

DIGITAL ARCHITECTURE- A Revolutionary Approach

PROPOSED INSTITUTE FOR
RESEARCH AND DEVELOPMENT
IN DIGITAL ARCHITECTURE

By

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A REPORT

Submitted in partial fulfillment of the requirements for the degree of
Bachelor of Architecture.



University of Mumbai

2017

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AIKTC     

SCHOOL OF ARCHITECTURE

CERTIFICATE

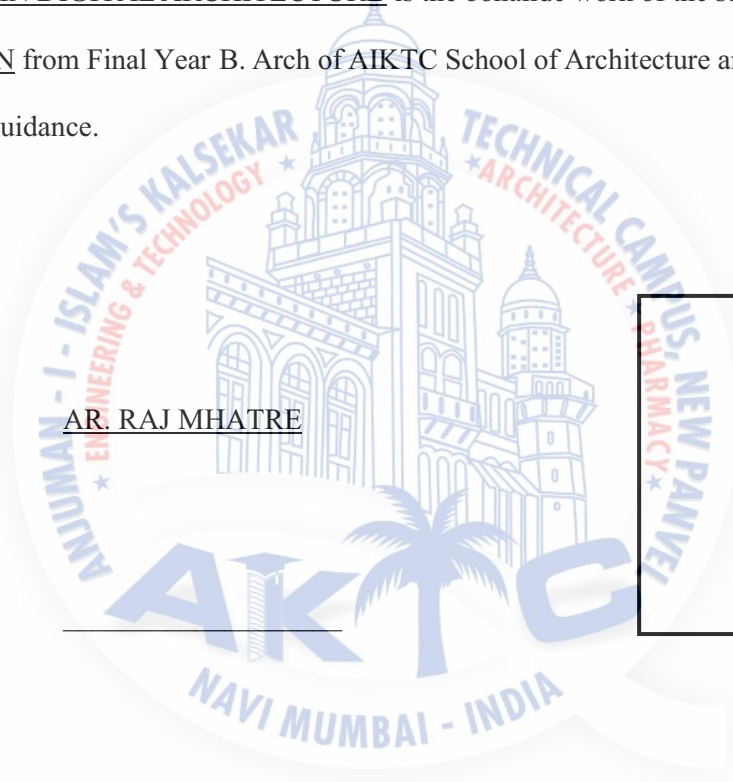
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Name of the guide: AR. RAJ MHATRE

Sign of the Dean: _____

Date:



DECLARATION

I hereby declare that this written submission entitled

“INSTITUTE FOR RESEARCH AND DEVELOPMENT IN DIGITAL ARCHITECTURE”

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Signature of the Student:

Name of the Student: SIDDHARTH JAIN

Roll No: 13ARC12

Date:

Place:

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As I present this dissertation, I would like to express my gratitude to everyone who helped me with formulation and creation of this project without whom this project would not have been possible.

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I can never thank my family enough for the immense confidence and trust they have constantly shown towards me. I want to take this opportunity to express my deepest gratitude to my parents.

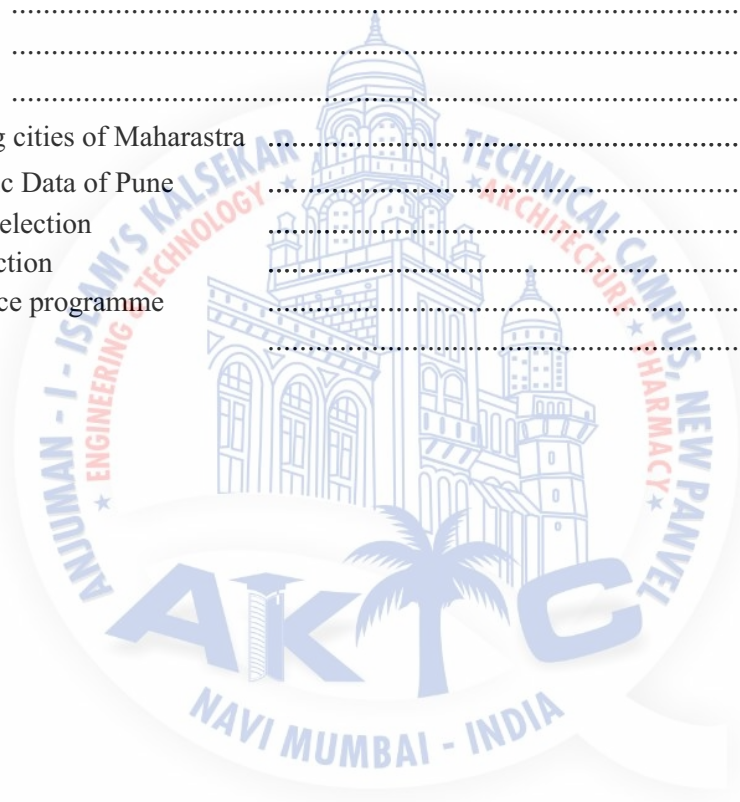
I thank Juned Shaikh, Nida Chikte, Anish Potdar for all the good times and the much needed breaks! I thank Ruhma Ukaye for being an immeasurable support system and help towards the completion of this book. I thank them all for the thought provoking discussions and helping me meet the deadlines!

I thank the authorities of Makers Asylum, Mumbai, Singhad COA, BNCA and Suzlon One Earth, Pune to for their support and guidance in my project.

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Abstract:

Digital architecture with its significant applications have been a catalyst in changing the way we live and aspire to. The term “Digital Architecture” has been coined by William Gibson in 1984. Many firms all over the world have been practising, experimenting and researching in this field, but all are in silo’s.

Based on discussions and talks with experts in the field we might infer that many institutes started experimenting and adding this field as a post graduation program, but very few excelled, but many were shut down because they were not able to produce practical output. The main reason behind shutting the programs were that everyone started a program in the existing college of architecture where most of them had it like an extension to their existing programs.

This experiment which were add-ons; the institutes didn't had enough resources and expertise to execute the innovative ideas in the past.

With the technological advancements, digital architecture covers a wide range of topics under its roof which spreads from product level to urban level projects.

Under digital architecture many topics are covered such as

- Intelligent cities
- Self sufficient buildings
- Intelligent construction
- Computational design
- Self sufficient habitats
- Bionic architecture
- Fractal architecture
- 3-D printed buildings
- Living systems
- Virtual Reality and Augmented Reality
- And Many more.

With this wide range of palette it has a wide scope of expanding from a course to a full fledged institute which has its prime focus in research and development of existing and future possibilities of this field. It is a creative field where it always looks for something new and innovative, because conscious, premeditated design process has been here for thousands of years, parametric modelling introduces new input to the process, thus has potential of yielding innovation.

Nature has always been giving us inspiration and ideas for the field of innovation. It has always helped us in giving new ways of living and green solutions for the future. It is constantly giving us environmental, economic and health & community benefits. Bionic architecture draws inspiration from nature to create innovative forms which are functional and practical both. Amalgamation of Bionic architecture and Digital architecture can lead to create much efficient and innovative structures.

In Indian context, there are many colleges which teach different aspects of Digital architecture but they all are scattered. Few of the colleges are IIT IDC, CEDAC, Xavier's college and many multimedia institutes. There are two colleges which teach this field in educational programs for M.Arch and none of them have been successful in producing practical outputs (based on the inferences from case studies) which can help students understand the depth and importance of this field in future. Even there are very few firms which have been practising and researching in this field. Resources are very limited in India which leads to Indian students shift to other countries in search of knowledge.

Proposed thesis is more towards on experimental basis for creating an institute for research and development in digital architecture which can provide the lacking resources to the needful and help promoting the field of Digital Architecture in India. The architectural expression of the institute will work towards blending bionic architecture and digital architecture, because when nature and technology goes hand in hand with each other, it can give a better output.

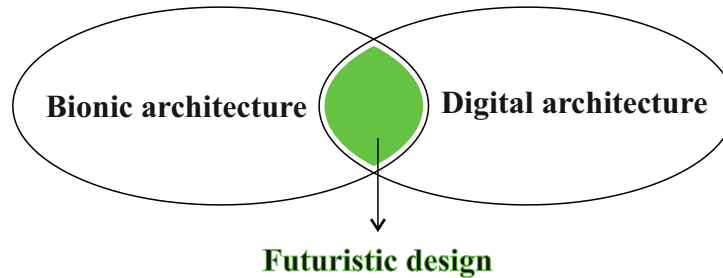


Chapter 2.1 Introduction

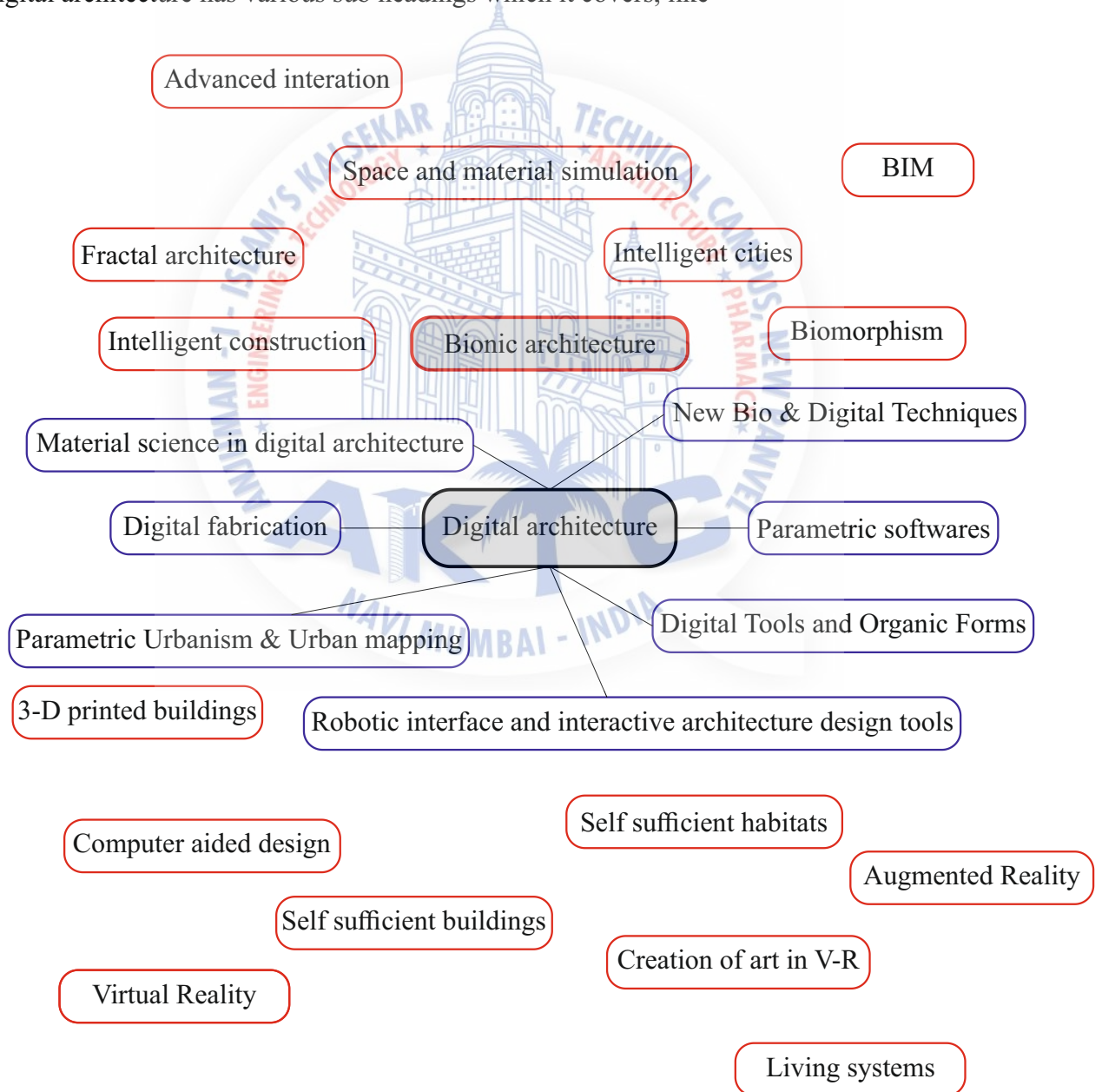
Summarizing the Essence and Scope of Digital Architecture with respect to multiple perspectives of the field.

Introduction

Bionic-architecture and Digital architecture are seen in silo's till now. Each of these fields have reached to enormous levels of innovation. Conventional design processes have been here from years, hence Parametric modelling allows yielding innovation. Parametric design uses Bionic Architecture as an inspiration to develop better forms. Digital architecture helps in yielding faster, efficient and innovative designs.



Digital architecture has various sub headings which it covers, like



Legend



In spite of these, Digital tools like Virtual Reality has also advanced where Google tilt Brush, enables anyone to create art in Virtual world, Vivid imaginations which are not bound by time and spaces results in creative creations by people. Virtual reality also enables Architects to simulate and let users experience the 3d virtual model in Time where it can simulate real time effects for better understandings.

3-D printers are now capable of printing our imaginations into real world, so what if we create vivid and innovative ideas in Virtual world and let 3-D printers Bring it to our real world.

The institute will offer an Course and workshops for all these fields which could enable, not only Architects but Engineers and Artists also to learn and simulate these various techniques.

Institute purely looks at how can Sustainability and Bio-digital architecture can be clubbed together to create Futuristic Institutes for all. Institute can also contain various programs where local public could also interact and get to know more about Sustainability and other aspects.

The above mentioned nearly covers of what digital architecture covers in academic field and what are its future potential add-ons.

In India, Only 2 colleges teach digital architecture as a master's program which are Sinhgad COA, Pune and BNCA, Pune. Even if this field holds potential and many people wish to learn more about this field, but they don't have enough access to these resources, which is leading to giving less importance to this field.

There are many reasons because of which this field is not booming in India:

1. **Lack of Education sources:** there are very few institutes which teach focus mainly on digital architecture. This is leading to students migrate to different countries in search of knowledge regarding this topic and people are experimenting and executing these type of projects outside India.

2. **Lack of Tools and Machinery:** In entire India there is only one Fablab which is in BNCA, Pune which is used to educate people regarding these future technologies. There are few alternative education sources like Makers Asylum which gives people access to these machineries to research, innovate, and execute their ideas and turn them into reality.

3. **Lack of Practical execution:** Very few firms in India practice and execute Projects in the field of digital architecture, and they are

A. Nudes, Mumbai.

B. Morphogenesis, New Delhi.

C. Rat[LAB] - Research in Architecture & Technology, New Delhi.

The only reason is that people don't practice this field much is because of its execution cost factor, due to lack of machineries and expertise cost of these projects goes very high.

4. **Cost factor:** If there were many tools and machineries made available to the public, then the cost factor of these projects would have gone down drastically leading to increase in demand for these projects.

Aim : Amalgamation of Bionic and Digital Architecture to create futuristic institute

Objectives :

- To study different aspects of Digital Architecture and its implications
- To study different technologies which can act as plugins to develop Digital Architecture further.
- To study different aspects of Bionics which can help Digital Architecture to perform efficiently.
- To provide lacking resources to create an institute for digital architecture
- **Scope :**
- The institute offers a space for architects, artists and engineers to experiment and innovate in the field of digital architecture.
- It will help the users to transform their vivid imaginations of virtual world into the real world.
- The program can be divided into 40-60 ratio where 40% can consist of institute for learning and 60% can consist of experimental areas and a green park where all the exhibits could be made available to public for awareness in Digital architecture.

Limitations:

- This technology is not available to all and very few architects are aware about it.
- This research is more towards experimental basis.
- So the output would be 100% workable or not is still a question
- Cost of this technology is very high, hence very few use it.

Need for this Institute in Indian context:

By looking at its background, it clearly states that this field of architecture holds a lot of potential to grow and help in innovation of new ideas. It gives a lot of opportunities for research, execution, learning new tools and provide an alternative to conventional architecture. But due to lack of resources masses are not able to understand its importance and hence there is a need for a place where all the aspects of education, execution, tools and machinery are present under one roof.

Hence to promote digital architecture and open new doors for professionals from varied backgrounds, i.e architects, engineers and artists, the thesis proposes a module for an Institute For Research And Development In Digital Architecture and after looking at its post occupancy analysis, where it can be repeated in other parts of India for expanding its reach for the people.

When this institute will open its doors for the masses, it can provide those lacking resources to the people. It will open doors for people to experiment in this field and find cost effective ways to execute any projects related to this field. It can help train professionals not only for its design processes but as well as have knowledge of executing these projects. The institute will provide spaces for the students to work, research, execute and also exhibit their work to the masses.

When more and more people will start knowing about this field then it can showcase how can it be cost effective and help to innovate new ideas.

Research methodology :

- Basic Research: to understand the depth of Digital architecture.
- Why it is important and how can it help in future.
- Historical research: To trace down the history and its roots so that it would help in the development in future.
- Experimental Research: how can it be made user friendly.
- How can it be made cost effective.
- To study its sphere of influence in different fields of architecture

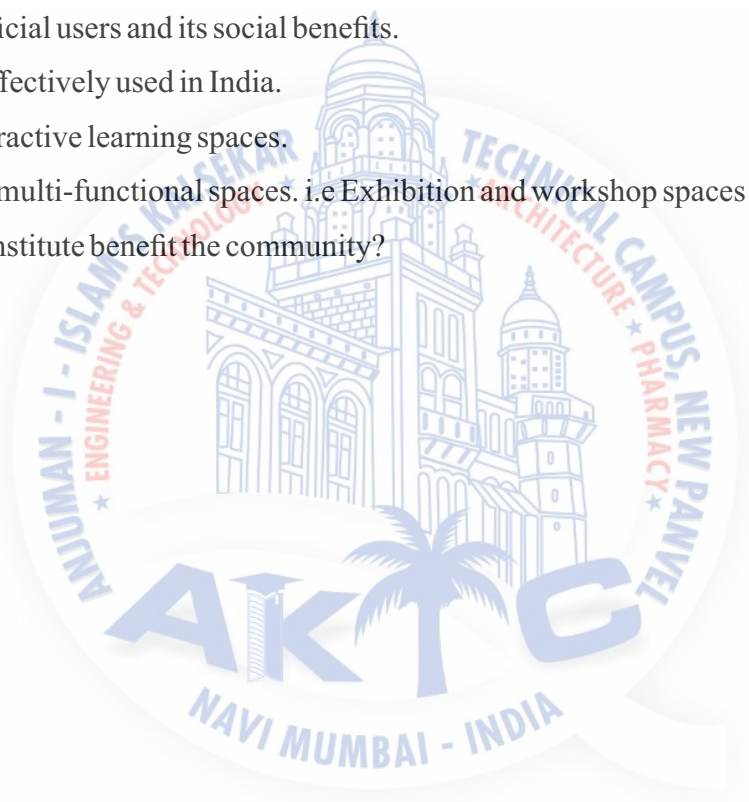
1. Product design.

2. Small scale to Big Architectural projects.

3. Social Projects, etc.

To study its beneficial users and its social benefits.

- Why it is not effectively used in India.
- Exploring interactive learning spaces.
- Collaborating multi-functional spaces. i.e Exhibition and workshop spaces
- How can this institute benefit the community?





Chapter 3.1 Literature Review

In a nutshell, explaining the key words and the jargon of digital architecture.

Literature review

Definations and descriptions

Digital architecture?

Digital Architecture is a field of engineering that utilises digital media in the process of its architectural design. Digital Architecture will help in designing the concept, design development, and detail designing of the architecture's form.

Source:<https://www.careerindia.com/courses/unique-courses/what-is-digital-architecture-015089.html>

Digital architecture uses computer modeling, programming, simulation and imaging to create both virtual forms and physical structures.

Source:https://en.wikipedia.org/wiki/Digital_architecture

Parametric design?

Parametric design is a process based on algorithmic thinking that enables the expression of parameters and rules that, together, define, encode and clarify the relationship between design intent and design response.

Source:https://en.wikipedia.org/wiki/Parametric_design

Virtual Reality?

The computer-generated simulation of a three-dimensional image or environment that can be interacted with in a seemingly real or physical way by a person using special electronic equipment, such as a helmet with a screen inside or gloves fitted with sensors.

Source: Google Dictionary

Augmented Reality?

A technology that superimposes a computer-generated image on a user's view of the real world, thus providing a composite view.

Source: Google Dictionary

3-D Printer?

A printer attached to a computer, that can make a solid object from a digital model by printing many separate layers of the object. With this state-of-the-art 3-D printer you can turn your ideas into real objects.

Source: <http://dictionary.cambridge.org/dictionary/english/3-d-printer>

CNC Machine?

CNC means Computer Numerical Control. This means a computer converts the design produced by Computer Aided Design software (CAD), into numbers. The numbers can be considered to be the coordinates of a graph and they control the movement of the cutter. In this way the computer controls the cutting and shaping of the material.

Source: <http://www.technologystudent.com/cam/cnccut1.html>





Chapter 3.2 Articles

Expressing digital architecture from the columns of professional experts. This chapter broadly summarizes the potential of Digital architecture.

Articles by Other authors**Exploring The Mind-Blowing Realm Of Digital Architecture**

Source:<https://www.forbes.com/sites/quora/2016/06/03/exploring-the-mind-blowing-realm-of-digital-architecture/#77902ff170fe>

Summary: The articles broadly speaks about the integration of architecture and digital world. It speaks about the benefits of it and how it can benefit many users like architects, client, contractor, the city and realtors.

The integration of architecture and digital realms has endless opportunities, according to Leah Alissa Bayer, architect-in-testing in Silicon Valley. They research in the field of digital architecture and how can it grow more.

It also speaks about how the communication between an architect and the client can be made better, how can it help in design process and a better execution of the project.

It gives some examples of how digital architecture can give produce better results.

1. Realistic renderings and walkthrough, how can it give clients a better understanding of built environment.
2. Intelligent technologies: how does the softwares help us to design more environment friendly designs by doing simulations which tell us more about real life problems which might occur in the post design execution, hence it helps in providing better solutions.
3. Innovation in softwares and tools: Powerful algorithms and computational development created the latest movement, parametric design, allow for innovative structural forms we've never built before. 3D printing, has been a huge player in freeing us from typical construction of prescriptive forms and moving us towards low-waste, on-site robotic manufacturing of extraordinarily advanced, adaptive, and precise structures informed by real-life contextual conditions and user needs.

It overall tells us about the potential digital architecture holds in the future.

The dawn of the virtual reality in architecture | Gunita Kulikovska | TEDxRiga

Source:https://www.youtube.com/watch?v=-KGPf_PM8gQ

Summary: Virtual Reality in Architecture

1. A better ability to think in 3-D
2. it is not just a presentation tool but it can be more educative.
3. it can increase capacity of our brain to understand the drawings and designs in a more better way.
4. it connects humans with architecture in a profound way which we have never seen before.

Advantages of VR check: Less wastage of materials, resources, man-hours on building false expectations

It brings that vivid vision of space into life



Creation of art in Virtual Reality

Digital tools like Virtual Reality has also advanced where Google tilt Brush, enables anyone to create art in Virtual world, Vivid imaginations which are not bound by time and spaces results in creative creations by people. Virtual reality also enables Architects to simulate and let users experience the 3d virtual model in Time where it can simulate real time effects for better understandings.



Fig. 1; *Source: Google images/Google tilt brush*



Chapter 4 Case Studies

A compilation of study and analysis of projects involving the strategies and applications of Digital architecture on different scales. This section sums up the detailed comparative study of design programs across India and overseas.



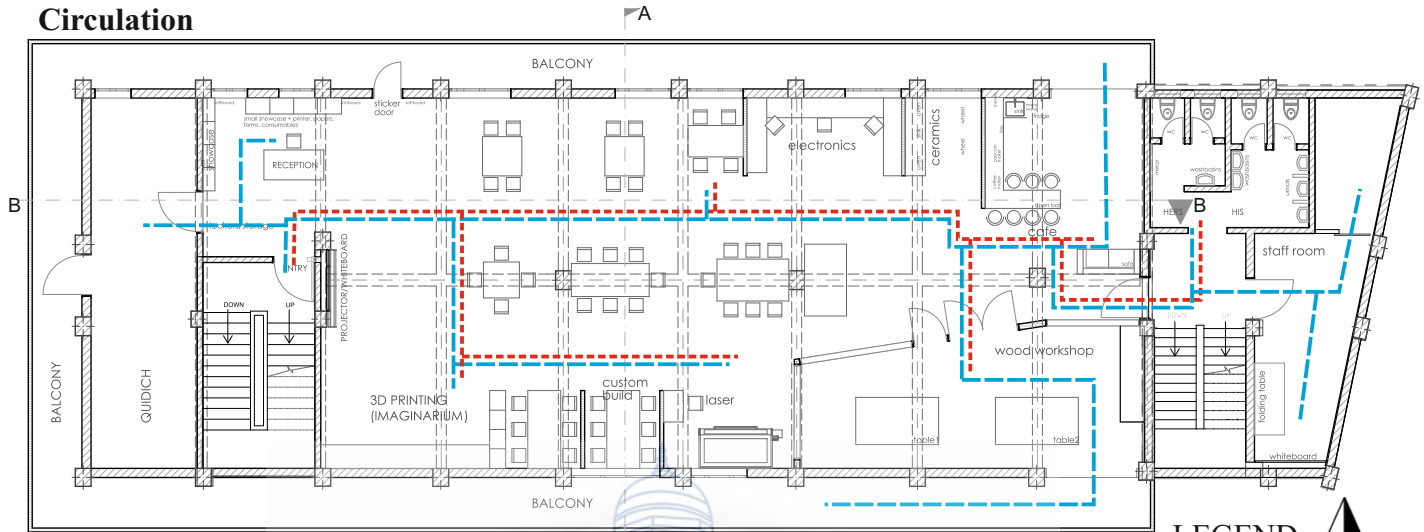
MAKER'S ASYLUM, ANDHERI, MUMBAI

Maker's Asylum is a community makerspace to get your hands dirty and make your ideas happen.

