ARCHITECTURAL PORTFOLIO

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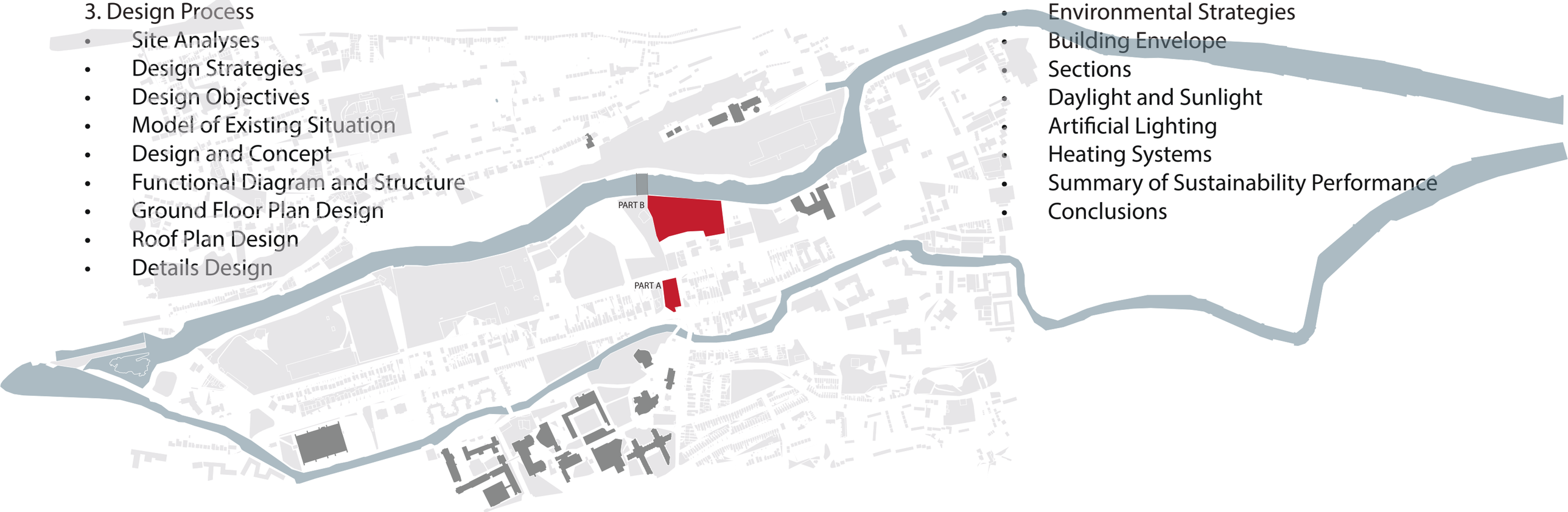
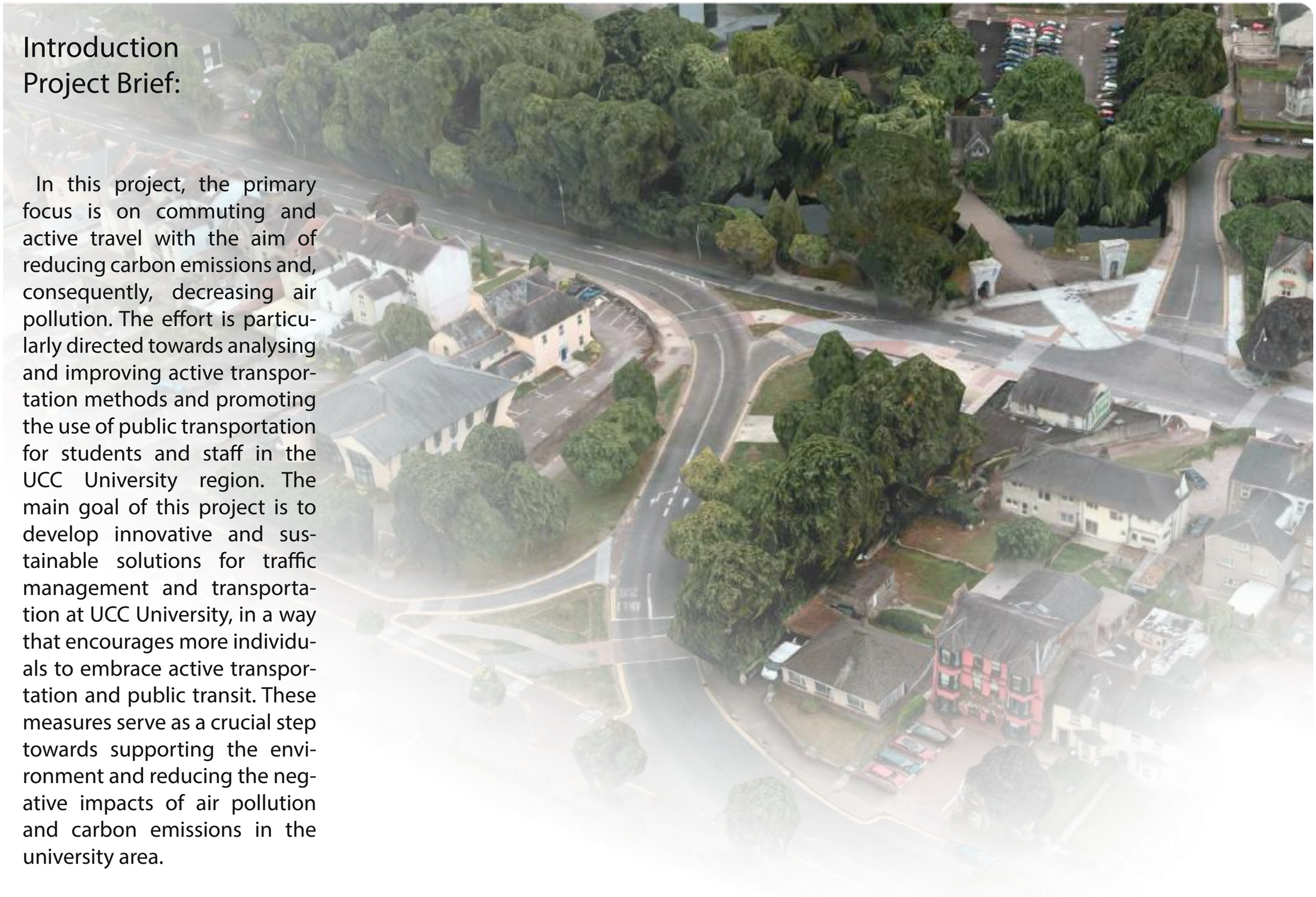




Introduction
Project Brief:

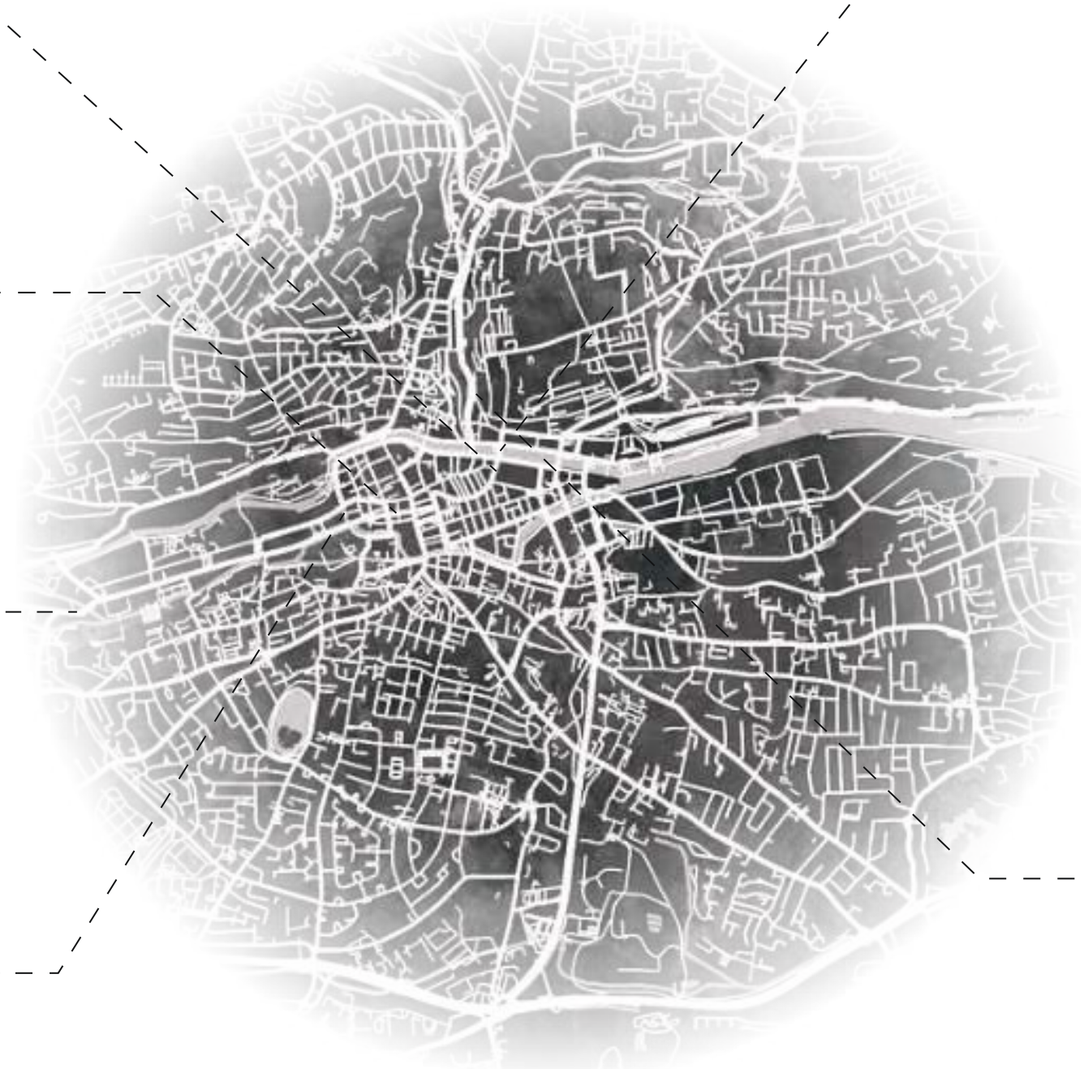
In this project, the primary focus is on commuting and active travel with the aim of reducing carbon emissions and, consequently, decreasing air pollution. The effort is particularly directed towards analysing and improving active transportation methods and promoting the use of public transportation for students and staff in the UCC University region. The main goal of this project is to develop innovative and sustainable solutions for traffic management and transportation at UCC University, in a way that encourages more individuals to embrace active transportation and public transit. These measures serve as a crucial step towards supporting the environment and reducing the negative impacts of air pollution and carbon emissions in the university area.

Research Process

Cork City Transport History

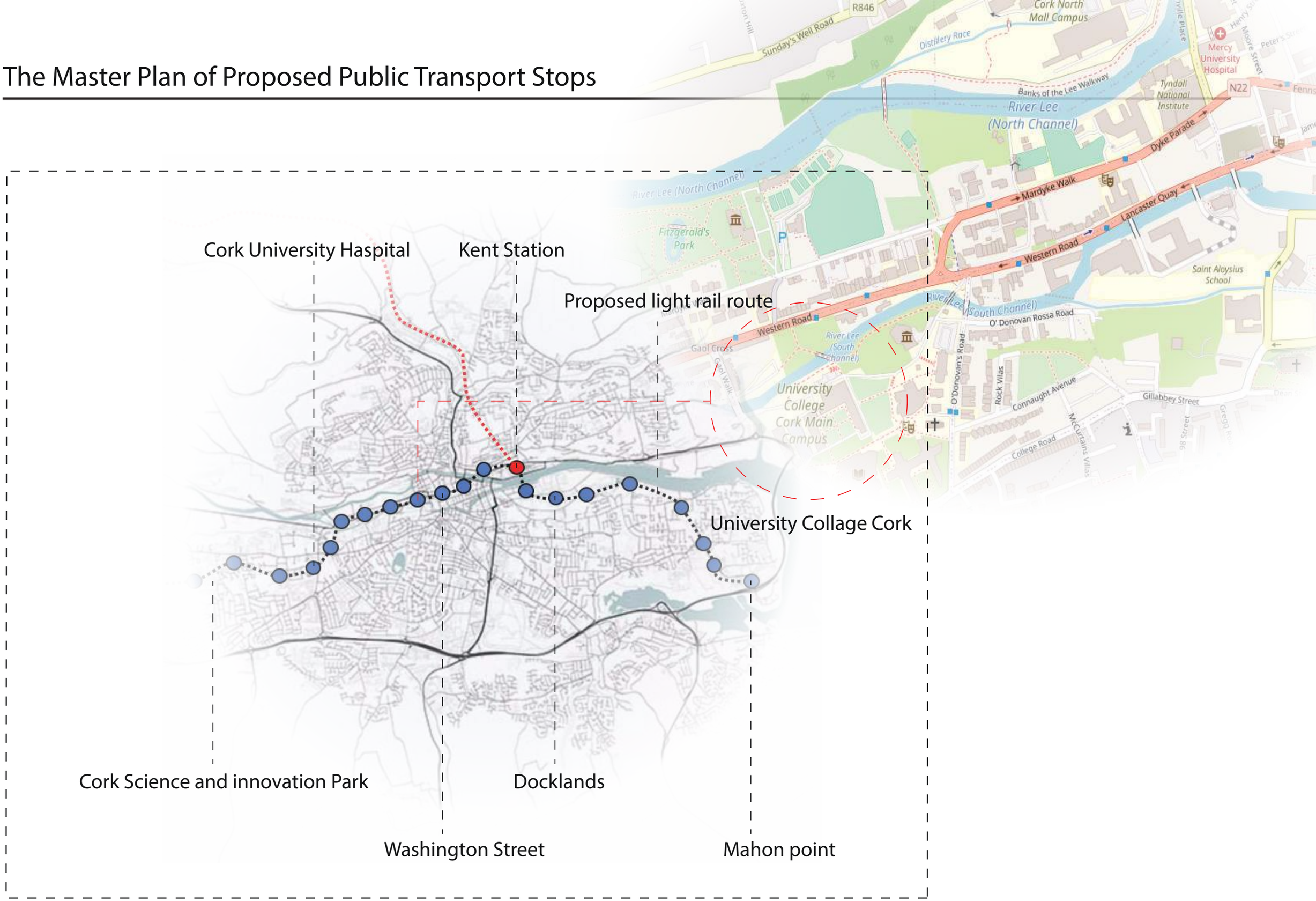
Streets just a space for traffic and commuting?

Streets turn into rivers after heavy rains.

