

TEKU SCIENCE CENTER

Teku, Kathmandu

By:

RINA THAPA

760132

A thesis submitted in partial fulfillment
of the requirements for the
Degree of Bachelor of Architecture



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KHWOPA ENGINEERING COLLEGE
DEPARTMENT OF ARCHITECTURE
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CERTIFICATE

This is to certify that the thesis entitled **TEKU SCIENCE CENTER** at *Teku, Kathmandu*, submitted to the Department of Architecture of Khwopa Engineering College by **Ms. Rina Thapa** of Class Roll No. 32/ B.Arch./076 has been declared successful for the partial fulfillment of the academic requirement towards the completion of the degree of Bachelor of Architecture of Purbanchal University.

Ar. Rikesh Shrestha
Supervisor

Ar. Rashish Lal Shrestha
Thesis Coordinator

Ar. Biresh Shah
(External Juror)

Ar. Archana Bade Shrestha
Head of Department of Architecture

DECLARATION

I hereby declare that the thesis entitled “**Teku Science Center**”, submitted by me in partial fulfillment of the requirements for the degree of Bachelor of Architecture at Purbanchal University, Biratnagar, Nepal, is the result of my own independent work. All sources of information and assistance used in the preparation of this dissertation have been duly acknowledged within the text.

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Rina Thapa

760132/B.Arch.

Date.....

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ABSTRACT

A Science Center is an interactive learning hub where individuals of all ages can explore, experiment, and engage with scientific concepts in a fun and immersive environment. Unlike traditional classrooms, science center's emphasize **hands-on experiences** that make learning dynamic and accessible. This thesis aims to design a Science Center for Kathmandu, Nepal, that bridges the gap between theoretical science education and practical engagement. The methodology includes analyzing global precedents, studying site context, and developing architectural strategies that integrate interactivity, inclusivity, and innovation, creating a space where learning becomes both enjoyable and memorable.

The content of this thesis focuses on transforming the Teku Dovan site—historically significant as the confluence of the Bagmati and Bishnumati rivers but currently occupied by a waste transfer station—into a vibrant hub of scientific exploration. The program integrates multiple disciplines such as physics, chemistry, biology, astronomy, and environmental science through interactive exhibits, live demonstrations, educational workshops, planetarium shows, and public events, visitors can discover the wonders of science in a way that sparks curiosity and encourages critical thinking. The design addresses site challenges, including flooding and cultural significance, while fostering engagement, curiosity, and community interaction. The center is envisioned not only as an educational facility but also as a social and cultural landmark that encourages creativity, research, and technological awareness.

Ultimately, the Science Center transcends the role of a conventional educational facility, serving as a catalyst for innovation, lifelong learning, and community development. By enhancing scientific literacy, critical thinking, and creative problem-solving, it inspires future generations to pursue careers in science and technology while contributing to tourism, societal advancement, and national progress. This thesis demonstrates how architecture can act as a medium to connect education, culture, and innovation, transforming a neglected site into a vibrant symbol of discovery, creativity, and progress. The Science Center embodies a gateway to knowledge, encouraging individuals to learn, question, and innovate, thereby reinforcing the vital role of science and technology in shaping both national and global development.

Keywords:

Science Center, Interactive Learning, Scientific Literacy, Innovation, Nepal, Hands-on Education, Community Engagement

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CHAPTER 1

INTRODUCTION

1. Introduction

Science, derived from the Latin term *scientia*, meaning "knowledge," is a methodical endeavor that constructs and organizes knowledge in the form of testable explanations and predictions about the universe. Far beyond being a mere collection of facts, science is a process of understanding the world through **observation, experimentation, and logical reasoning** (Hawking, 1988). It serves as both a tool for practical applications and a gateway to intellectual exploration and curiosity.

Albert Einstein, one of the most celebrated figures in modern science, stated, "Science is a wonderful thing if one does not have to earn one's living at it," emphasizing that the **pursuit of science can bring immense intellectual fulfillment when driven by curiosity rather than necessity**. This reflects the dual nature of science as both a practical tool and an area of intellectual discovery—something that science center's aim to highlight by making science both enjoyable and accessible.

Hence, **a science center** is an institution designed to engage the public in **the exploration and understanding of science**. Unlike traditional museums, science centers emphasize interactive, hands-on experiences that encourage visitors to experiment and discover scientific principles firsthand. According to the Science Centers World Summit, a science center is defined as "an institution that uses interactive exhibits and educational programming to inform the public about science and technology in an enjoyable and engaging way" (ASTC, n.d.).

Originally conceptualized as tools for education, science centers have evolved into dynamic spaces that foster curiosity, critical thinking, and a deeper understanding of how science influences the world. The main objective of a science center is to make science accessible and appealing to people of all ages, providing them with the tools to engage with scientific concepts in a tangible and memorable manner. By offering interactive exhibits, workshops, and live demonstrations, science center's help demystify complex topics, inspire curiosity, and ignite wonder. In doing so, they not only enhance scientific literacy but also create opportunities for public engagement with the latest scientific and technological advancements, encouraging the next generation of scientists, engineers, and innovators.

1.1 Brief History of Science Centers

Science centers have evolved from traditional museums to dynamic spaces that combine education, entertainment, and research. The first science centers emerged in the mid-20th century, focusing on interactive exhibits and hands-on learning. Over time, they have incorporated advanced technologies such as planetariums, observatories, and digital displays to enhance visitor engagement.

Early Science Centers:

Focused on static displays and scientific artifacts. Examples include the Deutsches Museum in Germany (1903) and the Museum of Science and Industry in Chicago (1933). These early centers primarily showcased scientific discoveries and historical artifacts rather than fostering interactive learning.



Figure: 1 Deutschers Museum in Germany

Modern Science Centers:

Modern science centers, such as the *Exploratorium* in San Francisco (1969) and the *Ontario Science Centre* in Toronto (1969), introduced interactive exhibits and immersive experiences. These centers emphasized hands-on learning, where visitors could actively experiment and engage with scientific principles. The concept of interactive exhibits was pioneered by Munich's *Deutsches Museum*, which featured moving exhibits that allowed visitors to push buttons and operate levers, encouraging participation. This model influenced the design of science centers worldwide, including the *Reuben H. Fleet Space Theater and Science Center* in San Diego (1971), which integrated an Omnimax theater and planetarium into the museum's design, pioneering a new configuration for science centers (Source: *Oppenheimer, F., The Exploratorium*, 1969).



Figure: 2 Museum of Science and Industry in Chicago

Science Centers in Asia:

In Asia, science centers evolved at a slower pace. Early exhibitions were organized by merchants, scientists, and collectors displaying their personal collections. It wasn't until 1977 that the first dedicated science centers were established in Asia, with *Science Centre Singapore* and *Nehru Science Centre* in India. The *Nehru Science Centre* in Mumbai, though established in 1977, opened to the public in 1985 and remains the largest science center in India, attracting over 600,000 visitors annually (Source: *Nehru Science Centre Publication*, 1985). *Science Centre Singapore* covers 60,000 square meters and includes outdoor exhibits, an Omnimax theater, and even a Snow City attraction introduced in 2002 (Source: *Science Centre Singapore Brochure*, 2002).



