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**INDUCTION OF HEALING ENVIRONMENT IN HOSPITALS  
THROUGH LANDSCAPE DESIGN**

**MASTER OF LANDSCAPE ARCHITECTURE**

**TANU**

Sch. No. 2014MLA001



**SCHOOL OF PLANNING AND ARCHITECTURE, BHOPAL**

**NEELBAD ROAD , BHOURI, BHOPAL - 462030**

**MAY 2016**

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## Declaration

I TANU, Scholar No. 2014MLA001 hereby declare that the thesis entitled INDUCTION OF HEALING ENVIRONMENT IN HOSPITALS THROUGH LANDSCAPE DESIGN submitted by me in partial fulfilment for the award of Master of Landscape Architecture, in School of Planning and Architecture Bhopal, India, is a record of bonafide work carried out by me. The matter embodied in this thesis has not been submitted to any other University or Institute for the award of any degree or diploma.

20/5/2016  
Date

TANU  
Student Name

## Certificate

This is to certify that the declaration of TANU is true to the best of my knowledge and that the student has worked for one semester in preparing this thesis.

RECOMMENDED

Prof. Savita Raje

Asso. Prof. Saurabh Popli

Asst. Prof. Sonal Tiwari

ACCEPTED

Ar.SavitaRaje,

Professor and Coordinator

Master of Landscape Architecture

Dr.RachnaKhare

Head

Department of Architecture

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**INDUCTION OF HEALING ENVIRONMENT IN HOSPITALS  
THROUGH LANDSCAPE DESIGN**

**A DESIGN THESIS**

***Submitted***

*In partial fulfilment of the requirements for the award  
of the degree of*

**MASTER OF LANDSCAPE ARCHITECTURE**

By

**TANU**

Sch. No.2014MLA001



**SCHOOL OF PLANNING AND ARCHITECTURE, BHOPAL**

**NEELBAD ROAD, BHAURI, BHOPAL - 462030**

**MAY 2016**

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## ABSTRACT

Hospitals usually tend to be seen by the public as removed from the urban context, as spaces to be feared, which one only accesses in emergencies or out of necessity. Hospitals are not only for patients with illnesses but also for people who come for regular checkups. The awareness of positive influences of outdoor environment on patients' healing process has long been present in hospital architecture. Despite the fact that economic factors had the greatest impact on hospital design during the past century, which caused a neglect of possible restorative benefits of hospital surroundings, recently developed and integrated healthcare systems are more focused on patients' needs regarding the effects of treatments and services on their satisfaction. This thesis presents an analysis of various aspects that need to be taken into account while planning of hospital outdoor spaces. It proposes a list of design considerations that may contribute to achieving a healing environment with positive effects on patients' well-being and outcomes of their medical treatments. The purpose of this thesis is to examine which elements and features and to what extent may assist in generating a supportive, inviting, secure and non-threatening atmosphere of the outdoor hospital surroundings that discharges negative reminiscences, experiences or assumptions on how unpleasant the stay in a hospital may be.

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## CHAPTER 1: Introduction

### 1.1. Background Study

Hospital is an institution which facilitates an organized medical staff and which is designed, used, and operated to provide healthcare facilities, therapeutic services, and continuous nursing care which ensures the health and well being of an individual. It is not only for patients with illnesses but also for people who come for regular checkups. (Linebaugh, 2013)The hospital experience often plays a vital role in one's life as it is a place – where their child was born, their beloved died, where they received life-saving treatment, rejuvenating therapy or care to overcome an episode of illness. Hospitals usually tend to be seen by the public as removed from the urban context, as spaces to be feared, which one only accesses in emergencies or out of necessity. For a patient, visitor, or member of staff, spending long hours in a hospital can be a stressful experience. They are the most difficult places for people to be. The building and the monotonous environment in and around the hospitals creates a negative impact on users. Mostly, the green areas of hospitals are obsolescent and not-functional. This psychological perception of their distance and separation can be decreased by more hospitable approaches to their content and design. (Linebaugh, 2013) .Green areas outside and inside hospitals are considered not only to be necessary but also beneficial. Outdoor contact with nature is likely to engage more than one of the senses. Nature within the hospital environment results in reducing stress, improving mood, and increasing healthcare satisfaction. Different terms have emerged to refer to outdoor spaces in hospitals: A healing, therapeutic, or restorative garden. Healing gardens are outdoor spaces which are designed to improve the patient outcomes and quality of life through access to nature, exercise opportunities, social interaction, and private reflection. They are not only designed for sick people, they serve the healthy and ailing environment. It can restore the natural balance in humans so that they do not feel stress and other pressure. (Poe, 2015)

### 1.2. Need of the project:

- Since there is lack of properly designed healing gardens in hospitals, there is a demand for the same.
- The idea is to provide a space where hospital does not add as a fear factor or hype but instead places where people can come visit the garden, relax and rejuvenate.
- To give home like environment for patients where they do not feel alienated and instead have various green active spaces to spend in.

### 1.3. Aim:

To provide healing landscapes for the hospitals which can enhance the people ability to conserve and regain their good health. The intention is to provide a healing environment which ensures good health with minimum medication.

### 1.4. Objectives:

- To understand the environment in and around the hospitals. How landscape can add positivity to it.
- To study the psychology and the needs of the users (patients, visitors and the staff).
- To understand the healing quality of nature and its components.
- To explore the concept of the healing gardens ,medicinal gardens and therapeutic gardens.
- To learn how healing gardens are designed for different users with specific needs and goals.
- To study the Typology and design criteria of outdoor spaces in hospitals.
- To integrate the services of hospital( garbage disposal, sewage, waste water, infected material, AC shafts, basement, shafts openings)
- To give design proposal displaying a synthesis from point 5 to 7.

### 1.5. Scope and Limitations

- The thesis deals with the landscape design required for hospitals to induce the healing environment keeping all the users in frame.
- The design proposal will be for general wellness and there will be no particular stress given on any disease.
- Since there are no existing good example of hospitals which have a healing gardens so there is an attempt to provide a proposal for the same.

### 1.6. Criteria's for Site Selection::

- To select a government hospital site so that to change the concept about government hospital and its environment among the masses and to portray cares.
- Easy accessibility.
- Opportunity to explore and design a bigger site in context to healing gardens.

### 1.7. Identified Site:

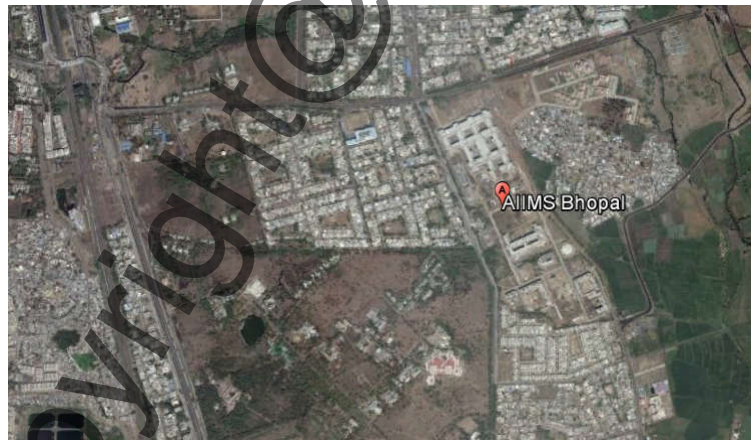


Figure 1. 1 Site Location

Source: Generated from Google Earth

### Site Details: All India Institute of Medical Science at Bhopal (AIIMS)

- Client of the Project: Ministry of Health and Family Welfare
- Management of the Project: Hindustan latex Ltd. (H.L.L)
- Architect of the project: Ar. Prem Choudhary & Associates



The proposed hospital project is a large development situated on the fringe of the city of Bhopal in Madhya Pradesh. Attracting several thousand patients and other visitors daily, the development is likely to have a significant impact on the city, both in terms of demands placed on the city's infrastructure including transport facilities and services, as well as the formation of an important landmark in the public consciousness of the citizens.

The hospital will receive patients from all over the region extending over western Madhya Pradesh, parts of eastern Rajasthan and eastern Gujarat as well as northern Maharashtra. With large volumes of the visitors expected to arrive here daily from all over the city and beyond, from the surrounding region, measures to facilitate and regulate the movement of the people into and within the complex will form essential components of a successful development plan for the facility.

#### 1.7.1. ARCHITECT PROGRAMME:

The project is comprised of two zones. a) Zone 1 b) Zone 2. The overall area of the site is 154 acres out of which Zone 1 consists of 58 acres and Zone 2 of 76 acres. The main Hospital block and institutional buildings like Medical, Nursing and Dental college also residential buildings like Under Graduate, Post Graduate and Nurse Hostels come under Zone 1. Zone 2 comprises of buildings like Director's bungalow, staff housing, guest house, Sarai and shopping complex.

##### **Zone 1: Total Area= 58 Acres**

- Hospital
- College
- Medical College
- Dental College
- UG and PG Hostel
- Nurse's Hostel

##### **Zone 2: Total Area= 76 Acres**

- Director's Bungalow
- Staff Housing (All Type)
- Guest House
- Sarai
- Shopping Complex

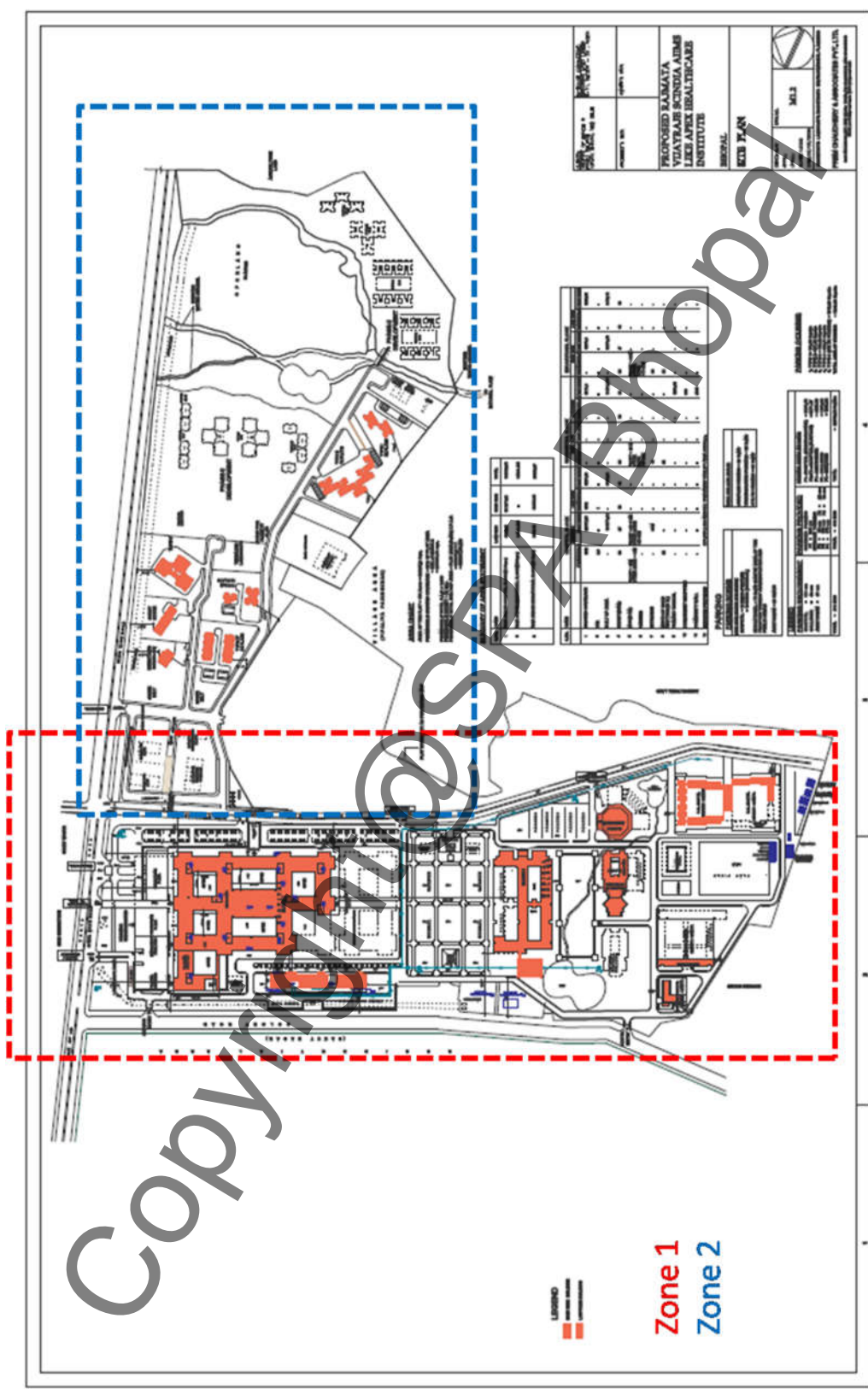


Figure 0.1: Study Area Detail

Source: Architect Prem Chaudhary & Associates, New Delhi

1.7.2. OUTDOOR REQUIREMENT FOR AIIMS HOSPITAL SITE:

- Areas for waiting for patients and visitors.
- Areas for walking and sitting.
- Areas for visitors to relax.
- Specific garden area for patients : herbal garden.
- Areas for alternative facility.
- Parking for ambulance, doctors and staff as well as public parking for patients and visitors.
- Parking areas for services.