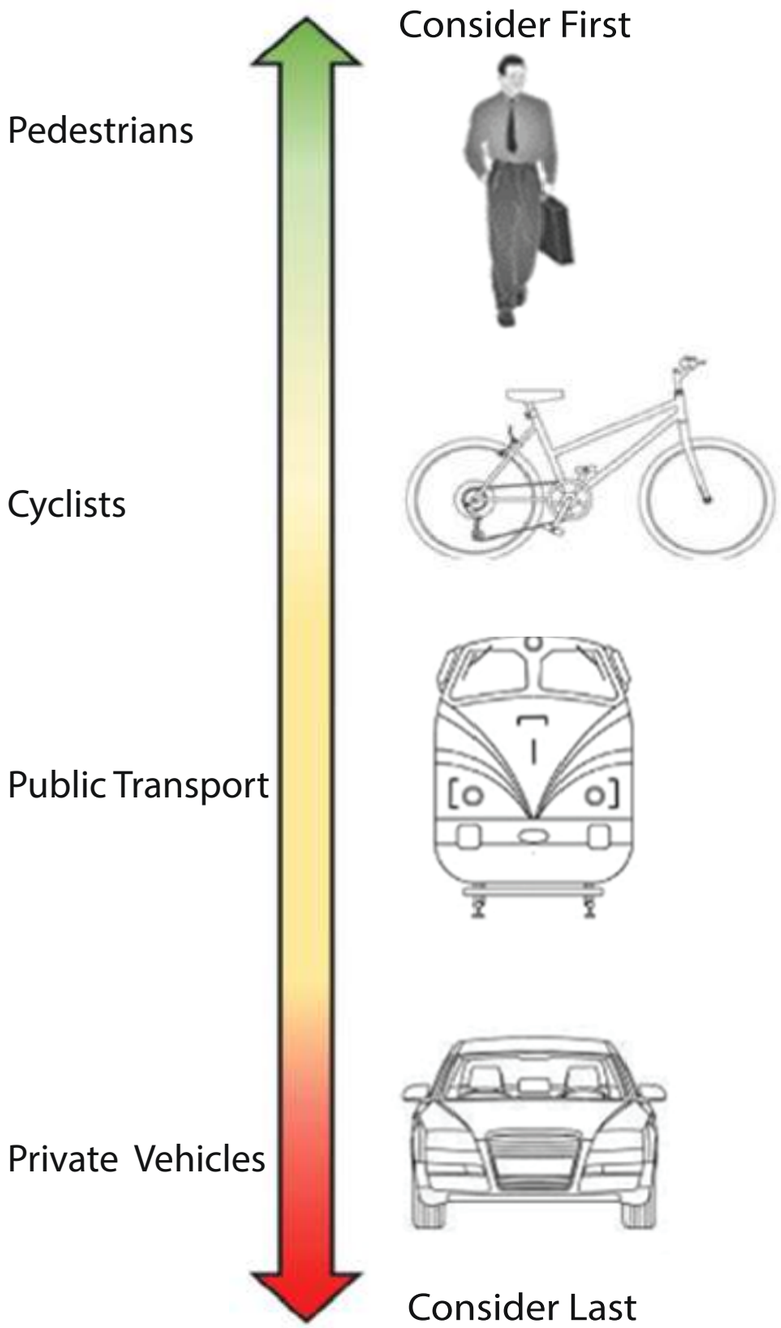


Streets Map of Cork City

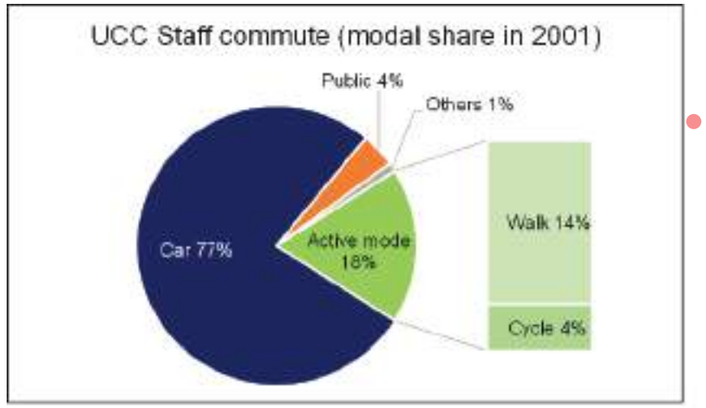
The Master Plan of Proposed Public Transport Stops

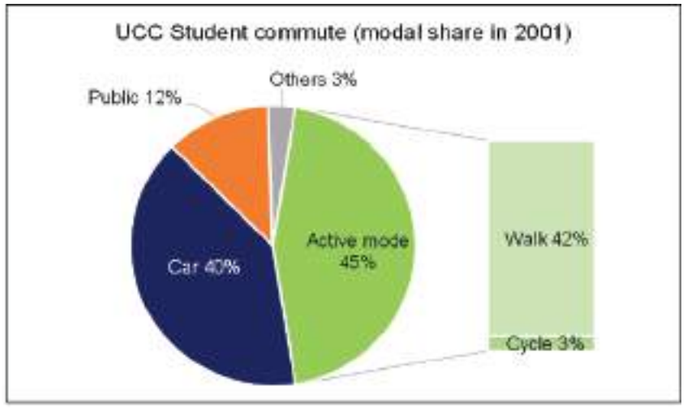


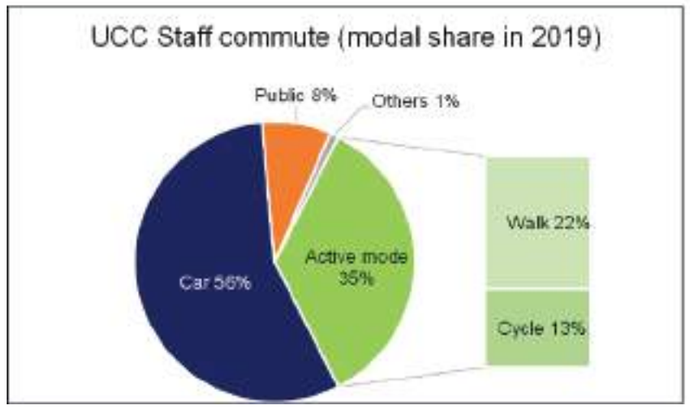
University User Commuting Patterns

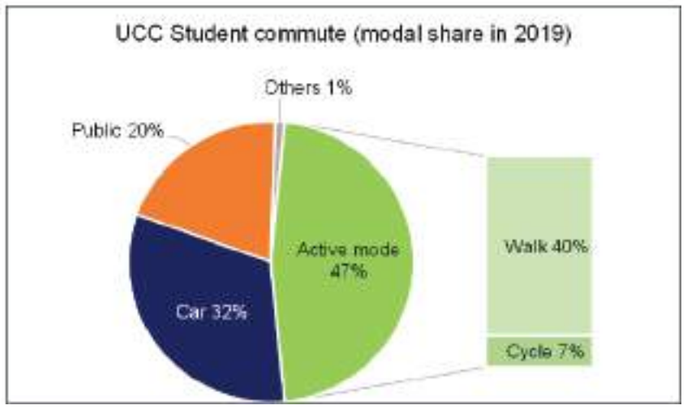


These graphs illustrate the commuting trends of students and staff to UCC over the past 20 years (from 2001 to 2019). Fortunately, there has been an increase in these numbers compared to previous years. To promote a sustainable environment in street design, it is crucial to prioritize pedestrians and active modes of transportation, among other groups.

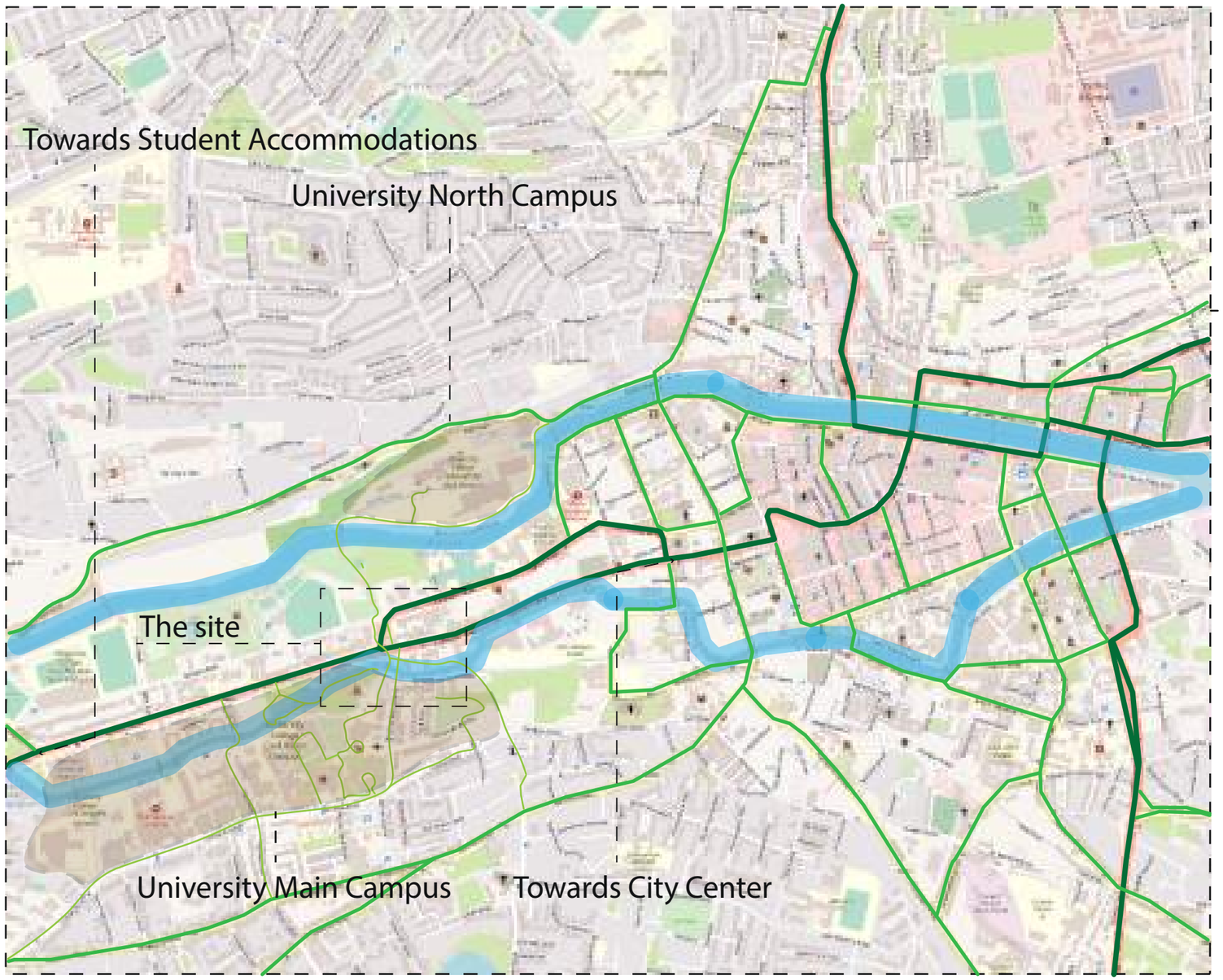








Mapping Traffic Nodes and Reasons for Choosing the site

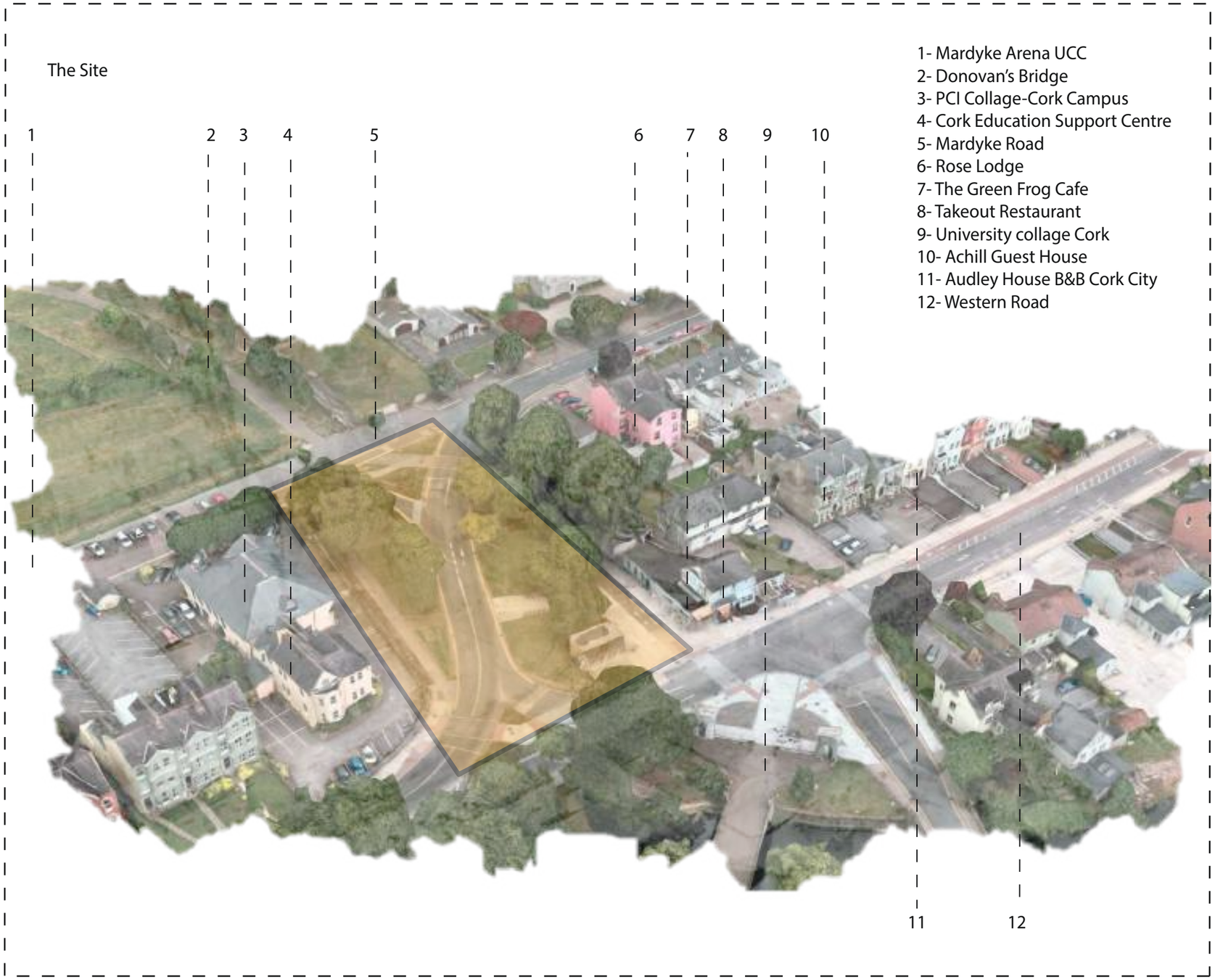


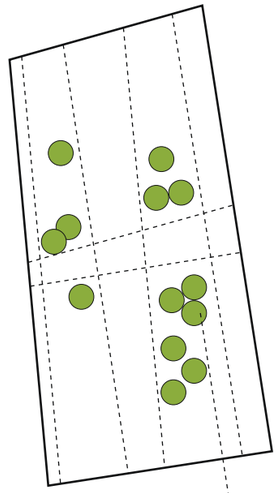
Streets Map of Cork City

Walkways
Light Road share with vehicles
Busy Road share with Vehicles
River Path

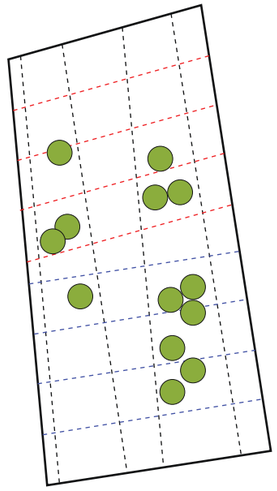
Design Process

Site Analyses

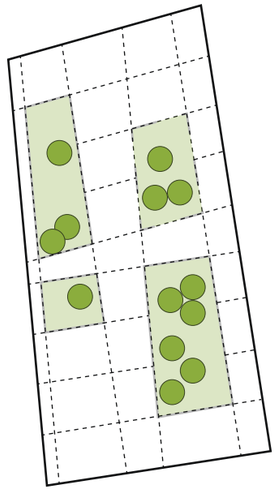




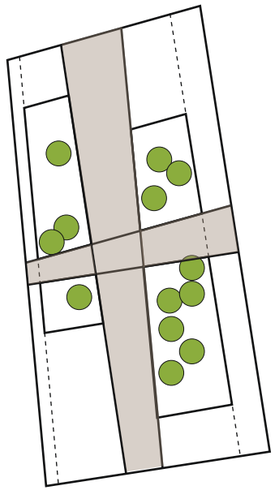
Site lines
Existing trees



Line parallel to site line



Opening



Road Axes

Design Strategies

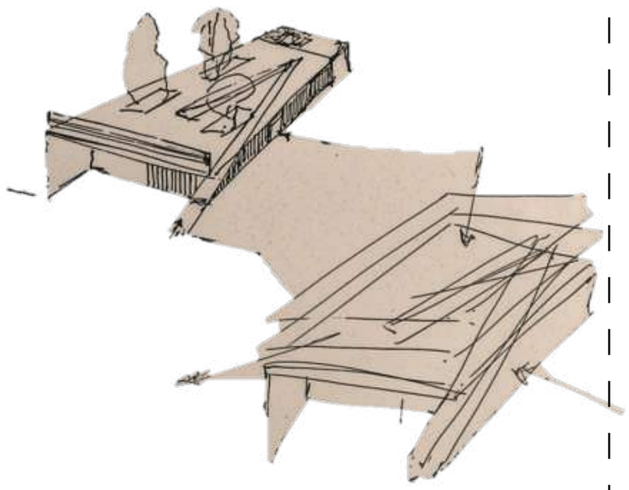
1. Universal Accessibility
- Barrier-free design
- Implementation of wider corridors and gradual inclines

2. Sustainability
- Integration of renewable energy sources
- Use of eco-friendly materials in construction
- Recycle rainwater
- Applying local material
- Keeping trees

3. Compliance with Irish Regulations
- Thorough review and adherence to transportation guidelines
- Implementation of safety measures

4. Compliance with Irish Climate
- Climate-resilient infrastructure planning
- Implementation of weather-appropriate design elements

5. Facilitation of Active Travel
- Development of dedicated bicycle lanes
- Integration of pedestrian-friendly zones

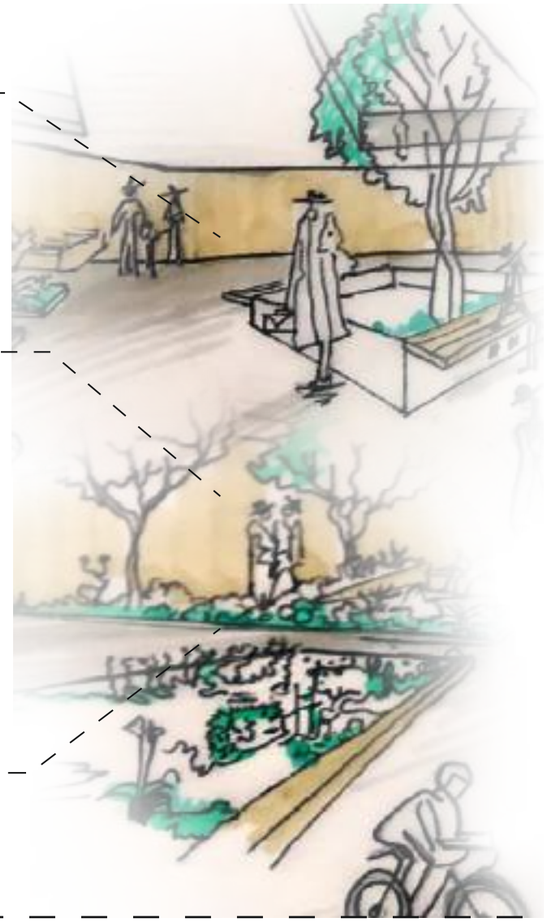


Design Objectives

Designing a human friendly walkable area

Establishing a designated area for bicycle parking to enable the continuation of journeys via public transportation for long distances.