Figure: 3 Family learning experience Exploratorium in San Francisco

Future Trends:

The future of science centers is leaning towards the integration of emerging technologies such as virtual reality (VR), augmented reality (AR), and artificial intelligence (AI) to enhance the learning experience. There is also a growing emphasis on sustainable design practices and community-centered approaches. Adaptive reuse of existing buildings to house science centers is becoming more common, demonstrating the sector's focus on sustainability and reducing environmental impact (Source: *Science Centre World Summit Report*, 2020). As robotics and AI continue to evolve, they are likely to play an increasing role in shaping the interactive experiences in science centers, providing new avenues for education and engagement.

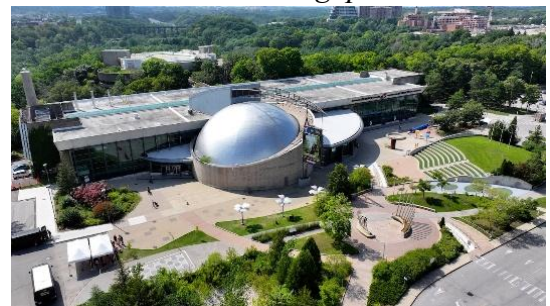


Figure: 4 Ontario Science Centre in Canada (1969).

Timeline of evolution of science center

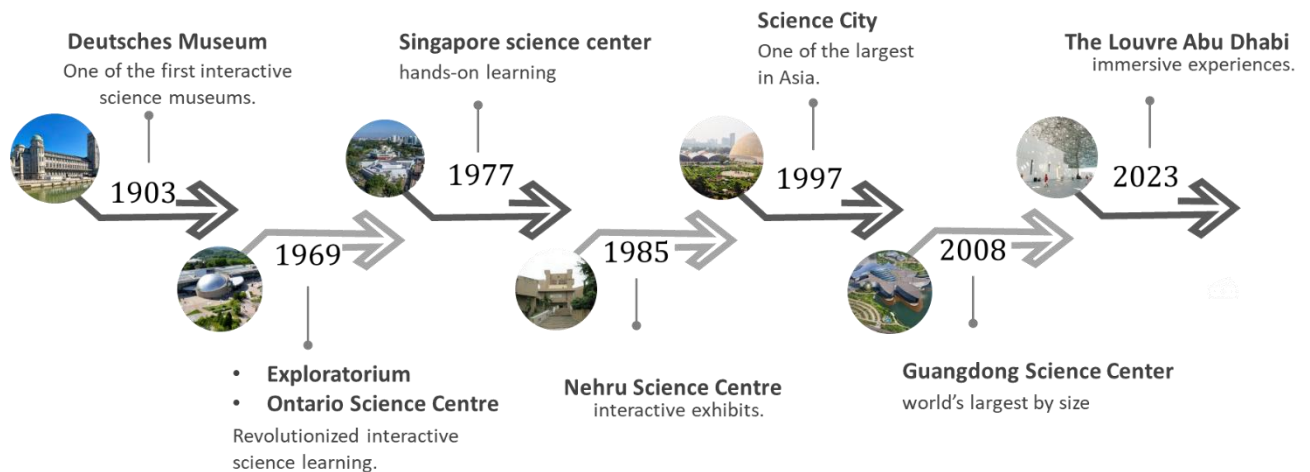


Figure: 5 History of science center in world

1.2 Nepalese scenarios:

The development of science and technology in Nepal began in the 1960s, with the adoption of the first National Science and Technology policies, marking the country's initial steps towards integrating science into national development. This effort gained further momentum with the establishment of the **National Council for Science and Technology (NCST)** and **Research Centre for Applied Science and Technology (RECAST)** in the 1970s. In 1982, the **Nepal Academy of Science and Technology (NAST)** was founded, laying the groundwork for scientific research, technology transfer, and preservation of indigenous technologies. However, despite these initial strides, the development of infrastructure for science education and public engagement remained slow, which led to a growing need for dedicated spaces like science centers to bring science closer to the people.

In the 1990s, initiatives like the **B.P. Koirala Memorial Observatory** in Nagarkot and the **Science Museum in Kirtipur** were established to promote scientific awareness and research. These projects, along with the **Pokhara Planetarium and Science Center**, reflect a growing interest in fostering scientific literacy across Nepal. However, Nepal's science infrastructure faces significant challenges such as limited funding, inadequate maintenance, and accessibility issues. The **Ministry of Environment, Science, and Technology (MOEST)**, restructured in 2005, has been instrumental in advancing scientific research and development, but the overall progress has been slower compared to other nations. This has created an urgent need for better integration of science into the educational system and public life.

The absence of widespread, accessible science centers in Nepal hampers the development of a scientifically literate society. Despite the efforts made by institutions like NAST, there is still a lack of well-maintained science education facilities. **Everest Science Center**, established in 2002, (everestscn.com) have emerged to provide interactive exhibits and educational programs. However, **limited resources and infrastructure** have hindered the widespread development of similar centers across the country. Moreover, One of the primary issues is the **lack of student interest in pursuing science at**

advanced levels. This trend is exacerbated by **outdated teaching methods**, (educarepublication.com) and a **shortage of skilled science educators**, (nextstepinfotech.com) particularly in rural regions. Consequently, **students often struggle to connect theoretical knowledge with practical applications**, hindering the development of a scientifically literate populace. To cultivate a culture of scientific inquiry and innovation, it is imperative to **expand and enhance science centers**, ensuring they are **accessible, well-maintained, and integrated into local communities**. Science centers are crucial to bridging this gap, as they provide hands-on learning experiences, promote research, and engage the public in understanding scientific concepts. As science and technology play an essential role in addressing national challenges, including poverty alleviation and environmental sustainability, the expansion of science centers in Nepal is vital for empowering future generations with the knowledge and skills needed to navigate a rapidly changing world.

Time line of the science center development in Nepal

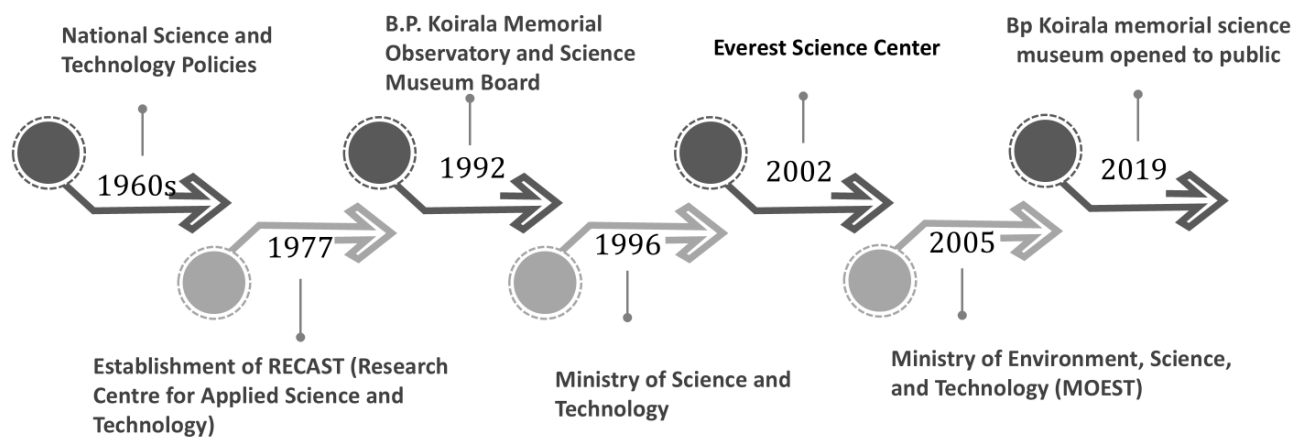


Figure: 6 timeline of science center development in Nepal

1.3 Project Justification:

Despite being the capital city, Kathmandu lacks **accessible** and impactful platforms for public science learning. Science literacy in Nepal remains low, particularly among the general population. The existing institutions — such as the B.P. Koirala Memorial Planetarium, Observatory and Science Museum and the Simulation Science Center at Kirtipur — are limited in scope, scale, accessibility, and public engagement. Everest Science Center Nepal (ESCN) current focused on low-cost hands-on exhibits and workshops located in Biratnagar.

