



k r i y a

center for stroke and neurological rehabilitation

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Bengaluru, India

Sreedevi Moodahanglur Sooryanarayana

College of Architecture
Texas A&M University



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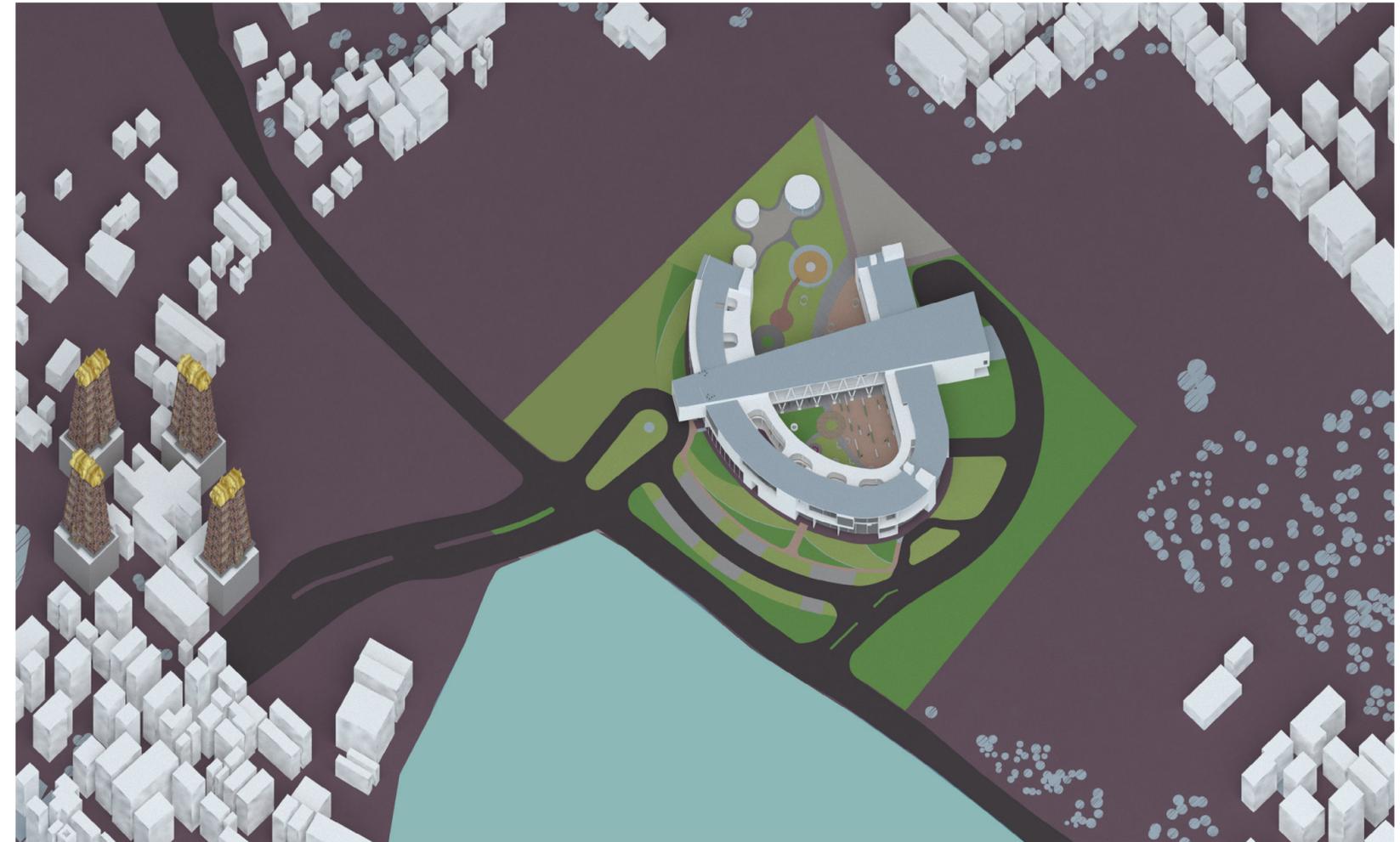
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Dedication

This is for you, Roopan Doss. Thanks for your kindness and endless support.



Kirk Hamilton
Committee Chair

Xuemei Zhu
Committee Member

Chanam Lee
Committee Member

Ray Pentecost
Studio Professor

meaning of 'kriya'

'Kriya' is a word in Sanskrit language which refers to -

“Purifying action, practice, exercise, rite, movement, function, skills” ; “to do, perform, postures, breadth and the sound that work towards a specific outcome”

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The design proposal is weaved around one of the major problems in India, Road traffic accidents. The consequences due to road traffic accidents may range from minor to major neurological disorders or even fatality. Unregulated traffic rules, reckless driving, drunken driving are amongst the most important factors contributing to accidents that occur in village roads and national highways. Additionally, there are no proper rehabilitation facilities for the victims of the road traffic accidents apart from the small private outpatient clinics that serve them. These clinics do not contribute effectively, since the process of healing takes months together. Hence, there is an increasing need to prevent, treat and educate the public regarding this growing issue.

The construct of this paper takes us through the journey of the proposed design for the Stroke and Neurological Center, starting from the background study required to understand the problem and create necessary design characteristics, followed by stating the express need for such design in the context, detailing the goals to be achieved by the design, and also, laying out the specific challenges faced during the design process. The background study is also well supported with the help of capable and detailed case study analysis undertaken. Combining all the provided information, this paper tries to provide the big picture involved behind the design, and delving deep into the planning, structure and philosophies that eventually led to the construction of the design.

As an architect, designing the spaces keeping in mind the end user and enhancing their experience in the space is very important. In expressing this, the architect can choose a path for themselves, which could be creative or traditional, iconic or subtle, abstract or direct and with material variations. The architectural thought behind this design was to make it symbolic to the outside environment and on the inside of the building, it is designed to be interactive, experiential, conversing between the inside and the outside through intermediate semi-open and open spaces, helping in healing of the patients through the therapies provided outdoors.

Road traffic accidents are one of the main causes of fatalities in India. The number of casualties caused by road accidents are more than the casualties caused by some epidemics in the country. Studies show that around 150,000 deaths occurred due to road traffic accidents in the year 2015. And according to the same studies, the sheer number of people who are left injured, or, in some more damaging cases, seriously incapacitated, are more when compared to the number of deaths caused by road accidents.

Further, many studies (Ministry of Road Transport and Highways, 2015; Transport Department, Government of Karnataka, 2015; Sastry, 2012) show that the major consequence for people involved in a road accident is identified as neurological disorders. Neurological disorders are considered as a broad spectrum and the consequences of road accidents may result in the following neurological disorders such as, traumatic brain injuries, spinal cord and brain injuries, whiplash, leg and knee injuries, paralysis, sprains and strains, stress injuries, nerve injuries and so on, which affects an individual both mentally and physically.

Depending upon the information available from statistics, it is evident that there is an increasing need to create awareness among the public about the safety measures while riding and driving, and for the treatment of patients diagnosed with severe neurological disorders after any injury. Hence, I have decided to design a facility which provides rehabilitation services to the aforementioned victims of the road traffic accidents and also create awareness among the public about road traffic accidents, through various programs.

The scope of the project has been narrowed down to provide physiotherapeutic treatment to the patients diagnosed with neurological conditions that were acquired from road traffic accidents. The center helps the victims to walk, balance and support their body weight, teaches self-care skills and thereby helps in providing a stress-free, self-sustaining lifestyle to its patients, and consequently, uplifting the overall well-being of an individual. At the same time, the center also acts as a platform which strives to create awareness about the road traffic accidents and safety measures that need to be taken against road traffic accidents.

Challenges faced by patients



Social isolation



Physical disability



Poor Communication



Tiredness and Fatigue



Emotional problems

Vision for changing the life of the people for the better

Since road traffic accidents can occur to anyone irrespective of their age, the consequences for different patients across the age group might change accordingly. These victims suffer from a range of injuries and are forced to go through specific challenges such as physiological changes, and pain of losing body parts or severely injuring them, communication problems such as difficulty in pronouncing or losing the voice, tiredness and fatigue due to injuries, inability to perform normal social skills, social isolation from family and friends and emotional challenges to deal with all of the above. These challenges are just a small part of the broad spectrum of the changes and the challenges that these patients face through the course of their period of recovery, and in some extreme cases, for their entire lifetime.

This design is aimed at emerging as an opportunity to change the life of the victims, the design is a refreshing space with programs to provide therapeutic treatments, and the building is designed to be therapeutic by itself. The building takes the patient through the process of healing, mothering them, helping them through the journey of getting over their insecurities, building their sense of independence, and ultimately, taking control of the environment.

Design Considerations



Engaging patients and their family



Visual access to nature



Blurring the indoor and the outdoor environment



Clear circulation system



Affordable Care

Art and nature as a positive distraction



Provision of natural light



Responsive architecture



Engaging the community in the healing process



Alternative therapies

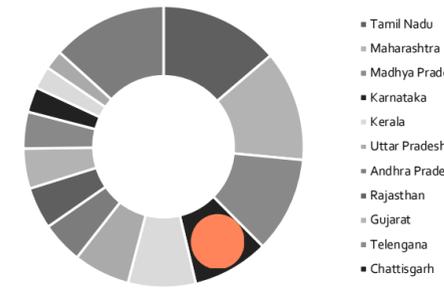


Figure 1(a) - Percentage Share in Total Number of Road Accidents (in %), 2015 (Ministry of Road Transport and Highways, 2015; Transport Department, Government of Karnataka, 2015)



Figure 1 (b)-Percentage Share in Total Number of Persons killed in Road Accidents (in %), 2015 (Ministry of Road Transport and Highways, 2015; Transport Department, Government of Karnataka, 2015)

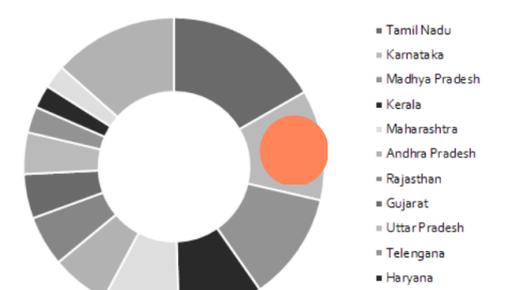


Figure 1 (c) - Percentage Share in Total Number of Persons Injured in Road Accidents (in %), 2015 (Ministry of Road Transport and Highways, 2015; Transport Department, Government of Karnataka, 2015)

Figure 2 - Age Profile of Road Accident Victims (Passengers as well as drivers)

(Ministry of Road Transport and Highways, 2015; Transport Department, Government of Karnataka, 2015)

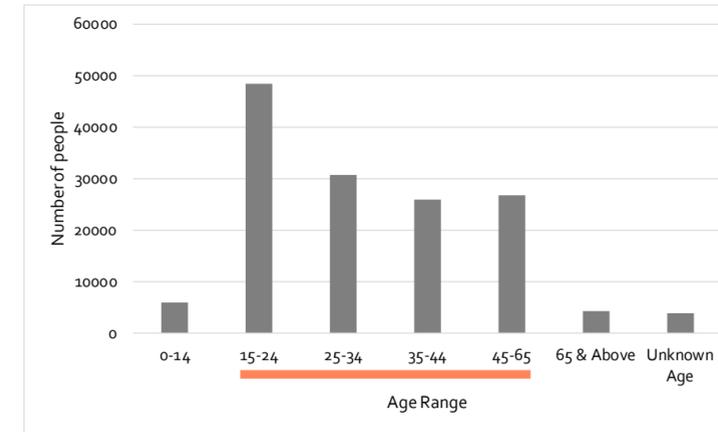
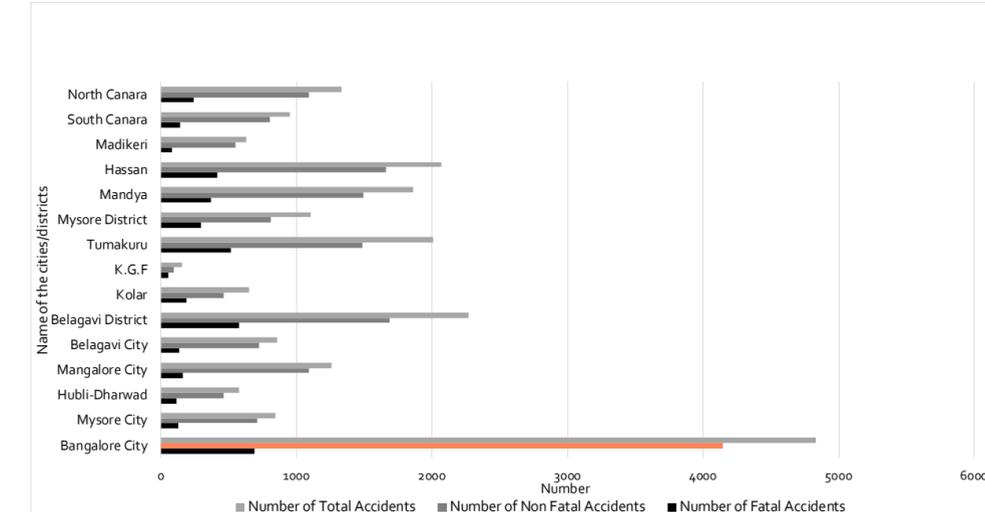


Figure 3 - Details of Accidents during the year (January 2015 - December 2015) in Karnataka, India

(Ministry of Road Transport and Highways, 2015; Transport Department, Government of Karnataka, 2015)



<p>Serving population</p> 	<p>Medical or clinical conditions that are treated in the Center</p> 	<p>Goals</p> 
<p>Age group</p>  <p>Gender</p>  <p>Geographic location</p>  <p>Inpatient Beds</p> 	<p>Targeted towards the people belonging to the age group between 20 and 65 years. Treatments are effective for the above mentioned age group, but available to all age groups.</p> <p>Male and Female Adults</p> <p>Bengaluru, Karnataka, India</p> <p>10</p>	<p>Traumatic brain injury including a fall, blow to the head, gunshot wound or other traumatic injury. Post Traumatic Epilepsy Stroke/ Head injury Spinal cord and back injuries Whiplash (neck injury) Leg and knee injuries, broken bones Paralysis Stress Concussion, sprains and strains, stress fracture etc., Nerve injuries</p> <p>- Design that blends in with the nature but is still distinctive - Visual access to nature - Responsive architecture</p> <p>Educating and engaging the public, patient and the family Shared efficiency and flexibility</p> <p>Serve future expansion.</p> <p>Envision an energy efficient design and have minimal future maintenance cost. Provide affordable care to the public.</p> <p>Form</p>  <p>Function</p>  <p>Time</p>  <p>Economy</p> 

Functional and Spatial Description

(NewRo Rehab, n.d.; Bangalore Neuro Centre, n.d.; Recoup, n.d.; National Institute of Mental Health and Neuro Sciences (NIMHANS), n.d.; Space Planning Criteria, 2016)

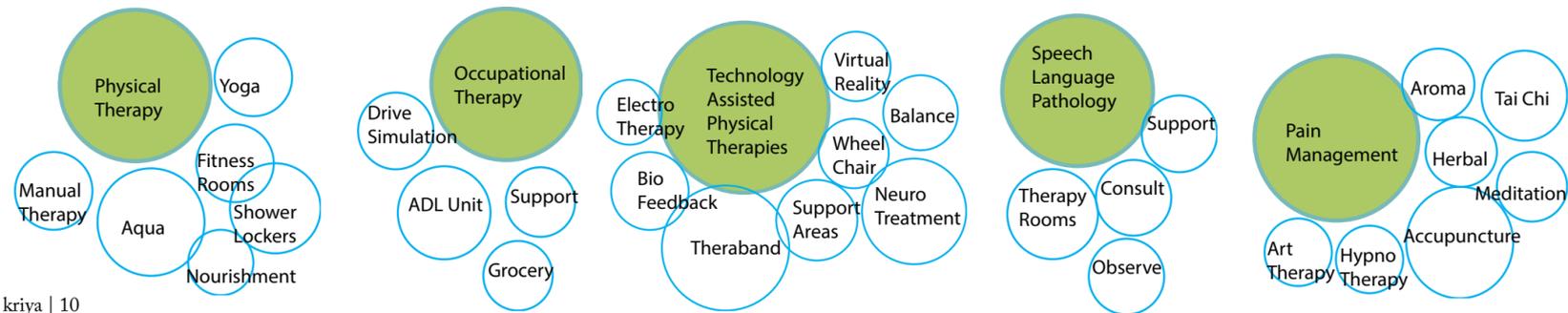


Figure 4 - Theraband



Figure 5 - Fitness



Figure 6 - Biofeedback



Figure 7 - ADL Suite

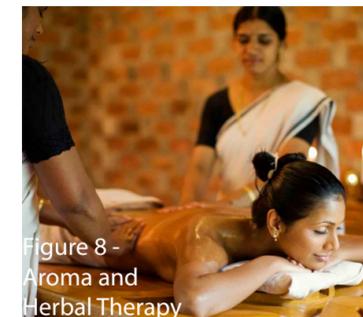


Figure 8 - Aroma and Herbal Therapy



Figure 9 - Aqua Therapy



Figure 10 - Manual Therapy



Figure 11 - Virtual Reality



Figure 12 - Speech and Audio Consult



Figure 13 - Horticulture Therapy

Sayanomoto Clinic

Saga, Japan
(Yamazaki Kentaro Design Workshop, 2016)

This is a mental health clinic in Saga City specializing in the treatment of patients with dementia.