Designing a space to encourage people to use public transportation



Model of Existing Situation

Mardyke Road

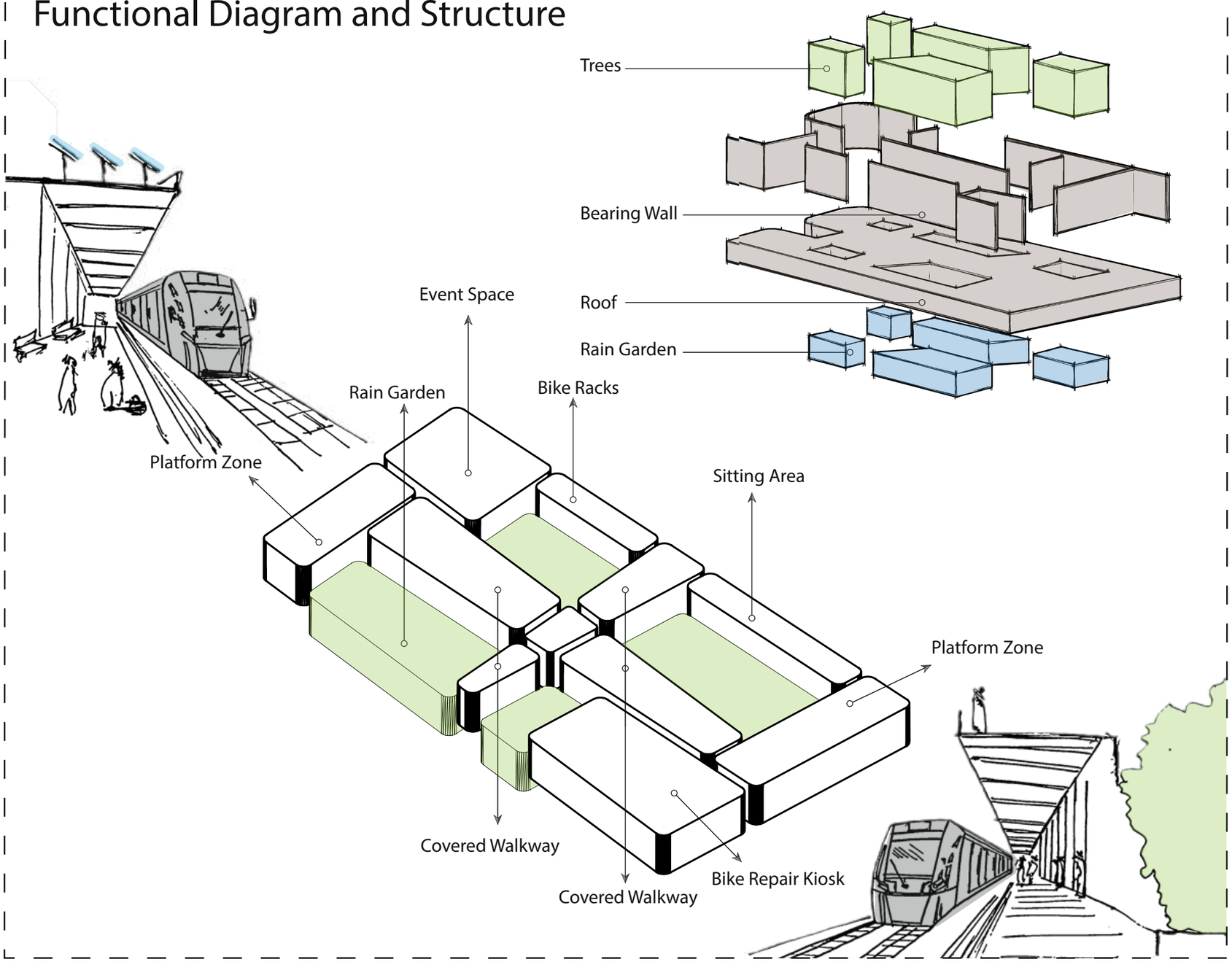
University Entrance

Western Road

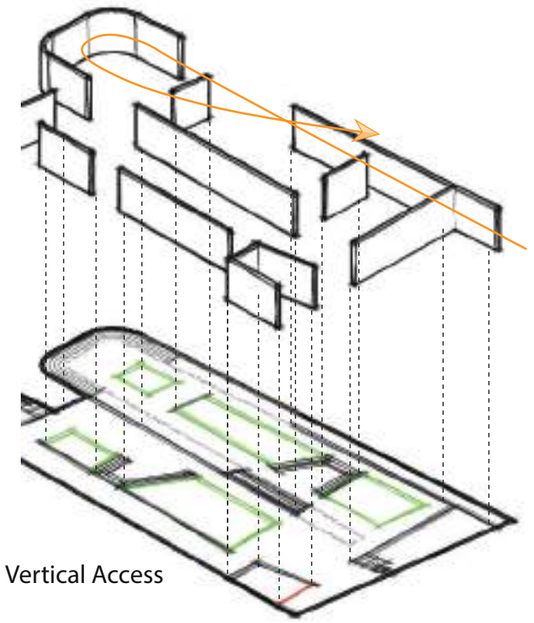
Junction Overview

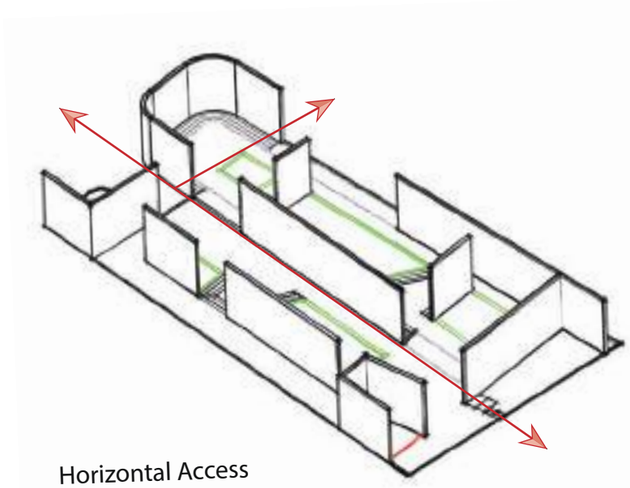
Design and Concept

Functional Diagram and Structure



Design and Concept



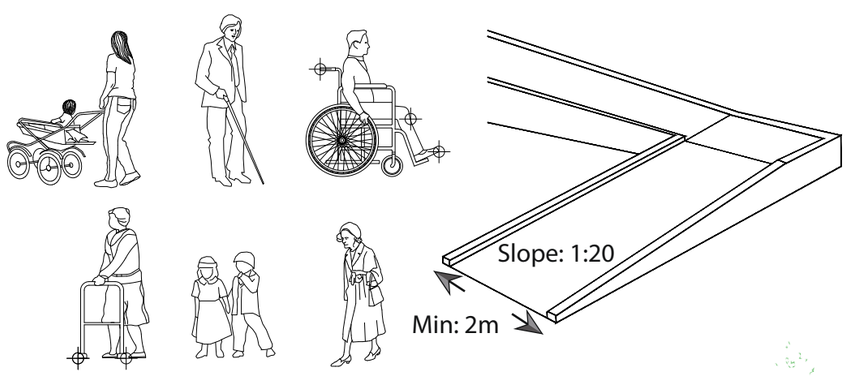


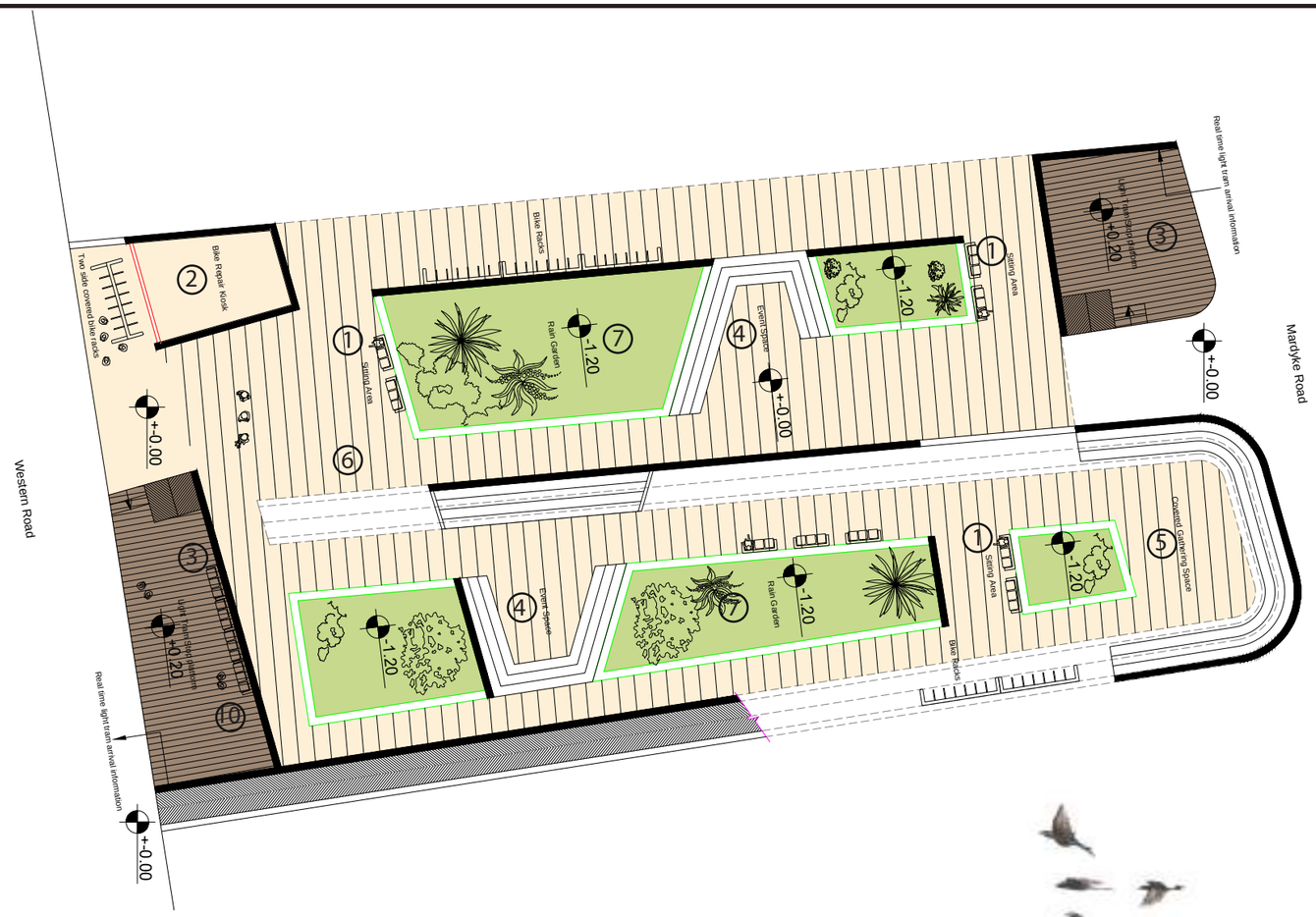
Ground Floor Plan

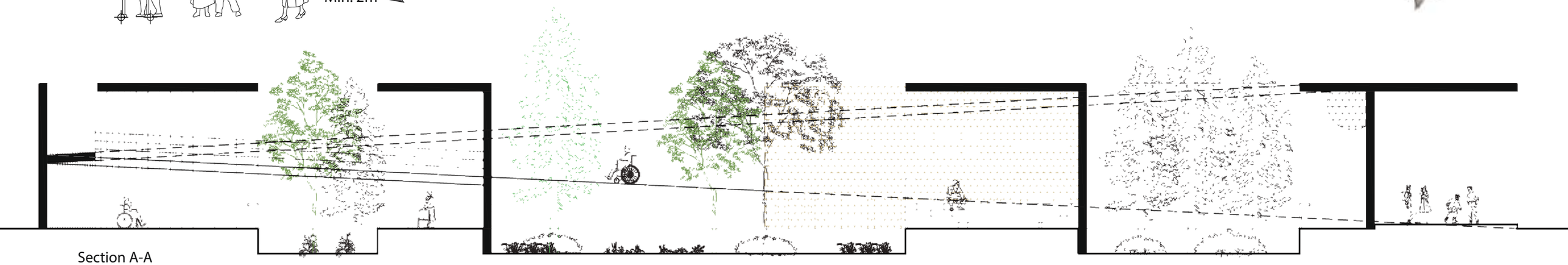
1-Seating Area: (Benches+Solar-powered charging table)
2-Bike Repair Kiosk: Providing a service to cyclist
3-Sheltered Tram Station
4-Event Space
5-Covered Gathering Space
6-Covered Walkway
7-Rain Garden
8-Solar PV Panels
9-Outdoor Lecture Space
10-Real time light tram arrival information

Pedestrians:

-Pushchair Users
-Blind or Visually Impaired Persons
-Wheelchair users
-Mobility Impaired Persons
-Young children
-Elderly Pedestrians







Section A-A

Roof Plan

1-Seating Area: (Benches+Solar-powered charging table)
2-Bike Repair Kiosk: Providing a service to cyclist
3-Sheltered Tram Station
4-Event Space
5-Covered Gathering Space
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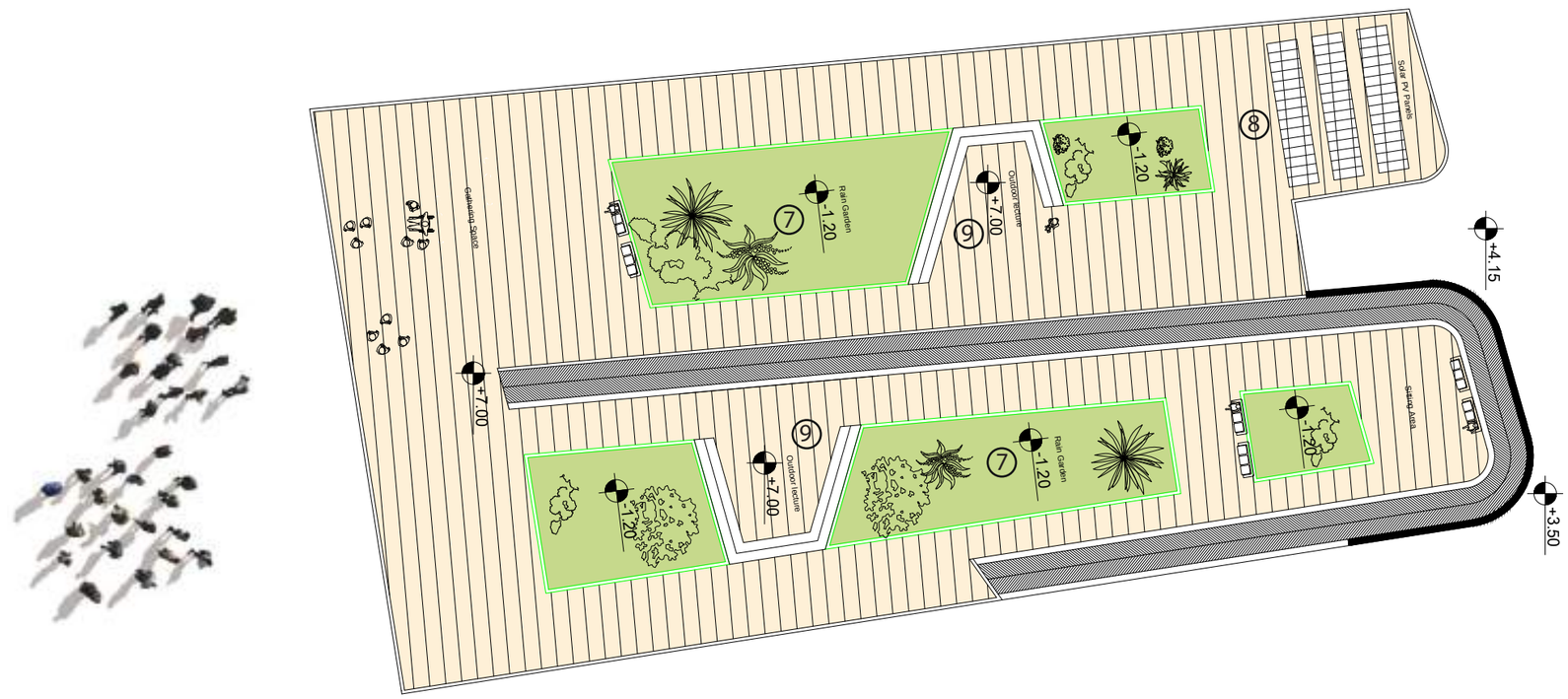
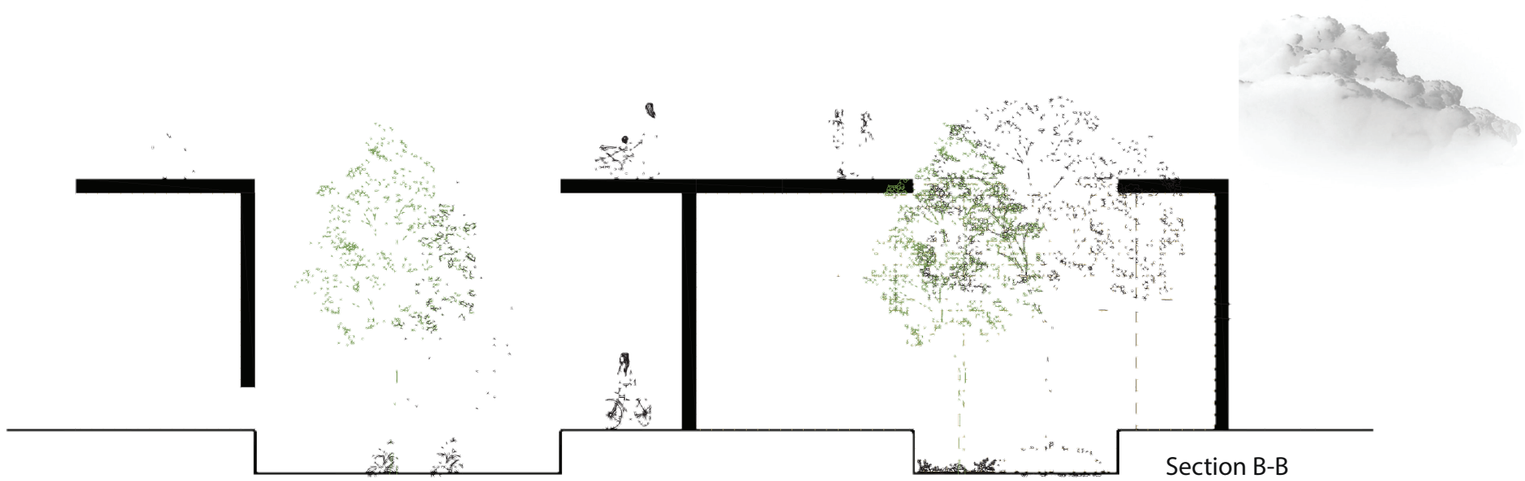