1.7.3. TOTAL NUMBER OF EXPECTED POPULATION IN THE HOSPITAL PREMISES:

- Hospital complex beds- 850
- OPD patients -5000
- Attendant with bed – 850
- Staff – 1200 No's per shift

1.8. Methodology:

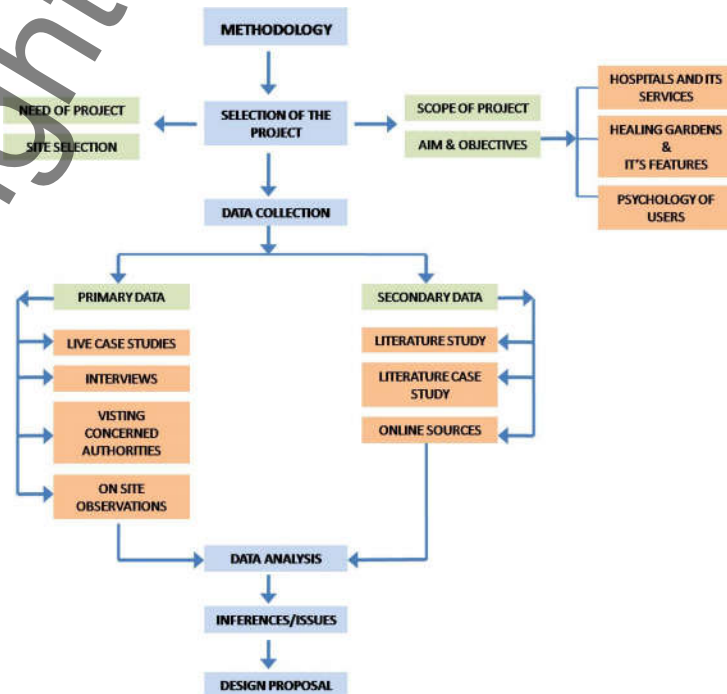


Figure 0.2 : Brief Methodology

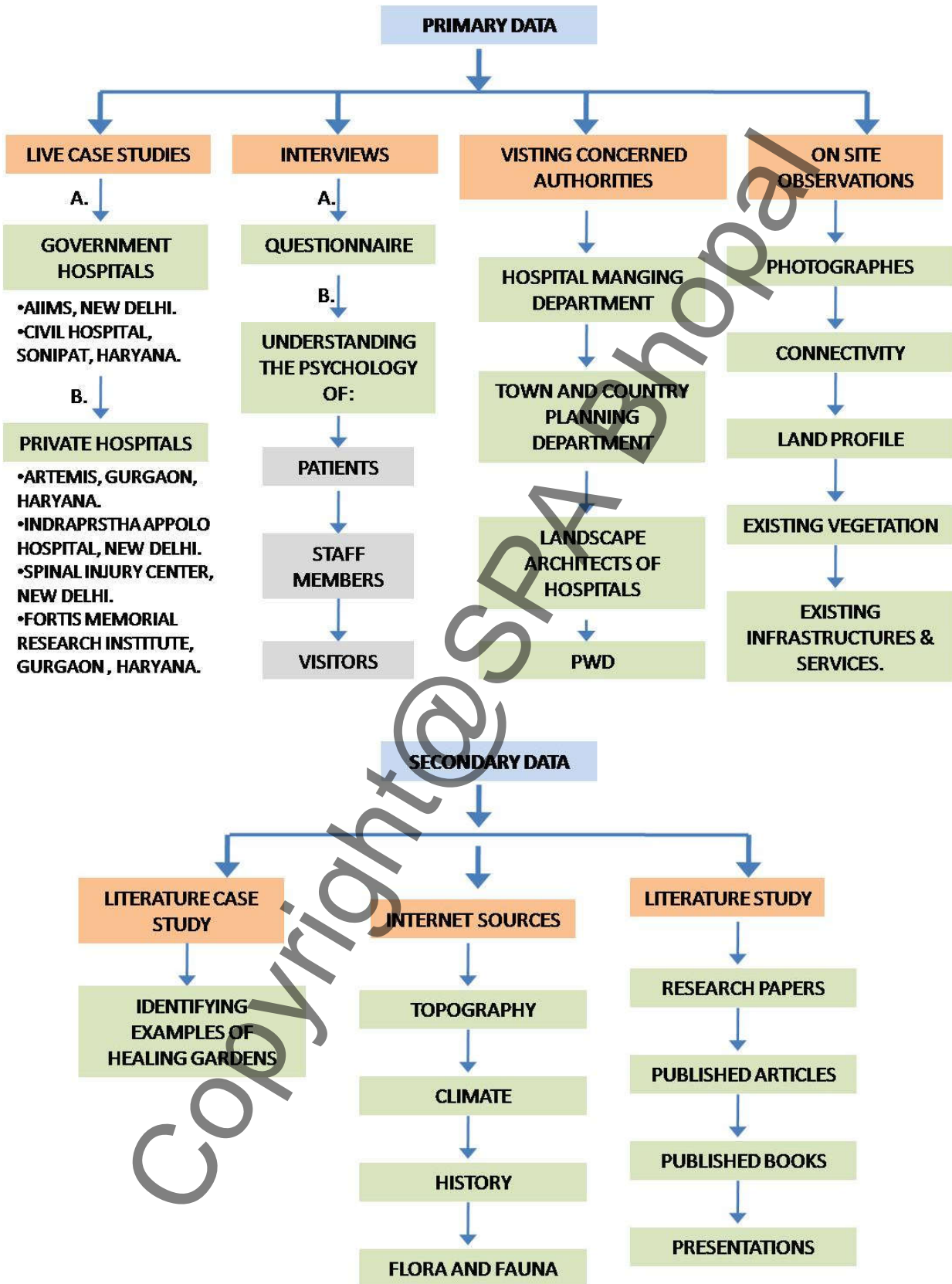


Figure 0.3: Detailed Methodoloav

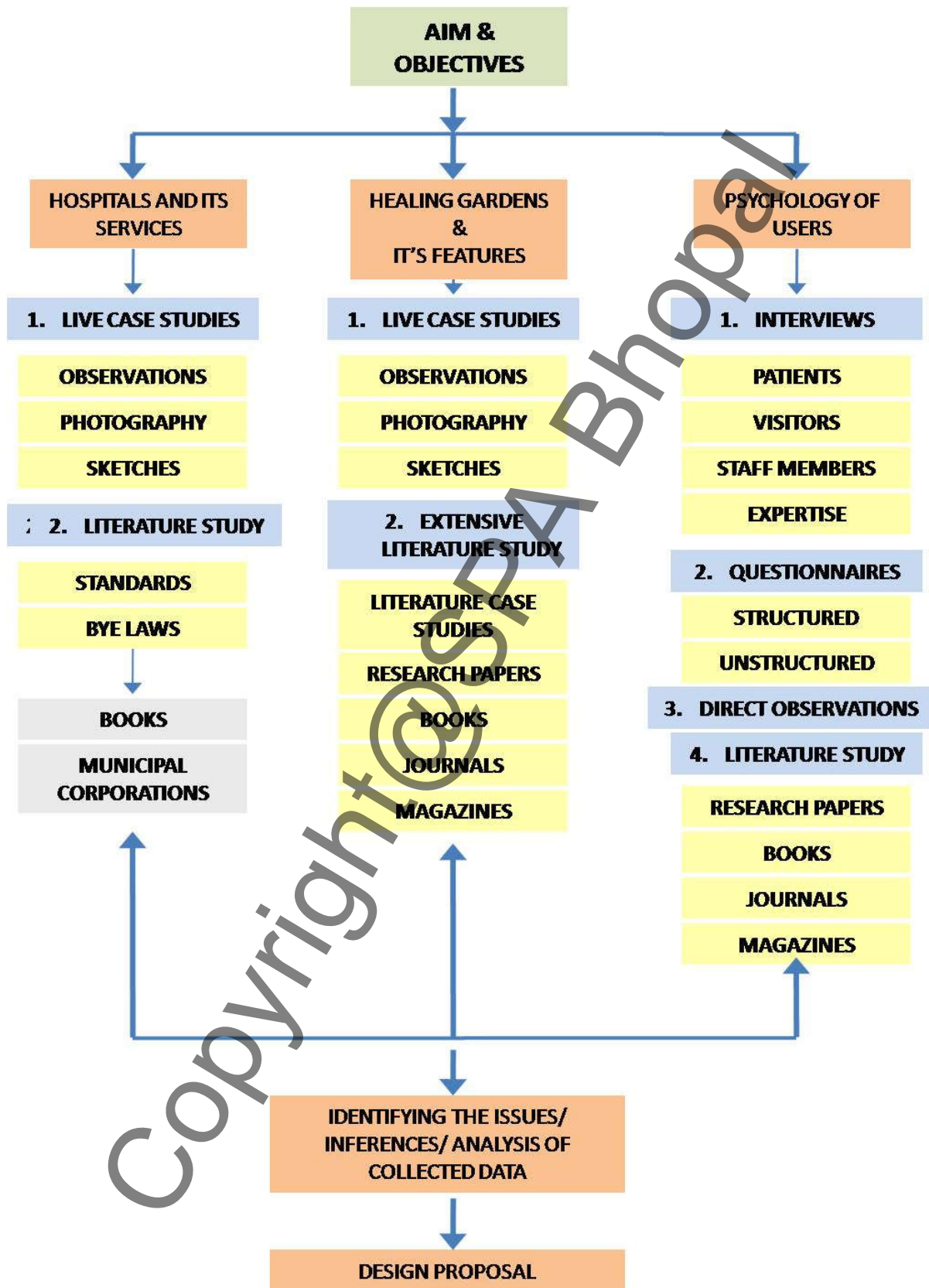


Figure 0.4 : Detailed Methodology

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## Chapter 2: Literature Study

### 2.1. History

- Indians believe that the knowledge of medicinal plants is older than history itself, gifted hundreds or thousands of years ago to the original inhabitants of India by Brahma, the Divine Creator. Thus, when the sages of the Ayurveda sought to heal human suffering they were able to draw on knowledge that had already been evolving for millennia in the forests of India.
- Long before Charaka's appearance, the study and use of medicinal plants in Ayurvedic medicine had already spread throughout India with such force that by the third century B.C. the Emperor Asoka, whose empire covered most of the Indian subcontinent, was providing what we would call today free health care to all his subjects.
- The time of the Emperor Asoka's grandfather that the first European records of Indian medicinal plants were begun, by the physicians and generals who accompanied Alexander the Great on his campaigns in India. It is thought that the international exchange of information on India's plant medicine predates both Alexander and Ayurveda, since indigenous Indian seeds such as coriander have been found in the tombs of the Egyptian pharaohs, and Indian plants were used by the textile makers of Mesopotamia for the making of dyes.
- Charaka's treatise describes 1,500 plants and identifies 350 of them as valuable for medicinal purposes.
- Awareness of positive influence of outdoor environment on patients' healing process has long been present in hospital architecture.
- Evidence of planned restorative gardens can first be found in the European medieval monastic hospices, where patients' cells bordered and had a direct access to arcaded courtyard.





Figure 0.1 : Ancient Egyptian Hieroglyphs depicting the 'architect' explaining his garden scheme to the pharaoh. & St. Catherine's Garden in the monastic infirmary, London, 1154.

Source: *The Gardens and Ponds of Ancient Egypt*

- The recognition of possible restorative benefits of nature has started to disappear as the emphasis of hospital design shifted towards increasing staff's efficiency and away from creating a therapeutic environment.
- Thus, hospitals erected during the Modern Movement resemble high-rise office buildings, with large parking lots that replaced traditional gardens.



Figure 0.2 :Garden Lodge of the Royal & Hospital Beaujon, inspired by the American hospital architecture, Clichy, 1932-1935.

Source: *Hospital outdoor spaces - therapeutic benefits and design considerations* -Dejana Nedučin\*\*, Milena Krklješ, Nađa Kurtović-Folić

- Regardless of age or culture, humans find nature restorative.
- Marcus and Barnes found that more than two-thirds of people choose a natural setting to retreat to when stressed.

- 95% of those interviewed said their mood improved after spending time outside, changing from depressed, stressed, and anxious to more calm and balanced.

## 2.2. User Groups

There are three distinctive groups of users of both indoor and outdoor hospital spaces.

– Patients, employees and visitors, each having its own requirements and patterns of use.

### 2.2.1. Patients

- The health-care environment should be designed taking into patients' psychological as well as physical needs, disabilities, and duration of stay.
- Long-term inpatients or outpatients will have more varied requirements than short-term ones, and their holistic treatment will be enhanced by access to gardens, sheltered outdoor plazas, common social areas, and reading resource areas.
- Patients undergoing different kinds of treatment may use these areas for different purposes: for example, orthopedics patients may need to use walking in the gardens; facilities for seniors may need handrails and more shaded areas; physical therapy patients may need to tend to plants at different heights; and psychiatric patients may need “memory cues” and planted areas which minimize the risk of injury.



Psychiatric



Physical therapy



Orthopedic



Senior

Figure 0.3: Patient categories

Source: Google Website

### 2.2.2. Visitors

Visitors are also in need of positive distractions while spending time with their family members or friends. These visits are frequently reassuring, but may as well be emotionally intense, and thus require a supportive environment.

### 2.2.3. Employees

- Varying from the medical to administrative and supporting staff, are a critical group of users since they spend every working day within the hospital environment.
- All of them use outdoor space as an effective means for achieving a restorative escape from stressful jobs and aversive conditions in the hospital.



## 2.3. BENEFITS OF NATURAL ENVIRONMENT WITH IN HOSPITAL

### 2.3.1. Physical benefits

- Interaction with a natural environment has a positive effect on patients' feeling of well-being, which in turn has a salutary effect on their physical health.
- There are theoretical and practical studies illustrating the positive effects of interaction with nature on blood pressure, cholesterol levels and stress-reduction: a study by Robert Ulrich concluded that patients recovering from operations were discharged earlier, took fewer medicines when they had windows in their rooms overlooking nature, compared to patients in similar rooms facing brick walls. A study of the home environment similarly found that

a living context with windows overlooking a natural scene produced “micro-restorative experiences” that enhanced a sense of well-being, as against a context with views of built elements (Dejana Nedučin, 2009).



Patient facing the walls

Interaction with nature

Figure 0.4: Physical benefits of natural environment within hospital

Source: *Hospital outdoor spaces - therapeutic benefits and design considerations*-Dejana Nedučin\*\*, Milena Krklješ, Nađa Kurtović-Folić

### 2.3.2. Psychological benefits

- Being able to choose between having privacy and interacting socially may assist in the process of recovery of patients, for most of whom the rigid regulation of time and activity in the hospital can have negative psychological effects, such as loss of self-esteem or the feeling of control, and a resulting increase in stress.
- Research shows that high blood pressure and heart activity caused by stress can be decreased if patients are exposed to natural scenes, because such scenes engage them, draw their focus away from themselves and disturbing thoughts, and so contribute to their recovery.
- Research conducted in London by the Bow Centre has used flower and cutting gardens for horticultural therapy; patients are overwhelmingly in favor of well designed hospital landscapes, because of their positive psychological effects and the chance to pass time there (Dejana Nedučin, 2009).

### 2.3.3. Social benefits

- Everyone, regardless of age or illness, needs recreation and social support; participation in social activities may also be the only means of family and community interaction and integration, and of sharing similar experiences, for the physically disabled.
- Studies have shown that patients with strong social support networks typically experience less stress and better health, as well as better recovery and survival rates for various conditions, than those who are isolated. Social support improves immune functions and moods, and results in better compliance with treatment.
- Natural environments in health care facilities contribute to social integration by providing spaces for social interaction and support (Dejana Nedučin, 2009).

### 2.4. Design Considerations

Planning of hospital outdoor spaces that would support, enhance and promote positive healthcare outcomes relies on the design considerations set up to meet strictly defined norms, regulations and criteria.

#### 2.4.1. Potentials of the Site

While planning suitable locations for different types of outdoor areas, there are several issues that need to be taken into consideration, such as:

- Environmental factors: a) orientation b) insulation c) wind exposure d) views
- Distance from distractions: a) urban noise b) parking lots c) mechanical systems
- Physical configuration of the complex.
- Internal traffic system and its access points.
- Specific needs of different user groups; etc.

Proper acknowledgment and implementation of these factors may generally enhance beneficial value of the outdoor space. (Clare Cooper Marcus, MA, MCP and Marni Barnes, MLA, LCSW, 1995)

#### 2.4.2. Types Of Experiences

Active experiences are both physically and psychologically beneficial since they improve patient's cardiovascular fitness and reduce stress and depression. In addition, physical therapy and rehabilitation undertaken in a natural environment may enhance positive results of various medical treatments.

While staying in the hospital, a majority of patients is constantly under a strict regime, they frequently experience a loss self-esteem or control over their lives. Therefore, passive experiences of being able to select between seeking privacy and socially interacting may be beneficial from a psychological point of view.