WHY? To study fabrication lab used in public sector

Maker's Asylum Andheri- 6000 sq.ft lab
Maker's Asylum Delhi - 2000 sq.ft lab

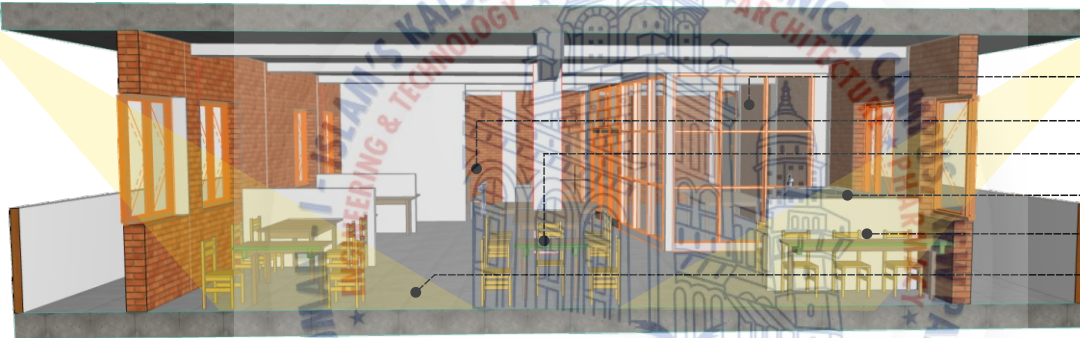
Circulation



PLAN

(SCALE: 1:200)

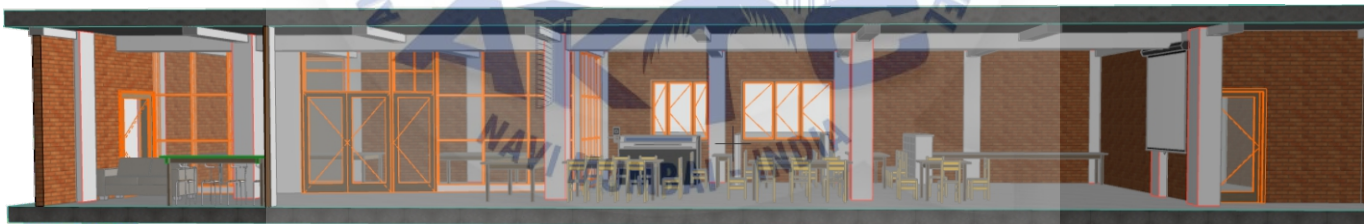
Space analysis



SECTION A-A'

(SCALE 1:100)

- Woodworking lab
- Café
- Regular
- Laser cutting area
- Private
- Studio



SECTION B-B'

(SCALE 1:200)

TYPES OF WORKSPACES



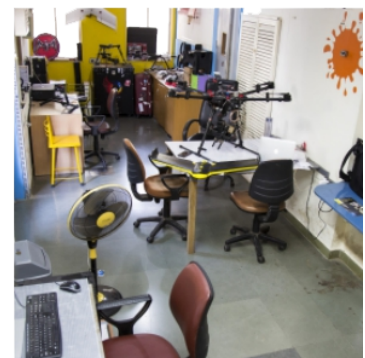
REGULAR

Ideal for individual makers, students, or professionals who need a space to work or make a mess.



STUDIO

Ideal for small teams or even individual designers, artists or anyone else who needs a small, dedicated booth.

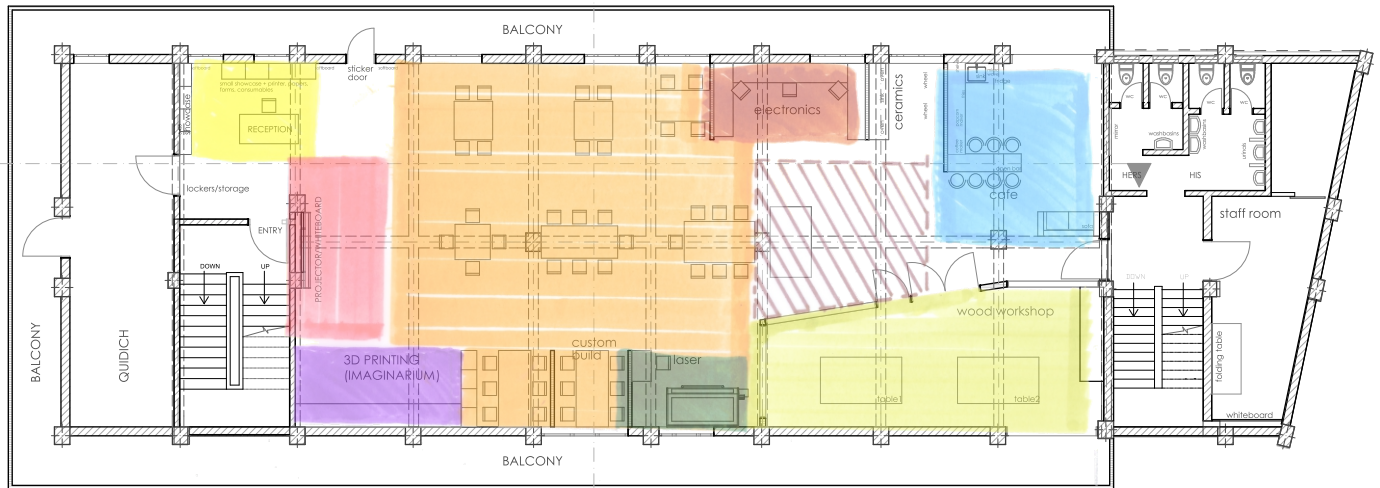


PRIVATE

Ideal for large teams working on hardware, software, social innovation or architecture.

AREA ZONNING

Site area: 560 sq.m



SPACE PROGRAM

- RECEPTION: 8.6 m²
- LECTURE AREA: 8 m²
- 3-D PRINTING ZONE- 10 m²
- RESEARCH ZONE- 66 m²
- LASER CUTTING ZONE - 9 m²
- WOOD-WORKING LAB- 28 m²
- CAFÉ ZONE- 18 m²
- RECEPTION AREA- 8.6 m²

Types of users

- Owner
- Space manager
- Students
- Professionals
- Kids
- Anyone who loves to build

LEGEND

- Reception
- Research Zone
- Lecture Area
- 3D-Printing
- Electronics Lab
- Wood working lab
- Laser Cutting
- Cafe
- Breakout Space.

Axillary spaces required:

- Quiet space for Reading and Working
- Separate Fabrication lab
- Exhaust for laser cutting and CNC

- 3D printers help only in Prototyping. Not for Large scale project
- No Space for large Printers for Large scale projects.
- Optimum Use of space

•Capacity:-

- 30 people (work)
- 50 people (lectures)
- Flexible space planning
- Research + Fabrication Lab = Output ↑

- Inter-disciplinary collaoration
- Fun
- Learn
- Experiment
- A place where ideas are converted into reality



• Aspirations of Users (Add on)

- textile lab - Ceramic lab - Robotic Arm



LABS

OVERVIEW

WORKSPACE

6,000 sq.ft. of space, wifi, work tables, rooftop, a pantry with a fridge full of drinks and some kickass labs for work and fun.



Woodworking
Powered By
Bosch & Dremel



Electronics



3D Printing
Powered By
Imaginarium



Laser Cutting



LASER CUTTING MACHINE



3-D PRINTING MACHINE



WOOD-WORKING LAB- OUTSIDE



WOOD-WORKING LAB-INSIDE



LECTURE SPACE

Fig.2; Source for images: ©Maker's Asylum official facebook page

BNCA, PUNE

WHY? To study course module taught in india

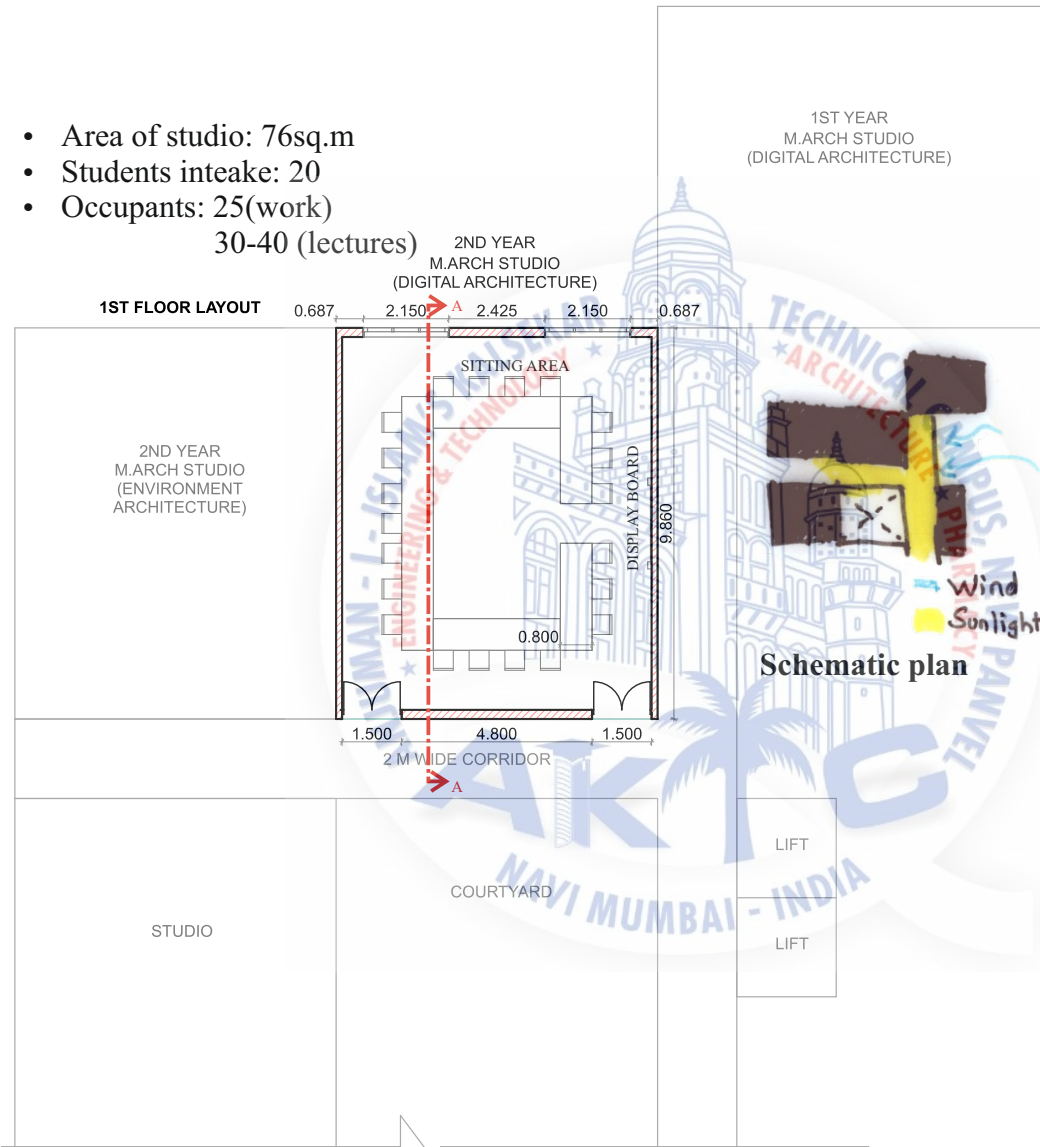
MASTERS IN DIGITAL ARCHITECTURE

- It started in 2013
- The major focus is on-
 - Process theories in Digital Architecture
 - Parametric Software skill sets
 - Digital fabrication and material research
 - Digital Design
 - Robotic interface and interactive architecture Design Tools
- It is a visiting school for AA school, London

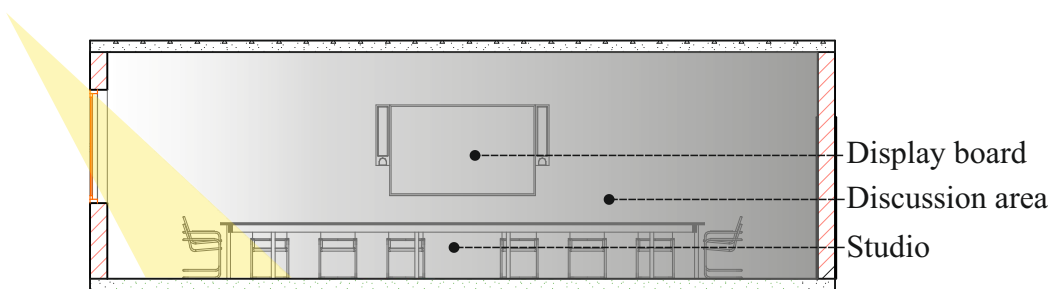
- Area of studio: 76sq.m
- Students intake: 20
- Occupants: 25(work)
30-40 (lectures)

COURSE MODULE

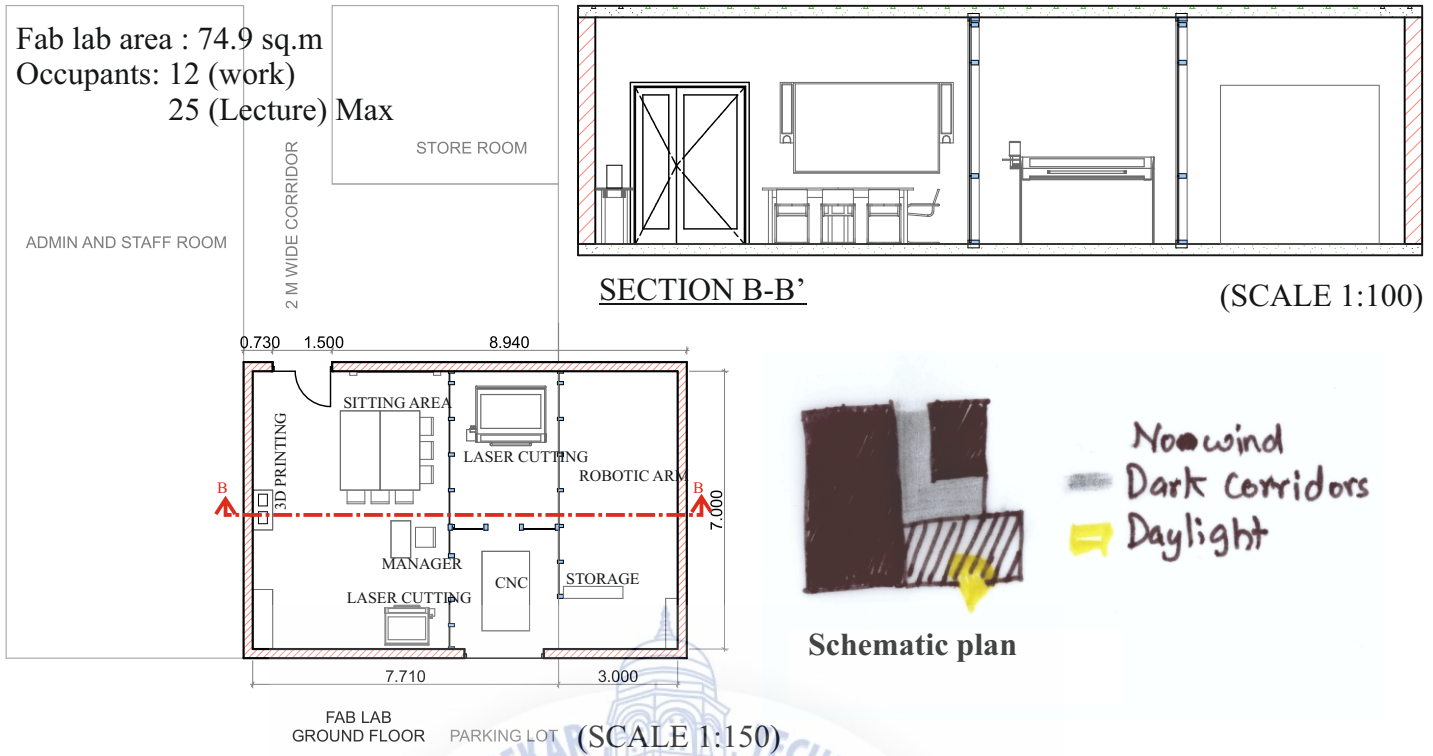
SEM I	
DA - T1	Digital Architecture Process Theories and History 2
DA - T2	Digital Architecture & Psychology
DA - F1	Digital Fabrication 1
DA - S1	Parametric Software's
DA - DS1 /DS2	Digital Design Studio I
DA-DT1/DT2	Digital Theory Studio I
SEM II	
DA - T3	Digital Architecture Process Theories and History 2
DA - T4	Material science and Digital Architecture
DA - F2	Digital Fabrication 2
DA - S2	Analysis Software's
DA-DS3/DS4	Digital Design Studio II
DA-DT3/DT4	Digital Theory Studio II
SEM III	
DA - T5	Research in DA
DA - T6	Parametric Urbanism and Urban Mapping
DA - F3	Digital Fabrication 3 (Installation)
DA - T7	Workshops And Seminars
DA-DS5/DS6	Digital Design Studio III
DA-DT5/DT6	Digital theory Studio III
SEM IV	
DA - S7	Thesis Design Studio
DA - T8	Culmination of Old and New Theories in Architecture



LEARNING STUDIO (SCALE 1:150)



SECTION A-A' (SCALE 1:100)



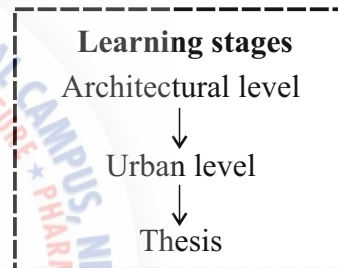
DIGITAL FABRICATION LAB PLAN

Aspirations of users

- Bigger Fab lab
- VR lab
- Simulation room
- Holographic Projection

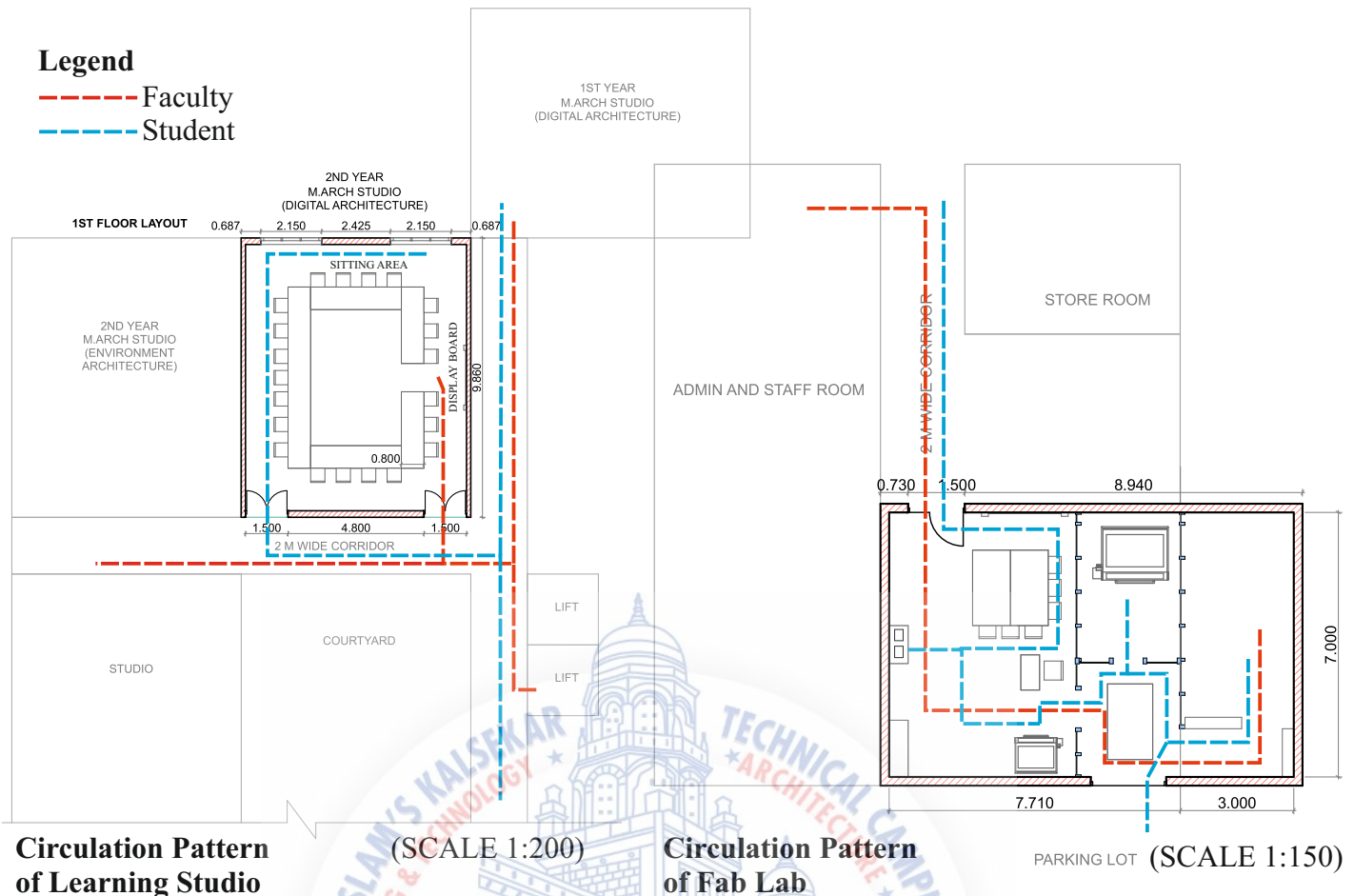
Topics Covered in teaching

- Canopies
- Furniture
- Prototyping



EQUIPMENTS AVAILABLE IN FABRICATION LAB

SR NO	NAME OF THE MACHINE	SIZE OF THE MACHINE	USAGE OF THE MACHINE
1.	Large scale laser cutter TIL - 1360	900mm x 1200mm	real scale project development such as furniture, structures etc.
2.	Large Scale CNC Cutting and Miling Machine	1200mm x 1200mm	real scale project development such as furniture, architectural prototyping etc.
3.	3D printer – PRINTDEL 3D MAX	300mm x 225mm x 200mm	real scale project development such as furniture, architectural prototyping etc
4.	GCC Spirit Laser Cutting Machine	460mm x 740mm	real scale project development such as furniture, architectural prototyping etc
5.	KUKA Robotic arm	2100mm x 2100mm x 2100 mm	Industrial jobs like cutting, miling, range of pick and place operations.