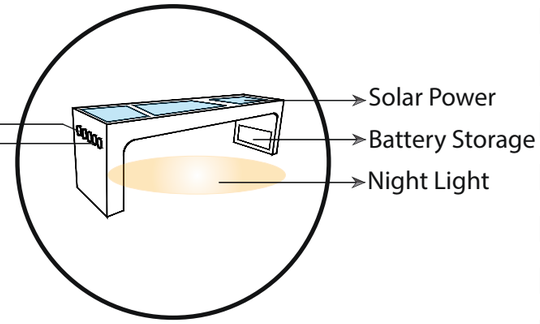


Section B-B

Details

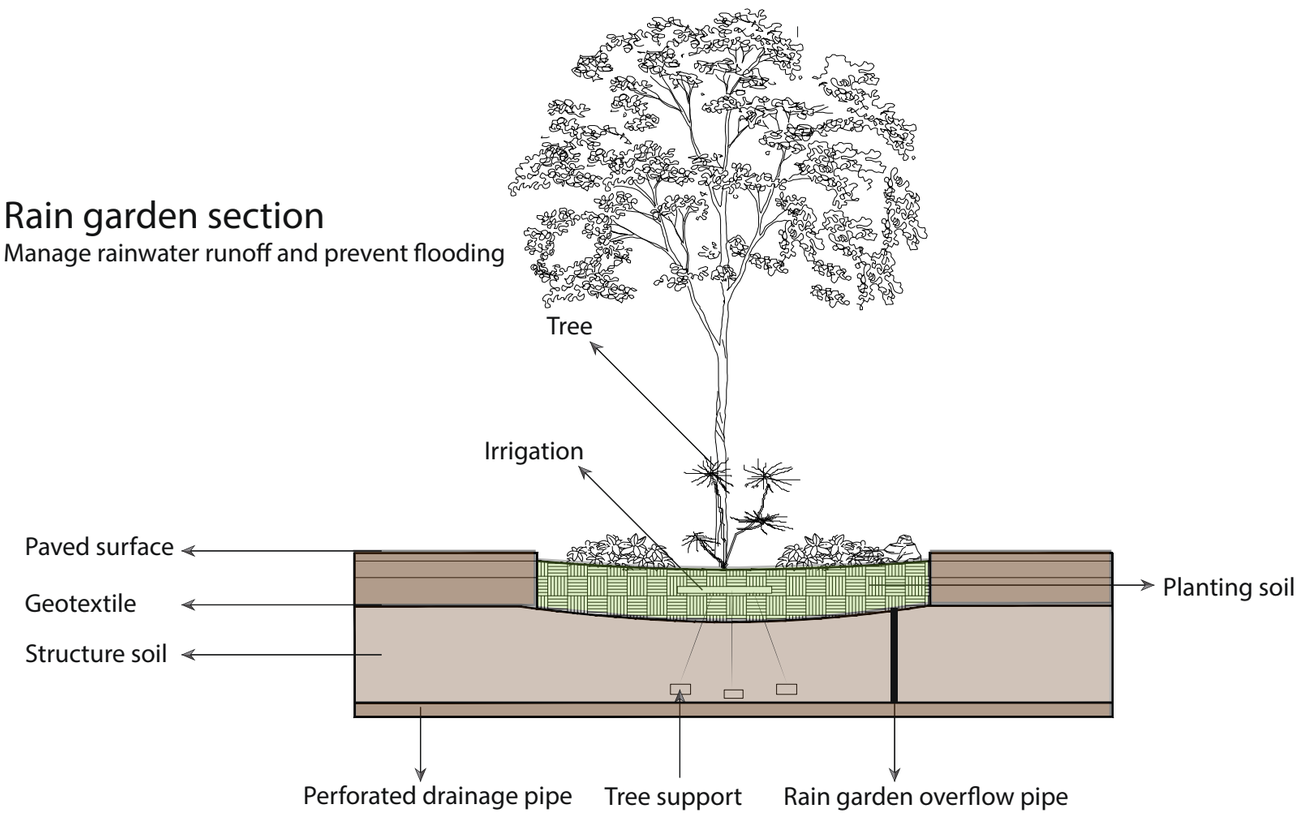
Smart Bench

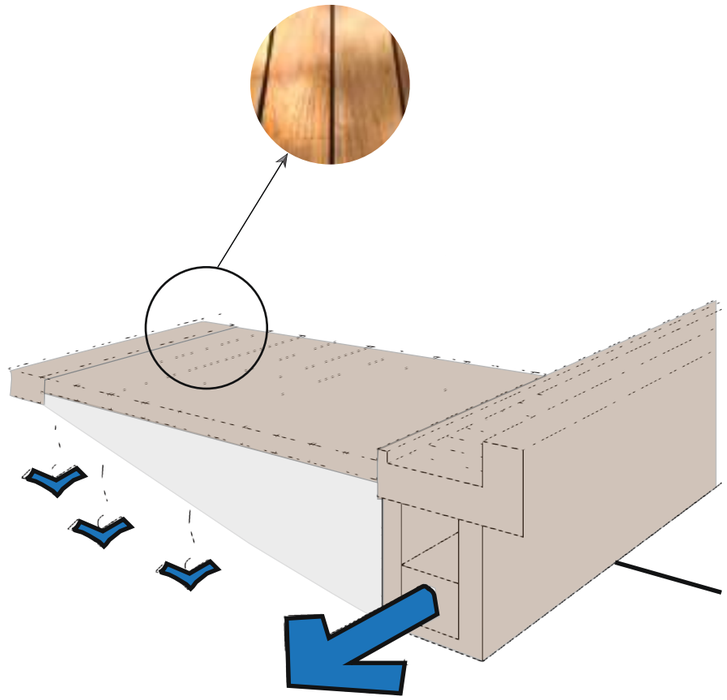
Solar-Powered lighting for pathways and seating areas
Insure visibility during cloudy and rainy days



Rain garden section

Manage rainwater runoff and prevent flooding





Integrated drainage system:

To direct rainwater away from walkway and gathering areas also this will prevent puddles and slippery surfaces

Floor Material :

Wooden deck floor, Choose non-slip less prone to staining or damage from rain

Roof Material:

CLT from 5 layers Solid Wood Panels 16.00*3.50m

PART B / Sustainable Multi-Functional Building

Introduction
Project Brief:

In line with our ongoing commitment to developing a low-carbon campus, this proposal outlines the design and implementation of a multi-functional building adjacent to the UCC main campus. The primary goal of this building is to seamlessly integrate essential services and promote sustainable practices. The public station designed in the part A, with features like cycle racks and a sheltered pathway, enhances sustainable transportation options for students and staff. The proximity of the multi-functional building to the public station encourages eco-friendly commuting and reducing the overall carbon footprint of the UCC's staff and students.

Building Components

1. Grocery Shopping Centre
Establish a grocery shopping centre within the building to meet the basic needs of students and staff.

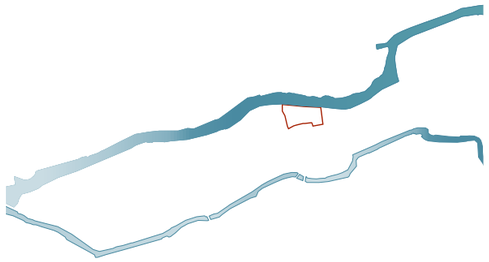
2. Student Services Hub
Create a dynamic space for student, providing technical services, academic support, game zone to encourage recreational activities and friendly competitions.

3. University Administrative Offices
Several of UCC's administrative offices are currently dispersed across the city, including essential units like the International Office and consulting offices. These offices can be effectively consolidated within the proposed building for enhanced accessibility.

Sustainability Features

Energy Efficiency: Implement renewable energy sources, such as solar panels and efficient lighting systems, to minimise the building's carbon footprint.
Water Conservation: Integrate water-saving fixtures and rainwater harvesting systems to encourage sustainable water use.
Waste Management: Implement a comprehensive waste sorting and recycling program throughout the building.
Materials: Introduce reusable and eco-friendly materials in the construction and operation of the complex.

SITE ANALYSES



Site boundary
River Lee

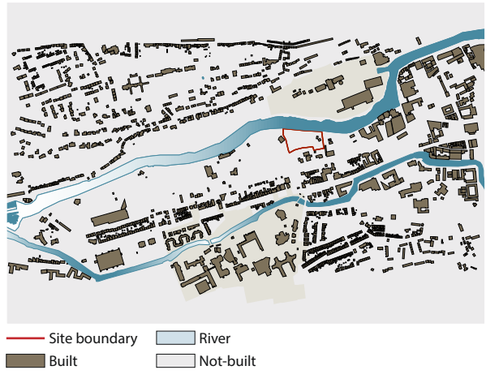
River network:
The site is bordered by the River Lee on the north side. Approximately 250 meters south of the site, another river flows in the same direction as the northern river. These two rivers are interconnected in both the east and west directions.

Site boundary
Major Road
Minor Road
Walkway
Cycling Road
Local Road

Street pattern, Hierarchy:
The area features a somewhat curved street layout, thoughtfully organized to follow the contours of the river, effectively shaping the site. Streets such as N22 and Western Road hold greater significance and hierarchy owing to their strategic location and connection to both the city center and student accommodations. In contrast, the surrounding streets, including the one leading to the site, experience lower traffic as they primarily lead to residential buildings. Notably, there are plans by the government to implement a light train system on N22 and Western Road. The anticipated train station, situated approximately 200 meters from the center of the site, is a key component of the future urban plan.

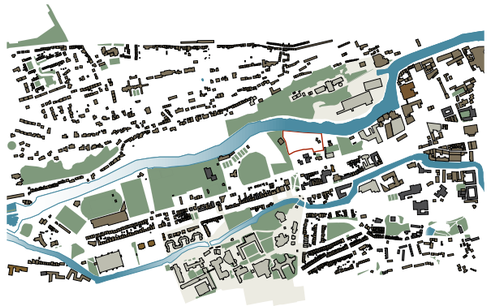
Site boundary
Green Spaces
Non-Built
Built

Open space network:
The site is linked to open spaces and parks via cycling routes and a spon lane. Within a 500-meter radius of the site, approximately 50% of the land is developed, 30% is designated as green space, and 20% constitutes non-built areas.



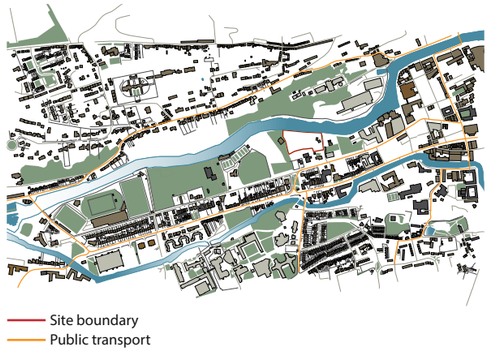
Site boundary
River
Built
Not-built

Figure ground:
The area is mainly characterized by residential and educational buildings. However, in the immediate vicinity of the site, there is a boating and tennis club on the west side, some commercial buildings, and University College Cork on the south side. Additionally, a national school is located on the east side. Furthermore, beyond the River Lee to the north, the site is connected to the North Campus of the university.



Site boundary
Residential Building
Green Space
Educational Building
Commercial Building
Medical Building

Land use, Density:
As previously mentioned, this area is densely populated with both educational and residential structures. The concentration of residential buildings is higher in the southern part of the site compared to the northern area. North of the river, there are various buildings and schools affiliated with UCC, including the School of Music, Plant Sciences Glass Houses, and the Aquaculture and Fisheries Development Center. Additionally, this region includes several buildings with diverse purposes. To the west of the site, near Fitzgerald Park, there is a sports complex with multiple sports and tennis courts. Next to this complex, there is a small public museum. In the eastern part of the site, there are several hotels and temporary accommodations. The surroundings of the site also bear historical and visual significance.



Site boundary
Public transport

Public Transport:
Around the site, N22 Street, Western Road, and Lee Road in the northern part are main routes for public transportation.

Landscape:
The large green area north of the site, though substantial in size, requires optimization. There is a beautiful walkway within this space that, unfortunately, also needs attention to enhance its current state. Presently, these green areas create an insecure and poorly lit environment. However, it's worth noting that Fitzgerald Park, situated 500 meters to the east, stands out as a significant park. Both this park and the surrounding green spaces feature a diverse array of trees, adding to the overall green landscape of the area. Also, the Lee River has provided a place for a bunch of creatures to live, for example, this space is rich in insect food and supports the population of bats. Also, otters are very common along the river. Below is a list of animals, insects, aquatic animals, birds, mammals and trees common in this area.

Site boundary

Topography:
The site is predominantly flat, but approximately 200 meters to the north, there is a relatively steep slope leading towards the river. This incline poses a risk of flooding as it channels rainwater directly into the river during rainfall.

Site Section

The site has beautiful view due to its location on the hillside.

Site has stunning view due to river Lee.

Around the site, it is possible to pass bicycles and access the northern campus by bicycle.

The site can only be accessed by vehicle from the east side.