Emphasis

The Sayanomoto clinic includes an educational space for the patients and their families, with a 30-metre long bookshelf containing a variety of coffee table books, rather than conceptual writing.

By creating this common space where patients, staff and families can interact, the center seeks to connect people through “Learning.”

This “Learning” common space was created intended for patients living with dementia and their families.

The educational space is lined with the bookshelf on one side and is open towards the nature on the other side.

This idea of an educational space along the corridor is referred and implemented in a unique way in my proposed design.



Figure 14 - Learning space

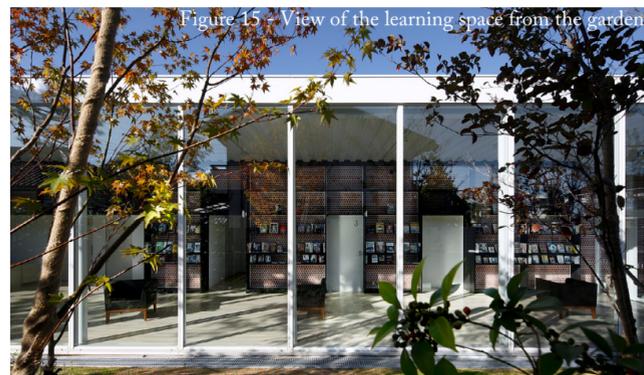


Figure 15 - View of the learning space from the garden

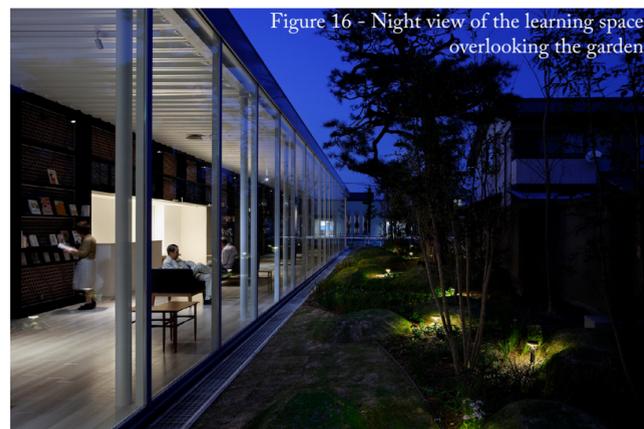


Figure 16 - Night view of the learning space overlooking the garden



Figure 17 - Indoor labyrinth



Figure 18 - Coffee bar

Family Lounge

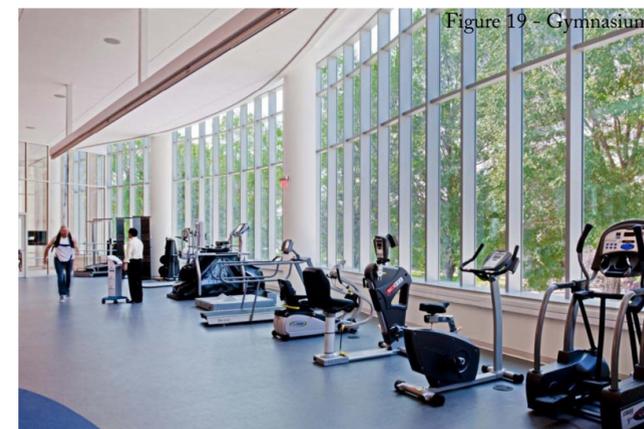


Figure 19 - Gymnasium

National Intrepid Center for Excellence

Bethesda, Maryland
(Foote & Schwartz, 2012; Ladd & Costello, 2012)

The National Intrepid Center of Excellence is a Department of Defense organization that provides TBI services with clinical care, diagnosis, research and education of military service members about psychological health conditions.

Emphasis

Throughout the facility there are a variety of comprehensive support spaces to help patients and their families maximize their potential for recovery. The spaces enable patients and family members to have a place to relax between treatments and provide emotional and spiritual support to one another.

Support spaces include semi outdoor and indoor spaces such as the patient/family coffee bar, child play area, central park which has a labyrinth, skylight space designed to accommodate theater performances; meditative activities; music programs; art therapy; and recreational play for families.

Secondly, the design of the family lounges as the break point, helps in cultivating interaction and engagement between the masses.

Lastly, the gymnasium space that is designed to open itself towards the nature with the view through the huge expanse glasses provides positive distraction to the patients and helps in the process of healing.

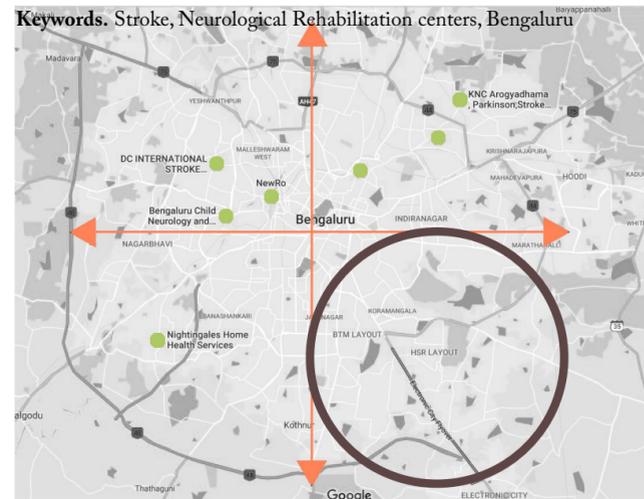


Figure 20 - Existing Stroke and Neurological Rehabilitation centers, Bengaluru

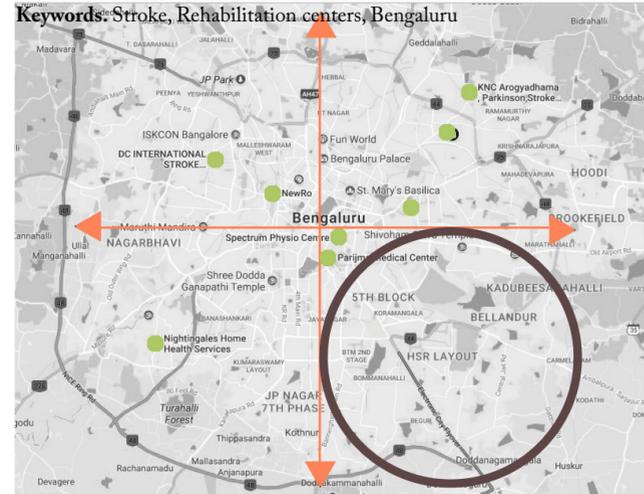


Figure 21 - Existing Stroke and Neurological Rehabilitation centers, Bengaluru

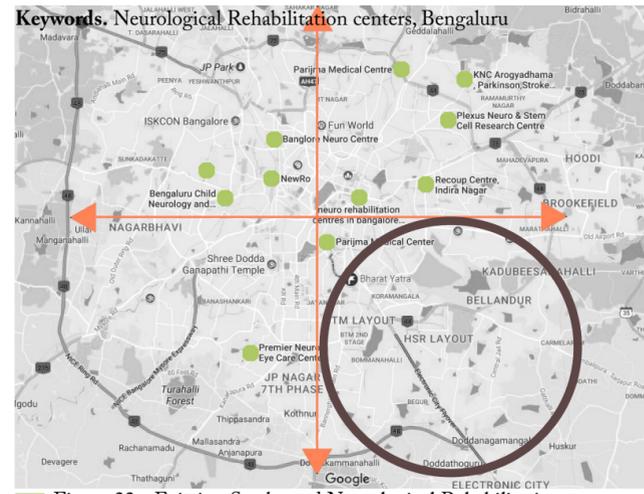


Figure 22 - Existing Stroke and Neurological Rehabilitation centers, Bengaluru



Different keywords were used in the search using Google Maps to study the number of Stroke and neurological rehabilitation centers present around the city of Bengaluru. This was soon followed by similar pattern recognition activities, to identify that the South East region of the city had very small number of Stroke and neurological rehabilitation centers, which did not provide

any inpatient services for the affected. Additionally, the major industrial areas and technology parks in the city were present along the highway on the South Eastern side of the city, called as Electronic City, which is a hot spot for frequent road traffic accidents. Based on the above mentioned factors, a decision was made to pick a site on the South East region of the city.



Map of Bengaluru city
Figure 23 - Existing Stroke and Neurological Rehabilitation centers, Bengaluru



Figure 24 - World map highlighting the Indian subcontinent

The study area chosen for the project, Bengaluru, is one of the eight metropolitan cities in the entire country, and is the capital of the state of Karnataka. Based on the statistics, Karnataka ranks second on the list for the number of road accident injuries reported in the country, and its capital, Bengaluru, ranks first in the state on the same statistic.

The site was selected based on rigorous analysis of the location and program description of the existing stroke and neurological centers in the city, along with a survey of the accident-prone roads and facilities available in and around the same. The selected site is on the Begur road, located in the South East region of Bengaluru city. The selected site is surrounded on its boundaries with a historical temple towards the south west, Begur lake towards its South East and thick vegetation towards its North East and residential neighborhood towards the North West.

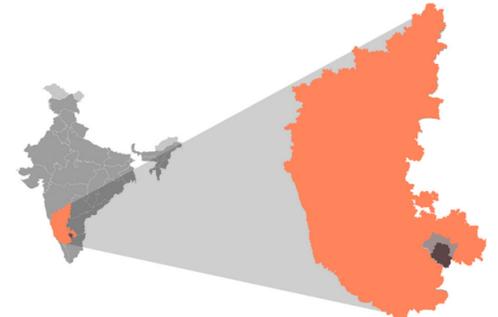


Figure 25 - Indian map highlighting the Bengaluru city within the Karnataka state

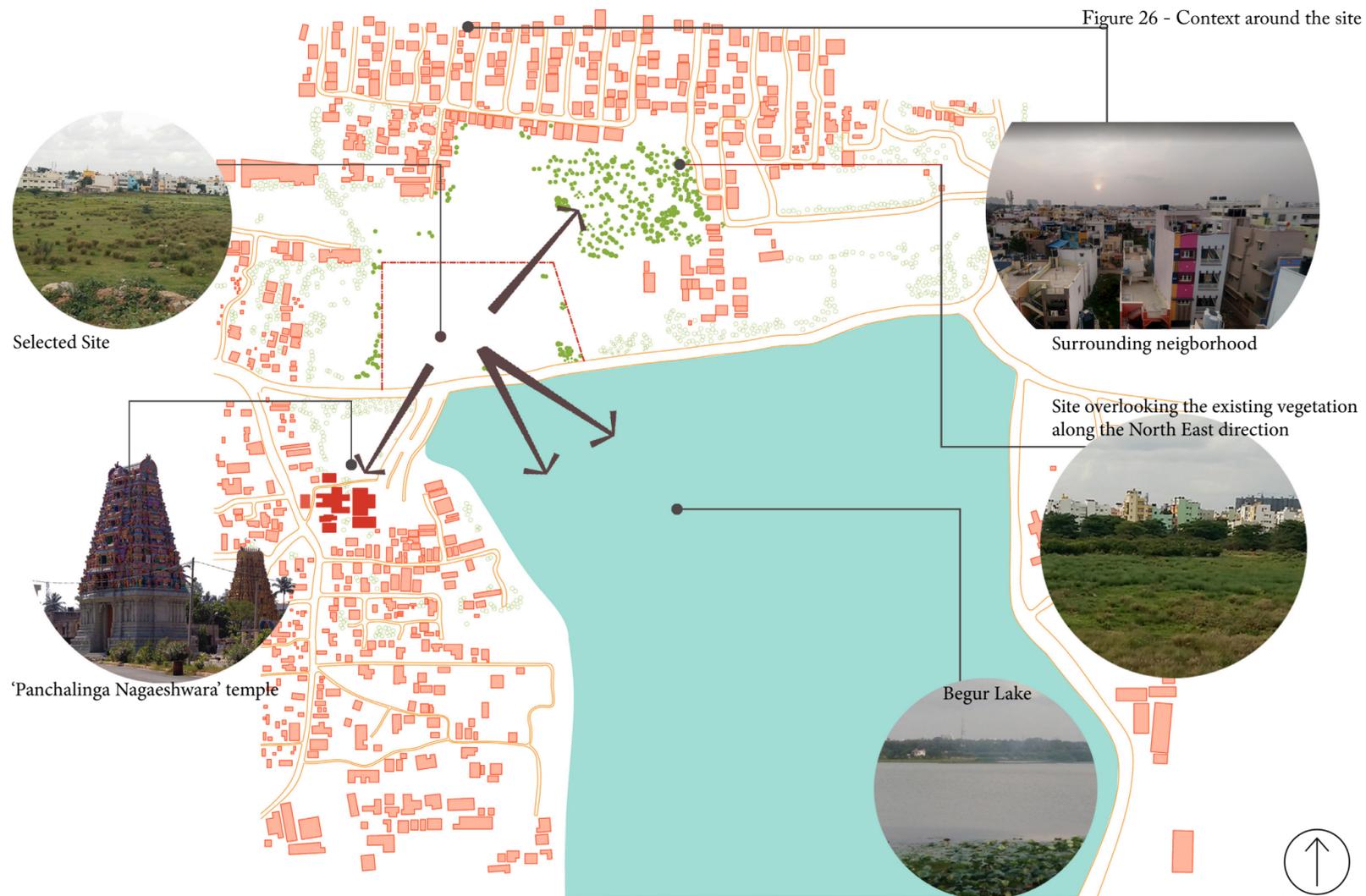


Figure 26 - Context around the site

The context of the site includes a historic temple to the front, Begur Lake opposite to the temple, and thick vegetation towards the rear. Apart from this, it is covered by five to six storey residential units towards the North West.

Overall, the selected site is a five-acre land, with no vegetation and the topography is almost flat,

except around the edges, where it slopes slightly and helping in draining water from the site.

Pancha Linga Nageshwara Temple
The Nageshwara temple complex is located in Begur, a small town within the Bangalore urban district of the state of Karnataka, India. Pancha Linga Nageshwara temple is located in the centre of

Begur, and has a 1100-year old inscription, which has the oldest existing reference to a place called 'Bengaluru'. There are two shrines within the temple complex, titled 'Nageshwara' and 'Nageshvarasvami'.

Begur Lake
Begur lake forms the perfect backdrop for the historical Pancha Linga Nageshwara temple.

The farmers from the surrounding areas, depend on this lake for irrigation during the summer season.

Vegetation
Delonix regia (Gulmohur), Pon-

gamia pinnata (Indian elm), Albizia lebbek (L.) Benth (East Indian walnut) are the common trees found at this location.

Residential neighborhood
Residential units with five to six storey buildings are located around the North Western corner of the site.



Figure 27 - Google image of the site and its surroundings.

Geography

The city of Bengaluru, lies in the south-eastern part of the Southern state of Karnataka. It has a tropical Savanna climate, with distinct wet and dry seasons. Due to its high elevation, Bengaluru usually enjoys moderate climate throughout the year.

Sun path

The western and the eastern facades should be shorter, since it receives the maximum amount of sunlight and heat all the time. Secondly, the southern facade receives high intensity sunlight, heat and glare. Natural daylight from the north and the north-eastern direction is soothing, and maximum number of openings should be provided facing that direction.

Wind flow

The primary wind flows from the south-western direction, the secondary wind flows from the east, and tertiary winds from the south-eastern and the north-eastern direction throughout the year.