B.P. Koirala Science Center, though important, is centrally controlled, rarely upgraded, and largely observational rather than interactive.

The Simulation Science Center primarily supports academic institutions, and is in small scale not publicly focused nor highly visible in urban life.

Establishing a Science Center and Planetarium in Nepal is imperative, given the current state of science education and student performance in the country. The following data highlights the need for such an institution:

Performance in Science Examinations:

- **SEE Examination Failures:** In the 2080 Secondary Education Examination (SEE), a significant number of students failed in core subjects. Specifically, 177,985 students failed Mathematics, and 126,933 failed Science.
- **Overall Underperformance:** The SEE results revealed widespread underperformance, with 242,313 students categorized as 'Not Graded' (NG). After Mathematics, Science had the highest failure rate.
- **Historical Trends:** The pass percentage in the School Leaving Certificate (SLC) examinations has been declining over the years. In 2013, the pass rate was 43.92%, a slight improvement from 41.57% in 2012, but still alarmingly low.
- Out dated course subject making it irrelevant: In the 2023 Grade 12 examinations in Nepal, a significant number of students failed in science subjects. Out of 390,868 students who appeared for the exams, 187,021 were categorized as non-graded, indicating they did not achieve the minimum required marks in at least one subject.
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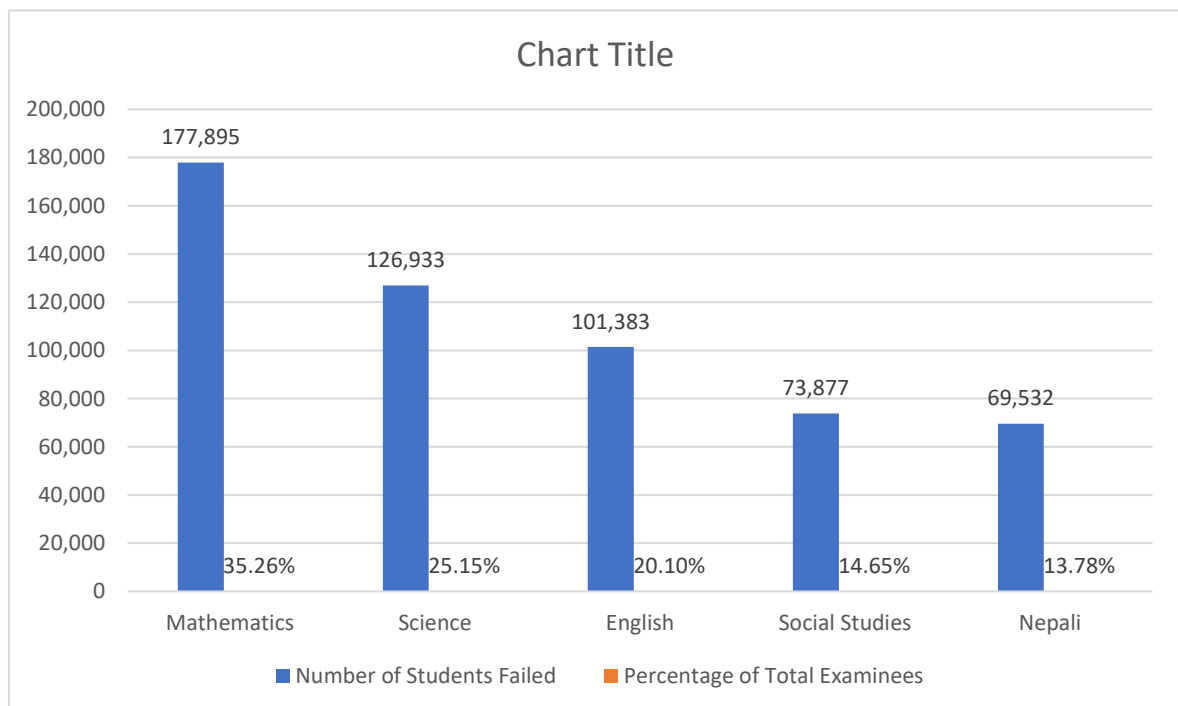


Figure: 7 Student failure rate

Delay development in this sector:

The delay in the development of Nepal's science and technology sector hampers the nation's potential to address its current challenges and to compete in the global marketplace. By establishing a Science Center and Planetarium, Nepal could foster a generation of scientifically literate individuals, bridge the gap in education, create opportunities for research, and reduce dependency on foreign technologies. Such a center could serve as a catalyst for the growth of the science and technology sector, contributing significantly to national development and economic prosperity. It would create a sustainable ecosystem for scientific exploration, innovation, and collaboration key factors in the country's long-term progress.

Based on the available data from the 2080 Secondary Education Examination (SEE) results in Nepal, the failure rates across various subjects were as follows: *Note: The total number of examinees was 504,414. (neb> kathmandupost.com)*

PROJECT AIMS:

1. To support the urban regeneration of Teku by repurposing a waste transfer site into a civic landmark grounded in ecological, cultural, and scientific relevance.
2. Responds sensitively to the site's flooding risks, cultural importance, and ecological context.
3. To design a multidisciplinary Science Center that promotes science communication, learning, and exploration through thoughtfully designed spaces such as exhibition galleries, planetarium, workshops, and outdoor science parks — making science accessible, experiential, and enjoyable for the wider public.

USER GROUPS

SCHOOL



STUDENT



LOCAL & TOURISTS



PROFESSIONALS



Mainly the user of science center is the school and student for their learning experiences and development. where as the site is located in the center of the main city it is accessible to general publics and local to attend event and workshop. More over professional and researcher can visit the center for research purposes.