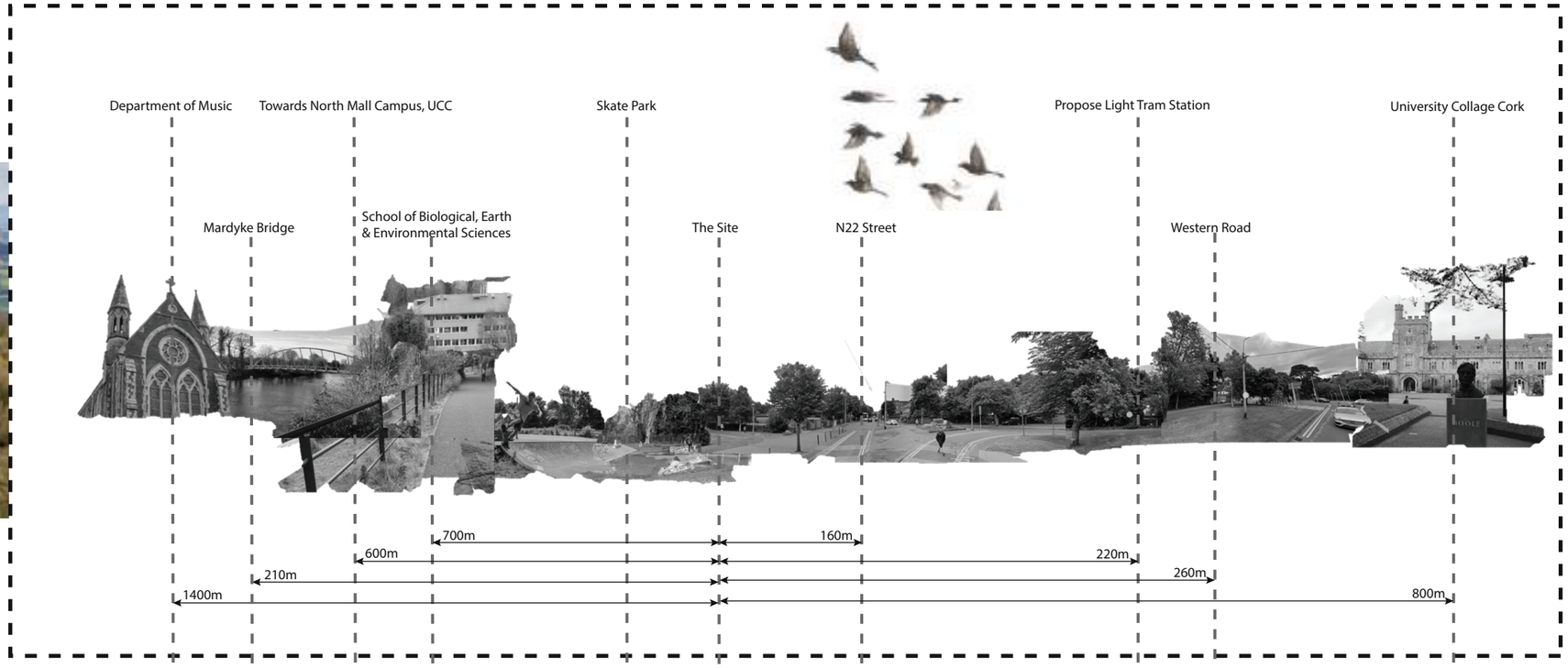
According to the predictions made in the not too distant future, this site will be on the path of the light tram.

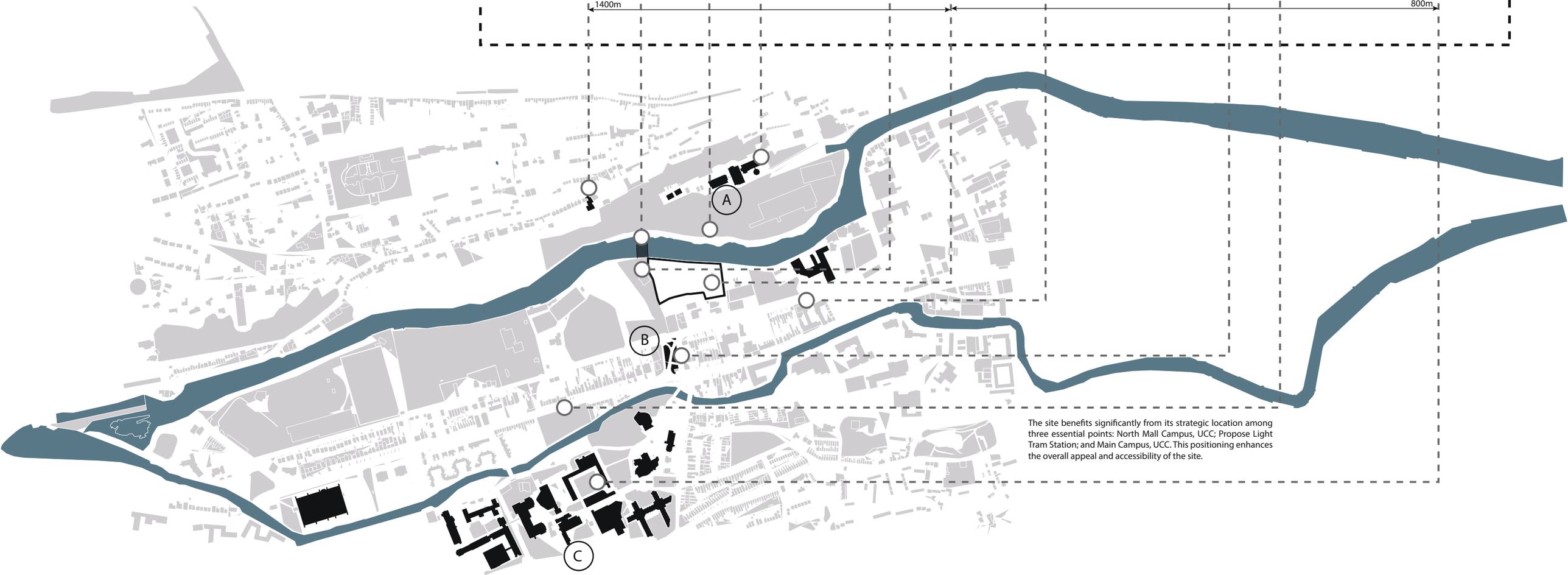
Site has strong connection to public transport.

A view of pedestrian access to the site.

A view of the main university campus near the site.

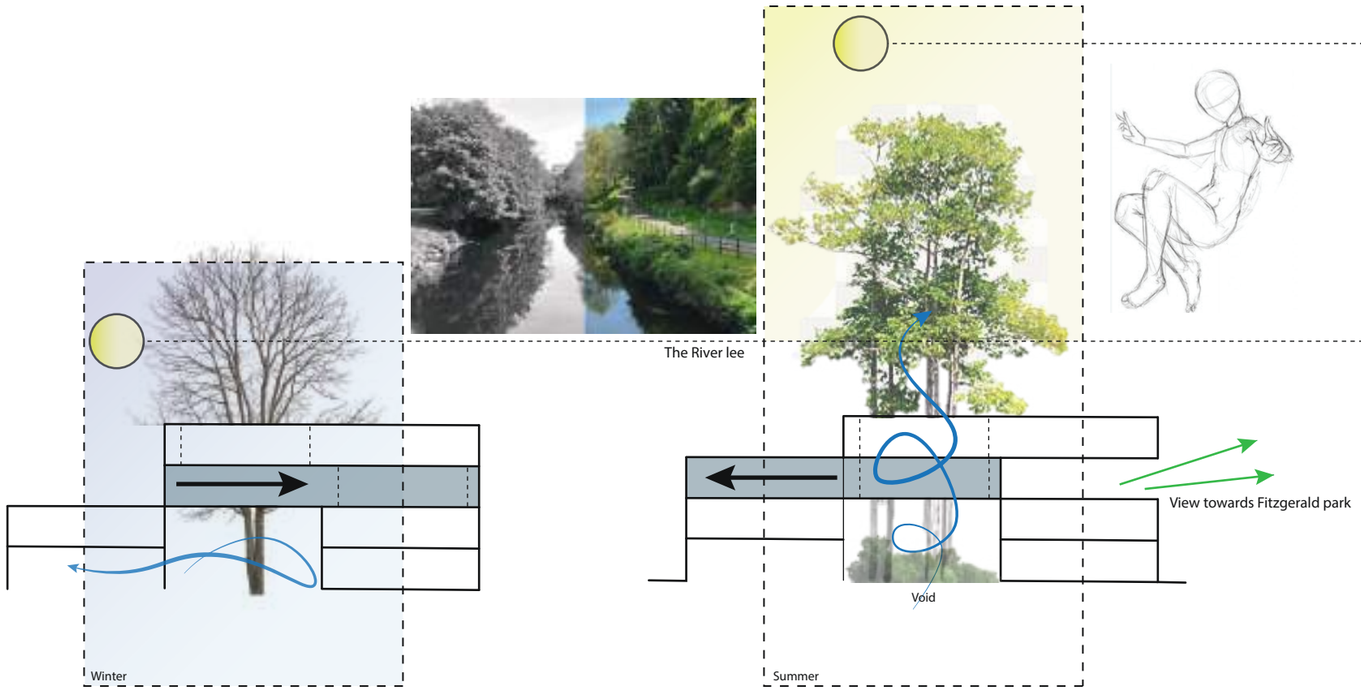
LANDMARK

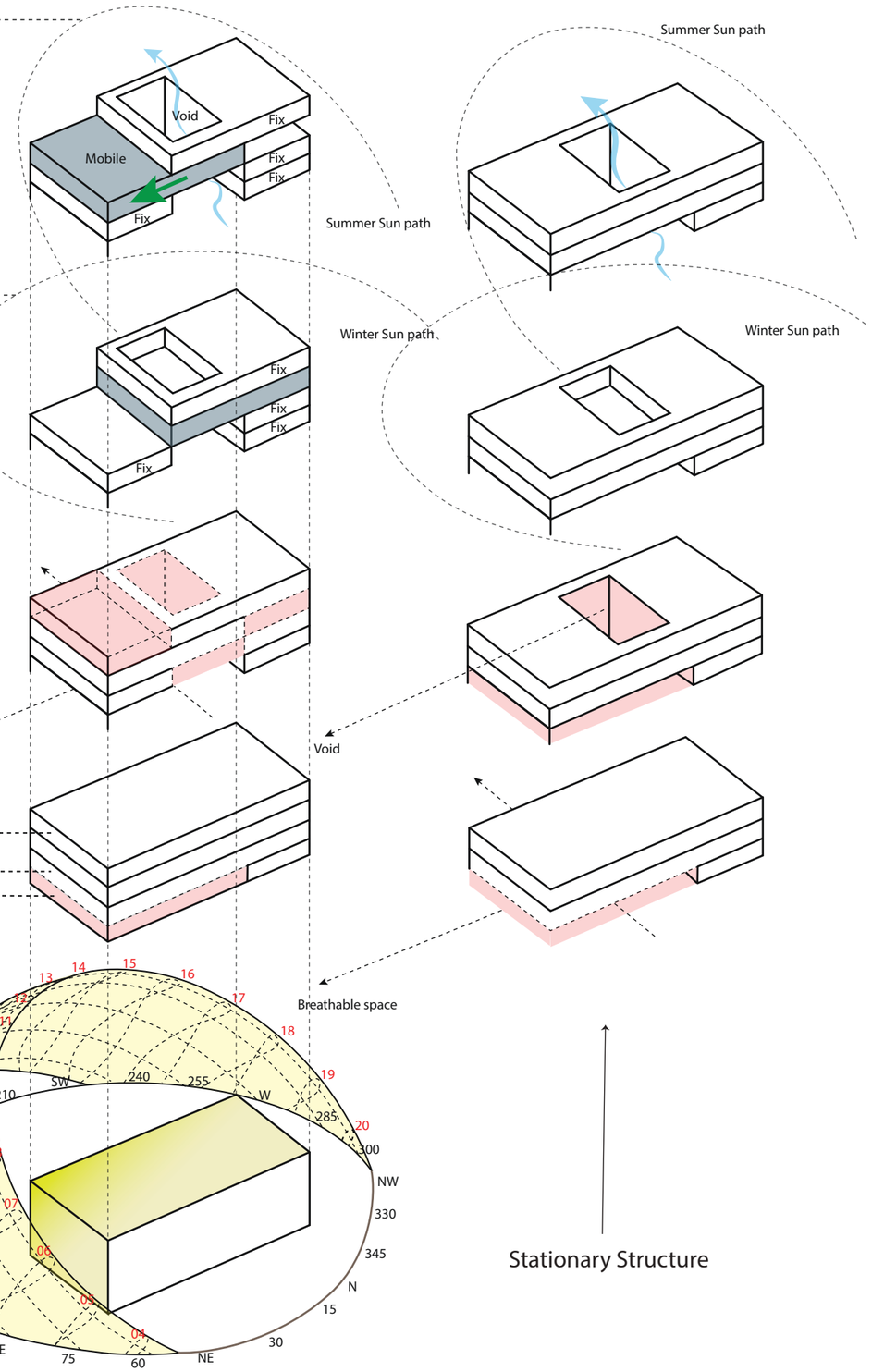


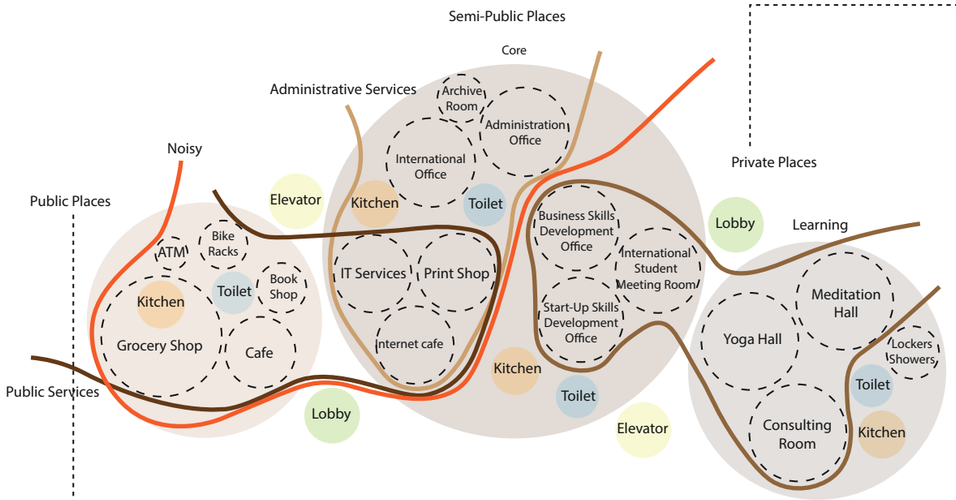


The site benefits significantly from its strategic location among three essential points: North Mall Campus, UCC; Propose Light Tram Station; and Main Campus, UCC. This positioning enhances the overall appeal and accessibility of the site.