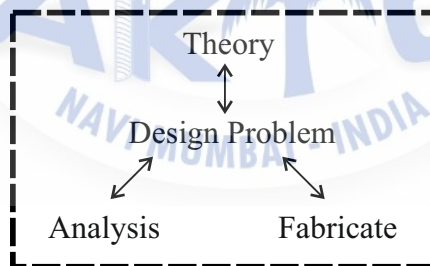


Merits:

- Only institute to have an robotic arm to make large scale project.
- Leading institute in India for Digital Architecture

Space v/s functionality:

- Studio not designed for Digital architecture course.
- Non-contextual design
- No exhaust in Fab lab
- Only Fab Lab in India used for education purpose

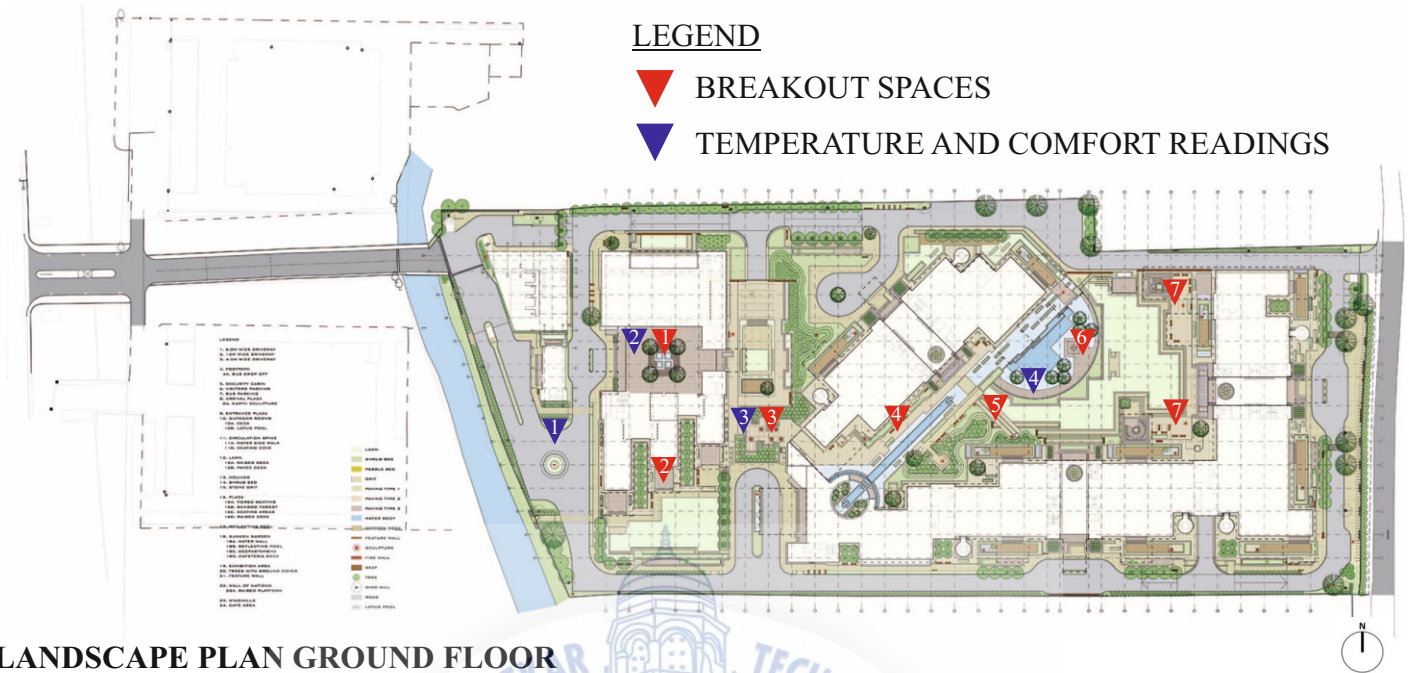


Types of 3-D Printers:

- 1.FDM (Fused depositing modelling)**
 - More wastage
 - Cannot Reuse residue
 - More Material needed
 - Slow Speed
- 2.SLS (Selective Laser Sintering)**
 - Zero wastage
 - Reuse of residue
 - Medium Speed
 - Uses Powder for printing
 - More Precision
- 3.Resin Printing**
 - Uses Liquid for Printing
 - Fast Printing
 - Faster Process
 - Less wastage

SUZLON ONE EARTH, PUNE, INDIA

WHY? To study sustainable strategies for designing in pune



- | | |
|--|--|
| 1. 26.0 MIN 73% HUMIDITY 9.52AM
27.1 MAX 75% HUMIDITY | 3. 28.0 MIN 65% HUMIDITY 11.00AM
30.2 MAX 68% HUMIDITY |
| 2. 23.0 MIN 65% HUMIDITY 10.41 AM
24.0 MAX 68% HUMIDITY | 4. 29.0 MIN 65% HUMIDITY 12.20 AM
31.0 MAX 68% HUMIDITY |

Project information

Location: Pune, Maharashtra, India

Built Up Area: 75,825 SQ.M

Site Area: 42087.31 SQ.M

Completion: 2009

Cost : Rs.280 crores US\$ 63 million (2009)

Occupant capacity: 2300 people

No. of Floors: 3

Services:

Principle Architect : Christopher Charles benninger

Structural Design : Dr. Santhosh ,Vastech

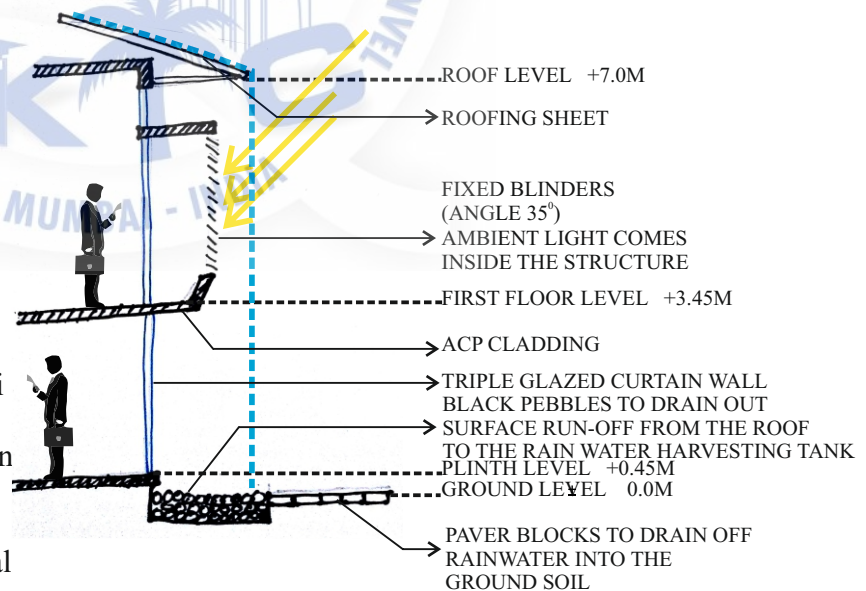
Landscape Design : Ravi & Varsha Gavandi
Landscape Architects, Pune

Interior Design : Space Matrix in association
with Manish Banker, Tao Architects, Pune,
India

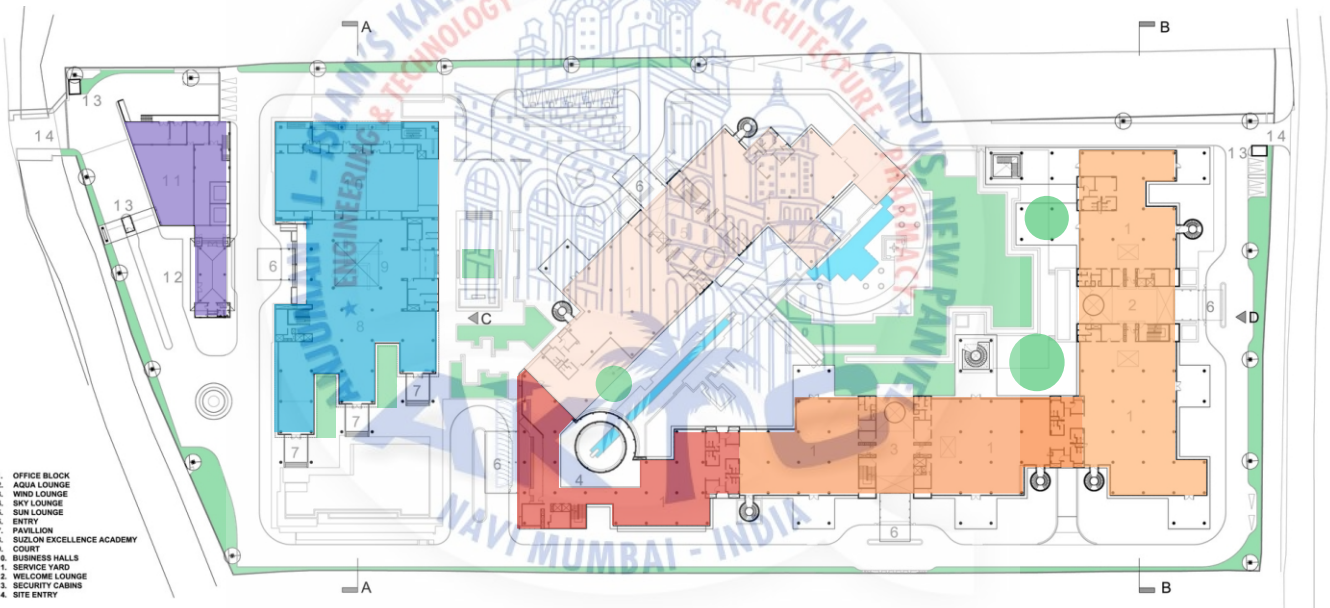
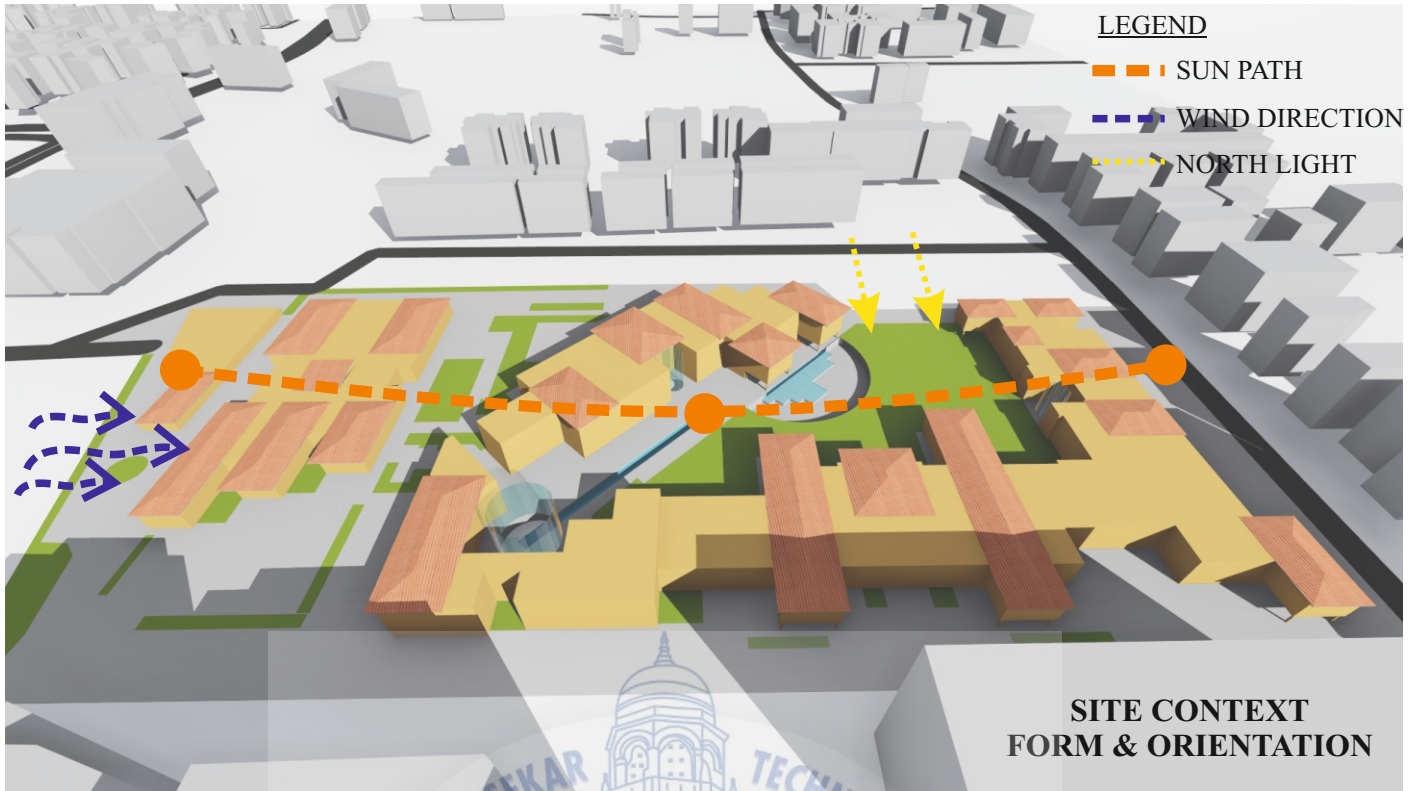
Green Building Consultants : Environmental
Design Solution, New Delhi

GRIHA: 5 STAR RATING

LEED: PLATINUM RATING



TYPICAL BUILDING SECTION



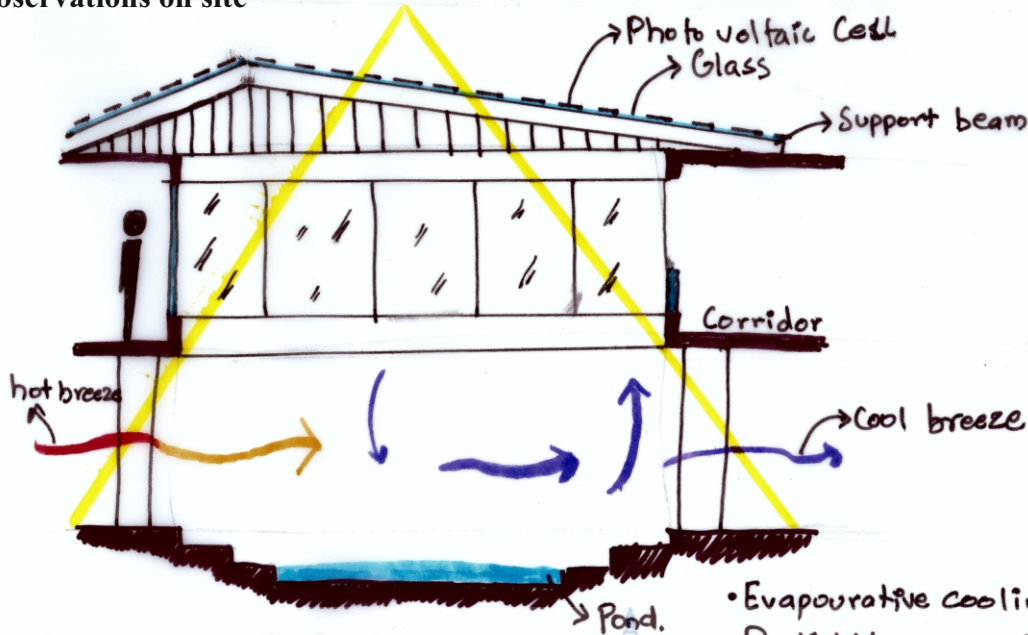
Suzlon One Earth Global Corporate Headquarters, Pune.

SR NO.	TYPES OF STORAGE TANKS	STORAGE CAPACITY
1.	FIRE FIGHTING	2.75 LAKH LTS
2.	RAINWATER HARVESTING	10 LAKH LTS
3.	HVAC & GARDENING	4.4 LAKH LTS
4.	DOMESTIC USE	1.5 LAKH LTS
5.	RAW WATER	0.5 LAKH LTS

LEGEND

- SERVICE BUILDING
- SEA- LEARNING ACADEMY
- WORK SPACE
- HEAD STAFF AND OWNERS
- IT ZONE
- RESEARCH ZONE
- BREAKOUT AND GREEN SPACES
- WATER BODY
- WINDMILL

Observations on site

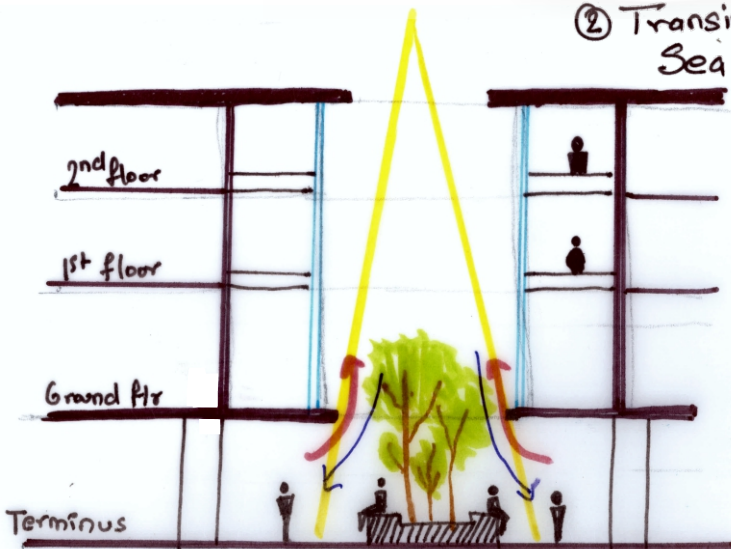


① Section at SEA

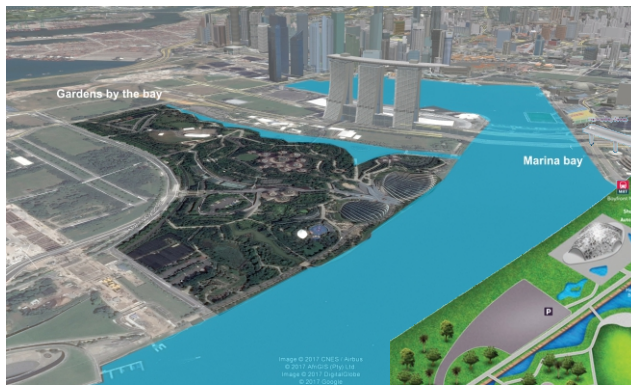
- Evaporative cooling
- Daylighting present in Corridors
- Comfortable temperature in Indoor



② Transition spaces between Sea and Sun lounge



③ Section of Sky Cylinder.
• Exchange of fresh air in

GARDEN BY THE BAY, SINGAPORE**WHY?** To study digital architecture application at urban scale projects**SITE CONTEXT****LEGEND**

--- PEDESTRIAN MOVEMENT

**SITE PLAN**

Architects: Grant Associates

Location: Bayshore Rd, Singapore Project

Year: 2012

Manufacturers: Penetron

**EXPLODED VIEW OF THE COOLED CONSERVATORIES**Fig. 3; *Source: Grant Associates*

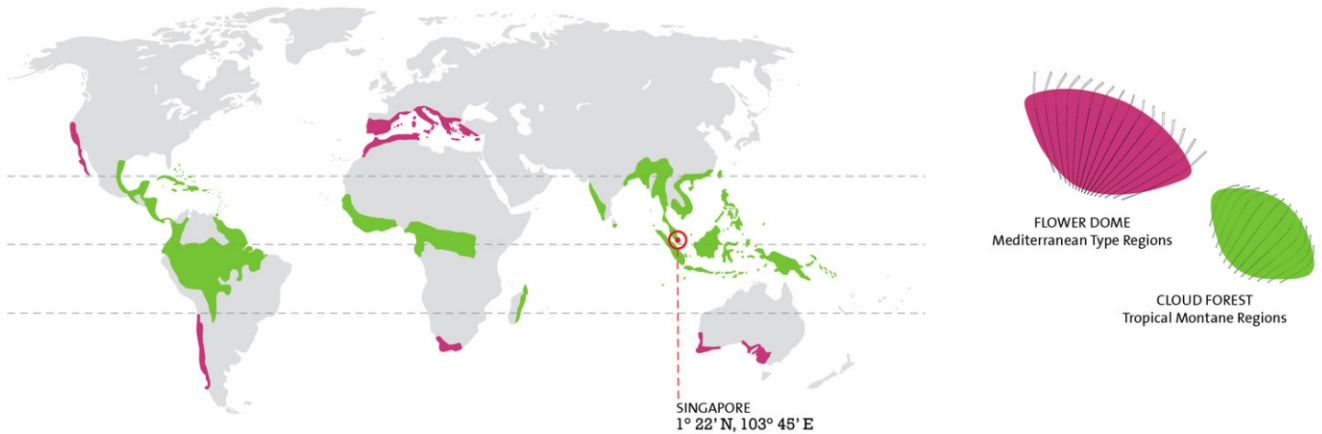
At 54 Hectares Bay South is the first and largest of three planned gardens at Gardens by the Bay in Singapore. Grant Associates has masterplanned the whole of Bay South, leading a core British design team to worldwide success. Our vision was to blend nature, technology, environmental management and imagination to create a 21st century focus for tropical horticulture and a unique destination experience.

Design details:

- 18 Supertrees (25-50m high) to act as iconic vertical gardens
- Aerial walkway and treetop bar offers unique views of the Gardens
- 2 giant Cooled Conservatories housing plants from Mediterranean and tropical Montane regions of the world
- Indoor mountain offering tropical rainforest experience
- Spectacular nightly light and sound shows
- 4 Heritage Gardens reflecting Singapore's cultural links with plants
- 6 World of Plants Gardens showcasing the biodiversity of plant life on our planet
- Dragonfly Lake and Dragonfly Bridge
- Numerous sculptures and architectural structures
- Intelligent environmental infrastructure

Powered sustainably via horticultural waste, efficient de-humification and thermal stratification

DOME CONSISTS OF FLORA AND FAUNA FROM AROUND THE WORLD

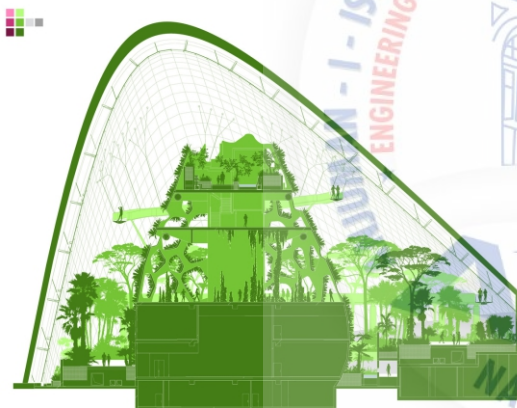


The two Cooled Conservatories at Gardens by the Bay offer a spectacular visual and spatial experience for visitors, telling the story of plants in all-weather ‘edutainment spaces’.

Created by a collaborative design team led by Grant Associates, the Flower Dome and the Cloud Forest combine stunning architecture by Wilkinson Eyre Architects, ingenious structural and environmental engineering by Atelier One and Atelier Ten, innovative interpretation by Land Design Studio, striking branding and signage by Thomas Matthews and visionary landscape design with planting procured by the Gardens by the Bay horticultural team.

They work in harmony with the Supertrees, both visually and environmentally, acting as centrepiece destinations within the Gardens.

Design details:



- Cooled Conservatories house 226,000 plants from every continent except Antarctica
 - 1.2 hectare Flower Dome replicates a cool-dry Mediterranean climate
 - Giant flower field with changing seasonal displays
 - Raised walkways to explore exotic planting
 - 0.8 hectare Cloud Forest recreates cool-moist climates of Tropical Montane regions
 - 35 metre high epiphyte clad mountain with waterfall
 - The Mountain houses galleries and a black box media exhibition themed around climate change and habitat loss
- Powered sustainably via horticultural waste, efficient dehumidification and thermal stratification

SECTION OF CLOUD FOREST DOME
SPAN : 60 M HEIGHT : 40 M

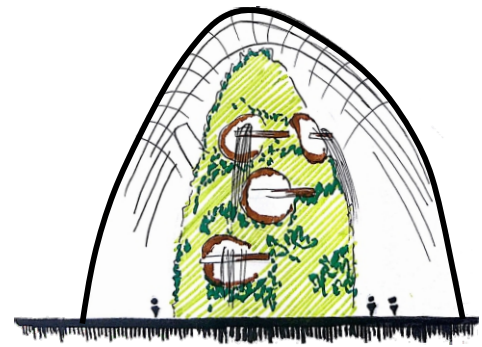


SECTION OF FLOWER DOME
SPAN : 90 M HEIGHT : 25 M

Fig. 4; *Source: Grant Associates*

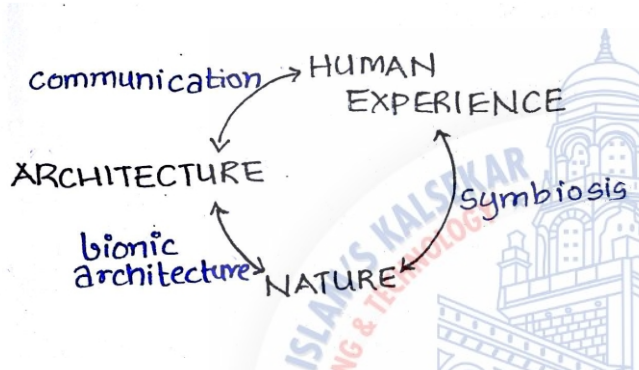


INSIDE CLOUD FOREST DOME

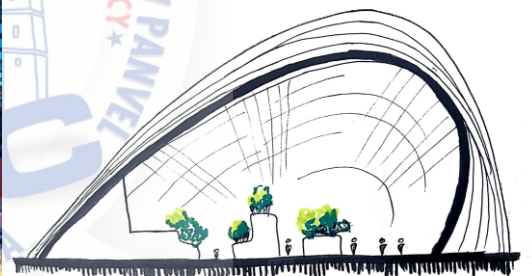


Lights and Experiences

INSIDE CLOUD FOREST DOME



INSIDE FLOWER DOME EXPERIENCES IN THE CAMPUS



Scale and Proportion



Blend of Bionic and Digital architecture



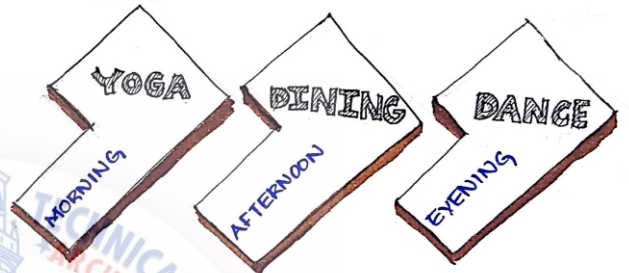
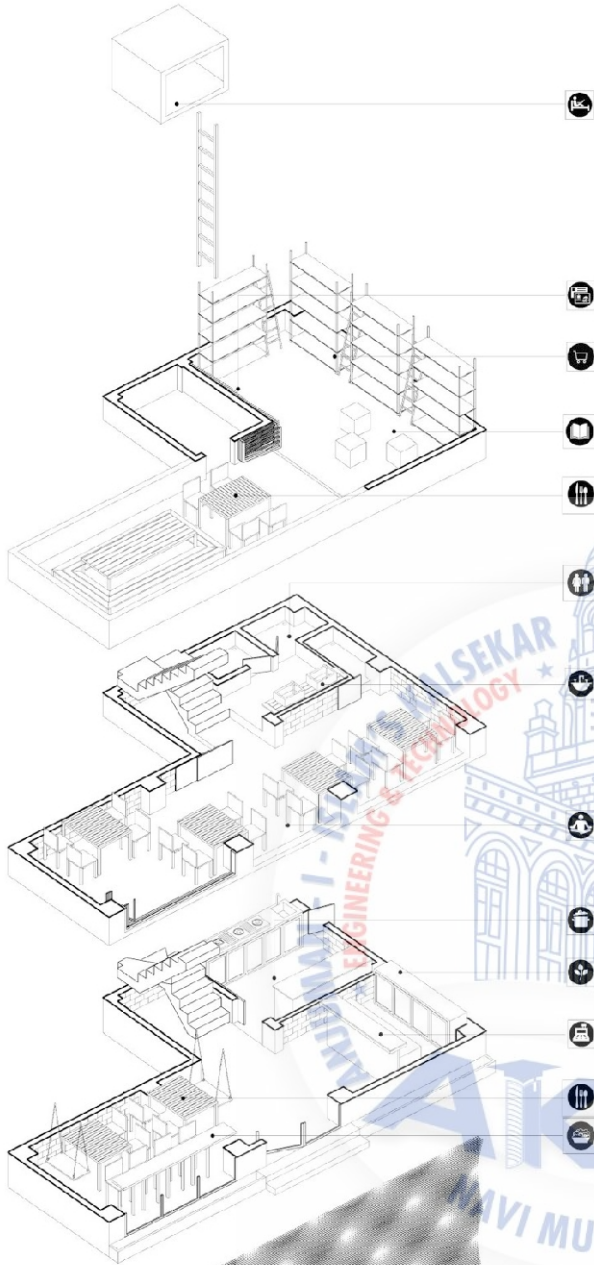
AERIAL VIEW OF GARDENS BY THE BAY