Direct or indirect sensory experiences of connection with nature and positive distractions involve stimulating one or more of five senses, calming the mind, reducing stress and encouraging person's own healing resources. This also applies to indirect contact with outdoors by viewing a distant and nearby nature through the window of patient's room (Clare Cooper Marcus, MA, MCP and Marni Barnes, MLA, LCSW, 1995).

#### 2.4.3. Variety of Spaces And Their Interrelation

Crucial programming and designing objective is to provide a variety of hospital outdoor micro spaces, targeting different needs of their users.

Series of diverse smaller squares and meeting points conventionally located to one another can create a cozy atmosphere and variety of experiences rather than a large one.

These spaces must offer a choice – places for both group and solitary occupancy; places in the sunlight or shade; places to pause and experience natural surrounding; places with open or closed views, etc. Some spaces may also awaken all the senses. (Yücel, 2013)



Figure 0.5: Plan of North Memorial Hospital Healing Garden showing the variety of spaces and their interrelation.

Source: *Hospital Outdoor Landscape Design*. Gökçen Firdevs Yücel



#### 2.4.4. Positive And Negative Distractions

- Emphasis on natural features as grounding points, such as the use of plants, rocks, wood or water, can only be beneficial to recovery.
- Negative distractions and intrusive stimuli on the other hand may obstruct recovery and aggravate stress, such as abstract and ambiguous sculptures or designs that can be interpreted in multiple ways.

Environments that are mysterious or complex to understand can be interesting and challenging to the healthy, but to ill they usually provoke counter-indicated effects (Yücel, 2013).



Figure 0.6: Examples of positive and negative distraction

Source: *Hospital Outdoor Landscape Design*. Gökçen Firdevs Yücel

#### 2.4.5. Accessibility, Familiarity And Security

- All hospital outdoor spaces must be designed to be physically secure and accessible to people of all ages and abilities, thus contributing to their positive psychological perception.
- When feeling stressed or depressed, many users search for environments that seem familiar and safe.
- Patients often feel both physically and psychologically vulnerable in hospitals, and a feeling of security should be provided. This includes sufficient lighting and public telephones in isolated areas so people can call for help, and other facilities and design elements in the garden that make them feel safe.
- There should be a feeling of enclosure but without the feeling that one is being watched.
- Features should include handrails and seating at frequent intervals, particularly near the entrance, to assist the elderly, the disabled or mobility-impaired, and an avoidance of paving materials like asphalt that reflect a strong glare (Yücel, 2013).





Safety and Security

### Visibility

The more a garden is visible and people are aware of it, the more its activity areas and paths will be preferred. At least one outdoor space should be visible or its location clearly indicated from the main entrance. Patients' rooms should have views of the garden so they can enjoy it even if they are unable to visit it (Yücel, 2013).

#### 2.4.6. Feeling Of Control

Research shows that a feeling of lack of control can lead to or aggravate depression, passivity, elevated blood pressure, and decreased immune system operation. A sense of control in the garden can be enhanced by getting users involved in its design; and different types of spaces and layouts can enable them to make their own choices – for example, a variety of pathways, of types of nooks where they can sit, of furniture (if some is moveable), or of views, ranging from close to distant.

#### 2.4.7. Physiological Comfort

- Hospital patients are often sensitive to temperature (burn patients, for example, generally have to keep out of direct sunlight), options such as sunny and shady **areas should be provided, as well as seating shielded from breeze by plants or structures.**
- Others patients have trouble getting up on their feet, so the garden should have garden seats with arms and backs, and also benches one can sprawl or lie on.

#### 2.4.8. Quiet

- If a garden is to have therapeutic value in a medical setting, it needs to be quiet — a complete contrast to the public announcements, TVs, and rattling trolleys of a hospital interior.
- People using the garden need to feel a sense of calm, and to be able to hear birdsong, wind chimes, or the sounds of a fountain.
- A study of four hospital gardens found that users were disturbed by incongruent mechanical sounds such as air conditioners and street traffic (Clare Cooper Marcus, MA, MCP and Marni Barnes, MLA, LCSW, 1995).
- At the planning stage, it is essential that future garden spaces are located way from traffic, parking areas, delivery driveways.

#### 2.4.9. Successful Way Finding

- People need to find their way around a hospital that frequently has a very complicated functional and organizational structure. Successful way finding system is a powerful navigation tool which provides necessary information, enabling decision making and planning of routes.
- Style of communication elements, including material, color, contrast and text, has to be consistent, carefully implemented in an overall hospital design and should not be tampered out with. On the other hand, too much information may overload visual communication and confuse the patient, which can induce puzzlement and fear in an already stressful environment (Clare Cooper Marcus, MA, MCP and Marni Barnes, MLA, LCSW, 1995).

#### 2.4.10. Different Options Indifferent Kinds Of Weather

Paths and places should offer variation in terms of sun, shade, protection from the wind and shelter from the rain.

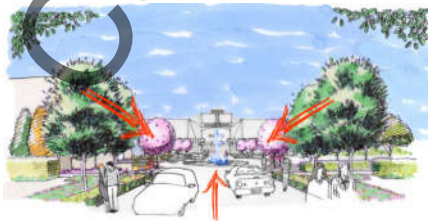
#### 2.4.11. Social Interaction

- There are places for amusement and pleasure where you can meet and look at people (Carlsson, 2013).
- There are plants and things to discuss. There are areas with outdoor tables and chairs for informal meetings (Clare Cooper Marcus, MA, MCP and Marni Barnes, MLA, LCSW, 1995).
- There are possibilities to socialize in different ways, e.g. places where many people can gather, places for users and visitors to be together by themselves, and places that offer the possibility to interact with people from outside the healthcare setting (Carlsson, 2013).

#### 2.5. Typology of outdoor spaces in hospitals

##### 2.5.1. Gateways And Entrances

- Gateways and entrances welcome people on arrival and provide cues for them to find their way around the site.
- They can perform this function if a comprehensive network of connecting paths is planned, specified, and followed up to ensure they are properly constructed .
- The main entrance should be accessed logically by the most direct path, and the entry way to the outdoor space should have no ramps or steps.
- Landscaping, artwork and detailing can prioritize the main access points.
- Entrances must be sufficiently wide to accommodate people with special mobility requirements; for the visually impaired, different kinds of surfacing materials can be helpful, and tactile elements should indicate thresholds. (Dejana Nedučin, 2009)



The main entrance should be accessed by the most direct path.



Landscaping, artwork and detailing can  
Prioritize the main access points.

Entrances must be sufficiently wide

Figure 0.7: Examples of gateways.

Source: *Hospital Outdoor Landscape Design*. Gökçen Firdevs Yücel

### 2.5.2. Courtyards

Courtyards are the central and most often used spaces in a hospital building complex, they tend to be used more by visitors and patients if they are easily visible, and should be sufficiently large to prevent overcrowding. Courtyard features may include landscaped tree-shaded areas, water features, flowerbeds and moveable seats (Dejana Nedučin, 2009).



Windows overlooking the courtyard which is easily visible

### 2.5.3. Plazas

- These outdoor areas, which are typically paved and furnished, should allow easy access to wheelchairs, walkers and crutches.
- They should include shade from flowering trees or spreading evergreens.

- A plaza should have shaded seating areas decorated with plants, colored shrubs and ground cover, and perhaps a water feature (Dejana Nedučin, 2009).

#### 2.5.4. Roof Gardens

Gardens located on roofs are visually attractive, enabling patients to look out from their rooms and have a comforting view of grass, paving stones, benches and people, rather than roofing material or medical equipment.

Roof gardens enable major energy savings that will more than compensate, in time, for the costs of building, structure, waterproofing, and landscape maintenance; and they also minimize the environmental impact of a health care facility (Dejana Nedučin, 2009).

#### 2.5.5. Healing Gardens

- Gardens which serve as safe and meditative environments for healing and recuperation date back to the medieval period, and have traditionally been features of hospitals, hospices, rehabilitation centers, and nursing homes .
- The wide range of activities related to healing gardens may be passive or active: looking at the garden from a window, sitting, eating reading, doing paperwork or taking a nap in the garden, prayer and meditation, walking to a preferred spot, gardening, exercise and sports, and children's play .
- The gardens are conducive to stress relief, relieving physical symptoms, and enhancing the feeling of well-being of hospital staff and patients.
- Successful healing gardens make use of certain fundamental design principles :
- Enhance feelings of control: People should be aware that there is a garden and be able to find, enter and use its space.
- The garden should have private areas which cannot be seen from overlooking windows and different kinds of spaces so users can feel they are making choices.

- All or some of the five senses can be chosen as focal stimuli in the garden's construction.
- Have a prevalence of green material and areas: Patients' sense of well-being is enhanced by soft landscapes, so plant material should be dominant and hardscaping reduced to a minimum: trees, shrubs and flowers should make up about 70% of the garden, with 30% in walkways and plazas.
- Encourage exercise: Designs should provide easy access and independence, as well as stress reducing structural elements such as walking paths for patients to encourage exercise, and play areas for children.
- Provide positive distractions: Stress levels among patients have been shown to decrease when they are in the presence of plants, flowers, and water features as well as when they are engaged in gardening.
- Minimize intrusions: Gardens should be designed to minimize negative factors like urban noise, smoke, and artificial lighting, in favor of natural lighting and sounds. Gardens that appeal to the different senses are ideal (although strongly scented flowers and other scents should be avoided for chemotherapy patients)
- Minimize ambiguity: Complex or mysterious settings that provide a challenge might be of interest to the healthy, but research shows show that abstract design may be contraindicated for patients who are ill or undergoing stress. For this reason, the use of abstract art may be unsuitable, and design should focus on clearly identifiable elements (Dejana Nedučin, 2009).

#### 2.5.6. Meditation Gardens

- This type of small, enclosed, quiet garden is designed with a central focal point to help patients (often a single patient at any given time, depending on the size) concentrate and relax as part of the healing process.
- It is a space for quiet contemplation, removed from distractions and private – that is, not visible from other indoor spaces.
- Meditation gardens are labeled as such and purpose-designed, and their layout is usually simple and minimalist, comprising, for example, a circle

representing life, a square symbolizing order, or symbols such as the Celtic knot, which represents travel.

- They usually have a lawn and/or a comfortable seating area with a focal point, typically a water feature, to encourage meditation.
- The vegetation should provide cool colors such as violets, blues and greens, rather than bright, warm or contrasting colors (Shukor, 2012).

#### 2.5.7. Viewing Gardens

Some health care facilities with limited space and budgets feature a small, enclosed garden that can be seen but not entered. Such gardens cost little to maintain, provide some green space, flowers, perhaps a water feature, and they can be seen from sheltered indoor seating areas; however, the elements of nature they provide are removed from the senses, as they cannot be approached, smelled, heard or touched (Shukor, 2012).

#### 2.5.8. The Viewing/Walk-In Garden

- In this variation on a viewing garden, the green space can actually be entered from a corridor or waiting room: because it has limited space and seating, it remains a quiet area which does not disturb the privacy of any nearby rooms or offices, and also provides comforting view for people waiting or passing by in the corridor.
- The main disadvantage is that people using the space may feel a lack of privacy, as they can be watched by others (Shukor, 2012).

#### 2.5.9. Edible Gardens

- A healing garden can be developed to a new dimension if herbs, fruit plants and vegetables are grown together with the usual planted vegetation in an easily accessible space.

- This “edible garden” should be simple and balanced, but designed in a repeating pattern with wandering paths demarcating public and private spaces.
- The vegetation would favor annuals over perennials; and the garden could feature a large number and variety of plants (Shukor, 2012).

#### 2.5.10. Parking Areas

Parking areas should be sufficient to accommodate staff and employees, and parking should ideally be reserved for staff at the back of the hospital so they do not have to deal with heavy traffic when they come to work.

Parking for patients, especially those with disabilities should be as close as possible to the entrance.

Patients and visitors unfamiliar with the hospital may easily be confused if parking space is difficult to find; this can be solved by using directional signs that can be altered or moved as conditions change (Shukor, 2012).

#### 2.5.11. Paths

- This circulation in the health-care facility should be independent of public roadways and private zones should be distinct, preferably with patient intake and outdoor recreational areas in the private zone. Traffic circulation should be organized so that individuals and ambulances can directly access emergency facilities.
- The main circulation routes should be clearly indicated, for example by giving easily understood names to the main corridors like “Hospital Street” or “Blue Corridor” or having colored lines along the walls or floor to designate main routes; or using lighting along a route .
- Primary routes should be accessible to everyone; however, some people will prefer to experience the natural environment unmodified and will not expect easy access everywhere (Shukor, 2012).



## 2.5.12. Paths and Surface.

- Minor walkways should be at least 1.5m wide, with drainage that will get rid of rainwater quickly.
- Provide five-foot minimum width at paths for one-way traffic to accommodate the turning radius of a wheelchair. For two-way wheelchair traffic, provide seven-foot minimum width.
- Create a change in texture at the edge of a path to help people with low vision to recognize when they are off the path. Raised edges on a path can create a tripping hazard.
- Path surfaces must be firm, smooth, and provide traction to allow for easy movement of wheelchairs and gurneys. Paving with deep grooves can be an obstacle. Concrete is a good choice, but can be expensive. Asphalt absorbs and radiates heat which can be hot in the summer. Decomposed granite is good for people in wheelchairs, but not for those on crutches. Newer rubberized paving materials are firm enough for wheelchairs and also cushion falls (Shukor, 2012).

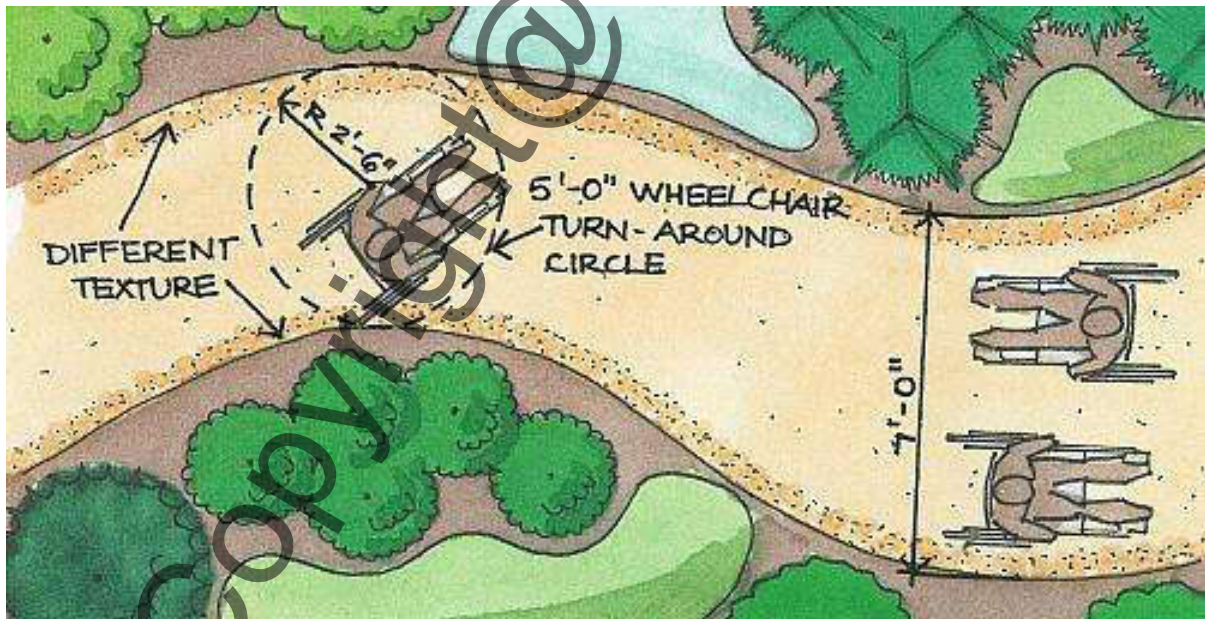


Figure 0.8 : Example of path width and design.

