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INSTITUTE OF ENGINEERING  
PULCHOWK CAMPUS

## **INFORMATION TECHNOLOGY HUB**

Submitted By:

DIPESH HIMALAYA  
074-BAE-212

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**DEPARTMENT OF ARCHITECTURE**  
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.....

Asst. Prof. Prajwal Hada

(Thesis Supervisor)

Date:

Department of Architecture,

Institute of Engineering,

Pulchowk Campus,

Tribhuvan University

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## **ABSTRACT**

Information Technology (IT) is the study, design, development, implementation, management of computer-based information systems, particularly software applications and computer hardware. Information and communication technology (ICT) is currently attempting to enter many facets of human civilization. Nothing else has influenced the advancement of human civilization at such a quick rate (during the past five decades) since the discovery of fire and the invention of wheels. IT is slowly but surely transforming how we conduct business, live our lives, educate our children, care for the sick, conduct research, and pass the time. Now is the age of information and communication. A completely new world where knowledge is crucial has emerged as a result of advancements in computer and communication technology. IT Hub is the central area where these advance progress takes place with the provision of IT related building, industry specific infrastructure and other business-related services.

This research is the compilation of sequential study of IT and IT park for my thesis project titled “**IT HUB**”. The concept is derived from the idea of proposing IT centric environment and platform. But unlike 'IT Park' the project will also provide the services and benefits of IT to general public. The area of information technology is developing so rapidly that it has been difficult to predict the next outcome. The main goal of my project is to provide friendly and productive environment for the IT companies, offices, IT students for exploring the sector of IT, platform for commercializing their work in front of the general public. This proposal shall try to explain various aspects and objective of the project and outlines the basic idea and requirement for the initiation of the project.

**TABLE OF CONTENTS**

<b>COPYRIGHT .....</b>	<b>I</b>
<b>CERTIFICATE.....</b>	<b>II</b>
<b>DECLARATION.....</b>	<b>III</b>
<b>ACKNOWLEDGEMENTS .....</b>	<b>IV</b>
<b>ABSTRACT.....</b>	<b>V</b>
<b>LIST OF FIGURES .....</b>	<b>XII</b>
<b>1 INTRODUCTION.....</b>	<b>1</b>
1.1 INFORMATION TECHNOLOGY .....	1
1.2 INFORMATION TECHNOLOGY HUB .....	1
1.3 HISTORY .....	1
1.4 CHARACTERISTICS OF IT PARK .....	2
1.5 SCENARIO IN NEPAL.....	2
1.6 RATIONALE OF THE RESEARCH .....	3
1.7 IMPORTANCE OF THESIS OR RESEARCH .....	4
1.8 PROBLEM STATEMENT .....	4
1.9 OBJECTIVES .....	5
1.9.1 Limitation:.....	5
1.10 RESEARCH METHODOLOGY .....	5
<b>2 LITERATURE REVIEW .....</b>	<b>7</b>
2.1 FRAMEWORK OF SPACES .....	7
2.2 OFFICE SPACES .....	7
2.2.1 Primary Spaces.....	7
2.2.2 Supporting Spaces.....	8
2.2.3 Circulation Spaces .....	9
2.2.4 Service Spaces .....	9
2.3 IT OFFICES .....	9
2.3.1 Introduction.....	9
2.3.2 Workstation and Offices .....	10
2.4 OFFICE PLANNING.....	12
2.5 OFFICE STRUCTURE.....	14
2.5.1 Programming section .....	14
2.5.2 Supporting section .....	14
2.5.3 Floor area requirement.....	15
2.6 PRIMARY WORKSPACE.....	15
2.7 SUPPORTING SPACES .....	19
2.7.1 Reception and Lobby Area .....	19

2.7.2	Meeting Rooms	20
2.7.3	Meeting Space	21
2.7.4	Conference Room	22
2.7.5	Breakout Areas	22
2.7.6	Restaurant/Café	23
2.7.7	Gaming Zone	23
2.8	EXHIBITION SPACE/ GALLERY	24
2.8.1	Exhibition Space Requirement	24
2.8.2	Display	25
2.8.3	Acoustics	25
2.9	PLAZA	25
2.9.1	Orientation	26
2.9.2	Configuration	26
2.9.3	Visibility	26
2.10	RESEARCH LABORATORY	27
2.10.1	Introduction	27
2.10.2	Research Laboratory Space Planning	27
2.10.3	Research Laboratory Module	28
2.10.4	Lab Workstations	28
2.11	RETAIL SPACES	29
2.11.1	Basic plan layouts for retail shops:	29
2.12	LIGHTING	30
2.13	BUILDING CIRCULATION	30
2.13.1	Stairs	30
2.13.2	Lifts	31
2.13.3	Escalators	32
2.14	RESTROOM	33
2.15	TECHNOLOGICAL ASPECT	34
2.16	SERVER/CONTROL ROOM	35
2.16.1	Design consideration	35
2.16.2	Temperature Control	35
2.17	INTELLIGENT BUILDING	36
2.18	BIOPHILIC DESIGN	37
2.18.1	Biophilic Design: Introduction	37
2.18.2	Biophilic Design and Workspace	38
2.18.3	Key Biophilic elements in Workspace	39
2.19	GREEN DESIGN	42
2.19.1	Green Roof	42
2.19.2	Green Walls	43
2.19.3	Atrium	43

2.19.4	Rain Water Harvesting.....	44
2.19.5	Permeable Paving.....	44
2.20	ARCHITECTURE EXPRESSION .....	45
2.21	PARKING STANDARD .....	46
<b>3</b>	<b>CASE STUDIES.....</b>	<b>48</b>
3.1	IT PARK, BANEPA, KARVE.....	48
3.1.1	Introduction.....	48
3.1.2	IT Park Master Plan .....	49
3.2	LEAPFROG TECHNOLOGY, CHARKHAL.....	50
3.2.1	General Information.....	50
3.2.2	Objective of Study .....	50
3.2.3	Site Analysis .....	50
3.2.4	Salient Features.....	51
3.2.5	Master Plan .....	51
3.2.6	Spatial Illustrations .....	52
3.2.7	Office Planning.....	53
3.2.8	Circulation.....	54
3.2.9	Lighting.....	55
3.2.10	Parking .....	55
3.2.11	Materials Used .....	55
3.2.12	Air Condition and Ventilation .....	55
3.2.13	Others.....	56
3.2.14	Analysis.....	56
3.2.15	Inferences.....	57
3.3	DEERWALK INSTITUTE OF TECHNOLOGY.....	57
3.3.1	General Information.....	57
3.3.2	Objective of Study .....	57
3.3.3	Planning and Observation.....	57
3.3.4	Analysis: .....	60
3.4	GOOGLEPLEX, MOUNTAIN VIEW, UNITED STATES .....	61
3.4.1	General Information.....	61
3.4.2	Objectives of Study.....	61
3.4.3	Description.....	61
3.4.4	Salient Features:.....	61
3.4.5	Site Plan .....	62
3.4.6	Master Plan .....	62
3.4.7	Concept .....	63
3.4.8	Space Illustration .....	64
3.4.9	Workspace.....	64
3.4.10	Breakout Spaces.....	67

3.4.11	Materials Used .....	68
3.4.12	Sustainable Features.....	68
3.4.13	Inferences:.....	70
3.5	TIDEL PARK, CHENNAI.....	71
3.5.1	General Information.....	71
3.5.2	Objectives of Study.....	71
3.5.3	Description .....	71
3.5.4	Salient Features .....	71
3.5.5	Site Analysis .....	71
3.5.6	Master Plan .....	72
3.5.7	Workspace.....	72
3.5.8	Supporting Spaces.....	72
3.5.9	Circulation.....	72
3.5.10	Parking – Surface and Double Basement.....	73
3.5.11	Materials Used .....	73
3.5.12	Materials Used .....	73
3.5.13	Inferences .....	73
<b>4</b>	<b>COMPARATIVE ANALYSIS.....</b>	<b>74</b>
<b>5</b>	<b>SITE ANALYSIS .....</b>	<b>77</b>
5.1	SITE SELECTION CRITERIA .....	77
5.2	SITE DESCRIPTION .....	77
5.2.1	Location .....	77
5.2.2	Site Surrounding .....	78
5.2.3	Site Condition/ Topography.....	79
5.2.4	Access .....	79
5.3	CLIMATIC STUDY .....	79
5.4	SOCIAL DESCRIPTION .....	80
5.5	CULTURAL DESCRIPTION .....	80
5.6	BYE-LAWS.....	80
5.7	SWOT ANALYSIS.....	81
5.7.1	Strength of the site .....	81
5.7.2	Weakness of the site.....	81
5.7.3	Opportunities.....	81
5.7.4	Threats.....	81
5.8	SITE PICTURES .....	82
<b>6</b>	<b>PROGRAM FORMULATION.....</b>	<b>84</b>
6.1	ADMINISTRATION.....	85
6.2	RENTABLE OFFICES.....	86
6.2.1	Rentable Office (30 People Module): 4.....	86

6.2.2	Rentable Office (60 People Module): 8	87
6.2.3	Rentable Office (80 People Module): 4	88
6.3	DATA CENTER	89
6.4	RETAIL STORE	89
6.5	RESTAURANT	89
6.6	PUBLIC ORIENTED SPACES	90
6.7	PARKING	90
<b>7</b>	<b>DESIGN AND FORMULATION</b>	<b>91</b>
7.1	WHAT IS IT HUB?	91
7.2	DESIGN CONCEPT	91
7.2.1	CONCEPT	91
7.2.2	CONCEPTUAL DEVELOPMENT	91
7.3	MASTER PLAN	97
7.3.1	Planning	98
7.3.2	Entrance	98
7.3.3	Landscape Feature	99
7.3.4	Parking Area	99
7.4	SPACES IN IT HUB	100
7.4.1	Office Foyer and Indoor Gardens	100
7.4.2	IT related stores and showrooms	100
7.4.3	Gaming Zone	100
7.4.4	Recreational Zone	101
7.4.5	Cafeteria	101
7.4.6	Administration	101
7.4.7	Breakout Areas	101
7.4.8	Office Workspace	102
7.5	CONSIDERATIONS IN DESIGN	103
7.5.1	Orientation	103
7.5.2	Green Roof	103
7.5.3	Atrium	104
7.5.4	Green Walls	105
7.5.5	Permeable Pavements	105
7.5.6	Solar Reflecting Coating	106
7.5.7	Double Pane Windows	106
7.5.8	Access Control System	106
7.5.9	Construction Materials	107
7.6	STRUCTURE DETAILS	107
7.6.1	Expansion Joint	107
7.6.2	Structural Details	108
7.6.3	Foundation	108

7.7	BUILDING SERVICES.....	109
7.7.1	Water Supply .....	109
7.7.2	Rain Water Harvesting.....	111
<b>8</b>	<b>CONCLUSION .....</b>	<b>117</b>
<b>9</b>	<b>REFERENCES.....</b>	<b>118</b>
<b>10</b>	<b>ANNEX .....</b>	<b>120</b>



## LIST OF FIGURES

Figure 1-1 High Tech Companies in Silicon Valley.....	2
Figure 1-2 Timeline showing history of IT in Nepal.....	3
Figure 2-1 Basic Framework of Spaces of IT Hub.....	7
Figure 2-2 Modes of Primary Spaces.....	8
Figure 2-3 Different modes of Service Spaces.....	9
Figure 2-4 Private and Semi-private Office Layout.....	11
Figure 2-5 Open Plan and Close Plan Workplace.....	12
Figure 2-6 Modified Open Plan Workplace.....	12
Figure 2-7 Typical Modular office plans and units.....	13
Figure 2-8 Basic furniture dimension and spacing in the workstation.....	14
Figure 2-9 Supporting Section.....	15
Figure 2-10 Cellular Workspace.....	16
Figure 2-11 Cellular workspace plan and group work efficiency scale.....	17
Figure 2-12 Combination workspace plan and group work efficiency scale.....	17
Figure 2-13 Team Workspace.....	18
Figure 2-14 Team workspace plan and group work efficiency scale.....	18
Figure 2-15 Open Workspace.....	19
Figure 2-16 Open Workspace plan and group work efficiency scale.....	19
Figure 2-17 Reception Desk.....	20
Figure 2-18 Waiting Lounge Plan Layout.....	20
Figure 2-19 Typical layout for small meeting rooms with standards.....	20
Figure 2-20 Layout for formal and informal meeting spaces.....	21
Figure 2-21 Layout of Conference Rooms.....	21
Figure 2-22 Breakout Space Layout.....	22
Figure 2-23 Functional Diagram of Restaurant Space.....	23
Figure 2-24 Gaming Console and Gaming Pods.....	24
Figure 2-25 Gaming Chair Dimension.....	24
Figure 2-26 London ICT Exhibition Archive.....	25
Figure 2-27 Illustrating the relationship between major and minor parts of the plaza.....	26
Figure 2-28 illustrating visibility requirements for major portions of corner public plazas.....	26
Figure 2-29 Spatial Requirement.....	27
Figure 2-30 Lab Modules.....	28
Figure 2-31 General Research Lab Plan.....	28
Figure 2-32 Typical straight, diagonal and pathway plan.....	29
Figure 2-33 Typical curved, geometric and varied plan.....	29
Figure 2-34 Staircase widths.....	31
Figure 2-35 Elevator Dimensions.....	31
Figure 2-36 Details of an Escalator.....	32

Figure 2-37 Biophilic design in workspace .....	38
Figure 2-38 Major 5 key biophilic elements in workspace.....	39
Figure 2-39 Natural Light, plantation and working environment.....	40
Figure 2-40 Water feature and use of Bright Colours.....	41
Figure 2-41 Sections of Green Roof .....	42
Figure 2-42 Green wall construction and components. ....	43
Figure 2-43 Atrium design for Daylighting and ventilation .....	44
Figure 2-44 Permeable Pavement Details.....	45
Figure 2-45 Architecture Expression of Googleplex (Left) and Cyber Gateway (Right)	46
Figure 2-46 Parking Details .....	47
Figure 3-1 Masterplan of IT Park .....	49
Figure 3-2 Site Analysis of Leapfrog.....	50
Figure 3-3 Masterplan of Leapfrog Technology.....	51
Figure 3-4 Access to basement parking, Secondary Access and Parking Area.....	51
Figure 3-5 Bubble diagram showing spatial connection between spaces (Third Floor & Fourth Floor).....	52
Figure 3-7 Third Floor .....	52
Figure 3-7 Fourth Floor .....	52
Figure 3-8 Meeting rooms and Workspace.....	53
Figure 3-9 Waiting Area and Multipurpose Hall cum Play area .....	53
Figure 3-10 Programming Section.....	54
Figure 3-11 Circulation.....	54
Figure 3-12 Use of CGI Sheets for roofing, Brick in interior walls and glass partition...	55
Figure 3-13 AC Units.....	56
Figure 3-14 Fire extinguishers, Water treatment and Generator area.....	56
Figure 3-15 DWIT Entrance Gate.....	57
Figure 3-16 Space Flow Diagram of DWIT .....	58
Figure 3-17 Different Outdoor Spaces of DWIT .....	58
Figure 3-18 Space flow diagram of Ground Floor Plan of Academic Block .....	59
Figure 3-19 Different Indoor Spaces of DWIT.....	60
Figure 3-20 Site Analysis.....	62
Figure 3-21 Landscape Network.....	62
Figure 3-22 Thematic sketch showing Constraints in site .....	63
Figure 3-23 Masterplan: Site Plan Landscape Scope .....	63
Figure 3-24 Thematic sketch showing Opportunities in the site .....	63
Figure 3-25 Campus View from the East Figure and sketch of building connection.....	64
Figure 3-26 Thematic diagram of space illustration .....	64
Figure 3-27 First floor plan of Building 43 .....	65
Figure 3-28 Second floor plan of Building 43 .....	65
Figure 3-29 Types of workspaces in Googleplex .....	66

Figure 3-30 Workspace in Googleplex .....	66
Figure 3-31 Use of Colored glass in workspace .....	67
Figure 3-32 Reception and Waiting area .....	67
Figure 3-33 Modern recreational space and nap pods .....	67
Figure 3-34 Indoor and Outdoor Breakout Spaces .....	68
Figure 3-35 Material use in Googleplex .....	68
Figure 3-36 Solar Panels in roofing .....	69
Figure 3-37 Green Transportation .....	69
Figure 3-38 Tidel Park .....	71
Figure 3-39 Tidel Park Site Plan.....	71
Figure 3-40 Landscape Area.....	72
Figure 3-41 Workspace Area.....	72
Figure 3-42 Parking Areas .....	73
Figure 5-1 Kathmandu Valley Major routes and proposed site.....	77
Figure 5-2 Proposed site for IT Hub and its surrounding .....	78
Figure 5-3 Pictures of the Site .....	83
Figure 6-1 Framework of Spaces.....	84
Figure 7-1 Conceptual Plan Development.....	93
Figure 7-2 Conceptual Section.....	94
Figure 7-3 Multi Terrace Approach.....	94
Figure 7-4 Vertical Zoning .....	95
Figure 7-5 Conceptual Form Development .....	96
Figure 7-6 Masterplan.....	97
Figure 7-7 Main Entrance Design.....	98
Figure 7-8 Landscape Features .....	99
Figure 7-9 Surface Parking .....	99
Figure 7-10 Indoor Garden and atrium .....	100
Figure 7-11 Breakout Space.....	101
Figure 7-12 Roofing Types.....	103
Figure 7-13 Roof Garden .....	104
Figure 7-14 Building Section with Atrium .....	104
Figure 7-15 Green Walls and break out space .....	105
Figure 7-16 Section of Permeable Pavement.....	105
Figure 7-17 Double Glazed Window Detail .....	106
Figure 7-18 Access Control System .....	107
Figure 7-19 Expansion Joint Detail .....	108
Figure 7-20 Rain Water Harvesting Section.....	111

## **1 INTRODUCTION**

### **1.1 INFORMATION TECHNOLOGY**

Technopedia defines INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) as, the integration of telecommunications and computers, as well as necessary enterprise software, middleware, storage and audiovisual, that enable users to access, store, transmit, understand and manipulate information.

It is “the study, design, development, implementation, management of computer-based information systems, particularly software applications and computer hardware”. It deals with the use of electronic computers and software to store, protect, process, transmit and securely retrieve information. This is the age of information & communication. The development in computer & communication technology has led to a whole new world where information plays a vital role. IT has extended to encompass many aspects of computing and technology. More and more vital business and services like banking, business, education, medical and other various sectors are adopting IT in order to enhance their work and services as it provides advantage of speed, easiness and accuracy.

### **1.2 INFORMATION TECHNOLOGY HUB**

A technology and innovation hub (sometimes referred to as a tech hub or ICT Hub) is a space where technologists, computer scientists, hackers, web developers and programmers congregate to network, share programs and design to bring their ideas to fruition. IT Hub is simply the composition of several office structure which will primarily be used by the offices for research purpose and along with that it will comprise of many rental offices as well as other facilities to attract public on the IT sector.

With the advent of science and technology, the information system has become part of our daily life as a part of communication, trade, education, entertainment, research, information, data management. The concept of e-networking has become the integral part of our life. Every sector is adopting ICT to enhance their work and services. The software and network platform required by these agencies are provided by IT companies which are currently scattered here and there. “IT Hub” will be an attempt to provide all necessary infrastructure, sound working environment with plug and play capability all intended to enhance the productivity of IT offices and establish an IT industry as a whole.

### **1.3 HISTORY**

The concept of IT park initiated from Silicon Valley California, America in the late 50ies. The 50ies saw the birth of semi-conductor industry led by advancement of microprocessor. Driven by influence of MIT (Institute of Technology) and hence availability of skilled manpower in the area, more and more IT related offices were established here. The

principal activity then involved fabrication of microprocessors of which silicon was main component, hence the name Silicon Valley came to existence. In Europe, the first technology park was founded in 1960s under the name of Sophia Antipolis Science Park. This Park today has around 2500 companies employing more than 38,000 people from 80 different nationalities.

#### 1.4 CHARACTERISTICS OF IT PARK



Figure 1-1 High Tech Companies in Silicon Valley

The development of Silicon Valley was a spontaneous process however in the developing countries, an organized development to cater IT offices similar to Business Parks became popular. This was mostly fueled by the government for the development of local IT sector. The idea was to provide space with necessary infrastructure, facilities and sound environment for the IT companies so as to make them more productive. This concept became widely successful in many countries and later came to be termed as Information Communication Technology Park (ICT Park) or more popularly IT Park.

The IT Park is almost always planned or developed in various phases as IT sector is bound to grow with time. It is one reason why IT Park are developed outside the main city core area. The expansion can be to such degree that it can take a form of IT city. The example of which includes Cyber Abad or HITEC near Hyderabad.

#### 1.5 SCENARIO IN NEPAL

Computer were first introduced in Nepal for census purpose in the mid 80ies and it was successful in reducing the time for census from 6 months to 6 weeks. Today Information and communication technology (ICT) is slowly but surely being used in different fields. Dozens of ISP exist in the country. Cellular mobile phones use is on rise. More and more skilled IT manpower is being generated in the country. Still benefit obtained from IT sector is not up to its full potential.

The need of IT park was spelled out in 9th fifth year plan. Proposal was put forward to develop Banepa as an IT city. Phase I of IT Park was completed in Banepa, Kavre. But IT park faced many setbacks like distant location including bombing of premises of by the

Maoists. The IT companies were reluctant to set up business there for security reasons. The distance from main city was another factor which prevented local IT companies from using IT park. The area of ICT is developing rapidly and Nepal must be prepared to accept the challenges of rapid advancement of IT and try to use it for national development.

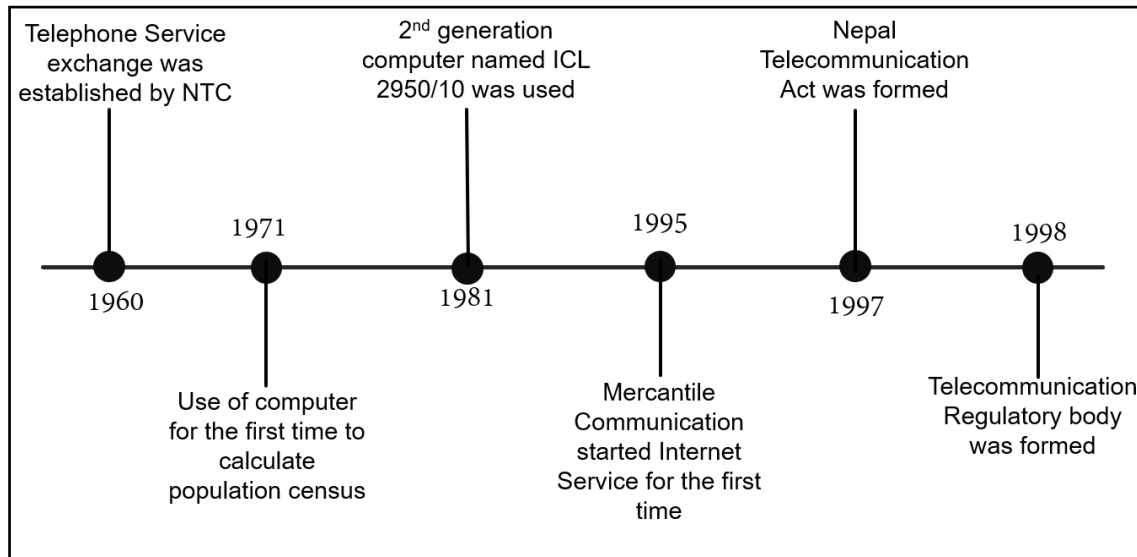


Figure 1-2 Timeline showing history of IT in Nepal

## 1.6 RATIONALE OF THE RESEARCH

Today's time is the age of information technology aka electronic age. The ICT industry is growing rapidly in the world and is estimated to grow further. The development in countries like India, South Korea can be attributed to their achievement in IT and communication sector. Although ICT manpower are increasing day by day in the country, due to lack of opportunities many of them go aboard. Hence, the development of IT Center is necessary to stop this brain drain phenomena.

IT companies and businesses scattered here and there face problems like expensive renting space, lack of proper infrastructure, services and quality space as well. Provision of suitable work space for such IT companies is essential for development of IT sector. In terms of feasibility, today ICT has become of one of the most successful businesses which is evident from success of international companies like Microsoft, Google, and Indian companies like Wipro, HCL. With the power of information storage, retrieval and processing provided by IT, the use of IT for such job is inevitable and sooner it is implemented, better will be the benefit. Today more and more companies are looking to third world companies like ours to set up their business primarily due to cheap skilled man power available and reduction in cost due to low exchange value of their currency. With IT Centre, the foreign companies can easily and quickly set up business here thus providing foreign income generation and job for the skilled IT personals in the country.



Computer have no doubt become the medium of information, education and entertainment. IT education has now become extremely important and to not use the benefit of ICT is to remain one step backward in today's world. Today the need of electronic resource center or e-library and broad band cyber cafe is evident, the requirement of which will be fulfilled by IT–Hub by creating a place for IT enthusiast and professional to share their knowledge and skills. The cyber park will help to create skilled IT man power in the country. Also, by location IT business and companies and cyber park in a single location, substantial saving can be achieved in terms of service, capital, Infrastructure development and sharing among others making the project more feasible and sustainable.

The investment in IT will no doubt have positive impact to the development of nation. There have been talks of having different smart cities in the country and the smart cities would literally be incomplete without an IT center or park in it. Hence, the proposed project is a must for the upliftment and growth of the city.

### **1.7 IMPORTANCE OF THESIS OR RESEARCH**

With increasing development and advancement in IT sector more work and office spaces to foster ICT related business and industries seems necessary. The IT center provides local IT companies a suitable base to evolve and develop. The local software and IT companies may not be able to afford to invest on their own building like their international counterparts. Hence, development of suitable working space and supporting infrastructure will help to provide suitable platform for local software companies to grow and allow the local IT sector to develop. The use of ICT is vast and includes every field. Its use today is hence no longer limited to business and technical field. With the means of internet vast amount of information is accessible to everyone. ICT can hence be effective educational tool. Virtual class rooms, multimedia have become part of education in developed countries. Implementation of IT in government and business sector means works and business can be easier, faster and smoother.

### **1.8 PROBLEM STATEMENT**

The technology industry has always experienced rapid change. According to McKinsey & Company, we may have seen a growth in e-commerce that was equivalent to ten years' worth of growth compressed into just three months in late 2019. McKinsey & Company forecasts that we'll see more technological advancement in the next decade than we did in the previous 100 years combined.

The Global Innovation Index (GII) report places Nepal 111th out of 132 economies, demonstrating how far behind we are in terms of innovation and technology. The fourth industrial revolution is currently underway in the world. Therefore, a technology revolution that will radically change the way we live, work, and interact with one another is just around the corner. The shift will be unlike anything humans has ever encountered in terms of magnitude, scope, and complexity. Although we are unsure of exactly how it will play

out, one thing is certain: a comprehensive and integrated reaction is required.

## **1.9 OBJECTIVES**

- Establish a proper space to centralize the scattered IT companies of the city
- Provide suitable working space and sound environment with necessary infrastructure for IT related companies to run their business.
- Attract foreign offices to set up their outsourcing business.
- Bring IT offices under one hood.
- Provide IT enabled facilities including resource center and other services for general public.
- To provide common ground for IT enthusiast and professionals to share their knowledge and skills.
- Support government incentive to develop Kathmandu or Bhaktapur or nearby city as ultimate IT city by providing IT center as suitable transition base around it.

### **1.9.1 Limitation:**

- The concept of IT park also includes Housing and recreational facilities.
- Housing will not be addressed as the project will evolve as business and office area so the surrounding area should be left for future development of the project itself.
- Regarding Recreational facilities, its need is secondary and is not outright important.

## **1.10 RESEARCH METHODOLOGY**

The proposed methodology will incorporate the following process in order.

- Selection of the topic and its scope.
- Problem identification
- Literature study
- Case Studies
- Interviews
- Analysis and evaluation
- Site selection and analysis
- Program formulation
- Conceptual design development
- Final design Development



A series of studies will be conducted for the purpose of this thesis, in order to formulate the program and spaces required. The methodologies and procedures to be used are literature review, case study, and design idea formulation and planning. This procedure entails identifying the project location, conducting a case study of similar projects to determine the building situation, and developing a design program. A design concept will be generated based on the literature review, case study, and research.

## LITERATURE REVIEW

- General study of IT Center
- History of IT parks, Technology and innovation centers
  - Worldwide
  - In the context of Nepal
- IT Center design and planning
- Developments in IT parks and planning
- Narratives in IT and Architecture
- Interviews
- Case studies
  - Primary case studies
  - Secondary case studies

## 2 LITERATURE REVIEW

### 2.1 FRAMEWORK OF SPACES

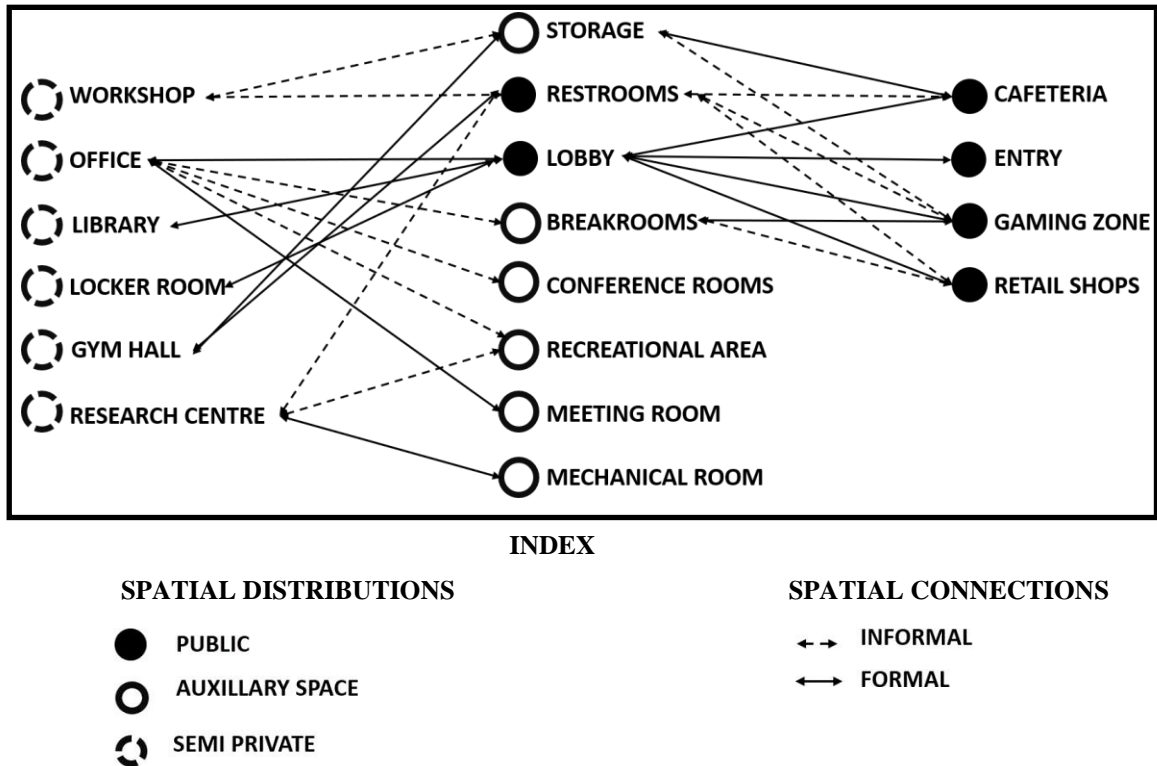


Figure 2-1 Basic Framework of Spaces of IT Hub

### 2.2 OFFICE SPACES

An office is generally a room or an area in which people work, but may also denote a position within an organization with specific duties attached to it. The main purpose of an office environment is to support its occupants in performing their job preferably at minimum cost and to maximum satisfaction. With different people performing different tasks and activities, however, it is not always easy to select the right office space. To aid decision-making in workplace and office design, one can distinguish three different types of office spaces: work space, meeting space and support spaces. For new, or developing businesses, remote satellite offices and project rooms, serviced offices can provide a simple solution and provide all of the former types of space.

Spaces, and how they are laid out, should reflect the needs of the user. However, because there are so many distinct users in office buildings, a wide range of uses for the spaces can be seen. Maximum flexibility is required by both the landlord and the tenant, as well as by the office staff for comfort and the facilities management for ease of maintenance.

#### 2.2.1 Primary Spaces

Spaces for solitary work include:

- **Workstation:** basic configuration of work surface, chair, storage and equipment.
- **Carrel:** screened area, containing single or multiple workstations.
- **Personal office:** fully enclosed spaces, usually with a door, for one or more people.
- **Team rooms:** enclosed spaces for a long-term team-working, which clients may also use.
- **Group spaces:** dedicated ‘family spaces’ for groups of people who May or may not work as teams.
- **Meeting points:** extended workstation to allow for informal meetings.
- **Meeting rooms:** enclosed spaces with formal or informal meetings furniture, plus special facilities such as electronic whiteboards, and audio- visual or video conference equipment.