Fig. 4; Source: Grant Associates

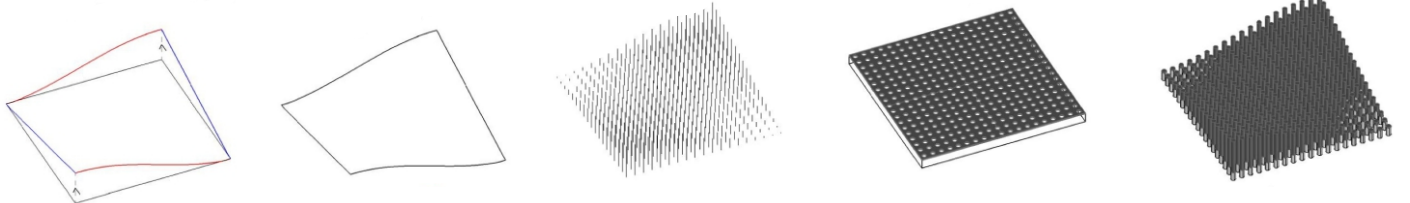
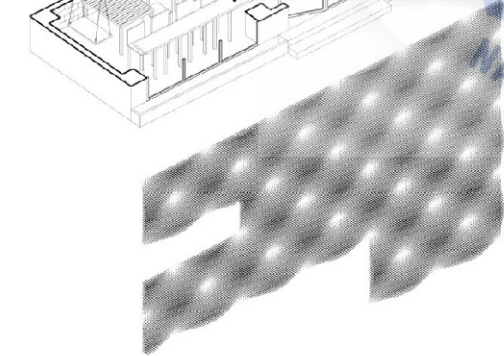
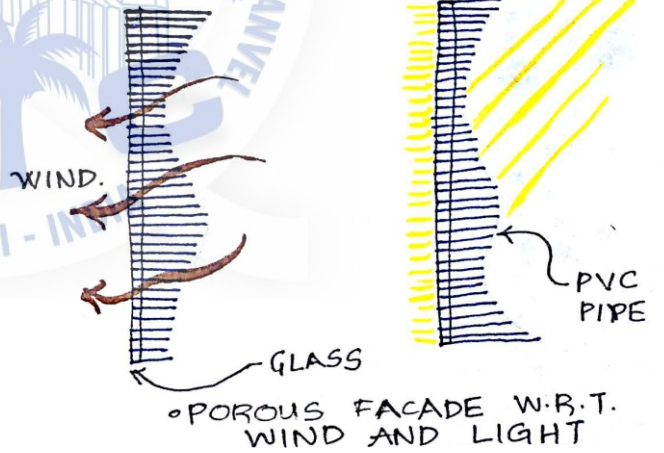
BAD CAFÉ, BANDRA, MUMBAI

WHY? To study digital architecture application at small scale project

Client : BAD CAFÉ
Location : Bandra West, Mumbai
Type : Hospitality
Status : Completed
Architects: Nudes
Architect in Charge: Nuru Karim
Area: 3250.0 SQ.FT
Project Year : 2015



MULTIFUNCTIONAL SPACE THROUGHOUT THE DAY



Development of facade ----->

IAAC, BARCELONA
MASTERS IN ADVANCED ARCHITECTURE

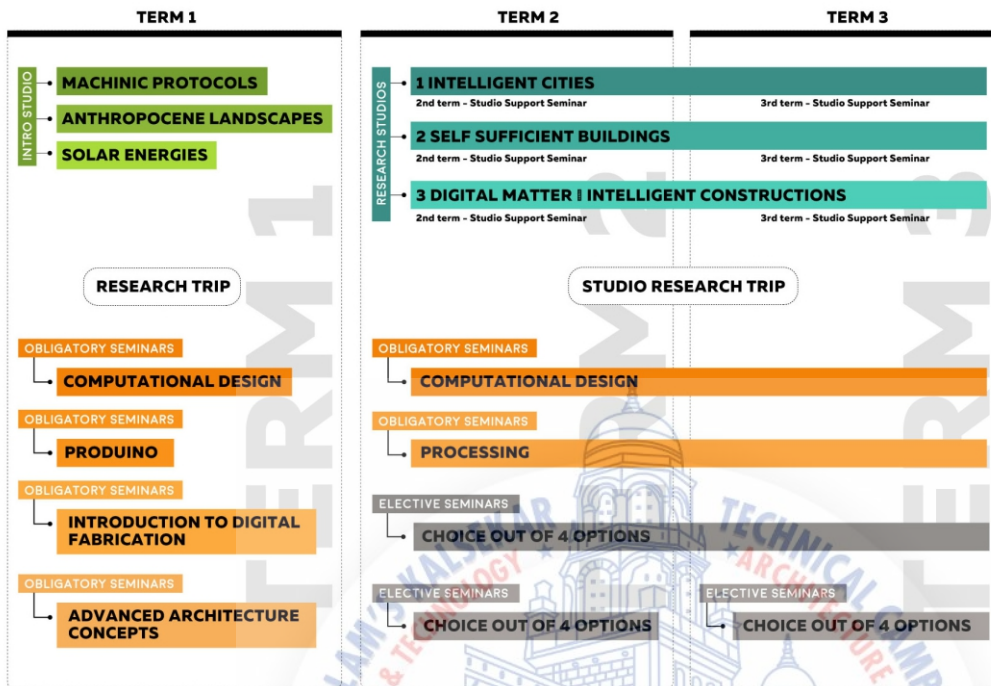
WHY? To analyse and improve the current course module

MAA - MASTER IN ADVANCED ARCHITECTURE

FIRST YEAR

OCTOBER - JUNE

Course Module

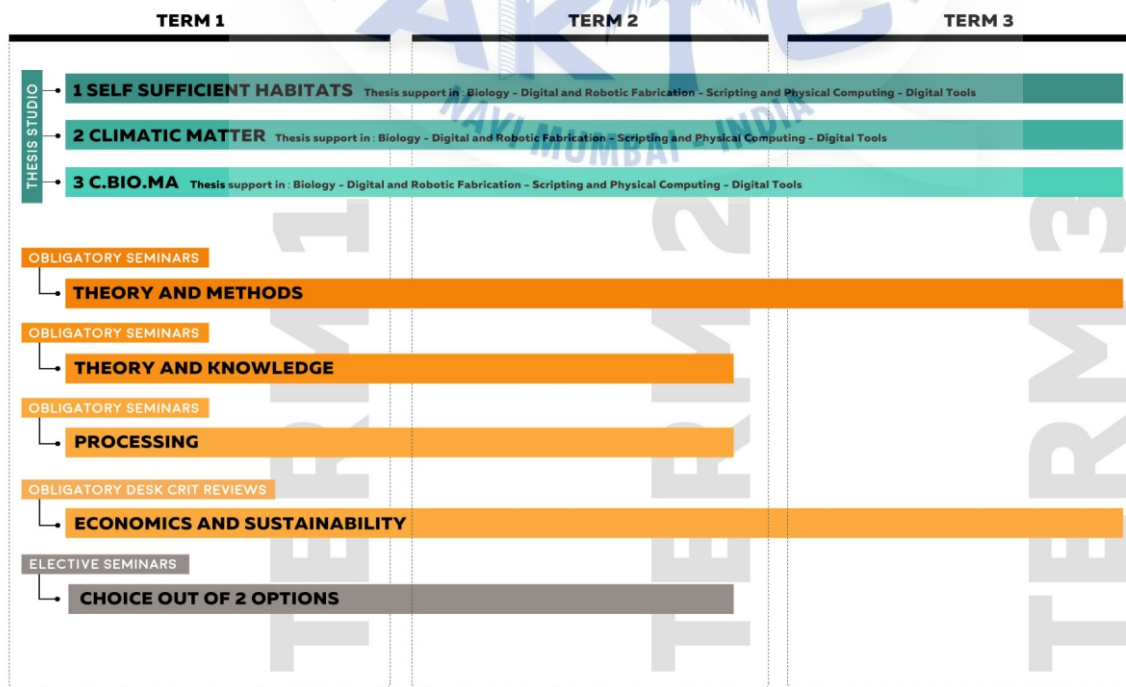


The following program refers to the Academic Year 2016-2017. The program for the Academic Year 2017-2018 may be subject to slight variations

MAA - MASTER IN ADVANCED ARCHITECTURE

SECOND YEAR

OCTOBER - JUNE



The following program refers to the Academic Year 2016-2017. The program for the Academic Year 2018-2019 may be subject to slight variations



MASTERS IN ADVANCED ARCHITECTURE

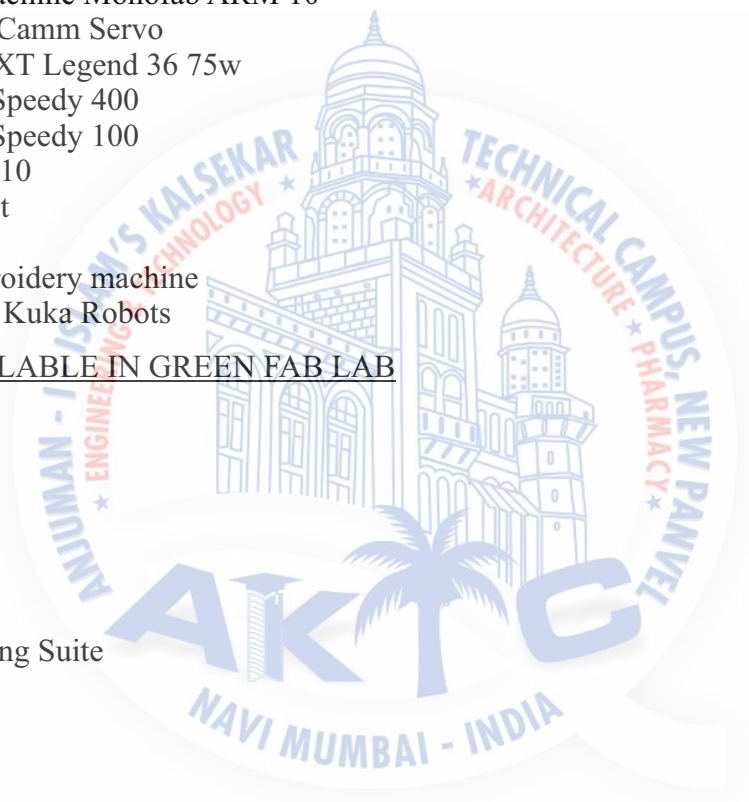
- _ It started in 2011
- _ They have 2 fabrication labs
- _ 1. Fab lab Area: 2000 sq.m
- _ It consists of an auditorium for 75 seats, a warehouse for large events and classrooms.
- _ 2. Green fab lab
- _ It works towards the creation of a self-sufficient habitat and research centre at Can Valldaura, one of IAAC's campus locations.

EQUIPMENTS AVAILABLE IN FAB LAB

- Large scale laser cutter Multicamm 2000
- Large scale milling machine – 3 axis Precix 11100 Series
- Large scale milling machine – 3 axis ShopBot
- Precision milling machine Monofab ARM 10
- Vinyl cutter GX-24 Camm Servo
- Laser cutter Epilog XT Legend 36 75w
- Laser cutter Trotec Speedy 400
- Laser cutter Trotec Speedy 100
- 3D printer Zcorp Z510
- 3D printer MakerBot
- 3D printer Formlabs
- Janome digital embroidery machine
- 6 axis robotic arm – Kuka Robots

EQUIPMENTS AVAILABLE IN GREEN FAB LAB

- Abb Robotic Arm
- Laserpro
- Roland Modela
- Roland Vinyl Cutter
- Ultimaker 2
- Shopbot
- Electronic Prototyping Suite
- Roland Monofab



NATIONAL INSTITUTE OF DESIGN, AHMEDABAD

WHY? To study good design school campus for space planning

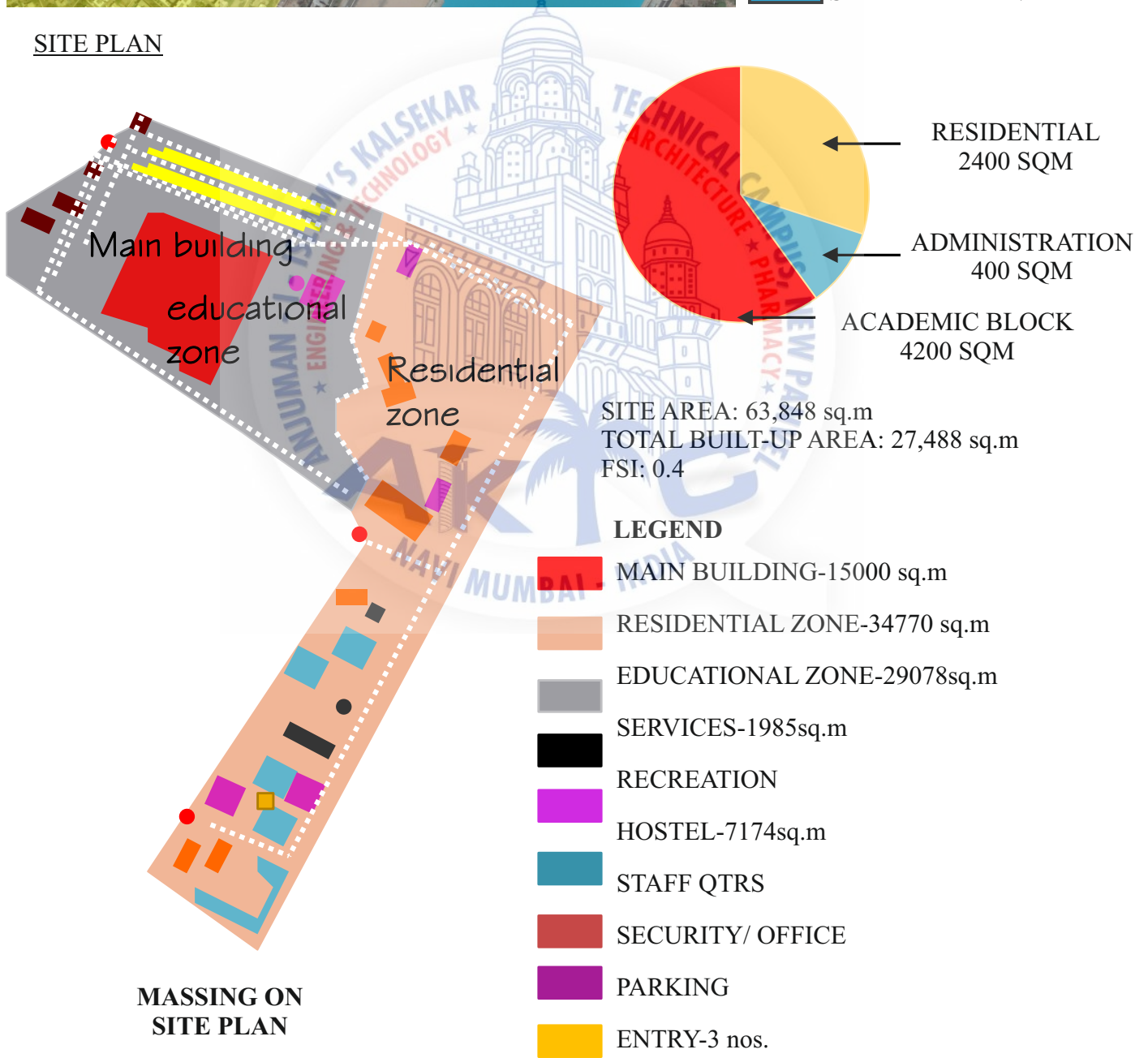


Client: Ministry Of Industry,
Government Of India
Stakeholders: Faculty, Students
Total Site Area: 63,848 sq.m
Architect: Giraben Sarabhai &
Charles Eames

LEGEND

- GOVERNMENT BUILDINGS
- COMMERCIAL ZONE
- RESIDENTIAL ZONE
- SABARMATI RIVER

SITE PLAN



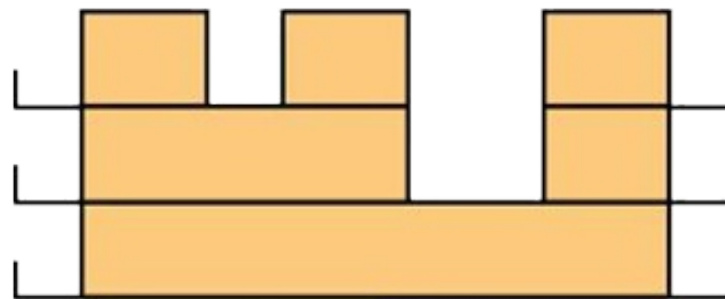
CIRCULATION

WALKING PATHS



FIRST FLOOR

COURTYARDS COURTYARDS



STUDENT AREA

THIRD FLOOR

SECOND FLOOR

FIRST FLOOR

ADMINISTRATIVE AREAS

SCHEMATIC SECTION

- Emphasis has been given on the pedestrian movement of the site.
- Vehicular movement is restricted.
- Horizontal circulation: The movement pattern develops on the ground floor through the court like spaces that developed under the structural grid.

FEATURES OF THE BUILDING

- Lawns are not only a feature of landscape but they act as interactive spaces which are used for informal gathering, cultural program, etc.
- Winds from the riverside are captured in the studios and workshops from the terraces due to adjustable glazing. Features like water bodies with jallis are used to filter the cooled air flowing over the water and passed in interiors.
- The campus has been designed taking into consideration the hot and dry climate of Ahmedabad. The activities are so planned that they spill over into inward looking spaces.
- The courtyards remain in the shadow for most part of the day. To allow the inflow of light into the workshops, sliding panels have been installed which run from the height of the skirting to about 10' from the floor level.
- Pockets of vegetation blend with the structure on the exterior as well as interior. Large trees protect the building from surface glazing and courtyards from excessive heating.

Fig. 5; *Source: Slideshare*

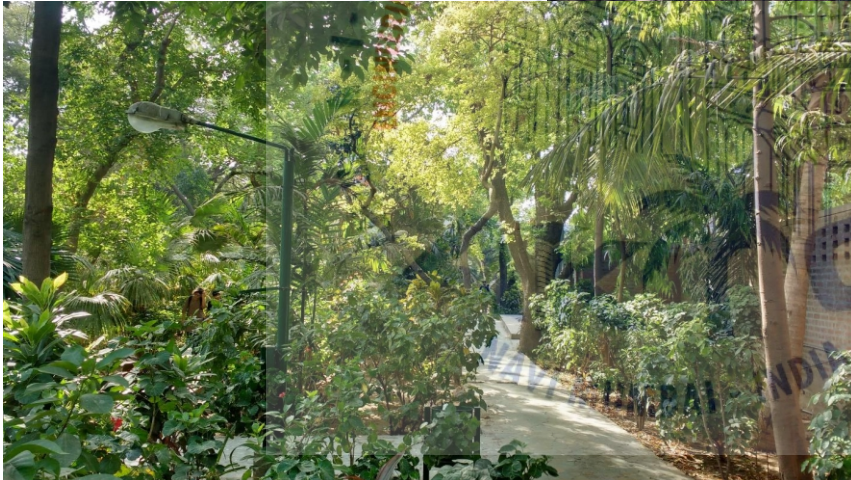


LANDSCAPE BLENDING WITH BUILT FORM

VIEW FROM THE STUDIO



SHADED PATHWAY LEADING TO NID FROM HOSTEL



SCALE AND PROPORTION

NATURALLY SHADED PATHWAYS



Fig. 6; *Source: NID Official Website*

INFERENCES OF CASE STUDIES

1. Maker's Asylum, Mumbai (Live Case study)

- Area: 560 sq.m
- Space v/s Functionality: ✓
- Research area needs a buffer zone before entering the fab lab
- Proper ventilation/Exhaust needed in Fab Lab
- Ergonomics of Machines
- Optimum usage of space

2. BNCA, Pune (Live Case study)

- Area of Studio: 78 sq.m
- Area of Fab Lab: 76 sq.m
- Teaching module
- Space v/s Functionality: ✗
- Only Fab lab in India used for institutional use
- Dark Studios-No light and Ventilation

3. Suzlon One Earth, Pune (Live Case study)

- Area: 42087 sq.m
- Sustainable Strategies to design climate responsive design
- Recycling of waste in site
- Ductless parking lot (in Basement)
- Form & Orientation
- Space v/s Functionality: ✓

4. Gardens by the bay, Singapore (Book Case study)

- Area: 250 Acres
- To study digital Architecture application at urban scale project
- Amalgamation of Digital architecture and Bionic Architecture
- How is public circulation in exhibition area
- Space v/s Functionality: ✓

5. Bad café, Mumbai (Book Case study)

- Area : 300 sq.m
- How dynamic facades create a vibrant experience in café.
- How digital architecture can intervene at small scale project.
- Multi-functional areas in axillary spaces.
- Space v/s Functionality: ✓

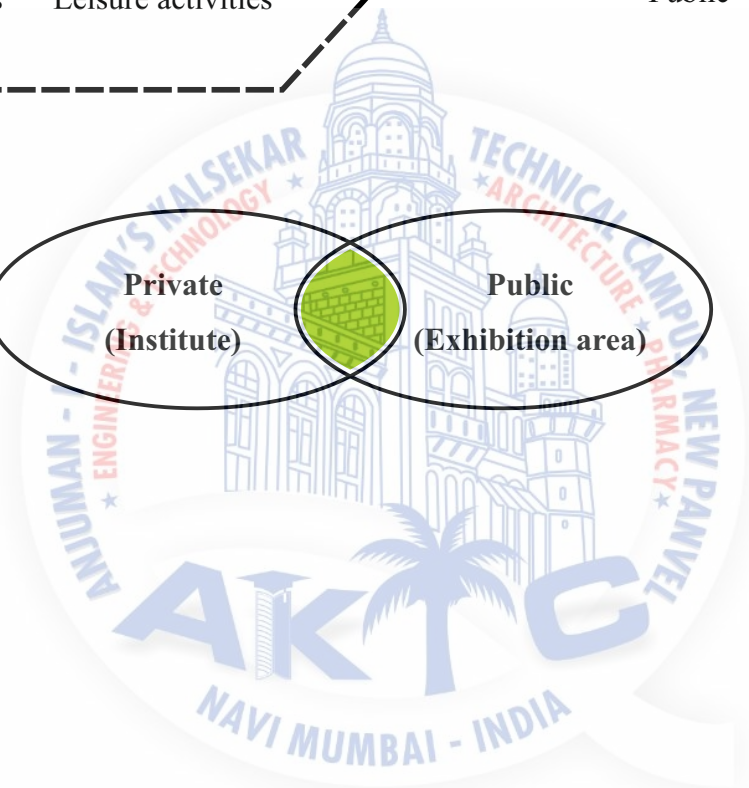
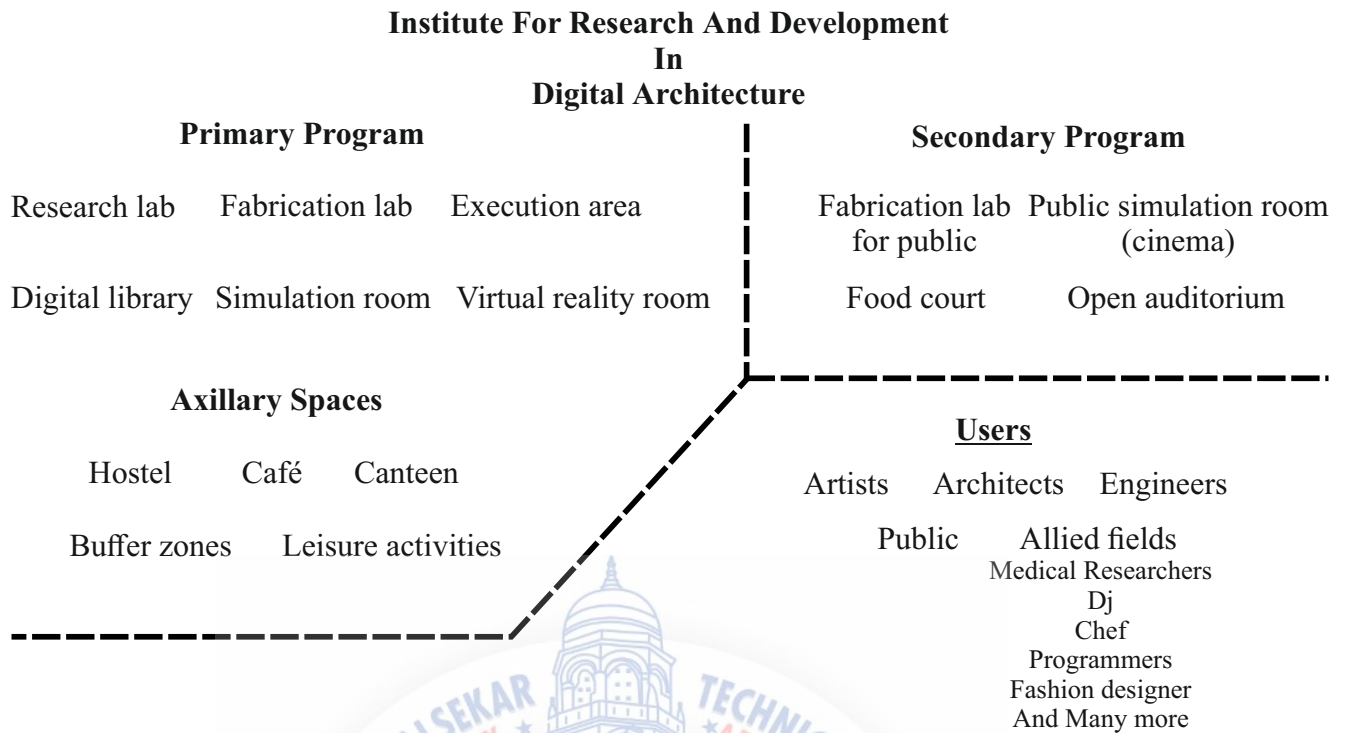
6. IAAC, Barcelona