The proposed Science Center at Teku fills this gap by offering:

1. A public-facing, inclusive, and interactive learning environment,
2. Integration of planetarium, exhibition halls, workshops, science parks, and live demonstration zones,
3. Easy urban accessibility at the heart of Kathmandu near Teku Dovan.
4. to promotes hands on learning and emphasizing by learning by doing concept
5. To assist school Curriculum practical by providing social venue
6. To foster public interest in science and technology

1.4 Project objectives:

The design of the Science Center aims to create an inspiring, engaging, and educational space that encourages public interaction with science. The objectives for this project are as follows:

1. **To establish an interactive environment that encourages two-way communication** between exhibits and visitors, allowing for a more engaging and dynamic learning experience.
2. **To acquire, preserve, and showcase objects of scientific, historical, or cultural importance** that offer valuable insights into humanity's heritage, environment, and advancements in science, thereby promoting a deeper understanding of the world around us.
3. **To foster public interest in science and technology** by providing an engaging platform that inspires curiosity and scientific inquiry among visitors of all ages.
4. **To provide a creative space for emerging scientists and innovators** to nurture and develop their talents, encouraging the next generation of scientific minds and fostering innovation.
5. **To create a social space where visitors can not only engage with exhibits but also gather and interact**, making the center a hub for community activities and discussions about science.
6. **To promote learning through hands-on experiences**, allowing visitors to explore, ask questions, and understand scientific concepts through active participation and experimentation.
7. **To complement traditional science education** by providing an experiential platform that enhances the understanding of science beyond textbooks, offering practical, real-world applications.
8. **To offer a unique platform for exploring astronomical sciences**, providing a rare opportunity for visitors to engage with celestial phenomena.
9. **To provide an accessible and valuable resource for the general public** to learn about space, the stars, and the planet they inhabit, especially in a country where such educational experiences are limited.
10. **To promote research and development in science and technology** through the establishment of a museum and an academy that facilitate innovation and the advancement of scientific knowledge.
11. **To enhance the application of science and technology** in various sectors of society by educating the public on their practical uses and benefits, while encouraging wider dissemination of scientific knowledge.
12. **To support the nation's progress by advancing science and technology** in areas critical to Nepal's development, fostering an environment that encourages research, creativity, and technological growth.
13. **To inspire scientific curiosity and critical thinking** among the broader population, cultivating a scientific mindset that can contribute to national development and global competitiveness.

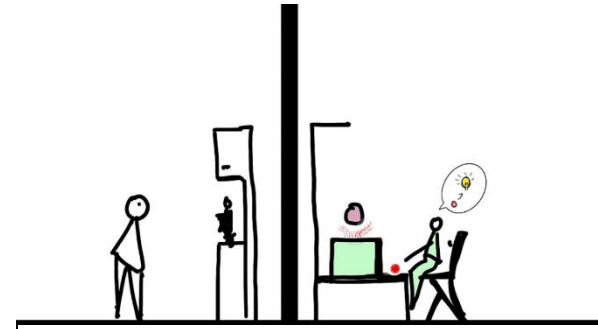


Figure: 8 display vs interactive modules

1.5 Scope of science center project

The Science Center is designed to be a comprehensive hub for scientific education, discovery, and innovation. Its scope covers the following:

1. **Interactive Scientific Exhibits**

The Science Center will feature a wide variety of hands-on exhibits across different scientific disciplines such as physics, chemistry, biology, environmental science, astronomy, and technology. Visitors will engage directly with these exhibits to deepen their understanding of scientific concepts.

2. **Educational Programs and Workshops**

The center will offer workshops, lectures, and seminars to facilitate learning, with a focus on school students, university learners, and the general public. These programs will cover both basic and advanced scientific topics, and foster a culture of inquiry and research.

3. **Research and Innovation Hub**

The Science Center will provide space for emerging scientists, researchers, and innovators to conduct experiments and share their work. The center will serve as a platform for scientific research and technological innovations in fields that have direct relevance to Nepal's development, such as renewable energy, agriculture, and infrastructure.

4. **Planetarium and Space Education**

A key component of the project is a planetarium, which will provide a space for astronomical education. Visitors will be able to explore the universe through immersive technology and simulations, enhancing their understanding of space, planets, stars, and the cosmos.

5. **Community Engagement and Public Events**

The Science Center will be a space for public engagement in science, with interactive exhibits, science fairs, public demonstrations, and collaborative events that bring together science enthusiasts, educators, students, and professionals.

6. **Educational Outreach to Schools**

The project will focus on establishing outreach programs to schools across Nepal, bringing the Science Center's exhibits, programs, and experiences to students who may not be able to visit in person. These programs will encourage young minds to take an interest in science and technology.

7. **Promotion of Sustainable Practices and Technologies**

The center will incorporate sustainable practices in its construction and operation, aiming to set an example for environmental responsibility. It will also showcase the latest developments in sustainable technologies, renewable energy, and eco-friendly solutions.

8. **Involvement of National and International Partnerships**

The Science Center will engage with national and international scientific organizations, universities, and research institutions. Collaborative programs and events will bring global expertise to Nepal, fostering international exchange in the field of science and technology.

1.6 Limitations of the Science Center Project

The **limitations** of the Science Center project refer to the challenges and constraints that may hinder its execution, operation, or full potential. These limitations include:

1. **Financial Constraints**

The project may face limitations in terms of funding and financial resources required to build and maintain state-of-the-art exhibits, infrastructure, and technologies. The cost of construction, technological implementation, and continuous operation may exceed available budgets.

2. **Technological Limitations**

While the project aims to incorporate advanced technologies like VR/AR and interactive exhibits, the rapid pace of technological innovation may result in the center's infrastructure becoming outdated sooner than anticipated. Keeping up with new technologies and regularly updating exhibits may present challenges.

3. **Limited Reach in Remote Areas**

While the Science Center aims to provide educational outreach, its physical location may limit access for students and communities in remote or rural areas of Nepal. Transportation barriers and geographical limitations could restrict some groups from benefiting from the center's resources and programs.

4. **Sustainability Challenges**

While the center will adopt sustainable practices, it may face challenges in maintaining environmental sustainability due to energy consumption, waste management, and resource use. The high-tech nature of the center may require considerable energy resources, posing sustainability challenges.

5. **Cultural and Educational Barriers**

The concept of interactive, hands-on science learning may be new or unfamiliar to some communities in Nepal. Overcoming cultural and educational barriers, particularly in rural areas where traditional education methods prevail, could pose a challenge in terms of engagement and participation.

6. **Limited Public Awareness and Interest**

Despite the growing need for science education in Nepal, there may still be limited public interest or understanding of the importance of science and technology. Public outreach efforts will be necessary to increase awareness and encourage people to visit the center and participate in its programs.

7. **Space and Infrastructure Limitations**

The available space for the center's construction may impose limitations on the size and scope of exhibits and programs. Land availability, zoning regulations, and building codes may restrict the scale and design of the center.

8. **Dependence on Government and Institutional Support**

The success of the project may depend heavily on the support and cooperation of the government, local authorities, and educational institutions. Political, administrative, or institutional hurdles may slow down the implementation or expansion of the Science Center.

9. **Staff and Resource Limitations**

The project will require a skilled and experienced staff to manage the operations of the Science Center, including curators, educators, researchers, and technicians. There may be a shortage of qualified personnel in Nepal, which could limit the effectiveness of the center's programs and exhibits.