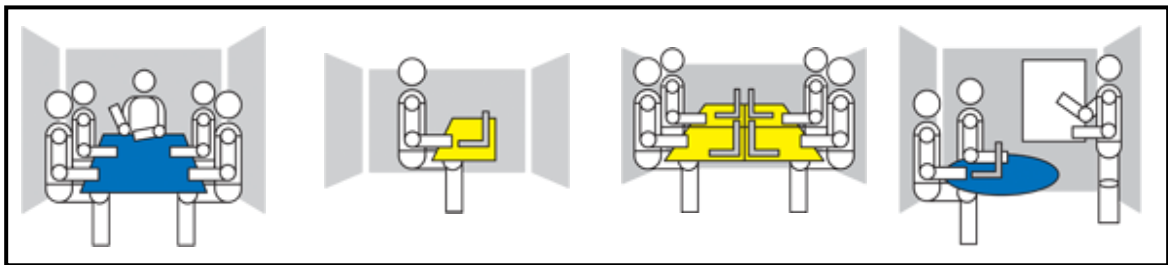


Figure 2-2 Modes of Primary Spaces

### 2.2.2 Supporting Spaces

Support spaces serve the operation of the whole building, and may also present a public face.

These include:

- **Reception areas:** balancing control and welcome, with a reception desk, visitors seating and display; provision for security and deliveries.
- **Restaurants:** including cafes and eating areas with formal and informal seating which may be used all day for group or individual working.
- **Resources Centers:** balancing control with services, the resources centre may well house samples and videos as well as paper and electronic reference materials.
- **Garden terraces and atriums:** potential use as workspaces, climate permitting.
- **Presentation suites:** varying from a single room to an auditorium with supporting facilities, these will contain audio- visual room and video-conferencing equipment.
- **Training suites:** a flexible layout of workstations allows for different learning configurations.
- **Health centre:** varying from workout equipment in a small room to a gym, swimming

pool and dance areas with changing rooms attached.

### 2.2.3 Circulation Spaces

A circulation space which covers both primary and secondary routes includes:

- **Corridor and passages:** enclosed and open routes through the building, providing clear direction and the opportunity to interact.
- **Lifts, and lift lobbies and staircases:** position and design again encourage interaction.
- **Escalators:** their capacity provides an excellent means of moving people quickly and visibly between levels.
- **Delivery areas and goods lifts:** positioned for easy access to all parts of the building.

### 2.2.4 Service Spaces

Service space includes:

- **Mail room:** business processes will dictate layout and size
- **Staff Rooms:** toilets, shower, changing rooms and sitting spaces for catering, maintenance and visiting staff.
- **Storage:** for furniture, office supplies, cleaning equipment and maintenance supplies; and secure storage for the office equipment.
- **Service storage:** for delivery and for waste that may be separated into clean, dirty, recycling and compacted.
- **Plant room:** a main plant room and a patch or control room to each floor of area.
- **Security rooms:** housing CCTV monitors and working stations for security staff.

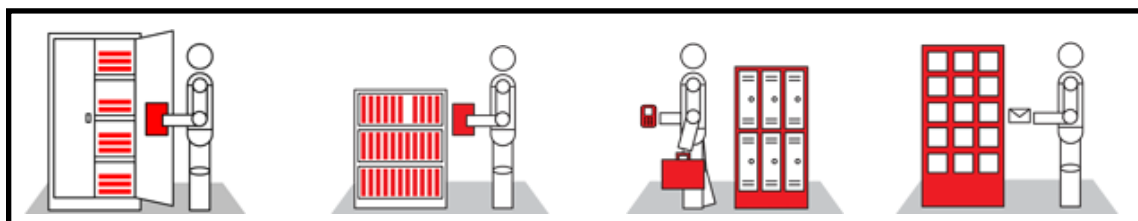


Figure 2-3 Different modes of Service Spaces

Source: (office,2020)

## 2.3 IT OFFICES

### 2.3.1 Introduction

IT offices are simply offices with workstation-friendly infrastructure, amenities, and layout. Similar to conventional offices, they can be either optimistically created to appeal to the widest possible range of tenants, which is uncommon given the stature of IT businesses in Nepal, or specifically designed to fit a specific set of requirements (one under discussion). The primary tasks performed in IT firms are software development and programming. This includes creating the platforms and assistance that different businesses, organizations, services, and the government need.

Some of the field in which IT companies are intensively involved includes:

1. Information product industry such as data entry, transaction, call center operation, animation  
and drawing, web hosting and design
2. Digital product industry like Nepalese music and films
3. Services like billing and consumer services
4. Publishing, marketing, advertising, sales and customer support.
5. Banks, airlines, cinema permitting booking ticket on-line and pay them on-line
6. Hotels and tourism related services
7. Stock Market

The IT offices execute a variety of tasks, including setting up IT platforms and provide assistance for the aforementioned companies. The demand for IT offices that provide software platforms for their organizations and services can only increase given the expanding use of IT in a variety of areas. Additionally, there are various kinds of IT offices, particularly outsourcing IT firms, or overseas IT firms eager to outsource their labor in order to cut costs.

Most IT offices are one of these types

1. Software developers (local or foreign outsourcing companies)
2. Data Processing and transcription companies, Multimedia firms
3. ISP and communication offices, website developers and designers
4. Training and E-training offices
5. Light hardware companies (esp. assembly and testing)
6. E-banks, Call centers

### **2.3.2 Workstation and Offices**

Recent trends attempt to give a spatial design that is suitable for all of an organization's particular workplace needs. This entails offering flexible workspaces that may accommodate group work, when necessary, as well as private offices for focused work. Office structures often fall into one of three categories: closed plan, open plan, or modified layout.

Selection criteria include

- The amount of planning flexibilities required
- The amount of visual and acoustic privacy required
- Initial and life cycle costs

The basic units of workstation are desks and therefore they require the most consideration. The following general rules are applicable in positioning desks:

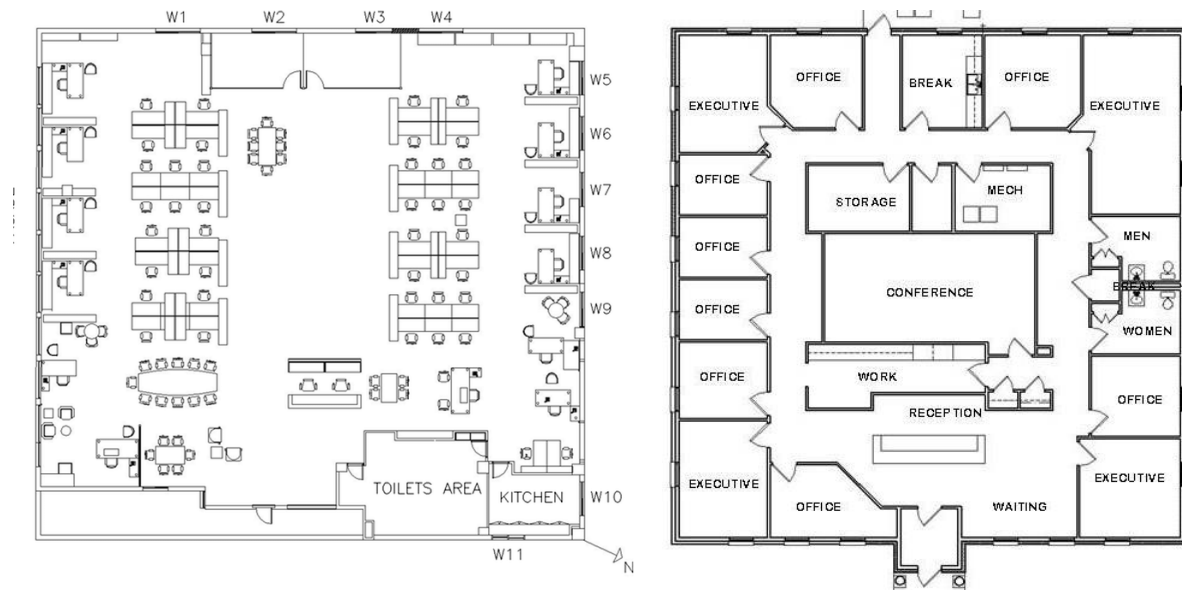
- Desk should face the same direction unless there is a compelling functional reason
- To do otherwise. The use of this technique provides for straight works flow pattern, facilitates communications, and creates a neat and attractive appearance.
- In open areas, consideration should be given to placing desks in rows of two. This method will permit the use of blank- type partition as a divider for those activities which require visual privacy while still obtaining maximum utilization.
- Desk should space at a distance of 6 feet from the front of a desk to desk behind it.
- In private offices desks should be positioned to afford the occupant a view of the door.
- In open work areas the supervisor should be located adjacent to the receptionist or secretary. Access to supervisory work stations should not be through the work area.
- Desks of employees having considerable visitor contact should be located near the office entrance.

**In a closed-plan office**, full-height walls or partitions separate the area into offices, and floor-to-ceiling dividers with doors divide the support space. Private offices are frequently found in shared rooms or along hallways. Controlled atmosphere, security, visual privacy, physical separation, and use of traditional and system furniture are all advantages. Less effective than open plan, lack of flexibility, cost of relocation, limited individual and group interaction views, and need for more complex mechanical system are some of the drawbacks.



**Figure 2-4 Private and Semi-private Office Layout**

**In an open-plan workplace**, all workstations should be placed in areas that are not divided by floor-to-ceiling walls or doors. Supports spaces are found in rooms that are completely partitioned and have doors. Energy-efficient use, increased planning flexibility, vistas, simplicity of communication, and lower life cycle costs are benefits of this approach. The lower level of environmental control and visual privacy, as well as the higher initial cost, are drawbacks of this idea.

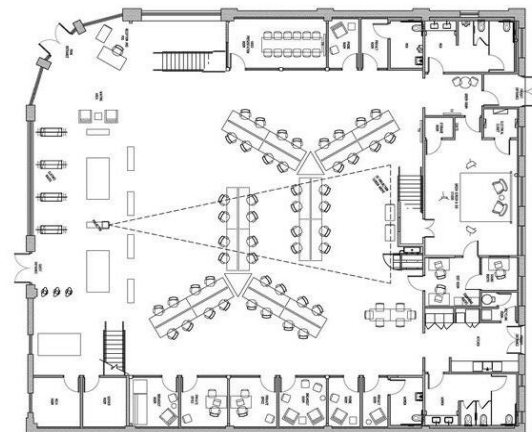


**Figure 2-5 Open Plan and Close Plan Workplace**

**Modified open plan concept**, offices combine elements of both the others by positioning certain workstations in an open plan with systems furniture and others in private offices, administration support is also located in enclosed rooms.

#### **Advantages of Open Office Planning:**

- Better flexibility in planning work stations.
- Better natural lighting and ventilation.
- Requires 20% fewer light fixtures
- Construction cost is 50% less than conventional planning as it eliminates partition cost.
- Better communication and flow of work.
- Higher efficiency: usable space as high as 80-90%



**Figure 2-6 Modified Open Plan Workplace**

## **2.4 OFFICE PLANNING**

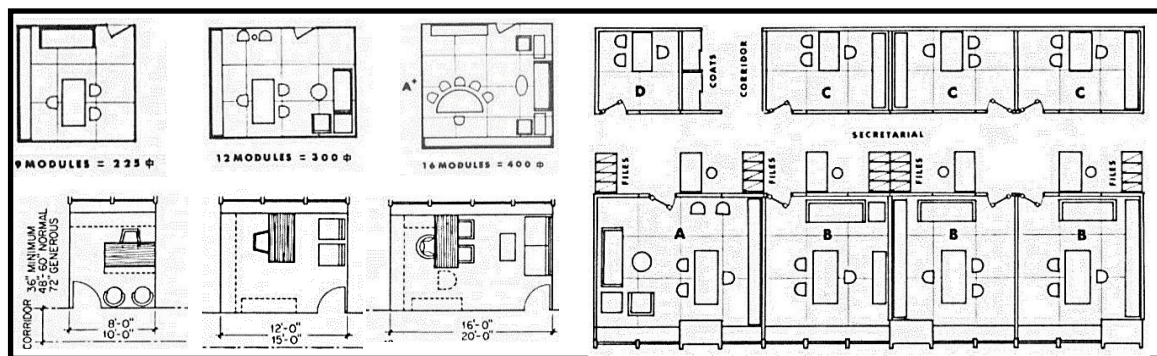


Office layout is frequently built on a module created from the required clearances, conventional furniture, and equipment. The planning unit or module for large offices is based on one desk and chair and measures approximately 1.5 m by 1.8 m. The module can be used to create a regular grid for the planning of big office areas because its dimension works well for the aisles between desk rows.

The least viable office layout along with the wall and window designs are the determining variables in the design of private offices. For this, a planning module between 1.2 and 1.5 meters tall serves the function admirably. The smallest office using this module would be made up of two modules, measuring 2.4 to 3 meters wide, and a convenient variety of office sizes is offered in increments of one module.

The column spacing also must be designed with this module. Flexibility of interior space is so important in office building design that the extra cost of clear span framing with the elimination of all interior columns is sometimes considered.

- Efficiency of an office building design is measured by the ration of rentable space to total space. Average efficiency is about 70% maximum possible is about 85%.
- The non-rentable space consists of the elevators, stairs, toilets and their associated lobbies, corridors and service ducts.



Source: (Chiara, Time Saver Standards.)

Figure 2-7 Typical Modular office plans and units

The facilities program's space allocations are typically based on a constant space module. If a headquarters building is being enlarged, the module is formed from the analysis of needs, conformity with manufacturers' standards, and an existing module. Since offices best suit the modular design, the office module will direct the building's layout.

The greatest advantage of modular planning is the flexibility that can be attended. The basic module is extended to the structural grid.

- The 5'x5' office planning module is commonly used and it is the basis for sizing most partition. The module 4'x4' and 6'x6' also can be used.
- It is usually necessary to depart from the module at corridors in which case a "half



module” should be used.

## 2.5 OFFICE STRUCTURE

The study, design, development, application, implementation, maintenance, or management of computer-based information systems has been defined as information technology in a business setting. Information technology adds value to businesses by automating operations, supplying data for decision-making, establishing connections with clients, and offering tools for increased productivity.

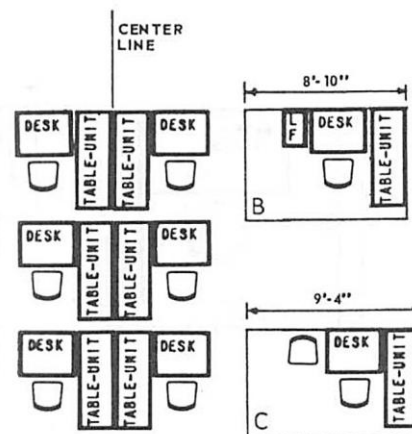
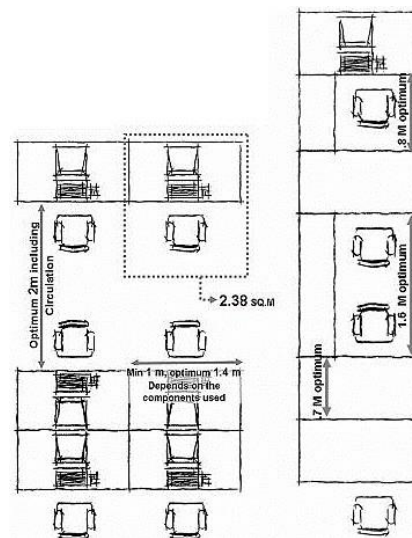
In general IT offices can be divided into two sections

- a. Programming Section
- b. Supporting Section

### 2.5.1 Programming section

The main area of the IT offices is where the work is done, which is the programming section, also known as the workstation. The workstations where programmers conduct tasks including programming, software development, testing, data entry, designing, and web creation are the primary elements of the programming department.

The programming portion is separated from the supporting sections in a good workplace since it has no direct relationship with the supporting section and any disruptions can reduce productivity and attention. The size of the programming section is set by the area of the given suspended floor, which is a basic necessity of good IT work space, even when the office space is offered in an open plan with layout done by offices. Workstation setup is simple and adaptable due to the power, network, and communication cables that are provided beneath the floating floor. The workstations are typically set up in open groups when privacy is not a concern, or alternatively, semi-closed workstations can be employed if privacy is necessary and space is not an issue.



Source: (Chiara, Time Saver Standards.)

**Figure 2-8 Basic furniture dimension and spacing in the workstation**

### 2.5.2 Supporting section

Supporting sections includes all the other units including administration and accounts and public service units. They are not directly involved in the work, but they are responsible for running and providing support to the programmers. Supporting sections in general includes the following rooms- Management section, Meeting room, Pantry, Server room, Reception & waiting, Store and rest rooms. Given the wide requirements of the offices, the layout of the units is left to the tenants themselves and units are separated generally by using aluminum partition walls. However, a separate room with permanent brick partition wall for the pantry and the rest room (if provided) are included in the design (besides the toilets, w/c and AHU room).

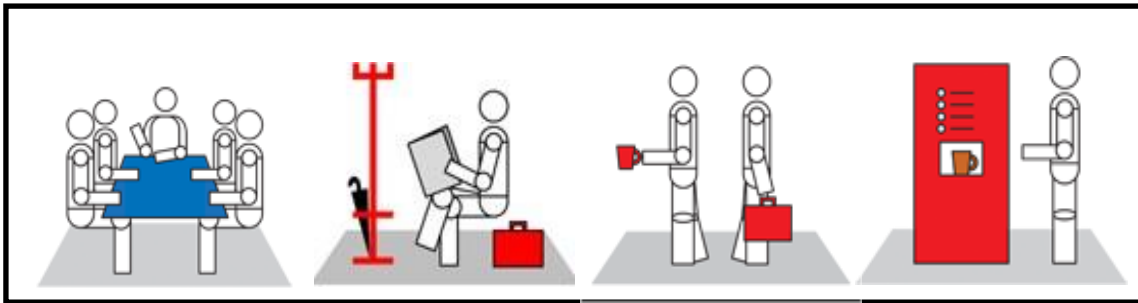


Figure 2-9 Supporting Section

### 2.5.3 Floor area requirement

Office area requirements are calculated in two parts:

- People space is calculated as (standard individual space x numbers of people) + allowances for immediate ancillary needs + a factor (usually 15%) for primary circulation.
- Non- people space should be calculated by estimates based on practice + an additional factor for primary circulation.

## 2.6 PRIMARY WORKSPACE

A workplace is a place of employment where a person goes to work for their employer. It is a space designated for use by an office worker. The demands of the person using the workspace should be reflected in the design and layout of that area. Today's offices no longer consist of the stereotypical rows of desk and chair combinations. Maximum flexibility, convenience, and ease of maintenance are required for the staff. However, because there are so many diverse users in office buildings, there is a wide range in how space is utilized. Modern work habits are changing how spaces are used and, in turn, how they are designed. The primary purposes of a workplace are to establish areas for people to work, gather, and collaborate.

The main purpose of a workspace is to support its occupants in performing their job – preferably at minimum cost and to maximum satisfaction. With different people performing different tasks and activities, however, it is not always easy to select the right type of office workspace. The various types of spaces hence mentioned is explained

henceforth.

### **Types of Workspaces:**

- a. Cellular Workspace
- b. Combination Workspace
- c. Team Workspace
- d. Open Workspace



**Figure 2-10 Cellular Workspace**

#### **a. Cellular Workspace**

The cellular office is a traditionally private space that suits up to half a dozen staff who need to either work in constant close collaboration, privacy, silence or with clients. In a cellular plan office, full height walls or partition divide the space into offices and support space by floor to ceiling partitions with doors.

Some advantages of cellular offices are:

- Controlled environment.
- Physical separation & Security.
- Visual privacy and lower noise levels.

Some disadvantages of cellular offices are:

- Less efficient than open plan.
- Layouts are more expensive as every staff, generally has a designated desk.
- Restricted individual and group interaction.

#### **b. Combination Workspace**

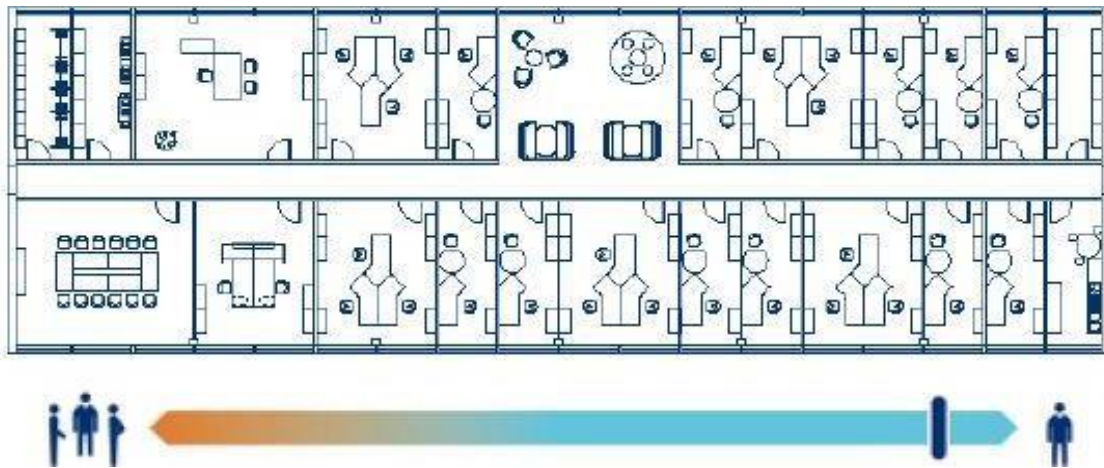
In response to the changing nature of office work, the combination workspace is an architectural reimagining of the office space as a marketplace of collaboration with individual production zones where personal productivity can take place. As communication and collaboration take precedence in many offices, individuals spend more of their time as members of many cross-functional teams. The combination office supplies the platform for this co-working space.

Some advantages of combination offices are:

- Highly flexible layouts.
- Suitable for changing and growing teams.

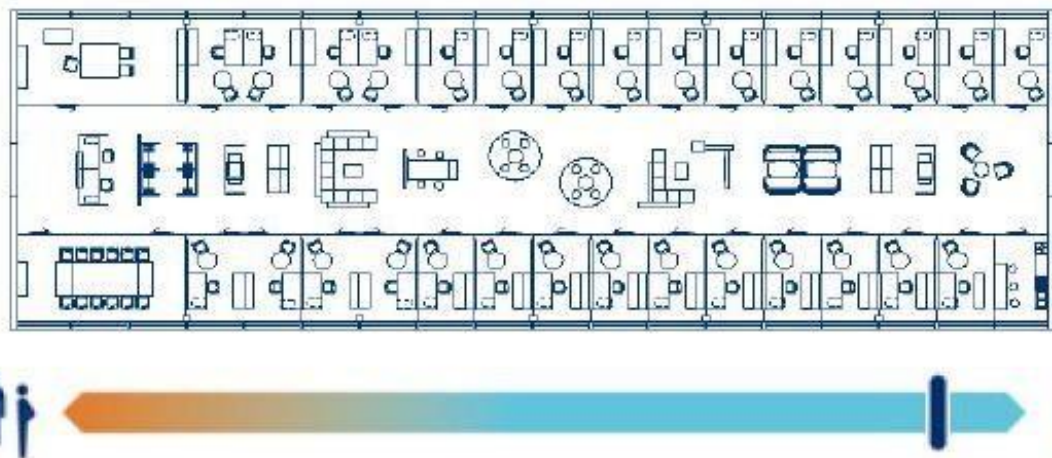
Some disadvantages of combination offices are:

- Can be space inefficient.
- Work and collaboration zones go unused.



Source: (The world of work is changing: CHALLENGE EVERYTHING, n.d.)

**Figure 2-11 Cellular workspace plan and group work efficiency scale**



Source: (The world of work is changing: CHALLENGE EVERYTHING, n.d.)

**Figure 2-12 Combination workspace plan and group work efficiency scale**

### c. Team Workspace

As computers became more prevalent in the workplace, the more structured divisions of the open plan office gave way to clustered workspace arrangements that encourage team collaboration among groups. The flexible design of the team office structure is still a popular layout in many modern offices, providing the conditions for direct communication and effective teamwork.

Some advantage of Team Workspace:

- Good ‘middle ground’ between open plan and combination offices.
- Increase in productivity, mobility and security.

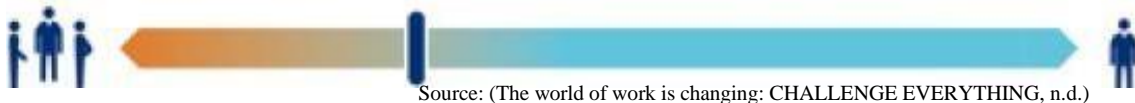
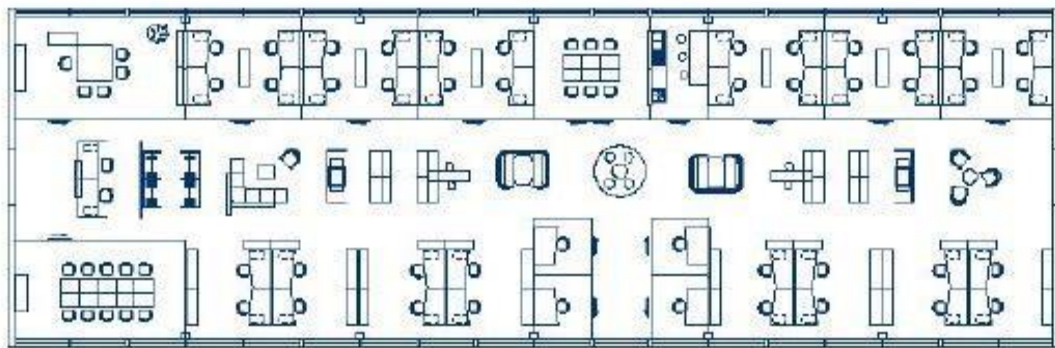
Some disadvantage of Team Workspace:



- Layouts not as flexible under radical change or upheaval.
- Multi-directional facing can make glare reduction difficult.



Figure 2-13 Team Workspace



Source: (The world of work is changing: CHALLENGE EVERYTHING, n.d.)

Figure 2-14 Team workspace plan and group work efficiency scale

#### d. Open Workspace

In open planned office, locates all workstation in open spaces with no division by floor to ceiling partition with doors. Brings together the advantages of several office forms in open-plan application scenarios. Space efficiency is achieved with compacted, non-territorial workplace areas. Supports spaces are located in floor to ceiling partitioned rooms with doors.

Some advantages of Open Workspace:

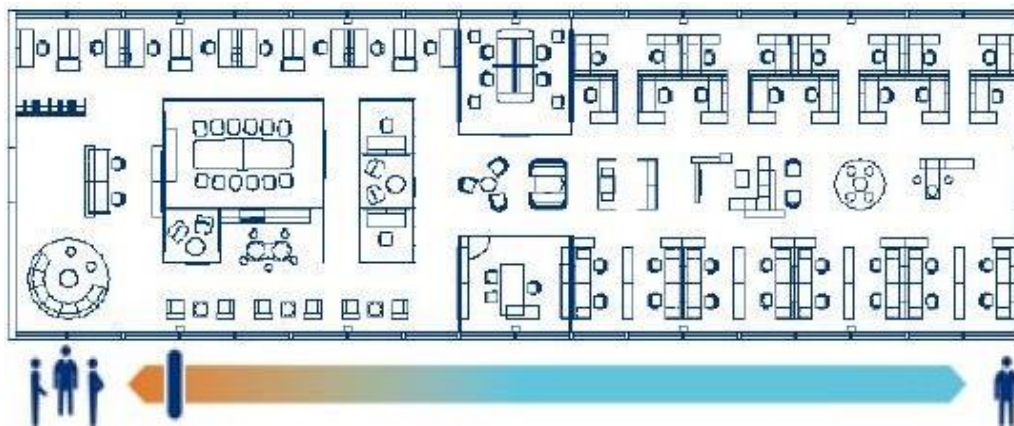
- Increased opportunities for interaction and communication.
- Employees feel a sense of freedom and trust.
- Suits larger companies that require a lot of cooperation between employees.

Some disadvantages of Open Workspace:

- There is less privacy without segregated workstations which should be a key consideration for businesses working with particularly sensitive information.
- Open plan offices can create a feeling of isolation and anonymity.



Figure 2-15 Open Workspace



Source: (The world of work is changing: CHALLENGE EVERYTHING, n.d.)

Figure 2-16 Open Workspace plan and group work efficiency scale

## 2.7 SUPPORTING SPACES

### 2.7.1 Reception and Lobby Area

Reception may still be a desk by the door or at the end of a marble hall, but increasingly reception areas are the heart of the organization. Reception areas should be programmed as two separate components consisting of the Waiting Area and Reception Workstation.

#### -Waiting Area (sized to suit requirements)

- Waiting areas may include chairs, coat storage, display material (bulletin board, pamphlet rack etc.) and public access workstations.
- Wheelchair accessible areas should include open space for a minimum of one

wheelchair to wait complete with a 7'-6" turning radius.

**-Reception Workstation (8.4m<sup>2</sup> or 90 square feet)**

- Reception workstations must provide a minimum of one 36" wide section for barrier free access as per Universal Design Guidelines.

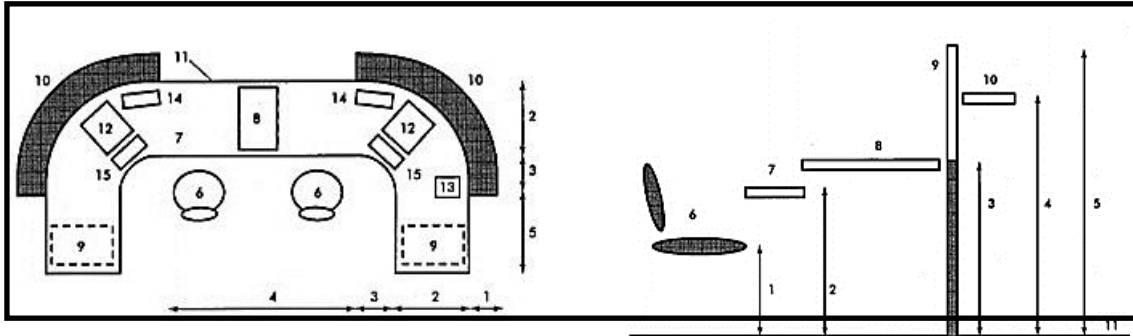


Figure 2-17 Reception Desk

Source: Pickard,2002

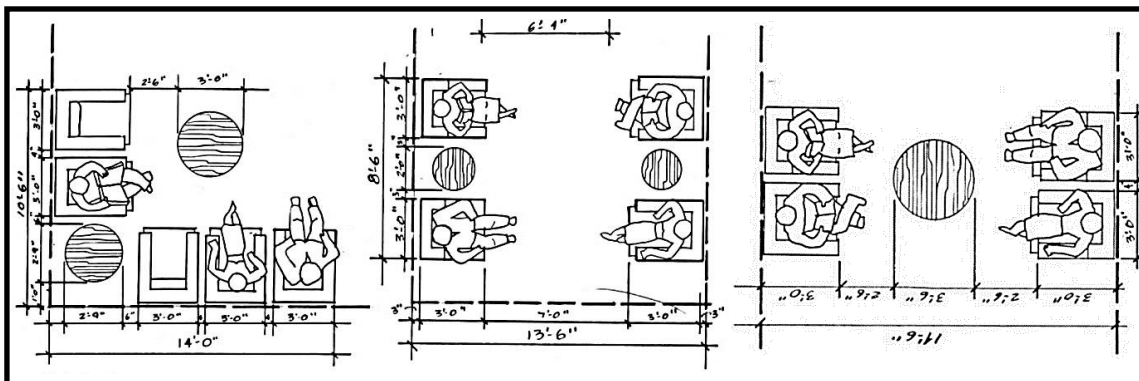


Figure 2-18 Waiting Lounge Plan Layout

**2.7.2 Meeting Rooms**

Space guidelines for meeting rooms are based on the number of people they are to accommodate. As a guide, an area allowance of 1.85 m<sup>2</sup> (20 sq. ft.) per person for table seating is used for room calculations.

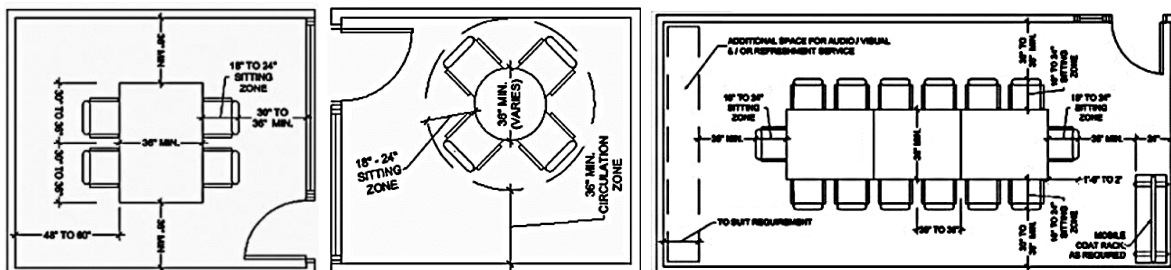


Figure 2-19 Typical layout for small meeting rooms with standards



Small meeting rooms to accommodate meeting table and chairs for 4 - 6 people. Medium Meeting Room to accommodate meeting table and chairs for 8 -14 people with possible storage space for audio/visual equipment and a possible horizontal surface for refreshment layout. Large Meeting Hall or training room to accommodate meeting table and chairs for more than twenty people.