- Area of Fab lab: 2000 sq.m
- Area of green fab lab: 1000 sq.m
- Space v/s Functionality: –
- Course Module

7. National academy of design, Ahmedabad

- Area: 63484 sq.m
- Space v/s Functionality: ✓
- Campus Development
- Buffer spaces
- Relation of built v/s open

8. Comparative analysis between different course module.





Chapter 5 Research Design

A collection of Guidelines and standards with prospects of being applied in the Design Space Programme

Standards and data collection

Names of Machines	Brand	Work Area (in mm)	Materials	Applications
MULTICAM 2000	Multicam	1500mm x 3000mm	Wood (30mm), methacrylate or perspex (30mm), cardboard (40mm), paper, fabrics, non-PVC acrylics and other organic materials.	Real scale project development such as furniture, structures etc.
MILLING MACHINE– 3 AXIS PRECIX 11100 SERIES	Precix	1500mm x 3000mm x 300mm	Polyurethane foams, cork, wax, wood, MDF, soft materials that can be milled	Milling of 3-D models, full scale furniture parts, molding and casting, architectural elements, etc.
MILLING MACHINE– 3 AXIS SHOPBOT	ShopBot	4270 x 2310 x 1730 mm	Polyurethane foams, cork, wax, wood, MDF, soft materials that can be milled	Milling of 3-D models, full scale furniture parts, molding and casting, architectural elements, etc.
MILLING MACHINE MONOFAB ARM 10	Roland Monofab SRM 20	203.2 x 152.4 x 60.5 mm	Wood, plastics, HD foam, Wax, copper for circuits, etc.	Jewellery, milling wax molds, copper circuits printing , scanning three-dimensional objects, etc.
VINYL CUTTER GX-24 CMM SERVO	Roland GX-24 camm-1 servo	Cutting length: 25 m (max) Cutting width: 50-700 mm	Vinyl, Flexible Copper Paper, Cloth, plastic sheets and other materials	Signage, cutting ?exible electronic circuits, cutting patterns, etc.
LASER CUTTER EPILOG XT LEGEND 36 75W	Epilog XT Legend 36	450mm x 950mm	Wood (5mm), methacrylate or perspex (5mm), cardboard (8mm) , paper, fabrics, non-PVC acrylics and other organic materials.	Signs, cutting pieces of models, raster, cut patterns, etc.
LASER CUTTER TROTEC SPEEDY 100	Trotec Speedy 100	610mm x 305 mm	Wood (5mm), methacrylate or perspex (5mm), cardboard (8mm) , paper, fabrics, non-PVC acrylics and other organic materials.	Signs, cutting pieces of models, raster, cut patterns, etc.

Names of Machines	Brand	Work Area (in mm)	Materials	Applications
LASER CUTTER TROTEC SPEEDY 400	Trotec Speedy 400	1000mm x 610 mm	Wood (5mm), methacrylate or perspex (5mm), cardboard (8mm) , paper, fabrics, non-PVC acrylics and other organic materials.	Signs, cutting pieces of models, raster, cut patterns, etc.
3D PRINTER FORMLABS	Formlabs	125mm x125mm x165 mm	Liquid photopolymer resin	Printing prototypes directly from 3D modeling, molding small objects, jewelry prototypes, etc.
3D PRINTER ZCORP Z510	Zcorp	200mmx250mm x 350mm	Special high resolution plaster , with binder	Printing prototypes directly from 3D modeling, molding small objects, jewelry prototypes, etc. 2.3 Research design 2 Institute For Research And Development In Digital Architecture 3D
3D PRINTER MAKERBOT	MakerBot Replicator 2	285mm x 153mm x 155mm	PLA ?lament	Printing prototypes directly from 3D modeling, molding small objects, jewelry prototypes, etc.
JANOME DIGITAL EMBROIDERY MACHINE	Janome	240mm x 200mm	Vinyl, Flexible Copper Paper, Cloth, plastic sheets and other materials	Embroidery patterns on fabrics, bags, accessories, etc.
6 AXIS ROBOTIC ARM– KUKA ROBOTS	Kuka Robots			

Guidelines use for initial faces/ Research Concept

- Integration of green and digital architecture
- Incorporation of public open spaces for promoting digital architecture





Chapter 6 Site Justification

This Section incorporates the research and process for selecting a Site with comprehensive analysis of different areas. There are sub divisions on different scales to justify the scrutiny thoroughly.

City selection to execute design thesis:

Overview:

A City is a large and permanent human settlement. Cities generally have complex systems for sanitation, utilities, land usage, housing, and transportation. The concentration of development greatly facilitates interaction between people and businesses, sometimes benefiting both parties in the process, but also presenting challenges to managing urban growth. 21st century is also known as the century of cities. Almost 70% of the world's population will stay in the urban setup by 2050. Cities have a major impact on the economic and social development.

Recent statistics state that 75% of the world's resources and energy are consumed by cities and generate about 80% of the greenhouse gases. Naturally this situation demands a change with regards to the development and management for all types of infrastructure within cities. This scenario shows that urban environment with a growing demand for efficiency and resources, the government has to consider evolution and take a step forward towards sustainability. Indian cities being one of the less urbanized countries of the world with only 27.78 per cent of its population living in urban setups, our country is facing a serious crisis of urban growth at the present time. Whereas urbanization has been an instrument of economic, social and political progress, it has led to severe environmental problems. Urban sprawl is rapidly encroaching the precious agricultural and forest land. The urban population of India had already crossed the 285 million mark by 2001. By 2030, more than 50 per cent of India's population is expected to live in urban areas. To accommodate this population, there is rapid growth in the infrastructure and this is largely neglected in enduring it.

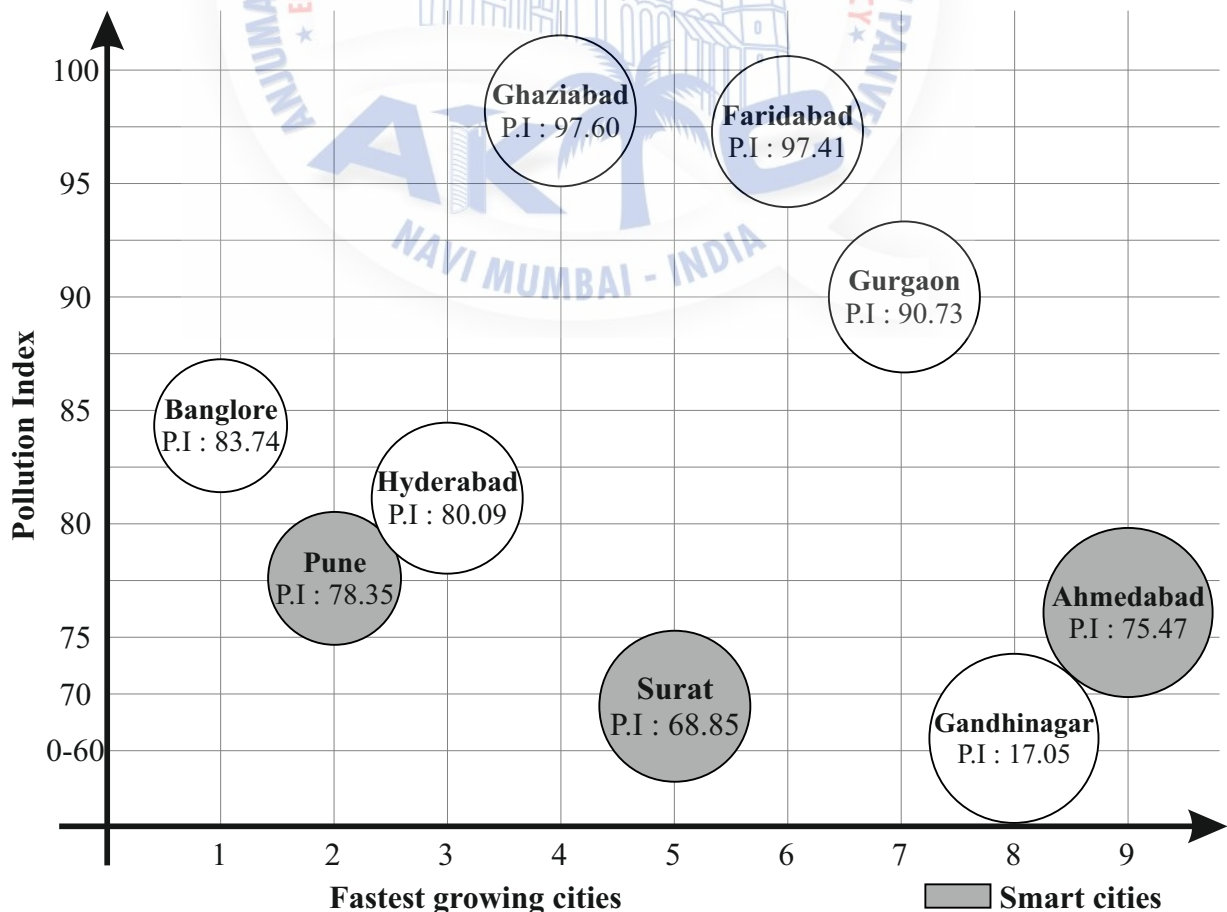
Growth of the cities v/s Pollution index

Fig.7; Data Source: <https://www.numbeo.com/pollution/rankings.jsp>

<http://www.walkthroughindia.com/offbeat/top-35-fastest-developing-and-emerging-cities-of-india>

This data clearly states the amount of pollution an average human faces on a daily basis. This arises the need to not just build cities, but Smart Cities. The concept of a Smart City is that investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic development and a high quality of life, with a wise management of natural resources, through participatory action of government. Making a city smart is not just about technology and connectivity. Digitalization or digital innovation had opened up tremendous potential for new ways of interaction with citizens, spaces and systems; and have become a part of a connected conversation. Digitalization has led to innovation of new forms and technologies, green architecture, eco-friendly and sustainable architecture. Though digital and green architecture are always seen in silos, these two fields combined can give great results. As an architect, I wish to make use of the digital means to create my Institution in parametric format all the while it being an excellent example of a sustainable piece of architecture. In India, the knowledge of these fields is largely exiguous. With evolving technologies digital architecture has reached the next level of excellence. The institution offers a scope to learn and to create the same. As Bjarke Ingels has rightly said that Sustainability can't be like some sort of a moral sacrifice or political dilemma or a philanthropical cause. It has to be a design challenge. It is about making different life forms possible without making a compromise on aesthetics. My institution promises of the same.

20 Smart Cities Proposed by Govt of India

- | | |
|------------------|----------------|
| 1. Bhubaneswar | 11. Indore |
| 2. Pune | 12. NDMC |
| 3. Jaipur | 13. Coimbatore |
| 4. Surat | 14. Kakinada |
| 5. Kochi | 15. Belagavi |
| 6. Ahmedabad | 16. Udaipur |
| 7. Jabalpur | 17. Guwahati |
| 8. Visakhapatnam | 18. Chennai |
| 9. Solapur | 19. Ludhiana |
| 10. Davanagere | 20. Bhopal |

Source: <http://smartcities.gov.in/content/innerpage/cities-profile-of-20-smart-cities.php>

Inference:

If we compare these cities, Pune has better scope for this research as it is a Learning and technology hub. This research can act as an prototype to replicate in all other cities



Chapter 6.1
Emerging cities of
Maharashtra

An outline of different emerging cities with scope of promoting and executing digital architecture on an optimum level.

Emerging cities of Maharashtra

Pune city has emerged as a major educational and IT hub. The city ranked second in India in terms of quality of living in 2017 and also second fastest growing cities in the Asia-Pacific region.

Lets compare the emerging cities of Maharashtra

Pune v/s Mumbai v/s Navi Mumbai on the basis of

- Educational hub
- Topography
- Connectivity
- Transportation

1.Educational hub

According to an article on <http://timesofindia.indiatimes.com>

With 811 colleges, Pune varsity 2nd largest in country

Hemali Chhopia | TNN | Nov 4, 2013.

Fig.8; *Source: <http://timesofindia.indiatimes.com/home/education/news/With-811-colleges-Pune-varsity-2nd-largest-in-country/articleshow/25196438.cms>*



University	Affiliated colleges
Osmania University, Hyderabad	901
Pune University, Pune	811
Nagpur University, Maharashtra	800
Rajasthan University, Jaipur	735
Mumbai University	171

Inference: According to source: https://collegedunia.com/architecture/navi-mumbai-colleges?city_id=336

Total number of affiliated colleges for architecture in respective cities

Mumbai- 17

Navi Mumbai- 7

Pune-21

But Masters in digital architecture is only taught in 2 institutes and both are in Pune.

Institutes where digital architecture is taught

BNCA, PUNE - Master In Digital Architecture

SINHAGAD COA, PUNE - Masters In Computer Applications

IAAC, BARCELONA - Masters in Advanced Architecture

- Masters in Advanced Interaction

ELISAVA escola de diseno, Barcelona - Masters in Advanced Architecture

Universitat Internacional de Catalunya (UIC), Barcelona - Masters in Biodigital Architecture

AA SCHOOL OF LONDON- Masters in Emergent Technologies

Sciarc, Los Angeles, California - Masters in Advanced Architecture (Ma001)

University of Nottingham - Masters in Digital Architecture and Tectonics

2. Topography

Pune

- Pune has a more organic urban spread where it is growing from the centre spreading outwards.
- It has more land availability for future development as compared to Mumbai and Navi Mumbai.



Source: Google maps

Mumbai

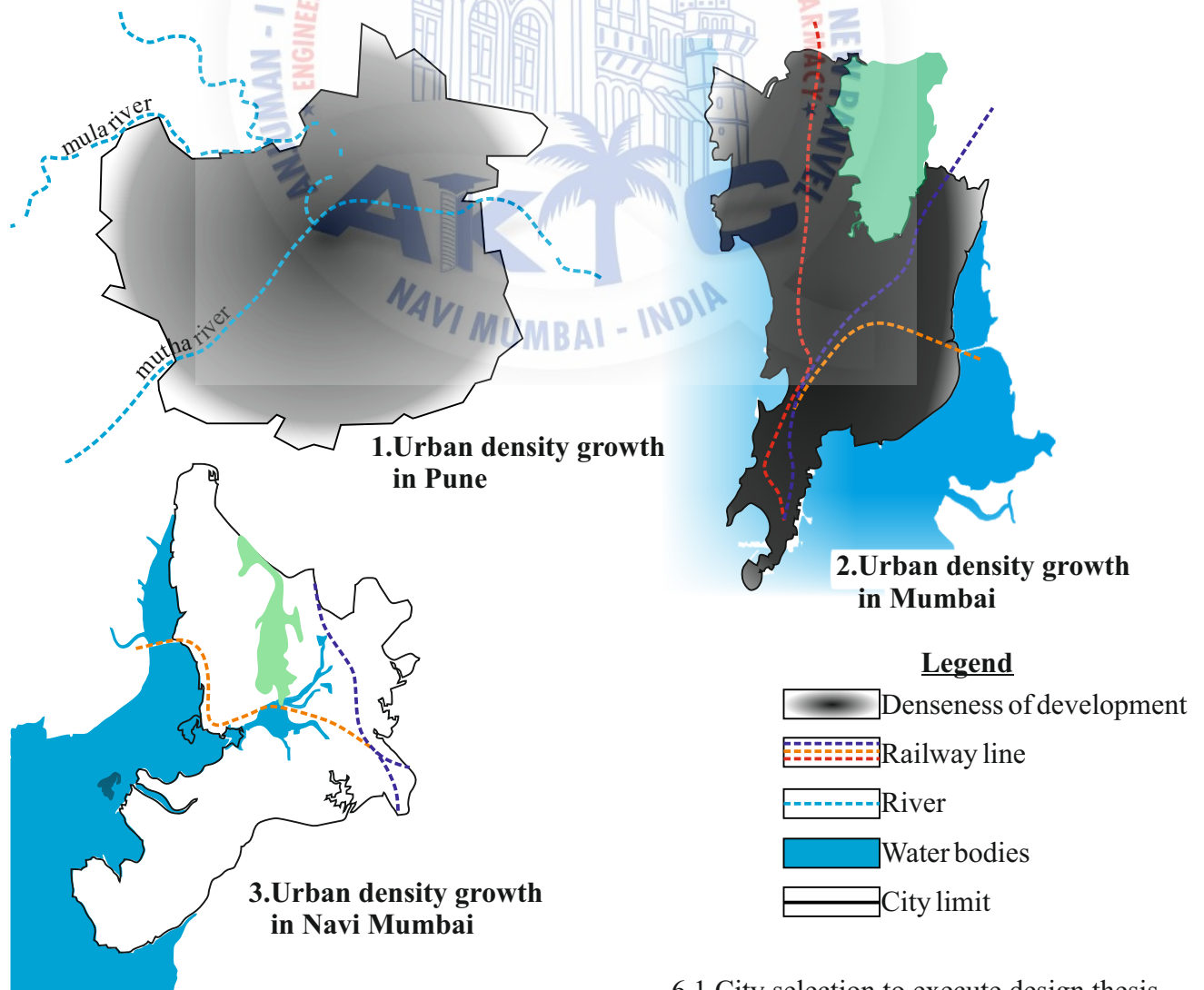
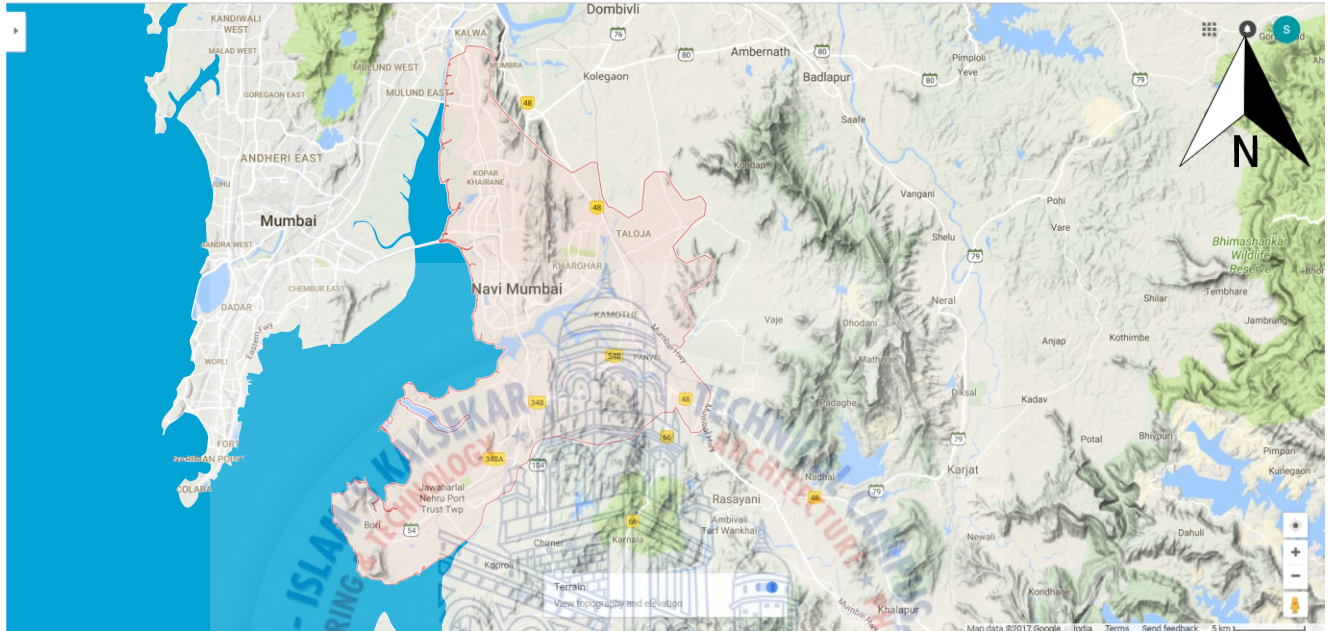
- Mumbai has a more linear urban spread where it is growing from south and spreading on north and eastern side
- It has less land availability for future development as compared to Pune and Navi Mumbai.
- It is an economic capital of India but it is going under decongestion as it is over-exploding and has scarcity for resources



Source: Google maps

Navi mumbai

- Navi mumbai has been growing more towards north but away from the railway line
- The main urban development focus is more towards decongesting mumbai, so it has more number for residential zone
- But in terms of connectivity railway line is on one side and the city is growing on the other side, hence it is a major drawback



2. Connectivity & Transportation

Pune

- Pune has only **B.R.T.S System** as public transportation system.
- **Metro** is being proposed in pune city and will be completed by 2021
- There are **more number of 2-wheelers** in the city as compared to other cities
- It has train services which connect Pune to other cities but the main station of Pune is in the heart of the city and it is very far from the city outskirts. People need to travel approx 1-2hrs depending on traffic to reach to station
- It has National Highway which connects pune to other nearby cities.
- One **NH 60** connects Dhule and Pune in the state of Maharashtra
- **NH 65** starts at Pune and ends at Machilipatnam, Andhra Pradesh. It runs along the states of Maharashtra, Karnataka, Telangana and Andhra Pradesh.
- Other **NH 48** connects Delhi and Bengaluru via Mumbai and Pune.
- **Pune airport** handles both domestic and international flights with approx Passenger movements 6,787,391 and Aircraft movements 46,932 yearly.

Mumbai

- The number of private cars more than 9 lakh- 45% increase over five years.
- As for two-wheelers- 17 lakh.
- **Buses** at a frequency of around 80 buses per hour on a stretch (ferrying 4,000 commuters).

Source: Number of vehicles in Mumbai up 50% in 5 years | TNN | Jan 3, 2017

[Http://timesofindia.indiatimes.com/city/mumbai/no-of-vehicles-in-city-up-50-in-5-yrs/articleshow/56302918.cms](http://timesofindia.indiatimes.com/city/mumbai/no-of-vehicles-in-city-up-50-in-5-yrs/articleshow/56302918.cms)

- It also has 3 **intercity railway lines- Central, Western and Harbour railway line**, which provide good connectivity for the public to reach in different parts of the city.
- It has **metro** which gives east west connectivity and **monorail** which connects different smaller fragments for the city. I.e Waldala- Chembur.
- It has many Trains which connect to other cities running almost daily
- **Mumbai airport** handles both domestic and international flights with approx Passenger movements 45,154,345 and Aircraft movements 305,465 yearly.

Navi Mumbai

- Navi mumbai has harbour railway line as its major public transportation system and but it is location on the one side and the urban development is happening on the other side.
- Interior parts are connected by buses which are an alternative to rickshaws in the city.
- From belapur to kharghar, a metro is under construction to give faster connectivity to the users into the interior parts of kharghar.
- Navi Mumbai airport is being proposed to decongest the Mumbai airport which is still under proposal stage.