CONCEPT

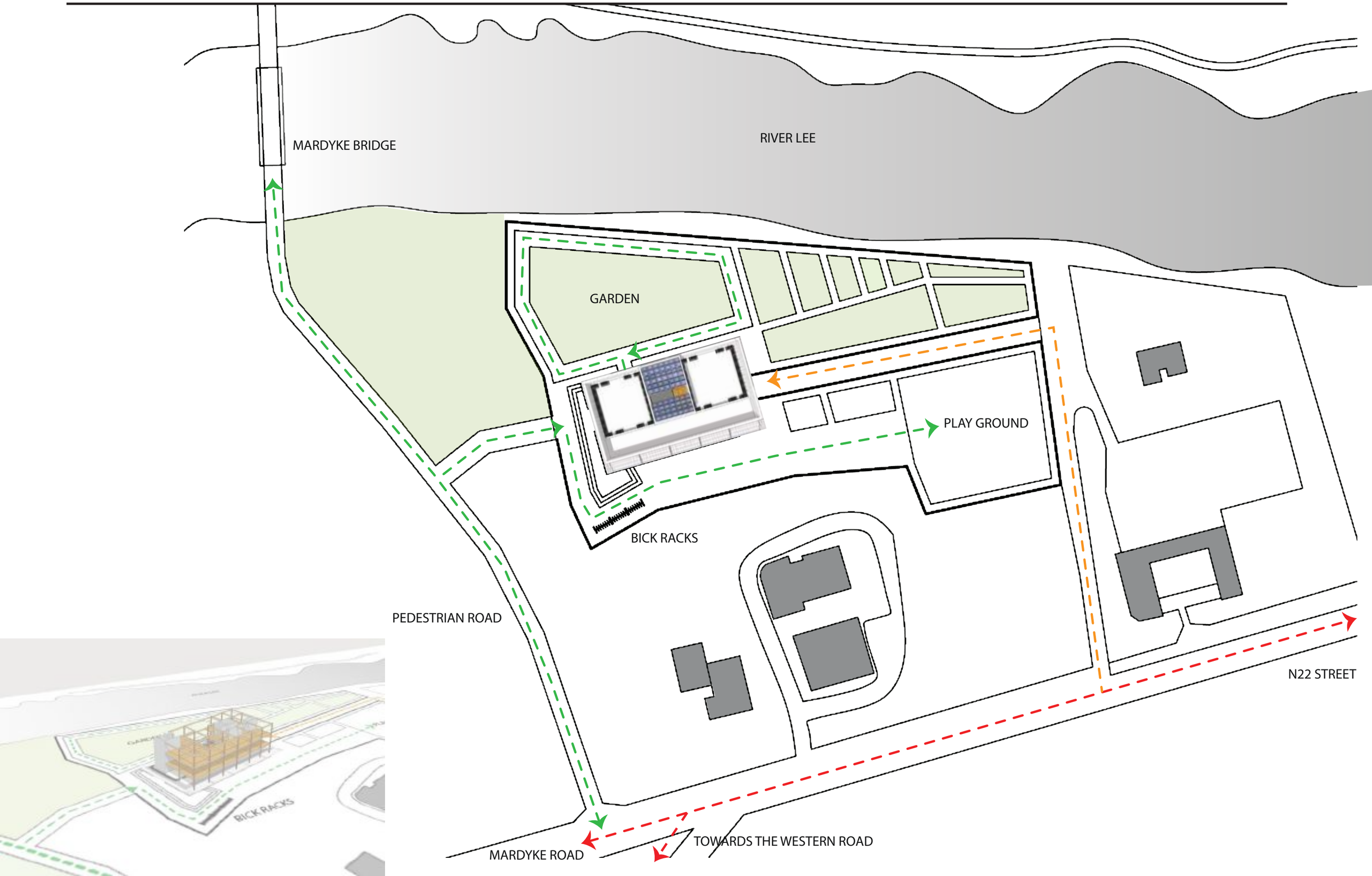






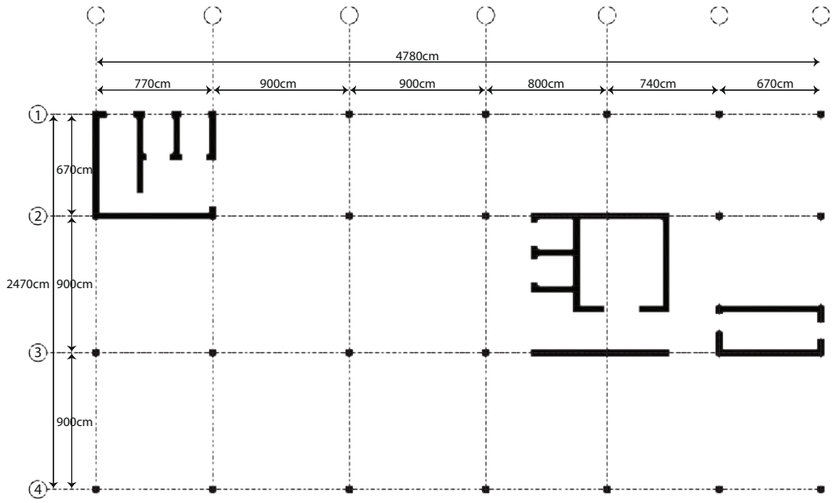
DESIGN DESCRIPTION:
Since ancient times, the influence of sunlight and environmental conditions has been of particular importance in architecture, especially in building design. By understanding the positive features of environmental conditions and their effects on the performance of spaces, exceptional uses can be made. Light is the primary factor in the quality, dynamism, and vitality of architectural spaces and holds a special position among the elements that constitute space. Therefore, the building is designed with an emphasis on sunlight and the utilization of natural environmental potentials. It utilizes natural sunlight for illumination during the day and accumulates thermal energy at night. In winter, with proper orientation, it absorbs the maximum sunlight and creates open and dynamic spaces. The natural airflow system helps control temperature and humidity. However, it doesn't stop there. The building on the third floor is movable and, depending on seasonal needs, responds differently to various temperatures. In warm seasons, it opens up like a human embrace, allowing heat to pass through its arms, and in cold seasons, it seems to encircle its hands around itself, preserving the warmth within to prevent heat loss and ensure a sense of warmth.

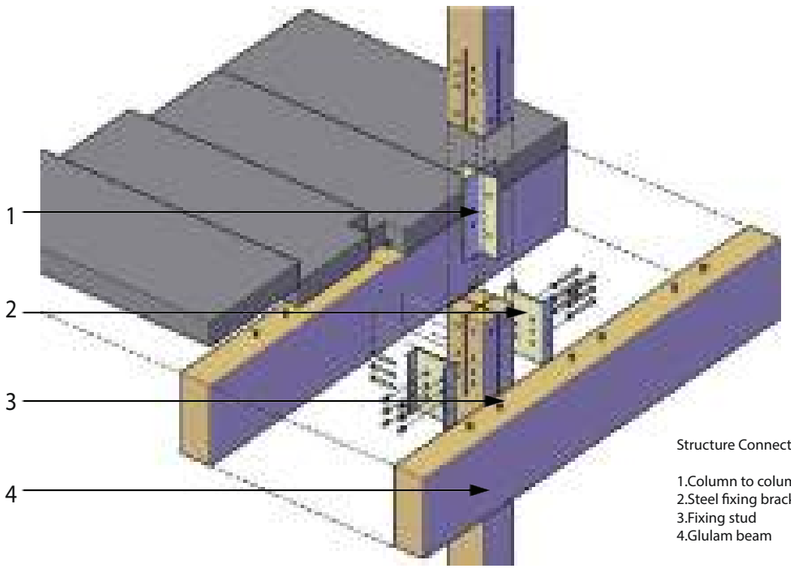
SITE PLAN


MARDYKE BRIDGE
RIVER LEE
GARDEN
PLAY GROUND
BICK RACKS
PEDESTRIAN ROAD
N22 STREET
MARDYKE ROAD
TOWARDS THE WESTERN ROAD
BICK RACKS

STRUCTURE

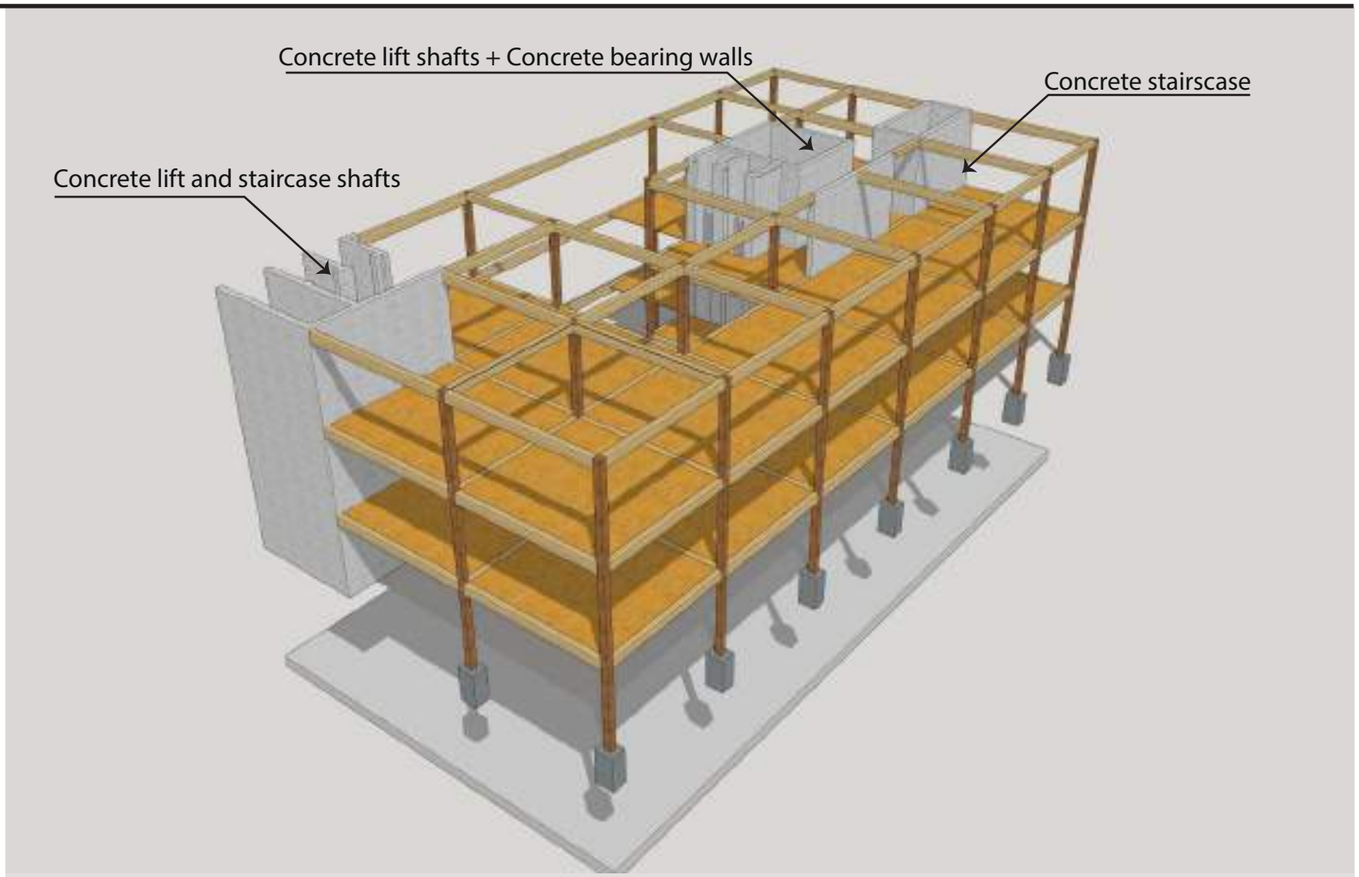
In order to reduce CO2 emission and less energy consumption compared to the production of concrete and steel, the columns and beams are designed with glulam (Glued laminated timber) and all the walls and floors except staircase and elevator shaft are made of CLT panels.
The structure follows a simple grid system that ensures the building's stability. These elements are braced by tree concret solid box as staircase and elevator shaft in North-West, Central and South-East sides.
Regarding the other advantages of using this material, the following can be mentioned: saving time and labour, connections, less weight of the structure, cost-saving, efficient and finally a green-natural product and helping the environment.
But, the foundation are made of concrete due to bearing the load of the building and the presence of moisture.

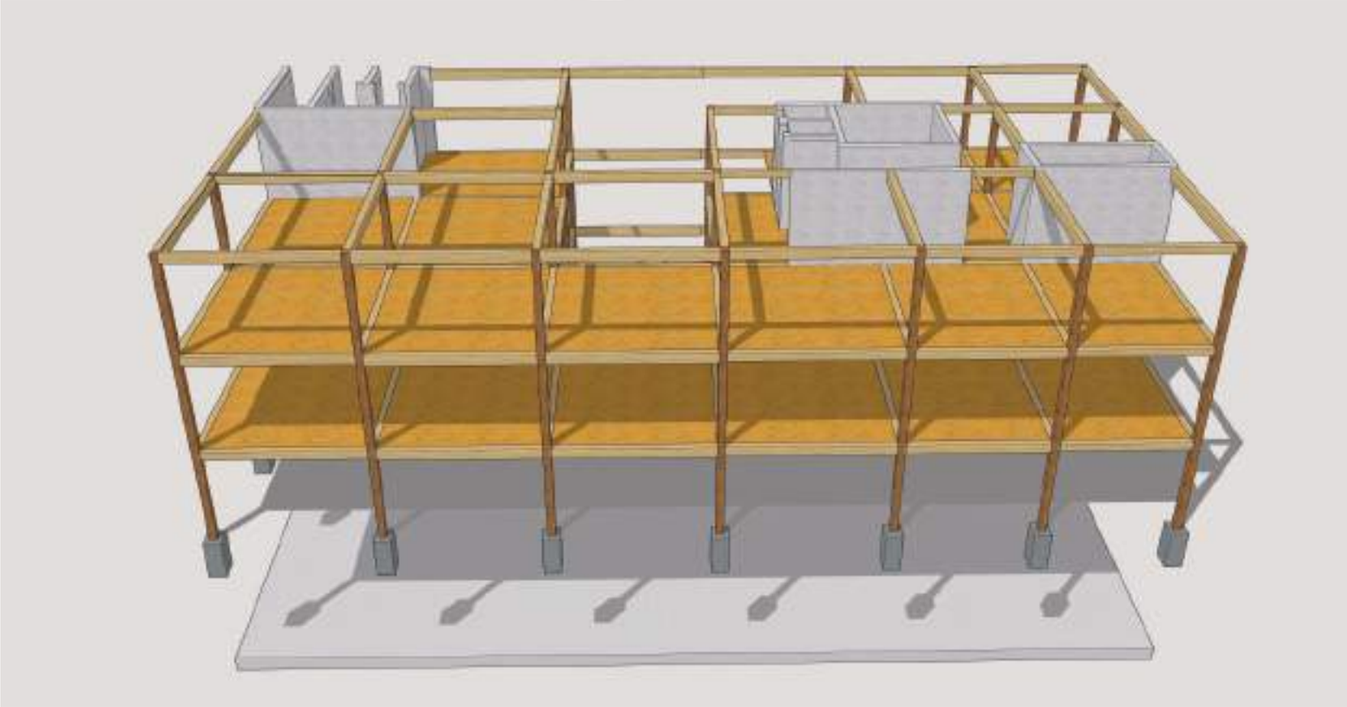




Structure Connection:

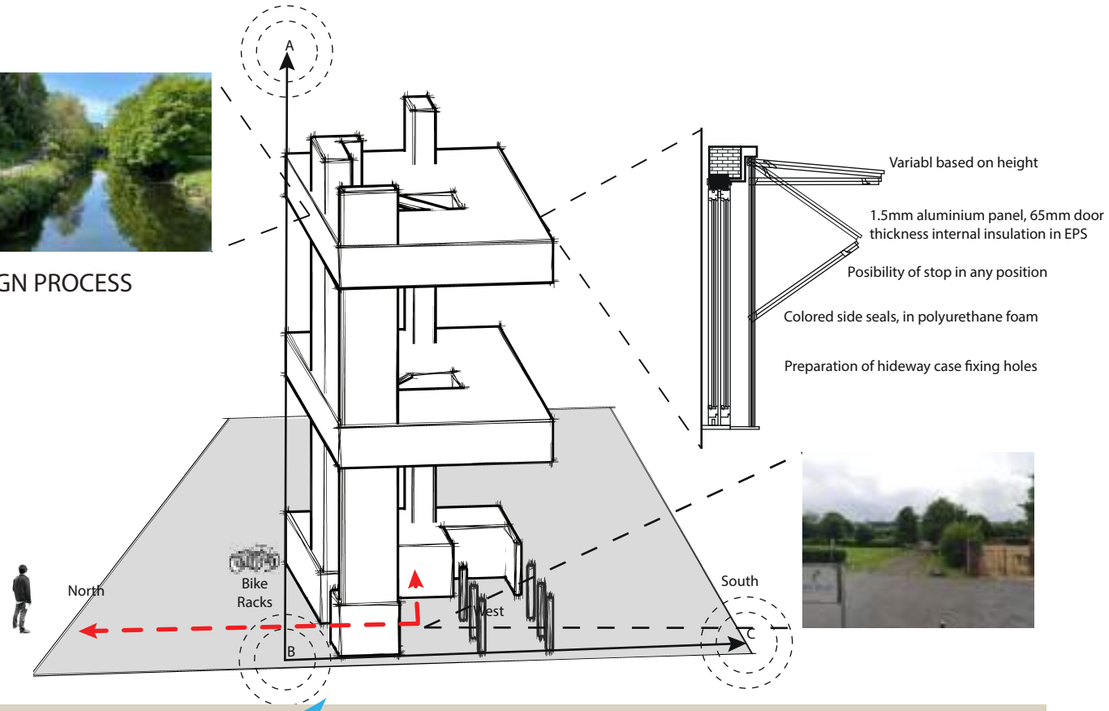
1.Column to column connection
2.Steel fixing bracket
3.Fixing stud
4.Glulam beam