To avoid the heat and the glare from the southern direction, traditionally in India, Jaali (Lattice) screens of various materials and patterns are used to protect the indoor built environment from the harsh sunlight.

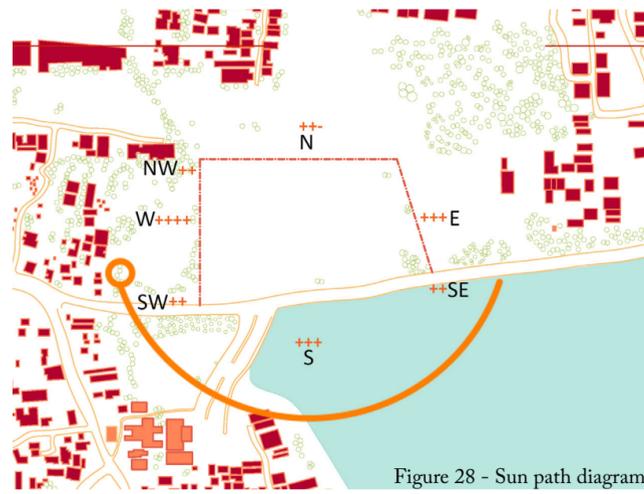


Figure 28 - Sun path diagram

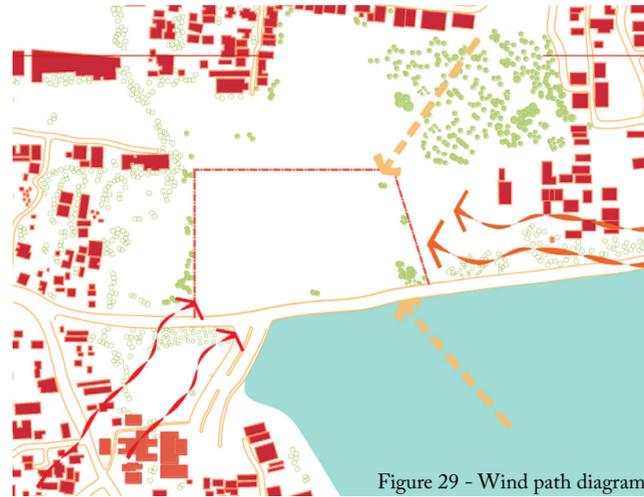


Figure 29 - Wind path diagram

- Primary wind - South West
- Secondary wind - East
- Tertiary wind - South East and North East



Goals derived from the form, function, time and economy specific to the project

(As explained in the Problem seeking book by William Pena)

1. Creating an architecture that is anchored between the two elements on the site, a natural element – the lake and the man-made element – the temple; both of which are calming, stress relieving, peaceful and acts as a positive distraction, and help in the process of healing.
2. Providing visual access towards the nature and the landscapes within the site and surroundings, which acts as a positive distraction, thereby helping to alleviate stress and encourage physical well-being.
3. A rehabilitation design wedged into the fabric of the sub-urban area that is warm, inviting, caring, serving and educating the patient, their family and the public about the conditions and their effects.
4. Engaging the family members accompanying the patients in various activities.
5. Efficient design of shared spaces to enhance the efficiency of the staff and the center.
6. Achieving responsive architecture considering the geographical location of the site and the context around it.
7. Envisioned to be energy efficient and to have minimal future maintenance cost.
8. Providing affordable care to the public.
9. To serve future expansion.
10. To enhance the economic conditions of the people in the neighborhood.

Design Challenges/ Research

1. Rigorous analysis on the kinds of movement and physical conditions, the causes for these conditions and its effects on the members of the family and the society.
2. Investigation on the types of neurological disorders.
3. To explore the types of the treatment, recovery methods and the rehabilitation programs for specific conditions.
4. Space listing for the proposal.
4. ADA requirements for the design.
5. Mental, emotional and physical challenges that the patients undergo and the variety of programs that could be implemented in the center to alleviate the same.
6. Investigation on how the visual access and the outdoor physical therapies could contribute to the overall well-being of the victim.

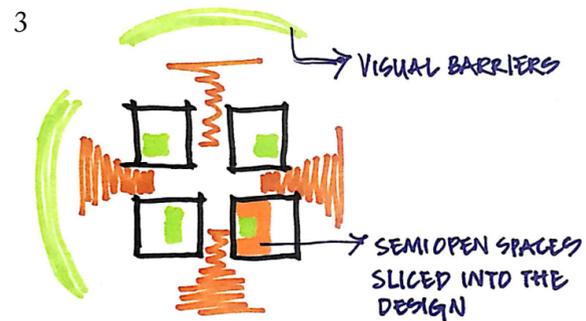
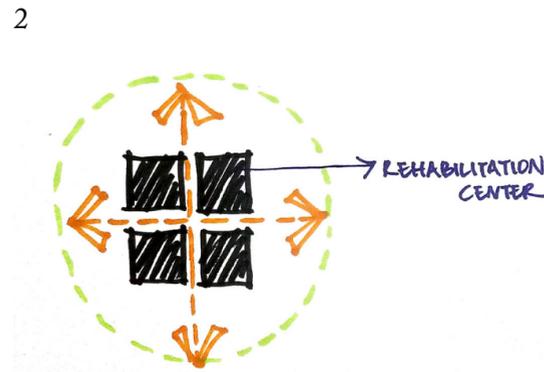
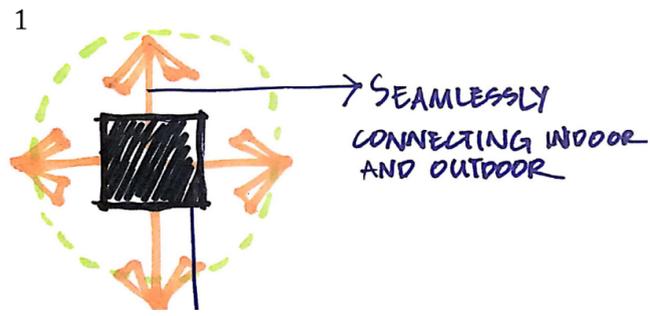
The main idea of the proposed rehabilitation center is to connect the indoor and the outdoor spaces together. Studies and research show that therapy for the patients in the outdoor environment is very essential since life after treatment would require them to accommodate to life in the outside world.

So, in the proposed design, along with the treatments provided inside the hospital, patients are exposed to the outside environment and treated outdoors through a variety of outdoor programs.

As a result, the patients learn to adapt to the external conditions after leaving the hospital.

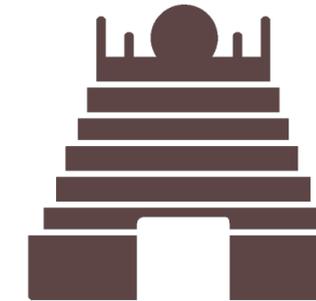
Breaking the mass and connecting the built to the unbuilt.

Later, green spaces of different scales and experiences are introduced into the design with different therapy areas, family engagement spaces, quiet meditation spaces and play areas.



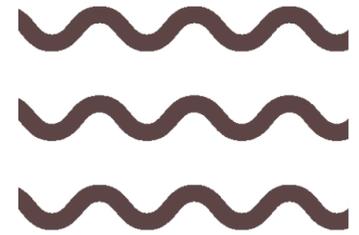
A man made element Temple

A temple evokes a feeling of peace, acts as a stress reliever, promotes a calming environment and also acts as a positive distraction to the patients.



Natural element Lake

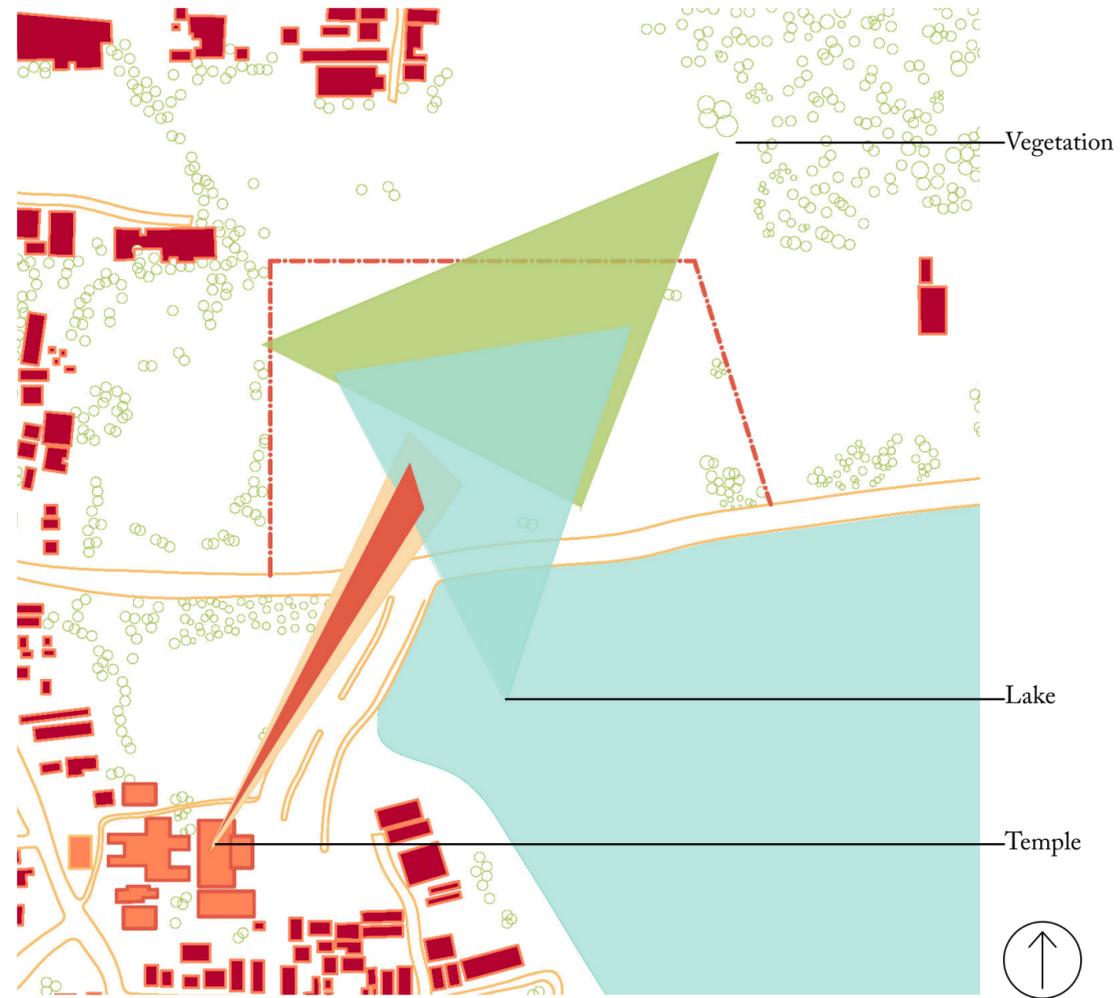
Evidence based study shows that visual access towards nature acts as a positive distraction to the patients, relieves stress, helps them in calming, bringing positive feelings and gives a sense of peace



The big idea

Creating an architecture that is anchored between these two elements (the lake and the temple), which will help in the process of healing and bring in a positive change in the patients' lives.

Figure 31 - View corridors from the site pointing to the temple, the vegetation and the lake



Public space Therapy space Inpatient Units

The massing is divided into three blocks with respect to the site context that has a temple, a lake and thick vegetation.

1. Regulating lines are drawn from the site towards the temple to create a dialogue between the building mass and the temple. This part of the building mass acts as the main public space where the temple axis is accentuated in the proposed building mass at certain points with different types of programs such as monumental stairs, a labyrinth, the Alhambra-inspired pond, sculptural garden and the indoor hydro therapy pool.
2. Therapeutic gym block, which is the main component of Physical Therapy, is placed such that there is direct visual access towards the lake.
3. Inpatient units are placed in the rear end, for the privacy of patients and to provide them with a view towards the vegetation.

Through the process, the building is evolved with the therapy block placed at two levels, forming a semicircular shape to make the best use of the lake's view and the public space evolving into a trapezoidal form with a strong temple axis contained within.

The orange block (public space), is placed facing the temple, indicating to having a constant dialogue between the temple and the rehabilitation center.

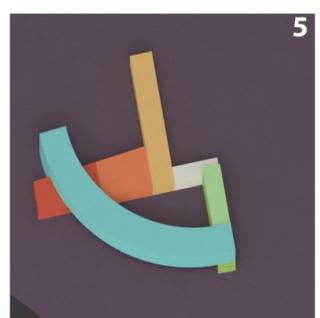
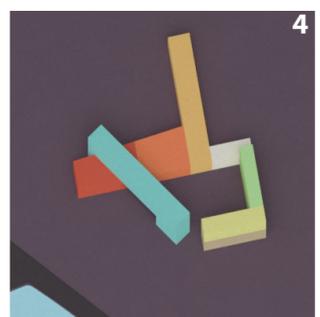
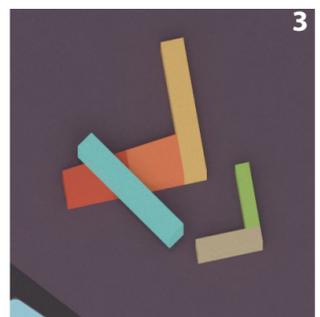
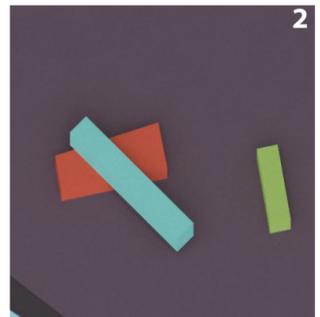
The blue block, which also contains the therapy gym, was raised to a higher level to get a proper view towards the lake.

The green block which holds the inpatient units is placed towards the rear side of the site facing towards the vegetation, providing visual access to the nature.

Additional support areas such as administration, staff area, utility and storage, mechanical spaces are differentiated and added.

The therapy area (Blue block) is further curved to provide a continuous and overall view towards the lake, thereby making the best use of the lake.

So, on the whole, here is the complete form with a semi-circular arc mass providing visual access towards the lake and the indoor landscape area. The trapezoidal form accentuating the temple axis and the rear inpatient block with the view towards vegetation. with view towards vegetation.



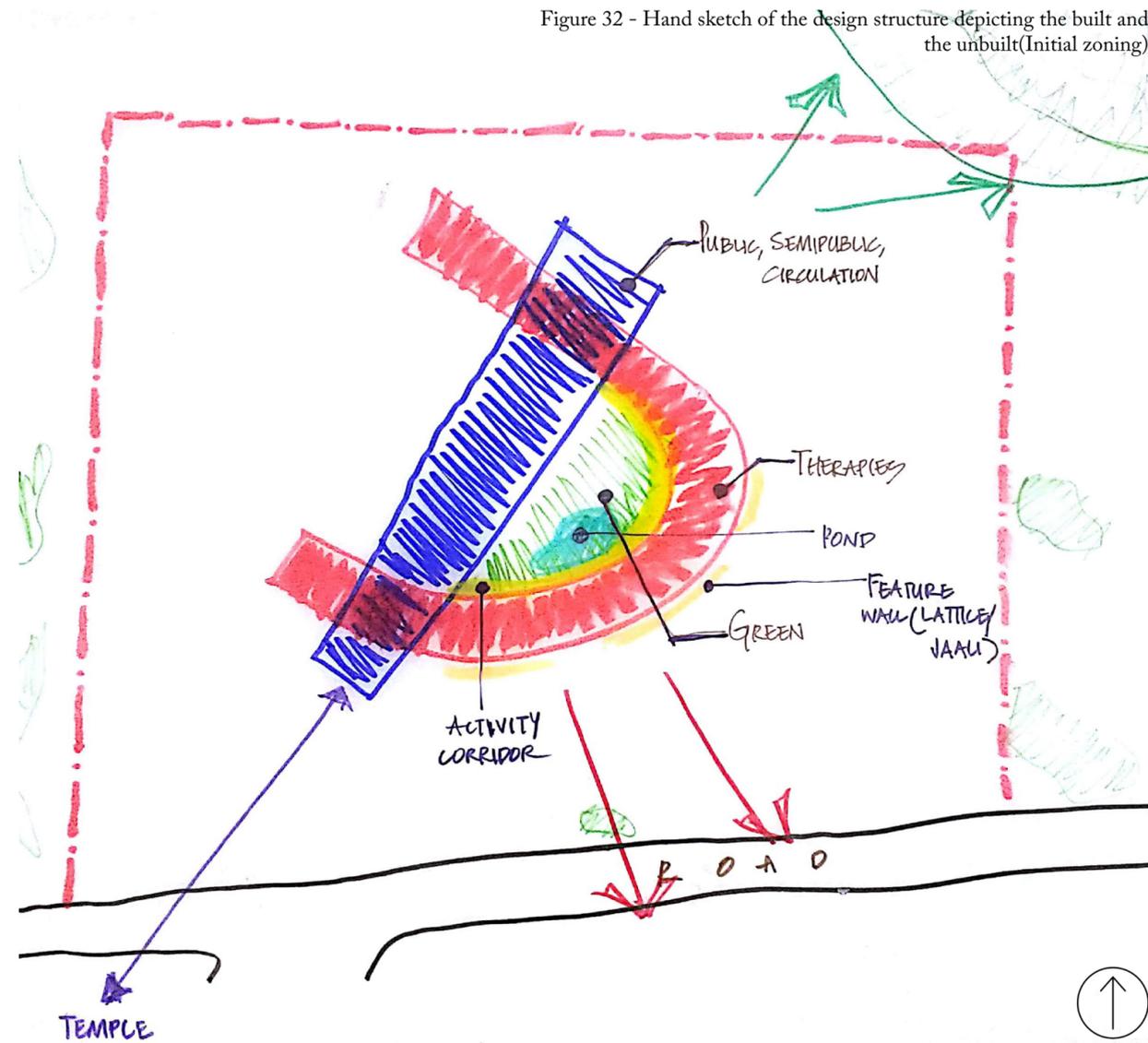


Figure 32 - Hand sketch of the design structure depicting the built and the unbuilt (Initial zoning)

This architectural piece is proud to show its form, and welcomes patients irrespective of their disabilities, age, financial status and social norms, speaks loud and bold to the patients, their families and the general public regarding the effects of road traffic accidents and steps to prevent them.