### 2.7.3 Meeting Space

How space for meetings is designed and allocated is central to the advanced workplace. Meeting rooms that are shared, and can be booked, are taking the place of meeting spaces in personal offices.

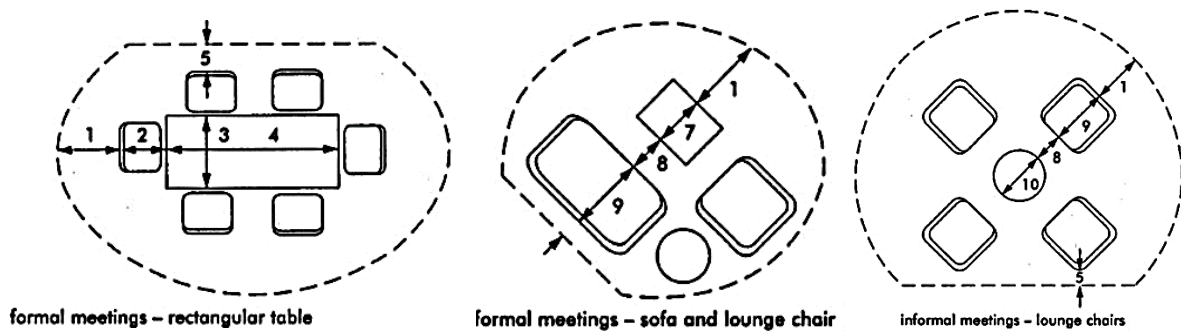


Figure 2-20 Layout for formal and informal meeting spaces

Meeting spaces take up less space than meeting rooms, and they are more often furnished with lounging furniture - sofas, occasional chairs and even beanbags - than enclosed space. Small meeting rooms, for up to four people, are in higher demand in most organizations than large rooms. Where presentations take place, more space will be needed for audio-visual or video-conferencing equipment.

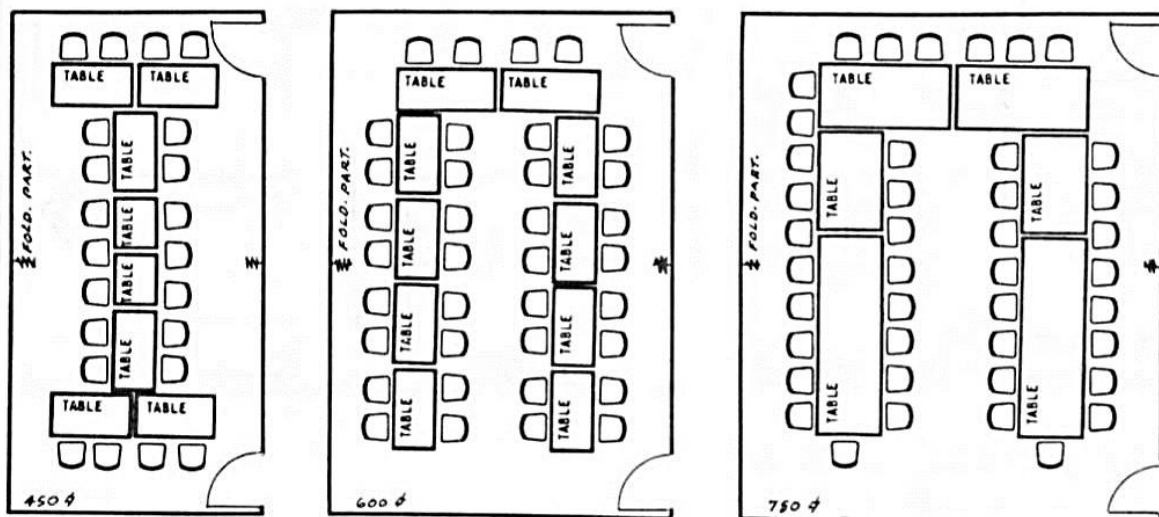


Figure 2-21 Layout of Conference Rooms

Source: Chiara



## 2.7.4 Conference Room

Conference and assemblies are an important part of an office. Since there is no established standard suggesting the number of conference rooms based on the number of people, the needs will vary widely among offices and depends largely on the nature of their work.

In an office complex, separate conference rooms permit maximum utilization. Where feasible, training and conference requirements should be pooled and conference space used as auxiliary office area for visitors.

## 2.7.5 Breakout Areas

Break - out rooms are spaces intended for use by personnel who normally occupy open area workstations. These rooms provide a quiet area to support work requiring a high level of concentration, private telephone conversations. Data drop, power and phone lines should also be considered. As a guide, the recommended planning ratio is one break - out room for every 45 staff. As a minimum, one break - out room per floor must accommodate the accessibility guideline for required turning radius.

### ➤ Process to design breakout spaces

- Collaboration and privacy: A breakout space can be a place for staff to have a screenbreak and relax, or share ideas and hold informal meetings.
- Well-being: Well-being in the workplace is no longer just “nice to have”. Employees are the biggest asset, so office design must support a culture of belonging, placing the staff at the centre.
- Attract & retain staff: Whilst keeping current staff at the centre of your design plans, it is also important to use your break out space to attract new talent. Office space should make people feel excited at the prospect of coming to work for you.
- Brand colors: Just as with the rest of the office, a break-out space must reflect both brand colours and brand values. Breakout space speaks the volumes about office, so the design must communicate with the outside world.

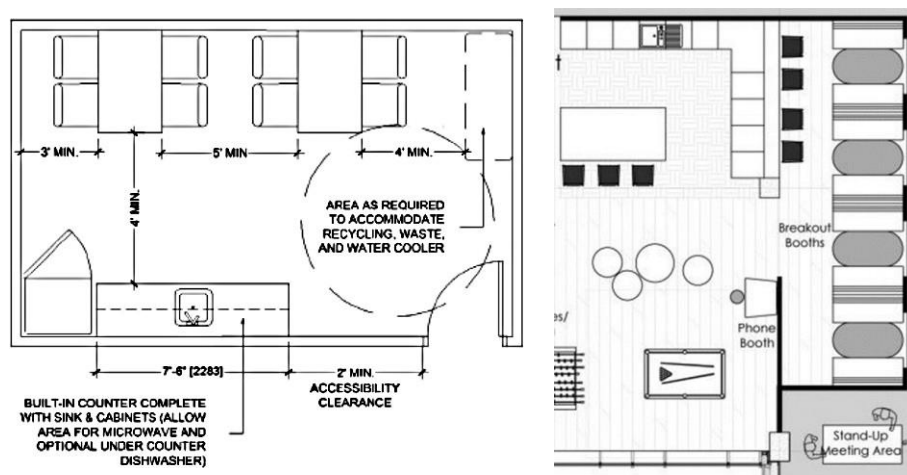
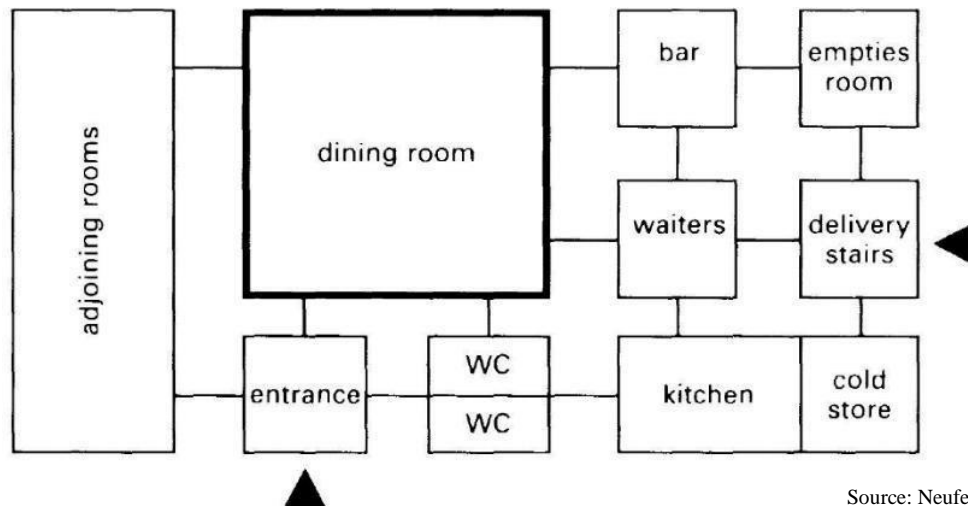


Figure 2-22 Breakout Space Layout

Source: Penketh

### 2.7.6 Restaurant/Café

Restaurants act as resting and refreshment part so the provision of eating is very essential in designing leisure or entertainment centre. To make functional, the organizational sequence should be carefully planned. The restaurant space should be flexible, functional and should be within easy access to outdoor spaces as well as other programs. Number of seatings varies according to targeted capacity and function of space.



**Figure 2-23 Functional Diagram of Restaurant Space**

- It must be easily seen and be in a prime position not tucked away to use up some unallocated space, but fed off a main pedestrian flow with a positive, striking and identifying entrance.
- Public toilets for the food court must be conveniently accessible, clearly indicated and adequate in number.
- Cashiers should be near to exit.

#### **Area Required:**

- Per seat 1.5-2.15 sq.m
- Net Kitchen 12-25%
- Dining Room 40-60%
- Main aisle width= min. 2 m
- Intermediate aisle width= 0.9m – 1.2m

### 2.7.7 Gaming Zone

Gaming zone provides a stress free, and youth dominated environment where groups can meet and engage in a cooperative game. These gaming zone helps to promote a social interacting environment by promoting the development of groups of players to play the

gamemore effectively. It's a platform to test newly developed games with professional gamers.

- Virtual Reality

Virtual Reality (VR) is use of computer technology to create a simulated environment Instead of viewing screen in front of them, users are immersed to interact with 3D worlds.



Figure 2-24 Gaming Console and Gaming Pods

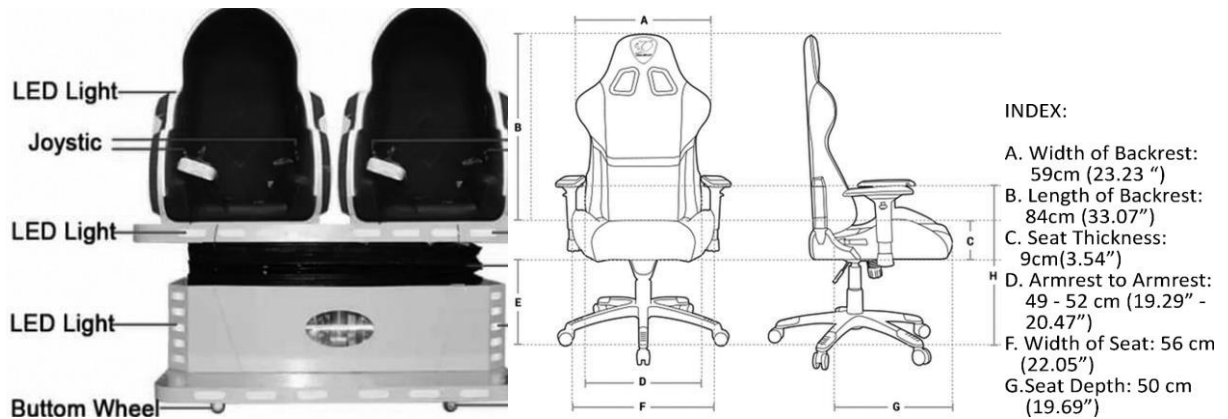


Figure 2-25 Gaming Chair Dimension

## 2.8 EXHIBITION SPACE/ GALLERY

The Exhibition Spaces are intended as a combination of indoor and open-air exhibition space in order to create relation between covered and green open spaces through thematic content.

### 2.8.1 Exhibition Space Requirement

Nature of access route	Best practice widths
Heavy use in both directions	1800mm

Moderate use with passing places	1500mm
Minimum use	900mm

### 2.8.2 Display

Object display: Most importantly, individual item must be placed at an appropriate viewing level, in suitable light. Each object must be given a visible context.

Case design: Visual and practical matters have to be considered.

A screen design: Where insufficient wall area is available for display/hanging, screen systems are important.

### 2.8.3 Acoustics

Noise levels should be controlled within zones by appropriate choices of material finishes on floors, walls and ceilings, and the shaping of interior spaces to prevent flutter and unwanted amplifying effects. To generalize and simplify, the penetration of low-frequency sound is lessened by structural mass, of middle frequencies by diffusing and absorbing surfaces, and of high-frequency sound by the elimination of small-scale air gaps in doors, windows and partition walls.



Figure 2-26 London ICT Exhibition Archive

## 2.9 PLAZA

Plaza is a square or open space where public facility are available. A plaza is a community amenity that serves a variety user including building, tenants and visitors and members of the public. This space may function as pedestrian site arrival points, settings for recreation and relaxation, and inconspicuous security features for high profile buildings.



### 2.9.1 Orientation

South-facing plazas are generally preferred, unless particular lot configurations prevent such orientation. Where lots do not have south-facing portions or where the south-facing portions are less than 40 feet in width, the plaza is permitted to face either east or west. In no cases are plazas permitted to be only north-facing.

### 2.9.2 Configuration

Plazas should generally be regular in shape. The main portion of the plaza must account for at least 75% of the plaza area. The smaller areas are then considered to be “minor portions” and are limited to no more than 25% of the plaza area. Major and minor portions of the public plaza are generally held to the same design standards.

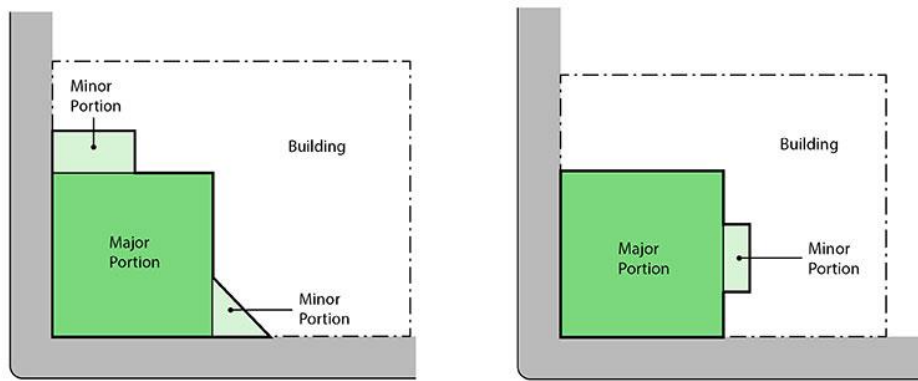


Figure 2-27 Illustrating the relationship between major and minor parts of the plaza

### 2.9.3 Visibility

Plazas are required to be completely visible when viewed from any adjacent street frontage. However, to maintain design flexibility for certain plazas that are located on corners where streets do not meet at 90-degree angles, the visibility requirements only require complete visibility from one street frontage and at least 50% visibility from the other street frontage.

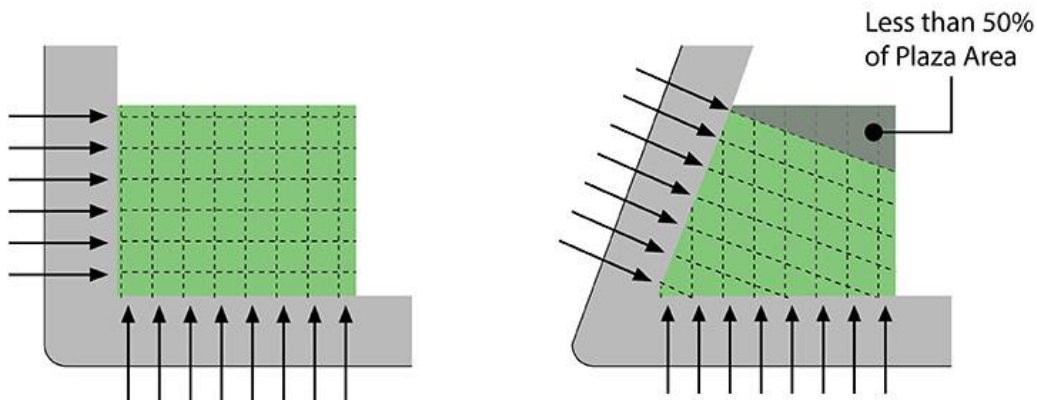


Figure 2-28 illustrating visibility requirements for major portions of corner public plazas

## 2.10 RESEARCH LABORATORY

### 2.10.1 Introduction

It is imperative that laboratory planners are aware that the research facility must not be designed exclusively and permanently for any one pattern or type of research work. The focus of research is constantly changing. It should be expected that the direction of the facility's research program may change between design and activation. Therefore, the goal is to achieve a facility that is flexible enough to accommodate future programs while maintaining cost efficiency at the time of design. The design of a laboratory is a response to four major challenges:

**Flexibility:** The nature of research can change in unpredictable ways. It is important to assess the kind and extent of flexibility that can be rationally planned while considering ADA guidelines.

**Safety:** High risk factors to researchers include possible of explosion. Exits must be clearly marked and must eliminate the possibility of endangering the workers.

**Quality of Environment:** The presence of natural light, pleasing colors, and a quiet environment within the laboratory enhance productivity.

**Cost Efficiency:** Assuring quality facilities while maintaining cost efficiency is a strong goal.

### 2.10.2 Research Laboratory Space Planning

- Rectangular more efficient than circles, hexagons (although aesthetics).
- Buildings with standard configuration, equal with standard laboratory equipment and furniture and with unrestricted accessibility to mechanical utility.

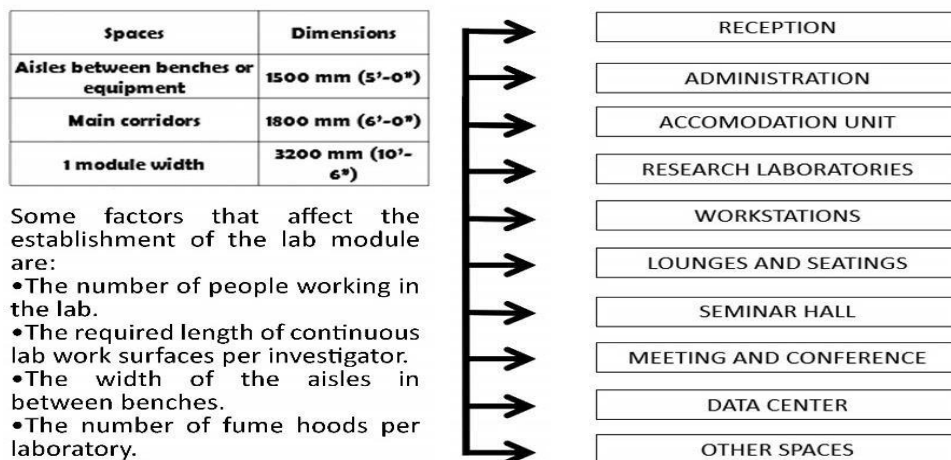


Figure 2-29 Spatial Requirement

### 2.10.3 Research Laboratory Module

- Aisle width: 5', 6" wall thickness separating one lab from another.
- Bench length of 12 ft -15 ft per person with uninterrupted length.

### 2.10.4 Lab Workstations

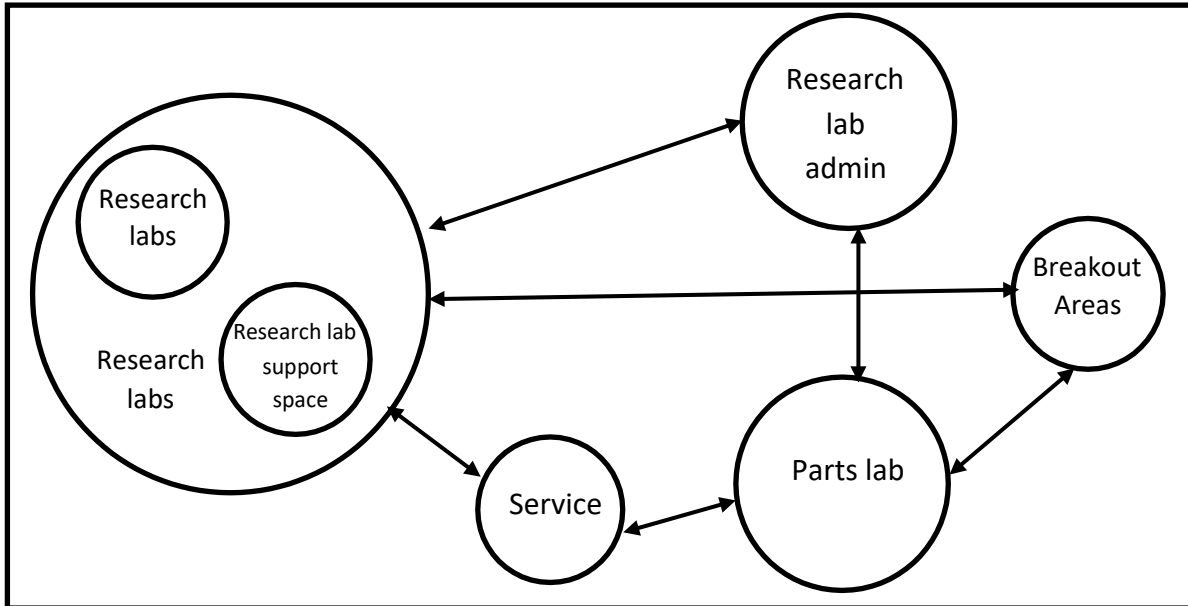


Figure 2-30 Lab Modules

- The bench fixed or movable is the module which determines its measurements, including work space and passage space. Standard workbench- 120cm width.
- Laboratories for teaching and practical needs large number of workstations, usually with simple basic equipment.

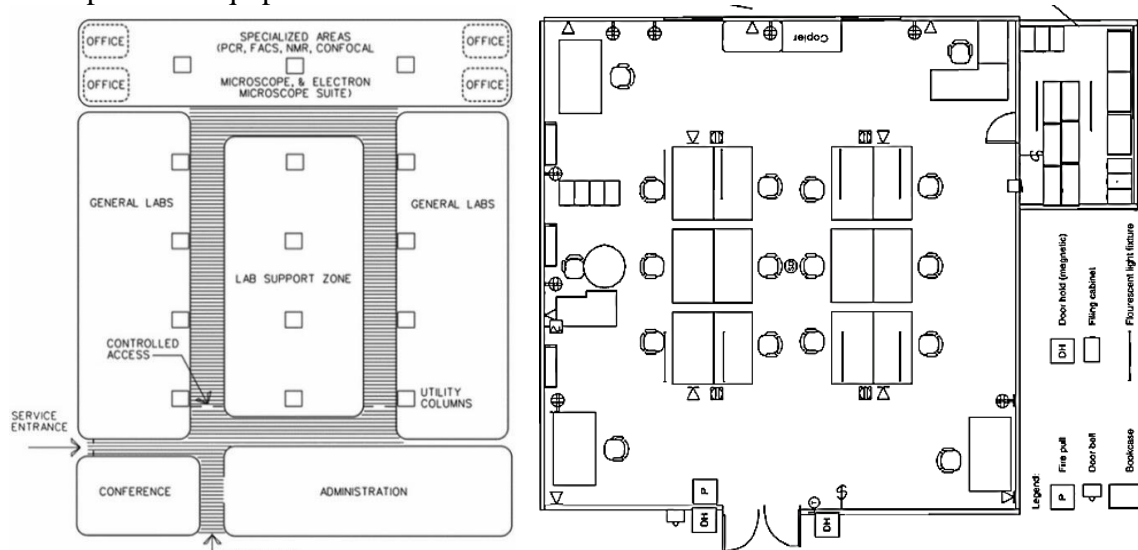


Figure 2-31 General Research Lab Plan

## 2.11 RETAIL SPACES

### 2.11.1 Basic plan layouts for retail shops:

#### **Straight Plan:**

It is a conventional form of layout that utilizes walls and projection to create smaller spaces.

#### **Diagonal Plan:**

The cashier is in the central location, with sightlines to all the areas of the space. It permits the angular traffic flow and creates perimeter design interest and excitement in movement.

#### **Pathway Plan:**

This type of plan gets shopper smoothly from the front to the rear of the store. The merits of such a layout are that the path can take any shape and that it creates a design pattern.

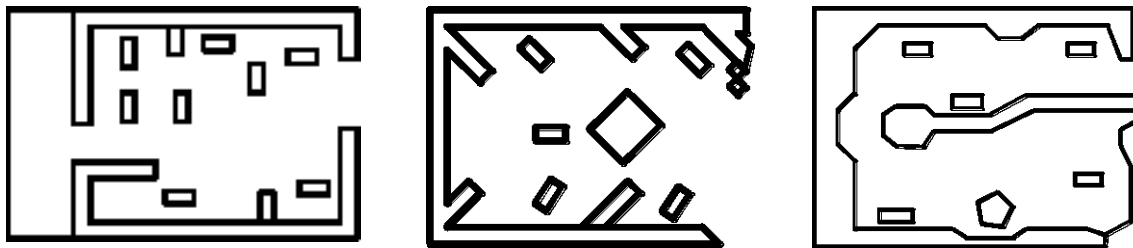


Figure 2-32 Typical straight, diagonal and pathway plan

#### **Curved Plan:**

The curved plan creates an inviting, special environment for the customer. The curved theme can be emphasized with the walls, ceiling and corners. People respond to circular and curved shape which soften the angular and square plan.

#### **Geometric Plan:**

The designer creates forms with shapes derived from showcases, racks in a geometric plan. The designer can use wall angles to restate the shapes dominating the sales floor.

#### **Varied Plan:**

For products that require back-up merchandise to be immediately adjacent, the varied plan is highly functional. It is a variation of the straight-line plan with sufficient square footage allowed for box or carton storage off the main sales floor with perimeter wall stocking.

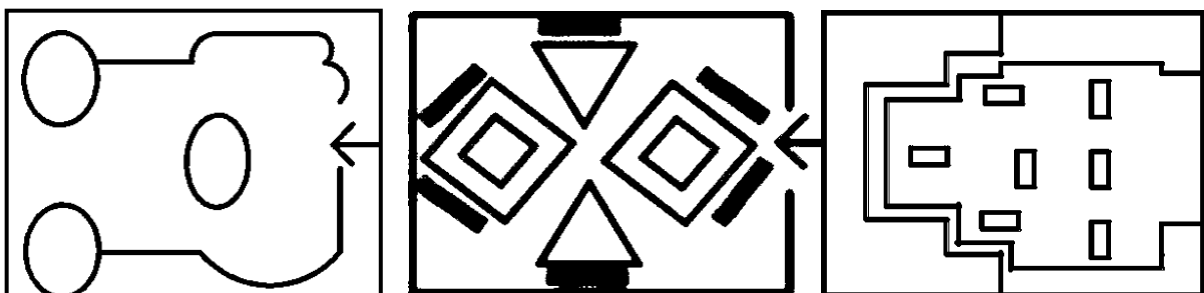


Figure 2-33 Typical curved, geometric and varied plan



## 2.12 LIGHTING

The recommended lighting level for different office areas are:

Space	lux
Office	500
Workstation near window	300
Reception areas	100
Conference room	300
Rooms for public use	200
Circulation areas	100
Washroom	100
Stairs	100

## 2.13 BUILDING CIRCULATION

The way people move around a building will affect how much they interact. Major focuses, such as cafe or library, can be positioned in such a way that encounters - and thus communication – are facilitated. Small seating areas along circulation routes, attractive lighting and color, and views out, can all encourage casual interaction.

### 2.13.1 Stairs

Circulation may be of two types: horizontal and vertical circulation.

The width of the horizontal circulation is:

Primary circulation, min,	1.5m
Secondary circulation, min,	0.9-1.5m
Tertiary circulation, min,	0.9m

The vertical circulation may consist of staircase, lift and escalators. The width of the staircase should be provided such that one should pass easily without dashing to other person as shown in the fig. below.

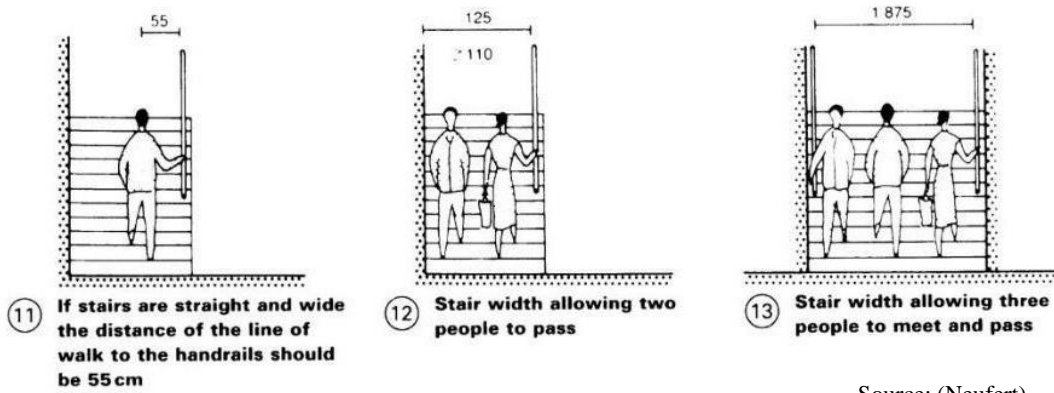


Figure 2-34 Staircase widths

Source: (Neufert)

### 2.13.2 Lifts

The positioning of lifts and lift lobbies and their no. and speed can be critical to how staff and visitors perceive the building. Lift should move a minimum of 15% of the building’s population within 5 minutes, with a maximum weight of 30 seconds and an actual car capacity of 80%.

- Lift lobbies should be 1.8-2.75 m if lift is on one side only.
- 3-3.75m if lifts are on both sides.

#### Lift Provisions

- Lift should be near the entrance of a building. All lifts should be made accessible to wheelchair user by having a minimum clear door width of 900 mm.

#### Call Buttons

- The call button at the lift lobby should have a clear floor space of at least 900 mm by 1200 mm with no obstruction, to allow access by a wheelchair user.

CENTRE OPENING AUTOMATIC POWER OPERATED DOOR													
LOAD		CAR INSIDE		LIFT WELL		ENTRANCE	LOAD		CAR INSIDE		LIFT WELL		ENTRANCE
PERSONS	Kgs.	A	B	C	D	E	PERSONS	Kgs.	A	B	C	D	E
4	272	1100	700	1900	1300	700 (Min.)	10	680	1400	1250	1800	1800	800
5	340	1100	900	1800	1500	800			1300	1350	1800	1900	
6	408	1200	900	1800	1500	800			1300	1350	1900	2100	
8	544	1100	1000	1900	1700	700 (Min.)	13	884	2000	1100	2500	1750	900
		1400	1000	1800	1600	800			2000	1100	2500	1900	
		1300	1100	1800	1700	800			2000	1300	2500	2100	
8	544	1300	1100	1900	1900	800	16	1088	2000	1300	2500	1950	1000
		1300	1100	1900	1900	800			2000	1300	2500	2100	
8	544	1300	1100	1900	1900	800	20	1360	2000	1500	2500	2150	1000
		1300	1100	1900	1900	800			2000	1500	2500	2400	

Figure 2-35 Elevator Dimensions

## Indicators

- Tactile indicators should be provided on the floor leading towards the lift.
- Braille floor indications should be provided on both sides of the door jamb of the elevator entrances on all floors and placed at 1500 mm above floor.
- All doors should have a visual panel at eye level of not less than 500 cm<sup>2</sup>.

## Special Recommendations for Visually Impaired

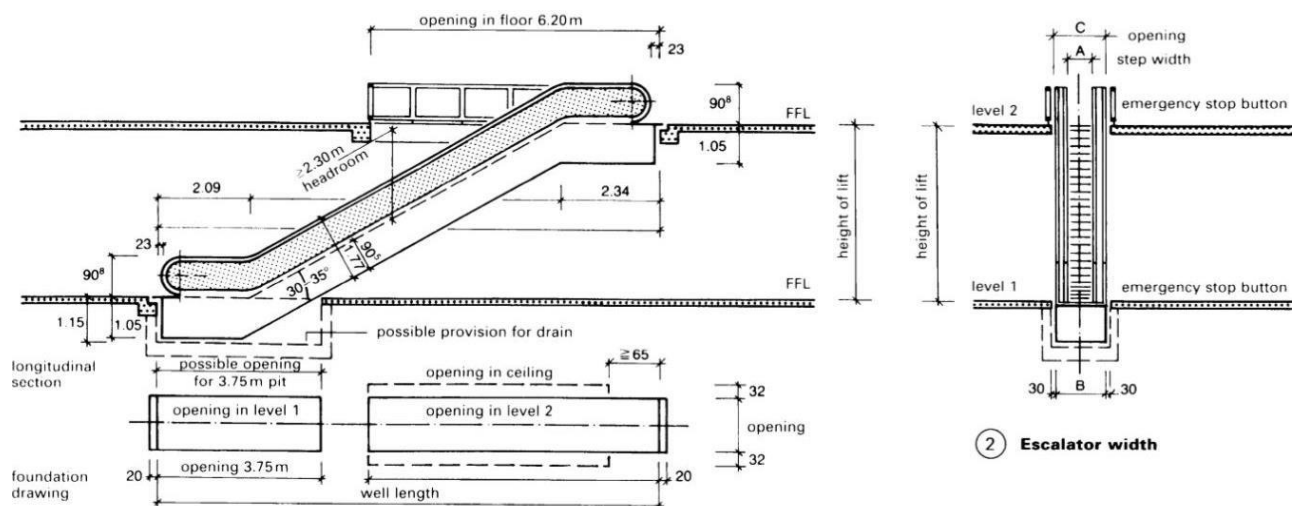
- Braille and tactile marking indicators should be provided and placed to the left of lift call and control buttons.
- Tactile markings should have a minimum dimension of 15 mm to 20 mm high and should be raised a minimum of 1 mm and have contrasting color background.
- The control buttons inside the lift shall be placed at a height of between 900 mm and 1200 mm from the floor level.
- Lift call and control buttons shall not be touch-sensitive but should require a light positive pressure to activate them.

