings. IITGN was also supported throughout this process by our "owner's architect", Design and Planning Counsel, who were our partners in all decision-making. This publication is one in a series that explains the complex decision-making, design, and construction process for the new campus. These publications have all been developed through a collaborative process involving all concerned: architects, consultants, and the IITGN community.

The publications in this series have been made possible because of several visits of Marjorie Greene to IITGN as a Scholar-in-Residence. During these visits she worked to systematically compile the various materials presented here, collaborating with IITGN colleagues as well as our architects and consultants.

ABOUT THIS PUBLICATION: This publication showcases the design of the housing that was built for staff and faculty on IITGN's new campus. Vatsu Shilpa Consultants were selected for this project. The following pages describe the design and construction of faculty and staff housing with the intention that it will be a handy reference for other architects and designers involved in similar projects.

[^0]
## EXECUTIVE SUMMARY

## Context

The modern city of Gandhinagar and the historical city of Ahmedabad provide the context for the architectural design of the housing complex. Gandhinagar represents the face of urban development and growth in Gujarat. Ahmedabad represents the rich architectural history of the region suggesting the elements and scale of the housing design.

## Site Layout

The site for this phase of staff and faculty housing covers 16 acres. The design clearly defined a central pedestrian spine through the housing, connecting green pockets at various scales. The intent of the design was to provide a variety of spaces of human scale, making the experience of walking through it akin to the experience of walking through the old city of Ahmedabad. The narrow pathways are a contemporary interpretation of the narrow streets of the po/s in Ahmedabad, while the wider spaces are intended to become community spaces, encouraging social and cultural activities.

## Cluster Housing

There are three types of housing units provided in the initial residential campus, for a total of 270 units. They are all built as low-rise clusters. Type A consists of 3 bedrooms, living and dining rooms with separate balconies, a study room, a multipurpose room and a kitchen with a utility balcony. Type B consists of 2 bedrooms, living and dining rooms with separate balconies, a study room and a kitchen with a utility balcony. Type C consists of 2 bedrooms, living and dining rooms with a common balcony and a kitchen with a utility balcony.

## Common Spaces

Lobby areas in the corridors of the clusters have built-in seating. These areas have been designed as extensions of the dwelling units in a manner that can be personalized by the occupants, contributing to the overall quality of the area and making it more lively and interactive.

## External Structures

The clusters have been finished with grit plaster and texture paint, with continuous horizontal and staggered vertical grooves, making the built mass more intricate. To break the monotony of the housing mass, utility structures are designed to add lightness and colour-these include the parking sheds, community pavilions, and entrance canopies, all designed with lightweight tubular steel with coloured polycarbonate sheet roofing.

Drawing on the housing in old Ahmedabad for inspiration, jalis embellish the staircase and lobby areas, windows, verandahs and kitchen utility balconies. Made of non-asbestos cement fibre boards, they not only enhance the look of the buildings but help to reduce heat gain and increase natural ventilation.

## Landscape Strategies

The landscaping of the site was guided by the arrangement of the clusters that form the central spine, with its green areas of varied scales. Plantings at different scales (shrub planters, smaller planting beds, green lawn areas, shade trees and flowering trees) help define public and private spaces and a range of outdoor activities.


## ACKNOWLEDGEMENTS

IITGN would like to acknowledge the contributions of all the stakeholders in the development of the IITGN permanent campus: architects, landscape architects, structural designers and consultants, IITGN engineers and other staff, Central Public Works Department (CPWD) engineers, contractors and the construction workers. Several IITGN faculty members have also been involved in the project from the beginning. The project would not have been possible without the effort and dedication of all these people. This project would also not have been possible without the financial support provided by the Government of India.


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## Introduction

Addressing the need for expansion of the Indian Institutes of Technology system, the Government of India has established a number of completely new institutes. This includes the Indian Institute of Technology Gandhinagar (IITGN), which became part of the system in the 2008-09 academic year. The Institute was initially housed on the premises of Vishwakarma Government Engineering College in Chandkheda, Ahmedabad, Gujarat. In July 2012, the Government of Gujarat provided a piece of land on the banks of the Sabarmati River at Palaj village, Gandhinagar District, measuring about 161 hectares (399 acres) for the IITGN permanent campus.