The built and the unbuilt is designed in four stages

- The semicircular arc
- The open space enclosed by the curve
- The trapezoidal form slicing through the curve
- The open space extending outwards from the center

Semicircular Arc – A therapeutic healing zone

This curve houses all the clinical programs of the center. This also provides visual access to the natural elements in the design, both inward, looking towards the therapeutic garden, and outward, looking towards the relaxation garden and the Begur lake. Combining such views on either side of the built space and focusing most of the clinical programs in this area, allows for the improved and more efficient healing of patients.

This long-curved corridor space on the inside of the building contains descriptive artwork and informational exhibits to create awareness among the patients and public, establish companionship and provide encouragement to the patients.

The open space enclosed by the curve

This open space in the center is enclosed by the semicircular arc/therapy block on all the three sides and is merging with the trapezoidal form on the other side. This zone houses the outdoor therapeutic programs for the rehabilitation center such as group therapies, art therapies, tai chi, horticultural beds and central plaza. This acts as a protective space for the dependent patients, which is peaceful, quiet, safe, secure; yet semi-open.

The trapezoid form slicing through the curve A transitional and prevention space

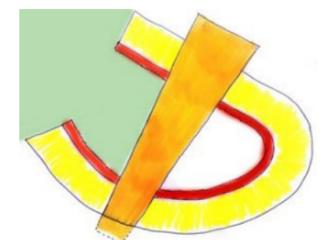
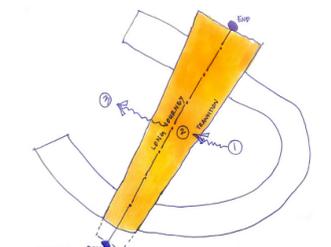
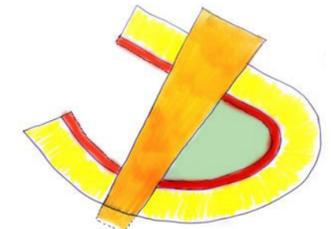
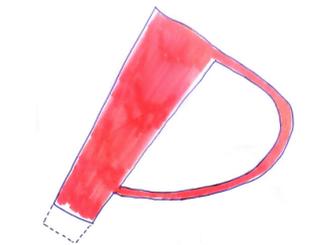
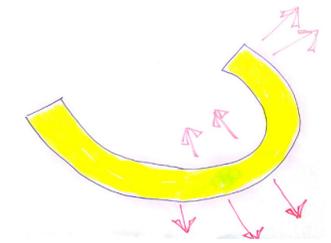
This trapezoidal area depicts a 'transitional zone' in a person's life. It is a space, which gives the experience of looking through the journey of life, which is not short, but one must walk through it and will see the end at some point. This space is a transitional medium from secured, formal and protected open area with victims who suffered from insecurities and dependency to more open and controlled environment.

In addition, the primary entrance for the center is provided at the front face of the trapezoid which accentuates the point of entry and the fact that people could experience this transition between the protected and the unprotected, as soon as they enter the building.

This form contains an exhibition space which educates, prevents and creates awareness among the public and the victims about the road traffic accidents.

The open space extending outwards from the center

This being the open zone, which is active and fun, is accessed both by the patients those who have overcome their disability and are independent, and the public for their engagement with the patients and their entertainment.



The complete form - Progression of healing

Overall, the design is establishing a progression in the process of healing of the victims, with its clinical programs housed in the semicircular arc, a zone with its protective nature, then the central semi-enclosed space designed to house the outdoor therapies for the dependent victims, the open area further with its informal, active and fun nature for the patients and the public who are in control of their body. Finally, these two zones are connected through the partly enclosed trapezoidal block which acts as a transition zone between them.

The building form along with its landscape, portrays the positive progression of healing in the patient's life from being dependent to becoming independent, from being insecure to controlling the body and the environment; which involves a long journey by itself. This is accentuated by the expanding outdoor path/walkway that connects the protected open space to the unprotected and open space.

The Planning

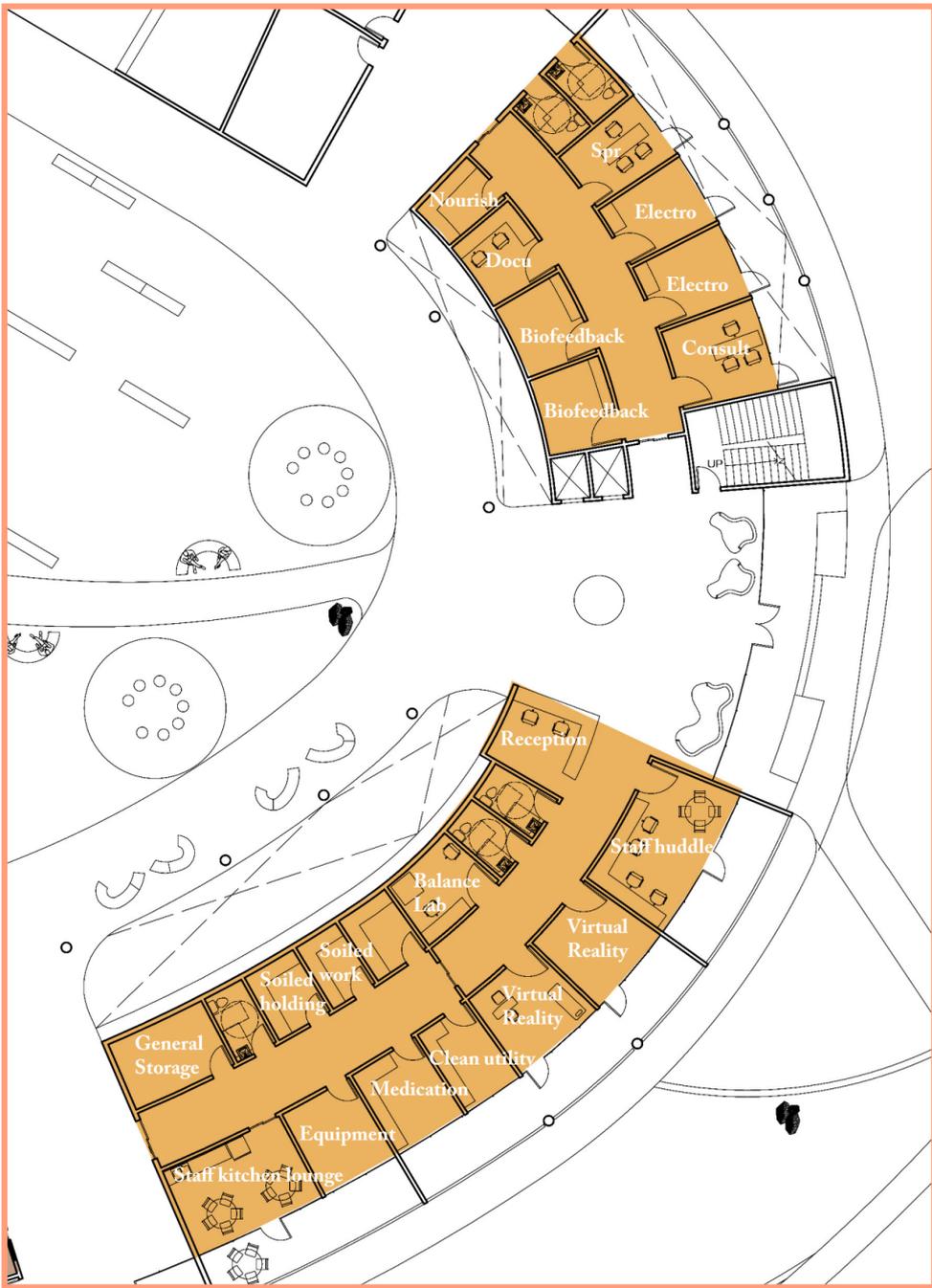
The rehabilitation programs such as the consultation and examination, diagnostic imaging, technology assisted therapies, occupational therapy programs, pharmacy and hydro therapy pool are placed in the Level One of the semi arc structure.

The level one and the level two of the trapezoidal form contains the public space which contains the gallery and exhibition spaces that helps in creating awareness and safety measures regarding the road traffic accidents among the community.

Additionally, the corridor space of the semi arc structure acts as an awareness corridor where the walls behind the courtyards are painted by the local artists from the community with themes involving content related to traffic safety, accidents and so on.

Therefore, the proposed center acts as a rehabilitation center till the office hours and then the center is open for the public to organize exhibitions and workshops related to the road traffic accidental issues. Lastly, the center also provides a platform for the local artists to exhibit their skills through their work being on the corridor walls of the rehabilitation center.





Technology Assisted Therapies

This block contains programs such as bio feedback, virtual reality, balance lab, which constitute the indoor therapies. Additionally, it also contains support areas such as equipment, medication, general storage, soiled heating, clean utility, patient toilets, waiting and reception spaces, shared staff kitchen and lounge, staff toilets, and staff huddle.



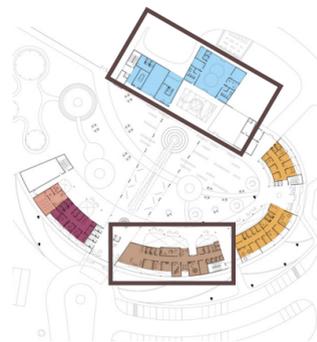
- Pharmacy
- Consultation and Exam rooms
- Diagnostic and Imaging
- Technology Assisted Therapies
- Occupational Therapy

0 10 50 100 200ft



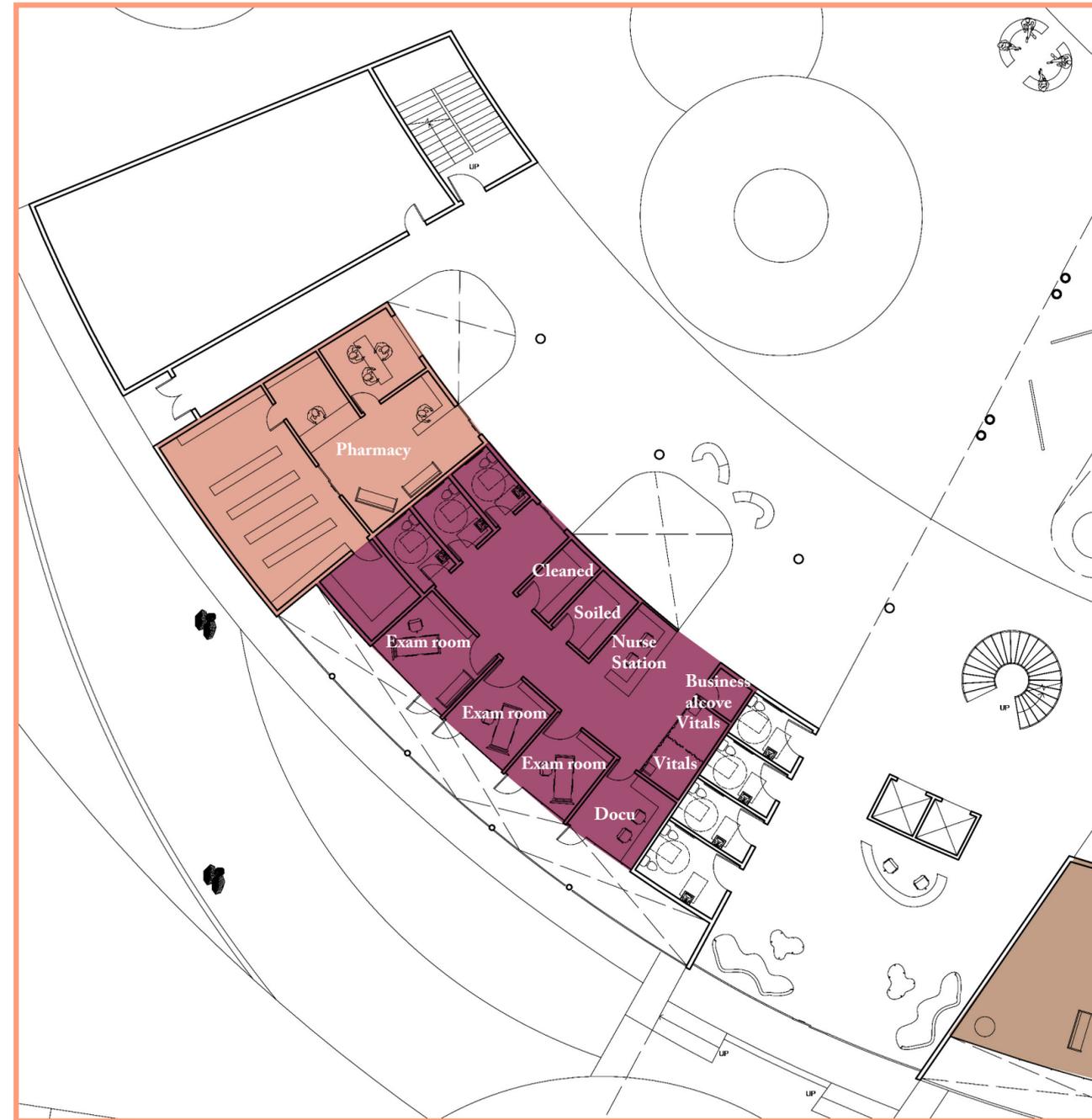
Occupational Therapy

This block contains the Aqua therapy pool which is aligned with the temple axis line in the trapezoid-shaped public space. Additionally, it includes the ADL suite, Mock-up grocery store, Drive simulation unit to help the patients in participating in their daily activities such as swimming, doing groceries from a store, household chores and driving.



Diagnostic Imaging

This area includes the CT scan, MRI, X-Ray and their associated utility spaces, which is a part of the diagnostic imaging department of the building design.



Exam and Consultation

This block includes several exam rooms next to each other, with a nurse station and vitals at the entrance, which also holds general requirements such as clean utility and soiled holding, staff and patient toilets, documentation area and a small business alcove.

Additionally, pharmacy is placed next to this area which serves the rehabilitation center. The pharmacy is divided into sub-waiting, reception, consultation, pick up and storage areas.