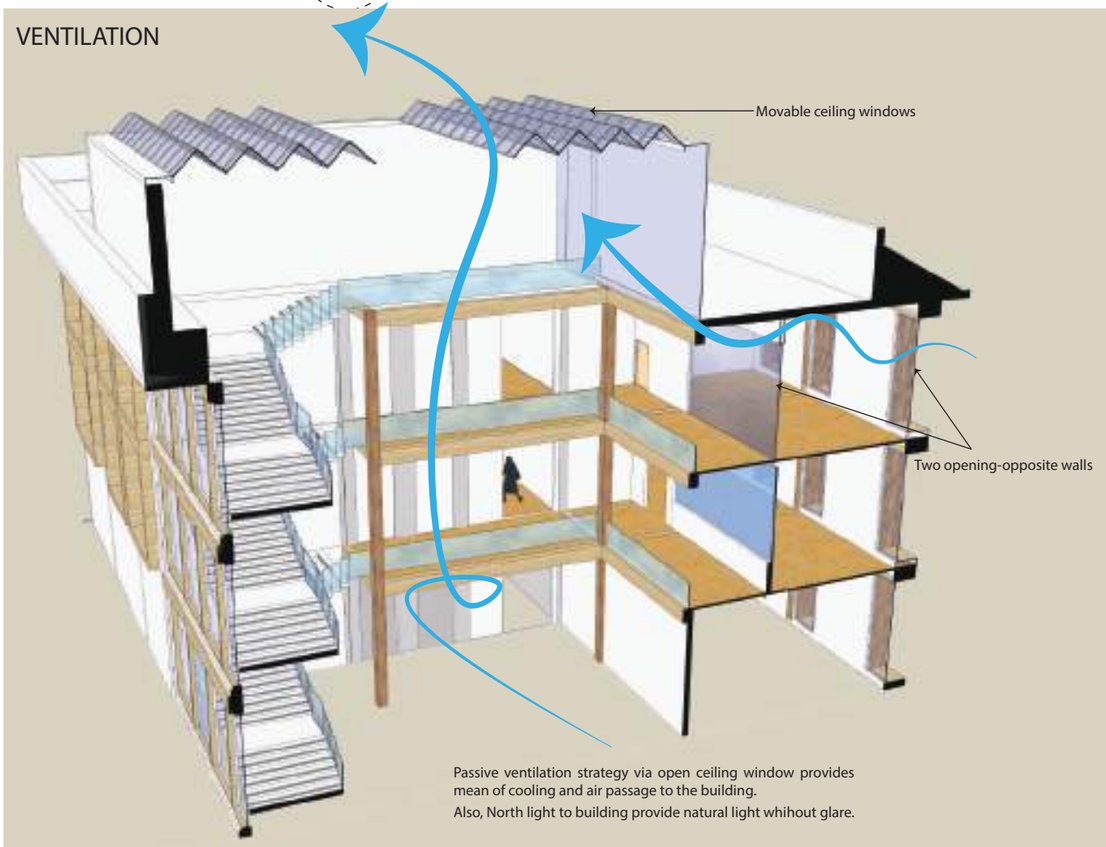


DESIGN PROCESS AND PLANS

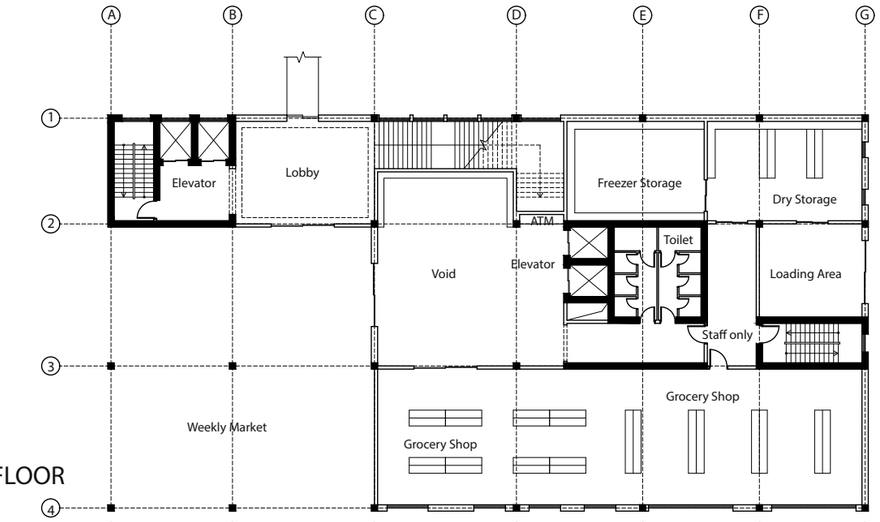
DESIGN PROCESS



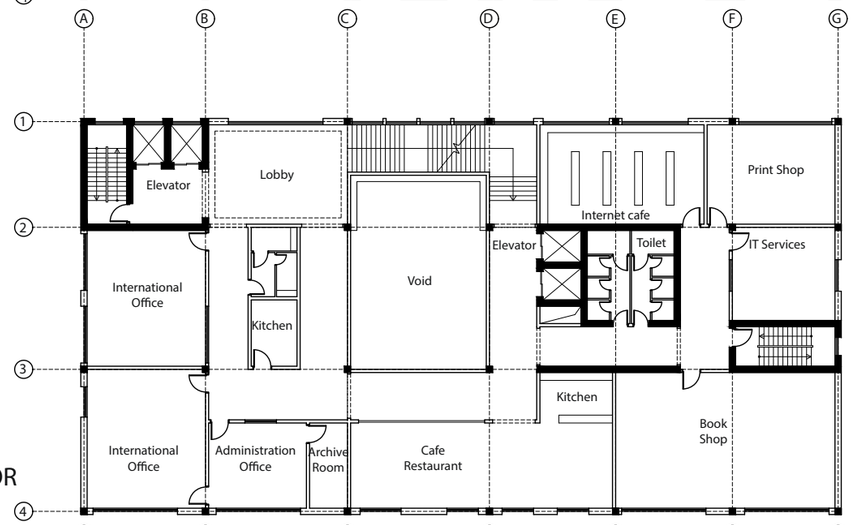
VENTILATION



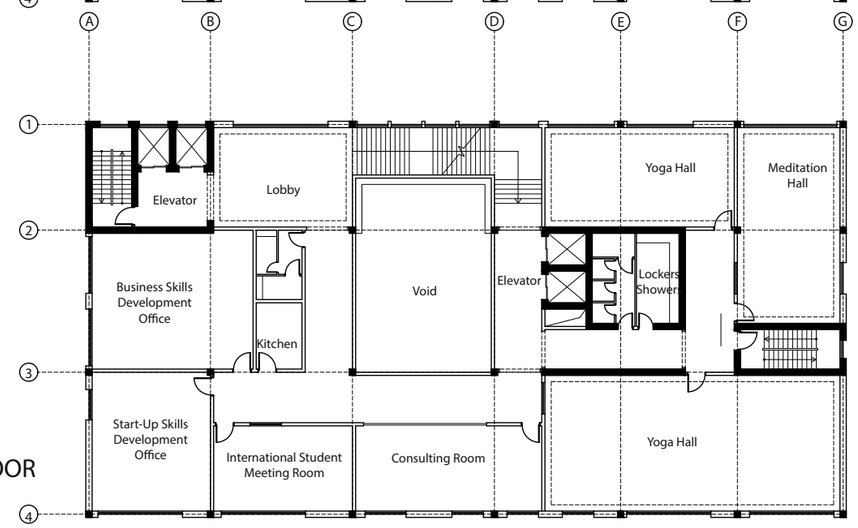
GROUND FLOOR



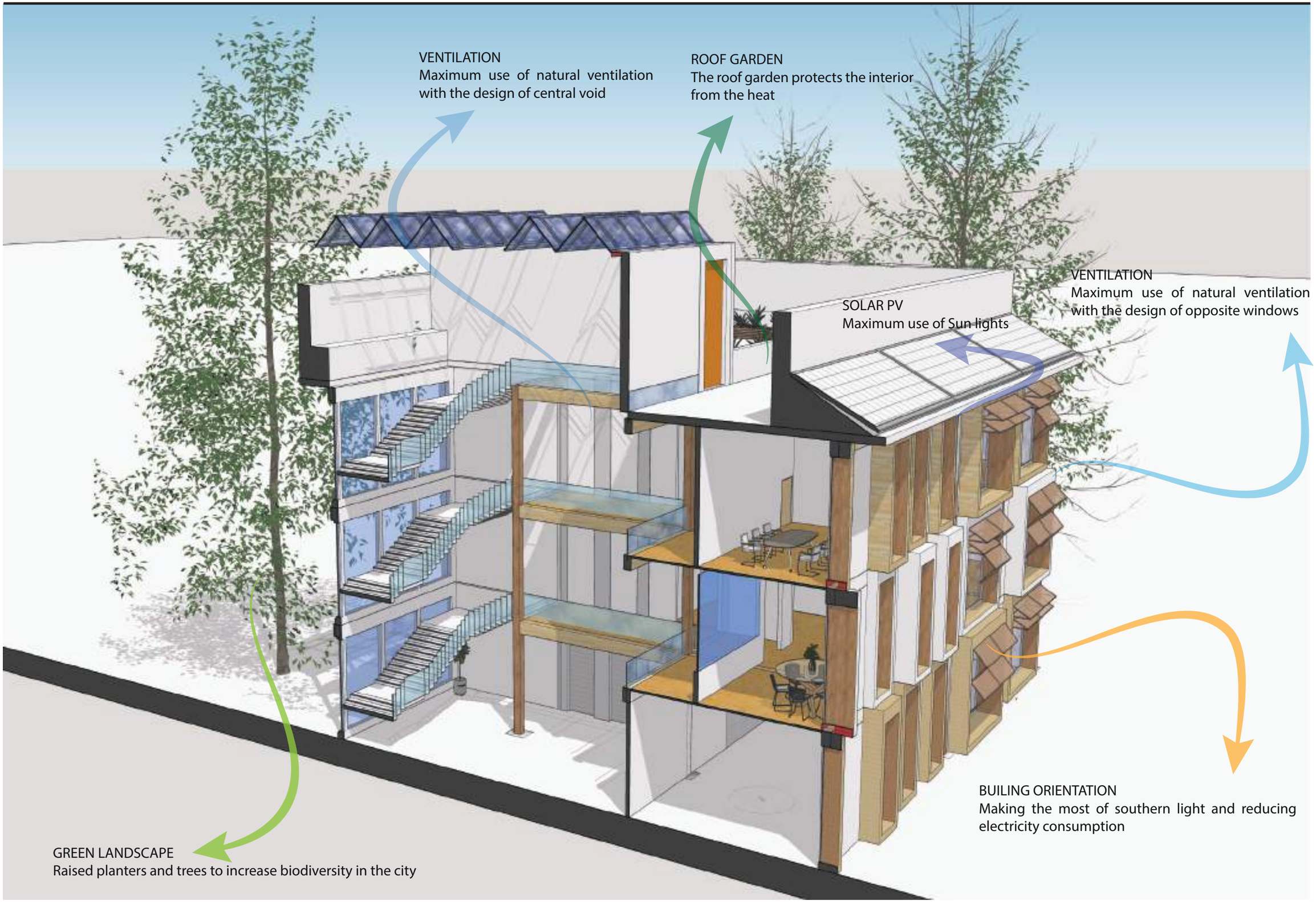
FIRST FLOOR



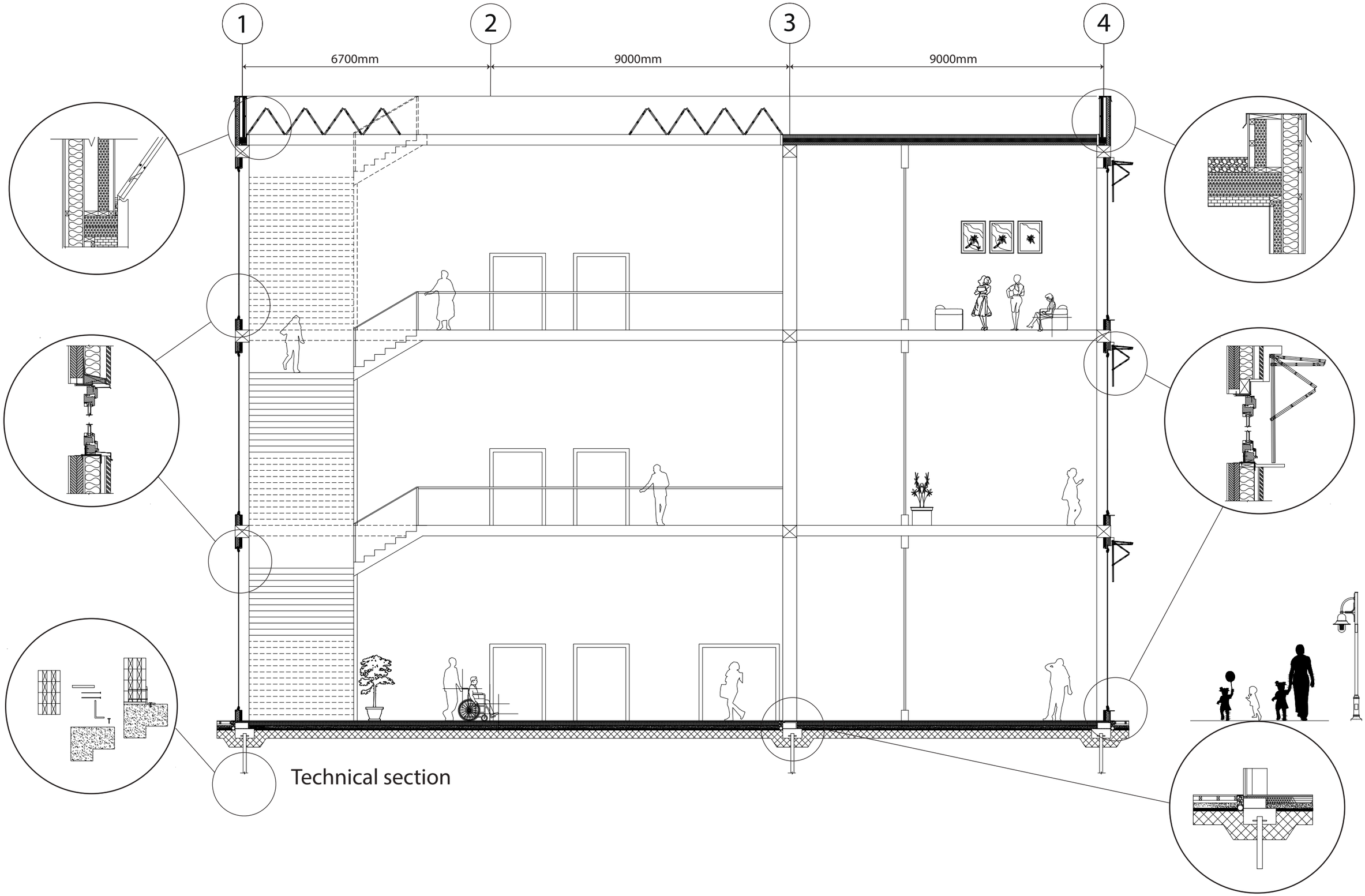
SECOND FLOOR



ENVIRONMENTAL STRATEGYS

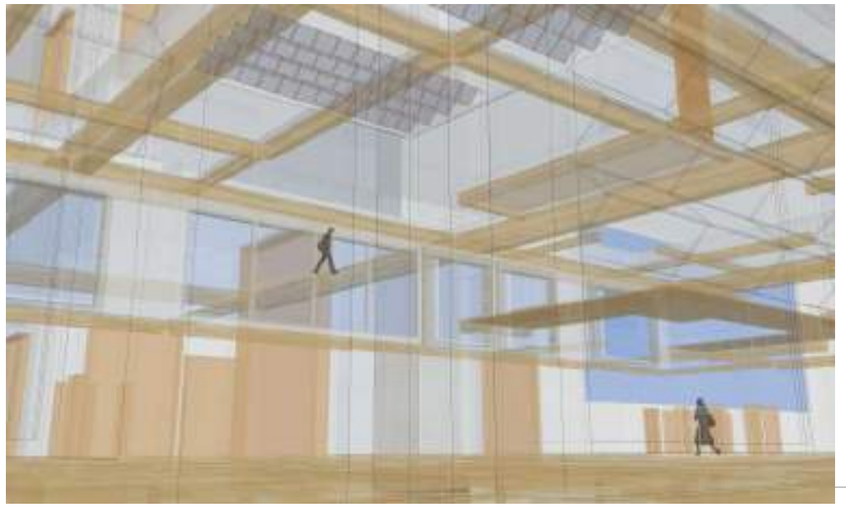


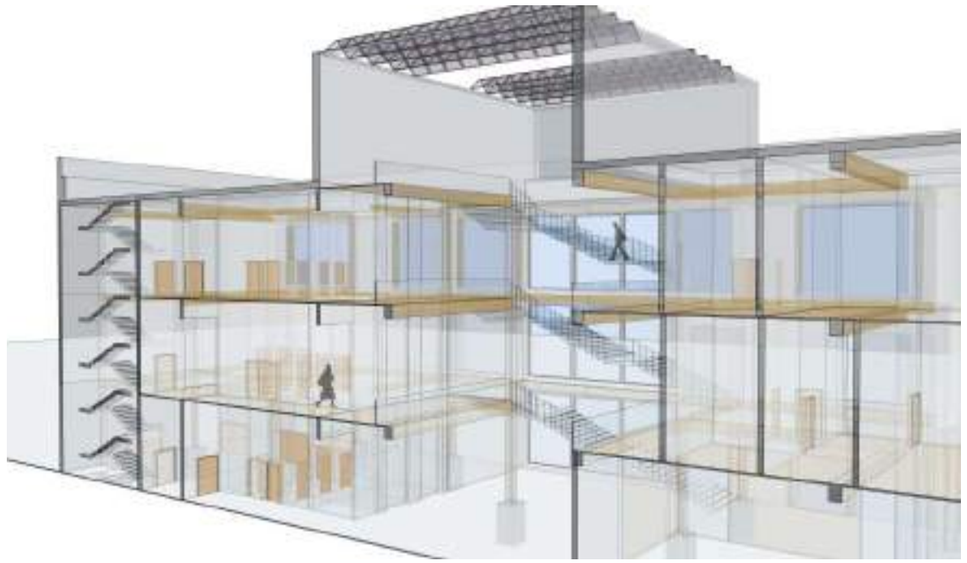
BUILDING ENVELOPE



Technical section

SECTIONS



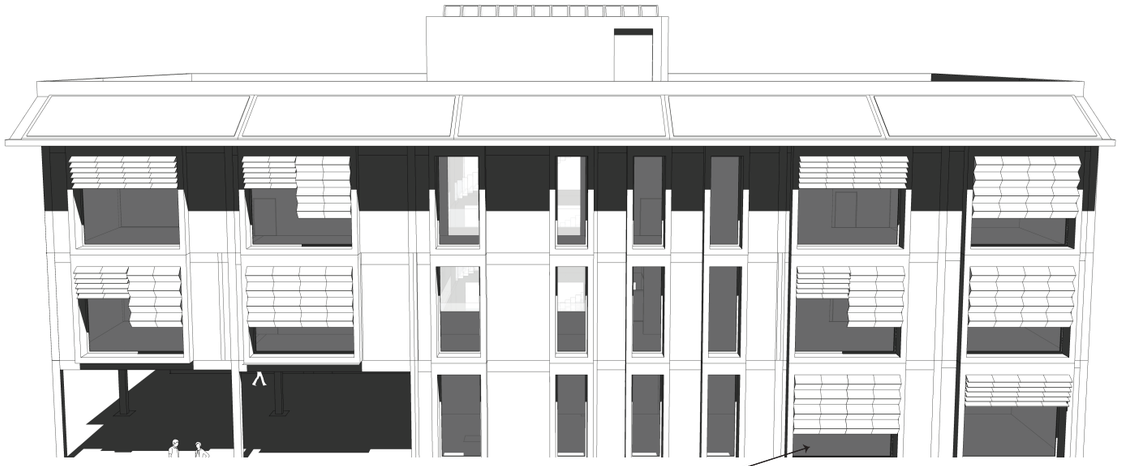


MATERIALS

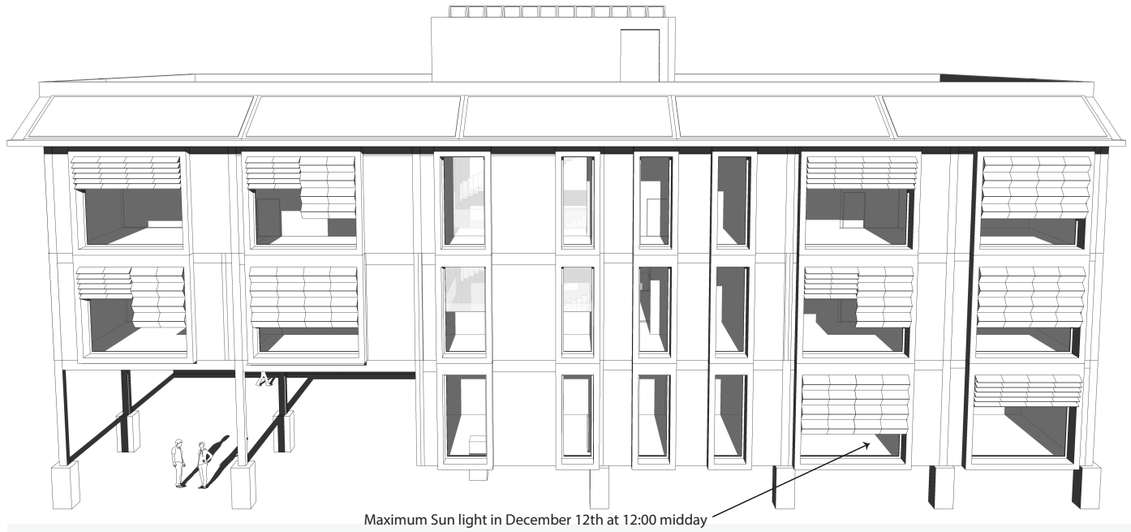
The materials chosen for this building prioritize environmental sustainability. I have made extensive use of recycled materials throughout, even incorporating old bricks from the previous small building into features like storage and garden walls, leveraging their natural thermal mass. As a result, the majority of materials used are sustainable, with minimal carbon emissions. Additionally, wooden frames have been utilized for all openings instead of metal or aluminium, while low-e glass has been employed for windows in place of traditional glass, further enhancing energy efficiency.
Different materials combine to provide texture and interest, and create an extremely tactile building which is also a teaching tool for demonstrating ecological design.

DAYLIGHT AND SUNLIGHT

Within the building, I have integrated various student service departments, such as a grocery shop, administrative office, and mental health facilities like a yoga and meditation hall. Emphasizing the importance of natural light in these spaces, I have prioritized the incorporation of large windows into the building's facade. This design approach ensures ample sunlight penetration, contributing to a welcoming and vibrant environment.



Maximum shaiding in June 12th at 12:00 midday



Maximum Sun light in December 12th at 12:00 midday

ARTIFICIAL LIGHTING

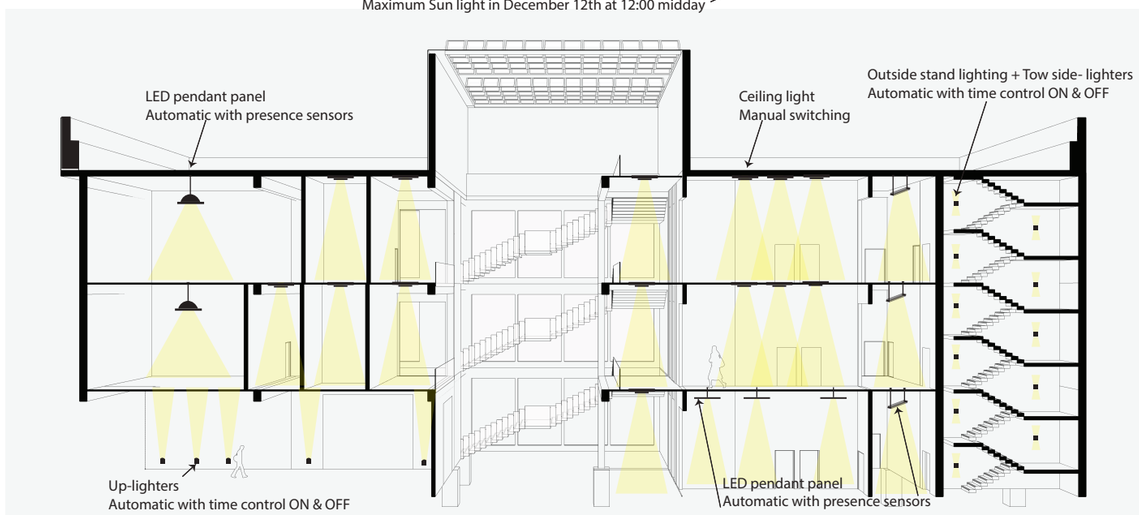
In designing the artificial lighting system for the building, a paramount consideration was its environmental impact and energy efficiency. To achieve this, I implemented several measures aimed at minimizing energy consumption and maximizing sustainability.

Firstly, I opted for LED lighting fixtures throughout the building. LED lights are renowned for their energy efficiency, consuming significantly less electricity compared to traditional incandescent or fluorescent bulbs. This not only reduces the building's carbon footprint but also leads to substantial cost savings over time.

Furthermore, I tried to incorporated motion sensors and daylight harvesting controls into the lighting system. Motion sensors automatically turn off lights in unoccupied areas, preventing unnecessary energy wastage. Daylight harvesting controls adjust the intensity of artificial lighting based on the amount of natural light available, ensuring optimal illumination levels while minimizing energy usage during daylight hours.

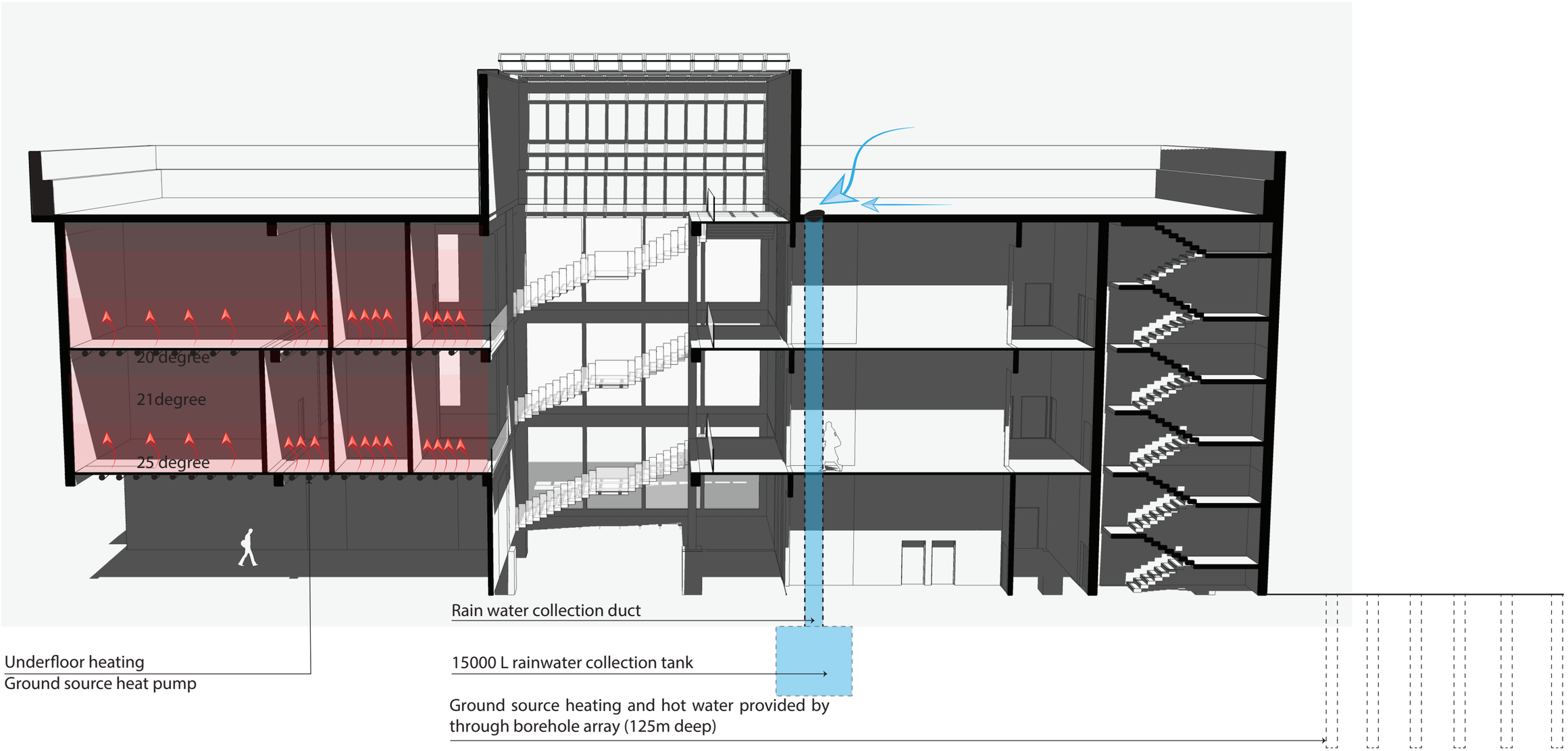
In addition to energy-efficient lighting fixtures and controls, I prioritized the use of eco-friendly materials in the construction of lighting elements. Fixtures were crafted from sustainable materials such as recycled aluminum or bamboo, further reducing the environmental impact of the building.

Overall, my approach to artificial lighting embodies a commitment to environmental sustainability, combining energy-efficient technologies, smart controls, and eco-friendly materials to create a lighting system that minimizes energy consumption and environmental impact while providing comfortable and well-lit spaces for building occupants.



HEATING SYSTEMS