The campus development work was split into master planning and architectural design. The Masterplan development was completed by a consortium and the comprehensive architectural design was provided by architectural firms selected through a competitive architectural selection process. Separate architectural firms were selected to design the student hostels, the faculty and staff housing, and the academic buildings. Vastu Shilpa Consultants (VSC) was awarded the design of the faculty and staff housing of the campus. VSC conceptualized the design in a holistic manner, working in partnership with the IITGN community. The following pages describe this design.




## Concept

### 2.1. Site location

The site is located on the eastern bank of the Sabarmati River, across from the city of Gandhinagar and easily accessible from Ahmedabad, Gandhinagar and the GIFT (Gujarat International Finance Tec) city.

### 2.2. Urban and historic context

The modern context of Gandhinagar and the historical context of Ahmedabad play a vital role in the evolution of the architectural design of the housing campus. The city of Gandhinagar is the face of urban development and the growth of Gujarat as a state. Ahmedabad represents the historic development of a city within the given climatic context.

### 2.3. The climatic context

The main goal of climatic design, on a macro (settlement) and micro (building) level, is to reduce uncomfortable conditions created by extreme environmental factors; in the Gandhinagar context mainly heat and dust.

Buildings must be adapted to extreme summers and variations in day/night conditions to achieve a well-balanced indoor climate. During the summer months cooling is required to bring temperatures within comfortable limits. The intense radiation of the sun has to be tamed; glare from both direct and indirect exposure has to be filtered; protection from dust and flying insects is also needed. Settlements and buildings therefore have to be compact, providing shade and controllable ventilation.


Ahmedabad, through its traditional pol neighborhoods and houses, suggested the elements, scale and hierarchy of spaces used in the housing design. A contemporary interpretation of these elements such as narrow shaded pathways, internal courtyards, terraces and jali fenestration provides the architectural vocabulary of this design. The creation of a street network maintains the element of surprise that is found in the traditional Indian street, thus enhancing the spatial expressions envisioned by the master planner.

## Design Evolution

Though governed by the basic principles of the pol housing in the old city of Ahmedabad and climatic adaptability, the design of the site layout went through various permutations before arriving at the final option. Initially the overall residential area was divided into parts; a rectangular parcel towards the east covering approximately 15 acres and a triangular parcel of 25 acres above it. The triangular Parcel 1 housed the high-rise housing units and the rectangular Parcel 2 had the low-rise units. Initially 520 housing units were fit in Parcel 1 and 412 units in Parcel 2 respectively. The initial layout was then revised to accommodate 544 high rise units and 432 low rise units. Upon reviewing the initial proposals it was decided that the sectoral divisions in Parcel 2 were to be avoided since it covered more paving as well as restricted flexible parking options; and that Parcel 1 would be kept for future development in Phase 2 and Phase 1 would be a part of Parcel 2 facing the east. The remaining portion of Parcel 2 was renamed Parcel 3 and also kept for future development. The new Phase 1 parcel layout was further developed with various alternatives of housing, parking and entry layouts. Several options were also tried by modifying the peripheral road layout and accommodating different housing units. The parcel was again compressed with a new housing layout that started creating the initial idea of the central spine. Finally the parcel was modified into the current 16 acres of land housing 270 units for Phase 1.

## LEGEND (for sketches on facing page)

1. Initial proposal depicting high-rise Parcel 1 with 520 units and low-rise Parcel 2 with 412 units. Total area to be developed was approximately 40 acres
2. Proposal depicting high-rise Parcel 1 with 544 units and low-rise Parcel 2 with 432 units. The number of connections was increased between Parcel 1 and 2.
3. Proposal depicting the introduction of Phase 1 and 2 . Parcel 1 was assigned for future Phase 2 development and part of Parcel 2 was assigned for Phase 1.
4. Proposal depicting modification of the previous Phase 1 proposal in terms of entry points and parking.
5. Proposal depicting modification of the peripheral road layout to accommodate more housing units.
6. Proposal depicting a modified peripheral road layout with a road differentiating Parcel 1 and 2 to accommodate more housing units.
7. Proposal depicting a compressed Phase 1 parcel with the central spine and parking at the road periphery.
8. Final proposal covering 16 acres of land with the fully developed central spine and accommodating 270 housing units.



Site Layout

## Mifintirn

Spread over 16 acres of land, the design clearly defines a central pedestrian spine connecting housing of three different types.

The central pedestrian spine connects green pockets of various scales, encouraging social and cultural interaction. These spaces offer the possibility of a variety of activities and experiences for residents. The intent is to provide a variety of spaces of a human scale, making the experience of walking through it akin to what one feels in the streets of the old city of Ahmedabad.