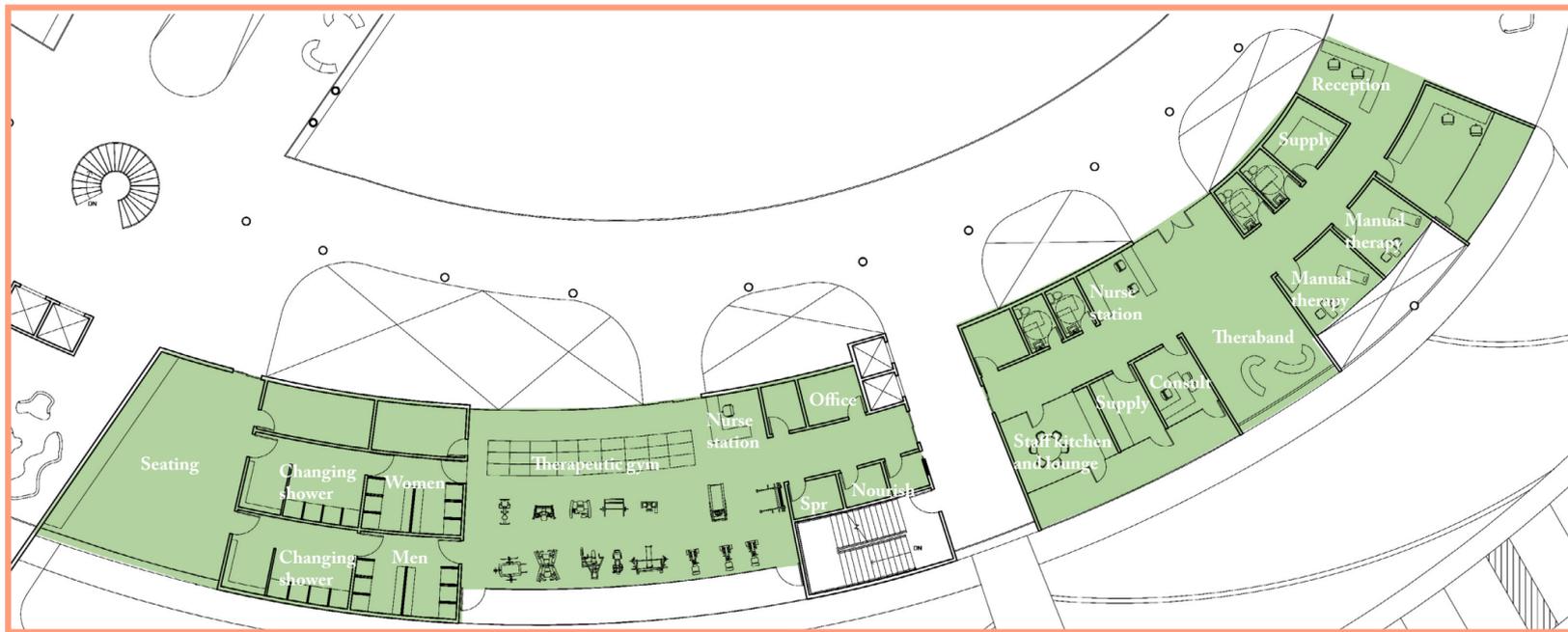
Pain management/ Alternative medicine

This area contains herbal, aroma and hypnotherapy rooms where the patients are treated with massages. Also includes additional support areas such as sub-waiting, reception, patient toilets, laundry, staff kitchen and lounge, documentation, physician room, soiled, clean utility and toilets for the staff.

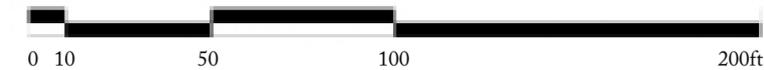


Technology Assisted Therapies

This spatial arrangement includes therapeutic gym, manual therapy rooms and neuro developmental spaces. It also contains the support areas as shown in the plan below.

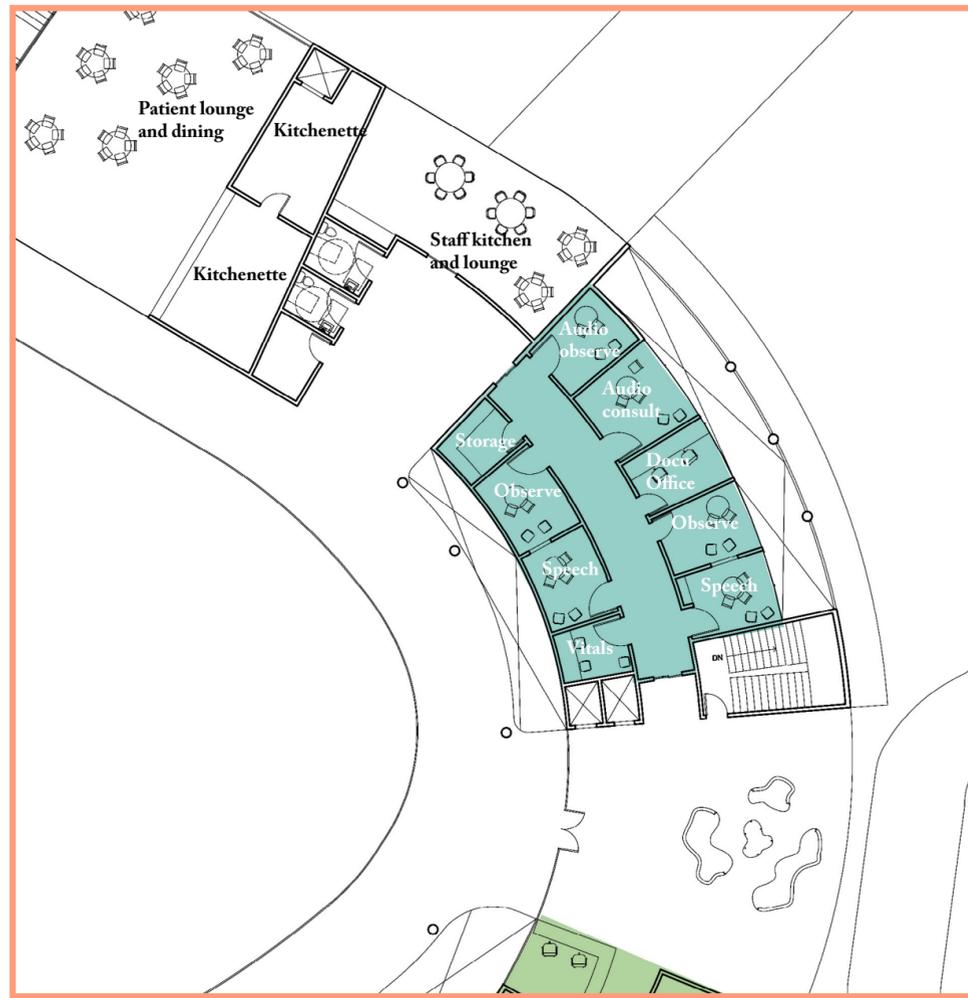


- Pain management/ Alternative medicine
- Technology Assisted Therapies
- Speech and Language Pathology
- Inpatient Units
- Administration and staff area



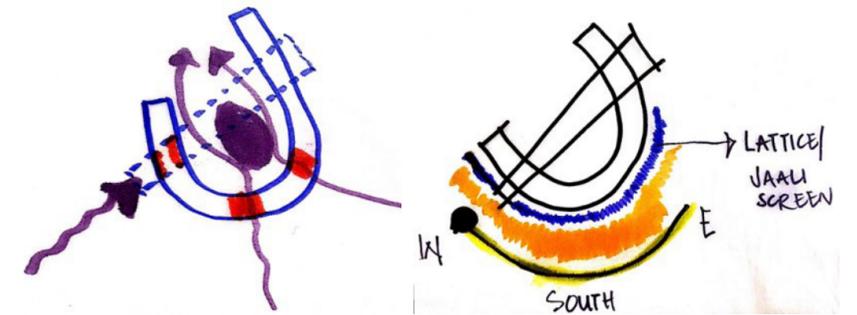
Speech and Language Pathology

The department contains the audiology and speech consultation rooms, observation rooms, shared staff areas, subwaiting and reception.



Inpatient Units - 10 beds

Inpatient units are a very important part of the rehabilitation centers. Reviewing and analyzing the existing inpatient rehabilitation centers in the city, this number was finalized. The units are placed at the rear end of the site for privacy and to provide a view towards the vegetation.



The building is opening up towards the lake to provide the visual access, which resulted in the southern façade of the building with glass windows. Since, the sun glare from this direction is heavy, the façade is covered with the lattice/jaali screens that is local to the region.

Apart from this, the building catches the primary and the secondary wind that flows into the building from the South West, Eastern and the South Eastern direction at three points that funnels and lets the breeze inside the building. This acts as an efficient natural ventilation system, avoiding the HVAC system.



Front view - Kriya

The primary entrance of the center which leads to the public space is located here. The facade showcases the perforated corten steel sheet which acts as a barrier and helps in controlling the glare from the southern sun. This space between the screen and the building skeleton is used as an outdoor green space for the staff.

क्रिया
Center for Stroke and Neurological Rehabilitation



Sectional Elevation

The section below is cut along the public space. It explains the movement beginning from the entrance, the reception hall, monumental stairs, the exhibition boards arranged along the alhambra pond, which ends with the labyrinth. The section also depicts the seater and the horticulture beds used by the patients.



section

Figure 33(a) - Part Section

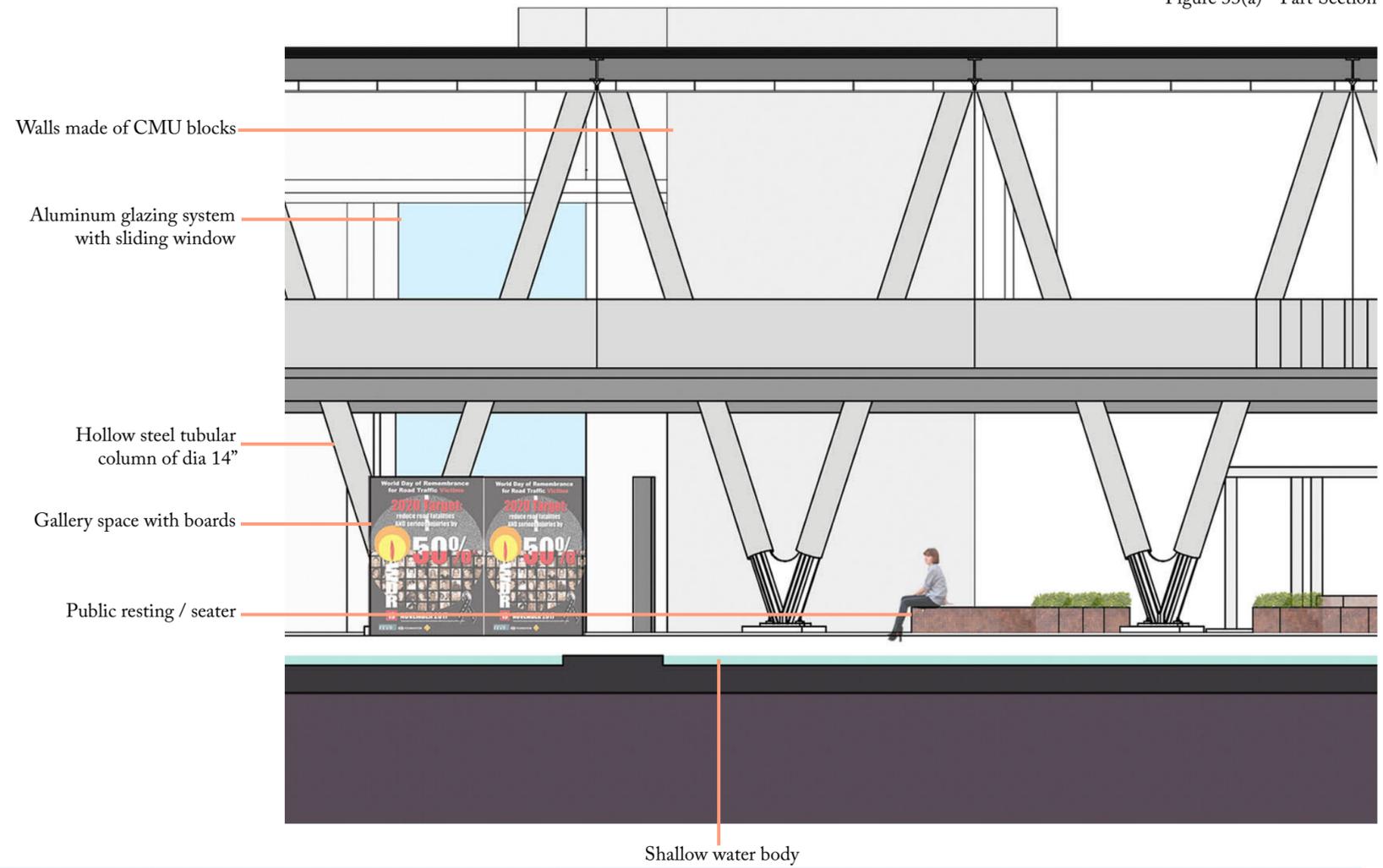


Figure 33 - Sectional Elevation

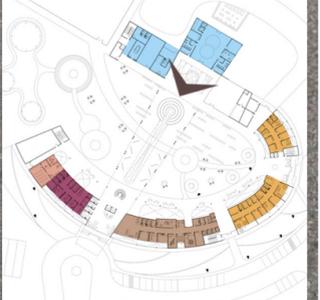


View from the labyrinth

The view below is showcasing the public movement along this trapezoidal transitional space, with the exhibition spaces on either side of the alhambra pond, the columns supporting the structure, the arrangement of the public resting seater, and the monumental spiral stairs at the rear end near the primary entrance.



Achieved -
Engaging the community in the healing process



**View through the corridor
Art and exhibition gallery**

The idea was to bring in the street culture of the Bengaluru city, where the walls along the roads in the city are painted colorfully with the help of local artists. These paintings may portray a historical incident, a building or it could be a famous leader of the country.

The same idea is carried out in this rehabilitation center, where this art corridor is open for the public after the rehabilitation center hours (where each department could be secured and this corridor could be left open for the public). These paintings here could encourage the local talents, the paintings could tell their stories, or it could also be a modern which explains the safety measures to control road traffic accidents.

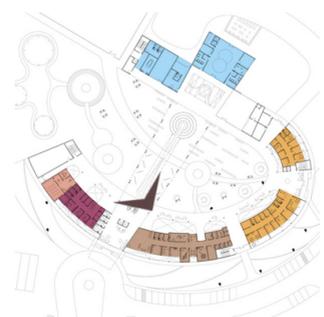
On the other hand, the corridor's pathway has furniture for the public and the patients to rest and the furniture holds bookshelves to entertain readers (Jones, Walker, Drass, & Kaimal, 2017).

Achieved-

Art and nature as a positive distraction



Engaging the community in the healing process



View through the secondary entrance

Once the patient completes consultation and imaging process, the appointments are scheduled, if they are visiting patients. So, the patients could use this secondary entrance, which directly lets them into the therapy departments instead of passing through the main public reception area.



View through the Level two

On one side, the corridor is looking towards the interior landscape area and on the other side, the level two corridor path is overlooking the art corridors with pockets of green spaces with bamboo trees.



View through the examination room

The intermediate space between the corten steel sheet screen and the examination room is used as an outdoor lounge space for the staff.



Achieved-

Art and nature as a positive distraction



Visual access to nature



View through the gymnasium

The therapeutic gymnasium overlooks the Begur lake providing visual access to the nature which is proven to be helping in relieving the stress and calming oneself.



Achieved-
Engaging patients and their family and the staff



View through the Central Plaza

The way from the secondary entrance is directly connected to central plaza which acts as a landmark in the proposed design. It helps the patients to orient themselves in the building and in wayfinding. The horticul-

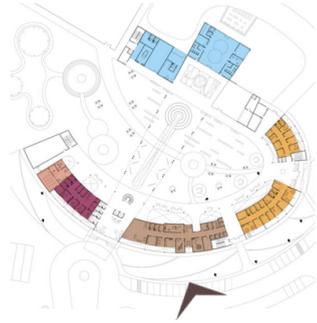
ture beds with seater along side are placed in the horticulture garden for the patients to sit and relax.

On the other hand, the garden includes group therapy areas for the patient and the staff to interact.