### 2.13.3 Escalators

Escalators can carry large no. of people quickly, but they are expensive in terms of both money and space. They are not designated as stairs in the provision of emergency escape. Escalators rise at an angle of between 30° and 35°. Escalators length are calculated as follows:

Length in plan

- With 30° escalators= 1.732x storey height
- With 35° escalators= 1.428x storey height



Source: (Neufert)

Figure 2-36 Details of an Escalator

### Escalator Provisions

- Escalator width to be specified according to traffic volume.
- Moving handrails shall be at a height of 900 mm and on both sides of the escalator.
- Escalator steps should be clearly differentiated with markings of contrasting colour.
- Minimum of 3 flat steps at the beginning and the end of the escalator shall be provided.
- It is highly recommended for escalators.

### Escalators Safety

- Railings around the escalator void should be placed to meet closely to the escalators.
- Additional railings extended from the escalator handrail should be provided to increase the buffer area in crowded areas.
- Visual and tactile warnings should be provided at landings to indicate the presence of an escalator.
- Clear signage should be provided to indicate the direction of escalator movement.
- Headroom warning shall be provided under the escalator.

## 2.14 RESTROOM

The location of the toilet facilities near work areas is preferred over a remote location in promotion good health habits, lessening loss of labor time and permitting closer employee supervision. Separate facilities should be provided for men and women. They should be separated from the food areas by a hall way or double entrance.

The size for separate toilet compartment should be at least 36” by 66” with a swing out or pocket door. An inswing door can be used if the width of the door is added to the depth of the compartment. For example, if the compartment has a 24” door and 24” to the 66” length of the compartment the new 90” depth accommodates the inswing of the door.

No. of men	No. of WC	No. of urinals	No. of men	No. of WC
1-15	1	1	1-15	1
16-20	1	1	16-30	2
21-30	2	2	31-50	3
31-45	2	2		

46-60	3	3	51-75	4
61-75	3	3		
76-90	4	4	76-100	5
91-100	4	4		
100+	4	4 + 1 for every 25	100+	5+1 for every 25

**Ratio of users to Toilet Fixtures**

## 2.15 TECHNOLOGICAL ASPECT

The core component of an IT workplace is technology. The shape and style of IT buildings can vary depending on the location, but one factor that remains constant is the technology employed there. A new design approach that integrates electronic controls and capabilities and offers flexibility of layout, plug-and-play setup, accommodate future expansion, and office equipment is required for the IT offices and workplaces because they need a variety of information, services, and accommodations for emerging office technologies, including access to telecommunication networks and electronic office equipment. Information systems are used by IT offices to manage their business. Company operations may be hampered or halted entirely if a system goes down. In order to reduce the possibility of a disruption, it is essential to create a dependable infrastructure for IT operations.

### A. A/C and Ventilation

Programming requires commitment, endurance, and inventiveness, hence the atmosphere in which these IT work spaces are conducted should be managed. However, the controlled environment is crucial for equipment as well as for the work force. The components may be affected or harmed by excessive heat or cold. Additionally, even though natural air is preferable for IT workplaces due to the dust it carries, natural lighting is still preferred. Therefore, having air conditioning in an IT work area is essential for a productive office.

Individual air conditioners won't be effective given the size of the space to cool, so a central chiller or air handling equipment are utilized instead. These devices circulate heated or cooled air throughout the workspace. Because hot air tends to rise, it is more effective to distribute from the bottom or floor. However, because the design of such a system is complex, air distribution takes place from the walls or through the ceiling. Since heat enters or is lost through the building's exterior walls while the interior portion stays fairly constant, the air outlet is desired to be close to those walls. Such features provide even heating.

### B. Electricity and Communication/Networking Provision

Unplanned office space results in a prolonged installation process and a network of visible,

unmanaged, and frequently disruptive workspace.

A suspended floor of 100 to 150 mm is utilized to distribute power and networking wires to the workstations. Access to the network and power cables is made simple by the opening at regular intervals. The space with the server room, and therefore with the internet, is connected through a network inlet room. In order to distribute the network line from the server to workspaces, this room includes a "intermediate distribution frame." Each office and service unit, such as cyber cafes and e libraries, should have access to the electrical and network inlet rooms, which are located near the networking and cabling duct.

## **2.16 SERVER/CONTROL ROOM**

A server room is a space designated for the continuous operation of computer servers. It is typically air-conditioned. A data center is an entire structure or station used for this purpose. One of the variables influencing a server room's energy use and environmental impact is the climate. The environmental effects will be more tolerable in regions with a cooling temperature and a plentiful supply of renewable electricity.

### **2.16.1 Design consideration**

Server rooms should be located in areas where noise will not disturb classrooms, offices, etc.

- All server rooms should have solid walls extending from the floor to ceiling.
- Locked racks or a cage may also be used to provide a secure perimeter layer.
- The server room must be located in an area that can bear the weight of all systems, including Foreseeable planned growth.
- When feasible, door frame size should be sufficient to allow for easy introduction
- and removal of equipment. For new construction, doors should be 42 inches wide
- and 9 feet tall. If hinges are exterior to the room, doors should use locking hinge pins.
- The ceiling of the room should be at least 9 feet high.
- The server room should not have exterior windows.
- The arrangement of equipment should provide for adequate clearance around
- computing racks; 4 feet at the front and 3 feet at the rear are recommended.

### **2.16.2 Temperature Control**

- The server room must have sufficient temperature control to maintain temperatures within the operational limits defined for the hardware located in the room.
- The server room should have dedicated redundant air conditioning sufficient to

maintain temperatures between 65- and 70-degrees Fahrenheit. Fully enclosed racks with built-in cooling may also be used.

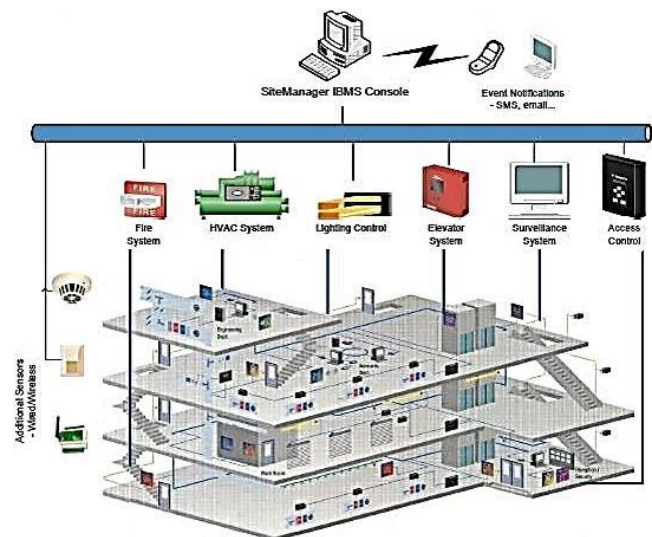
- For large rooms, cooling systems and equipment should be installed in a hot aisle / cold aisle configuration to maximize efficiency.

## 2.17 INTELLIGENT BUILDING

Intelligent building can be defined as the ‘Use of technology and process to create a building that is safer and more productive for its occupants and more operationally efficient for its owners’. The personal environment is controlled via the PC, telephone, etc., and integration of interfaces between different systems and people they serve becomes increasingly simple.

An Intelligent building system generally covers three key elements:

- Communications Network and Office Automation.
- Building Management System.
- Smart Office System



Source: (Intelligent Building System and Facility Management)

**Fig: Intelligent Building System Scheme**

### a. Communications Network and Office Automation System

The Communications Automation System lays the high-speed framework for exchanging voice, data and video within the building and to the outside world. This system reduces heavy workloads and human error to enhance efficiency, quality and the working environment. Voice, data, video conferencing and electronic data exchange, are provided



via the building's high-speed backbone network to the benefit of each office.

#### **b. Building Management System.**

Building Management System is a computer-based control system installed in buildings provides automatic monitoring, interaction and management for mechanical and electrical equipment such as electricity, ventilation, water supply, security and fire control to the building. The purpose of BMS:

- To provide the facilities necessary for maintaining a comfortable working environment.
- Control by various means such as time clocks or temperature switches that provide the on and off signals for enabling pumps, fans or valves (mechanical systems).

#### **c. Smart Office System**

Smart Office Solution is built by the right expertise to implement the project / system, delivering the best technologies that can let our customers business more efficiency and offerings the solution for more effective operation. On-stop shop modeling can let our customer easier to use and maintain. Smart Office solutions include Access Control, Audio/Video Intercom, wireless networking Infrastructure, Structure Cabling System, CCTV/DVR surveillance System, Computer Room Facilities, electrical distribution, lighting control and Information Display System, etc.

## **2.18 BIOPHILIC DESIGN**

### **2.18.1 Biophilic Design: Introduction**

The terms "bio" and "philia" both refer to life or living things. The word "biophilia" means "love of life." Erich Fromm coined the phrase for the first time in 1964 to express a psychological orientation of being drawn to all that is alive and vital. But after Edward Osborne Wilson published his book "Biophilia" in 1984, the phrase gained popularity. Philias refers to the appeals and good emotions people have for particular environments, pursuits, and things found in their natural habitats. According to the idea of "biophilia," people have a biological need for connection to nature on a physical, mental, and social level, and that connection has an impact on our own well-being, productivity, and society interactions.

Designing for humans as a biological organism, or biophilic design, means taking into account the mind-body connections as markers of health and wellbeing in the context of

what is regionally suitable and responsive. The goal of good biophilic design is to create spaces that are inspiring, restorative, healthy, and integrated with the functionality of the location and the urban ecosystem to which it is applied. Influential perspectives taken into consideration include health conditions, socio-cultural norms and expectations, past experiences, frequency and duration of the user experience, the many speeds at which it may be encountered, and user perception and processing of the experience. Above all, biophilic architecture needs to foster a sense of place.

### 2.18.2 Biophilic Design and Workspace



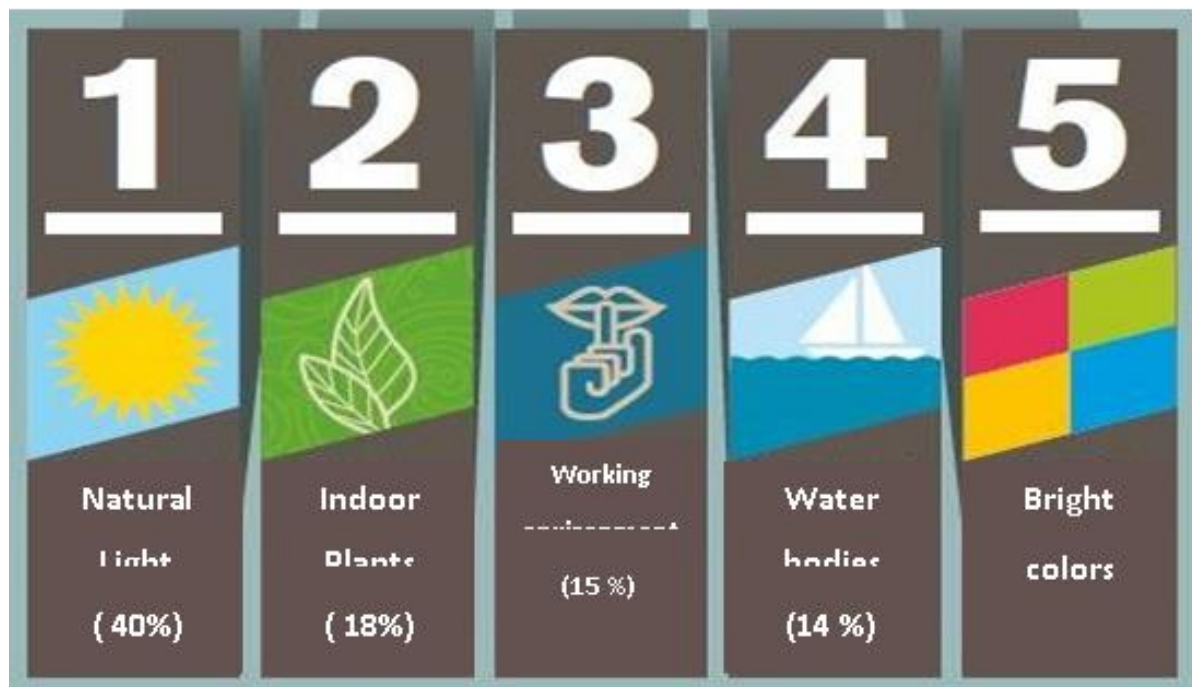
Source: Biophilic Design: A Marriage of Functional Design and Nature  
**Figure 2-37 Biophilic design in workspace**

Arriving at the office before the sun rises and leaving at dusk can cause a real sense of deprivation from the outdoors. Windowless cubicle farms and airless open-plan floors can kill motivation and take a toll on worker performance, possibly even their health.

Biophilic design is a new development in workplace architecture. This means that incorporating elements that promote a connection to nature within the office's walls—such as natural materials, colors and patterns inspired by nature, indoor plants, and views of greenery—can aid in our mental recovery from our daily tasks and maintain our positive well-being. A rising amount of research is demonstrating the tangible and quantifiable advantages that natural components like plants, light, colors, and shapes have on businesses and employees. The beneficial benefits range from worker satisfaction and innovation to increased output, lower absenteeism, better staff retention, higher revenues, and a stronger ability to recruit top talent. Biophilic design elements assist in creating a work environment that optimizes the environment for performance, health, and well-being. Employees' awareness of the natural environment has enhanced, they experience less stress and mental

weariness overall, and they accomplish tasks more cognitively. Stephen Kaplan, an environmental psychologist, claims that spending time in nature stimulates the mind and aids in regaining concentrated attention and focus. He even asserts that this improves people's ability to concentrate.

### 2.18.3 Key Biophilic elements in Workspace



Source: Browning B. 2015

Figure 2-38 Major 5 key biophilic elements in workspace

#### I. Natural Light

Natural light is a crucial determinant of all three employee outcomes – well-being, productivity and creativity. Exposure to natural light is important to improving quality of life. Areas with glass windows or adding natural light lamps in workstations can have profound impacts on the office environment. Having easy access to outdoor areas also allows for more open and natural workspaces to thrive. Providing a space in the workplace for relaxation and recharging promotes a positive impact on well-being. Just like dynamic temperatures, natural light conditions are always at a flux because of cloud cover and the time of the day.

Being consistently exposed to harsh artificial lighting interrupts this rhythm, causing fatigue, boredom and sleeplessness at night. The workspace should be bathed in natural

sunlight. This break area thus refreshes people in every possible way. So, natural light is one of the major elements of biophilic design in workspace.

## II. Indoor Plants

By just adding a few plants around your office, especially in areas with higher work traffic, office workspace will start to feel more grounded with nature. Even if they're artificial, it is a great place to start, but using all-natural plants and vegetation can greatly improve indoor air quality. Adding plants, trees, gardens and green roofs to urban environments improves rainwater runoff and act as 'biofilters' for carbon dioxide. Being surrounded by nature subjects one to fragrances that are extremely healing and incredibly memorable. Plants aroma trigger powerful memories in the human brain.

## III. Working Environment

A positive work environment makes employees feel good about coming to work, and this provides the motivation to sustain them throughout the day. There is also a growing body of research that shows the spaces we inhabit have distinct physiological and psychological impacts on us. Spaces with elements of biophilic design are more attractive and have been found to provide proper work environment to the employees.



Source: Examples of Biophilic offices

Figure 2-39 Natural Light, plantation and working environment

## IV. Water Bodies

The presence of water adds fluidity in terms of sight, sound, touch and light patterns in a space. This has a soothing effect on people and has even been shown to enhance mood and boost self-esteem. Aquariums, fountains and even artwork depicting water bodies can create a sense of natural calm. Cool and subtly lit, it brings a sense of calm to meetings and brainstorming sessions. In spacious offices, flowing water installations like fountains,



water walls are highly recommended, as they stimulate multiple senses at once.



Source: Spacetor

Figure 2-40 Water feature and use of Bright Colours

## V. Use of Bright Colors

Colours representative of the natural world, such as greens, blues and browns, have been shown to trigger biophilic responses. Bright colors such as reds, blues and greens are also conducive to higher focus and task accuracy. Use of such colors help to stimulate creativity, focus and higher energy levels.

A study exploring the effects of biophilic design in the workplace found certain elements had specific effects on people working in the space. The following table outlines some examples of how to create spaces that meet common client objectives for office space.

Objective	Biophilic Design Elements
<b>High Motivation</b>	Colors: Blue, White Access and view of outdoor green space Incorporate live plants as a part of the interior design
<b>Workforce Productivity</b>	Colors: Blue, Yellow, White Windows that provide scenic vistas Natural lighting
<b>Spur Inspiration And creativity</b>	Colors: Yellow, Blue, Green, White Minimalist Use of live plants and water feature

## 2.19 GREEN DESIGN

Green design, also known as green construction or sustainable building, is the practice of creating structures and employing processes that are environmentally responsible and resource efficient throughout the life-cycle of a building: from design to construction, operation, maintenance, renovation, and deconstruction. This method widens and supplements the economic, functionality, durability, and comfort issues of building design.

### 2.19.1 Green Roof

A green roof is a roof of a building that is partially or completely covered with vegetation. Natural greenery in our cities provides connection to nature, and absorbs the stressful and promoting our health and wellness. If maintained properly, 10m<sup>2</sup> of green roof consumes approximately the same amount of CO<sub>2</sub> as a 13-foot-high tree per year. There should be proper provision of drainage system, root barriers and water proofing membrane.

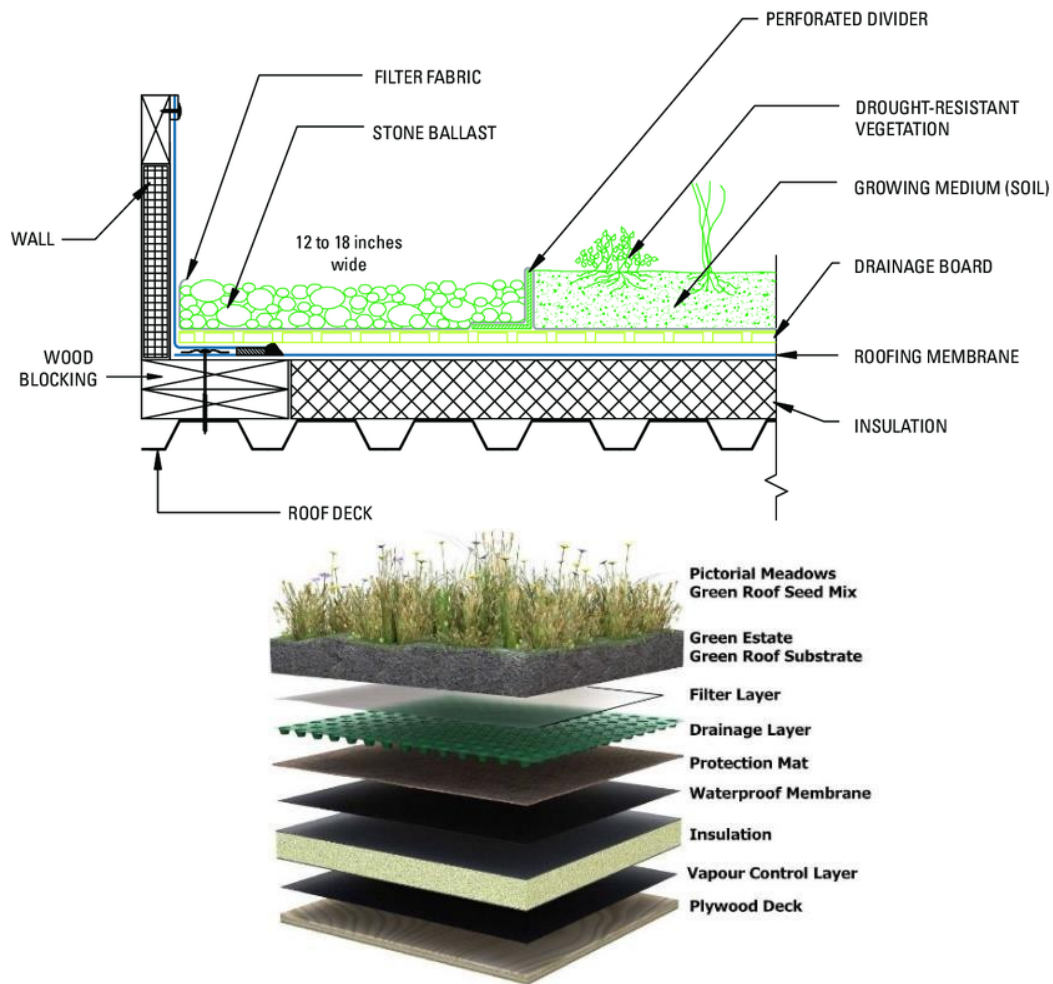
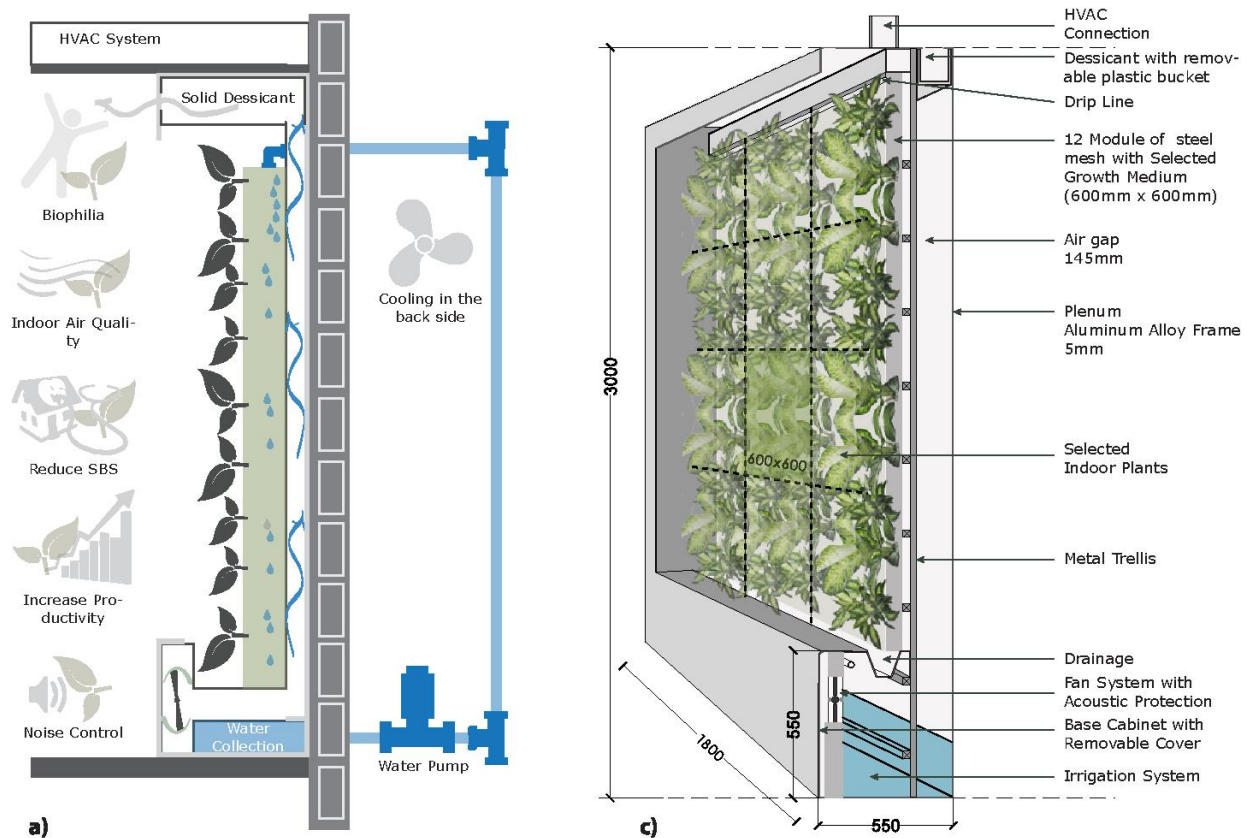


Figure 2-41 Sections of Green Roof

Source: Vila

### 2.19.2 Green Walls

A green roof is a roof of a building that is partially or completely covered with vegetation. Natural greenery in our cities provides connection to nature, and absorbs the stressful and promoting our health and wellness. If maintained properly,  $10\text{m}^2$  of green roof consumes approximately the same amount of  $\text{CO}_2$  as a 13-foot-high tree per year. There should be proper provision of drainage system, root barriers and water proofing membrane



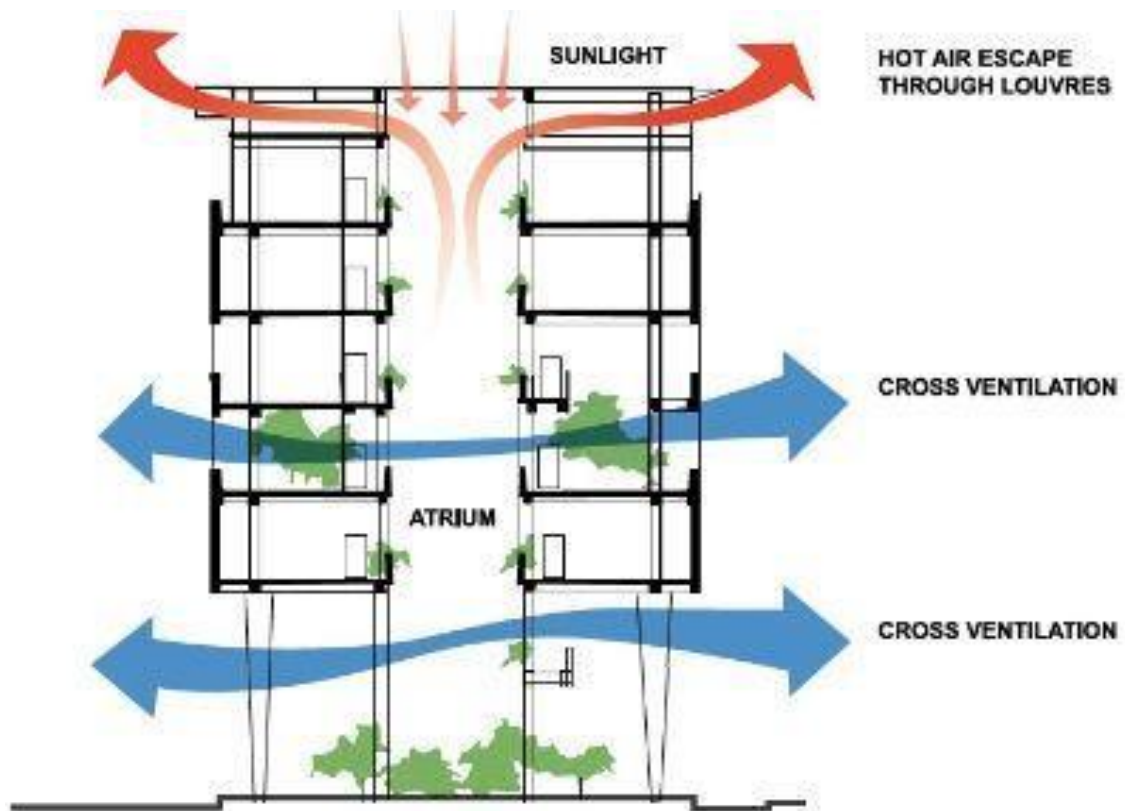
Source: prodyogi.com

Figure 2-42 Green wall construction and components.

### 2.19.3 Atrium

An atrium is a large open space, often several stories high and having a glazed roof and large windows. Atria gives sense of feeling of space and light. The atrium concept allows natural light into the centers of building, thus eliminating deep, dark spaces. The use of daylighting, a free energy source, can offset the cost of electricity, the most expensive energy source. Cross-ventilation is maintained through required indoor air quality and convective cooling.





Source: Atrium Design

Figure 2-43 Atrium design for Daylighting and ventilation

#### 2.19.4 Rain Water Harvesting

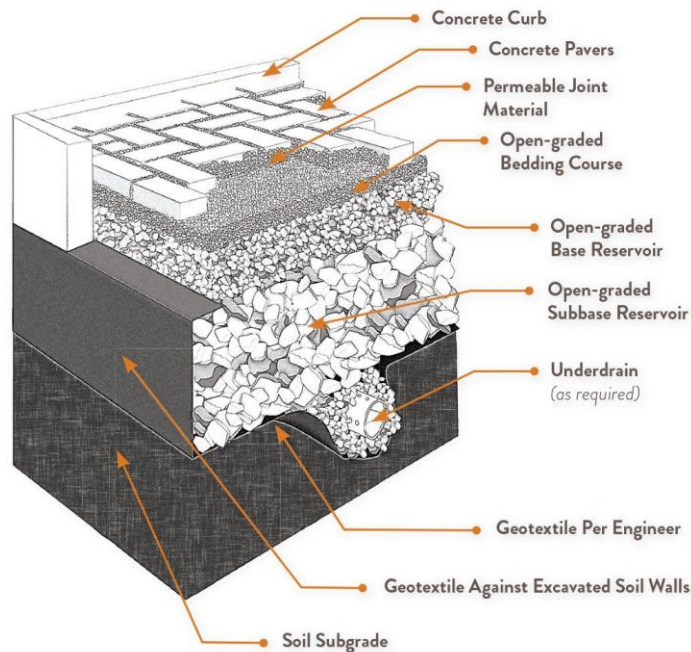
Rainwater harvesting is the process of intercepting storm-water runoff and putting it to beneficial use. Rainwater is usually collected or harvested from rooftops, concrete patios, driveways and other impervious surfaces. Buildings and landscapes can be designed to maximize the amount of catchment area, thereby increasing rainwater harvesting possibilities. Intercepted water then can be collected, detained, retained and routed for use in evaporative coolers, toilet flushing, pet and car washing, indoor plant watering, pet and livestock watering, and lawn and garden irrigation.

#### 2.19.5 Permeable Paving

Permeable paving is a method of paving pathways to enable infiltration of stormwater runoff. Permeable pavement surfaces typically include pervious concrete, porous asphalt, paving stones and interlocking pavers. Unlike traditional impervious paving materials, permeable paving systems allow stormwater to percolate and infiltrate through the pavement and into the aggregate layers and/or soil below. The goal is to control stormwater at the source, reduce runoff and improve water quality by filtering pollutants in the subsurface layers.

Permeable pavement surfaces are made of either a porous material that enables stormwater to flow through it or nonporous blocks spaced so that water can flow between the gaps. Stormwater flows into and is stored in an underlying stone reservoir. Permeable pavement is

commonly used on roads, paths and parking lots subject to light vehicular traffic, such as cycle-paths, service or emergency access lanes, road and driveways.



Source: Permeable pavement Design

**Figure 2-44 Permeable Pavement Details**

## 2.20 ARCHITECTURE EXPRESSION

The IT office building must have some level of functionality, but it also needs to have its own distinctive architectural style. Expressionist architecture is increasingly common in IT office buildings, as seen in India and other parts of the world. There is no governing criteria when it comes to the architectural expression of IT buildings, however the majority of them make heavy use of totally glazed facades. This is meant to represent the cutting-edge technology used in the building. Given the technology that is housed in the structure, the vernacular and conventional architectural methods and forms are obsolete in an IT park.

Since IT parks are one-off projects for a region, the architectural expression and shape of the building play a significant role in luring tenants, and the landmark or aesthetic expression is also crucial. The building is a reflection of the client's status. In comparison to other types of workplaces, IT businesses today have the highest turnover, which enables them to afford the price of creating these pricey structures. But function and usefulness should always come first. We should think twice before employing fully glass facades everywhere since they may affect the inside working environment and increase the cost of

heating and cooling. Today's energy efficient buildings are also on the rise and are increasingly valued.