Clusters were oriented after studying the sun-path and shadow pattern in the summer months and considering the prevalent wind movement directions. Thus the walkways that formed around the green spaces in the central spine remain shaded, creating public spaces with favourable temperature conditions.


[^1]

Overall site plan

2. PEDESTRIAN SPINE


## $\operatorname{coc}_{4}$




general and emergency vehicular access layout
Each housing cluster has access to an adjacent parking lot and is separated from parking through a buffer of green spaces. Parking and vehicular access is limited to the periphery of clusters, thus not interfering with the activities of internal areas.

Each cluster of housing is designed to have 9 individual units, with units varying from 100 to 230 square metres of area.

The central spine connects house clusters through courts of various scales, forming narrow and wide pedestrian walkways. Orientation of the clusters form intriguing spaces in the central spine, creating interest and curiosity among people who walk through it. These spaces of varied scale become gathering areas for people of different age groups, encouraging social activities reminiscent of that in the traditional pol housing clusters of Ahmedabad. Pathways and green spaces of varying scale thus form hierarchical community spaces in the spine, ideal for the extreme climatic conditions of the area.

Parking lots are located adjacent to the clusters, limiting the vehicular access to the periphery of the site. Thus, the central spine remains free of any vehicle circulation. But in the case of an emergency, these internal pathways can accommodate vehicles.



### 4.1. Intimate scale of spaces

Narrow pathways created in the central spine remain shaded during afternoon hours due to the house clusters located on either side. These narrow spaces then open into larger green areas of the central spine.


### 4.2. The wider spaces

The narrow shaded pathways in the central spine connect to the larger green courts and wider pathways around them. These larger green areas become community spaces encouraging social and cultural activities.

Even though the housing is dense, privacy is maintained through the placement of each building. The offsets and orientations are such that windows of different blocks and units do not face each other. The buildings are placed to create interesting spaces.
--- a current resident

## Cluster Types

### 5.1. Three Types

Each house type is a combination of three modules inter-linked through a series of public and semipublic spaces of varying sizes that include entrance lobbies, corridors and corridor lobbies. These spaces act as transition areas from the entrance lobby (public area) to the dwelling unit (private area) and also provide an opportunity for the chance meeting, thus encouraging social interaction. The vestibules at the entrances of all modules become a public space leading to the semi-public spaces of the living and dining rooms. Living and dining rooms at one end are in turn connected to the kitchen and utility areas and at the other end lead to the private spaces of the bedrooms. This organization of spaces ensures that the privacy of residents is not disturbed by the activities in the public and semi-public areas. There are no shared walls between any of the units.

Optimum room sizes are provided as per requirements that were specified by the IITGN community. Each module has an efficient floor plan. Each module of Cluster Type C consists of 2 bedrooms, living and dining rooms with common balcony and kitchen with utility balcony. Each module of Cluster Type B consists of 2 bedrooms, living and dining rooms with separate balconies, study room and kitchen with utility balcony. Each module of Cluster Type A consists of 3 bedrooms, living and dining rooms with separate balconies, study room, multipurpose room and kitchen with utility balcony. Cross ventilation is provided throughout all the units and they all have a compact layout to minimize unusable areas within each unit.

A kitchen garden area was provided with each ground floor unit. Residents are free to grow herbs, vegetables and fruit-bearing and flowering trees and shrubs.


Sketch highlighting transition of spaces within a typical module


## Sketch highlighting transition of spaces

within a typical cluster


Sketch highlighting cross-ventilation within a typical cluster

Sketch highlighting double-layer insulation effect within a typical cluster


Typical cluster plan for Type C



Axonometric view of typical unit Type C




Axonometric view of typical unit Type $B$




Axonometric view of typical unit Type $A$



### 5.2. The common spaces

There is a merging of indoor and outdoor spaces. Lobby areas in the corridors of the clusters are provided with built-in seating. These areas behave as an extension of the dwelling unit, designed in a manner which could be personalized by the occupants and thus contribute to the overall quality of the area, making it more lively and interactive, with its unique gathering space for residents and visitors. This encourages social interaction.

Given the hot and dry local weather, the design extensively uses buffer spaces such as balconies and built in wardrobes along with generous use of jalis to minimize heat gain in living area and bedrooms



Confined Masonry Construction Typology

In designing the new campus, the Masterplan envisaged the use of confined masonry for the construction typology for both the student hostels and the staff and faculty housing. This was the first application of engineered confined masonry construction in India for a large-scale project involving public buildings.