South east elevation

The elevation showcases the curved building form along with the perforated corten steel sheet skin at certain intervals throughout the building. The main building uses CMU blocks with lime plaster, painted white and aluminum glazing system.



elevation

Figure 34(a) - Part Section

- Walls made of CMU blocks, lime plastered and painted white
- Railings of perforated corten steel sheet
- Aluminum glazing system with sliding window
- 8' x 5' perforated corten steel sheet

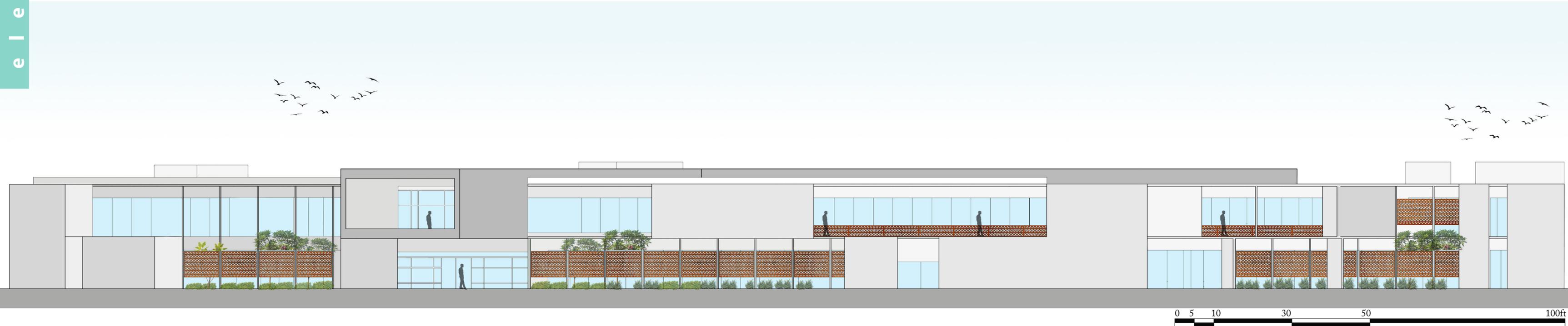
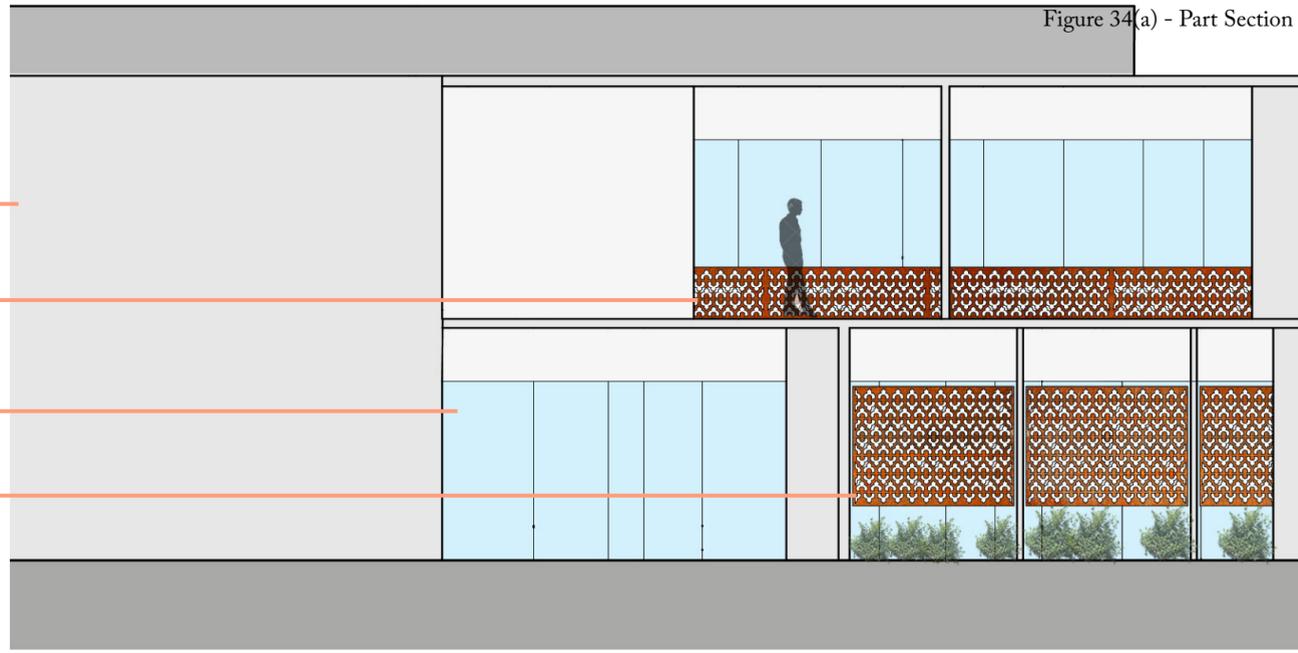




Figure 35 - Bhava Chakra

Samsara

Meaning - Cyclical nature of all life, matter, existence. A worldly life of constant change, that is rebirth, growth, decay and death. In Indian traditions, Bhava chakra (Circle) may be employed for focusing attention of practitioners, as an aid to meditation and trance induction.

In Kriya, the landscape is designed on the idea which represents that everything in life is not permanent, but different stages that a person goes through. Here, main nodes are in the form of circles, to improve the concentration of the patients.

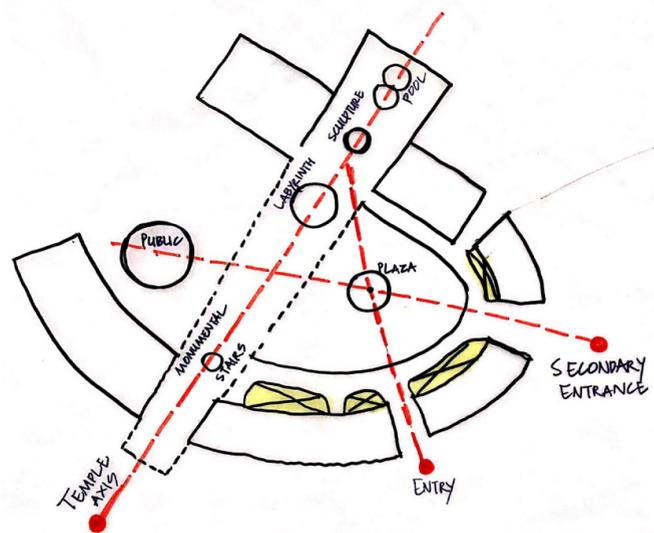


Figure 36 - Diagram showing the axis taken along the temple and accentuated through various programs at certain intervals such as monumental stairs, labyrinth, sculptural garden and aqua pool. Regulating lines are drawn from the secondary entrance, staff entrance which lead to the placement of the central plaza, and the public plaza from which the other nodes and the paths originate.

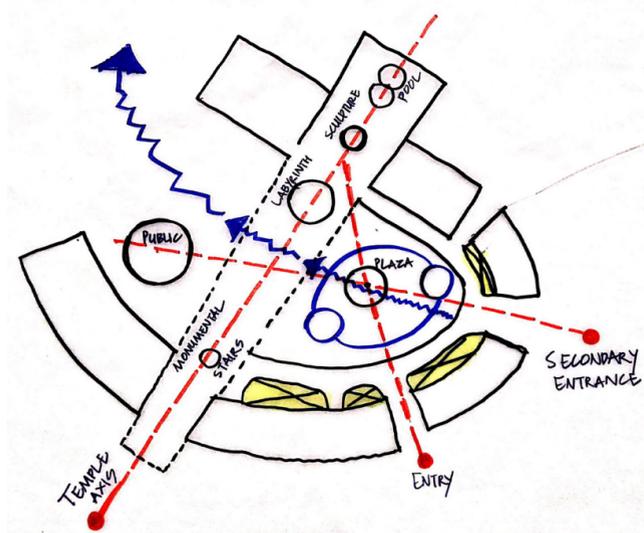
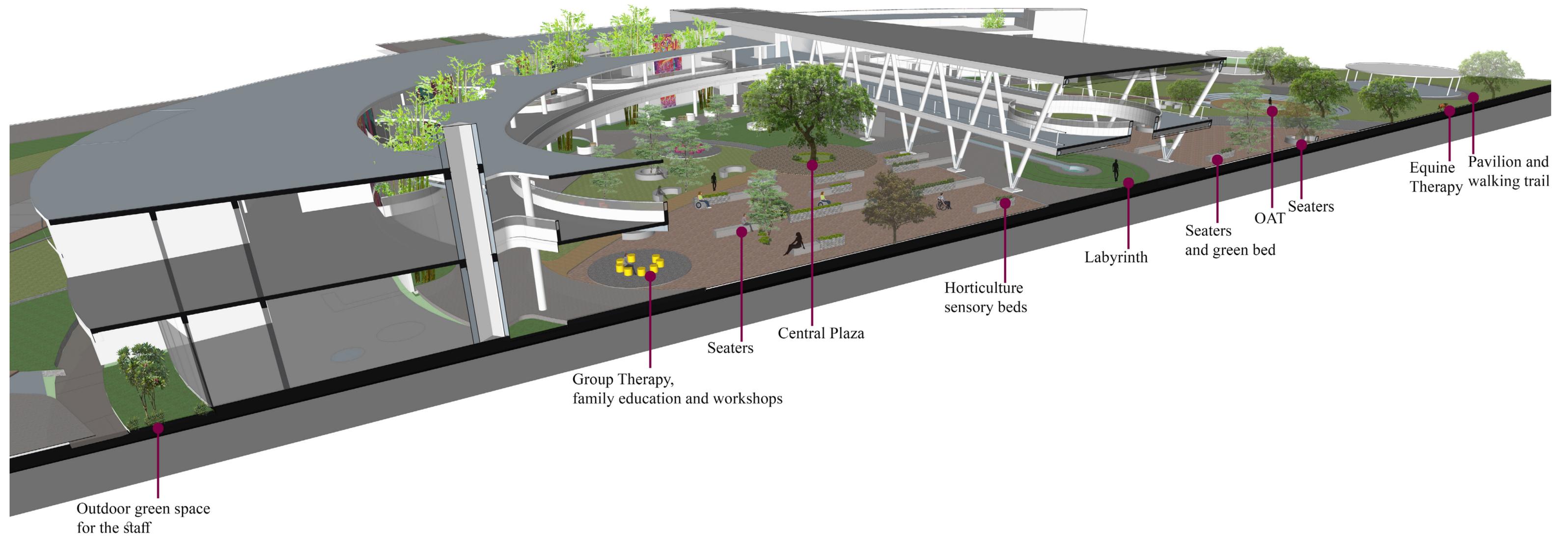


Figure 37- Diagram showing the progression of healing. The landscape area between the treatment rooms and the trapezoid-shaped public space is considered protective, quiet and treats the patients who are dependent on the staff and the caregivers. In the process, the trapezoid shape acts as a transitional space. The space towards the extreme left is active, fun and independent and used by the patients, who are able to support themselves and for the public.





The sectional perspective explains the different therapy programs placed in the outdoor area. These programs are arranged according to the progress in the healing process of the patients. It starts from the dependent/protective landscape area to the transition zone, which then transfers to an independent area where the patients would be able to control the environment.



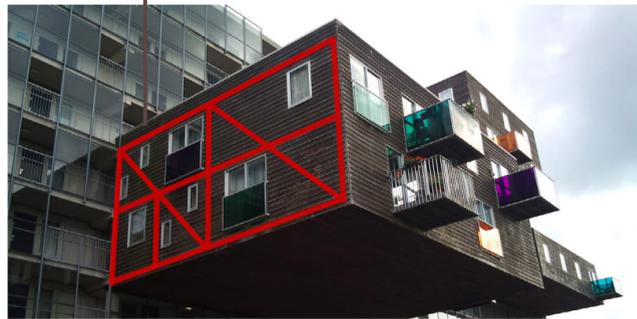
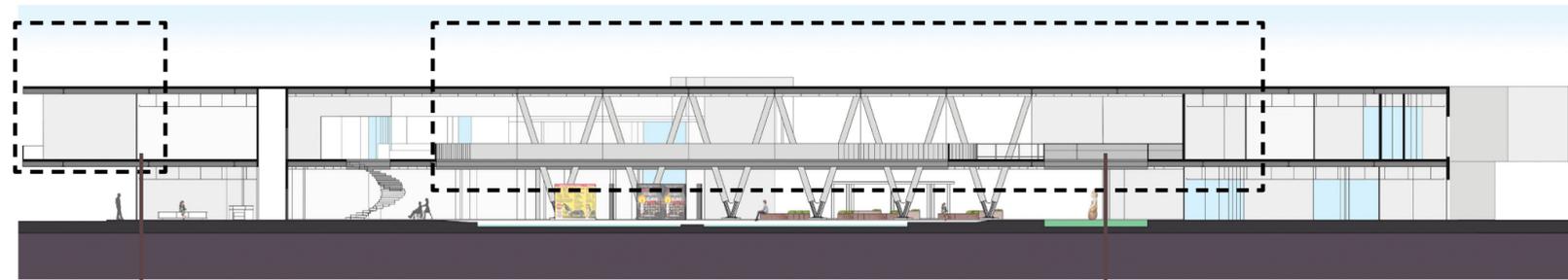


Figure 38 - Cantilevered structure supported with the help of horizontal, vertical and diagonal members



Figure 39 - Cantilevered structure



Figure 40 - Warren truss

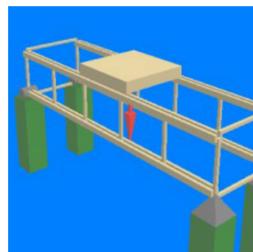


Figure 41 - Cantilevered structure anchored between the supports

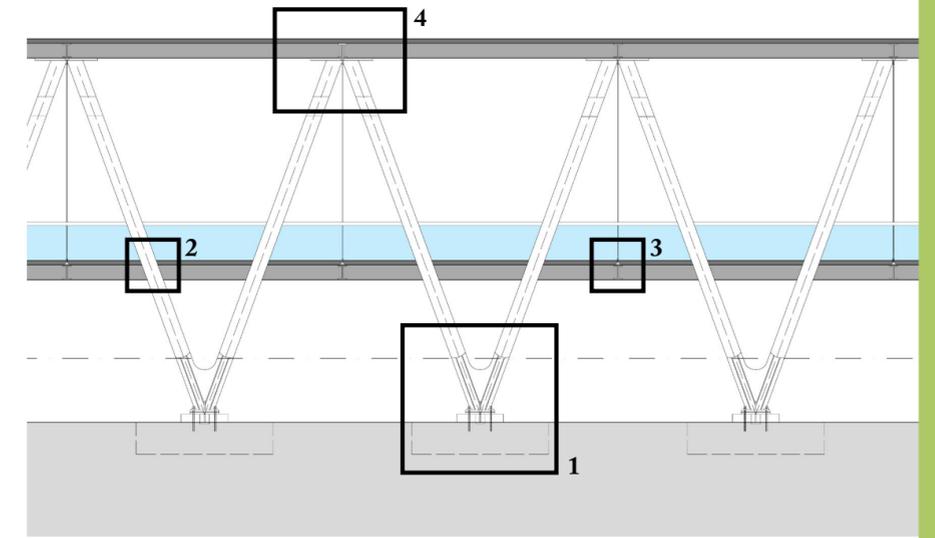
The facility is designed with concrete and steel framing system, column beam structure and two-way slab construction. The trapezoidal block is anchored between the curved arc structure with the help of warren truss system. The front portion of the trapezoid that is pointing towards the temple is cantilevered with the help of box truss system sandwiched between the steel corrugated sheet.

Sustainability.

The building involves natural ventilation system and has implemented the use of Jaali screens to avoid the glare from the South sun.

Colors and materials.

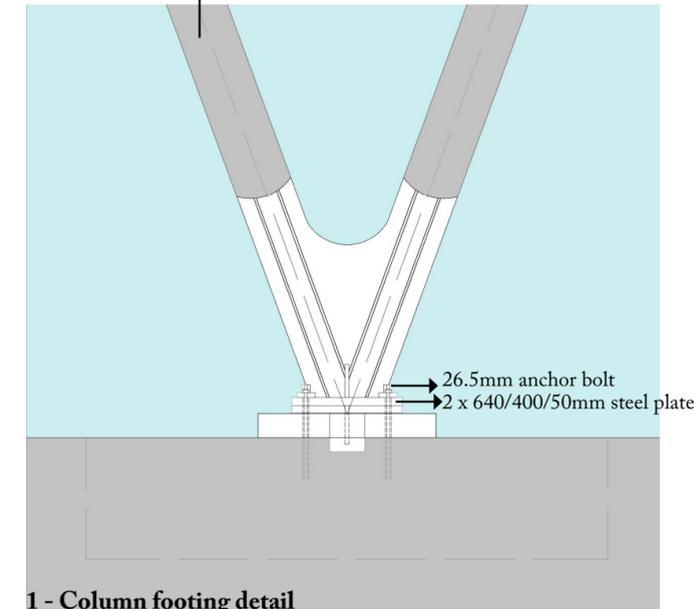
The arc block is built with walls made with concrete blocks and is painted in white color. On the other hand, the juxtaposed trapezoidal form is held by the hollow steel tubular columns spanning two floors.