Figure 2-45 Architecture Expression of Googleplex (Left) and Cyber Gateway (Right)

## 2.21 PARKING STANDARD

Commercial: shops-floor area up to 80sq.m. 80sq.m <floor area> 100sq.m – 1 car space

For every additional 100sq.m. or part of it exceeding 100sq.m addition of 1 car space should be done

Dimension of parking shall be 5.0 X 2.5 m with a min. width of aisle of driveway of 3.5 m for one way movement and 7.2 m for two-way movement. Minimum inside radius of 4.5 m preferred.

Head room: In the parts of a building (above or below GL ) used for parking if wheeled vehicles, the minimum headroom shall be 3.5 m.

Conditions:

- Area of each stall shall be flat and free kerbs and other encumbrances.
- Angled parking, where a stall is adjacent to a large element like wall, minimum stall width shall ne 2.7 m for paralleled parking, where cars cannot be parked by reversing, minimum stall length shall be 7.2 m.

Multi-level Parking:

- No. of storey's permissible
- Gradients and ramps: 1 in generally 10 or 12
- Clear height between floors: 2.1m min
- Parking stalls dimensions: 2.5 X 5.0 m
- Inside radius of curve: 7 m min

- Width of traffic lanes, ramps and entrances: 5.7 m min
- Gradient of sloping floors not steeper than 1 in 20
- Loading standards: 400 kg/sq.m max
- Ramps, if two ways shall be separated.

Type of vehicle	Length(m)	Breadth(m)	Height(m)	Turning circle radius (m)
Motorcycle	2.20	0.70	1.80	1.00
Car				
• Standard	4.70	1.75	1.50	5.75
• Small	3.60	1.60	1.50	5.00
• Large	5.00	1.90	1.50	6.00
Bicycle	1.70-1.90	0.6	1.00-1.25	0.70
Pick up van	4.37	1.64	1.90	5.00

Turning radius: Outer radius – 5m Inner radius – 3.5m track – 2.5m

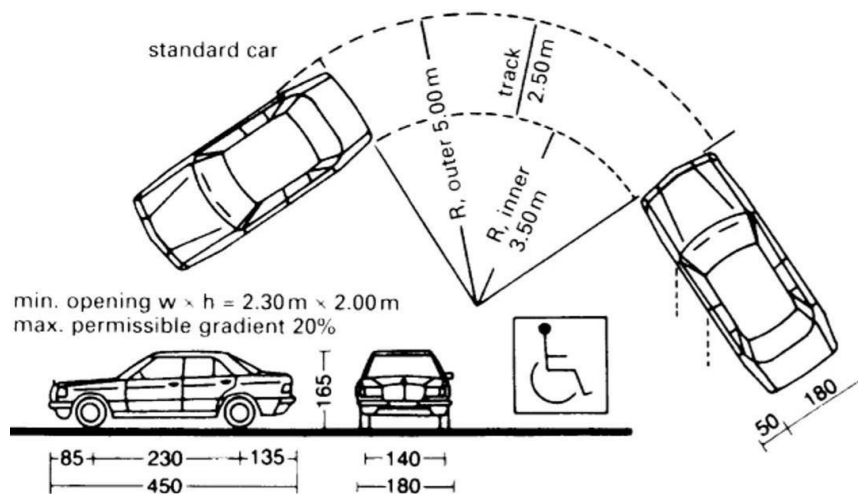
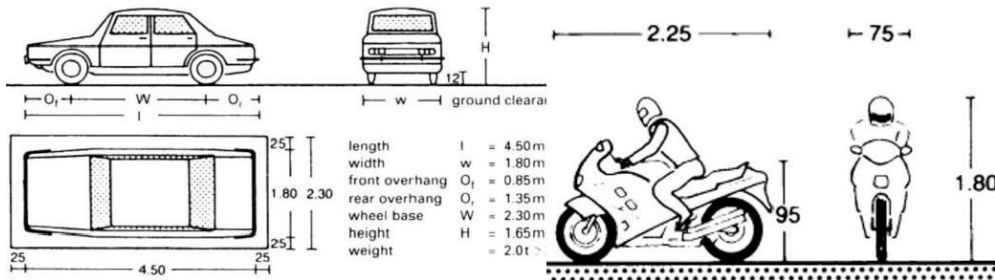
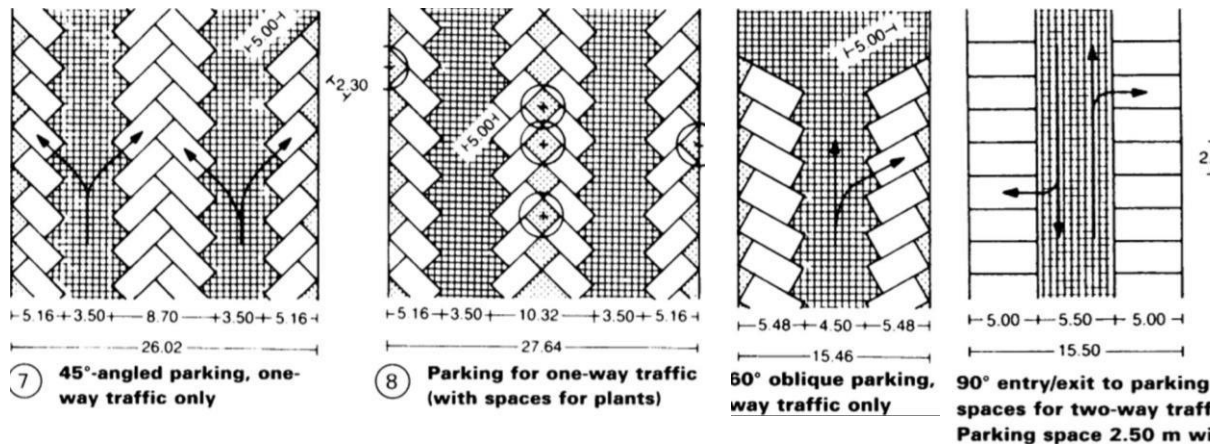


Figure 2-46 Parking Details





### 3 CASE STUDIES

#### 3.1 IT PARK, BANEPA, KARVE

##### Purpose of Study:

To understand the planning and requirements of the IT park.

##### 3.1.1 Introduction

The information technology park, Banepa is the first and only IT park in Nepal with state of art features and facilities. Built with a mission to place Nepal to the IT map. The construction of IT park started in 1999 and with lots of trouble and security concerns, the first phase was completed in 2004.

##### A. Location

On the Banepa-Panauti road, the park is situated around 30 kilometers east of Kathmandu. The location descends steeply to the west and slopes eastward as it is located in the foot plain of the Dhaneshwor hill. The location, which now covers an area of 234 ropanis (12 hectares) and has growth ambitions, is located in a tranquil rural setting with a clean environment and has an unrestricted 360-degree perspective of the natural world. SOS Village is located on the southern side, while farmland has been set aside on the eastern and northern sides for future growth.

##### B. IT Park Concept in Nepal

To keep up with the rapidly expanding IT business and for the general development of the IT sector in Nepal, the idea of an IT park came into life in the last two decades. The major goal was to cluster IT-related enterprises and draw in primarily foreign IT companies in order to focus efforts on ensuring their growth and development.

The government of Nepal started working on creating an IT park there in order to fulfill its goal as stated in the Ninth Five Year Plan. Banepa was chosen as Nepal's IT city after

extensive case studies of foreign IT parks, and the site is located along the Banepa-Panauti route in the Kavre district (but no effort was taken).

### C. Vision and Objectives of IT Park

- To facilitate the promotion, development and export of computer software and ICT related products and services
- To create skilled human resources and help develop software related expertise and create appropriate working environment in the field of IT
- To attract national and international agencies to setup their IT based activities including foreign investment in IT sector
- To provide one window service to entrepreneurs in the software development field
- To facilitate research and development in IT sector

#### 3.1.2 IT Park Master Plan

The master plan of IT Park was prepared by building Design Consultants (BDA). The master plan incorporates all the project components within the area and is divided into two phases.

This was intended for making the project feasible and to allow organized expansion of the IT park. The phase I of IT park consists of:

1. Administrative Block
2. Business Block (1)
3. Parking Services
4. Residential Units
5. Power plant
6. Water Treatment Plant Security Post
7. Business Blocks – 2
8. Remaining Residential Units
9. Recreational Centre
10. National Informatics Centre
11. Kinder Garden
- Other Facilities

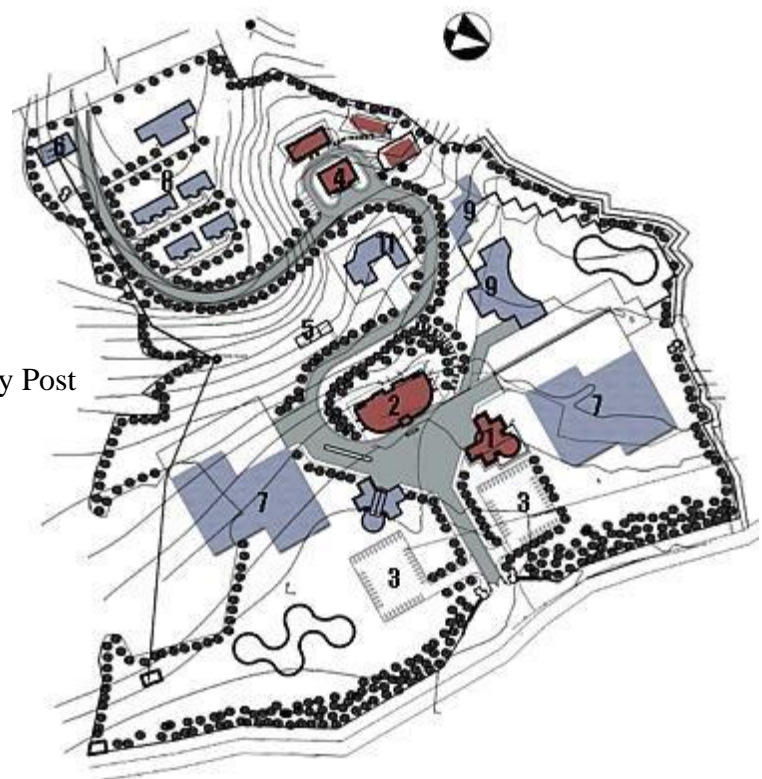


Figure 3-1 Masterplan of IT Park

Although spaces for phase II units have been allocated in the master plan, the individual design of the units hasn't been finalized. Phase II was planned to be implemented after the success of Phase I but till now, the Phase I is yet to reap any fruits.

The focus of the master plan is the central office building which is directly visible accessible from the main entry. All the other building are laid out around it. The site has been divided into two zones. On the front, business units have been provided and on the rear steep area, more private units consisting of residences and other supporting units. The entry road is 9m wide and black topped and have flanked by ample parking space (75 vehicles, good enough for future needs) and landscaping.

## 3.2 LEAPFROG TECHNOLOGY, CHARKHAL

### 3.2.1 General Information

Leapfrog Technology is a software development company established with a vision to build world-class software and become a role model in Nepal. The company's initial projects were mainly aimed at taking mobile banking to rural Nepal, but it has now expanded its services to healthcare, financial technology, and education sectors.

**Location:** Charkhal Rd, Dillibazar, Kathmandu

**Design:** Green Design Nepal

**Area:** 7000sq.ft

**Date of establishment:** 2010

**No. of worker:** 300 engineers + 100

### 3.2.2 Objective of Study

- To study about the planning, programs, requirement of IT office.

### 3.2.3 Site Analysis

- Provision of Primary and Secondary Road.
- Highly feasible site for office building.
- Close to institutions of higher learning.
- Easy access for the workers as the office is present in core city area.
- Bus stop present at the opposite side, so ease of public transportation.
- Appropriate and close to urban centre with highly evolved socio- economic overheads.



Figure 3-2 Site Analysis of Leapfrog



### 3.2.4 Salient Features

- Office building of basement + ground + 4 floors.
- Office Space (4700 sq. ft each floor).
- 3rd and 4th floor for office space.
- Multipurpose hall provided and also used as play area.

### 3.2.5 Master Plan

- The building is oriented to west direction.
- Leapfrog has two buildings. The main building block is accessible from the primary road and the second building is accessible through the secondary road.
- Both surface and basement parking has been provided.
- Sufficient surface parking is provided to both the buildings in the buildings and also separate parking is also provided.

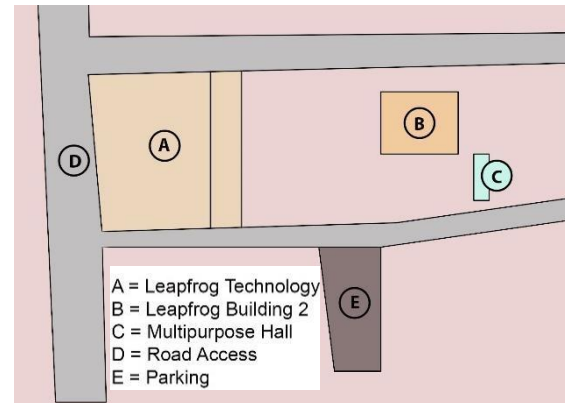


Figure 3-3 Masterplan of Leapfrog Technology

- The office is present in the 3rd and 4th floor of the building.
- Proper pathways and landscape design are provided in building 'B'.
- Block 'B' basically caters the administration and programming sections.
- Multipurpose hall of 500 sq. ft is provided which is also used as play area for the employees.



Figure 3-4 Access to basement parking, Secondary Access and Parking Area

### 3.2.6 Spatial Illustrations

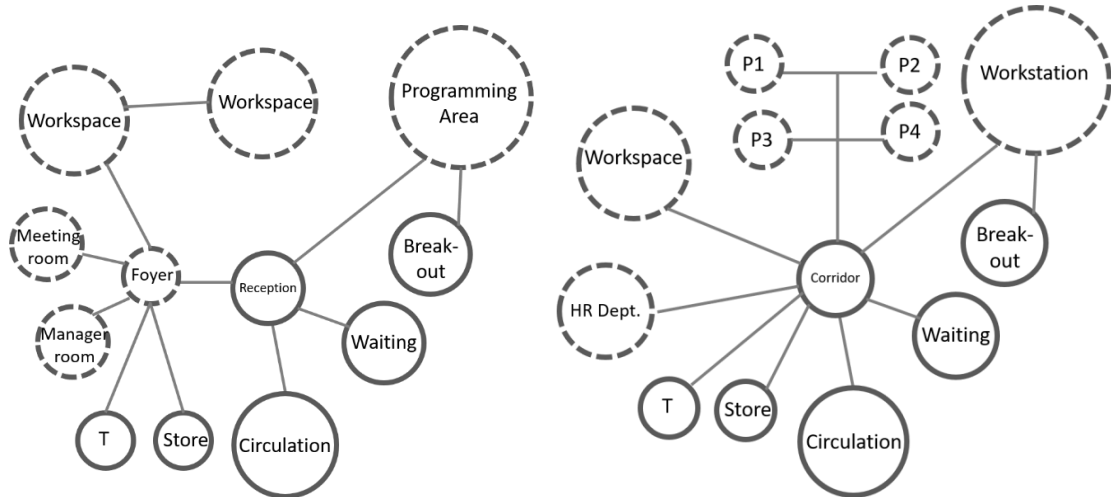


Figure 3-5 Bubble diagram showing spatial connection between spaces (Third Floor & Fourth Floor)

- Open planning workspace are done in order to enhance interaction between the employees.
- Tempered glass partitions have been used in office space.
- Various supporting spaces such as meeting rooms, breakout areas, play areas are provided.
- Workspace are kept in the periphery whereas the service areas are kept at the back side of the building.
- Breakout spaces and play areas are provided.
- The supporting spaces are separated by glass partition and the programming section are partitioned by concrete walls for the sake of company's privacy.
- Also, rooms are separated on the basis of various project.
- Team works are encouraged in the office so the workspace has been planned in open planning system.
- This has helped in boosting creativity of employees.

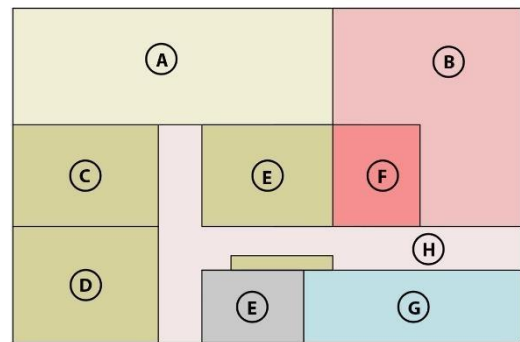


Figure 3-7 Third Floor

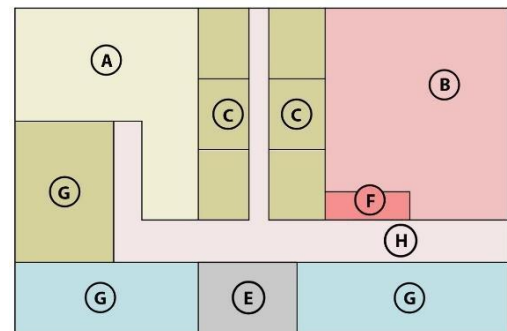


Figure 3-7 Fourth Floor

- A = Workspace
- B = Programming Section
- C = Meeting room
- D = HR Room
- E = Circulation
- F = Breakout Area
- G = Service Room
- H = Passage

### 3.2.7 Office Planning

The office areas have been divided into 2 sections:

- Supporting Section
- Programming Section

#### a. Supporting Section

- It consists of a room of administrative room. Beside that it includes meeting rooms, reception waiting space pantry and rest rooms in this unit.
- The eastern part of office includes all the sections which are not directly involved in programming. The rooms provided includes management units, Training section, Administrator room, server room, store. Besides essential units including W/C, Pantry is provided.
- The reception and waiting spaces are provided at the centre position and the workspace are placed in the periphery of the building so it gets maximum sunlight.
- Use of nature-oriented color i.e., green and brown has been done in the workspace. Such colors keep the employee active, happy and comfortable throughout the day.
- Also, indoor games are provided and small canteen is provided at the rooftop.

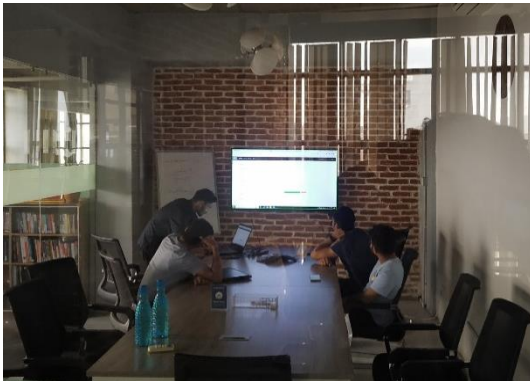


Figure 3-8 Meeting rooms and Workspace



Figure 3-9 Waiting Area and Multipurpose Hall cum Play area



## b. Programming Section

- The programming section is the main space as it is where the programs are developed.
- Modified open plan layout is implemented to increase the efficiency of work.
- The seating has been planned in the rectangular form according to room layout.
- Use of bright colored chairs are provided in the workspace in-order to break the monotony from continuous coding work.

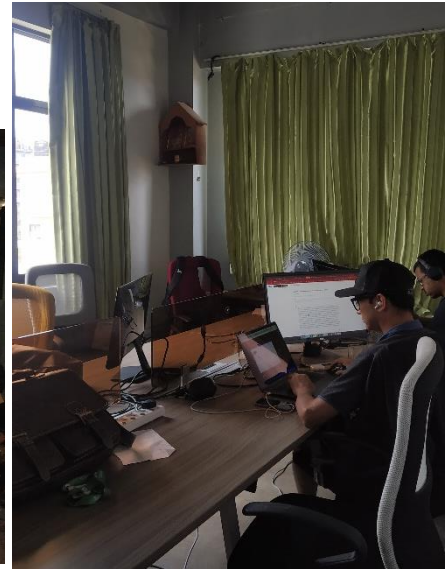


Figure 3-10 Programming Section

### 3.2.8 Circulation

- The stairs and lifts are present together in the north wing but lift is not used since it is not in the working condition.
- Staircase are enhanced by the use of plant pots.
- Universally accessible design; ramps is provided.



Figure 3-11 Circulation

### 3.2.9 Lighting

- Maximum use of daylight as the workspaces are well planned at the building periphery.
- Programming section uses artificial lighting.
- Lux level of 500 is used throughout the office area.

### 3.2.10 Parking

- Surface Parking: 100-150 bikes and 10 cars
- Basement Parking: 40 -50 bikes and 6 cars

### 3.2.11 Materials Used

- Use of brick facade in the interior.
- Open electrical system with concrete ceilings to reduce cost.
- CGI sheets for roofing. Glass Curtain wall in exterior.
- Touch of nature and earthy colors to make the office environment vibrant.

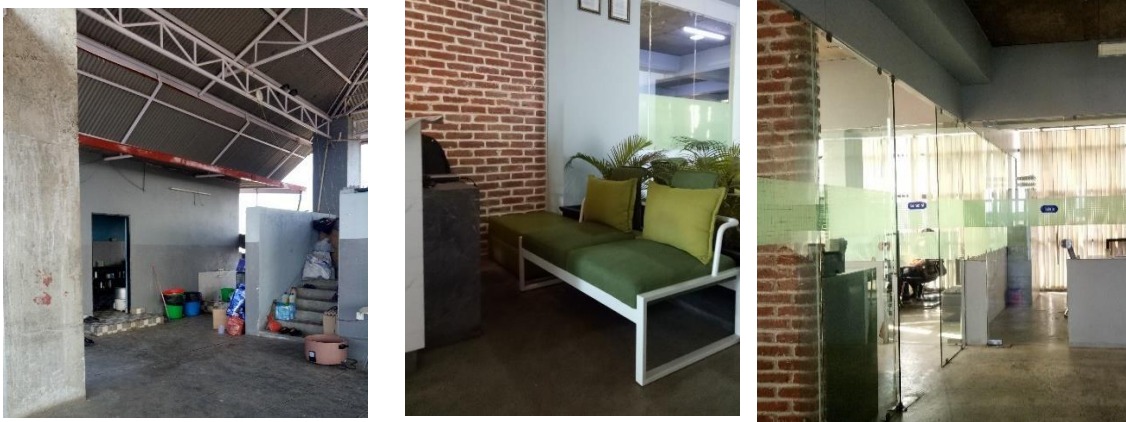


Figure 3-12 Use of CGI Sheets for roofing, Brick in interior walls and glass partition

### 3.2.12 Air Condition and Ventilation

- Use of AC has been seen in the workspaces area in very few numbers.
- Maximum utilization of natural ventilation has been done.
- The ceilings are not concealed which makes it more cost effective and provides ease in maintenance.



Figure 3-13 AC Units

### 3.2.13 Others

- Provision of fire extinguishers: 3 in each floor.
- Provision of water treatment areas and generator area.



Figure 3-14 Fire extinguishers, Water treatment and Generator area

### 3.2.14 Analysis

- Distinct segregation of space essential to prevent any disturbances while programming.
- The layout of workstation and excellent recreational areas helps to increase creativity and well-being of employees
- Insufficient activities in a recreational area due to lack of games available and a bit distant from the workspace.
- Well sufficient natural light in the meeting room, lobby and workspace.



- Use of glass partition on the meeting room gives sufficient light on lobby space.
- Casual open seating space gives welcoming feeling on the entrance.
- Sufficient 2.6m width lobby space gives occupants free walking space.

### 3.2.15 Inferences

- Proper planning of the work space plays a vital role in success of company and good working environment.
- Most of the projects are team project, so there should be frequent conversation between the team members, open plan or hybrid plan is good.
- No. of meeting space is to provide as there are no. of projects are simultaneously going on.
- Yoga, meditation space can also be provided in recreational space.

## 3.3 DEERWALK INSTITUTE OF TECHNOLOGY

### 3.3.1 General Information

- Location: Sifal, Kathmandu
- Building Type: Residential, Institutional

### 3.3.2 Objective of Study

- To study about the planning, space requirement of an institute/academy related to information technology



Figure 3-15 DWIT Entrance Gate

### 3.3.3 Planning and Observation

- It is a complex of institution/academic building, corporate (software company).
- It consists of 11 blocks all together ( 3 academic, others are for services, administrative, cafeteria, labs etc.
- large open space for recreational, canteen dining area for students and employee of Deerwalk Inc.
- electronic security system such as surveillance camera, access control etc. are high used or door to door.
- The main open social space is very helpful for all students, employee as this space is helping in collaboration, communication not only between students but also among

students and employee

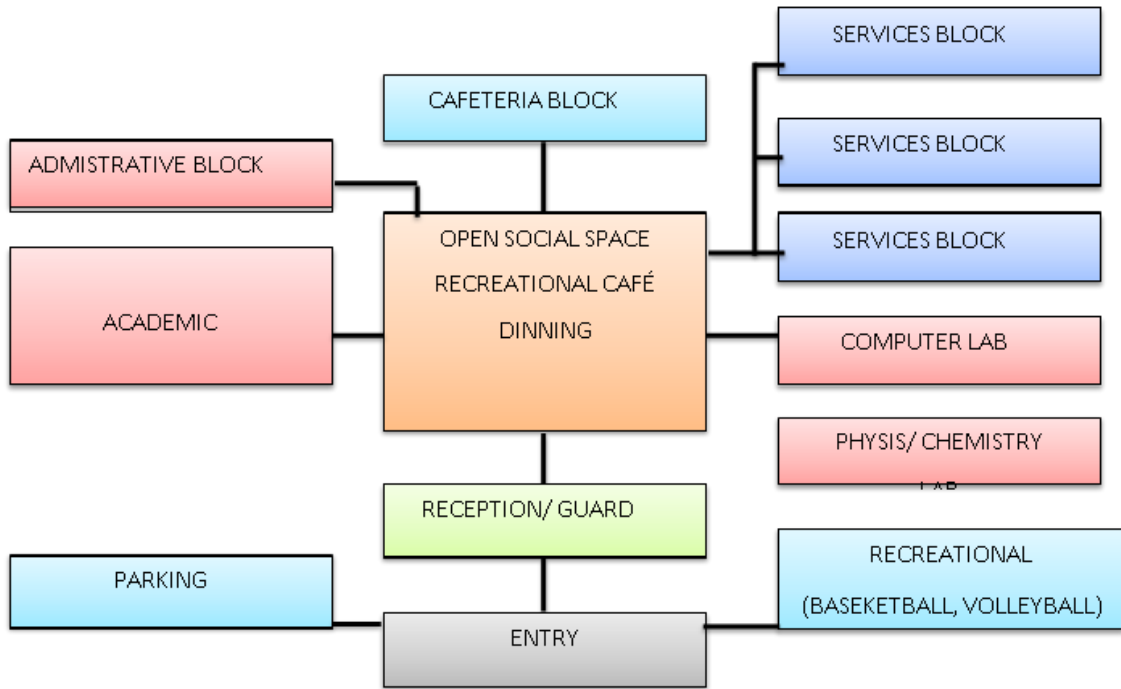


Figure 3-16 Space Flow Diagram of DWIT



Open social space and cafeteria



Academic block and Basketball court

Figure 3-17 Different Outdoor Spaces of DWIT

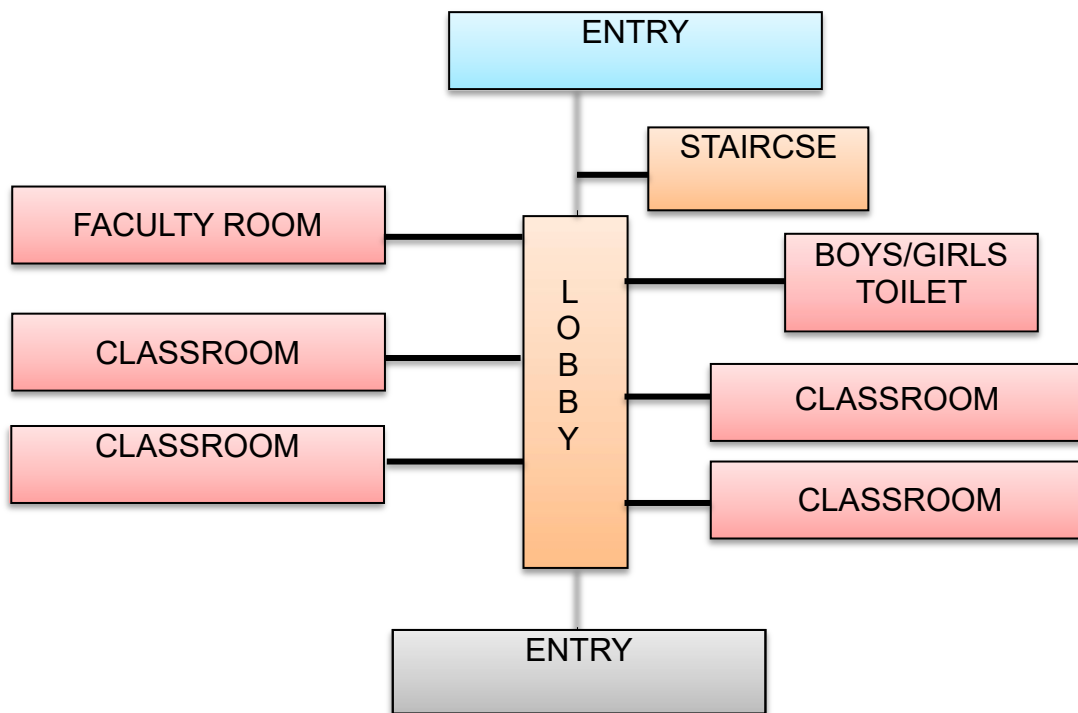
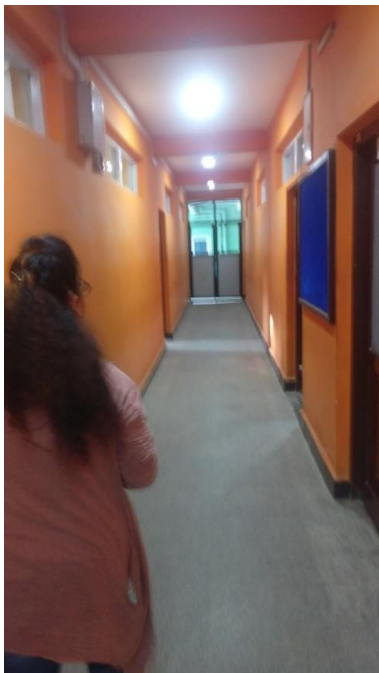
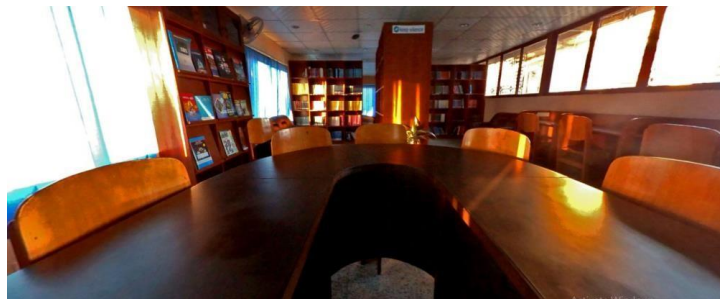


Figure 3-18 Space flow diagram of Ground Floor Plan of Academic Block



Corridor



Library



Faculty Room



Cafeteria



Staircase



Classroom



Seminar hall

Figure 3-19 Different Indoor Spaces of DWIT

### 3.3.4 Analysis:

- As all the building are rented or bought by the Deerwalk, planning was confusing
- IT Services and academic block were merged in single building where students were not allowed to enter.
- Academic and services can be managed properly for not crisscrossing each other.
- Administrative block is one of the farthest from the entrance which is not functional as there will series of visitors to visit.
- Almost every door has security check in, if we leave one building and go another we have to frequently use check in card.
- Greenery and open social space is very much alive and used space. Act as courtyard.



### 3.4 GOOGLEPLEX, MOUNTAIN VIEW, UNITED STATES

#### 3.4.1 General Information

- Googleplex: Official name of Google Campus
- Location: 1600 Amphitheatre Kkwy, US
- Architect: Clive Wilkinson Architects
- No. of employees: 8000
- Office space: 1, 85,800 m<sup>2</sup>
- Original core has 46,500 m<sup>2</sup>



#### 3.4.2 Objectives of Study

- To study the modern workspace trends.
- To study the various biophilic elements incorporate in the design.
- To study about various sustainability approaches used in the building.
- To study about the interesting spaces that can be obtained in modern office.
- To study about the new office planning.

#### 3.4.3 Description

"Googleplex" is a portmanteau of Google and complex (meaning a complex of buildings). Since the buildings are of relatively low height, the complex sprawls out over a large area of land. The interior of the headquarters is furnished with items like shade lamps and giant rubber balls. The lobby contains a piano and a projection of current live Google search queries. Facilities include free laundry rooms, two small swimming pools, multiple sand volleyball courts, and eighteen cafeterias with diverse menus.

#### 3.4.4 Salient Features:

- It is said to be one of the cool office designs.
- Encouraging interaction among workers by providing suitable working environment.
- Application of Sustainable design features applied in the design.
- Google garden used for growing foods.
- Various range of office decoration attracting public and clients.
- Leed (Platinum) Certified Building.
- Advocates a green-conscious and healthy lifestyle among its employees.