The heating system at this building utilises an underfloor heating system with a ground source pump. This pump is buried beneath the playground and harvests solar energy to heat the building. In winter, as the sun hits the ground, it heats up and the deep layers of the earth remain consistently around 10 and 16°C due to thermal conditions. The ground source pump is able to take this low level of heat and concentrate it into much higher temperatures, providing heating and hot water for the entire building. To achieve this, there are 125m deep boreholes that pump cold water down to be heated, and then the hot water is pumped back up and used for heating. In the summer, the ground source pump has a reverse effect, as the temperature is cooler underground compared to the building. This cooler air is brought up by the pump and used for ventilation around the building. Additional ventilation is provided to the eastern room throughout the year, as this rooms requires more than natural ventilation due to the heat generated by the exercises. This ensures that the entire building is heated and ventilated efficiently, making use of the renewable energy from the ground source pump.



SUMMARY OF SUSTAINABILITY PERFORMANCE

Outstanding

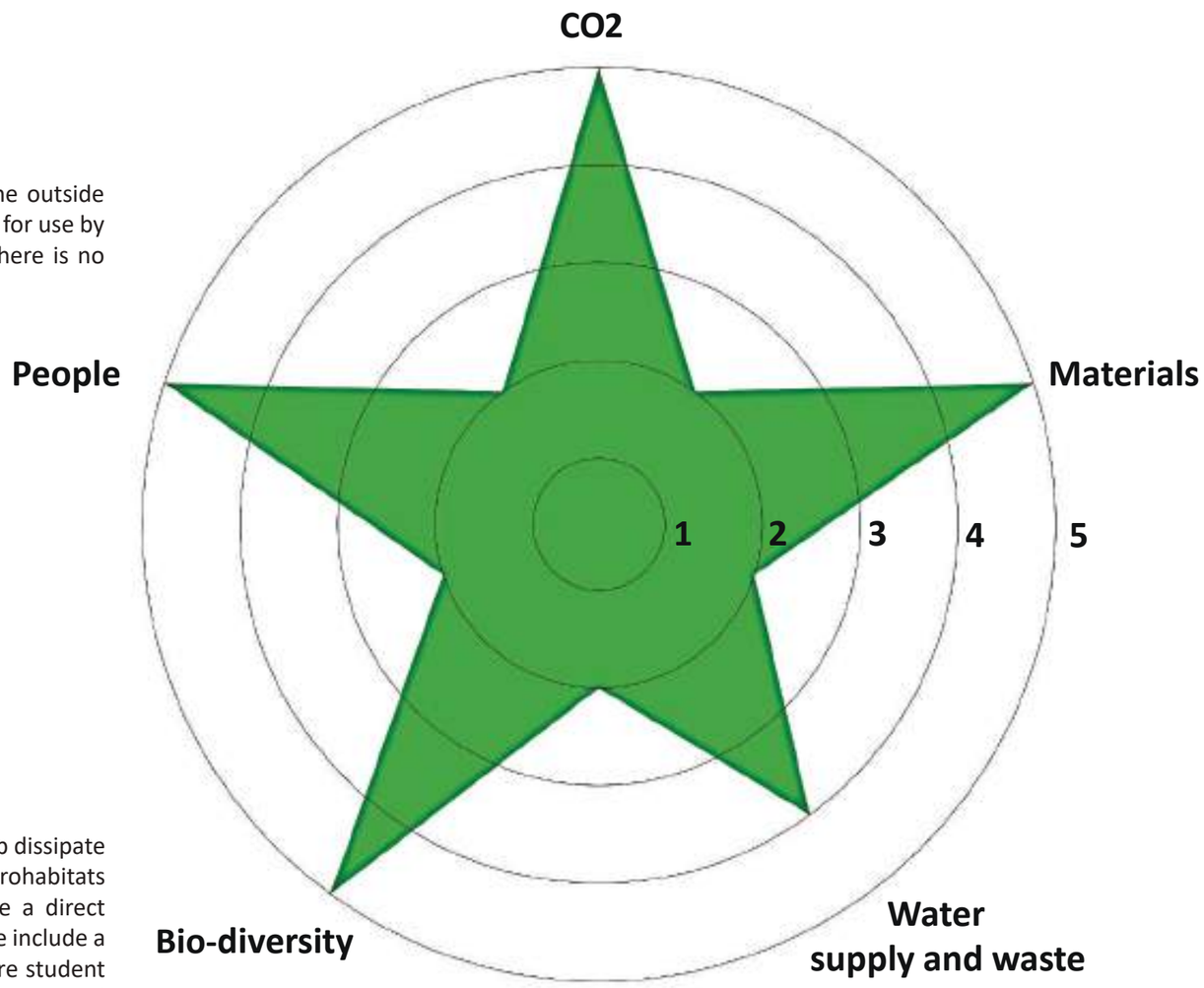
Passive design method enable Building to reduce its energy needs, and reduction CO2 emission 70% than a typical building.

Outstanding

The building have a direct connection with the outside environment, also contains a community room for use by students. There is no (excessive) noise, and there is no trouble for other rooms.

Outstanding

Most of the materials are in preference 1 and has been tried to used some old and recycle materials, for example bricks from the old small building were recycle and used within the new building.



EcoStar

Outstanding

Improved habitat on green roof, green roof help dissipate water flow during heavy rain and provide microhabitats for local animal spaces and groundfloor have a direct connection with the outside environment,these include a series of allotments and a nature garden where student or other visitors can learn about food management and ecology.

Well above current standard

Rainwater is collected to flush toilets and irrigate the green roof.

CONCLUSIONS

This Multifunctional building boasts numerous sustainable features that have contributed to its ecofriendly status. The building was designed with a high emphasis on functionality, sustainability, constructability, efficiency, aesthetics, and durability. One of the key sustainability features of the building is its ground source pump, which is buried under the playground and harnesses solar energy to heat the building. Additionally, the building has 100 square meters of photovoltaic solar panels on the south side of the roof, which provide electricity to power the ground source pump. It's important to note that these solar photovoltaic panels are different from solar thermal panels, as they generate electricity rather than heat. This means that the energy can be used to power the ground source pump, making them highly efficient even on cloudy days with low light intensity. The use of photovoltaic solar panels has significantly reduced the building's energy bills, and their low maintenance requirements make them a practical and sustainable approach. The building also takes pride in showcasing its sustainable features and building elements inside the premises. In fact, building is considered one of the most carbon-efficient building in the cork city, thanks to its passive design principles and modern construction methods. The building has taken bold steps towards the future of architectural design by integrating sustainability into its core, creating a low carbon and highly renewable approach.

THANK YOU

SAHAR PARISHANI

May-2024