1.7 Methodology:

The approach adopted for the proposed project involves the following steps to ensure the achievement of desired, satisfactory, and optimal results for the Science Center:

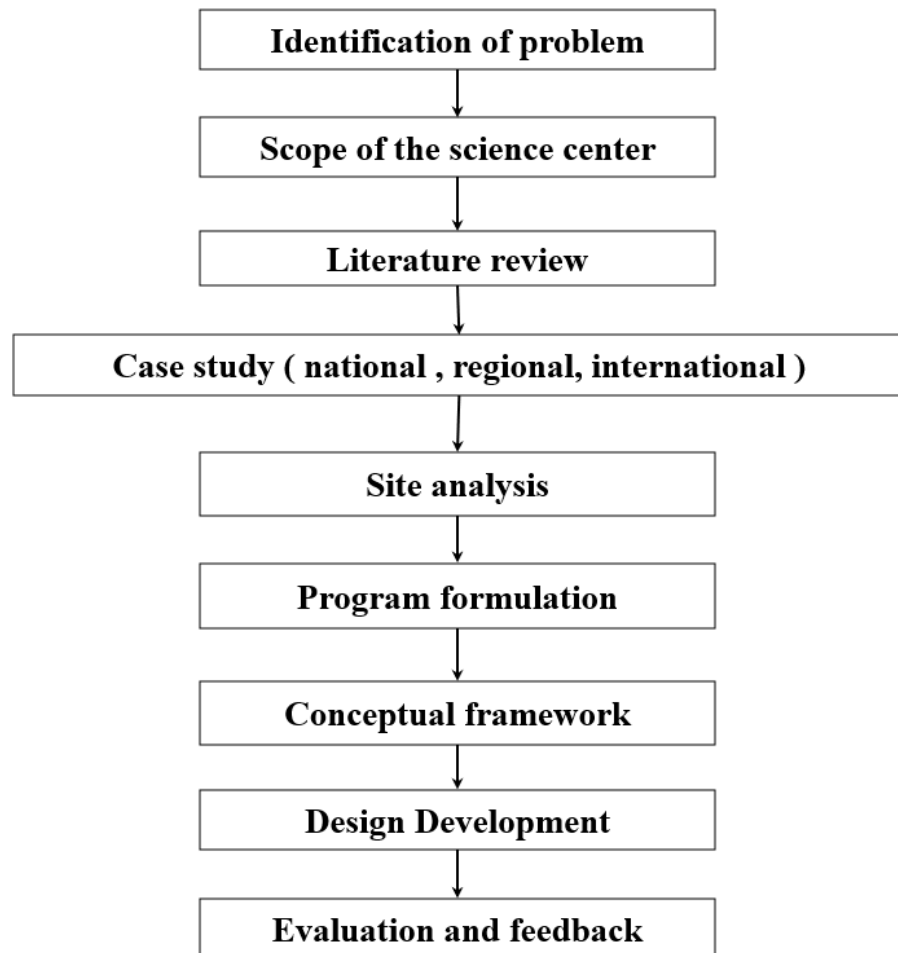


Figure: 9 Methodology

CHAPTER 2

LITERATURE REVIEW

1. Literature review

Science centers are dynamic educational institutions designed to stimulate curiosity and foster a deeper understanding of science, technology, engineering, and mathematics (STEM) among visitors of all ages. They achieve this by providing interactive exhibits, hands-on activities, and engaging programs that encourage exploration and learning. These centers serve as bridges between formal education and informal learning, offering experiences that complement traditional classroom instruction.(source : ctsc.org.za)

Purpose and Importance of Science Centers

The primary goal of science centers is to make science accessible and enjoyable, thereby enhancing public understanding and appreciation of scientific concepts. They aim to:

- **Stimulate Curiosity:** By presenting intriguing exhibits and activities, science center's spark interest and encourage visitors to ask questions and seek answers.
- **Promote Inquiry-Based Learning:** These institutions support learning through exploration and experimentation, allowing visitors to engage directly with scientific phenomena.
- **Provide Educational Resources:** Science centers offer resources and programs that align with educational curricula, supporting both students and educators in the pursuit of knowledge.

2.1. Site selection:

Site selection for a Science Center involves considering various factors to ensure its **accessibility**, sustainability, and **integration with the community**. The location should be easily **reachable by public transport** and offer pedestrian and bicycle access, with ample parking for visitors. Environmental factors like climate, natural surroundings, and the potential for sustainable design are crucial, along with the site's impact on the local ecosystem. The site should be **close to educational institutions** to foster collaboration and serve as a community hub, reflecting local culture and offering space for future expansion. Additionally, the area should be safe, with low crime rates and resilience to natural disasters. An iconic, visible location can make the center a landmark, attracting visitors and enhancing public engagement. Finally, the budget and economic viability of the site, including land costs and infrastructure development, must be considered to ensure long-term sustainability.

2.2 Interactive learning design:

Interactive learning design is an educational approach that emphasizes active engagement, hands-on experiences, and user participation to enhance learning outcomes. It is widely used in science centers to make complex scientific concepts more understandable and engaging for visitors of all ages. This approach integrates technology,

interactive exhibits, simulations, and real-world applications to create an immersive learning environment.

Science center's implement interactive learning design through exhibits, digital interfaces, workshops, and live demonstrations. Exhibits often feature touch screens, augmented reality (AR), virtual reality (VR), and mechanical installations that allow visitors to manipulate objects and observe cause-and-effect relationships. For example, physics-based exhibits may include motion simulators, while biology sections may have microscopes with digital screens for detailed exploration. These interactive components foster curiosity and encourage self-directed learning.

Types of Interactive Learning

Interactive learning in science centers can be classified into various types:

1. **Hands-on Exhibits** – Physical installations where visitors can manipulate objects, such as water flow models or magnetic field experiments.
2. **Digital Interactives** – Touchscreen displays, VR simulations, or AI-based learning tools that provide an immersive experience.
3. **Live Demonstrations** – Scientists or educators conducting real-time experiments or presentations to engage audiences.
4. **Collaborative Learning Spaces** – Group activities that encourage teamwork, such as robotics workshops or problem-solving challenges.
5. **Gamified Learning** – Incorporating game elements like quizzes, leaderboards, or escape-room-style problem-solving to make learning more engaging.