- Avoid materials that produce glare. Light concrete can be especially troubling to older people. Use tinted concrete if possible.

- Limit grade changes in most highly used outdoor areas. The slope of a walk must not exceed 5% or 1 foot of rise for 20 feet of length. Cross slope must not exceed 2% or 1 foot of rise for 50 feet of length.
- Where slope does exceed 1:20, provide a support railing for those with unsure footing. Consult your local building codes for exact accessibility requirements (Shukor, 2012).

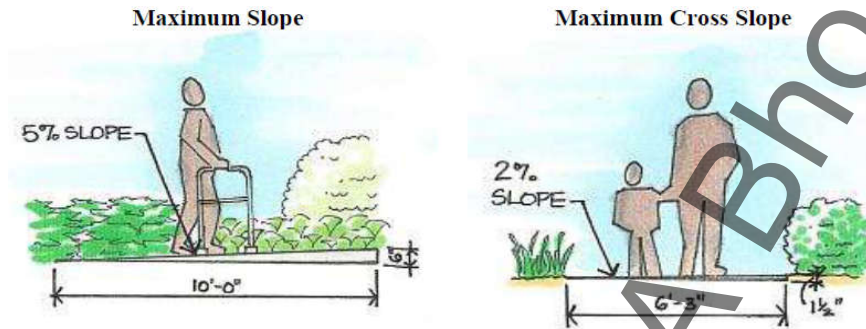


Figure 0.9 : Maximum slope and cross slope

Source: *Hospital Outdoor Landscape Design*. Gökçen Firdevs Yücel

### 2.5.13. Children's Gardens

- Children are usually discouraged from moving around in hospital environments lest they disturb the health-care workers or patients; there should be spaces set apart for them where they can move as freely as they need or wish to, as they need to engage in imaginative play regardless of the condition of their health.
- Children need to feel they can create and make changes by interacting with their environment and moving objects and parts; as a result, flexible play areas should be designed to stimulate their imaginations and give them the pleasure and therapeutic benefit of creative activity.
- A children's area might, in addition to using primary colors and providing climbing structures, include a path maze, a chalkboard masonry wall, child-sized sculptures, or a miniature bridge traversing a faux rock stream, which can also be crossed on stepping stones.
- Routes should be stable and made of surfaces like decomposed granite, asphalt, wooden boardwalk, resilient mats, and concrete, to resist slipping.

- There might be platforms so children in wheelchairs can safely move onto and off play structures; and sand play areas may be made available at different heights, so they can be used on the ground or from a Wheelchair (Shukor, 2012).

#### 2.5.14. Dining Areas

- The dining area is used by more people than any other hospital area, there are more potential outdoor space users in it; having an outdoor space near the dining area is essential.
- There should be tables in the space for eating, reading, and writing activities, and to serve as territorial markers, as people rarely intrude on a table that is being used.
- Shade and semiprivate group spaces can also be provided by umbrella tables with chairs (Shukor, 2012).

#### 2.5.15. Art

- Artworks form part of the healing environment, and works of art in health-care facilities featuring images of nature have been linked with stress relief in diverse groups of people. In hospital spaces which can easily be accessed, artworks which create inviting, habitable spaces should be incorporated into the design.
- The type of artwork used is also important; it should have what Niedenthal et al. (1994) describe as “emotional congruence”, For example, abstract art might be seen as interesting by a relaxed person, but as frightening or threatening by a person in a state of anxiety.
- As the hospital environment tends to increase stress so, artworks, sculptures and other design elements should provide an unambiguously positive message, complex or abstract art is therefore not suitable for this kind of setting (Shukor, 2012).

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### 2.5.16. Water

- Water can be incorporated in any of its many guises: as a gushing stream in a fountain it is symbolic of the life force (chi, prana), of surmounting obstacles, and initiating new life.
- As a waterfall, it is symbolic of a leap into the unknown, of courage, and triumph over fear.
- As a still pond or pool, water is symbolic of contemplation, of the soul's yearning for truth, renewal and healing.
- Adding a bridge over moving water is a powerful symbol of our ability to overcome obstacles. It also helps to define the journey within the garden and to create a sense of natural transition into a more pristine environment.
- Water can be designed to encourage interaction with wildlife: songbirds, butterflies, humming birds. It is important to avoid using pesticides or chemical cleaners such as chlorine or potassium. Use only animal-approved pond liners and bird baths.
- Provide bird baths and feeders to encourage use of water features by wildlife.
- Try to incorporate natural objects into water features: sea shells, hollow rocks, stone bowls, tree stumps.
- Provide some very shallow water for its reflective qualities: include rocks and allow some to be only partially submerged so they can act as launching pads for birds and butterflies. Encourage frogs and snails. Provide pools for fish and water lilies.
- Always provide sitting opportunities near water features both for the view as well as the sound (Anthopoulos K. Petros1, 2011).

### 2.5.17. Seating

- Seating should be available where people would actually want to use it, typically enclosed and towards the back, facing an attractive view or focal point, and not obstructing people on the path.

- Comfortable, movable, and varied seating can increase usage of the garden, especially by hospital staff; there should be benches and chairs for individuals, and more social seating arrangements for groups .
- Social seating arrangements (right-angled or centripetal benches, or movable chairs) should be conveniently located near the garden entrance, where they are most likely to be used by staff for short breaks.
- In addition to semiprivate areas there should be some benches arranged in a line rather than in a group, facing a view or circulation area.
- Benches are usually situated at rest places or corridors with an exterior view .
- Space should be left beside a seat to accommodate a wheelchair or electric scooter.
- Raised features can help wheelchair users and people who cannot easily bend down, and should attract others as well, for example if the edge can serve as an informal seat.
- Seats can be artworks in themselves.
- The material used should not retain heat or cold, so concrete, aluminum and steel should not be used: wood or hard plastic are preferable.
- Moveable chairs can be rearranged depending on the sun or shade, and to adjust the size of the seated group (Anthopoulos K. Petros1, 2011).

#### 2.5.18. Signage

- Site signage should indicate: directional or one-way traffic, restrictions, parking, deliveries, patient entry points, entrances to facilities, etc.
- Tactile signs should be fixed at a height of 150cm (120cm for children).
- Other sensory indicators, such as audible water features and wind chimes may also be used to assist way finding for the visually impaired in the garden (Anthopoulos K. Petros1, 2011).

#### 2.5.19. Lighting

- The primary purpose of lighting is to enhance safety and security.

- Parking areas, entrance and service roads, and also isolated or dark areas need to be clearly defined and lit; bollards or bulkheads are usually used for this purpose.
- Lighting along pedestrian routes should be mounted at a height where faces can be seen and recognized, and any entrances, intersections or hazards such as changes in path level should be indicated by beacons.
- An added therapeutically benefit of night-time lighting is that it enables safe use of the space at night, and viewing of the garden from indoors (Anthopoulos K. Petros1, 2011).

#### 2.5.20. Receptacles

- The locations of trash containers should be considered as an essential element of health-care facility planning, as they allow for easy disposal of food and paper products outdoors.
- The number of receptacles required depends on the population density and the activity level in an area, as well as how often they are emptied; overflowing litter bins indicate a need either for more of them or for more frequent service.
- There should be litter containers at all transition areas such as doors, building entries, parking access points and social and pedestrian spaces.
- To provide a less disturbing environment, receptacles should be placed at least 3.6m away from where people tend to socialize (Anthopoulos K. Petros1, 2011).

#### 2.5.21. Plant Selection

- Lush, colorful planting that is varied and eye-catching so as to suggest the image of a garden. Over and over, trees, plants, and greenery were cited as the most significant helpful characteristic..
- Appropriate plant selection, with special attention given to cultural requirements and correct placement in the garden, is one of the essential

elements of a therapeutic garden environment, as dying and unhealthy plants have a negative psychological impact on those observing them.

- If possible, use plants that have some medicinal value. Choose plants that engage all the senses.
- Use a variety of textures, scents, colors, as well as plants that make pleasant sounds as wind rustles their leaves.
- Providing seasonal interest allows people to connect with the cycle of nature.
- Avoid thorny or toxic plants, especially in gardens used by children or people with certain psychological disorders.
- Incorporate elements that will attract wildlife including berry producing shrubs, birdbaths and bird feeders. Avoid plants that attract large numbers of bees or undesirable insects.
- Choose insect- and disease-resistant varieties to eliminate pesticide use (Anthopoulos K. Petros<sup>1</sup>, 2011).

#### 2.5.22. Color and light

- Color and light are the soul of a healing garden. More than any other quality, it is the ephemeral interplay of tones, hues, and changing intensities that draws out our own soulful understanding of life and its incredible variety and beauty. Because color is transitory in nature, color also helps us to understand our own mortality. The result is an acceptance of life and our healing journey.
- It is best to keep color schemes simple and to build resonances gradually. Color should be integrated with forms, and should exalt rocks, water features, and vegetation. It should be added only as the need arises.
- Although color appreciation is subjective, there are some basic qualities that are universally agreed upon.

- Red for example is symbolic of passion, activity, courage and helps to reduce depression and lethargy. It should be used sparingly as it can make the garden feel smaller.
- Orange is similar to red and will stimulate the nervous system, enhance will power and vitality. It helps to reduce monotony and lack of motivation.
- Yellow is cheerful, warm and stimulating, it is symbolic of clear thinking, harmony in relationships, and family life, and will stimulate the nerves and the brain.
- Green is the color of peace, growth and renewal. It supports knowledge, wealth and family.
- Blue/indigo is the color of spirituality and helps to induce calmness, sincerity and rest. Used excessively it can induce passivity and depression. It stimulates knowledge, a sense of mission, and career.
- Violet/purple is the soulful aspect of the self. It signifies deep love, mystery, contemplation and the unconscious. It needs to be surrounded by brighter colors.
- White is the color of purity and of the matrix on which all other forms and colors are laid. It stimulates our spirit and helps to release distractions (Anthopoulos K. Petros1, 2011).



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Figure 2.1 : Ancient Egyptian Hieroglyphs depicting the 'architect' explaining his garden scheme to the pharaoh. & St. Catherine's Garden in the monastic infirmary, London, 1154..... 10

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3.2.6. Conclusions:

- Variety of spaces and their inter relation plays a major role in the outdoor spaces of hospitals. Even small space can make the user happy and comfortable.
- There should be positive and negative distraction.
- One should focus on the accessibility, familiarity and security for the users.
- Visibility: one should be aware of the spaces designed in the hospital so that they can use it.
- There should not be “the feeling of control” one should be free to move anywhere in the hospital campus.
- Users should have the opportunities in which they can make choices for ex. Whether they want to sit alone , or in group for social interaction.
- The planting scheme should be that it offer a different colors in different weathers so there should be different varieties in different weathers.
- The entrance to the spaces should be direct, visible and welcoming so that it can create an interest.
- There should be separate entry for the ambulance.
- Parking areas should be separate for the staff members and should be away from the quiet areas.
- Use of sculptures, painting and water features creates the interest as well as the motivation for the users.
- If possible give dinning spaces in outdoor areas.
- All the wards should have the view from the windows.
- User must experience the all 5 senses in the outdoor space whether in texture form, scent form, eating form or in hearing form.

## Chapter 3- Case Studies



Figure 3. 1 : Spinal Injury Center, New Delhi

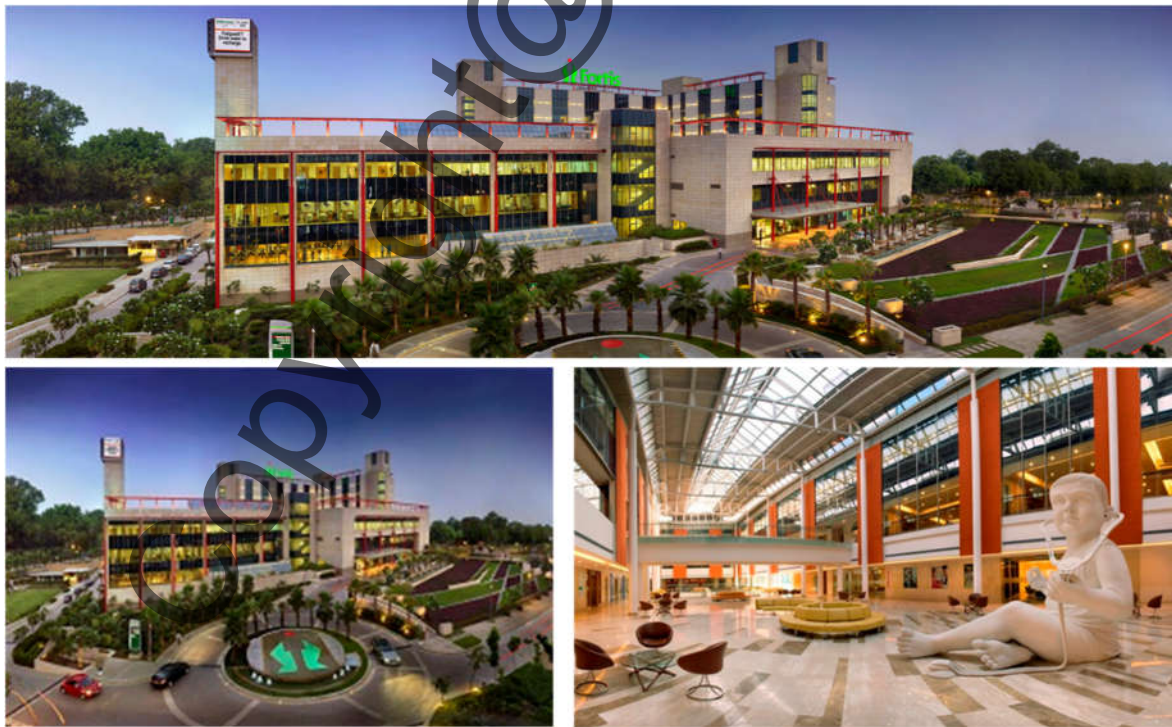


Figure 3. 2 : Fortis Memorial Institute, Gurgaon



Figure 3. 3 : AIIMS, New Delhi



Figure 3. 4 : Indraprastha Apollo Hospital, New Delhi

<b>Design Considerations And Typology.</b>	<b>I.S.I.C., NEW DELHI</b>	<b>FORTIS, GURGAON</b>	<b>APOLLO , NEW DELHI</b>	<b>AIIMS , NEW DELHI</b>
Entrances	✓	✓	✓	✓
Entry/Exit	1 entry and exit	Separate entry/ exit	Separate entry/ exit	Separate entry/ exit
Entry Gardens	✓	X	X	X
Front Porches	✓	✓	✓	✓
Emergency Entry	Separate entry	Separate entry	Separate entry	Separate entry
Courtyards	✓	X	X	X
Plazas	X	X	X	X
Roof Gardens	X	X	X	X
Healing Gardens	X	X	X	X
Meditation Gardens	X	X	X	X
Viewing Gardens	✓	✓	✓	✓
Edible Gardens	X	X	X	X
Parking Area	Not Separate	Separate	Separate	Separate
Children's Garden	X	X	X	X

<b>Design Considerations And Typology.</b>	<b>I.S.I.C., NEW DELHI</b>	<b>FORTIS, GURGAON</b>	<b>APOLLO , NEW DELHI</b>	<b>AIIMS , NEW DELHI</b>
Dining Areas	✓	X	X	X
Water Features	X	X	X	X
Site Furnitures	✓	✓	✓	✓
Variety Of Spaces	✓	✓	✓	X
Positive And Negative Distraction	X	X	X	X
Familiarity	X	X	X	X
Security	✓	✓	✓	✓
Social Interaction	✓	X	X	X
View From Windows	✓	X	X	X
Different Options In Different Weathers	✓	✓	X	X
Joyful And Meaning Full Activities	X	X	X	X
Paths & Surfaces	✓	✓	✓	✓
Vertical Landscapes	✓	X	X	X

Table 3. 1 : Comparative Analysis on design considerations and their typologies



### 3.1. INDIAN SPINAL INJURIES CENTRE, NEW DELHI

#### 3.1.1. About the hospital and its location

- **APPROACH TO SITE** : 75m wide Mehrauli- Mahipalpur road.
- **TOTAL SITE AREA** : 11.04 acres = 44.678SQ.M.
- **AGE** : No age limit.
- **USERS** : Patients, Visitors & Staff members.
- It is a **110 bedded** spinal injury centre.
- This centre has been equipped through Indo-Italian friendship with the latest medical and technical equipment.
- The centre was ready in **September 1992** for the treatment of acute injuries from around Delhi and surrounding areas.
- It has been acknowledged as highly specified centre by the **government of India** and recognized internationally for its quality services over years.