Confined masonry buildings are expected to have better earthquake performance than unreinforced masonry wall construction and reinforced concrete (RC) frames with infills. Evidence from numerous earthquakes in other countries indicates that good seismic performance can be achieved with confined masonry even without a high level of engineering, provided the quality of construction is maintained.


Housing during construction (Photograph by IIT Gandhinagar)

Confined masonry is a building technology that uses the same basic materials found in unreinforced masonry construction and RC frame construction with masonry infills, but with a different construction sequence and system. In confined masonry construction, the masonry walls carry the seismic loads and RC confining elements are used to confine the walls. These confining elements are critical to its better earthquake performance. They are effective in enhancing the stability, integrity and ductility of the masonry walls. This is in contrast to RC frame buildings with infills where the concrete frames are needed to carry the load. These RC frame buildings are more complex to design and build.

Confined masonry uses locally available materials and known construction technologies and is particularly appropriate for up to four-storey buildings. The faculty and staff housing buildings were ideal candidates for the adoption of this technology in terms of building height (three- and four-storey buildings) and
layout and a significant amount of walls relative to floor area (wall density). Confined masonry construction has also proven to be more economical compared to RC frame construction for the selected buildings.

A frame structure was adopted in certain critical areas (staircases). Clay bricks were used for the foundation and fly ash bricks, manufactured on site, were used for the walls above the plinth level.

This technology, construction details, and the challenges associated with its use for the campus housing buildings are discussed in more detail in a separate publication in this series, Confined Masonry for Residential Construction.


Housing during construction (Photograph by IIT Gandhinagar)


We are lucky to live in IIT Gandhinagar, it is so clean and beautiful, there are no chor (thief), there is nice music program with prizes and food, the designs on road (plantations) are very nice.....
--- a 6 year old current resident

## 7

## External Parcel Structures

### 7.1. Housing mass and lightweight utility structures

Clusters in the residential campus are finished with grit plaster and texture paint with continuous horizontal and staggered vertical grooves, thus making the built mass more intricate. To break the monotony of the housing mass, utility structures are designed to add lightness and colour to the campus. Parking sheds, community pavilions and entrance canopies are thus designed of lightweight tubular steel with coloured polycarbonate sheet roofing, to contrast with the mass of the buildings.


Lighting at housing, highlighting coloured polycarbonate sheet roofing (Photograph by IIT Gandhinagar)

### 7.2. Parking structures

The parking structures are a series of square modules of three different heights and are made out of a mild steel tubular structures with roofing of multi-cell polycarbonate sheets. Trellises are provided on the rooftop to support creepers, which are designed as part of the structure.


Parking structures (Photograph by IIT Gandhinagar)


Jali (Architectural rendering by Vastu Shilpa Consultants)

### 7.3. Jali

Jali screens are provided in the staircase and lobby areas, windows, verandahs and kitchen utility balconies. The design of the jali panel is modified and repeated in these spaces, creating interesting patterns. Jalis not only enhance the look of the buildings but also help to reduce heat gain and increase natural ventilation as well as diffuse light, making them particularly suitable for such extreme climatic conditions.

### 7.4. Community pavilion

The pavilion is a combination of four modules similar to those of the parking structures, which become a covered gathering space in the common lawn areas.


### 7.5. Canopies

Canopies are provided at the entrance lobbies of Cluster Types A and B, and are also an adaptation of the parking structures.


Canopies (Photograph by IIT Gandhinagar)

The details in the external structures contribute to our enjoyment in using the spaces. The colorful canopies and flowering vines are a pleasure to stand by waiting for my child's school bus, and the pavilion is a perfect place for exercise or small gatherings.
--- a current resident


Open spaces in Housing (Photograph by IIT Gandhinagar)


## Landscape Strategies

The landscape of the site is guided by the arrangement of the clusters forming the central spine, which has green areas of varied scales. Shrub planters are designed along the edges of the clusters to segregate pedestrian walkways from clusters, maintaining privacy for the residents. These shrub planters are extended in the internal circulation areas of the clusters forming small planter beds, thus integrating built-up and green areas. Common green areas of larger scales include large lawn areas, kids play areas and vegetable gardens. Larger lawn areas are useful for organising social and cultural events. The variety of spaces allow people of different ages to choose and indulge in desired social activities. Vegetable gardens in smaller green pockets provide usable greens for the residents. While each component of campus development included its own landscape plan, the landscape architect for the Masterplan also provided review and input to ensure a cohesive look to the landscaping of the entire campus. Thus many plants in the common areas are similar and the landscaping is consistent.