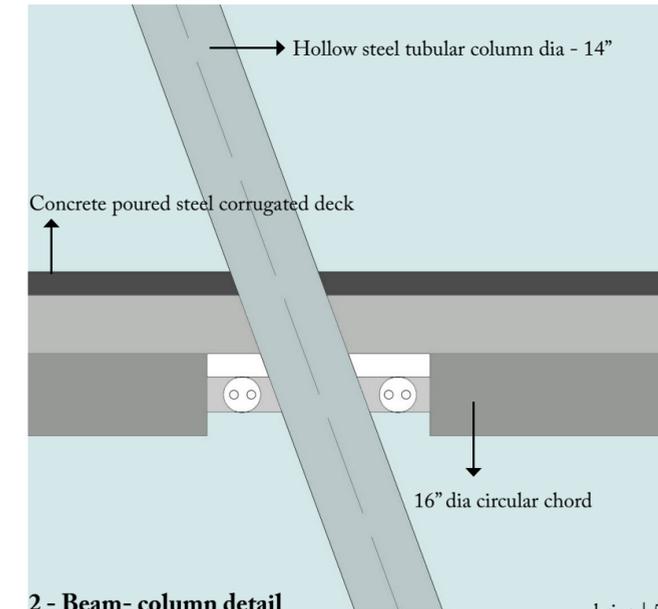
Column details

Structure

Hollow steel tubular column dia - 14"

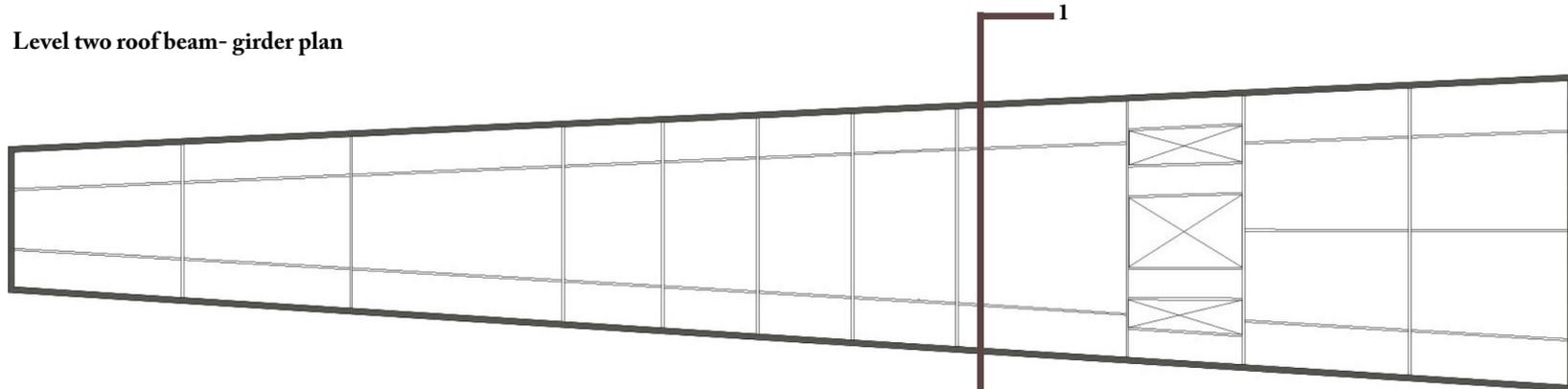


1 - Column footing detail

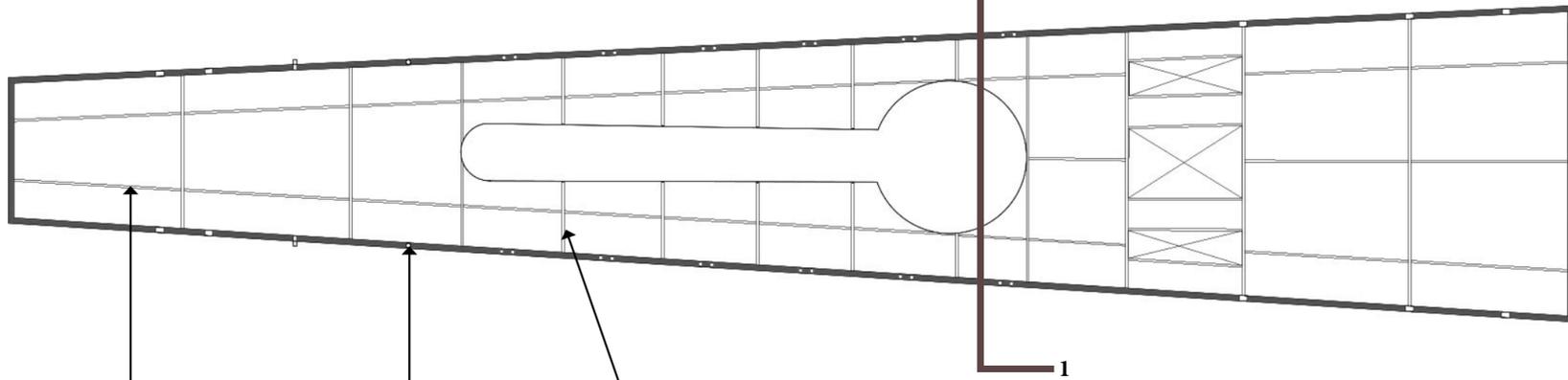


2 - Beam- column detail

Level two roof beam-girder plan

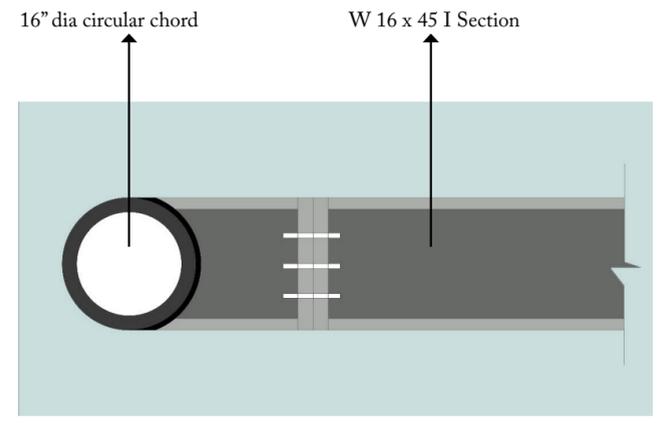


Level two floor slab beam-girder plan

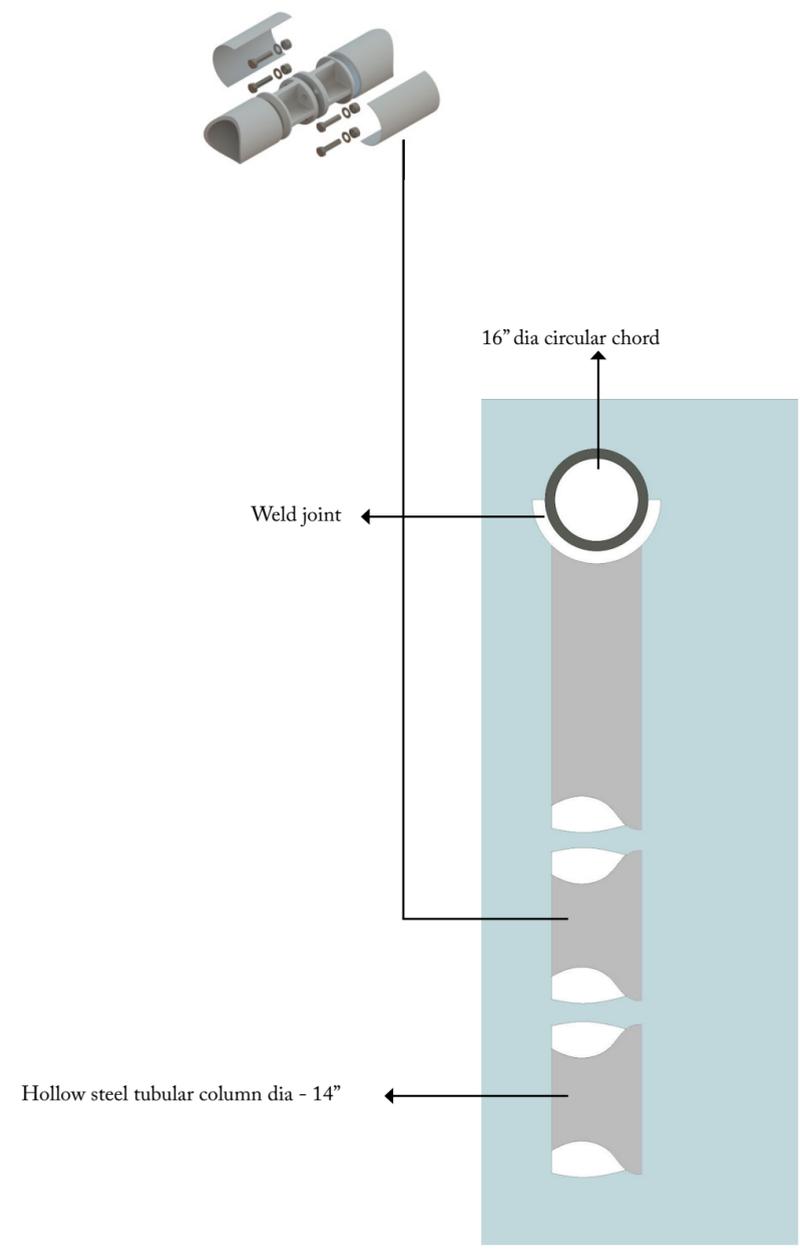


W10 x 30 I section 16" dia circular chord W16 x 45 I section

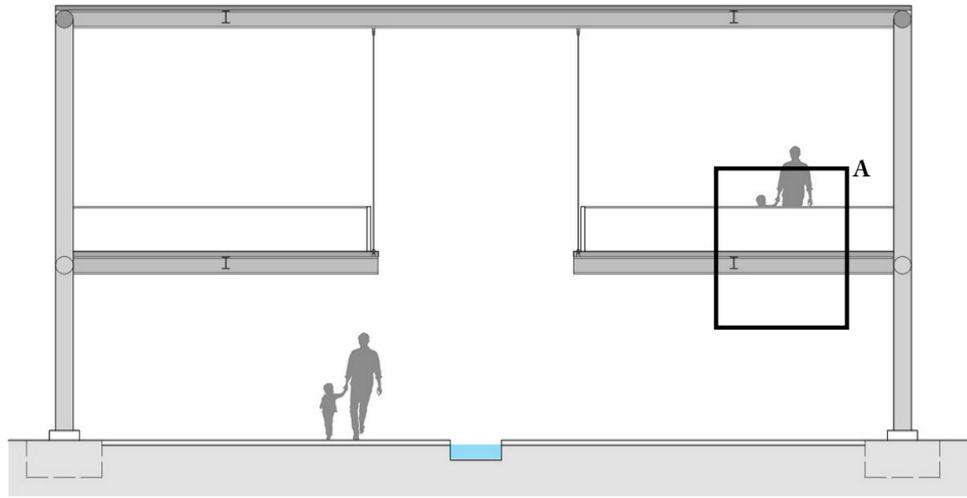
The trapezoidal structure is spanned and supported with the help of hollow steel tubular columns and series of girders supporting the roof and slab of the trapezoidal form. Additionally the floor slab of the level 2 with a cut in the slab in the center, overlooking the labyrinth below, has been supported by steel cable that has been held by the top roof member of the level 2 area.



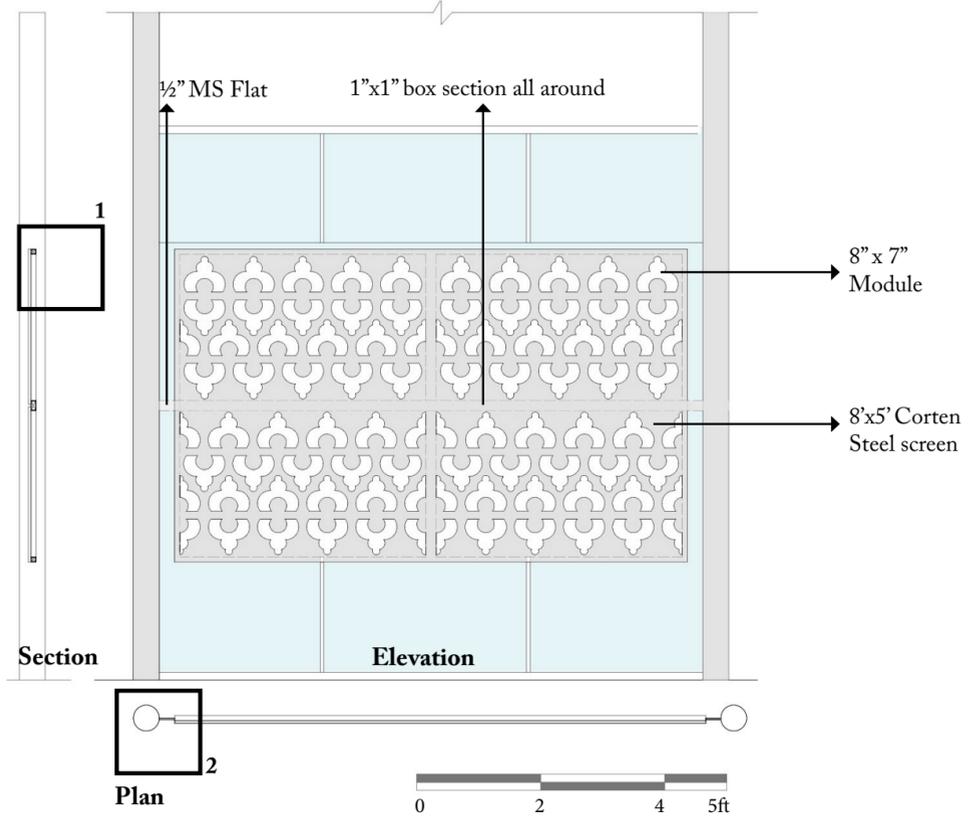
3 - Beam to beam connection detail



Detail 4 - Beam column detail



1- Cross section along the trapezoidal public space



The design of the Jaali screen is inspired by the repeated pattern that appears in the temple design, opposite. Corten steel is used for the manufacturing of these jaalis to give the center, a natural rustic look.