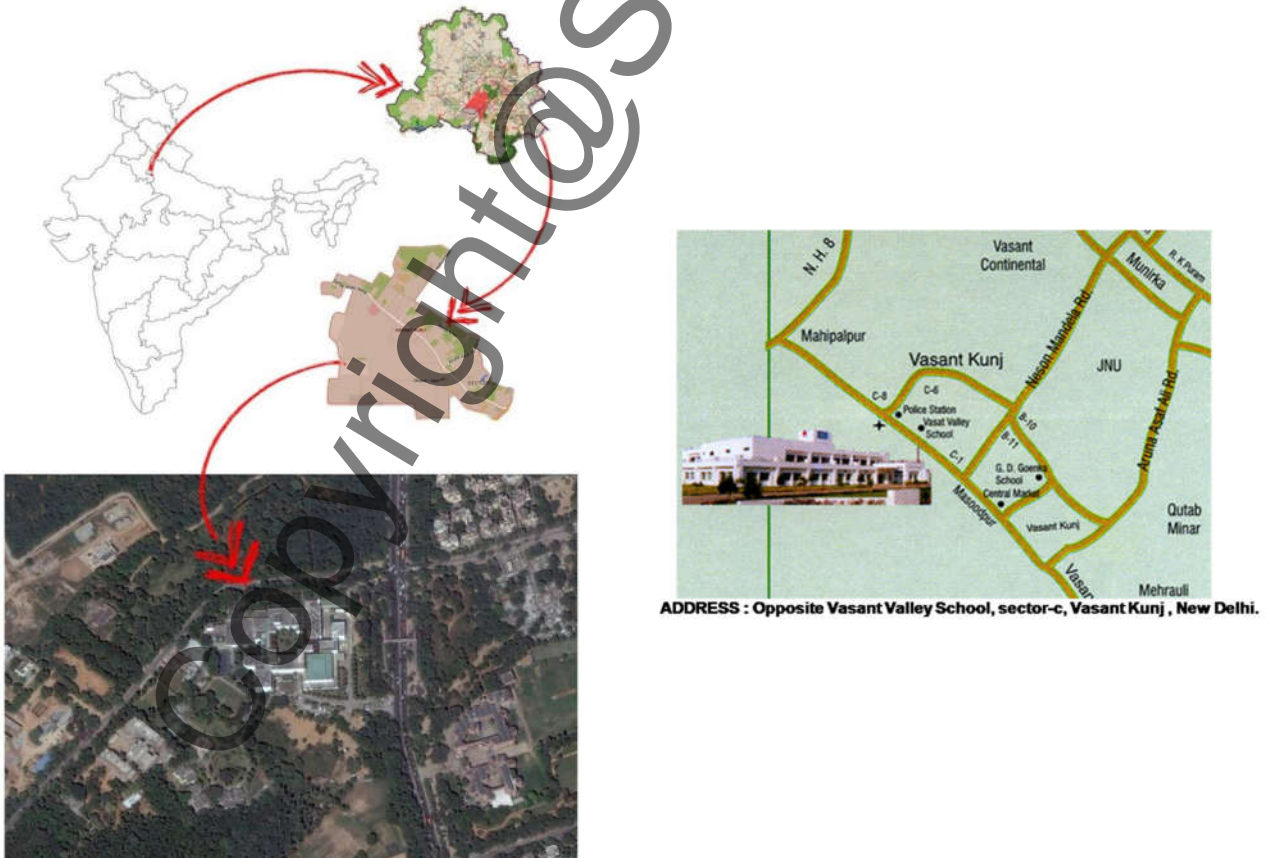
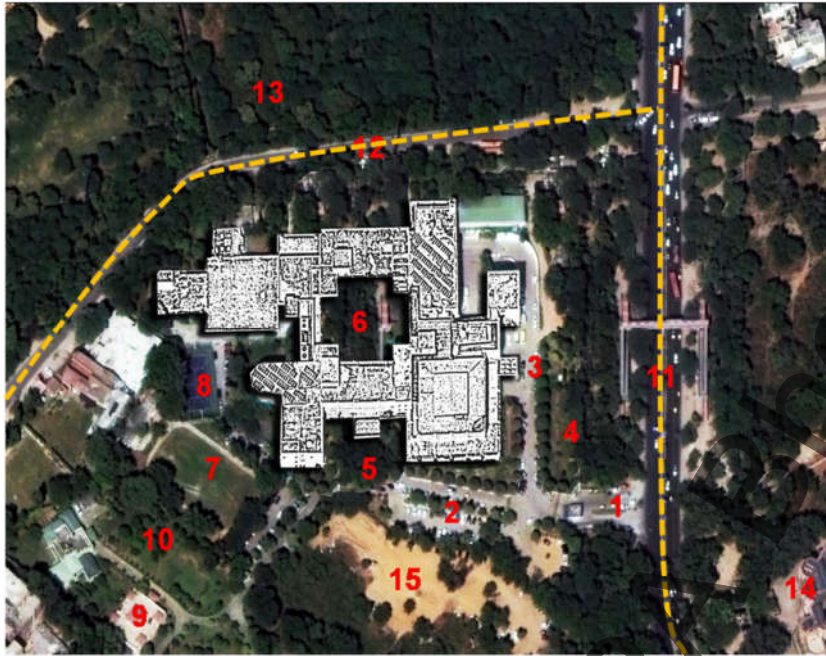


Figure 3. 5: Site Location

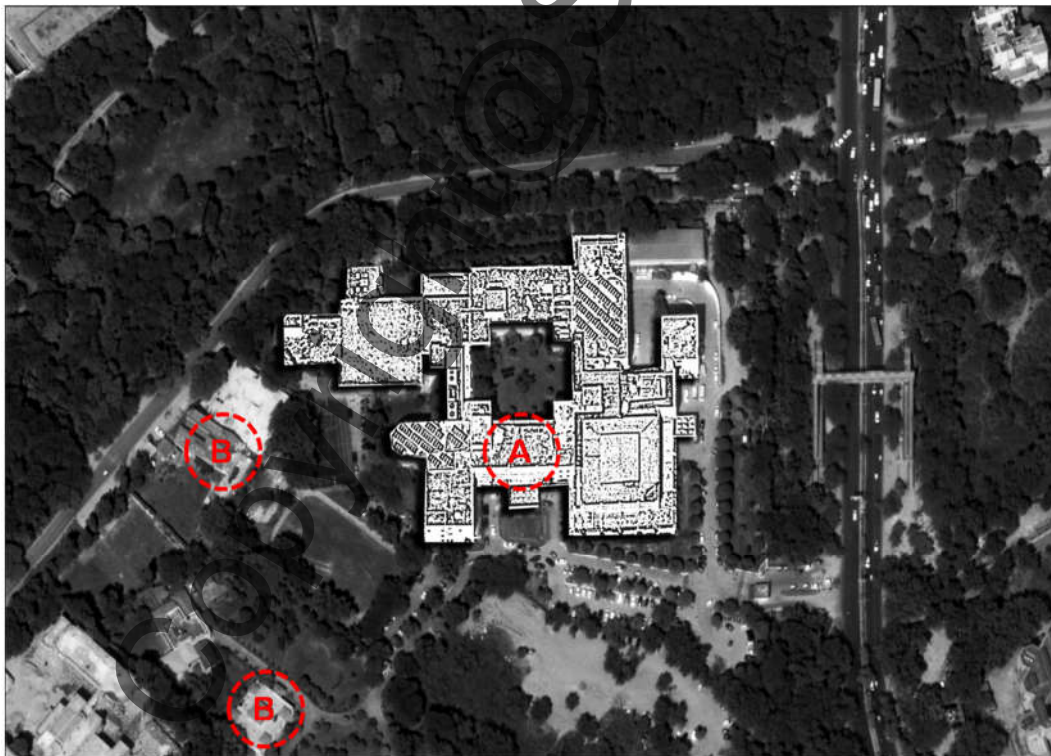
3.1.2. Master plan



1. Main entrance.
2. Parking area.
3. Emergency drop off.
4. Entry garden.
5. Entrance to hospital building.
6. Courtyard.
7. Outdoor space for visitors, patients & staff.
8. Tennis court.
9. Residential area.
10. Green area for residential zone.
11. 75m Mehrauli – Mahipalpur road.
12. 30 m wide road.
13. Dense green area.
14. Vasant valley school.
15. Open area.



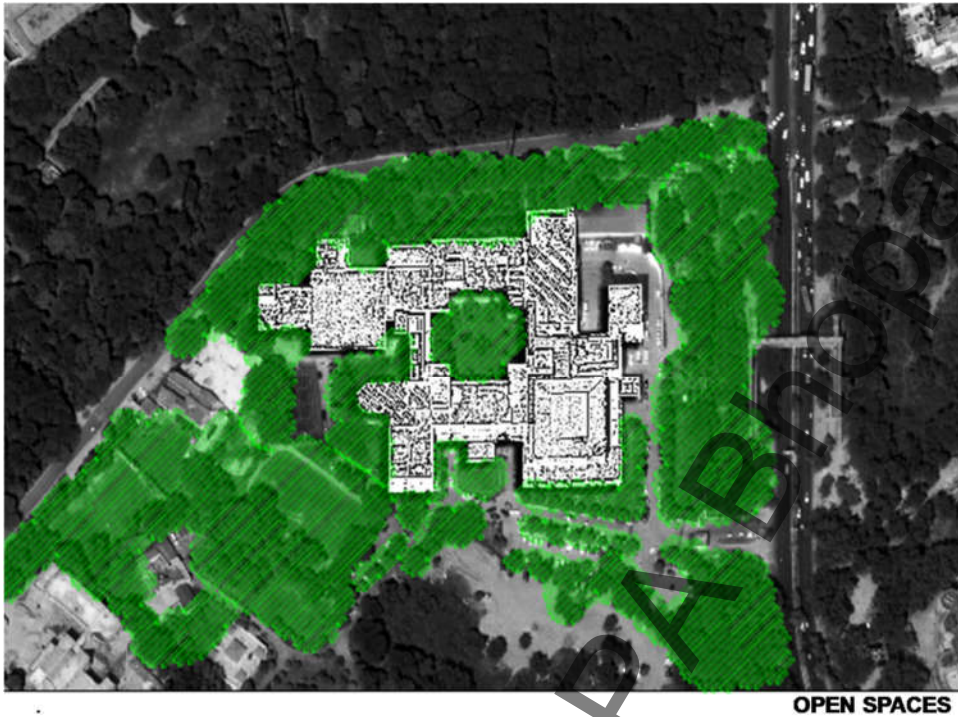
3.1.3. Built up area



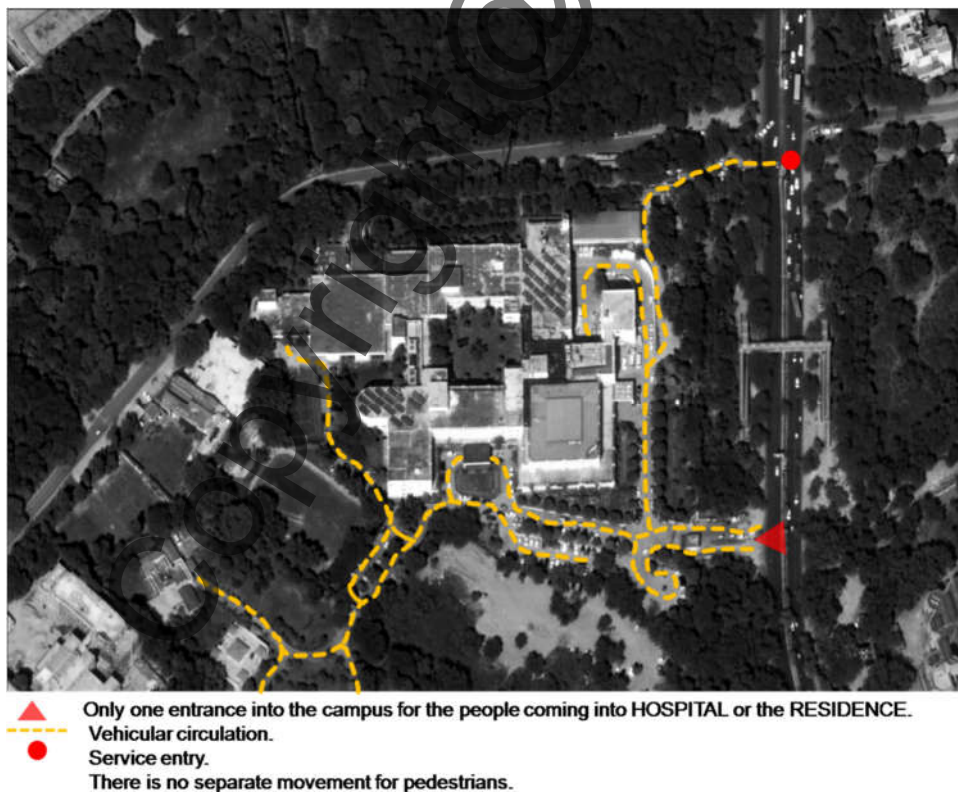
A. HOSPITAL BLOCK.  
B. RESIDENTIAL AREA.