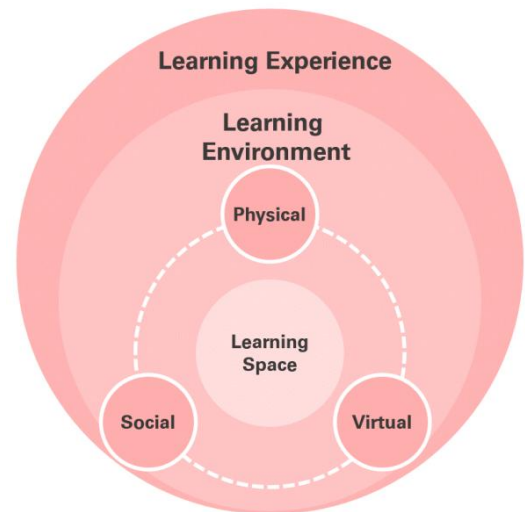


Figure: 10 Interactive learning environment

Major Factors in Designing Interactive Learning Spaces



COLLABORATION
LEARNING WITH OTHERS



DISCUSSION
TALKING ABOUT LEARNING



FEEDBACK & REFLECTION
LEARNING ABOUT LEARNING



EXPLICIT
LEARNING FROM AN EXPERT



DEMONSTRATION
PRESENTING LEARNING



EXPERIENTIAL
MAKE, EXPLORE, INVESTIGATE

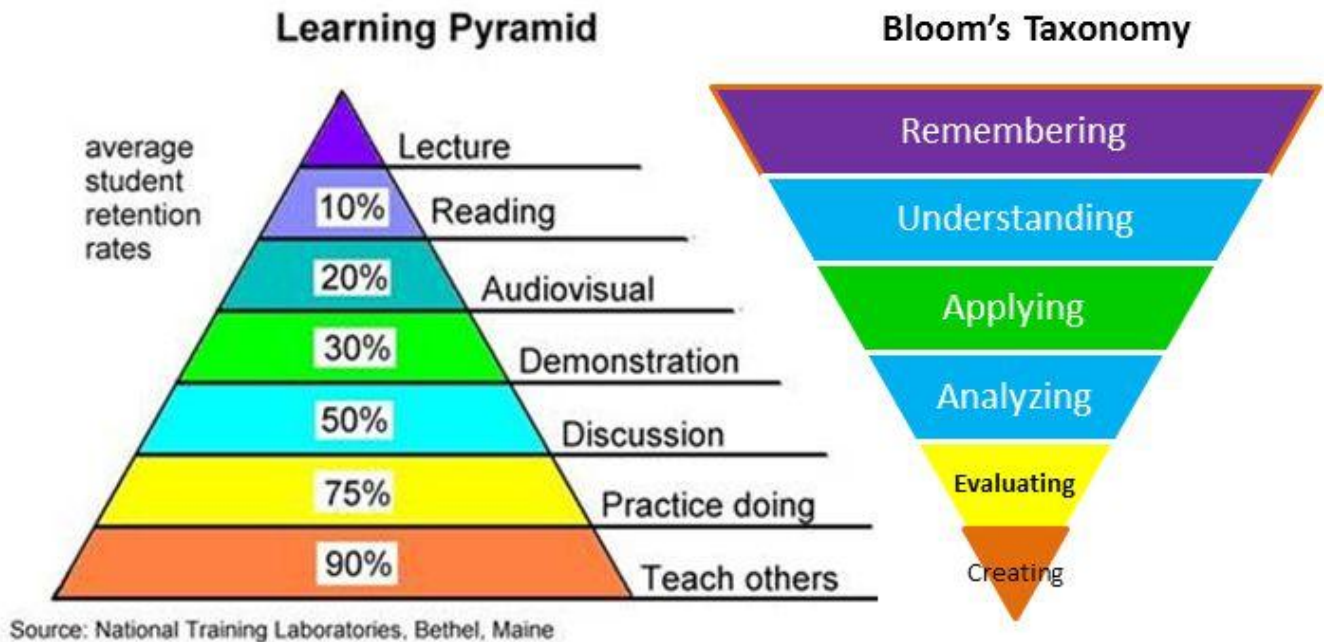


Figure: 11 learning pyramid

When designing an interactive learning environment in a science center, spatial planning plays a crucial role. The layout should facilitate movement and exploration, with distinct zones for different learning experiences. Key spatial elements include:

- **Thematic Zoning** – Dividing areas based on scientific disciplines, such as physics, biology, astronomy, and environmental science.
- **Flow and Navigation** – Ensuring a logical sequence that guides visitors through various exhibits in an intuitive way.
- **Engagement Nodes** – Creating focal points where visitors can gather for interactive experiences or group activities.
- **Lighting and Acoustics** – Using appropriate lighting to highlight exhibits and managing sound levels to prevent sensory overload.
- **Integration of Outdoor Spaces** – Some interactive learning centers extend outdoors for nature-based learning, such as botanical gardens or astronomy observation decks.

2.3 Exhibit space:

An exhibit area in a science center is a designated space where interactive displays, models, experiments, and multimedia installations are placed to educate visitors about scientific concepts. These areas are designed to encourage hands-on learning, curiosity, and engagement with science in an accessible and enjoyable way. Exhibition areas should be essentially generic spaces with the exhibits creating defined interior spaces and atmosphere.

Types of Science Exhibits

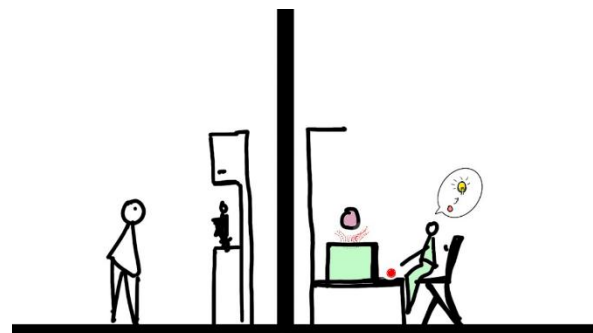


Figure: 12 exhibit space vs demonstrative space

Science center's feature a diverse array of exhibits, each designed to highlight different scientific principles and encourage hands-on interaction. Common types include:

- **Interactive Exhibits:** Hands-on displays that allow visitors to manipulate objects and observe outcomes, fostering experiential learning.
- **Themed Exhibits:** Displays focused on specific scientific topics, such as space exploration, human anatomy, or environmental science, providing in-depth insights into each area.
- **Live Demonstrations:** Scheduled presentations that showcase scientific experiments or phenomena, offering real-time learning experiences.
- **Planetariums and Observatories:** Facilities equipped with telescopes and projection systems to explore astronomical concepts and observe celestial events.

Factor to be consider while designing exhibition space are (molajoli,1990, pg 377)

- Viewers should be able to move through the exhibit without being forced to walk past objects they have already seen.
- There must be adequate space for visitors to move at different speeds. Some will move continuously; while others will stop to examine particular objects in greater detail.
- A viewer tends to turn to the right upon entering a gallery, circulation patterns should be designed with this in mind.
- The ability to survey the gallery area in one sweep will help viewers understand what is on display and decide what they want to see.

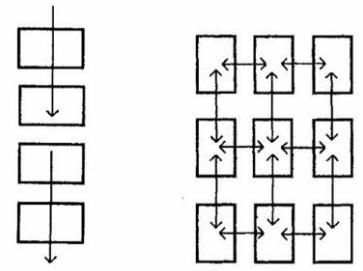


Figure: 13 linear and circular circulation

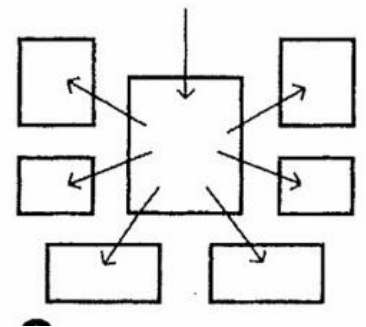


Figure: 14 centralized circulation

Different arrangements of exhibition spaces can be outlined as (Matthews):

- Linear arrangements of spaces with beginning middle and end.\
- loop type arrangement where essentially linear storyline leads naturally back to the beginning.
- An arrangement of core and satellites where each theme or detailed treatment of a subject leads back to a central introductory or orientation area.
- A more complex scheme combining linear, loop, and core satellites arrangement of spaces which is specifically structured to account for more or less stable relationship between collections and interpretive themes.

Different way of dividing the exhibition space:

(Source: Time saver)

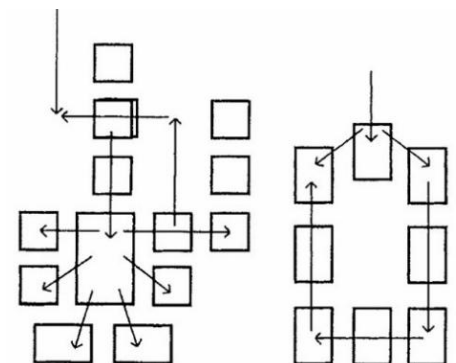


Figure: 15 linear loop and core based circulation

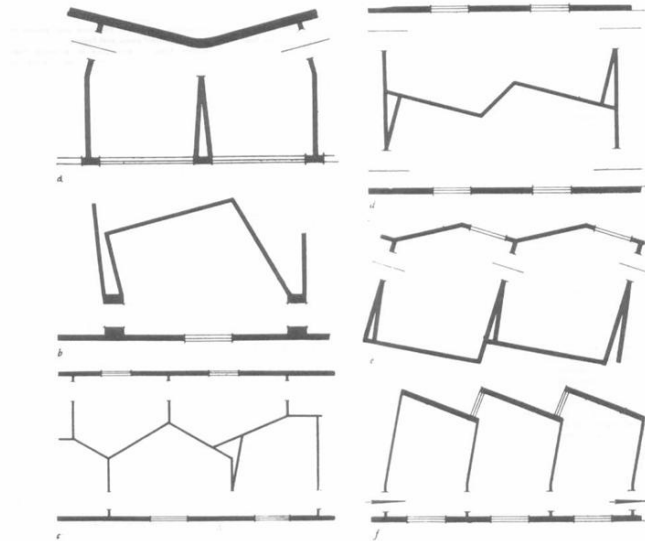


Fig. 4 Different ways of dividing up exhibition space.