Typical landscape layout

### 8.1. Tree plantation

A mix of different species of trees suitable to the local climate are provided along the central spine and on the periphery of the site. Trees with good foliage are carefully chosen to provide shade along the pathways and relief spaces for summers. Along with it, flower bearing trees are added at strategic locations to add colour and also to bring change in the mood of the residential campus with every passing season. Certain species of trees are specifically provided in the green pockets to generate gathering spaces, which with time will give unique identity to the area.


Neem tree at Housing (Photograph by IIT Gandhinagar)


Plantation at Housing (Photograph by IIT Gandhinagar)

### 8.2. External services

The service networks of the clusters connect to the main network for the entire campus by passing through the central spine. For the surface water drainage from the central spine and parking areas, a network of catchpits is provided that collects the surface water and then transfers it to the main water treatment plant of the campus. Rooftop rainwater is being taken through a separate network to harvesting tanks throughout the campus.


Typical drainage layout

### 8.3. Barrier-free environment

A barrier-free environment is a space or a set of services that makes the designed campus accessible to all. Ensuring barrier-free access is a basic social necessity. The faculty housing design was conceptualized incorporating aspects of a barrier-free environment along with other facilities. Hence, clusters are provided with ramps, space for lifts (even though at this stage no lifts have been provided), and sufficient widths for internal circulation.


Typical cluster plan highlighting barrier-free access

## Project Details

### 9.1. Wall finishes

External walls are finished with washed stone grit plaster up to the ground floor lintel level and with texture paint from there on up to the terrace parapet level.

Internal walls for corridors and all rooms are finished with smooth plaster and premium acrylic emulsion paint.


Wall finishes (Photograph by IIT Gandhinagar)

The small features in the apartment contribute to its charm. The use of wooden materials for the windows and doors, the unpolished tiles, the natural light give it an older charm in a modern setting. Even the smallest bedroom has two windows.
--- a current resident


Photograph by IIT Gandhinagar

### 9.2. Jali screens

Jali screens are provided at windows, kitchen utility balconies, verandahs and staircase lobbies. They are made out of non-asbestos cement fibre board fixed on mild steel hollow square sections.


Jali screen (Photograph by IIT Gandhinagar)

### 9.3. Flooring

All corridor floors are of polished kota stone, all room floors of matte-finished vitrified tiles and all toilet floors of glazed ceramic tiles.

### 9.4. Interiors

All doors and window frames are of teakwood. The main entrances to all houses have teakwood panel doors. Rooms have flush doors with veneer and toilets have flush doors with laminate. All window shutters are of teakwood with glass panels. All doors and windows have a melamine polish finish.


Interiors (Photograph by IIT Gandhinagar)

### 9.5. Wardrobes \& Kitchen Cabinets

In all houses, wardrobes and kitchen cabinets are of plywood box with laminate on the front and painted on the inside.


Wardrobes (Photograph by IIT Gandhinagar)


Kitchen cabinets (Photograph by IIT Gandhinagar)

### 9.6. Ceilings

All corridors have exposed RCC ceilings. The rooms of houses have a premium acrylic emulsion paint finish and the toilets of houses have false ceilings of moisture-resistant non-asbestos cement fibre board.


External development at housing blocks (Photograph by IIT Gandhinagar)

### 9.7. External development

The parking sheds, community pavilions, and entrance canopies are made of mild steel, the hollow circular sections with epoxy paint finish and with a multi-cell polycarbonate sheet as roofing material. The trellises for these structures are made of mild steel square hollow sections with epoxy paint finish.

### 9.8. Landscape and irrigation

Ground cover, shrubs and trees of different varieties suitable to the local climate have been provided. Pedestrian walkways have been paved with shot-blasted concrete cobbles and parking areas are paved with shot-blasted concrete interlocking paver blocks. Kerb stones are provided at the edges of softscape and hardscape. All ramps are provided with rough kota stone flooring in strips. Green areas are provided with sprinkler systems with different sprinklers as per their spread radius and sizes and the types of green areas. Sufficient provision is made for surface drainage through a system of suitably located catchpits and grids of sufficient diameter drainage pipes.