**BUILT UP AREA**

3.1.4. Open spaces



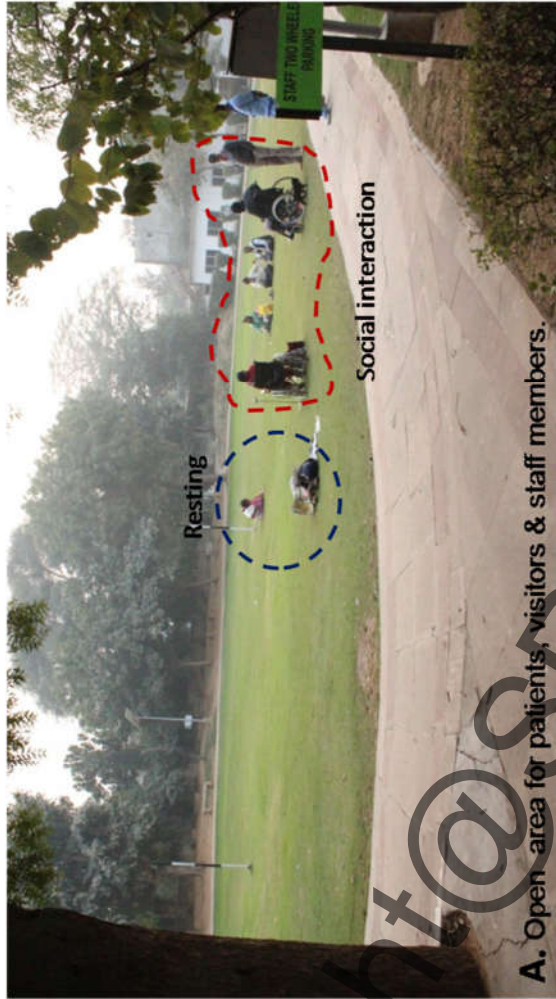
3.1.5. Circulation plan



3.1.6. Types of experiences



**ACTIVE EXPERIENCE**



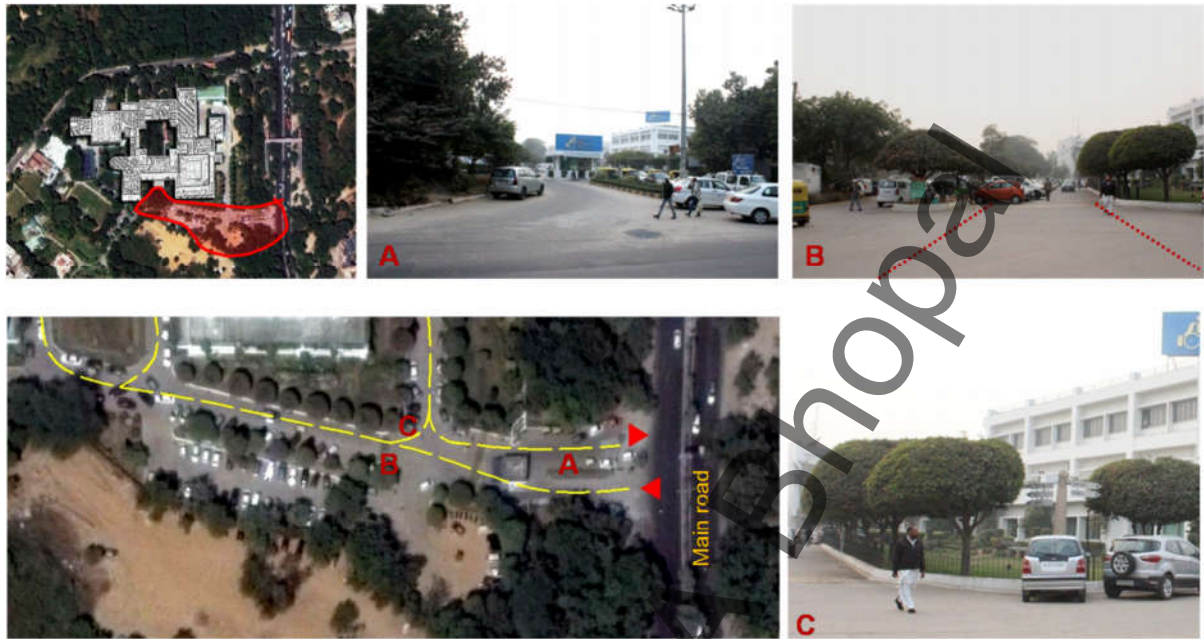
**A.** Open area for patients, visitors & staff members.



**B.** Tennis court for the users.

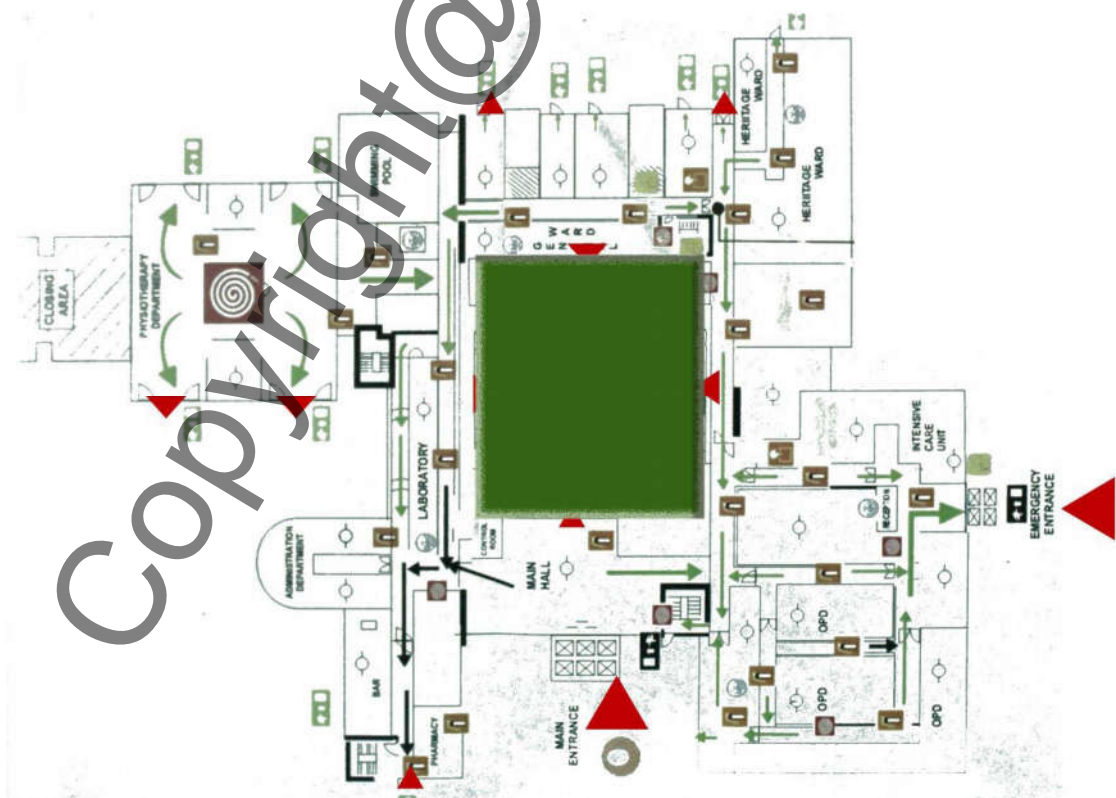


3.1.7. Entrance



- A** Entrance is **easily visible** from the road with a **buffer space** so that one can enter the hospital easily. But the entrance was **not welcoming**.
- B** Main entrance is accessed by the **direct path**. Roads were **not sufficiently wide**.
- C** **No separate movement** for pedestrians.

3.1.8. Hospital entry/ exits



3.1.9. Visual connections

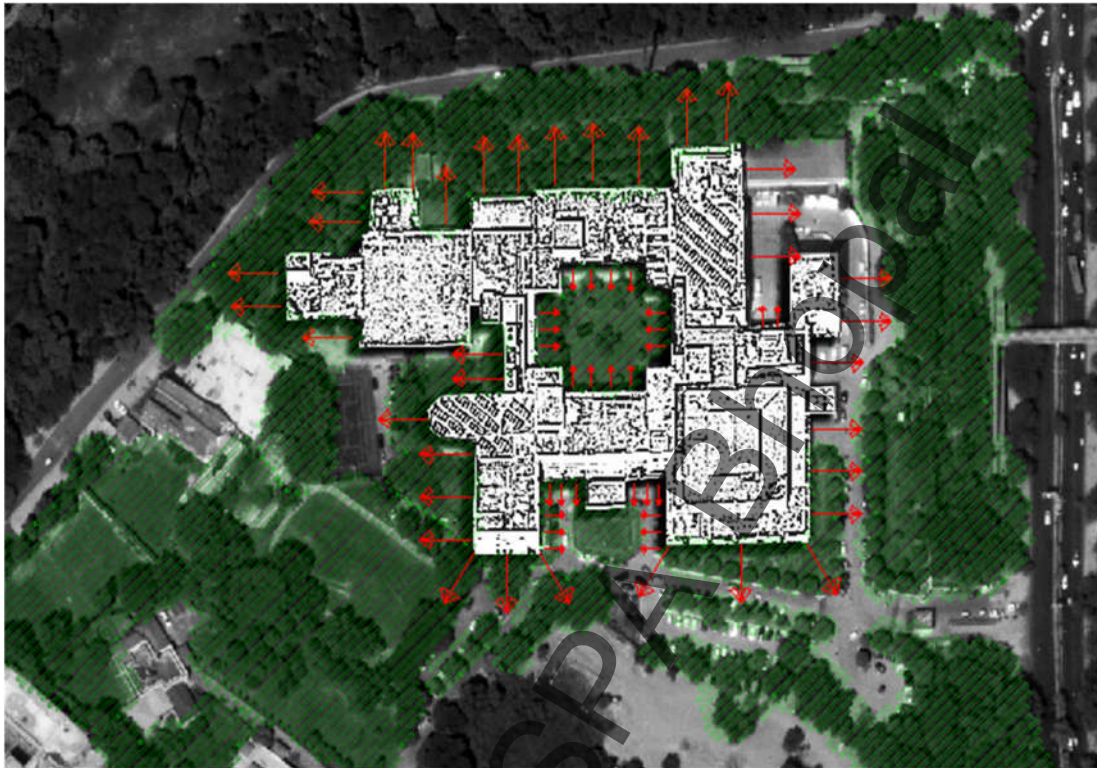


Figure 3. 6 : visual connectivity with outdoor spaces.



Figure 3. 7:Users were getting the view from window while sitting in the cafeteria.



Figure 3. 9:Patient experiencing the view from the room .



Figure 3. 8 : In waiting area users were getting the view of courtyard

### 3.1.10. Observations



Figure 3. 10 : No separate movement for pedestrians. Roads were not sufficiently wide.



Figure 3. 11: Separate emergency drop off area





Figure 3. 12: No separate parking area for staff members.

### Conclusions

- The main entrance of the hospital was not welcoming . So there is need of it so that people will come and visit the hospital without a fear.
- The Emergency and the OPD entrance was easily visible and accessible.
- There is no separate entry for ambulance.
- No separate parking area for staff members.
- Roads were not sufficiently wide because people were parking there .
- No separate paths for pedestrian movement.
- Vehicular movement was restricted and concentrated parking area.
- There is no variety of spaces like healing gardens, edible gardens, meditation gardens , children garden , outdoor dining areas.
- Less opportunities for social interaction.
- Sculptures were installed for the positive diversion of the users.
- The material used for the paths was comfortable for the users.
- There was feeling of control as patients were not allowed to go in outdoor spaces.
- There was no water feature in the whole site.
- Out of the five senses only visual connections were experienced ( no touch, hearing, tasting, smelling).
- No joyful and meaningful activities were introduced .

- There was only one seating space for the users. So there was a need of seating's at some intervals at least for the patients.

### 3.2. The Pavilion : The Pavilion at Jupiter Medical Center, Chris Garcia,2009

#### 3.2.1. Introduction

The Pavilion is a 120-bed assisted-living home and rehabilitation center in Jupiter, Florida. The facility offers palliative care to long term residents and rehabilitation therapy to individuals transferred from Jupiter Medical Center. The Pavilion's residents cope with a range of cognitive diseases and physical disabilities. Many of the residents have a history of Alzheimer's disease, dementia, stroke, aneurysm, diabetes, low vision, and physical impairment. Most residents are non-ambulatory and rely on a wheelchair and the assistance of family (Chris Garcia, 2009).

#### 3.2.2. Design Intention

A series of connected gardens emphasize four therapeutic outcomes based on Roger Ulrich's Theory of Supportive Gardens:

- **Sense of Control** - Choices to sit in sun or shade, in groups or alone. A continuous pathway unifies the outdoor areas, allowing access from multiple locations. Residents and patients can choose where and how far into the gardens they wish to explore.
- **Exposure to Nature** - A bird garden, raised water garden, and native plantings along a large pond provide wildlife habitat. Primary social spaces are oriented to feel predominant southeast breezes.
- **Exercise** - Winding paths encourage patients and staff to stroll or explore in wheelchairs. Benches and features such as water fountains provide subtle "goals" to reach.
- **Social Support** - Places for people to group with spatial considerations for wheelchairs. Focal points that facilitate conversation (Chris Garcia, 2009).

3.2.3. Master Plan



Figure 3. 13 : A strolling path connects a series of outdoor spaces with recognizable outdoor features as landmarks.

3.2.4. Circulation map

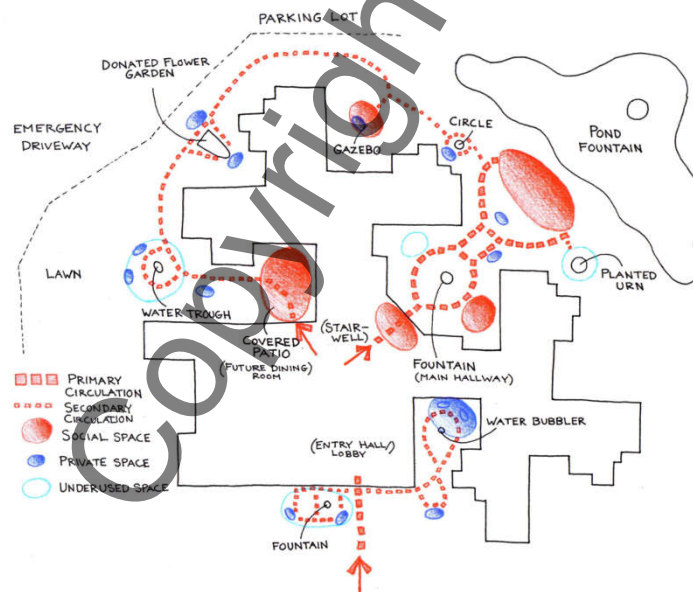


Figure 3. 14 : Large social spaces are strategically placed near entrances while smaller private spaces are distributed off of the main strolling path.