Comparing Pune v/s Mumbai v/s Navi Mumbai on basis of

1. Pollution 2. Traffic 3. Quality of life

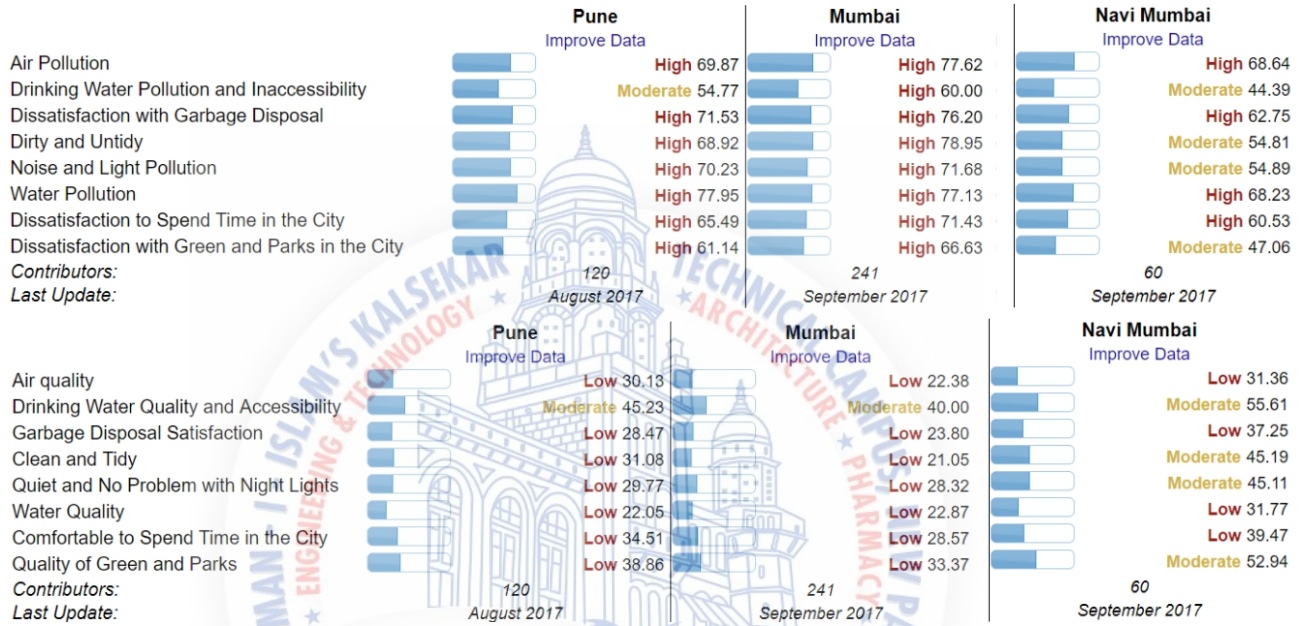
Pollution

Fig. 9; Source: <https://www.numbeo.com/quality-of-life/comparison.jsp>

Index	Pune	Mumbai	Navi Mumbai
Pollution Index:	79.82	86.48	72.16
Pollution Exp Scale:	141.13	154.32	127.27

Air pollution data from World Health Organization			
	Pune	Mumbai	Navi Mumbai
PM ₁₀	92	117	120
PM _{2.5}	49	63	64
PM ₁₀ Pollution Level:	High	Very High	Very High

Pollution Pune vs Mumbai



Quality of life

Index	Pune	Mumbai	Navi Mumbai
Quality of Life Index:	123.20	82.16	129.11

	Pune	Mumbai	Navi Mumbai
Purchasing Power Index	Moderate 87.99	Moderate 67.24	Moderate 74.45
Safety Index	Moderate 57.13	Moderate 54.61	High 71.77
Health Care Index	High 64.18	High 63.93	High 74.20
Climate Index	High 74.32	High 71.48	High 71.94
Cost of Living Index	Very Low 29.61	Very Low 32.23	Very Low 28.75
Property Price to Income Ratio	Moderate 8.60	Very High 28.26	High 13.11
Traffic Commute Time Index	High 46.54	High 58.15	High 46.50
Pollution Index	High 79.82	Very High 86.48	High 72.16
Quality of Life Index	High 123.20	Moderate 82.16	High 129.11
Minimum contributors in an underlying section:	43	74	8
Maximum contributors in an underlying section:	361	556	104
Last Update:	September 2017	September 2017	September 2017

Index	Pune	Mumbai	Navi Mumbai
Traffic Index:	205.66	272.32	204.22
Time Index (in minutes):	46.54	58.15	46.50
Time Exp. Index:	4,256.40	13,646.19	4,233.89
Inefficiency Index:	221.59	272.12	170.01
CO ₂ Emission Index:	6,239.36	6,538.30	6,338.33

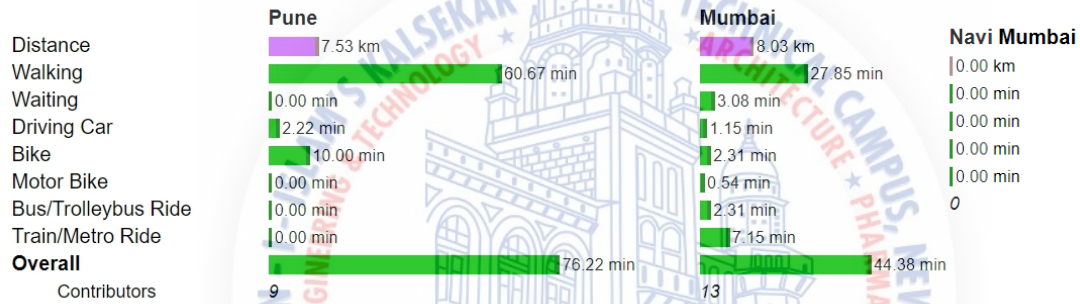
Improve data for Pune

Improve data for Mumbai

Main Means of Transportation



Average when primary using Walking



Average when primary using Car



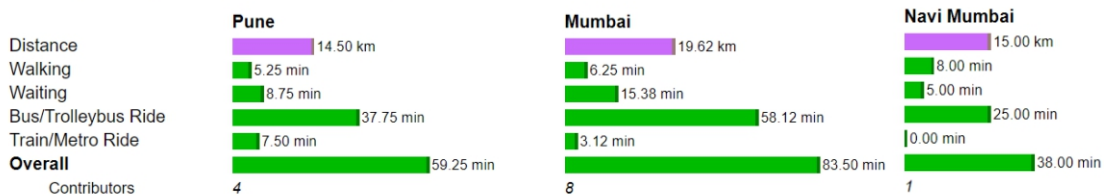
Average when primary using Bike



Average when primary using Motorbike



Average when primary using Bus/Trolleybus



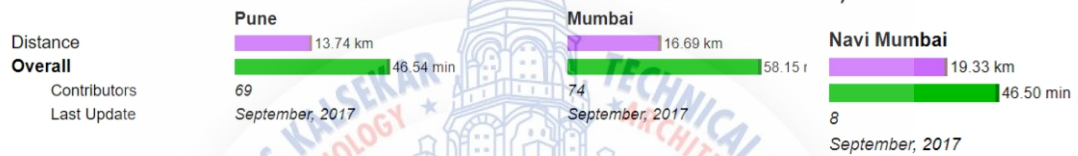
Average when primary using Tram/Streetcar



Average when primary using Train/Metro



Overall Average Travel Time and Distance to Work (school)



Comparative Analysis:

	PUNE	MUMBAI	NAVI MUMBAI
Educational hub	1	2	3
Topography	1	3	2
Connectivity	2	1	3
Transportation	2	1	3

Inference: Pune is more suitable for executing the thesis proposal

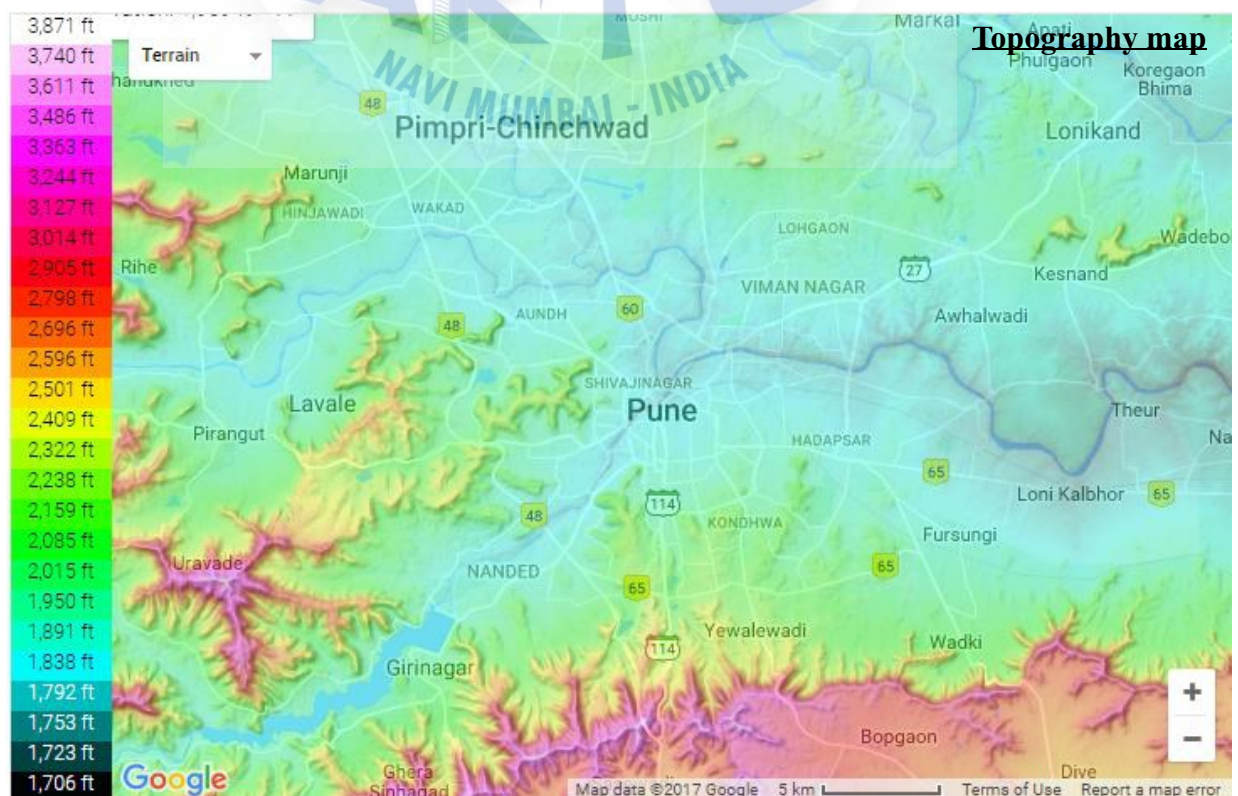
CITY: PUNE (18.5204° N, 73.8567° E)

Pune has a hot semi-arid climate bordering with tropical wet and dry with average temperatures ranging between 19 to 33 °C (66 to 91 °F).



1) **Landform:** On Southern to west side it is surrounded by mountains which go upto the height of 3800 ft high whereas the lowest is 1827 ft. From the S-W Mutha river enters the city and from N-W Mula River enters and meet at the central area of pune with Mutha river where it continues further to N-E.

Inference: The site is not much surrounded by high mountains and it is adjacent to the Mula-Mutha river which keeps flowing towards east





2)**Green v/s Built:** The image shows the green pockets surrounding Pune city.

Source:ArcGIS

Inference: The site has many open green land in the surroundings which can help in creating a cool micro-climate. The design should encourage and maintain the greens on the site to help in maintaining the micro-climate temperature.

3)**Some Basic readings**

MONTHLY MEANS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
Dry Bulb Temperature (Avg Monthly)	19	21	25	28	29	26	24	23	24	24	21	19	degrees C
Dew Point Temperature (Avg Monthly)	11	9	8	11	18	21	21	21	21	20	15	11	degrees C
Relative Humidity (Avg Monthly)	61	51	39	38	55	78	84	86	83	80	70	64	percent
Wind Direction (Monthly Mode)	270	270	290	290	270	270	270	270	270	90	90	90	degrees
Wind Speed (Avg Monthly)	0	0	0	0	2	2	1	1	1	0	0	0	m/s

Fig.10; Source:Climate Consultant

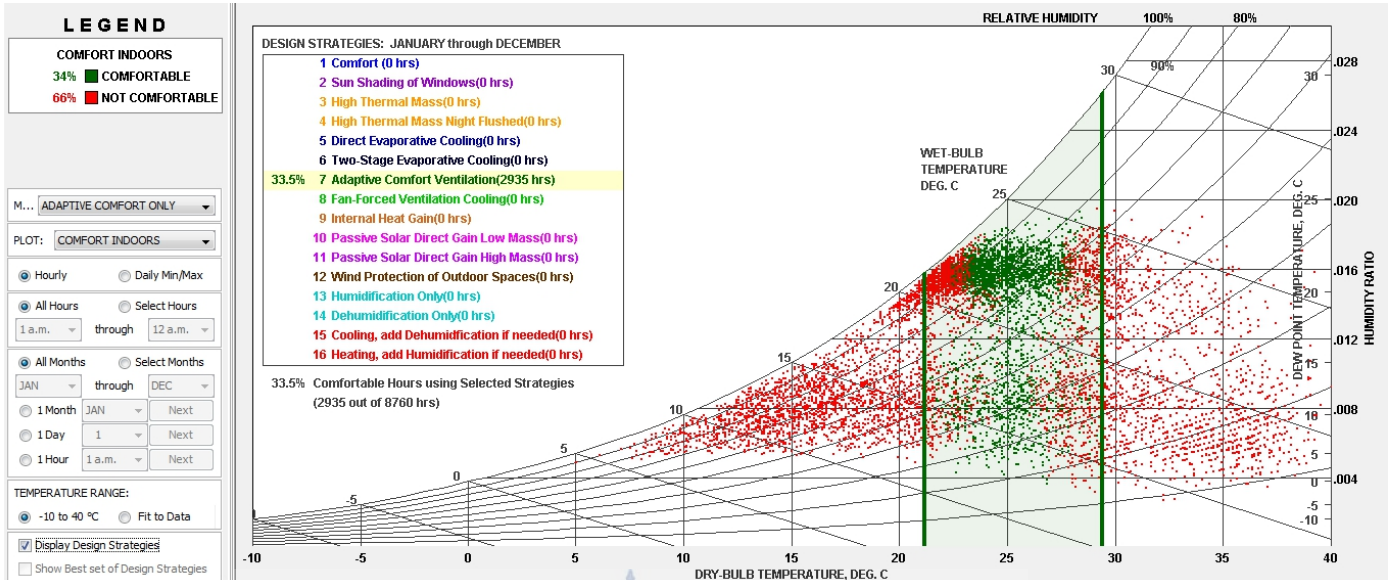
Inference: Max temp: 29°C May Min temp: 19°C Dec- Jan

 Max reading
 Min reading

Max Relative Humidity: 21% Jun-Sept Min Relative Humidity: 38% Apr

Max Wind Speed: 8m/s coming from west

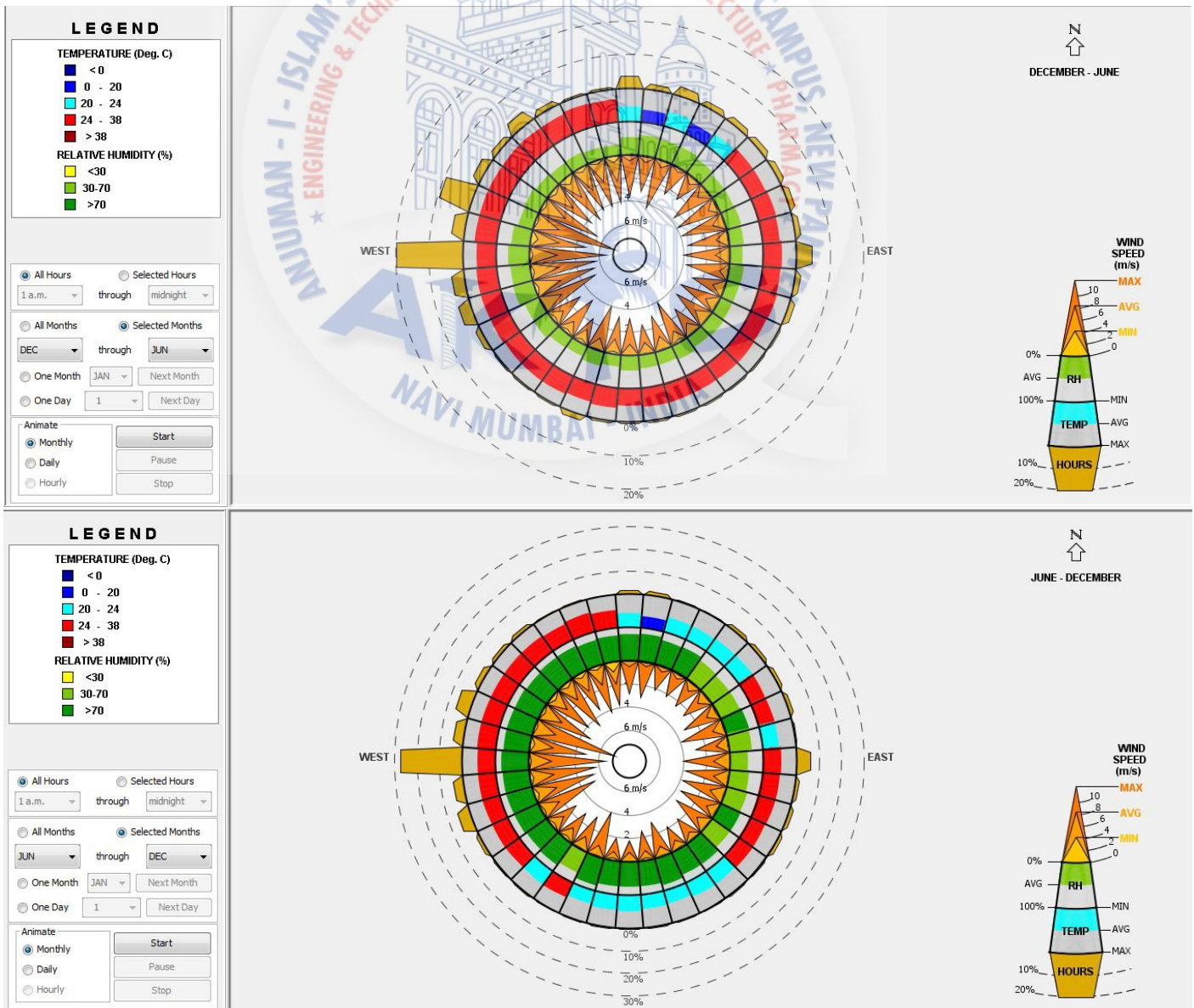
4) Bio-climatic chart

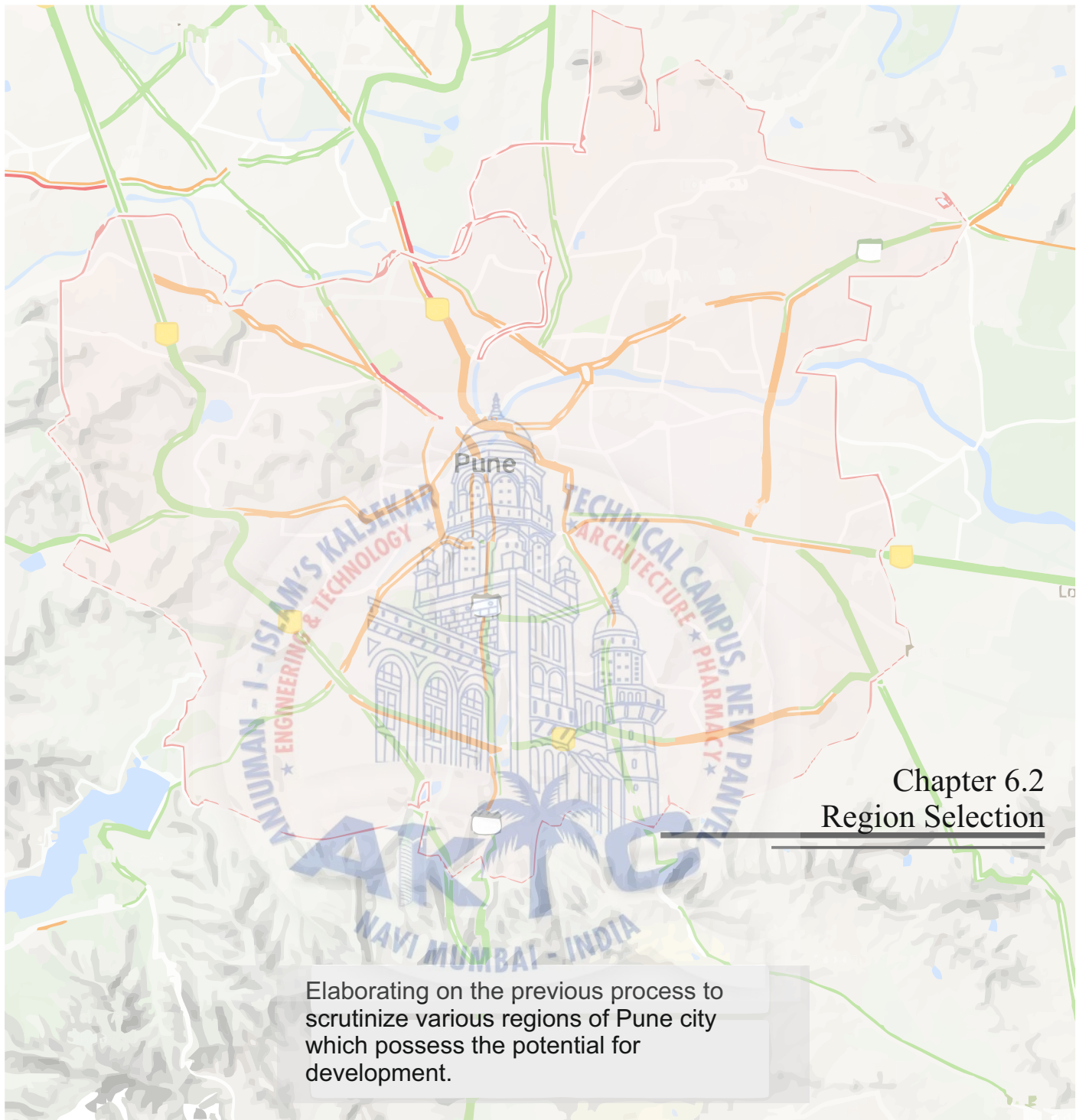


Inference: Max Wind Speed: 8m/s coming from west

N – S-W gives the maximum temperature ranging form 24 deg.C - 38 deg.C

5) Wind wheel





Region selection to execute design thesis

The Institute focuses on providing lacking resources to the public sector. Its prime targets are focusing on people from various backgrounds.

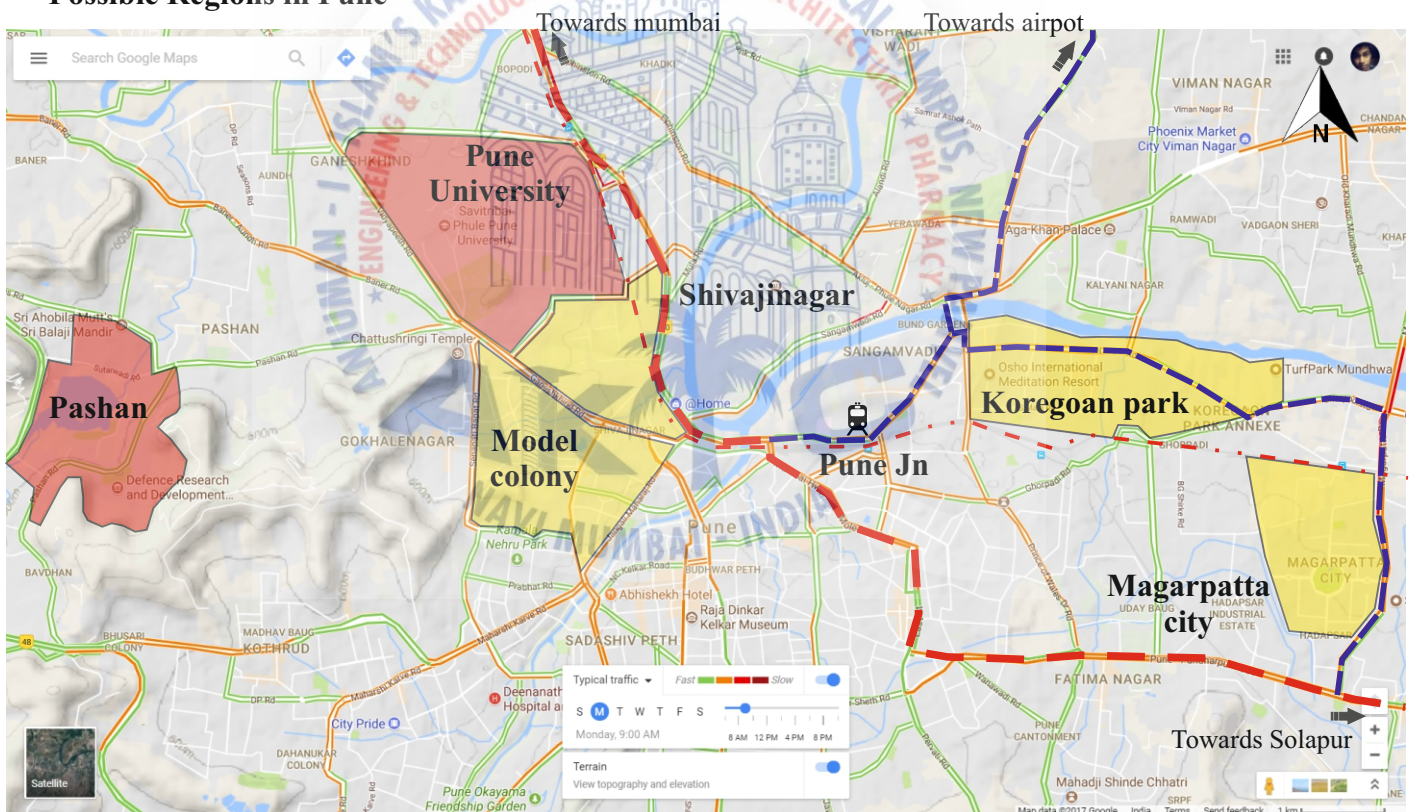
1. Architects,
2. Engineers,
3. Artists.