### 3.4.5 Site Plan

- The Googleplex is located between Charleston Road, Amphitheatre Parkway, and Shoreline Boulevard in north Mountain View, California close to the Shoreline Park wetlands.
- To the north: Shoreline Amphitheatre and Intuit.
- To the south lies Microsoft Corporation's Silicon Valley research complex, the Computer History Museum, and Century Theatres.
- To the east: Moffett Field



Figure 3-20 Site Analysis

### 3.4.6 Master Plan

#### 1. Landscape Network

- The first step was to analyze existing Mountain View California campus.
- Analytical study of existing site conditions and opportunities of connecting the 4 buildings into one community was done.
- Opportunities in the existing landscaping, hardscape, connectivity of the campus, division of outdoor activities was looked into.



Figure 3-21 Landscape Network

#### 2. Opportunities and Constraints

- They proposed ways in which existing opportunities could be pushed to a new level.



- They investigated each of the existing four buildings, and their relationship to each other, and the campus in general, discovered other constraints and opportunities.

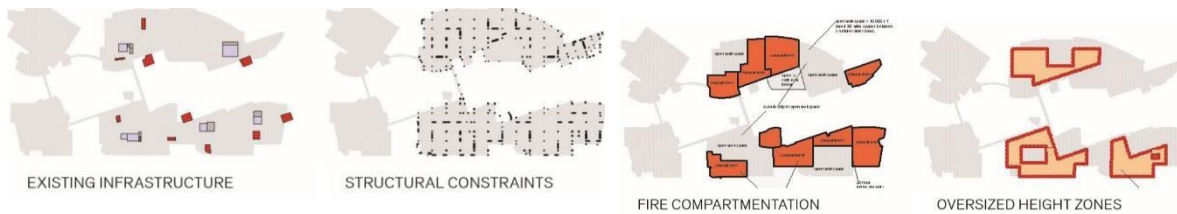


Figure 3-22 Thematic sketch showing Constraints in site

- All of these opportunities, as well as the infrastructure, were incorporated into the architectural solution for the Googleplex.
- The process started with a unified master plan for the entire campus which incorporated campus: outdoor sports activities, food, a common, and a park.

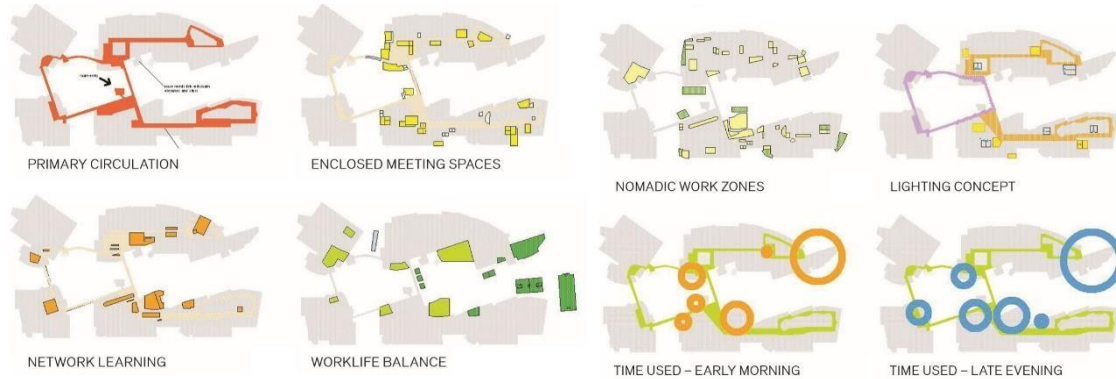


Figure 3-24 Thematic sketch showing Opportunities in the site



Figure 3-23 Masterplan: Site Plan Landscape Scope

### 3.4.7 Concept

- Flexibility and Adaptability: Allow teams to quickly form, collocate and relocate, density

- Concentration and Collaboration: Balancing individual and group
- Work/Life Balance: A work environment that is social, attractive, convenient.

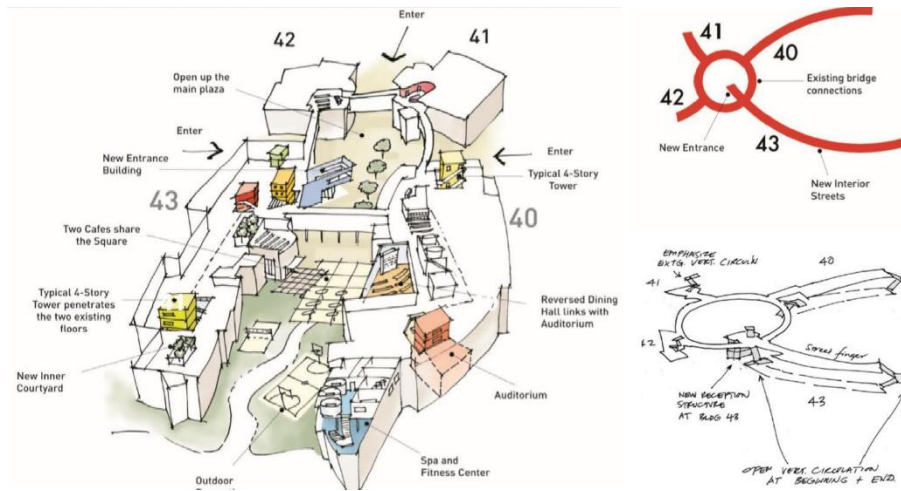


Figure 3-25 Campus View from the East Figure and sketch of building connection

### 3.4.8 Space Illustration

The concept of Education in Workplace

- Overall plan was designed to mimic the loosely structured nature of a university.
- Enclosed work areas for employees where they can be productive both individually and collaboratively.
- These spaces were systematically integrated into the overall design of each building by the use of a hot and cold diagram: Hot areas being more public and active zones, while cold being more secluded and private.



Figure 3-26 Thematic diagram of space illustration

### 3.4.9 Workspace

- The building plan is divided into three parts.
- The primary and the supporting spaces. These two spaces are blended in proper manner fulfilling the comfortable living environment.
- The primary workspace covers up to 70%, whereas the supporting space covers about

20% in the whole building.

- The services spaces which include toilets, stairs and lifts are provided 10%.
- For the ease and proper distribution of mass flow, 3 staircases are placed in the building.
- Also, the toilets are provided in 3 different positions catering the employee of every workstation.
- Along the workstation breakouts spaces are provided. So, the workers can work either in enclosed or open space.



Figure 3-27 First floor plan of Building 43

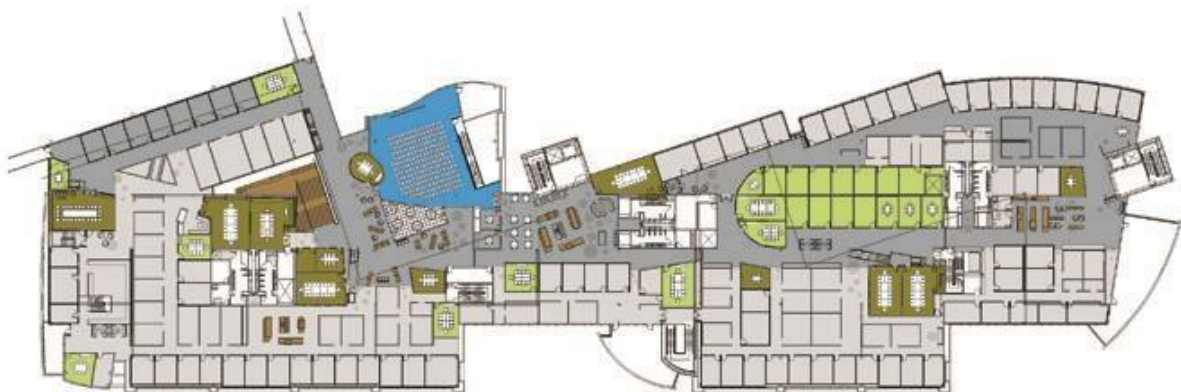


Figure 3-28 Second floor plan of Building 43

#### a. Primary Workspace

- The workstation and workrooms are present in the edges.
- These spaces are present away from the connecting points of two buildings.
- These spaces are placed in edges so that maximum daylight could be properly utilized.
- Also, these spaces are arranged in that manner so that employees could have



maximum view of the surrounding.

- Open plan workspace is encouraged as engineers worked best in groups of 3 to 4.
- The open planning in workspace promotes high collaborative works based on team.
- Use of colorful glasses as partition to identify various teams.
- Use of bright colored wall in the workstation creating happy environment.

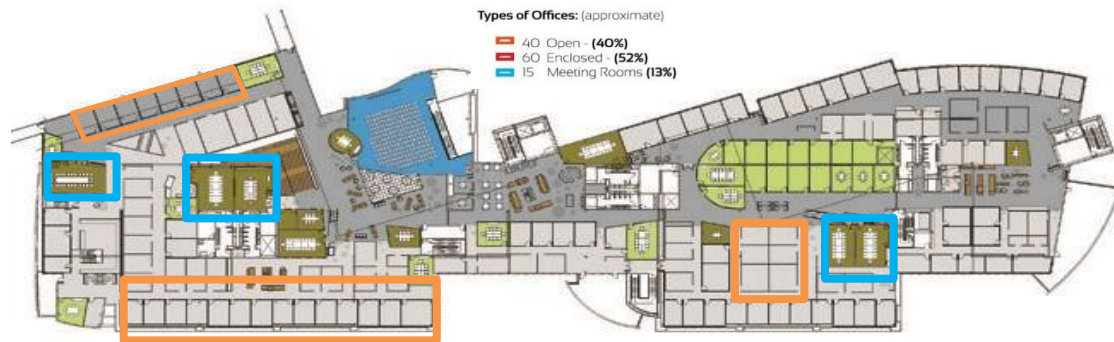


Figure 3-29 Types of workspaces in Googleplex

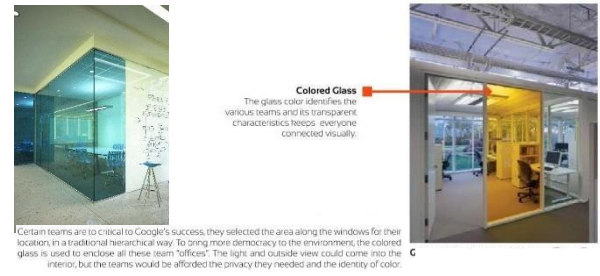
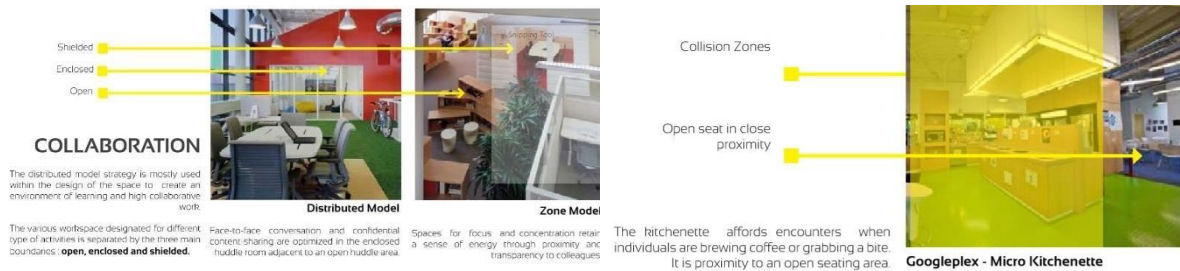


Figure 3-30 Workspace in Googleplex

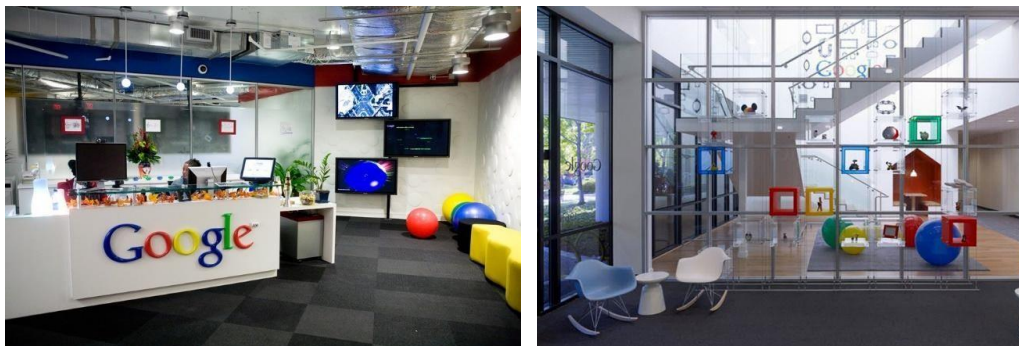
### b. Supporting Spaces

- Supporting spaces are present in the inward part of the building. So, that both the buildings can share the amenities.
- Collision zones create interaction and chance encounters among employees. During those brief encounters, employees can share knowledge and information.

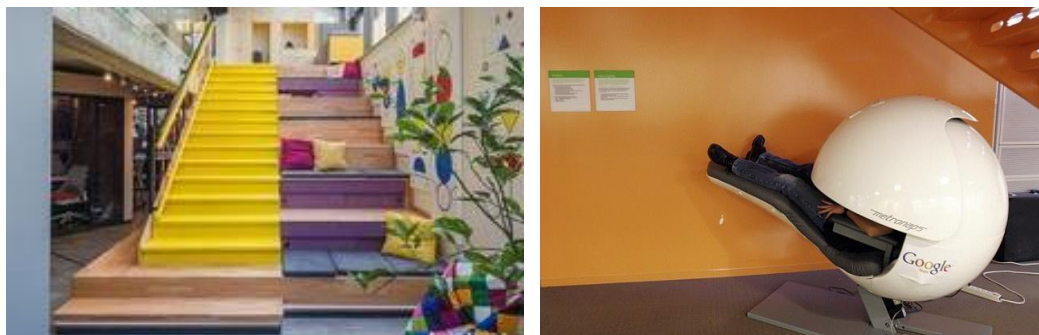


**Figure 3-31 Use of Colored glass in workspace**

- The design is based on the concept of the “city as a paradigm” where one main street (circulation path) connects the entire space.
- The supporting space are all themed in google colours. Colours such as green, blue red are used as the highlighting element in the space design.
- Shades of nature has helped to trigger the biophilic responses.
- Use of such colours has helped to stimulate creativity, focus and higher energy.



**Figure 3-32 Reception and Waiting area**



**Figure 3-33 Modern recreational space and nap pods**

### 3.4.10 Breakout Spaces

- Small indoor breakout area is provided within the workspace.
- These breakout areas benefit the employees and helps to recreate themselves.
- These breakout spaces help to boost up their energy and helps to break the monotony from long working hours.
- Resting areas are included in breakout areas where they can relax and work.
- Google themed colors are used in furnitures, couch and wall area of breakout spaces.





Figure 3-34 Indoor and Outdoor Breakout Spaces

### 3.4.11 Materials Used

- Curtain wall system in the building façade.
- Use of steel structure as a design element in the facades.
- Glass window double glazed with vacuum in between for better temperature and acoustic control.
- Glass partitions are made in workspace and in private more of brick walls are used.



Figure 3-35 Material use in Googleplex

### 3.4.12 Sustainable Features

The 3.1-million-square-foot Googleplex facility implemented a variety of measures spanning energy efficiency, renewable energy, water efficiency, and transportation alternatives. They are targeting 20% reductions on already high-performing buildings in energy, water and waste.

#### 1. Solar Panels

- Googleplex also uses over 9,000 solar panels.
- Their 1.9 MW solar installation supplies approximately 30% of peak energy consumption on the buildings it covers.



- 1.6Mw of electricity is generated with the help of solar panels.
- This system powers up to 30 percent of the campus' peak energy needs and was one of the largest solar power systems to be constructed on any corporate site globally.



Figure 3-36 Solar Panels in roofing

## 2. Water Efficiency

- They undertook a huge effort to convert their landscape irrigation to recycled municipal water (purple pipe), saving an estimated 24 million gallons of potable water.
- They've also been replacing water-intensive turf with drought-friendly native landscaping, as well as replacing shower heads and faucets in favor of low-flow ones

## 3. Water Efficiency

- Google has built a green transportation system that includes biodiesel shuttles and the largest corporate electric vehicle charging infrastructure in the country.
- Every day, Google shuttles keep thousands of Googlers out of the driver's seat and reduce their impact on the environment.
- This includes the newest generation of plug-in vehicles.
- Google estimates that their shuttles and G Fleet result in net annual savings of more than 29,000 metric tons of CO<sub>2</sub>.
- Color-branded bicycles are also provided for on-site use.

hers:

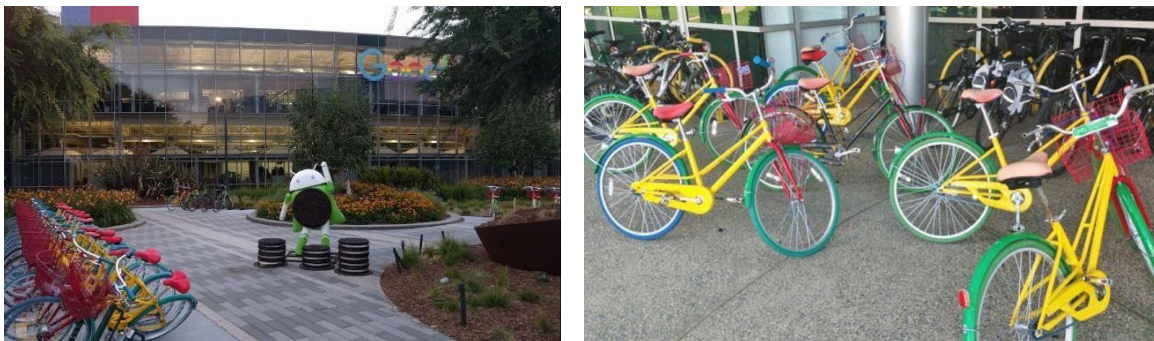


Figure 3-37 Green Transportation

- Glazing strategies and technologies in the clerestories are used. These glazing are used to control and scatter direct sunlight in order to minimize glare. This can be accomplished using an assembly glass coupled with automated shading devices.
- The landscaping by Hargreaves Jones is another focal point of the design.
- Perimeter bioswales and bioretention zones collect stormwater runoff for onsite treatment, and all rainwater from the building canopy will be immediately collected for local use.

#### **3.4.13 Inferences:**

- The open planning office seems to have created a positive impact on the employees.
- The workspace formally even seems to be less in accordance to the chart but “anywhere work” scheme increases way more than the expected data.
- Other standards in the design also seem to have fulfilled the literature’s requirement.
- Installation of sustainable features can be costly at first.
- Sustainable features to be added in building which helps to reduce the cost at high rate.

### 3.5 TIDEL PARK, CHENNAI

#### 3.5.1 General Information

- Location: Chennai, India
- Category: High Tech
- Site Area: 8 acres
- Project Area: 2000 AD



Figure 3-38 Tidel Park

#### 3.5.2 Objectives of Study

- To study about the office planning and its segregation.
- To study the building as a whole as being one of the exemplary structures of IT in India.
- To study international IT Park space and service requirement.

#### 3.5.3 Description

TIDEL Park is a 13-storied building, rated as the single largest IT park in India. TIDEL Park offers a plug and play environment that allows businesses to thrive in an industry. The groundfloor consists of the auditorium, TIDEL administrative office, food court, banks. The park has facility to accommodate 800 employees with all facility furnished.

#### 3.5.4 Salient Features

- Largest IT Park in India
- High rise building of 2 basements + ground floor + 12 floors
- Available office area: 4500-90000 sq. ft. each floor
- Hall: 650 seats capacity

#### 3.5.5 Site Analysis

- Provision of Primary Road i.e., Rajiv Gandhi Road
- Easy access for the workers as the office is present in core City area. Ease of public transportation.
- It is close to the Rajiv Gandhi Salai–Thiruvanmiyur West Avenue Junction, a high-density traffic junction used by about 30,000 vehicles a day.



Figure 3-39 Tidel Park Site Plan

### 3.5.6 Master Plan

- The whole site is divided into landscape area, plaza area, parking, main building.
- A setback of 113 m is left from the main road.
- Landscape area is provided as a barrier from the main road.
- Pedestrians and vehicular access are separated for the proper flow of people.



Figure 3-40 Landscape Area

### 3.5.7 Workspace

- The workspace is planned in team and combination workspace type.
- Modern furniture with touch of bright colours has been used.

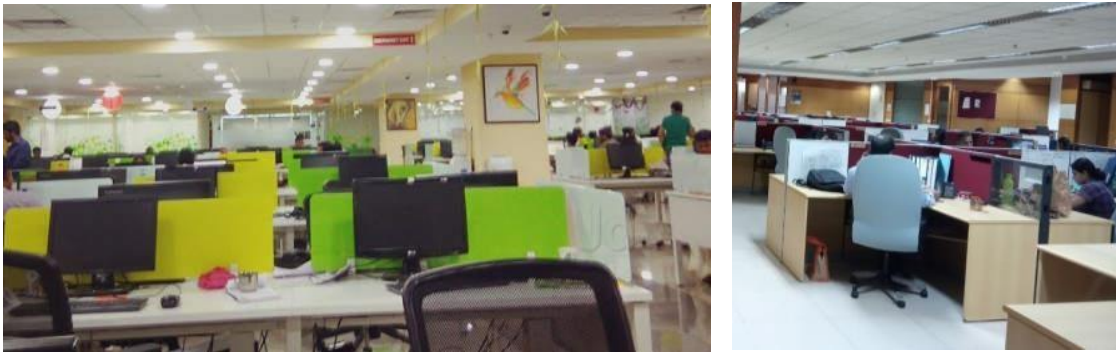


Figure 3-41 Workspace Area

### 3.5.8 Supporting Spaces

- Various supporting spaces such as conference room, seminar hall, meeting rooms are provided on floor basis.
- Also, training centers, server rooms are provided. Besides, essentials units including w/c, pantry is provided.

### 3.5.9 Circulation



- 10 Nos. high speed lifts (1.6 m/s) with 20 passengers' capacity each.
- 3 of the lifts are designed as service cum passengers' lifts.
- Automatic rescue device is provided in all the lifts.

### 3.5.10 Parking – Surface and Double Basement

- Two wheelers – 4000
- Cars - 1200



Figure 3-42 Parking Areas

### 3.5.11 Materials Used

- Exterior Glazing: Thermally efficient Double Insulated Glass.
- Cladding: Aluminum Composite Panels
- Building Façade: Mass of Glass and ACP

### 3.5.12 Materials Used

- Exterior Glazing: Thermally efficient Double Insulated Glass.

### 3.5.13 Inferences

- Planning of office areas in periphery for maximum daylight.
- Services are located centrally for uniform utility.
- Different service aspects of IT Offices.



## 4 COMPARATIVE ANALYSIS

S.no	Particulars	Literature	Leapfrog Technology	Deerwalk Institute of Technology	Tidel Park	Googleplex, California	Inferences
<b>SITE</b>							
1.	Area	-	650.32 sq.m		118,915.89 sq. m	2,87,999.42 sq. m	-
2.	Location	Preferably in close proximity to urban areas with highly evolved socio – economic overheads.	-Charkhal, Dilibazar -Close to institutions of higher learning. - Present in core city area. -Ease of public transportation. -Highly evolved socio-economic overheads.	-Sifal, Kathmandu -Close to core city area -Inside the Deerwalk Complex	- Rajiv Gandhi Thiruvanniyur -Ease of public transportation. -Close to railway station. -High-density traffic junction used by about 30,000 vehicles a day.	- Amphitheatre Parkway. -Highly evolved socio – economic overheads. -Closed to institution of higher learning.	-Close proximity to urban area is preferred. -Highly evolved socio-economic overheads is preferred.
3.	Orientation	-	West axis		North axis	South axis	South
4.	Land characteristic	Flat or Contour land preferable	Flat Land	Flat Land	Flat Land	Flat Land	Either flat or contour land.
5.	Plaza and Landscaping	-	-No plaza area, landscape provided around Block B	-common social interaction space available for interaction and communication	-113 m setback from the main road -landscape done as a barrier of noise from the main road.	-Analytical study of existing site conditions and opportunities.	- Proper plaza and landscaping elements enhances working environment

S.no	Particulars	Literature	Leapfrog Technology	Deerwalk Institute of Technology	Tidel Park	Googleplex, California	Inferences
<b>BUILDING</b>							
1.	Design Approach	-Energy efficient, -Inclusive Design	-Site Driven and Inclusive Design	-Site Driven and Inclusive	-Energy efficient -Site Driven Design.	-Sustainable Design Techniques -LEED Certified green building	-Energy efficient -Site Driven
2.	Building Expression	Varies	Modern Building	- Modern	High-tech Building	High-tech Building	Modern or High-Tech
3.	Construction Technology	Lightweight Construction and framed Structure	R.C.C Framed Structure	- RCC structure with few Steel structure supporting	R.C.C Framed Structure	Light weight steel framed structure	Lightweight Construction and framed Structure
4.	Construction Materials	Various option according to availability, economy.	RCC, Glass,	-RCC, Glass, ACP	Aluminum Composite Panels, Glass, Steel, R.C.C	Steel, Glass	Materials vary from the type of design and availability of materials.
5.	Roofing Structure	Various option acc. to the use	RCC Slab, CGI Sheet (Temporary Structure)	- RCC Slab, CGI Sheet (Temporary Structure)	RCC Slab	Steel structure	Long Span Steel Space grids
6.	Building Form	Building form should be developed with respect to site	-Rigid rectangular in shape. -Complements the surrounding buildings.	-Rigid rectangular in shape. -Complements the surrounding buildings.	-Rigid rectangular in shape. -Complements the surrounding buildings.	-Irregular in shape, -Building acting as a landmark of the location.	As per the desired design, blending with the site and surrounding buildings.
<b>PLANNING</b>							
1.	Zoning	Public, Auxiliary and Semi Private Spaces	Public, Auxiliary and Semi Private Spaces	Public, Auxiliary and Semi Private Spaces	Public, Auxiliary and Semi Private Spaces	Public, and Semi Private Spaces connected through auxiliary spaces	Public, Auxiliary and Semi Private Spaces
2	Entrance	-Welcoming - Wide entrances preferred.	-Direct entrance through circulation space.	- -Transitional approach from outdoor area to indoor.	-Transitional approach from outdoor area to indoor.	-Transitional approach from outdoor area to indoor.	-Transitional entrance from outdoor areas to indoor areas is preferred.

S.no	Particulars	Literature	Leapfrog Technology	OFFICE SPACE	Tidel Park	Googleplex, California	Inferences
1.	Workspace type	-Cellular -Open -Team	Open Planning Workspace	-	Open and Cellular Planning Workspace	Open Planning Workspace	Open Planning as it promotes efficiency.
2.	Furniture Arrangement	Varies acc. to workspace	Linear Open Arrangement	-	Linear Cubicle Arrangement	Angular and Linear Arrangement	Linear Open Arrangement
3.	Placement and connection of primary and supporting space	-	-Workstation is placed in the front side of the building. -Supporting spaces and service areas are placed at the backside.	-	-The workstation, supporting spaces are connected and placed accordingly. -Services are distributed to maintain the flow of people.	-Workstation is placed in the building edge to obtain daylight. -Supporting spaces are placed connecting the primary ones.	Workspace to be placed in the building edge to obtain daylight and supporting spaces connecting the primary ones.
<b>OTHERS</b>							
1.	Public Oriented Space	-	No such space oriented to public.	--	Restaurants cafeterias are present.	Gaming zones, restaurants cafeterias are present.	Should be present to attract the general public.
2.	Breakout Areas	-Breakout zones are must. One breakout space for every 45 employees	-Breakout zones such as play area tennis, foosball is provided in separate floor.	-	- Gym halls are provided in amenity building, which is segregated from workspace.	-Gaming area is provided where employee can have recreational time. -Provision of nap pods to take power nap.	-Boost up their energy. -Breaks the monotony from long working hours.
<b>PARKING</b>							
1.	Surface Parking	As per Design requirement	Surface Parking: 100-150 bikes and 10 cars	-Surface Parking: 100-100 bikes and 10 cars	Surface parking: 1500 cars	Surface parking around the periphery of the building.	As per Design requirement
2.	Basement Parking	As per Design requirement	Basement Parking: 40 -50 bikes and 6 cars.	-	1300 cars Two wheelers parking: 3000	-	As per Design requirement

## 5 SITE ANALYSIS

### 5.1 SITE SELECTION CRITERIA

- The main work in IT Hub is Programming and software development which requires peaceful environment than highly accessible site in a downtown. Hence, sub-urban areas are selected for IT Parks in foreign countries.
- IT is a fast-growing sector. Hence, sub-urban areas is more likely to provide space for at least limited expansion.
- Near Kathmandu valley, since most of the manpower is centralized.

### 5.2 SITE DESCRIPTION

The site plays an important role in success of any project. The site chosen for the project is located at Byasi, Bhaktapur. The main factor for selection of site were following:

- Not located fit the core city of Kathmandu but easily accessible from the city core.
- Located on periphery of Araniko Highway.
- Peaceful and pleasant setting for ideal work environment.

#### 5.2.1 Location

The site is located at ward no.2 Byasi, Bhaktapur. It lies at about 20-25 mins distance form Sallaghari Junction and 5-10 mins from old Thimi Road.

**Plot Area: 18,420 Sq. m. (36-3-1-1)**

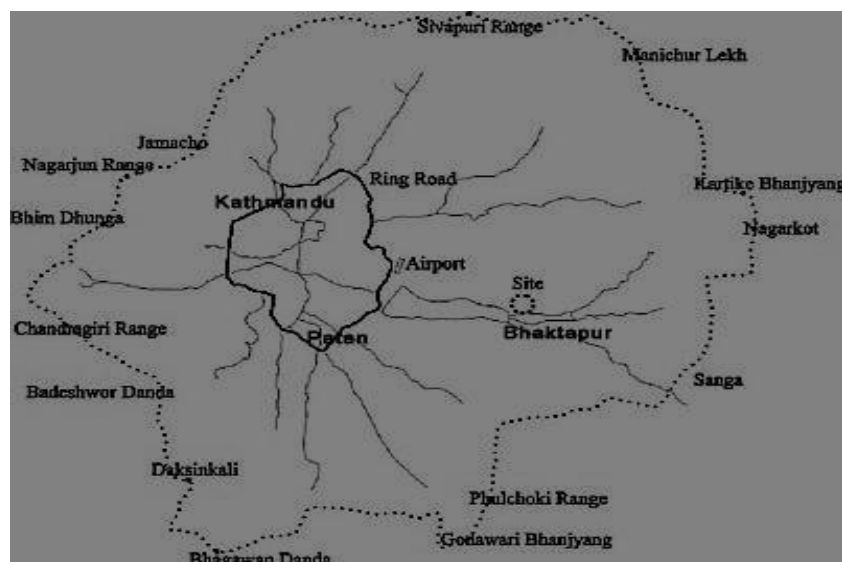


Figure 5-1 Kathmandu Valley Major routes and proposed site

### 5.2.2 Site Surrounding

The site lies in the area between Thimi and the main Bhaktapur town. The area on the southern side has been designated as Bhaktapur industrial zone. The area consists of NEA building, Pharmaceutical Industry, siddha pokhari and Birendra Sainik school on south-eastern part. A small Khasyan Khusung stream lies on the north. The main access road is the popular route to Nagarkot (not for public vehicles however). On the western part, there is a treatment pond used by Bhaktapur Municipality but is currently unused. On the eastern part, there are agricultural lands and on the northern part also there are agricultural lands and duwakot vdc. The Sallaghari junction is the important transportation junction of the area which has led to newer unplanned settlement around the old Thimi road.

<u>Directions</u>	<u>Site surroundings</u>
East	Agricultural lands
West	Agricultural lands
North	Small stream, agricultural lands and duwakot vdc
South-West	Sallaghari junction
South-East	Pharmaceutical Industry, siddha pokhari and Birendra Sainik school



Figure 5-2 Proposed site for IT Hub and its surrounding



### 5.2.3 Site Condition/ Topography

The site is south oriented. Overall, the site flat and lies about 1m below the road level. The site has been primarily used as a farmland from the past. Under the new bye laws, the area has been designated as mixed residential development zone. The nearby transportation junction of Sallaghari has led to newer residential settlement development mainly around the old Thimi road. There are few new residential buildings with in and around the site along with old greeneries or farmhouse.

#### Vegetation:

The land is primarily agricultural use for rice cultivation. There is limited vegetation around the site and shrubs. There is limited vegetation around the site while the nearby Sallaghari area as its name suggest in covered with pine trees.

### 5.2.4 Access

The site does not lie on the main transportation route but is easily accessible. For private transportation access is through 6, wide road which leads to Byasi. The road is the popular way to Nagarkot (but not for public transportation). The nearest public vehicle stop is on old Thimi- Bhaktapur road and lies at 4 min walk for the site. The Araniko highway and the main Sallaghari junction is about 20 mins walking distance from the site.