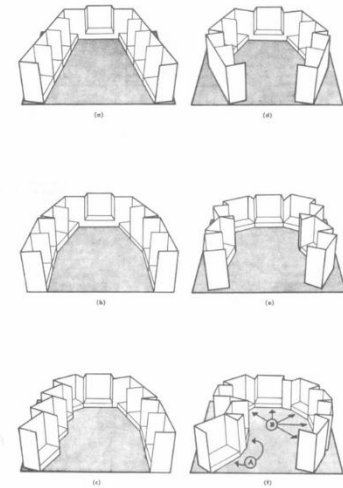


Fig. 7 Possible gallery arrangements.

Figure: 16 Different way of dividing the exhibition space

Circulation pattern in exhibits area:

In the initial stages as in the final stage, the pattern of tracks also has various psychological aspects. The circular pattern leads back to the entrance, and raises the following problems: the goal suggested is identical with the point of departure, it is possible at any moment to estimate approximately the amount of effort needed to complete the circuit, and a 'return crisis' may occur. The

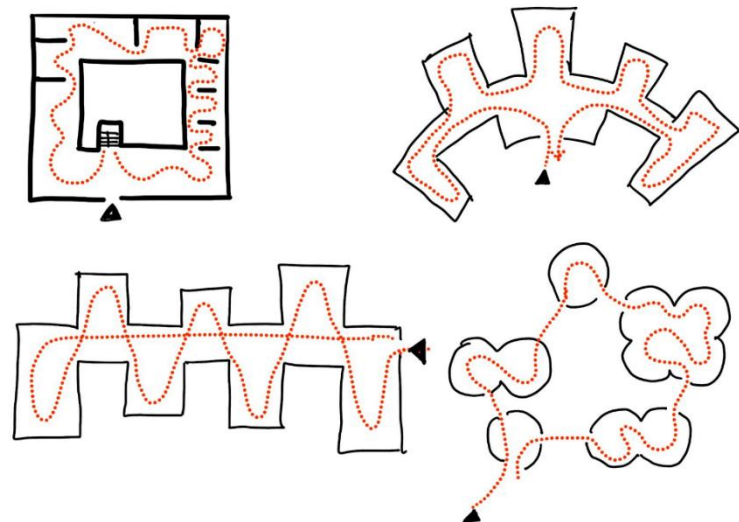


Figure: 17 circulation pattern in exhibits area

linear pattern has the following advantages: entrance and exit do not coincide, the amount of effort needed is unknown, and the goal may be unconsciously considered as genuine 'progress'. It should also be emphasized that, for reasons of psychological economy, the visitor should never pass the same way twice. (source: Shrestha ,2024) Entry and exit layout of the exhibit area: The entry and exit layout of an exhibition area is crucial for efficient visitor flow and overall experience. The **entry** should be welcoming, spacious, and informative, often featuring ticketing counters, information desks, and introductory displays to set the theme. A well-designed entrance ensures smooth circulation, accessibility, and engagement from the start. The **exit** should facilitate a seamless departure, prevent congestion while integrate elements like souvenir shops or feedback stations. Layouts can follow a **looped circulation** for re-engagement or a **one-way flow** for a structured experience. Proper signage, emergency exits, and accessibility features further enhance safety and visitor convenience. (source: Time saver)

2.4. Planetarium study:

A **planetarium** is a facility designed to simulate the sky and provide educational and interactive experiences related to astronomy. The most common feature of a planetarium is its large hemispherical dome, where projections of celestial bodies like the sun, moon, planets, and stars are displayed. These projections are achieved through sophisticated optical methods and mechanical systems that can move and rotate to simulate the movement of the celestial objects.

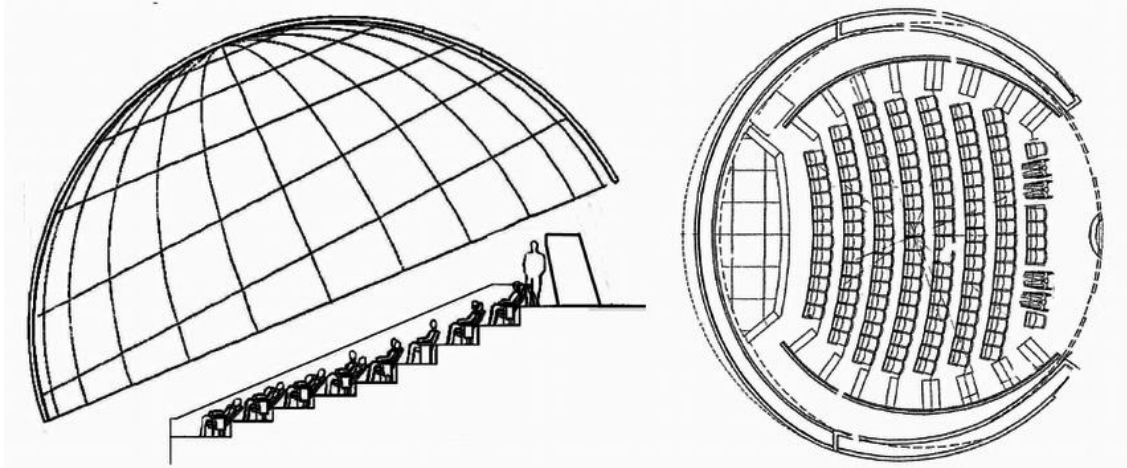


Figure: 18 planetarium plan and section

Concept: Making and Projecting the Night Sky

The process of creating and projecting the night sky onto a planetarium dome is far more intricate than a traditional cinema film projection. The night sky "film" doesn't exist in the usual sense, and the equipment used to display it is quite unique.

How the Night Sky is Projected

- **No Film:** Unlike a traditional movie projector, planetariums don't use film. Instead, the projection system is composed of a **large, dumb-bell-shaped instrument** that sits beneath the dome. This instrument functions like a **composite system**, incorporating nearly a hundred different projectors.
- **The Projecting Mechanism:** The instrument has **two spherical ends**, each of which carries **32 projectors**. All 32 projectors share a **common lamp** but are each equipped with a separate lens. The projectors work together to display the full sky on the dome.
- **Copper Plates with Holes:** At the heart of the projection are **specially made copper plates**. These plates have **multiple holes**, each of which corresponds to the configuration of stars in the sky. The holes are meticulously crafted, taking into account the apparent brightness of each star in the sky:
 - **Brighter stars** are represented by **larger holes** in the copper plates, while **dimmer stars** have **smaller holes**.
- **Spherical Projection:** Each of the 32 projectors from one sphere casts a **specific section of the sky**. These individual projections then **mesh perfectly** to create a cohesive and seamless image of the night sky across the planetarium dome.