With the aim of promoting Digital Architecture in India, a part of the institute will also be open to public where they can come in, and see how imaginations are converted into reality.

Thesis proposal demands a region in which it can be

1. Easily accessible to the public.
2. Close proximity to Public transportation services.
3. Close proximity to Residential zones, so that it can be easily accessible by the students.
4. Close proximity major road, where it can be promoted easily.
5. Preferably near the heart of the city

Possible Regions in Pune



Possible regions (Distance from Pune Jn station)

1. Pune University - 5.5 km
2. Shivaji Nagar - 3.1 km
3. Pashan - 8.6 km
4. Model Colony - 4.4 km
5. Koregoan Park - 3.4 km
6. Magarpatta & Amanora City - 9.4 km

Legend

- Mumbai- Pune highway
- Main connecting roads
- Railway line
- Institutional zone
- Residential zone

Facts about the Regions

Comparing the Short-listed regions on the basis of

1. Easily accessible to the public.
2. Close proximity to Public transportation services.
3. Close proximity to Residential zones, so that it can be easily accessible by the students.
4. Close proximity major road, where it can be promoted easily.
5. Preferably near the heart of the city

1. Pune University

1. It is one of the renowned institute zones in Pune.
2. It has close proximity to nearby residential zone and is nearby to the heart of the city.
3. The proposed institute cannot act as an extension to an existing College.
4. Land availability is less.
5. Distance from Pune station: 5.5km

6. Distance from Pune Airport: 12.4 km

2. Shivajinagar

1. It is one of the well known and well connected region of pune.
2. It has close proximity to pune station: 4.6 km
3. It is a prime residential zone and has many old institutes in its region.
4. Distance from Pune Airpot: 11 km
5. Land availability for new development is less.

3. Pashan

1. It is known for its pashan lake.
2. It has many residential zones and some old government and private institutes in its region
3. It has relatively more land availability for new development.
4. Distance from Pune Station: 8.6 km

5. Distance From Pune Airpot:

4. Model Colony

1. One of the Renowned college Symbiosis Institute is in this region.
2. It has less land availability for new development.
3. Distance from Pune Station: 4.4 km
4. Distance From Pune Airpot:

5. Koregoan Park

1. Most Elite region of pune, with many renowned structures like Osho Meditation Centre and has many residential and commercial zones within the region

2. Distance from Pune Station: 3.4 km

3. Distance From Pune Airpot:

6. Magarpatta & Amanora City

1. Its is a new development as a model township developments where a person can get all services, eg. residential, entertainment & leisure, commercial all at one place

3. Distance from Pune Station: 9.4 km

4. Distance From Pune Airpot:



Chapter 6.3
Site Selection

Analyzing numerous Sites with respect to different factors like proximity, resources, context, etc.

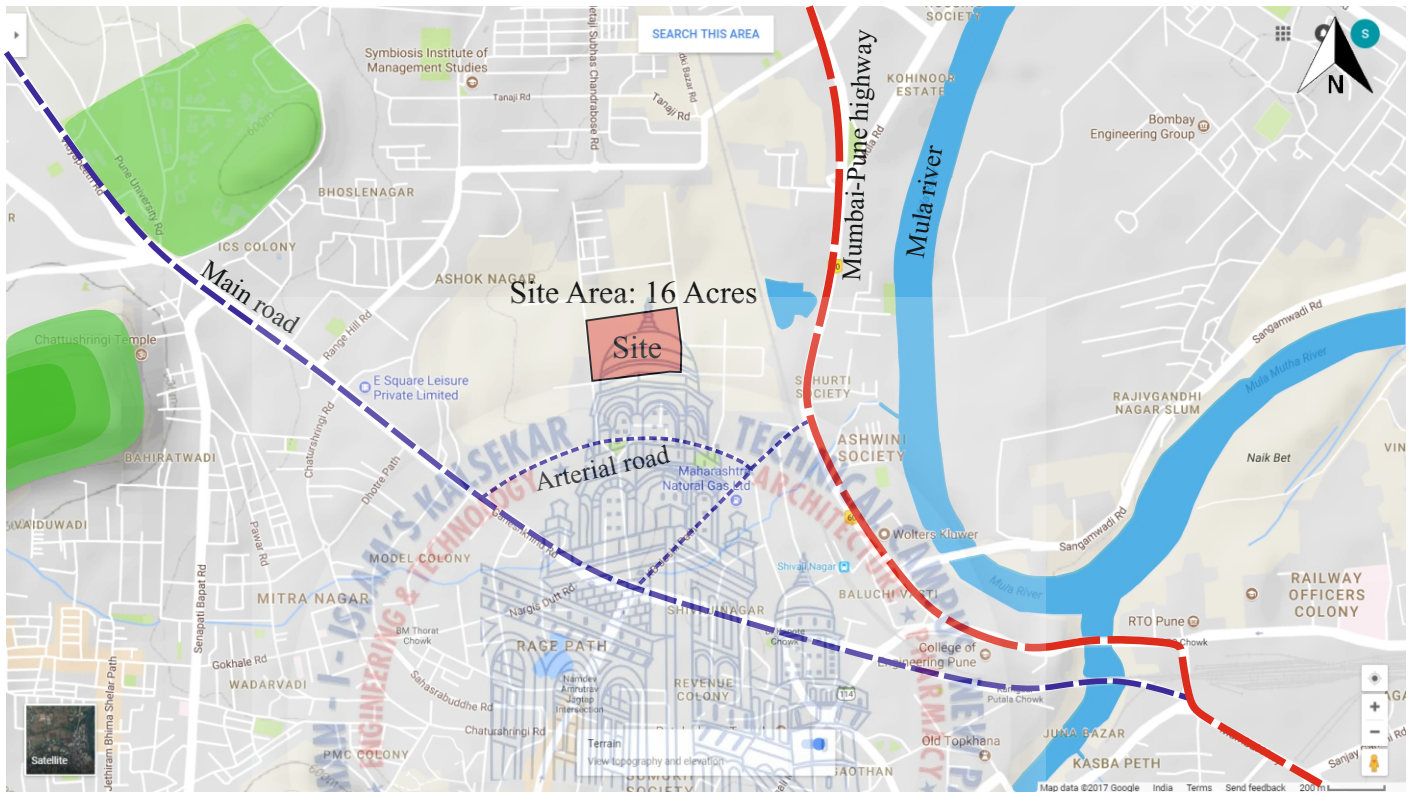
Possible sites to execute design thesis

1. Site near Shivaji nagar
2. Site near Pashan lake
3. Site near Koregoan Park.
4. Site Near Amanora city.

Sites are compared on the basis of

- | | |
|------------------------------|------------------|
| 1.Location Proximity | 3.Area |
| 2.Contextual features | 4.Landuse |

Site Near Shivajinagar



Proximity Data:



15 Min



27 Min



53 Min



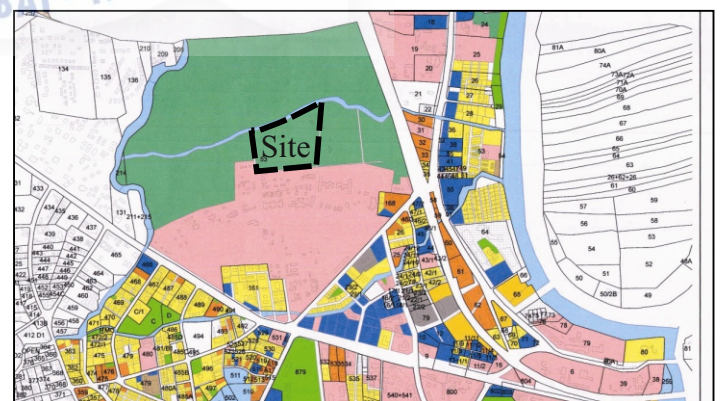
30 Min

Distance From Pune Jn: 4.3 km

Distance From Pune Airport: 11.4 km

Facts:

- It is in a prime location. Shivajinagar and model colony on each adjacent sides.
- Close proximity to the heat of the city.
- Site area required for execution thesis proposal is approx 10 acres, hence this site used for the proposal.
- Site comes under agricultural zone.



Landuse plan

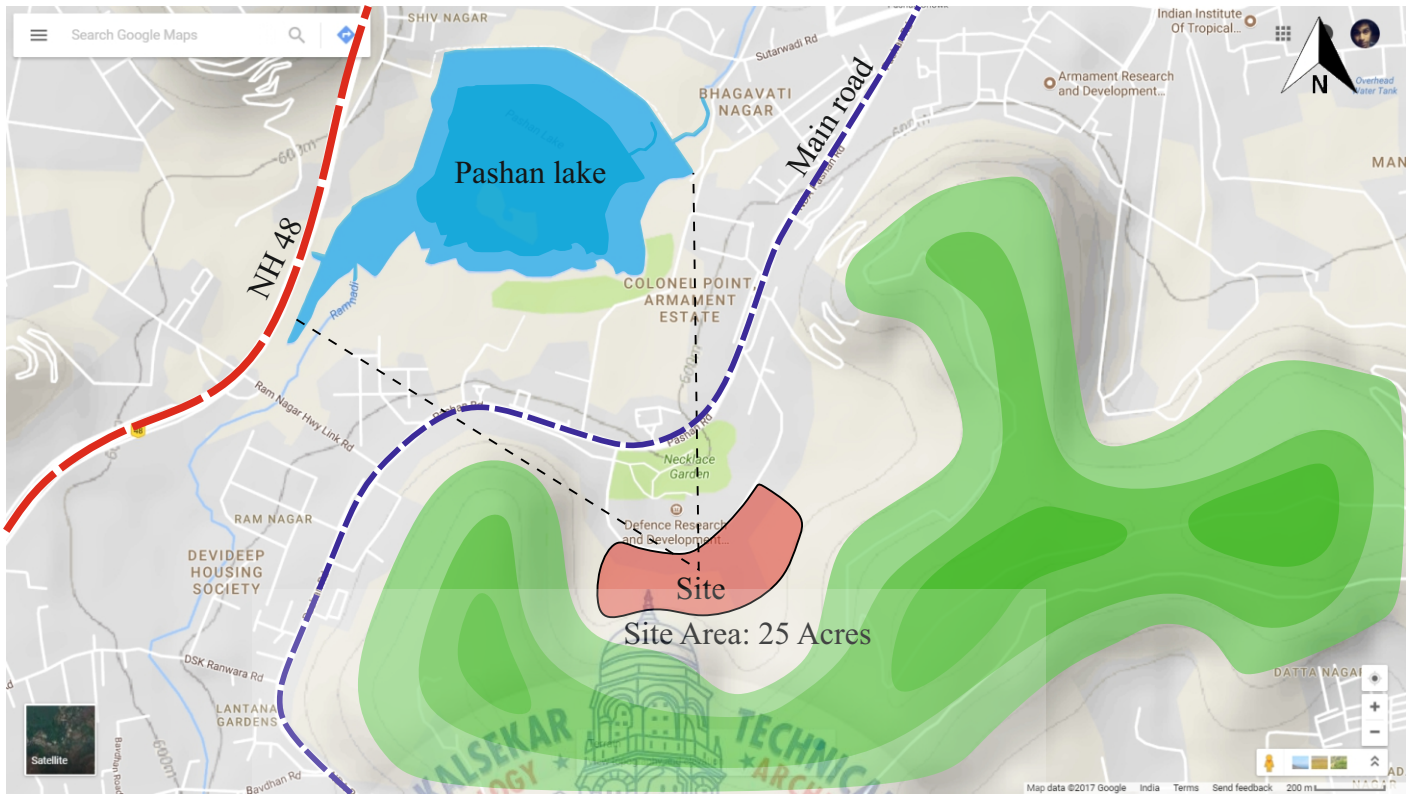
Fig.11; Source: DP 2007-27 P.M.C

Contextual features:

1. Close proximity to pune university, model colony and shivaji nagar.

Inference: Site has close proximity to prime location in Pune but it comes under Agricultural zone. Hence it cannot be used.

Site Near Pashan lake



Proximity Data:



Distance From Pune Jn: 12 km

Distance From Pune Airport: 17.8 km

Facts:

- Site is located in isolated area.
- Site is surrounded by hill top and in Pune, and in Pune they are reserved for ecological reasons.
- Site comes under defence zone.
- No access from main road, because the road passes through defence institute.



Landuse plan

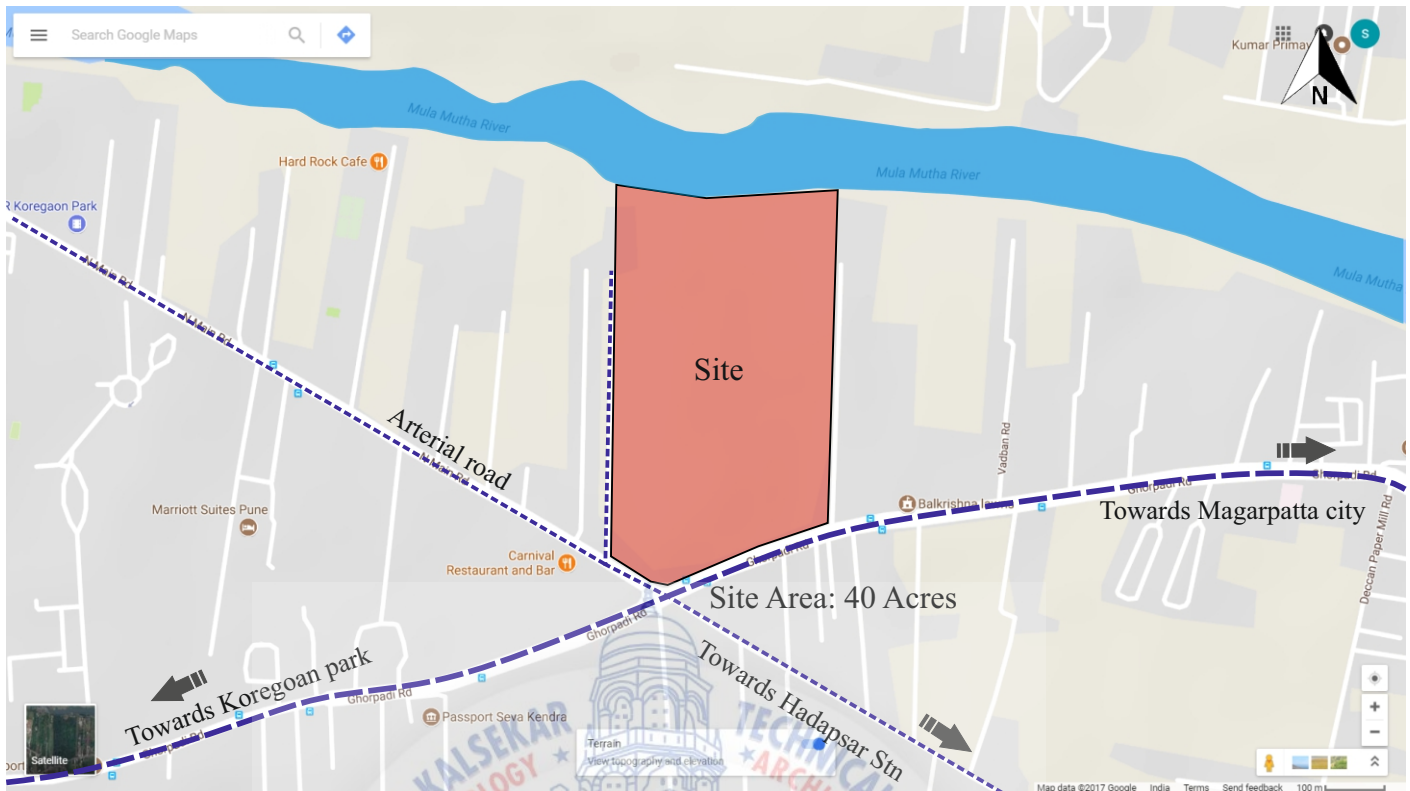
Fig. 12; Source: DP 2007-27 P.M.C

Contextual features:

1. Pashan lake is one of the prominent areas for bird watching.
2. Site surrounded by hill.

Inference: Site has good contextual features but it comes under defence zone. Hence it cannot be used.

Site Near Koregoan Park



Proximity Data:

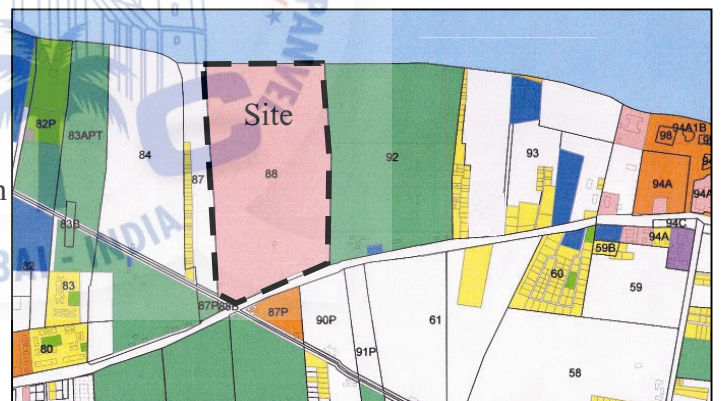


Distance From Pune Jn: 5.3 km

Distance From Pune Airport: 7.4 km

Facts:

- Site is located on a road junction
- Best proximity w.r.t the other short listed sites, located in one of the prime locations in Pune
- Many 5-star hotels in close proximity
- Existing use: Botanical survey of India, currently used for ecological purposes



Landuse plan

Fig.13; Source: DP 2007-27 P.M.C

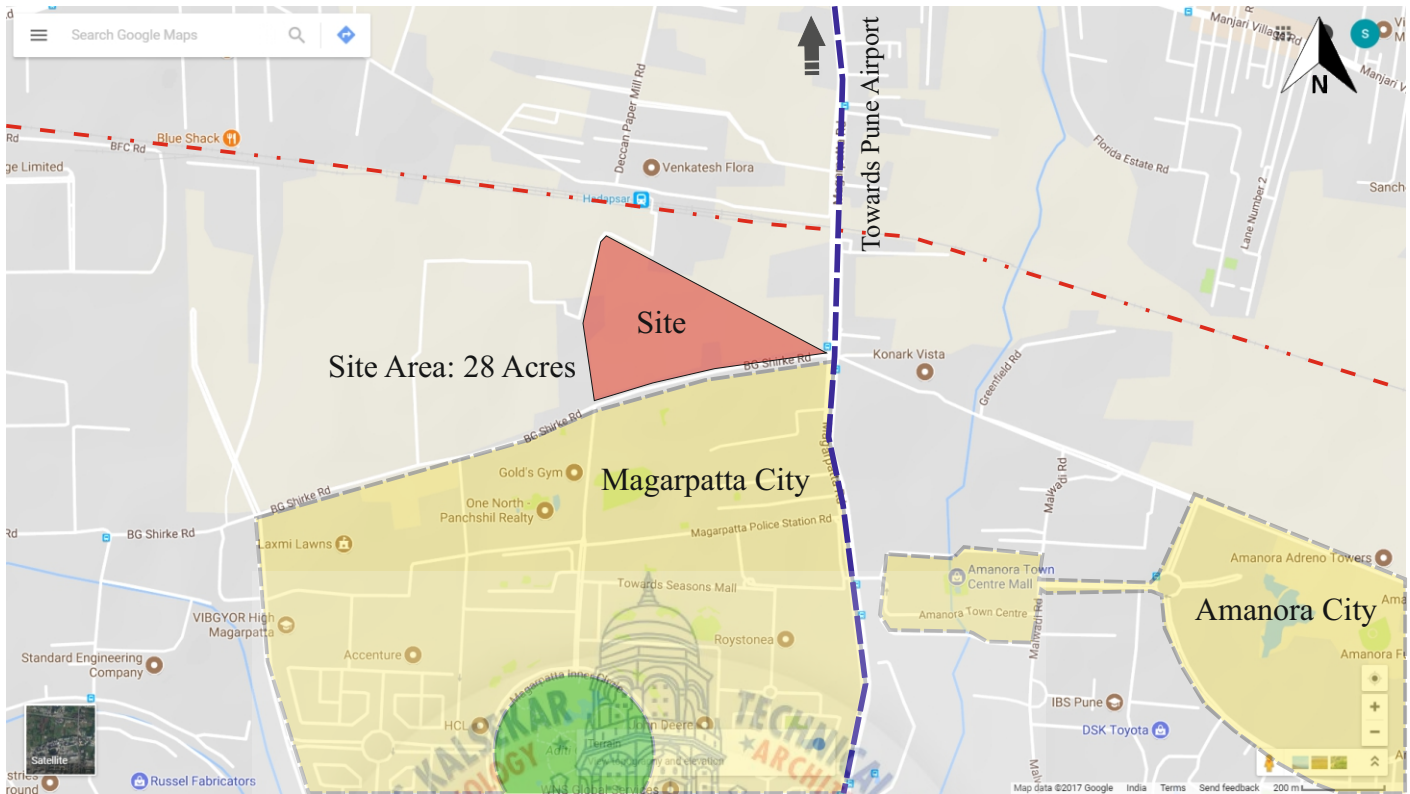
Contextual features:

1. Mulla muta river flowing from its backyard
- 2.Site covered with immense vegetation

Inference: Site is allocated for institutional zone and has close proximity to the city.

**Contextual are best suited for the program,
but it is already being used for some other activity
Hence it cannot be used.**

Site Near Magarpatta City



Proximity Data:



29 Min



43 Min



90 Min



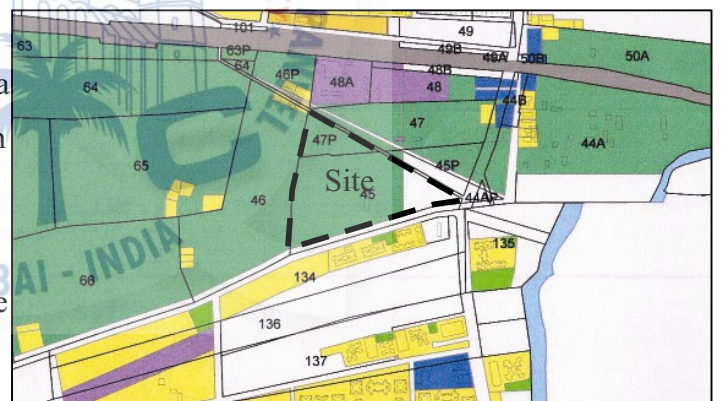
34 Min

Distance From Pune Jn: 9.3 km

Distance From Pune Airport: 11.5 km

Facts:

- Site is located near Magarpatta and Amanora city and Close proximity to Hadapsar station
- Its proximity is its advantages as it can get many users from its neighbourhood.
- Site boundary shape could be a disadvantage
- Currently the land is under dispute for converting it from agricultural to residential zone



Landuse plan

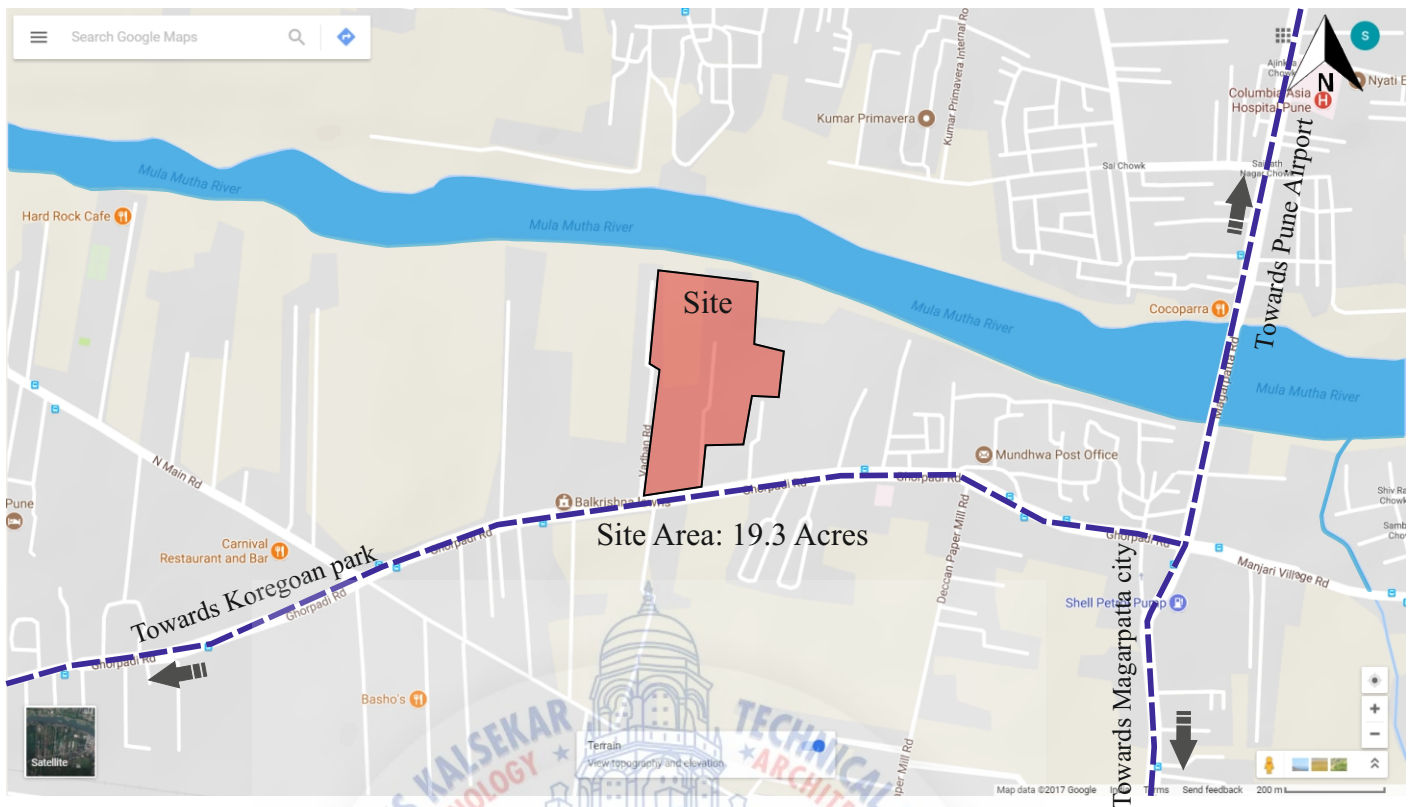
Fig. 14; Source: DP 2007-27 P.M.C

Contextual features:

1. Close Proximity to Residential zone
2. Site covered with many low height vegetation
3. It gets views and vista from its adjacent flyover and surrounding high rise buildings

Inference: Site has more contextual feature advantages over other sites, but it is demarcated under agricultural zone. Hence it cannot be used.