## 5.3 CLIMATIC STUDY

In order to have an overview of the climate prevalent in that area, climatology data of Kathmandu was taken for reference. The data has been taken as an average of 12 years

Mean Max. temperature	30° C
Mean Min. temperature	3° C
Mean temperature	19° C
Mean Precipitation	96.2 mm
Mean Humidity	12° C
Mean annual rainfall	1154.7 mm

Source - <https://www.timeanddate.com/weather/nepal/kathmandu/climate>

The climatic condition of Kathmandu is hence comfortably mild with neither a severe winter nor heavy tropical heat and rain. The winters are cold and dry and lasts from October to May while the summer and hot and humid and lasts from June to September. The average rainfall is 900- 1500mm annually most of them occurring during the monsoon time. The temperature in Kathmandu Valley is between 10°C-15°C in the winter days and 25°C-30°C during the summer days. The main wind direction is from west to east.

#### **5.4 SOCIAL DESCRIPTION**

Lying in outskirts of main Bhaktapur town on south-east, the site has been used as farmland from the past. Although the Sallaghari junction has fueled newer settlements in the area, the activity around the main site is limited. The nearby Sallaghari hill is religiously important. Today the settlement is increasing with commercial opportunities created by the junction.

Although the soil suits agriculture activities. In long term the unplanned residential settlement is sure to take over the area. So, a project to the scale of IT park will help to properly utilize this area which remain route to an important tourist destination of Nagarkot.

#### **5.5 CULTURAL DESCRIPTION**

The smallest district of the country, Bhaktapur, is now coming up with a unique name. The ancient city of Bhaktapur is now to emerge as a Cultural City, with all renovated temples, rich traditional dances and clean streets. Bhaktapur is developing as tourism destination by conserving the base of a Cultural City, the art, architectures, language and culture. The attempts of the municipality towards conservation of cultural heritage in the city area are appreciable and needs more efforts to maintain the temples and palaces. In this regard, 90% of the respondents agree that Bhaktapur is successful in conservation of Cultural monuments in some extent. Although the government has Building Ethics, it has not been implemented due to government process. And they also argue that It must be implemented the Ethics so that no more ugly, unscientific structure may come up in the well-conserved ancient city. In addition, while letting the citizens construct new buildings, the municipality must seriously monitor if the measures to protect the buildings from earthquake damages or not.

#### **5.6 BYE-LAWS**

The site lies in the mixed residential sub-zone. Since, the proposed project is an office cum public building bye-laws for public building for development zone have been considered:

- Site Area: 18,420 Sq. m. (36-3-1-1)

- Max. GC: 70% (40% for more than 1 Ropani)
- ROW: 10m from the center of the road
- FAR: 2.5
- Parking: at least 10 % of the site area

## **5.7 SWOT ANALYSIS**

### **5.7.1 Strength of the site**

- The current development and activity in the site is sparse, the site hence has the potential to cater any growth in future
- Sub Urban setting with little human activity and traffic volume in surrounding provides peaceful working environment.
- Easy accessibility for private as well as public transportation. Located just few minutes' walk from Sallaghari Junction.

### **5.7.2 Weakness of the site**

- Lies in the depressed area. Hence view of site restricted from north and western side.
- Although easily accessible through public transport, the distance from city center can be a minor issue due to traffic congestion in the Koteshwor Area.

### **5.7.3 Opportunities**

- The site lies in a comparatively peaceful area

### **5.7.4 Threats**

- Few residential buildings in the site
- Lies in the depressed area

## 5.8 SITE PICTURES



Main road access



South-West view of the site





East view of the site



West view of the site

**Figure 5-3 Pictures of the Site**



## 6 PROGRAM FORMULATION

Literature study and case study reveals that in an office complex besides the primary office space there is a need of the supporting spaces. The supporting spaces are the restaurants, recreational areas, and various commercial spaces to shore up the office space. The size and scale of the office complex may vary from the project to project but the basic objective is to create a healthy working environment for employees for better creativity and productivity.

After literature review and case-study, required components were obtained and program formulation is carried out.

### ➤ Major Components of An Office Complex

- Administration
- Rental offices
- Library
- Conference Hall
- Multipurpose hall
- Retail Store
- Restaurant and Cafeterias
- Public Oriented Space
- Data Centre

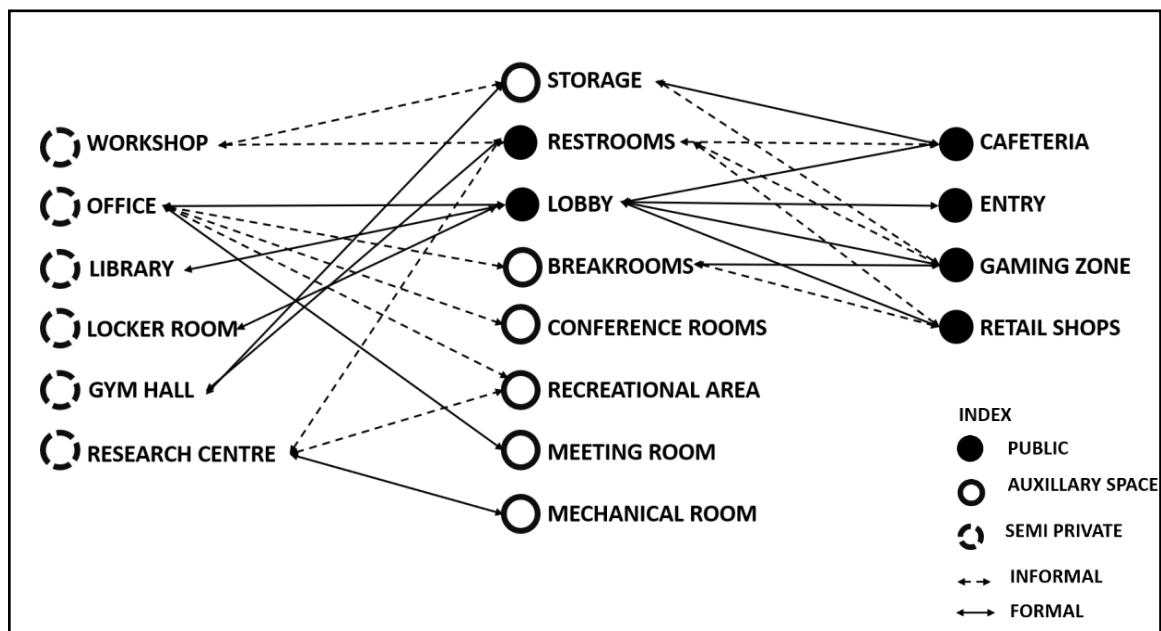


Figure 6-1 Framework of Spaces

## 6.1 ADMINISTRATION

This unit will be responsible for the management as well as functioning of the IT Hub. It would accommodate all the administrative services responsible for providing accounting support, record management, technical assistance, security, service management etc. for office and other facilities.

ADMINISTRATION				
S.no	Space	No. of Users	Area per Person (m <sup>2</sup> / person)	Total area (m <sup>2</sup> )
1.	CEO Room	1	30	30
2.	Workplace (Open Plan)	20	11	220
3.	Department Head	1	20	20
4.	Manager	2	10	20
5.	Human Resource	2	10	20
6.	Account Department	2	10	20
7.	Legal Department	1	20	20
8.	Risk Management	1	20	20
9.	Reception/ Waiting	4	6	24
10.	Technical Staff Department	5	8	40
11.	Technical Equipment Store	-	-	20
12.	Meeting Room	15	1	15
13.	Pantry	-	-	10
14.	Breakout Area	30	2	60
15.	Toilets:			
	– Gents	-	-	6.7
	– Ladies			5
	TOTAL			539

## 6.2 RENTABLE OFFICES

### 6.2.1 Rentable Office (30 People Module): 4

<b>RENTABLE OFFICE (30 PEOPLE MODULE)</b>				
1.	Workspace (Open Plan)	30	11m <sup>2</sup>	330
2.	Reception + Waiting	5	4	20
3.	CEO Room	1	30	30
4.	Marketing Department	5	10	50
5.	Account Department	2	10	20
6.	Project Manager	1	10	10
7.	Supervisor	1	10	10
8.	Testing Head	1	10	10
9.	Head	1	10	10
10.	Technician	1	10	20
11.	Presentation Hall	15	3	45
12.	Meeting Room	10	0.5	5
13.	Informal meeting room	10	0.5	5
14.	Interview Room	2	5	10
15.	File Storage	-	-	5
16.	Server Room	-	-	30
17.	Printer/Fax	-	-	5
18.	Breakout Areas	30	2	60
19.	Toilet			
	– Gents (2)	-	-	6.7
	– Ladies (2)			5
	TOTAL			686.7
	4 no. of Rentable Office			2746.8

**6.2.2 Rentable Office (60 People Module): 8**

<b>RENTABLE OFFICE (60 PEOPLE MODULE)</b>				
<b>S.no</b>	<b>Space</b>	<b>No. of Users</b>	<b>Area per Person</b>	<b>Total Area (m2)</b>
1.	Workspace (Open Plan)	60	11 m <sup>2</sup>	660
2.	Reception + Waiting	4	6	24
3.	CEO Room	1	40	40
4.	Marketing Department	8	8	64
5.	Account Department	4	8	32
6.	Project Manager	2	10	20
7.	Supervisor	2	10	20
8.	Testing Head	1	10	10
9.	Head	1	10	10
10.	Technician	4	10	40
11.	Presentation Hall	15	2.67	40
12.	Meeting Room	10	0.5	5
13.	Informal meeting room	10	0.5	5
14.	Interview Room	2	5	10
15.	File Storage	-	-	3
16.	Server Room	-	-	30
17.	Printer/Fax	-	-	5
18.	Breakout Areas	20	2	40
19.	Toilet Gents (3), Ladies (3)	-	-	10.05, 7.5
	TOTAL			1075.55
	8 no. of Rentable Office			8604.4

**6.2.3 Rentable Office (80 People Module): 4**

<b>RENTABLE OFFICE (80 PEOPLE MODULE)</b>				
1.	Workspace (Open Plan)	80	11m <sup>2</sup>	8 8 0
2.	Reception + Waiting	5	4	2 0
3.	CEO Room	1	30	3 0
4.	Marketing Department	10	8	8 0
5.	Account Department	3	8	2 4
6.	Project Manager	2	10	2 0
7.	Supervisor	2	10	2 0
8.	Testing Head	2	10	2 0
9.	Head	1	10	1 0
10.	Technician	4	10	4 0
11.	Presentation Hall	20	2.5	5 0
12.	Meeting Room	10	0.5	5
13.	Informal meeting room	10	0.5	5
14.	Interview Room	2	5	1 0
15.	File Storage	-	-	3
16.	Server Room	-	-	3 0
17.	Printer/Fax	-	-	5
18.	Breakout Areas	75	2	1 5 0
19.	Toilet – Gents (4), Ladies (4)			13.5, 10
	TOTAL			1425.5
	4 no. of Rentable Office			5702



### 6.3 DATA CENTER

Table: Data Center

<b>DATA CENTER</b>				
1.	Server Room	-	-	100
2.	UPS Battery Room	-	-	10
3.	Surveillance Room	2	5	10
4.	Security Check	-	-	10
5.	Computer Room	4	7.5	30
6.	Maintenance Room	-	-	10
	<b>TOTAL</b>			<b>170</b>

### 6.4 RETAIL STORE

Table: Retail Store (No. 15)

<b>RETAIL STORES</b>				
1.	Sales	24	3	72
2.	Storage	-	-	20
3.	Counter	2	2	4
	<b>SUB TOTAL</b>			<b>96</b>
	15 Retail stores			1440
4.	Toilets	-	-	50
5.	Maintenance & Repair	-	-	35
	<b>TOTAL</b>			<b>2965</b>

### 6.5 RESTAURANT

Table: Restaurant

<b>RESTAURANTS</b>				
1.	Dining Area	100	3	300
2.	Counter	-	-	20
3.	Kitchen + Dining	-	-	90
4.	Toilets	-	-	20
	<b>TOTAL</b>			<b>430</b>

## 6.6 PUBLIC ORIENTED SPACES

Table: Public Oriented Spaces

<b>PUBLIC ORIENTED SPACES</b>				
<b>1.</b>	Game Stations	60	3	180
	– Reception	4	5	20
	– Lounge	10	8	80
	– Server Room	-	-	70
	– Store	-	-	30
<b>2.</b>	Exhibition Space	-	-	200
	-Miscellaneous	-	-	50
	<b>TOTAL</b>			<b>680</b>

## 6.7 PARKING

Table: Parking

<b>PARKING</b>				
<b>1.</b>	Bikes	500	1.6	800
<b>2.</b>	Cars	300	15	4500
<b>3.</b>	Service Vehicles	3	30	90
	<b>TOTAL</b>			<b>5390</b>

Site Area: 18,420

Max. Permissible Ground Coverage: 40%

FAR: 2.5

Permissible Built-up Area: (Site Area X FAR): 46,050 sq. m

Max. GC: 6,425 sq. m (34.8 %)

Total Built-up area: 30,690 sq.m

## 7 DESIGN AND FORMULATION

### 7.1 What is IT HUB?

IT HUB is a center for office structure that will be utilized mostly by offices, as well as rental spaces and other services. This center can serve as a meeting place for IT enthusiasts and experts to share their knowledge and abilities. The center could serve as a reference point for future IT centers. The HUB focuses on a work environment that incorporates recreational and environmental features, which is achieved through a biophilic approach. The IT Hub is planned to be an environmentally friendly structure, with a strong emphasis on incorporating vegetation into the structure using the biophilia method. The greenery is not only used in the building's design, but it is also used in the building's interiors, exteriors, and roof.

### 7.2 DESIGN CONCEPT

#### 7.2.1 CONCEPT

The design concept relies around the evolution and advancement of ICT. No other industry has evolved at the rate that the IT industry has. Over the few decades, IT industry has become one of the fastest growing industries. Today's civilization includes a fast-expanding segment of information technology. Every human endeavor is impacted by information technology and the expanding range of capabilities. Technology has advanced significantly in recent years, revolutionizing the way people communicate and collaborate. IT is an ever-growing sector. IT is continuously expanding with time. Therefore, Spiral, an ancient symbol for growth and evolution, is taken as the representation of growth of IT. Concept is based on the philosophical meaning of Spiral i.e., GROWTH and later transformed into the form taking account into site orientation, boundaries, climatic study and visual angles.

#### 7.2.2 CONCEPTUAL DEVELOPMENT

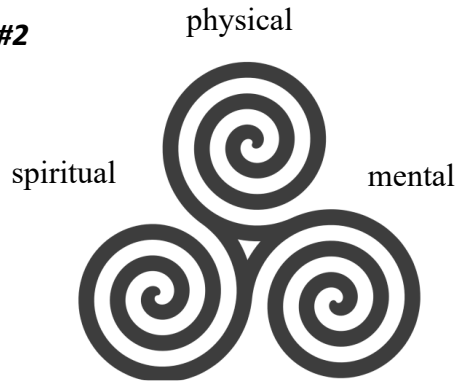
##### ➤ Plan Development

#1



- Spiral: Representing GROWTH and EVOLUTION of IT Hub

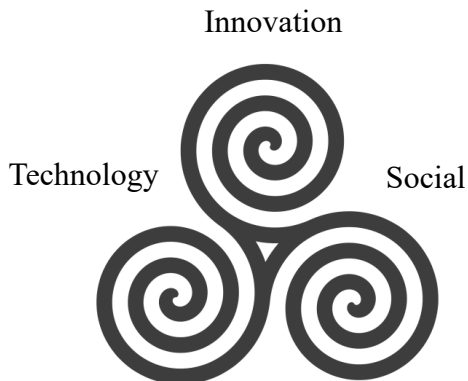
#2



Triple Spiral/ Spiral of Life

- Triple Spiral/ Spiral of life symbolized the physical, mental and spiritual development of human life.

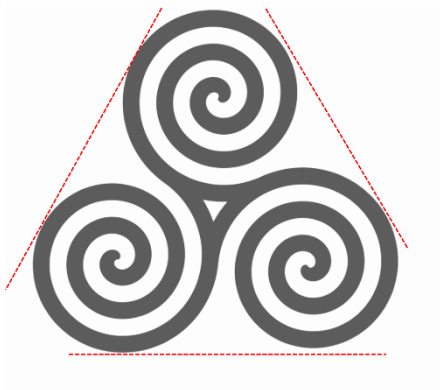
#3



Spiral of IT HUB

- Similarly, there are three major aspects to IT HUB. They are, Technology, Innovation and Social. This aspect completes the IT HUB and makes the Spiral of IT Hub.

#4



- Tangent lines are drawn around the spiral to give a definite boundary.

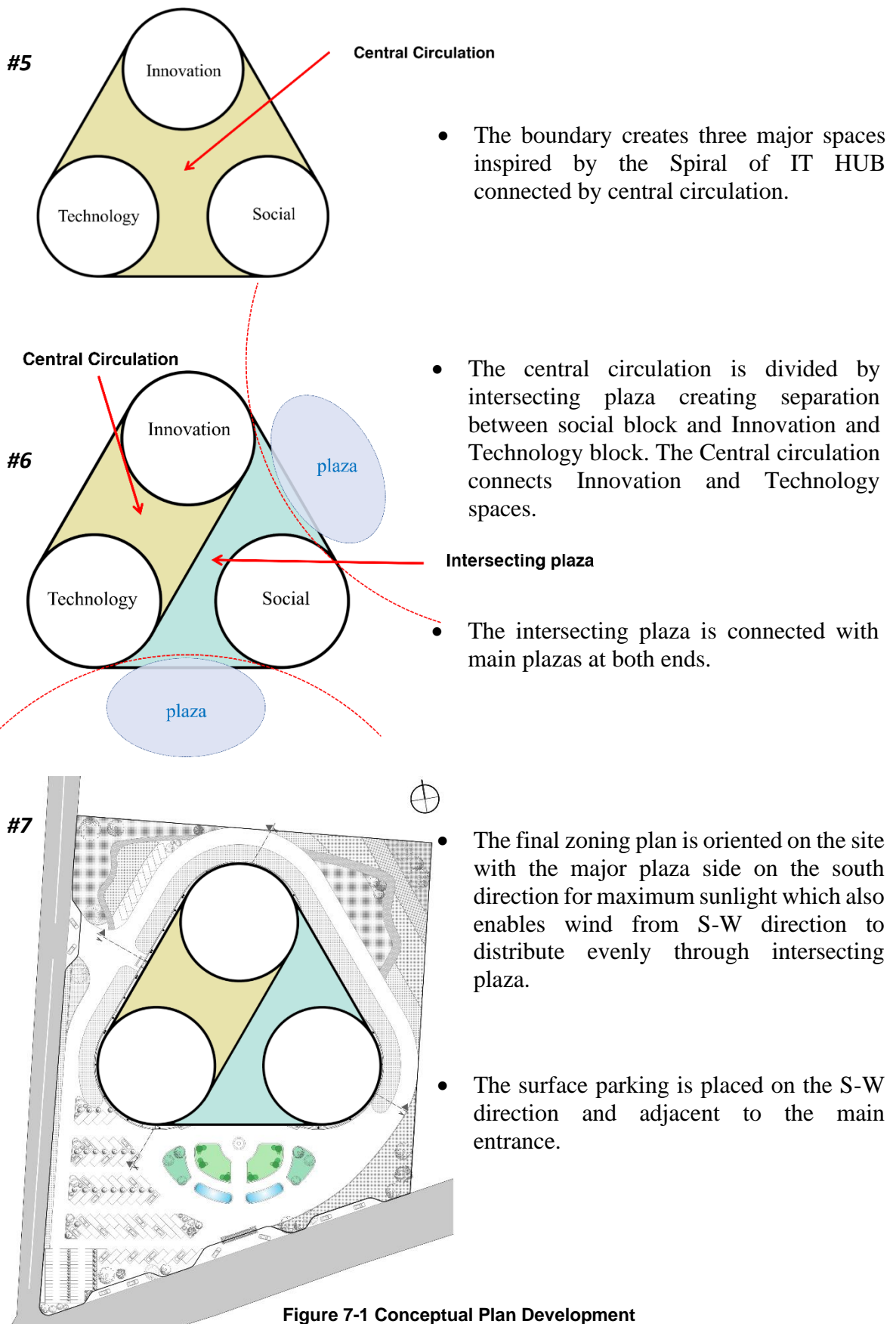


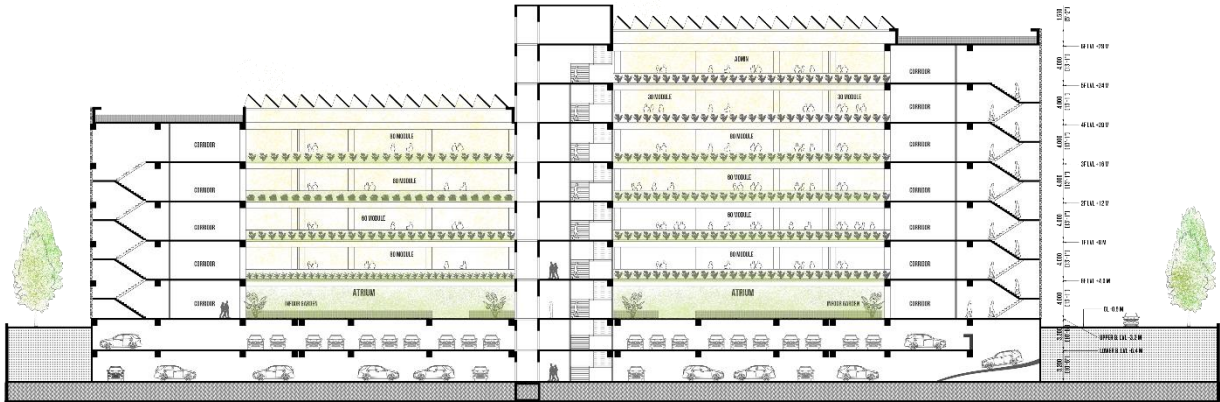
Figure 7-1 Conceptual Plan Development



➤ **Form Development**

**Approach 1: Nature inside the Building (Biophilic Approach)**

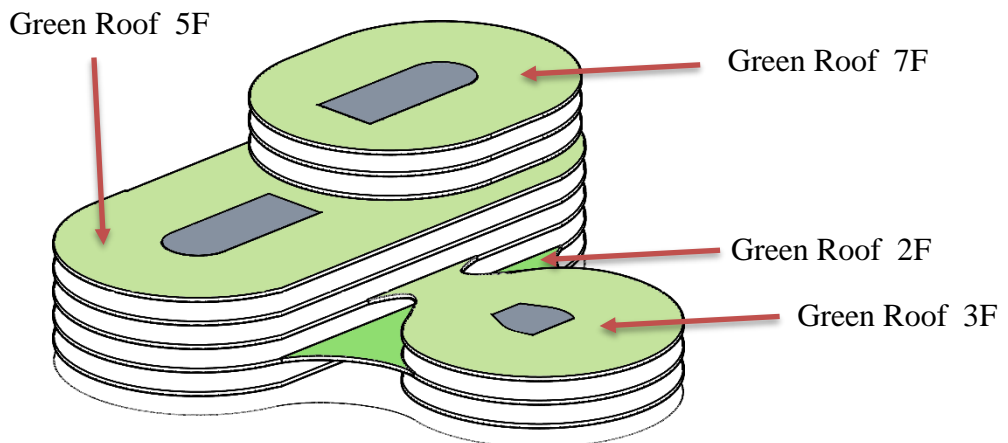
- ✓ Concept of Mass and Void is applied.
- ✓ Voids includes fenestration, atrium and outdoor areas i.e. Brings outdoors into the indoors.
- ✓ *Atrium* provides impressive aesthetic space, exposing indoor spaces to daylight.
- ✓ Incorporating *Indoor Gardens* in the atrium to increase the touch of nature.



**Figure 7-2 Conceptual Section**

**Approach 2: Multi Terrace Design**

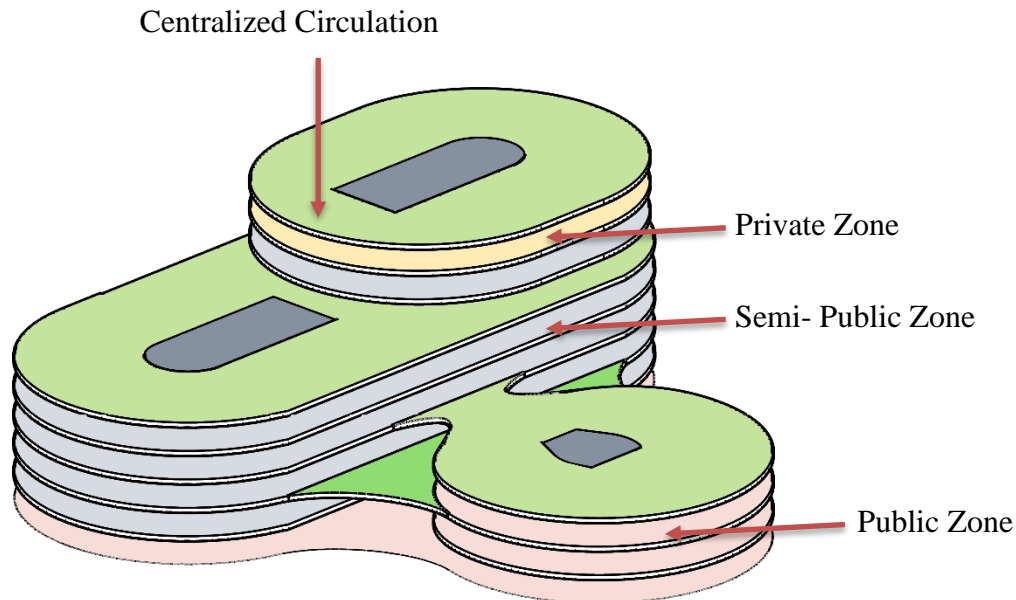
- ✓ With an aim of providing green breakout spaces to all the employees in the building, Multi Terrace design approach came to light.
- ✓ Reduction of mass as the building storey increases.
- ✓ Atrium not only lights the indoor spaces but also provides air circulation and communication among different levels of the building.



**Figure 7-3 Multi Terrace Approach**

**Approach 3: Vertical Zoning and Centralized Circulation**

- ✓ Building is divided into three zones; Public, Semi-public and Private Zones as per the use and function.
- ✓ Centralized circulation enables the users to communicate on multiple levels.



**Figure 7-4 Vertical Zoning**

**Form Development:**

- For the form development, the final state achieved from the plan development approach is taken.
- Extrusion of the plan is done. The intersecting plaza part is left unextruded for open mass circulation and grand entrance to the building itself.
- The overall plan is extruded on multiple floors creating multiple roof garden the aim of which is to act as a buffer or breakout space for all employees within the building.
- There is reduction of blocks as the building story increases.
- Atrium provides impressive aesthetic space, exposing adjacent indoor spaces to daylight, maximizing benefits from direct solar gain, and increases socialization and interactions. It also provides air circulation and communication among different stories of the building. Whereas, the outdoor breakout areas help the employees to recreate and refresh themselves from the long working hours.
- Horizontal bands and curtain walls are used to propose a minimalistic industrial outlook while vertical louvres are used to break the monotonous aesthetic of the final form.

Double height break out spaces punctures the volume as per the function at different locations giving the essence of Mass and void.

- As the name suggests, Intersecting Plaza intersects between social block and Technology-Innovation block while acting as a reception for both blocks, also maintaining the visual connection which in turn is connected on second floor through roof garden.

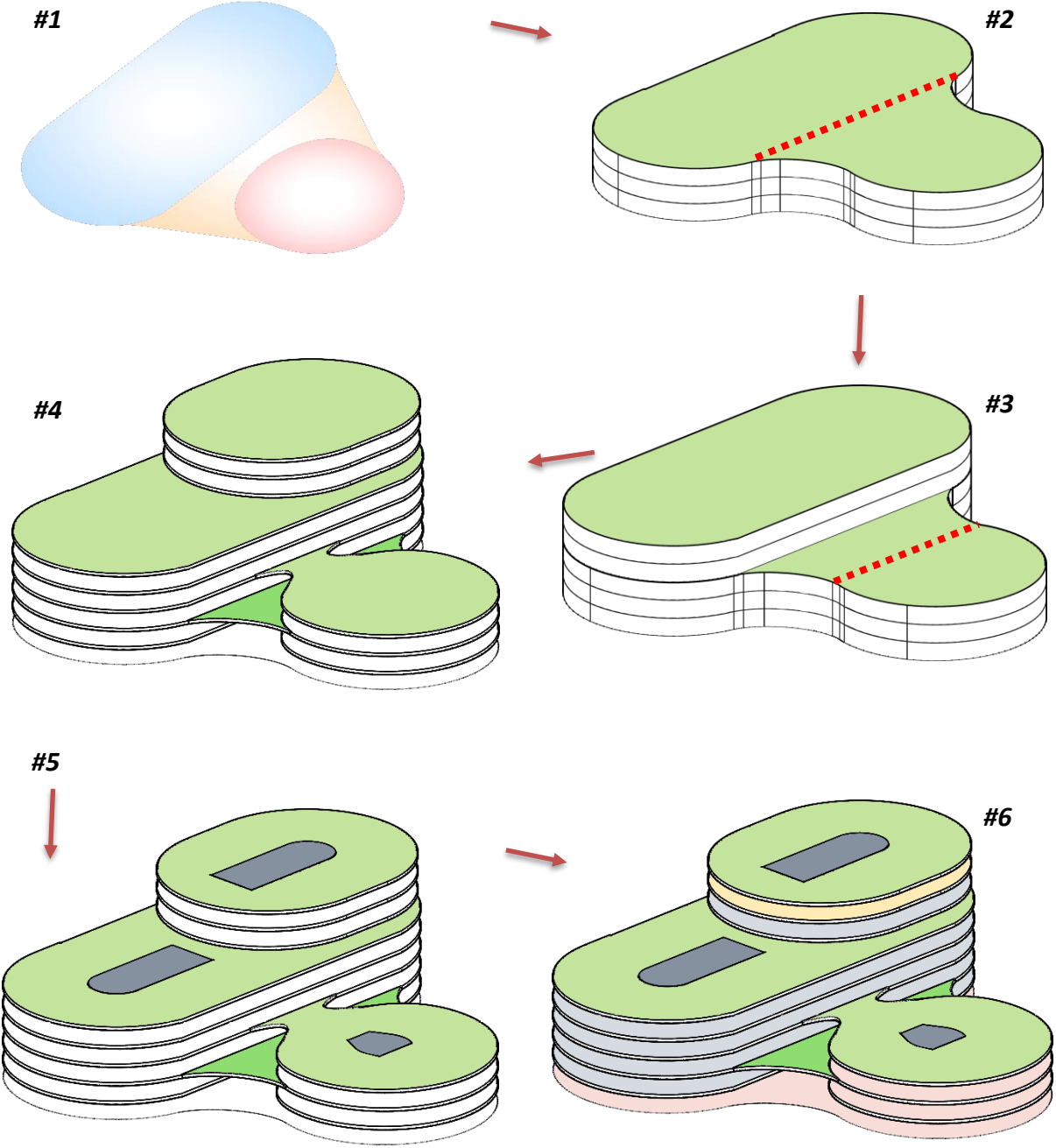


Figure 7-5 Conceptual Form Development

### 7.3 MASTER PLAN



Figure 7-6 Masterplan



### 7.3.1 Planning

The planning of the built and open spaces is done as per the site zoning. Considering the road location, entry was feasible from both primary and secondary road. Hence, Main entrance from the primary road and service entrance from secondary road. Surface parking is provided adjacent to the main entrance. Minimum surface parking space is provided so that maximum site area could be utilized for landscaping. Ways to basement area is right from the main entrance. Direct access is provided from parking to the plaza, plaza to intersecting plaza and main building.

Plaza is provided just outside the perimeter of the building in order to provide natural transition from outdoors to indoors. Intersecting plaza is connected to the plaza which acts as a corridor for the two separating blocks i.e., social block and technology-innovation block which is connected on second floor through roof garden. Through the intersecting plaza the building entrances are provided.

As per the analysis, the user zoning is divided as public and semi-public and private for some spaces. Social block entirely acts a public area which consists of atrium, indoor garden, restaurants, IT related stores and showrooms. Public areas in Technology-Innovation block are placed at lowers levels as the flow of public in this area of the building is maximum. Semi-public areas of this block include office areas, cafeteria, research laboratories while Administration zone is a private area. See Figure 7-4 vertical zoning.

### 7.3.2 Entrance

Primary entrance leads to wide-open plaza that extends to the intersecting plaza. Greenery has been included into the design of the entrance itself. The plaza also has various landscape elements and water features. Water features are positioned close to entrances to create a welcoming atmosphere for users by adding a calming water sound that improves visitors' mood.



Figure 7-7 Main Entrance Design



### 7.3.3 Landscape Feature

Garden spaces, seating areas, and pathways are examples of landscape features. Yet, seating is a crucial component of any garden. Seating area a beautiful view of the water features and gardens. The views of the gardens and other amenities are enjoyed by both visitors and employees.