### 9.9. Mechanical electrical and plumbing (MEP) services

MEP services include providing internal electrification of the buildings as well as the power distribution system, solar water heater system, power provision for split unit AC, street lighting and signages, firefighting hydrant system, water supply lines, sewer lines and storm water drains. A low voltage system facility includes data networking, telephone system, and external fiber network connectivity. Rooftop rainwater is taken through a separate piping network to the main harvesting tanks for the entire campus.

## Credits

| Owner | Indian Institute of Technology Gandhinagar |
| :---: | :---: |
| Advisor Works | Mr. Nagaraja B. N. (up to 30-04-2013) |
|  | Mr. L. P. Srivastava (from 05-06-2013) |
| Owner's Architect | Mr. Shobhit Tayal, Design and Planning Counsel Pvt. Ltd., Ahmedabad |
| Owner's Engineer | Mr. A. K. Kothari, Superintending Engineer (up to 28-01-2013) |
|  | Mr. G. C. Chaudhary, Superintending Engineer (from 04-02-2014) |
| Confined Masonry Experts | Prof. Svetlana Brzev, British Columbia Institute of Technology |
|  | Prof. Durgesh Rai, IIT Kanpur |
| Structural Peer Review | Prof. Indrajit Ghosh, Civil Engineering |
|  | Prof. Dhiman Basu, Civil Engineering |
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|  | Prof. Jaison A Manjaly, Humanities \& Social Sciences |
|  | Prof. Anulekha Dhara, Mathematics |
|  | Prof. Sriram Kanvah Gundimeda, Chemistry |
| Principal Architect | M/S Vastu Shilpa Consultants |
| Structural Consultant | M/s N K Shah Consulting Engineers, Ahmedabad |
| MEP Consultant | M/s Jhaveri Associates, Ahmedabad |
| Landscape Consultant | M/s lora Studio, Ahmedabad |
| Project Management | Central Public Works Department (CPWD), Government of India |
| Project Manager | Mr. L. K. Bhargava, Superintending Engineer (up to 29-01-2016) |
|  | Mr. Kapil Deo Narayan, Superintending Engineer (from 29-01-2016) |
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Chief Engineer (Capital), Roads \& Buildings Dept, Government of Gujarat, Ahmedabad (2009-2012)
Director (TS-I), Ministry of Human Resource Development Government of India, New Delhi (2009-2011)

Shri A. K. Jain, Former Special Director General, CPWD New Delhi (2012 - present)

Shri L. P. Srivastava, Former Additional Director General, CPWD \& Advisor (Works), IITGN (2012 - present)

Prof Ashwini Kumar, Professor-in-Charge,
Planning \& Resources, IITGN (2012-2014)
Prof Harish P. M., Dean (Campus Development), IITGN (2014 - present)
Dr Prabhat Kumar, Former CMD, Bharatiya Nabhikiya Vidyut Nigam Ltd, Kalpakkam, (2012-2016)
Shri M. B. Bhalala, Former Chief Engineer, Road \& Building Department, Government of Gujarat (2016 - present)

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Shri A. K. Jain, Former Special Director General, CPWD, New Delhi
Shri Kiran S. Wagh, Chief Advisor (Civil Infrastructure), IIT Bombay
Shri Prabhat Kumar, Former CMD, Bharatiya Nabhikiya Vidyut Nigam Ltd, Kalpakkam (up to January 2016)

Shri Balraj Chadha, Chief Engineer, CPWD, Gandhinagar (up to May 2016)
Shri A. K. Agarwal, Chief Engineer, CPWD, Gandhinagar (July 2016 - present)
Shri Laksh Bhargava, Project Manager, CPWD (up to January 2016)



This publication is one in a series describing the development of IIT Gandhinagar's campus on the bank of the River Sabarmati in Gandhinagar. The campus development provided numerous opportunities for innovation and the series is meant to document these.

The focus of this document is on the design of the initial phase of housing that was built for staff and faculty. The site for this initial design covers 16 acres, with a central pedestrian spine connecting green pockets. The narrow pathways are a contemporary interpretation of the narrow streets of the pols in Ahmedabad, while the wider spaces are intended to encourage community interaction. This publication describes the site layout and the types of housing units as well as the common spaces, the external structures and the landscape strategies for this housing.

Copies can be obtained by writing to the librarian@iitgn.ac.in


INDIAN INSTITUTE OF TECHNOLOGY GANDHINAGAR PALAJ, GANDHINAGAR - 382355



[^0]:    Sudhir K Jain
    Director and Professor
    Indian Institute of Technology Gandhinagar

[^1]:    NET EFFECTIVE SHADED AREA DURING SUMMER