## 3.2.5. Bioclimatic Map

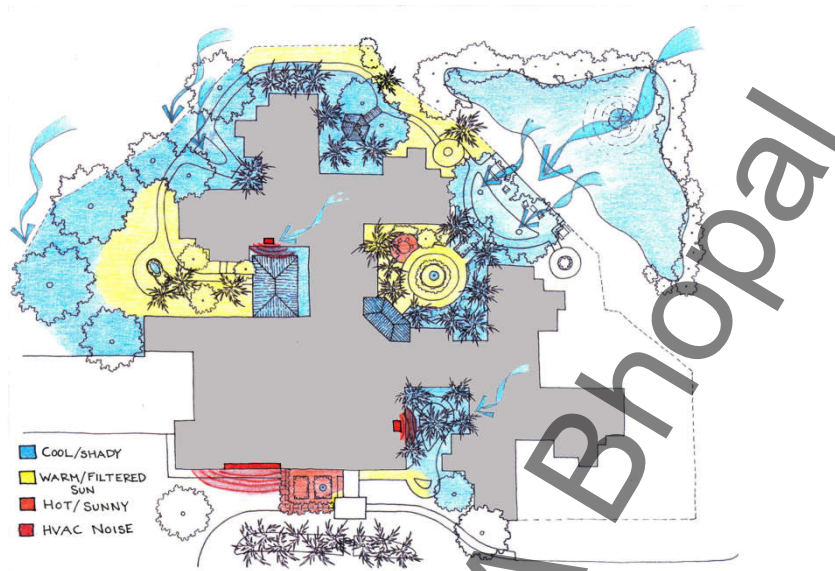


Figure 3. 15: An alternation between warm walks and cool destinations of respite creates thermal contrast and perceivable comfort. Noise and complete exposure to the southern sun discourages use.

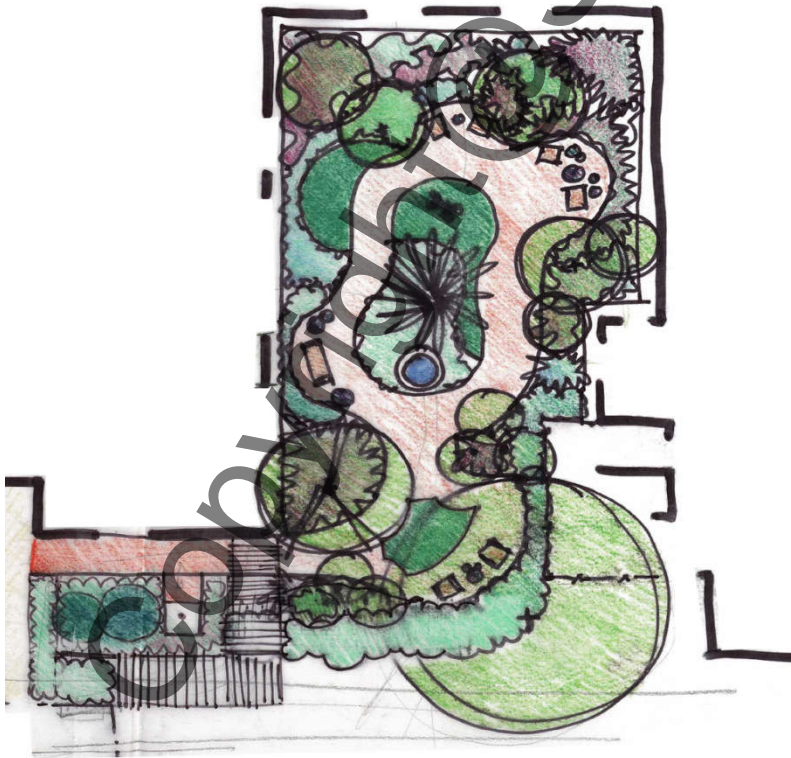


Figure 3. 16: Entry Courtyard and Schematic Sketch



Figure 3. 22

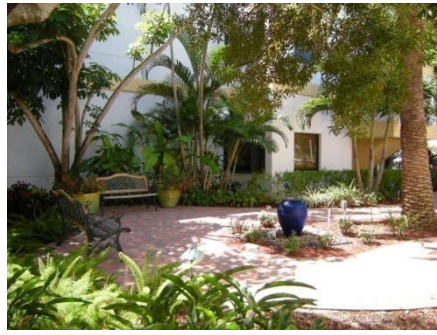


Figure 3. 17

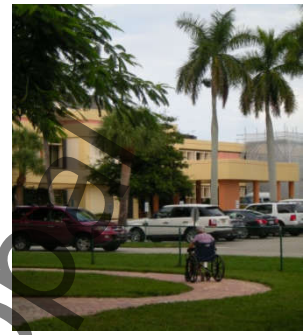


Figure 3. 21



Figure 3. 20



Figure 3. 19



Figure 3. 18

Figure 3.17:- A framed opening through the vines directs attention to a fountain while approaching the main entry.

Figure 3.18:- Benches in the “meditative courtyard” face a blue bowl of spilling water that distracts from a HVAC and encourages relaxation.

Figure 3.19:- A resident wheels independently along the strolling path’s series of outdoor spaces.

Figure 3.20:- A series of six outdoor spaces provide familiar destination points for socializing and resting and covered dining area.

Figure 3.21:- Differences in inner and edge path brick orientation helps facilitate guided movement and safety for elders with impaired coordination.

Figure 3.22:- The shaded blue picnic table in the cool grass is more thermally inviting than the glaring sunlit bench in Florida’s sweltering climate.



Picturesque shade patterns and a lush lawn provide visual comfort.



Direct exposure to the sun is beneficial for vitamin-D production and stronger bones.



Shade and a comfortable breeze flowing over a cool retention pond promote comfort and long group visits.



The cushioned seats and ceiling fans are conducive to resident naps under the entry patio.



Light-weight movable furniture allow for adaptable seating configurations.



Movable chairs, tables, and wheelchairs allow groups to configure an arrangement that best facilitates social interaction or rest.



Although wheelchair users do not sit on the benches, they often use them as stopping points to rest and stretch their legs on the seat.



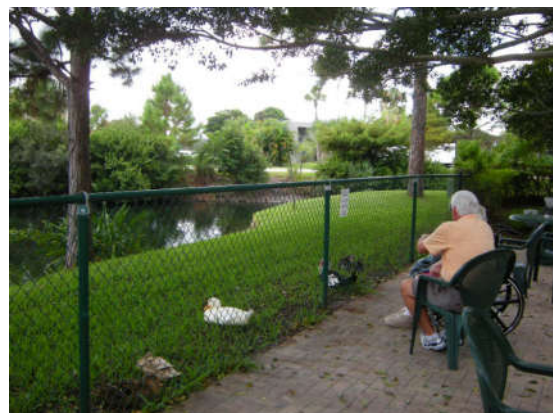
The retention pond attracts ducks. An ecological landscape provides positive views to wildlife and entertainment.



Large pots and profuse planting beds tuck this bench into an alcove, creating a private space for individual respite.



This large native shade tree gives a sense of place and shelter to the pond enclave for comfortable gathering.



## CHAPTER 4: Site Study & Analysis

### 4.1. Site Details:

The overall area of the site is 154 acres developed by Ar. Prem Kumar Chaudhery & Associates under Ministry of Health and Family Welfare.

### 4.2. Location of site

- The proposed hospital project is a large development situated on the fringe of the city of Bhopal in Madhya Pradesh.
- The site is situated in the south eastern end of Bhopal, off the National highway 12 to Nagpur , about 6km from the main city and about 25 km from the airport.
- The main access route to the site is from the north west end via Saket nagar and will be used by those arriving from the mainly city as well as from outside.



Figure 4. 1 : AIIMS, Saket nagar, Bhopal.

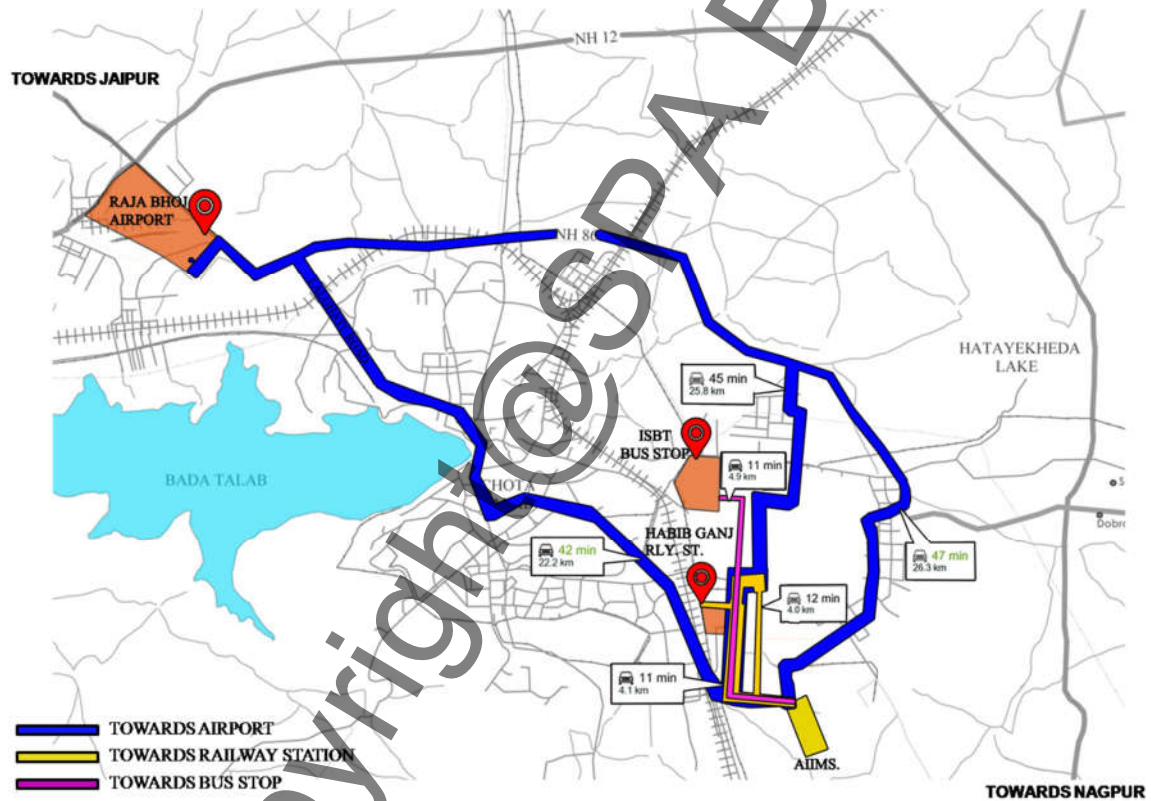
Source: Generated from Google Earth



Railway connectivity : 4.1 KM away (HABIBGANJ RLY. STATION)

- Total Annual Rainfall :1200MM.
- Wind Direction : SW-NE
- Latitude of Bhopal: 23,2667 (2316'0.120"N)
- Longitude of Bhopal: 77,4000 (7724'0.000"E)
- Altitude of Bhopal: 500 m

### 4.3. Connectivity



Map 4. 1 Connectivity map

## 4.4. Temperature , Climate, Humidity

	Relative humidity	Air temperature average	Air temp average high	Air temp average low	Rainfall	Wind velocity	wind direction
unit	%	° C	° C	° C	mm	m/s	° (angle from north)
January	56%	18	25	11	13.2	2	50
February	48%	20	28	12	8.7	3	50
March	37%	25	33	17	8.4	3	320
April	26%	30	38	22	4.3	4	290
May	32%	33	41	26	11.7	4	320
June	56%	30	37	25	120.2	6	270
July	86%	26	31	23	354.1	4	270
August	82%	25	29	23	363.3	4	290
Sep	69%	26	31	22	185.1	4	270
Oct	65%	25	32	19	31	2	0
Nov	47%	21	29	14	12.1	1	50
Dec	51%	18	26	11	11	1	50
source	ishrae	ishrae	NMC	NMC	NMC	ishrae	ishrae

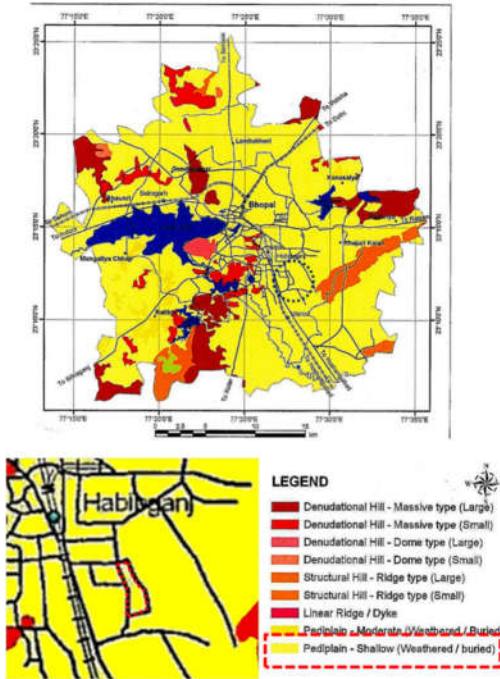
Figure 4. 2 Temperature, climate &amp; Humidity Chart

Source: Norwegian Meteorological Institute

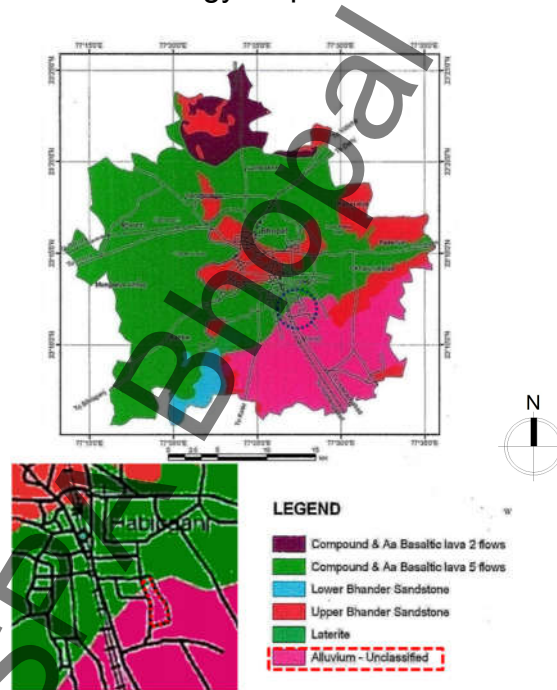
- The rainy season lasts from mid June to September .
- The winter from November to February
- The summer from March to June.
- October sees the transition from rainy to winter season.
- Monsoon is restricted mainly from June to august, and the city gets nearly 75% of its annual rainfall of about 1100mm in this period.
- After monsoon, the atmosphere becomes quite pleasant.
- In winters, the days are comfortable and the low temperature only occurs at night.