Figure 7-8 Landscape Features

### 7.3.4 Parking Area

The parking lot itself is paved with porous materials, but the surrounding area is paved with concrete pavers to help with ground water recharge. Without having to build separate structures, the parking area is provided with vegetation to fill the spaces between rows of parking and trees are employed to offer shade for the parking places.



Figure 7-9 Surface Parking

## 7.4 SPACES IN IT HUB

### 7.4.1 Office Foyer and Indoor Gardens

The building's entrance greets guests with an earthy greeting. There is a small indoor garden with seating places. Atrium space is offered to create an amazing aesthetic space, expose nearby indoor rooms to light, maximize the benefits of direct solar gain, and foster social interaction. Additionally, the atrium maintains a visual connection with the higher floors. Earthy hues are employed to improve the ambiance of the area and to foster a greater sense of connection with nature.



Figure 7-10 Indoor Garden and atrium

### 7.4.2 IT related stores and showrooms

There are IT-related stores and showrooms on the lower levels of the building, so there will be little public intrusion on the higher levels. The general population can develop their interest in IT in IT retailers. Floor layouts and space management, which includes the use of furniture, fixtures, displays, lighting, and signage, have been used strategically. The pattern of behavior and manner in which a consumer moves through a store also maintains the client's flow. The planning and design of the IT-related stores is done so as to enhance the consumer experience and add value.

### 7.4.3 Gaming Zone

The Gaming areas are also available on the lower floor of the building. A group can gather and play a cooperative game in a stress-free, youth-dominated setting at the gaming zone. By encouraging the formation of groups of players who can play the game more skillfully, these gaming areas help to foster a socially interactive atmosphere. It serves as a testing

ground for recently created video games with experienced players.

#### **7.4.4 Recreational Zone**

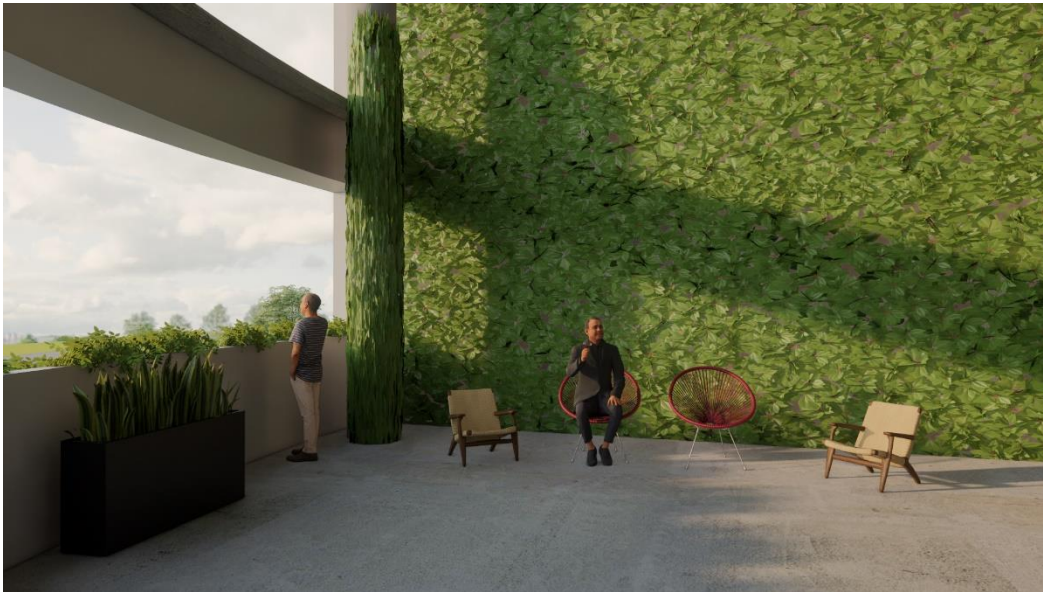
Along with gaming zone, recreational area is also provided on the same floor.

#### **7.4.5 Cafeteria**

Cafeteria is provided in 2<sup>nd</sup> floor so as to cater the employees within the Hub. Besides being a convenient place where employees can have their lunch, it is also a place of relaxation, and socialization.

#### **7.4.6 Administration**

The administrative spaces are intended to manage the IT Hub. Block's top floor is where administration is located. Working places, conference rooms, CEOs, and other auxiliary spaces like breakout rooms, collaboration pods, and discussion rooms are all included in the administrative portion.



**Figure 7-11 Breakout Space**

#### **7.4.7 Breakout Areas**

There is a break room indoors in every work space. Additionally, there are supplied double-height outside breakout spaces. To provide the greatest number of vantage points, outside double-height breakout areas were constructed. These areas act as social magnets that foster a sense of belonging among coworkers. It eases the strain of labor and offers vantage spots to take in the scenery. Games, colorful furnishings, and collaboration pods are

available in the breakout spaces. In breakout spaces, the use of vibrant colors is done to inspire creativity and enliven employee engagement, assisting them in improving creativity, productivity, and well-being. A variety of armchairs, ottomans, and high-back sofas are offered to improve workplace connection, promote casual brainstorming sessions, and encourage relaxed conversation.

#### **7.4.8 Office Workspace**

There are 3 different types of workspaces provided. There are office space rentals of 30, 60, and 80 modules. Planning for open workplace is done in each office. The open-plan office places workstations in undivided, open areas. Using colorful transparent glasses as partitions, managers' rooms and conference rooms keep everyone visually linked. This planning is understood to shift the emphasis from seclusion and the ability to focus to effective communication and engagement.

The workspace's open planning encourages highly team-based collaboration. Additionally, the 80 modular office provides a casual workspace. There are many supporting spaces available, including conference rooms, collaboration pods, discussion places, breakaway areas, and a pantry. All of the office space has access to atriums for ventilation and natural light. In the workplace spaces, there is landscaping and the usage of green walls. Near the atrium space are spaces for informal working sessions, discussion rooms, and collaboration pods. Workstations and other departments are located closer to the building's periphery.



## 7.5 CONSIDERATIONS IN DESIGN

Various considerations were made in the design to ensure the proper operation of the facility:

### 7.5.1 Orientation

The building form is placed primarily along the south direction to maximize the south orientation and for ease of air flow towards the building.

### 7.5.2 Green Roof

A building's roof that is partially or entirely covered with plants and a growing medium that is planted over a waterproofing membrane is referred to as a green roof or living roof. In addition to collecting rainwater, acting as insulation, and reducing stress for those who live nearby by creating a more attractive landscape, green roofs also help to cool down cities and lessen the effects of the heat island effect. They efficiently treat the air and filter water in urban and suburban areas by utilizing plants' inherent abilities to do so.

There are two different kinds of green roofs: intensive roofs, which must be at least 5.0 inches thick and can sustain a wider range of plants, and extensive roofs, which are shallower and between 0.79 and 5.0 inches deep, lighter than intensive green roofs, and require less upkeep. I've utilized extensive roofing in this instance, which is more modest than intensive roofing. Plants used for extensive green roofs need little care, little water, grow quickly, and are simple to replace.

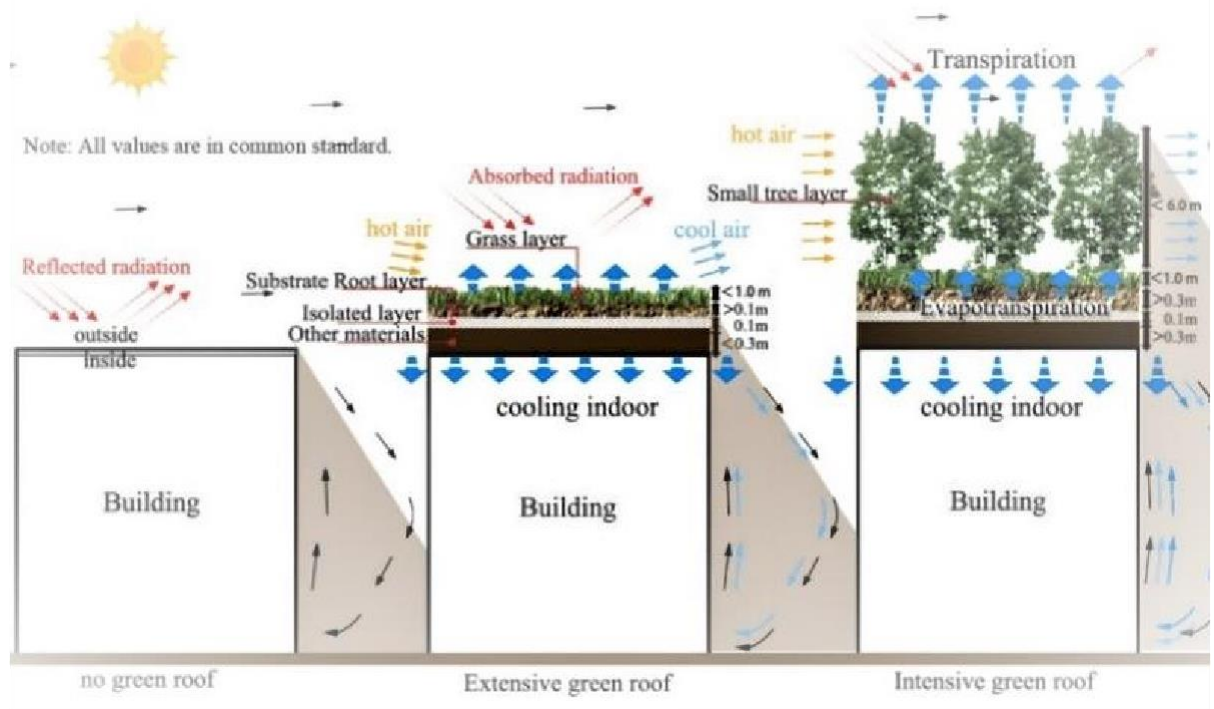


Figure 7-12 Roofing Types



Roof gardens are in third, fifth and seventh floors of the building. The third-floor roof garden is connected with the canteen. On the roof area, there is outdoor seating for the canteen. This is done so that when workers arrive for their lunch breaks, they may relax in the roof garden and see nature up close. They can come back feeling rejuvenated and ready to tackle the remaining responsibilities for the day. It's crucial to offer employees a place to unwind in order to aid in stress management and maintain their physical and mental wellbeing. Employees of the offices on the top floors can utilize a different roof garden that is available on the fifth floor.



Figure 7-13 Roof Garden

### 7.5.3 Atrium

The structure has atriums that are situated just inside the main entrance doors on both blocks. Buildings have atriums because they "provide an impression of room and light." Atrium spaces can hold an audience's attention. The atmosphere is comfortable, and the climate is controlled. By bringing natural light into the middle of the structure, the atrium enables day-lighting and eliminates deep, dark voids. The cost of electricity, the most expensive energy source, can be reduced by using daylight, a free energy source. To maintain the necessary indoor air quality and convective cooling, cross-ventilation and vertical ventilation, both naturally and mechanically assisted, are crucial. The building's atrium serves largely as a means of letting natural light into the inside. Moreover, the atrium functions as a ventilation system thanks to the stack ventilation effect.

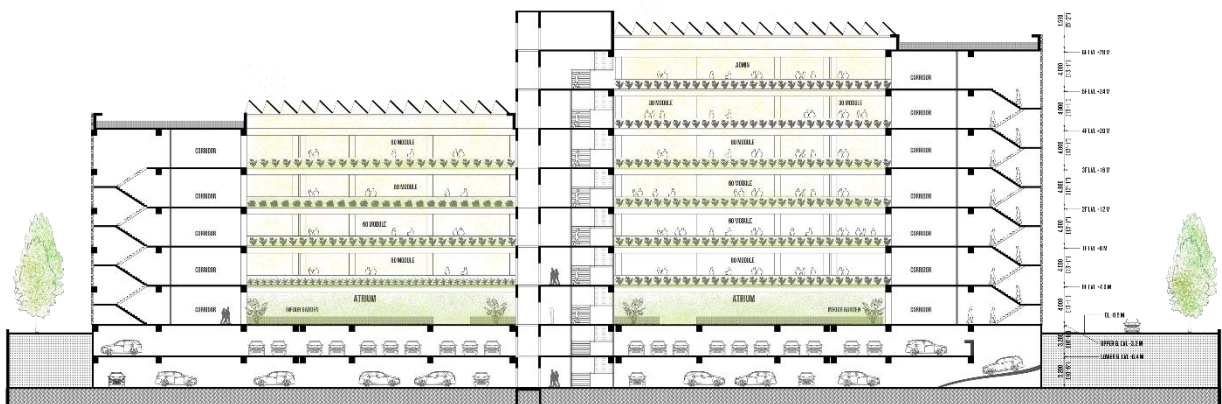


Figure 7-14 Building Section with Atrium

### 7.5.4 Green Walls

Vertical structures called "green walls" are covered with various kinds of plants or other vegetation. The walls typically have irrigation systems built into them since they contain real plants. Facades are rooted in the ground, whereas the growing medium for green walls is on the surface or structure of the wall. The green walls reduce noise, manage temperature, and purify the air. It fosters a sense of community.



Figure 7-15 Green Walls and break out space

### 7.5.5 Permeable Pavements

All of the permeable materials utilized to pave the design's roadways, walkways, parking areas, etc. A kind of pavement for vehicles and pedestrians that permits fluid infiltration is known as permeable paving. The top part of the road that people walking or driving on comprises up the base in pavement design. In order to allow fluids to pass through the base of permeable paving, either porous or non-porous media that are spaced apart from one another may be employed. Permeable paving can capture suspended solids, filtering contaminants out of rainwater while also lowering surface runoff.

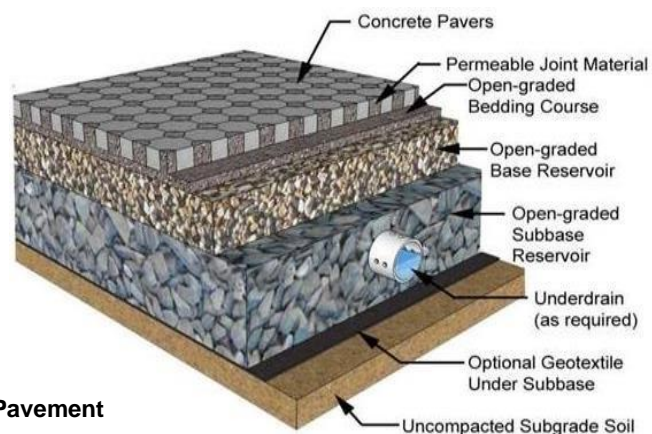


Figure 7-16 Section of Permeable Pavement

### 7.5.6 Solar Reflecting Coating

To create a long-lasting exterior coating, the majority of solar reflective coatings combine a binder with pigments and other ingredients. The end result can have a reflecting aluminized surface or a white or light-colored surface finish. Sun reflecting coatings provide a weather barrier that shields membranes from the sun's rays, extending their lifespan by lowering the stress caused by abrupt temperature changes and preventing water entry and ultraviolet (UV) deterioration. As a result, by lowering the high temperatures brought on by sun exposure, these coatings can increase the lifespan of numerous different types of commercial assemblies. Also, by reflecting almost 90% of the sunlight that strikes it, the reflection of solar radiation can lead to cheaper air-conditioning expenditures.

### 7.5.7 Double Pane Windows

Double-pane windows typically have two facing glass panels that are enclosed in a frame and are separated by a narrow gap, which is typically between 0.5 and 0.75 inches wide. The little compartment might be filled with argon or other non-toxic gases to help with insulation. In order to create the appearance of individual window panes, decorative frames or grids may be put between the glass panels. Due to the glass being one solid panel, these beautiful frames also make it incredibly simple to clean double-paned windows. No matter how old and stained the windows become in between cleanings, they will continue to be spotless and clean because they are protected from the elements. These windows improve insulation, noise reduction, energy efficiency, and temperature regulation.

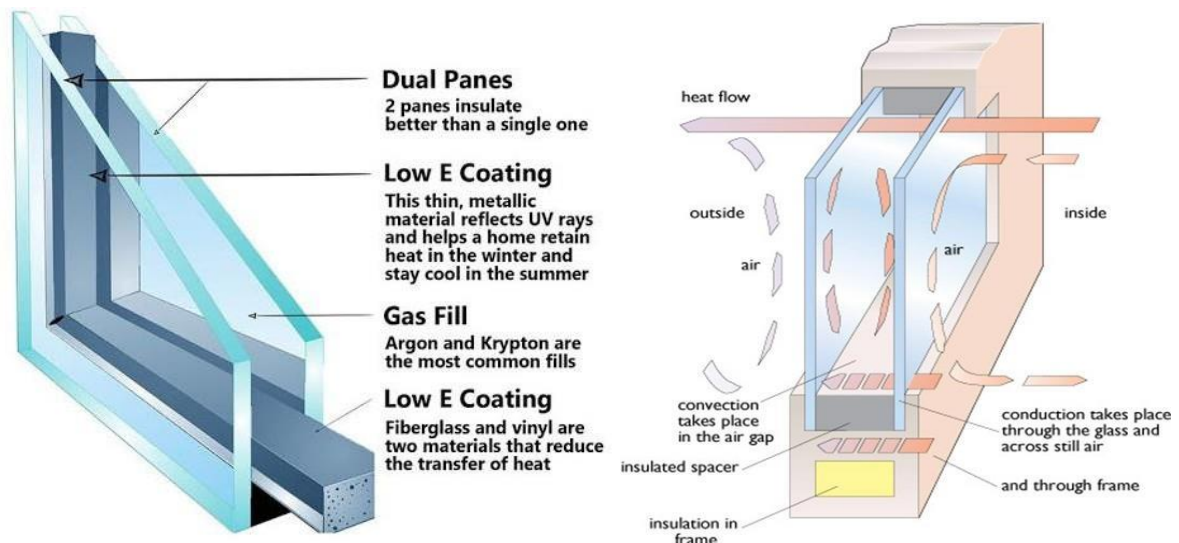


Figure 7-17 Double Glazed Window Detail

### 7.5.8 Access Control System

Electronic systems known as "access control systems" should have access to networks and

are intended to control through them. Access Control Systems identify, authenticate, and approve admission of a person into the premises, providing total protection and assuring system security. It is one of the most widely used systems for electronic door control and works by scanning a card or magnetic stripe through a reader on the door to gain access. The use of these access control systems is for security reasons. Office spaces and data centers are examples of places that need tight security. Hence, these locations can use a variety of access control systems, including biometric, door controllers, card readers, and others. Each access point may be independently managed depending on the needs of the business or organizations where high security is required. Network security is crucial, particularly for businesses that deal with sensitive data.



**Figure 7-18 Access Control System**

### 7.5.9 Construction Materials

The building is made of materials like glass, cladding, steel, and cross-laminated wood. The RCC structure was employed. Glass was utilized. It is composed of two parts, each 6mm thick, that are spaced one inch apart by a half-inch of air. To avoid fogging, the glass is manufactured with dry air within. It provides increased noise insulation, primarily shielding residents from outside noise. Also, it contributes to the resilience of the buildings themselves. A product of engineered wood with strong structural qualities and minimal environmental impact is cross laminated timber (CLT) (where sustainably sourced timber is used). externally. It can provide quick, dry on-site construction with good potential for airtightness and a sturdy wall and floor structure appropriate for most internal finishes.

## 7.6 STRUCTURE DETAILS

### 7.6.1 Expansion Joint

A mid-structure separation called an expansion joint is intended to reduce the strain that



building movement puts on the materials of the structure. These expansion joints allow one concrete element of the high-rise construction to move separately from other elements of the building or structure. Expansion joints need to be maintained every 35 meters. Thermal expansion and contraction brought on by temperature variations, wind sway, and seismic activity.

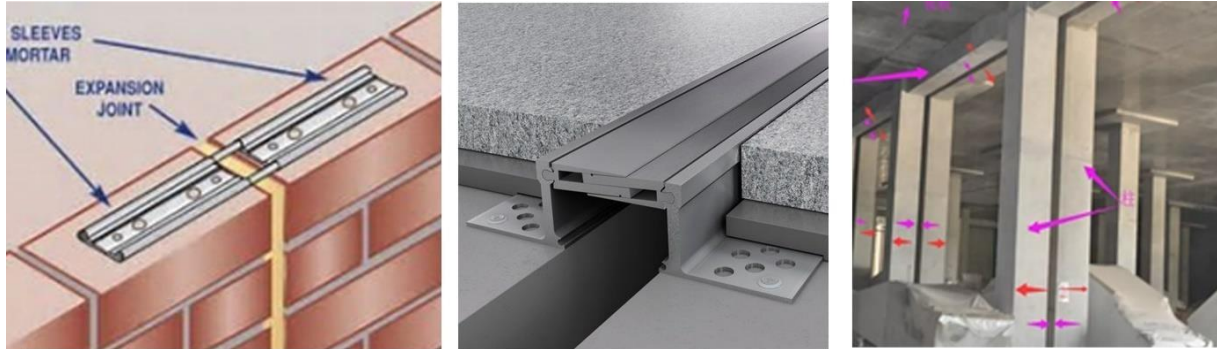


Figure 7-19 Expansion Joint Detail

### 7.6.2 Structural Details

The structure used in the design complex is RCC.

Slab depth = 150mm

Expansion joint = 150mm

Column:

Column size: Circular column Dia. 600 mm

Longest Span = 15m

Intermediate Span = 8m

Beam:

Primary Beam = 500 mm X 600 mm

Secondary beam = 400 mm X 300

### 7.6.3 Foundation

The building was proposed on a mat base. A mat foundation, also known as a raft foundation, is essentially a continuous slab resting on the ground that spans the building's whole footprint, supporting it and dispersing its weight to the ground.



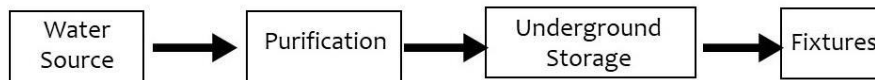
## 7.7 BUILDING SERVICES

Building services is one of the important portions of the design, it comprises of services that are used in day to day life as well as services used for emergency purpose. Proposed services for this project are an attempt to sustainability, environmental impact and for emergency purpose. The proposed services are as follows:

- Water Supply
- Rainwater Harvesting
- Sanitary
- Electricity
- Solar Energy Calculation

### 7.7.1 Water Supply

Pneumatic water pumping system has been proposed for the design. In this system, overhead water tank is not necessary and water is directly distributed from underground storage to different fixtures.



The size of the tank is determined by water demand calculation:

#### 1. IT Stores

No. of users: 300

Consumption:  $300 \times 15$  liters/day = 4,500 liters/day

#### 2. Restaurant

No. of users: 200

Consumption:  $200 \times 70$  liters/day = 14,000 liters/day

#### 3. Gallery

No. of users: 100

Consumption:  $100 \times 15$  liters/day = 1,500 liters/day

#### 4. Gaming Zone

No. of users: 100

Consumption:  $100 \times 45$  liters/day = 4,500 liters/day

5. Office

No. of users: 1000

Consumption:  $1000 \times 45$  liters/day = 45,000 liters/day

6. Administration

No. of users: 50

Consumption:  $50 \times 45$  liters/day = 2,250 liters/day

7. Cafeteria

No. of users: 500

Consumption:  $500 \times 70$  liters/day = 35,000 liters/day

8. Research Lab

No. of users: 40

Consumption:  $40 \times 20$  liters/day = 800 liters/day

**Table 7-1 Calculation of water demand in tabulated form**

Block	No. of users	LPCD	Total
IT Stores	300	15	4,500
Restaurant	200	70	1,400
Gallery	100	15	1,500
Gaming zone	100	20	2,000
Administration	50	50	2,500
Office	100	45	45,000
Cafeteria	500	70	35,000
Research laboratories	40	20	800
Total			92,700

Total amount of water required/day: 92,700 liters/day

- Fire Demand= 20% of 92,700
- Total Demand =  $92,700 + 18,540 = 1,11,240$  liters = 111.24 cubic meter

For underground Storage tanks:

- Tank 1,  $L*B*H = 6m*5m*2m$
- Tank 2,  $L*B*H = 6m*4.5m*2m$
- 

### 7.7.2 Rain Water Harvesting

Rain water harvesting is a technique of collection and storage of rain water at surface or in sub-surface aquifers, before it is lost as surface run-off. A system of harvesting rain water from the roof has been proposed and collected water is to be used for watering plants, in toilets. The system includes catchments, conveyance system and storage tanks.

Rain water is harvested considering two catchment areas, i.e. e. primary and secondary catchment area. Primary catchment area is the roof area and Secondary catchment area is generally hard landscape areas with permeable pavements.

#### Calculations:

Catchment Area = 12,420 sq.m

Rainfall Data = 1500 mm/year = 1.5m/year

Collection per year =  $1.5 * 12,420 \text{ m}^3/\text{year}$   
 $= 18,630 \text{ m}^3/\text{year}$   
 $= 18,630,000 \text{ liters/year}$

Effective use = 80% of 18,630 m<sup>3</sup>/year  
 $= 14,904 \text{ m}^3/\text{year}$   
 $= 14,904,000 \text{ liters/year}$

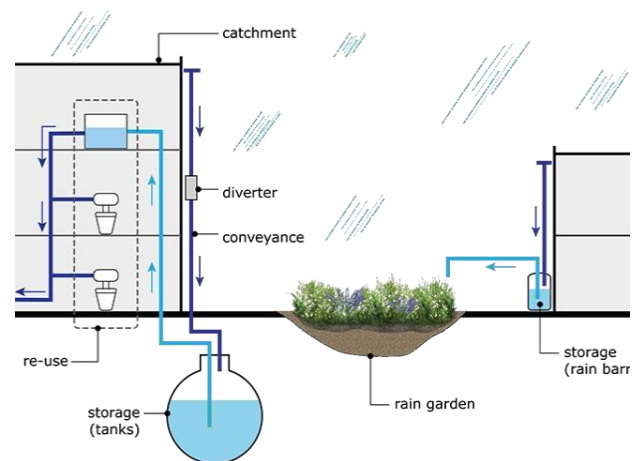


Figure 7-20 Rain Water Harvesting Section

## 7.8 3D VIEWS

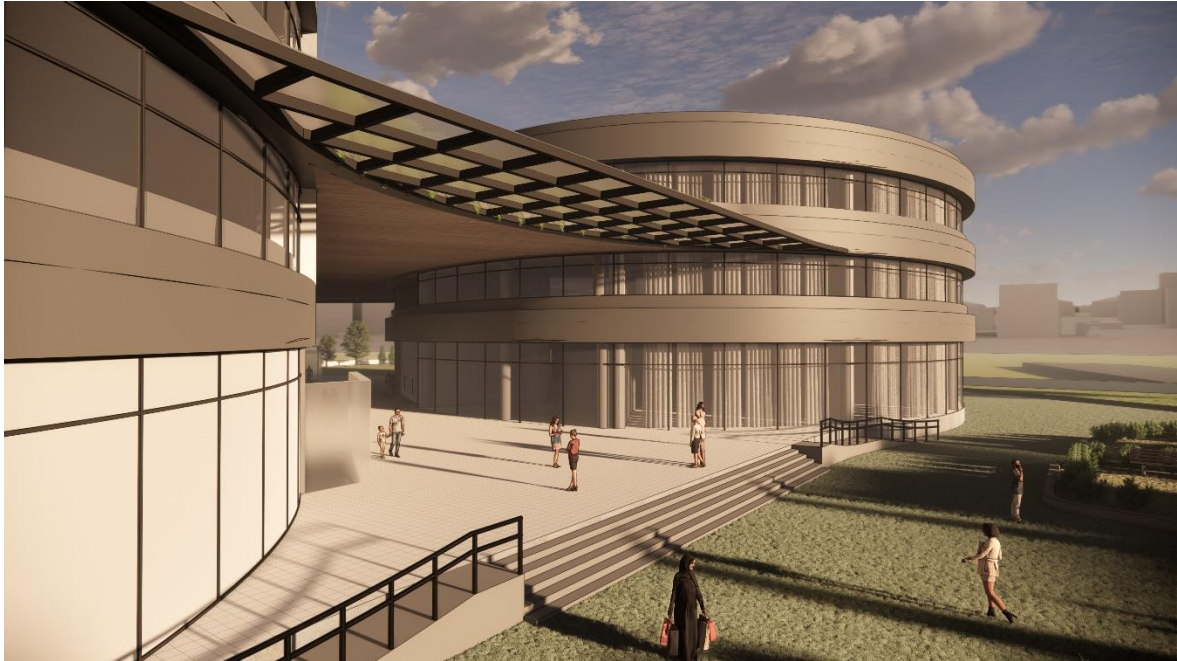


**Main Entrance**



**Front View (S-W)**





**Plaza and Intersecting Plaza**



**View from the West Direction**



### 7.8.1 Model Photos



Top View



View from the North-East Direction



**View from the South Direction**

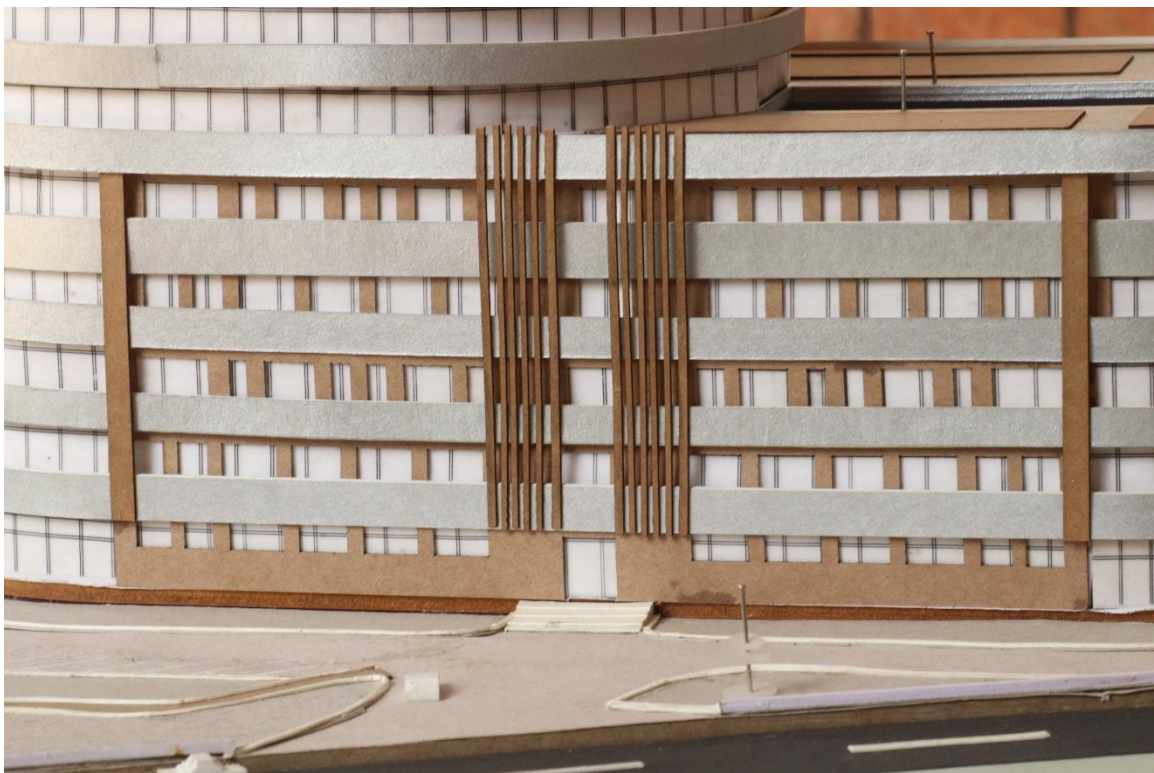


**View from the North-West Direction**





**View from the East Direction**



**View from the West Direction**

## 8 CONCLUSION

The IT HUB is a multi-office building design that unites people from the public, IT professionals, and IT enthusiasts under one roof. The IT HUB was created using the Biophilic Design methodology. Both internal and outdoor spaces in the building have intriguing plaza spaces that incorporate biophilic design elements. The modern human mind requires a new strategy to increase creativity and productivity. The idea of incorporating the external environment into the workstations has been implemented in the HUB because humans have an innate connection to nature. Bringing nature within, or into the workplace, to ensure that individuals are never cut off from the outside.

With a focus on using biophilic design principles, the IT center was created as an environmentally friendly structure. The use of vegetation into the building's design extends to its roof, exteriors, interiors, and other areas as well. It has made an effort to incorporate environmentally friendly design that supports tenant productivity and well-being while reducing negative effects on the environment. Offering a workplace and a conducive environment for work is the office building's main goal. By using biophilic design strategies, wellbeing, creativity, and productivity are either attained or increased in conjunction with nature.

In order to create a productive working environment, the project has concentrated on the architectural requirements of the office complex with creative workstations that provide both indoor and outdoor space. This IT Hub creates a structure that would reflect the IT industry on a national and international level while also enhancing the architectural and urban character of Bhaktapur. The facility may serve as a suitable benchmark or point of comparison for upcoming IT buildings. The layout can preserve natural resources, reduce energy use, and sustain the site's environment. As a result, the design's clever and deliberate utilization of biophilic patterns has produced breath-taking effects that can metaphorically touch the hearts of users.

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## **10 ANNEX**