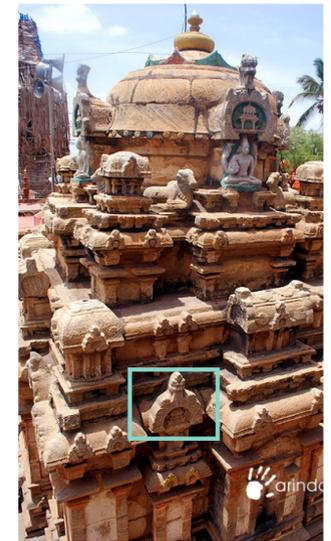
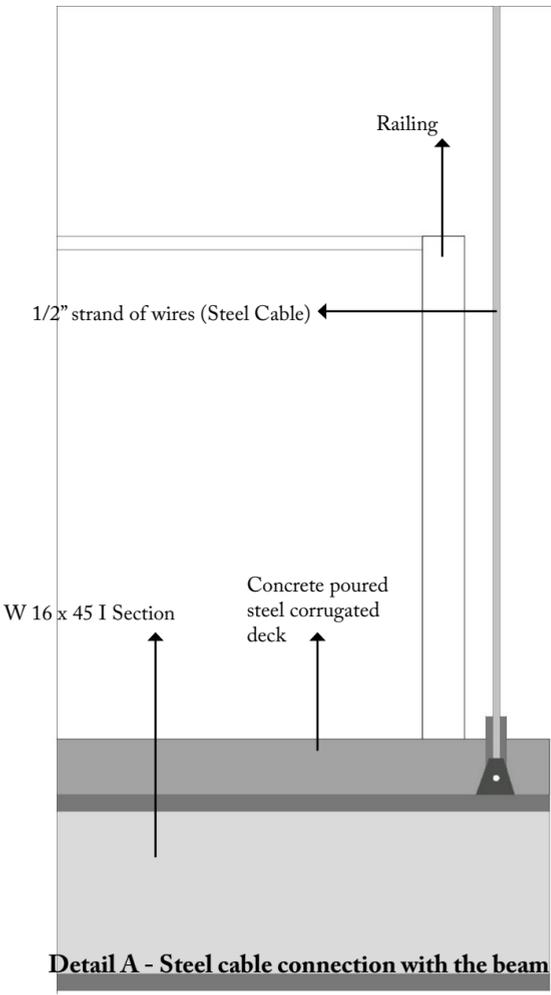
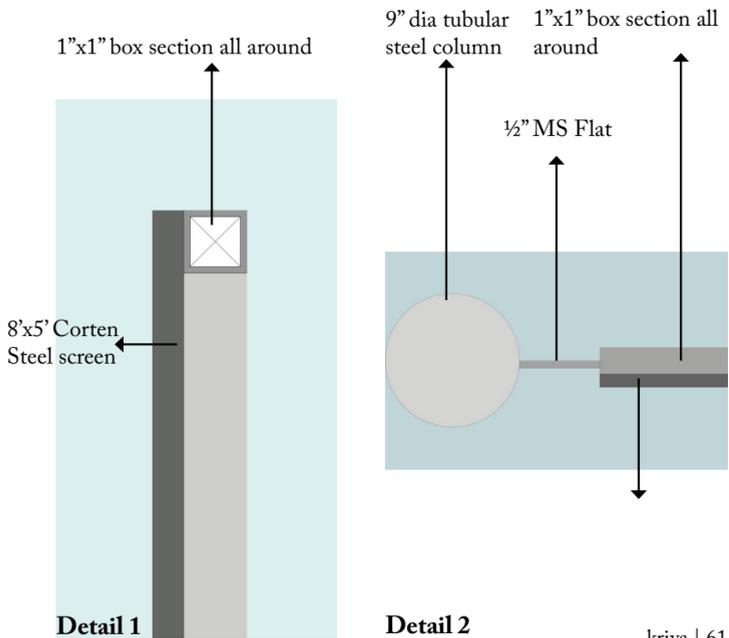


Figure 42 - Panchalinga Nagesh-wara temple, Bengaluru, India

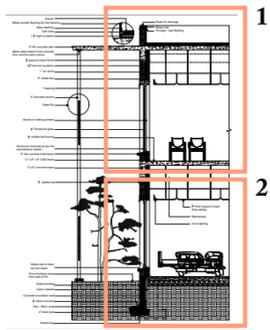


Detail A - Steel cable connection with the beam

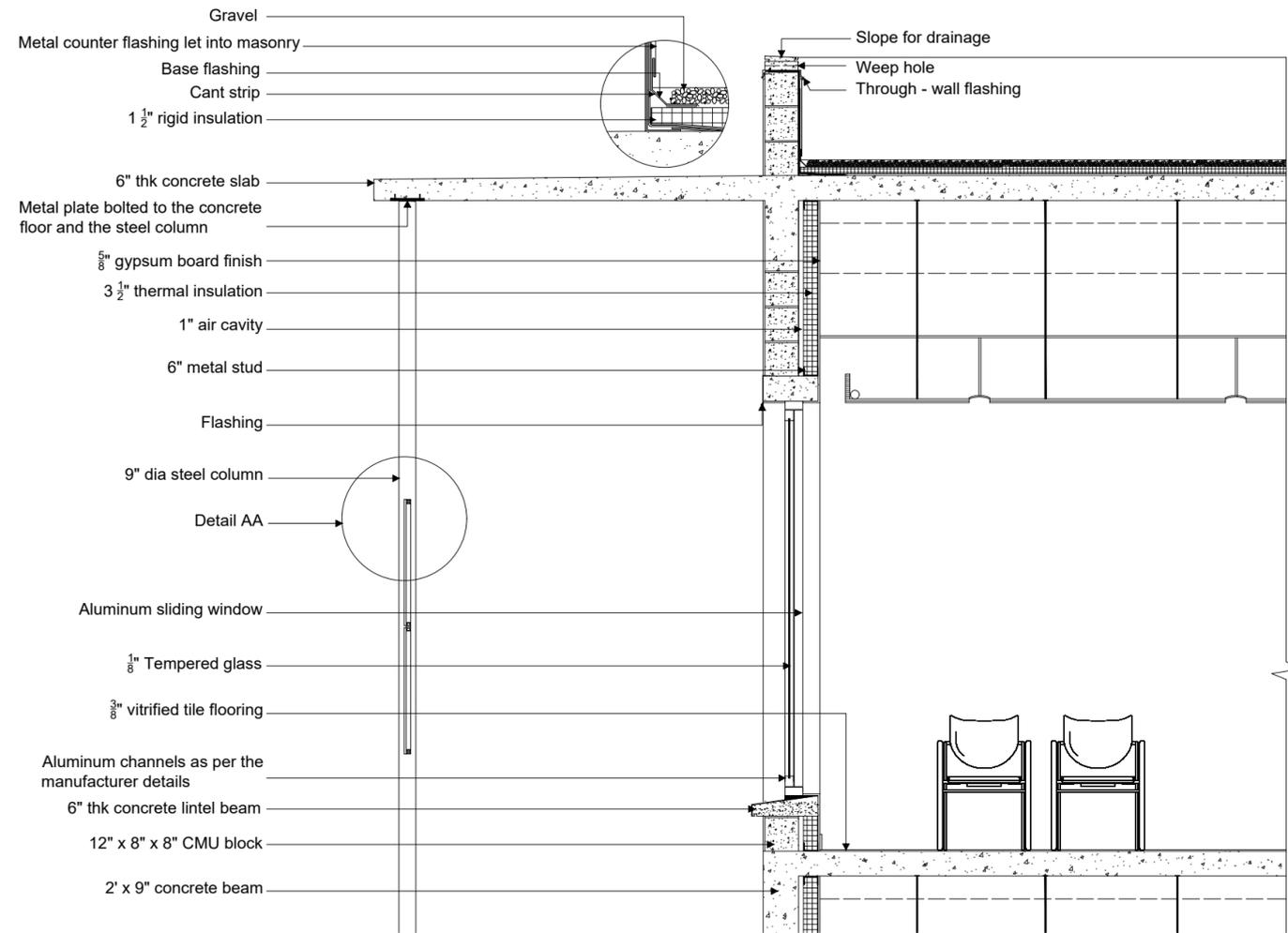


Detail 1

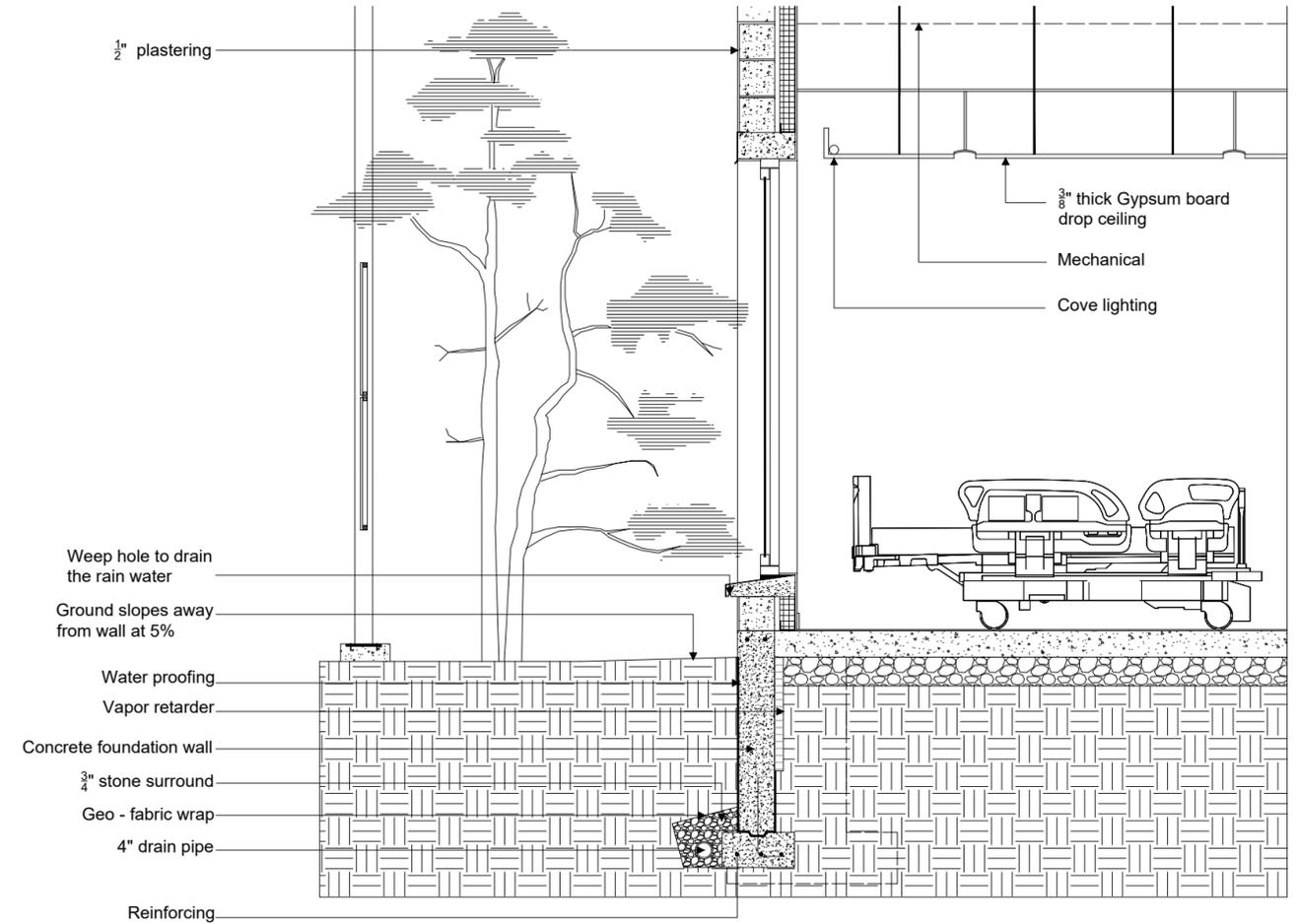
Detail 2



Typical wall section explaining the masonry - window connections, their details, parapet wall details, the connection between the hollow steel column with the concrete roof slab and the masonry- footing details.



1 - Part wall section - Top floor



2 - Part wall section - Bottom floor

The designing of the Stroke and Neurological rehabilitation was a wonderful learning experience that provided me with insights about the current risks faced by the people with road commutation in India, the physical and the emotional challenges that they would undergo because of these accidents.

As a designer, I enjoyed the process of space listing since I was completely new to this kind of a program. Referring through numerous existing rehabilitation centers in India and some international examples, taking inferences from them and coming up with the complete set of programs for the proposal, the way these individual spaces work as a therapy space, as a whole, and their connection with one another and the importance of the indoor – outdoor connection was well learnt.

The importance of landscape design in a rehabilitation center, where the idea of learning in the nature and from the nature came as a surprise. The reason behind this is the fact that when the patients are completely independent, they have to face the exterior environmental conditions. So, the concept of preparing them, in

learning to support themselves in the nature or the outdoors was one of the important things that I learnt through the design process.

In this learning process, amongst various things I learnt, there were few specific challenges that I came across. One of them was laying the site plan for the center since the selected area of the site was huge and I think that it would have been better if I had more time to design it or if I had collaborated with a landscape student for the site planning. Another significant challenge was the lack of sufficient case studies available for the selected site location. I could refer one neuro-rehabilitation center in the entire Bengaluru city that had inpatient units within the center and rest of the case studies were only small private outpatient clinics. So, I had to refer a lot of International examples to come up with the space listing for the proposal. Overall, I believe that there is a lot of potential and various possibilities to the design itself and it could serve the purpose of the community with the continuing care through its prevention, treatment and educational programs to the victims, their families and the common public.

'Adopt the pace of the nature, her secret is patience'
Ralph Waldo Emerson

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Figure 1(a). Percentage Share in Total Number of Road Accidents (in %), 2015. Adapted from Road traffic accidents in India - 2015 by Ministry of Road Transport and Highways, 2015, Retrieved from <https://data.gov.in/keywords/transport-research-wing>.

Figure 1(b). Percentage Share in Total Number of Persons killed in Road Accidents (in %), 2015. Adapted from Road traffic accidents in India - 2015 by Ministry of Road Transport and Highways, 2015, Retrieved from <https://data.gov.in/keywords/transport-research-wing>.

Figure 1(c). Percentage Share in Total Number of Persons Injured in Road Accidents (in %), 2015. Adapted from Road traffic accidents in India - 2015 by Ministry of Road Transport and Highways, 2015, Retrieved from <https://data.gov.in/keywords/transport-research-wing>.

Figure 2. Age Profile of Road Accident Victims. Adapted from Road traffic accidents in India - 2015 by Ministry of Road Transport and Highways, 2015, Retrieved from <https://data.gov.in/keywords/transport-research-wing>.

Figure 3. Details of Accidents during the year (January 2015 - December 2015) in Karnataka, India. Adapted from Annual report by Transport Department, Government of Karnataka, 2015, Retrieved from http://transport.karnataka.gov.in/index.php/information/details/archive_vehicle_statistic_2016

Figure 4. Theraband. Reprinted from http://www.kokilabenhospital.com/departments/centresofexcellence/centrefor_physicalmedicinerehabilitation/generalservices.html

Figure 5. Fitness. Reprinted from https://india.tradeford.com/in434136/best-rehabilitation-treatment-hospital-in-india-ndash-kokilaben-hospital_p679495.html

Figure 6. Biofeedback. Reprinted from <http://www.stack.com/a/control-your-opponent-with-isometric-training>

Figure 7. ADL Suite. Reprinted from <http://www.methodist-rehab.com/facility.htm>

Figure 8. Aroma and Herbal Therapy. Reprinted from <http://www.padhaaro.com/blog/things-to-do-in-pondicherry/>

Figure 9. Aqua Therapy. Reprinted from <http://unitedciigma.in/Why-CIIGMA/Media-Center/News/Free-Aquatic-Therapy-Awareness-Seminar-at-United-CIIGMA-hospital>

Figure 10. Manual Therapy. Reprinted from <http://happenings.lpu.in/lpu-school-of-physiotherapy-and-paramedical-science-organized-manual-therapy-workshop/>

Figure 11. Virtual Reality. Reprinted from <https://www.nbcnews.com/nightly-news/video/hospital-walls-disappear-into-virtual-reality-for-young-patients-643630659678>

Figure 12. Speech and Audio Consult. Reprinted from <https://www.practo.com/chennai/doctors-for-pure-tone-audiometry/thirumangalam>

Figure 13. Horticulture Therapy. Reprinted from <http://www.thehindu.com/society/Breaking-new-ground/article16735684.ece>

Figure 14 - 16. Sayanomoto Clinic, Japan. Reprinted from <https://www.archdaily.com/795348/sayanomoto-clinic-yamazaki-kentaro-design-workshop>

Figure 17 - 19. NICOE, Maryland. Adapted from *Explore: The Journal of Science and Healing*, 8(5), 282-290.

Figure 27. Google image of the site and its surroundings. Reprinted from Google Earth Pro

Figure 30. Jaali screen. Reprinted from <https://www.pinterest.cl/pin/500673683566250718/>

Figure 35. Bhavachakra. Reprinted from <https://en.wikipedia.org/wiki/Bhavacakra>

Figure 38. Cantilevered structure with the help of horizontal, vertical and diagonal. Reprinted from <https://www.pinterest.co.uk/pin/446349013053928372>

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Figure 40. Warren truss. Reprinted from <http://www.conteches.com/knowledge-center/pdh-article-series/design-considerations-for-pedestrian-truss-bridge.aspx>

Figure 41. Cantilevered structure anchored between the supports. Reprinted from <http://www.pre-engineering.com/modelsmart3d/ms3d-wide.html>

Figure 42. Panchalinga Nageshwara Temple, Bengaluru, India. Reprinted from https://en.wikipedia.org/wiki/Nageshwara_Temple,_Begur