## 4.5. Site study through Resource maps

## 4.5.1. Geomorphological map



## 4.5.2. Geology map



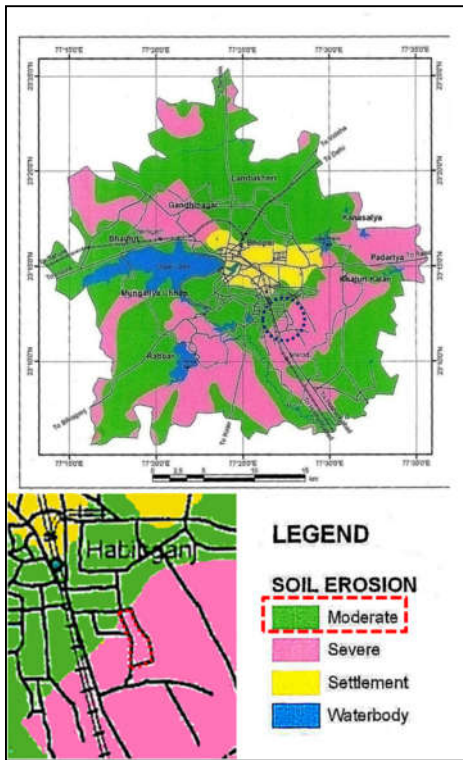
Map 4. 2 Geomorphology Map

Map 4. 3 Geology map

Source: *Town & Country Planning, Bhopal*

- The geological formations underlying the Bhopal area – at the eastern edge of the Malwa plateau- are largely red sandstone strata, with the depth of the rock varying according to the slopes.
- The top portions of the hillocks generally consist of hard red soil, mixed with the basaltic boulders.
- Black cotton soil is seen at various depths from 1 to 3 m.
- Alluvium soil : yellow , grey, reddish brown clay with rock gravel.
- Two types of soil on site : hard red soil mixed with basaltic boulder because of the red sandstone strata in Bhopal and the black cotton soil.
- Red soil is low in nutrients and the iron oxides in it can cause problems for plants.

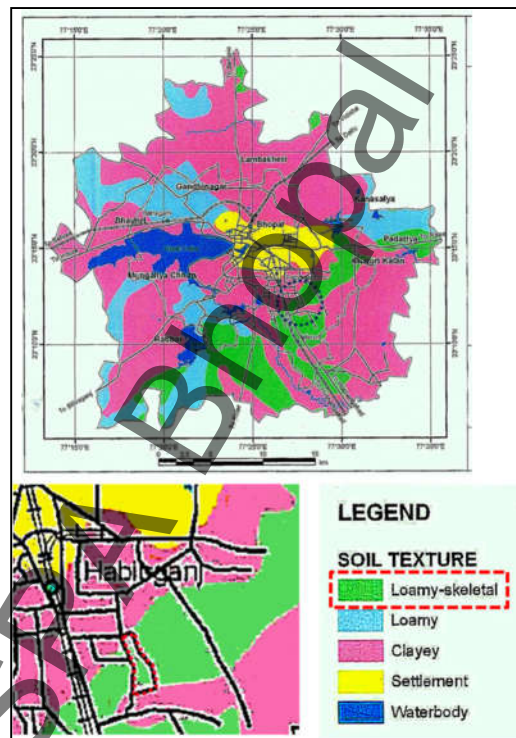
4.5.3. Soil Erosion Map



Map 4. 4 Soil Erosion Map

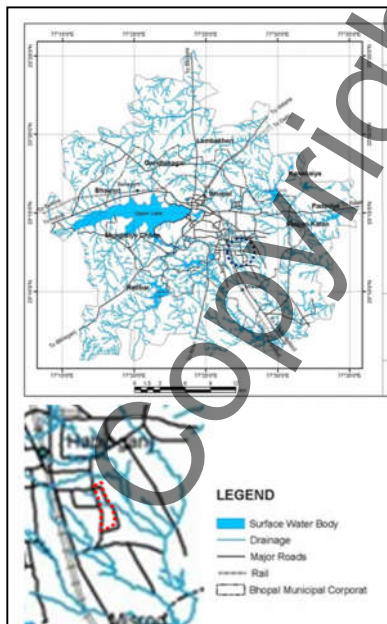
Source: Town & Country Planning, Bhopal

4.5.4. Soil Texture



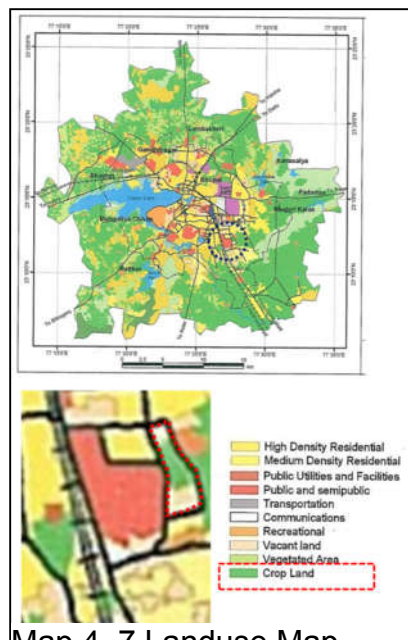
Map 4. 5 Soil Texture

4.5.5. Natural drainage map



Map 4. 6 Natural Drainage Map

4.5.6. Land use map (2005 year)



Map 4. 7 Landuse Map

## ACC. TO THE LANDUSE PLAN OF 2005:

- The site was proposed for the crop land use but after the proposal of AIIMS this land use was converted in to the semi public and public land use.
- The site is surrounded with residential area , public and semi public area : educational , Agricultural area.

## 4.6. Site surroundings



Map 4. 8 Site Surrounding

- The site is situated in the south eastern end of the city of Bhopal, off the national highway 12 to Nagpur , about 25 km from airport.
- The site is bounded by roads from 3 sides, the main access to the site which is from the north west end via Saket nagar connecting NH-12.
- This road will serve as a main route for those who arriving from the main city as well as from the outside.
- The railway stations, bus stops as well as airport are all accessed from this route .

- The smaller and less prominent route is on west , where the road brings people from the periphery of the city . This road has the right of way of 24 m which will going to serve both the land uses the residential as well as hospital.
- The other road is perpendicular to the main access route on east which divides the site into two which will be the part of site only and will be used by the hospital premises.
- The site is surrounded by three sides North, West and south by Residential land use and on east by village.
- Average height of buildings were G+1.
- There is a green buffer of 12 to 15m which creates a visual screen for the residences which are facing towards the site.

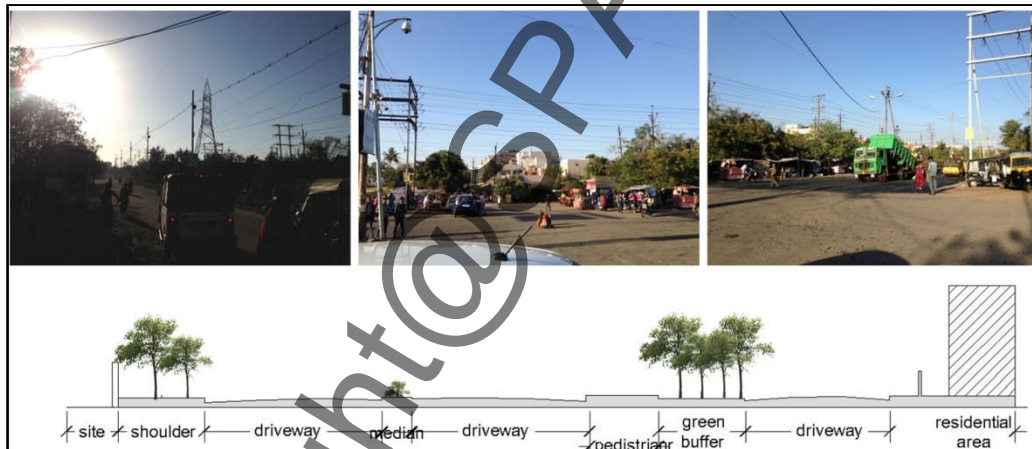


Figure 4. 4 Site Surrounding Area

#### 4.5.7. Existing Site Features

- The site is roughly rectangular in most part and widens at the south eastern corner . generally sloping from north to south, there is a level difference of 9.5 m from end to end with the gradual slope of 1in 12m.
- A mix of rocky areas and black sandy silt with clayey portions, the site has a low lying area in the south - eastern part that is prone to water logging.

#### 4.5.8. Soil and Geology

The site consists of two type of soil- Hard red soil mixed with basaltic boulders because of the presence of the red sand stone strata in Bhopal and the black cotton soil.

#### 4.5.9. Hydrology

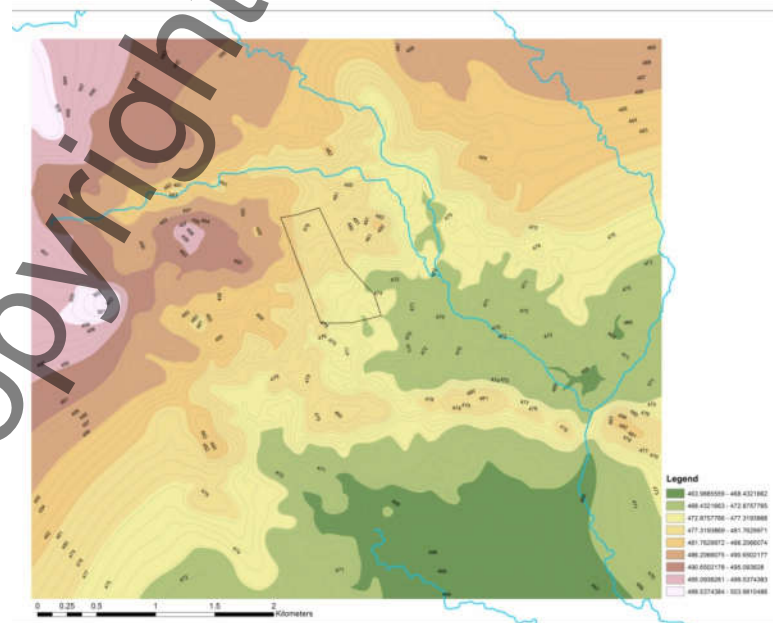
Underground water table:

According to the survey the water table is low , there is no water present till the depth of 60m. the source of water supply for this project will be from the municipal supply.

#### 4.5.10. Slope analysis

The lay of land is sloping gradually downward from North to South, with depression on the south east with the level difference of about 9.5m. There is a slope of about 1in 12.

The slope analysis of the site, most of the part is having the slope between 0 to 3% and rest of them lies between 3-5%. The slope of 5-10% of slope is very rare in the site.



Map 4. 9 Slope Analysis

Source: Generated in ArcGIS

4.5.11. Vegetation

- The vegetation within the site premises is very less, few of them are present at the edge of the road on east and some of them are present near the water body.
- The vegetation which is present at the edge of the road on east are young few of them have been planted recently.
- Though site is bounded with green buffer on north and east side, still there is very less vegetation found within the site.
- There is no shrubs is present on the site except of some wild bushes .
- The grass is found on almost all over the surface except in those areas where there is hard red soil with rocks.

Existing Trees:

1. AZADIRACHTA INDICA (NEEM) ----

Most dominant species, present along the road, few in the herbal garden area.

2. YELLOW OLEANDER -----

Present along the road and on the median.

3. SENNA SIAMEA (KASOD) -----

Present along the road.

4. ACACIA NILOTICA (BABOOL) -----

Most dominant species on the site.

5. ALLSTONIA SCHOLARIS (SAPTPARNI) ---

Present on the edge of the site.

6. TABERMAEMONTANA DIVARIATA (CHANDANI)

----- Present along the median.



4.5.12. Shadow analysis



Figure 4. 5 Shadow Analysis  
Source: Generated in Sketchup

4.5.13. Visual analysis



Figure 4. 6 Visual Analysis



Figure 4. 7 Visula Analysis

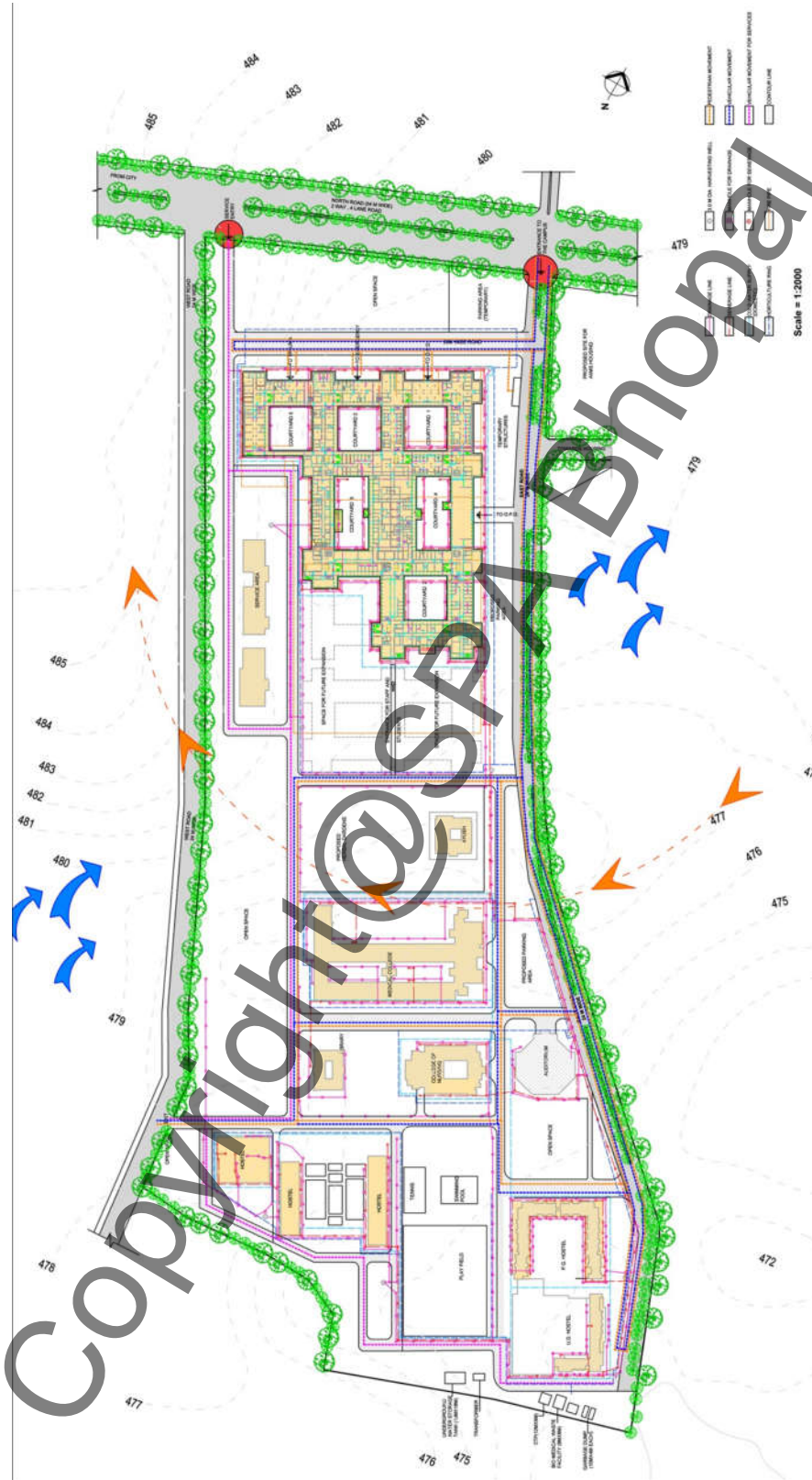


Figure 4. 8 Existing AIIMS Site Plan

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## Chapter 5- Design Proposal

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