Site Near Vadhbhan



Proximity Data:



25 Min



33 Min



80 Min



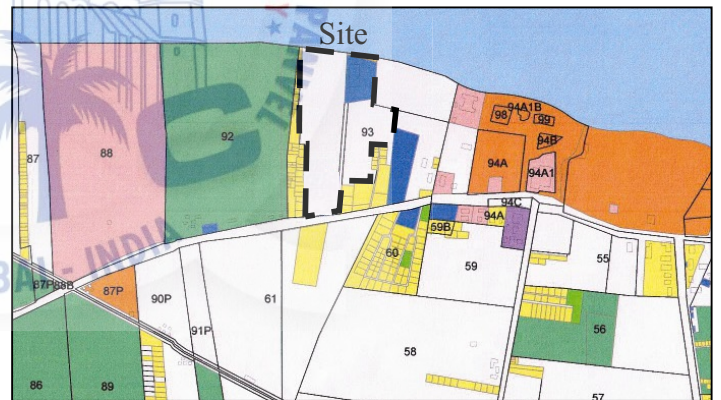
24 Min

Distance From Pune Jn: 6 km

Distance From Pune Airport: 8 km

Facts:

- Best proximity w.r.t the other short listed sites, located in one of the prime locations in Pune
- Many 5-star hotels in close proximity
- Existing Use: old abandoned egg tray factory in site
- Close proximity to hadapsar station



Landuse plan

Fig. 15; Source: DP 2007-27 P.M.C

Contextual features:

1. Mulla muta river flowing from its backyard
2. Site has an old abandoned Factory
3. Close proximity to Magarpatta and Amanora city

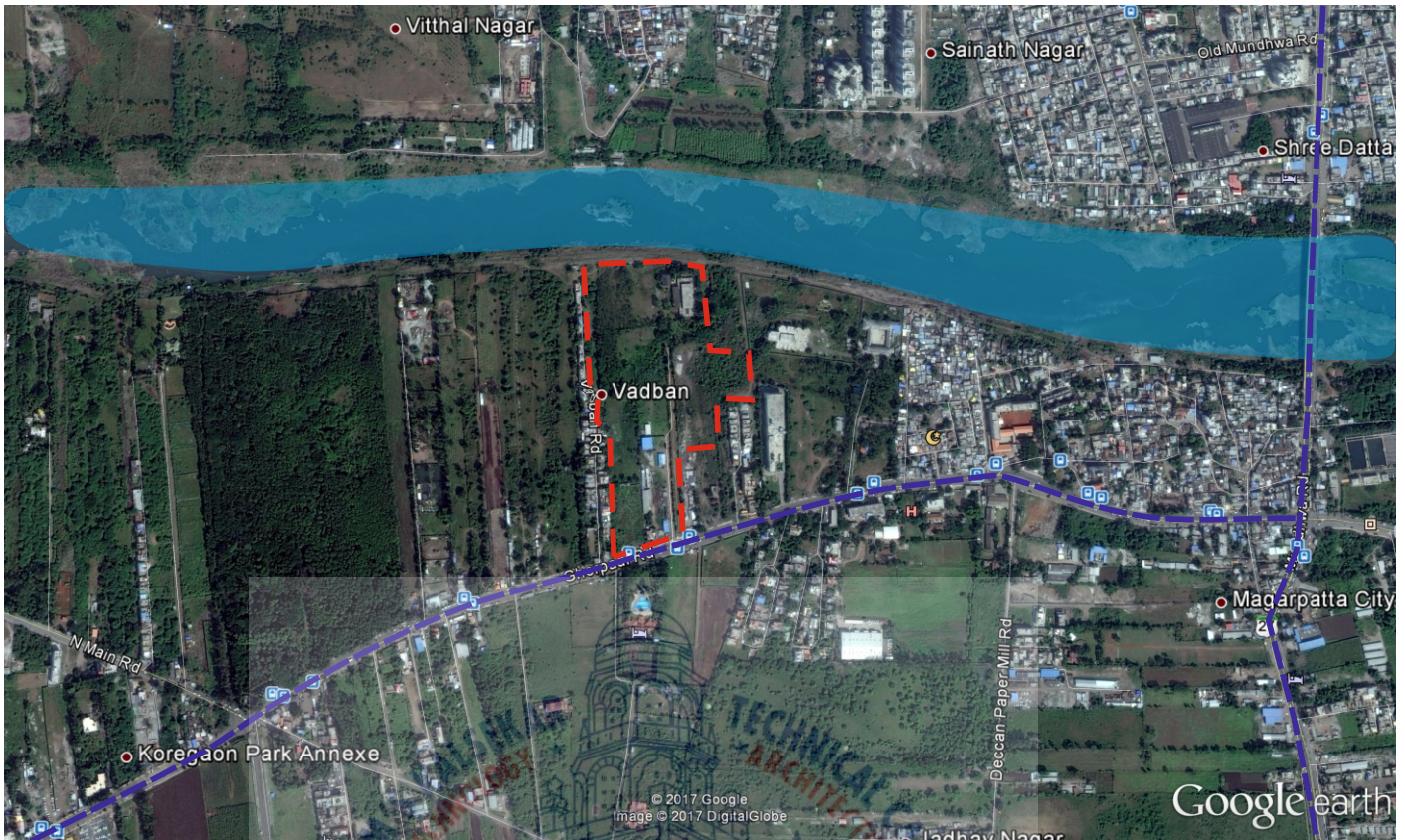
Inference: Site has more contextual feature advantages over other sites

Site is vacant and currently not under use and located near the heart of the city.

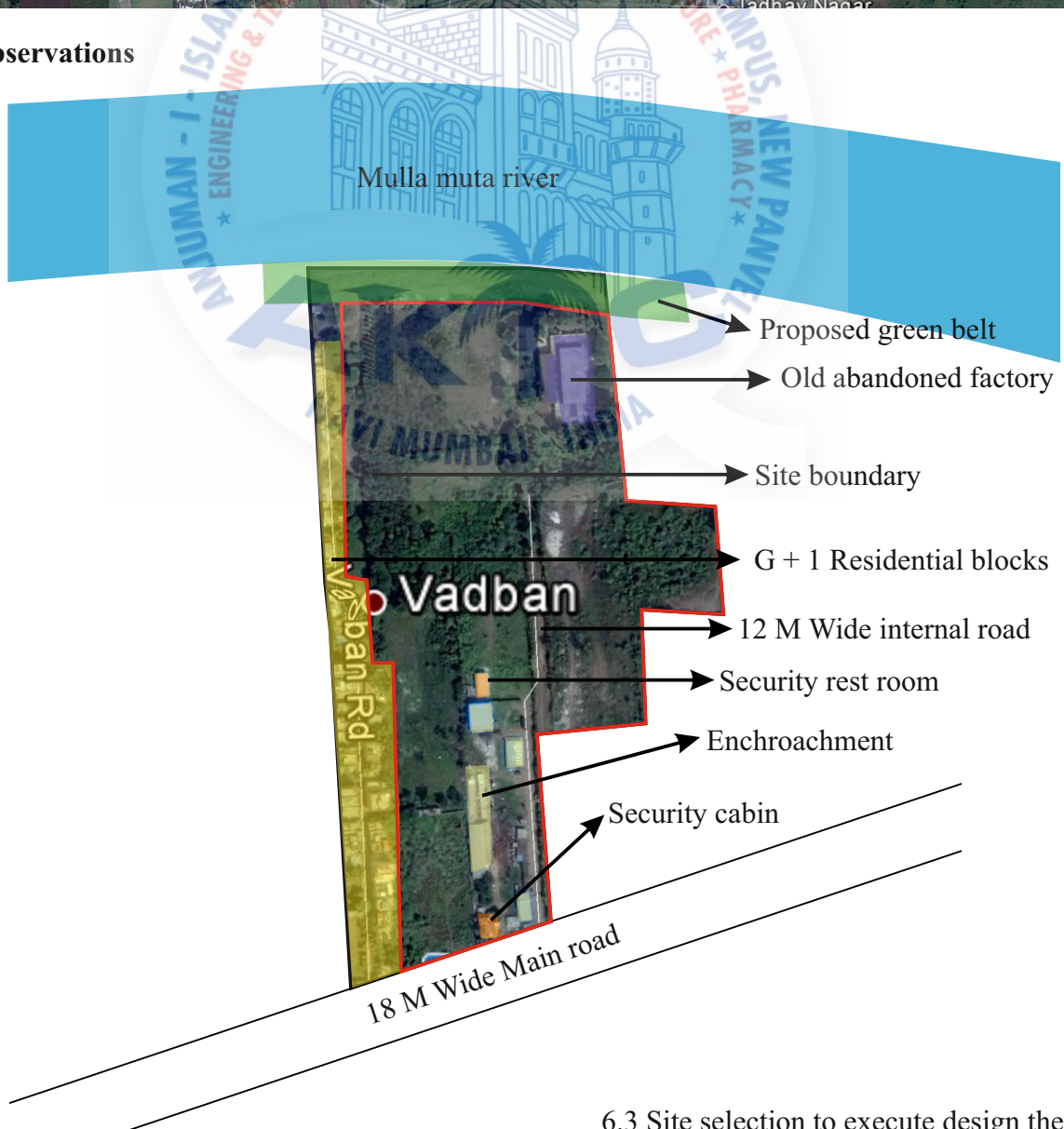
Main approach road is used by many users to reach their other destinations, hence best suited for executing thesis Proposal

This site can be used for executing thesis proposal

Google Earth image



Site observations



Site images



1. Site from river side, Green scapes in site



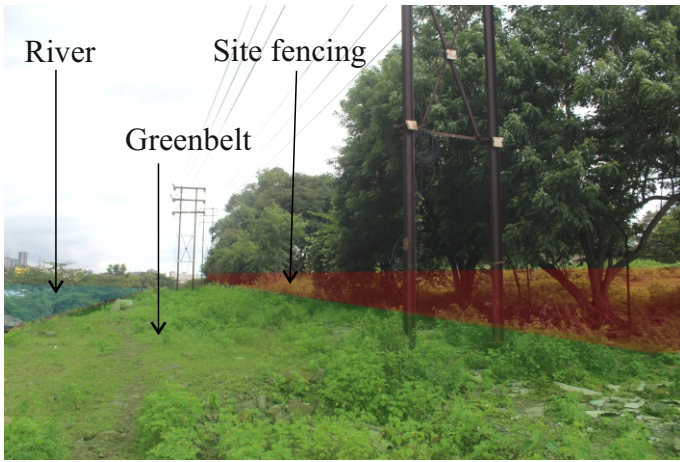
2. View of the abandoned factory



3. Unplanned vegetation on site



4. View from the front side



5. Electric overhead cables running adjacent to the site



6. Security restroom



7. 12M wide main access road into the site



8. 18M wide road touching the site



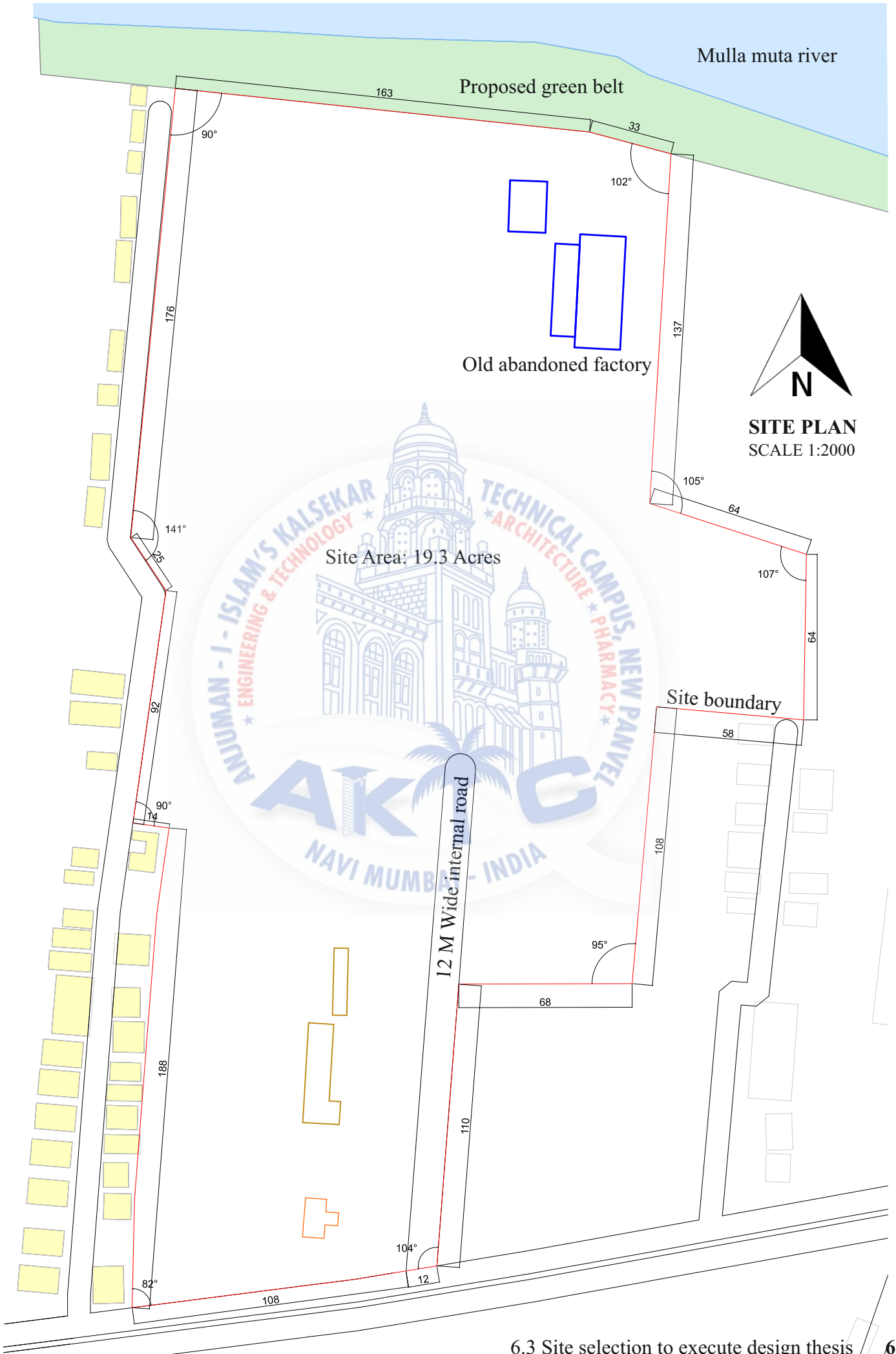
9. Steps leading to the river (waterfront opposite to site)



10. View of the River flowing adjacent to the site



11. Panoramic View of the river and context



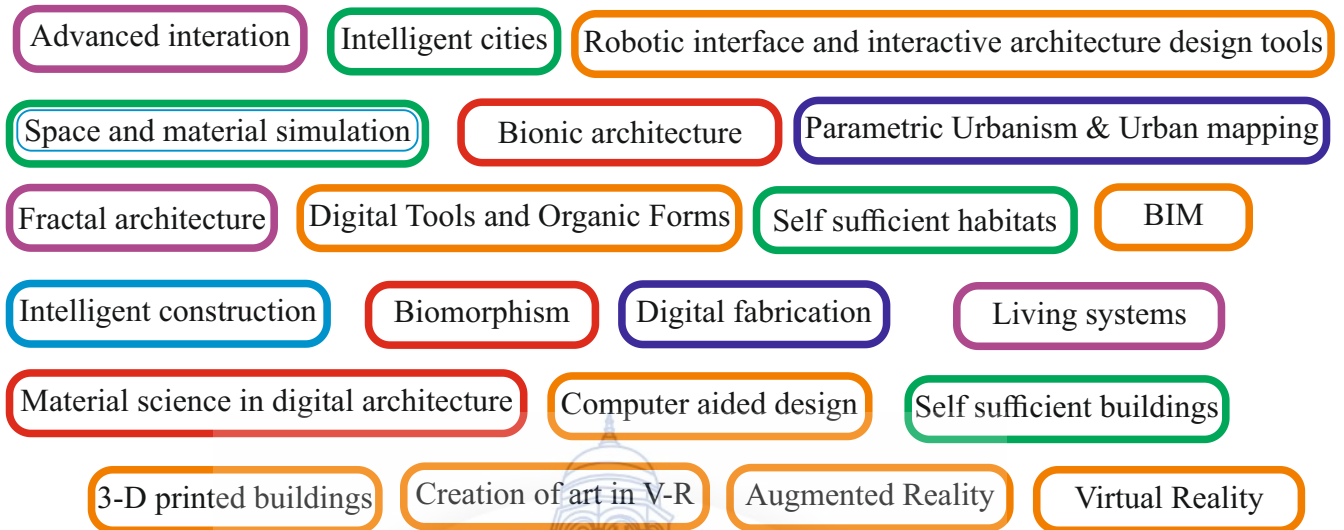
SITE PLAN
SCALE 1:2000



Chapter 7
Architectural Space
Programme

A collective approach towards developing the design program based on the research and analysis conducted through multiple media.

The institute focuses on adding plugins to the core subject to expand the possibilities and widening its scope for the research. The following topics which can help in research and development of the institute are.



Major Subjects:

1. Bio-digital Architecture || |
 2. Self-Sustainable structures || |
 3. CAD and Technologies | |
 4. Research and Development in Construction || |
 5. Fabrication and Digital tools || |
 6. Advanced Interaction || |
 7. Mapping | |
- **Advanced Architecture**
- **Advanced Interaction**

It covers applications of Digital architecture at various levels

1. Product level
2. Architectural level
3. Material level
4. Urban level

Types of Courses :

Intake of Students

<u>Certificate Course (C1) - 3 months</u>	30
<u>Certificate Course (C2) - 6 months</u>	20
<u>Ma01- 1 year (Advanced Architecture)</u>	25
<u>Ma02- 1 year (Advanced Interaction)</u>	25
<u>Ma03- 1.5 years (Advanced Architecture)</u>	25
<u>Ma04- 2 years (Advanced Architecture)</u>	50
<u>Ph01- 3 years (Bio-digital Architecture)</u>	10
<u>Ph02- 3 years (Self-sustainable structures)</u>	10
<u>Ph03- 3 years (Advanced interaction)</u>	10

Institute for research and development in digital architecture						
sr no.	Assigned area	No. of room	Preliminary area schedule			Total area (sq.m)
			Capacity	Min area per student	Area	
Built Area						
A Primary Program (Private)						
1 Research lab						
1.1	C1 lab	1	30	1.2	36	36
	C2 lab	1	20	1.2	24	24
	MA01	1	25	1.5	37.5	37.5
	MA02	1	25	1.5	37.5	37.5
	MA03	1	25	1.5	37.5	37.5
	MA04	1	50	2	100	100
	Ph01	1	10	1.5	15	15
	Ph02	1	10	1.5	15	15
	Ph03	1	10	1.5	15	15
	Research cell- For allied fields (Regular, Studio, Private)	1	20	3	60	60
2 Fabrication lab						
2.1	C1,C2	1	50	18	900	900
	MA	1	125	30	3750	3750
	Phd	1	30	30	900	900
3 Simulation Room (Space)						
3.1	MA	1	50	5	250	250
	Phd	1	10	5	50	50
4 Simulation Room (Material)						
4.1	MA	1	50	4	200	200
	Phd	1	10	4	40	40
5 Computer lab						
	C1- Rhino lab	1	15	1.2	18	18
	C1- Maya lab	1	15	1.2	18	18
	C1- Programing lab	1	15	1.2	18	18
	C1- BIM lab	1	30	1.2	36	36
	C2	1	20	1.2	24	24
6 V-R Room						
	Common	2	25	3	75	150
7 Digital Library						
	Common	1	245	1	245	245

8	Faculty room	1				
	C1		3	1.5	4.5	4.5
	C2		4	1.5	6	6
	MA01		6	1.5	9	9
	MA02		4	1.5	6	6
	MA03		2	1.5	3	3
	MA04		6	1.5	9	9
	Ph01		1	1.5	1.5	1.5
	Ph02		1	1.5	1.5	1.5
	Ph03		1	1.5	1.5	1.5
	Visting staff		10	1.5	15	15
9	HOD Cabin					
	C	1	5	3.6	3.6	3.6
	MA04	1	5	3.6	3.6	3.6
	MA01	1	5	3.6	3.6	3.6
	Phd	1	5	3.6	3.6	3.6
	Director	1	5	5	5	5
	Co-Director	1	5	5	5	5
10	Seminar Hall					
	Large	1	225	2	450	450
	Small	2	100	2	200	400
B Administrative Area						
1	Site Manager	1	3	3.6	3.6	3.6
2	Accountant	1	3	9	27	27
3	Surveillance					
	Hod	1	1	12	12	12
	Staff	1	5	20	20	20
	BMS	1	1	15	15	15
C Axillary spaces						
1	Café for Institute	1	150	0.7	105	105
2	Hostel					
	Dormitory	1	150	10.9	1635	1635
	Canteen	1	100	0.7	70	70
	Security cabin	1	2	5	10	10
	Hostel Manager	1	1	3.5	3.5	3.5

D Secondary Program (Public)						
1	Fabrication lab	1	75	18	1350	1350
2	Simulation Room (Cinema)	1	50	2	100	100
3	Food Court	1	200	0.7	140	140
4	Open Auditorium	1	200	0.5	100	100
	Total Students		225			
	Total Faculty		68			
	Total staff		7			
	Total Footfall		300			
	Total Built-up Area					11499
					Add 15% Circulation area	1724.85
	Final Built-up Area					13223.9
	Open/Non Built Area					
E Exhibition area						
	Execution /exhibition area/Workshop area		493	APD		
	Open area			APD	2000	2000
	Semi Closed			APD	3000	3000
	Parking					
	Total Area (Built+ Open)					18223.9
	Total Area Required for Site (sq.m)					39671.6
	Total Area Required for Site (acres)					9.80307

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Book by Patrick Bingham-Hall

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- Emtech AA school of London syllabus
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- The dawn of the virtual reality in architecture | Gunita Kulikovska | TEDxRiga
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Source: <https://www.forbes.com/sites/quora/2016/06/03/exploring-the-mind-blowing-realm-of-digital-architecture/#77902ff170fe>

List of Figures

Figure 1: Tilt Brush by Google

Source: Google images/Google tilt brush

Figure 2: Makers' Asylum, Andheri

Source for images: Maker's Asylum official facebook page

Figure 3-4:

Source: Grant Associates

Figure 5:

Source: Slideshare

Figure 6:

Source: NID Official Website

Figure 7: Growth of cities V/s Pollution Index

Source: <https://www.numbeo.com/pollution/rankings.jsp>

<http://www.walkthroughindia.com/offbeat/top-35-fastest-developing-and-emerging-cities-of-india>

20 Smart Cities Proposed by the Govt. Of India

Source: <Http://smarcities.gov.in/content/innerpage/cities-profile-of-20-smart-cities.php>

Figure 8: With 811 colleges, Pune varsity 2nd largest in country

Source: <http://timesofindia.indiatimes.com/home/education/news/With-811-colleges-Pune-varsity-2nd-largest-in-country/articleshow/25196438.cms>

Figure 9: Comparing Pune v/s Mumbai v/s Navi Mumbai on basis of

1. Pollution 2. Traffic 3. Quality of life

Source: <https://www.numbeo.com/quality-of-life/comparison.jsp>

Figure 10: Some Basic readings of climate

Source : Climate Consultant

Figure 11-15: Land Use Plan

Source: DP 2007-27

P.M.C