The Secret Life of Planetarium Stars

The "secret life" of these stars lies in the **precision and engineering** involved in creating their projections. The copper plates, combined with carefully adjusted projectors, ensure that the **brightness** and **position** of each star are represented accurately. This system allows the planetarium to simulate the night sky with high fidelity, offering an immersive experience for viewers.

Basic Structure of a Planetarium

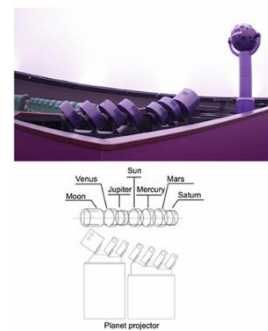
A planetarium typically consists of a **cylindrical hall**, with the **upper part** forming a **hemispherical dome**. The **inner dome** serves as the surface on which the sky is projected, creating the illusion of an expansive night sky. This dome is protected by an **outer dome**, which is aligned so that its center is **perpendicular** to the center of the inner dome. The distance between the two domes is usually at least **1250 mm**, allowing for structural integrity and proper spacing for projection mechanisms.

Classification of Planetariums

Planetariums are classified based on two main aspects: **the type of projector** and **the structure of the dome**.

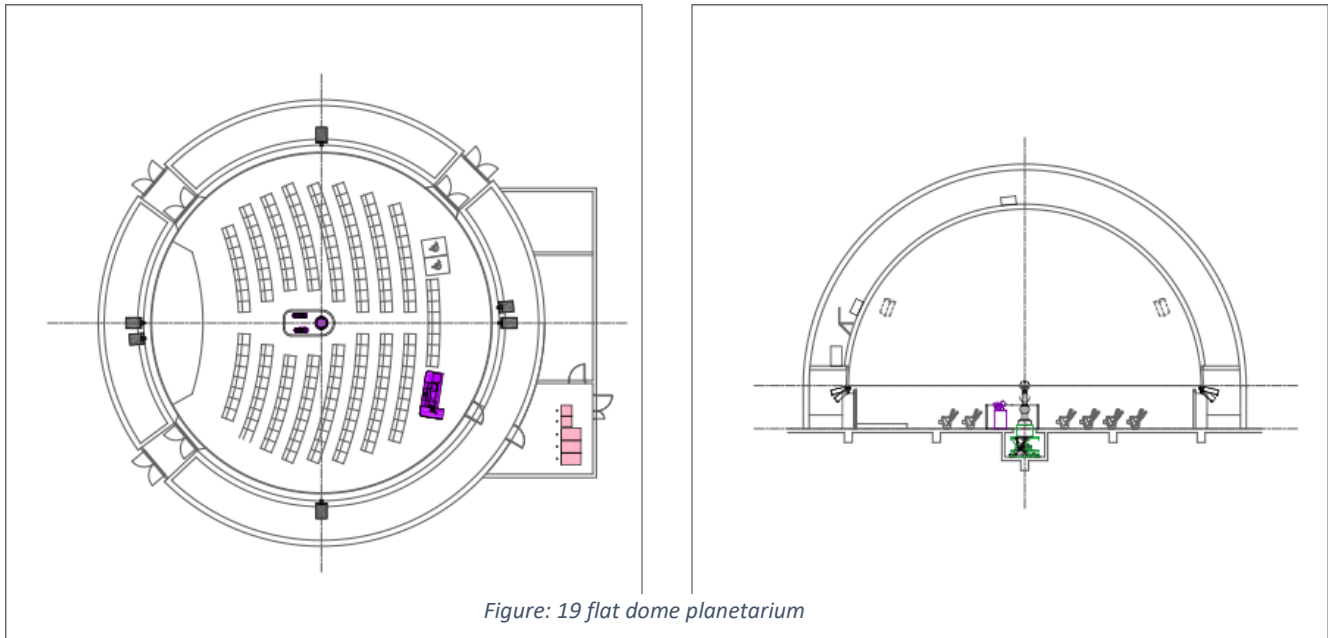
Classification by Type of Projector

- **Spitting Type:** A notable projector in this category is the **Zeiss-type projector**, which is highly regarded for its **sleek size**. This design minimizes interference with the viewer's line of sight, offering an unobstructed view of the projected sky.
- **Goto Projector:** The **Goto projector** is a more recent addition, used in places like the Science City in Calcutta. Its **3D output** is a remarkable feature, providing a more immersive and exciting experience for viewers.



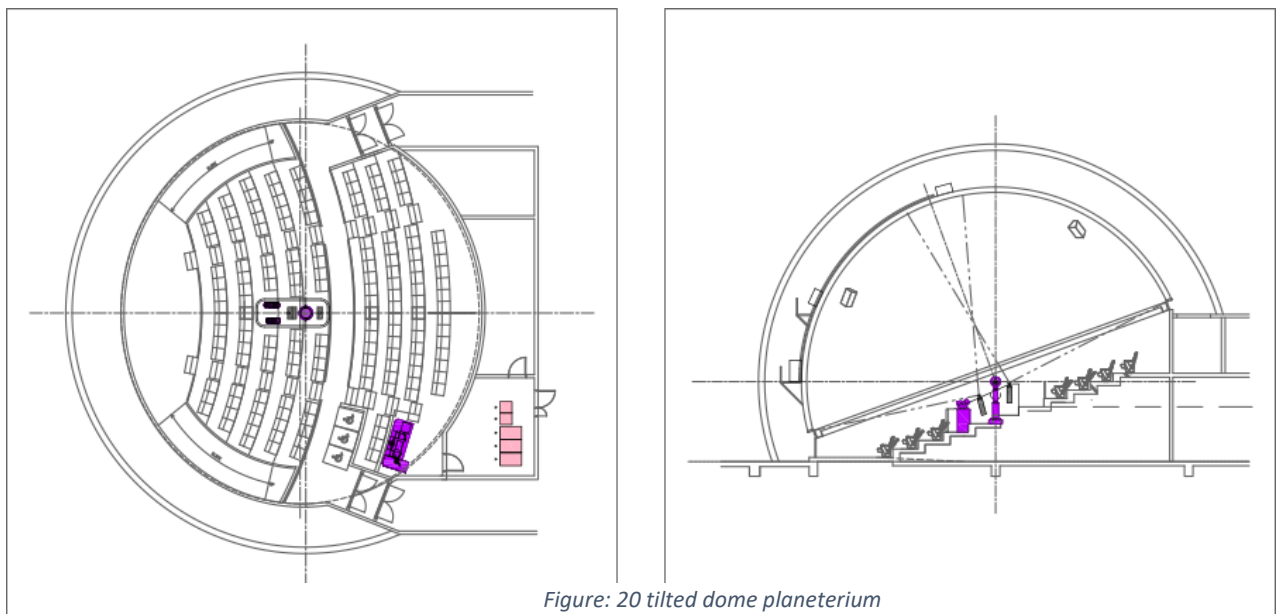
Classification by Type of Dome

- **Flat Dome Planetarium:**
 - ❖ The screen in this type of planetarium is **horizontal**, with the **semi-dome's axis** perpendicular to the horizontal plane.
 - ❖ The **horizon lines** are positioned at the same height as the central projector.
 - ❖ This type of dome is suitable for both **unidirectional** and **circular seating arrangements**.
 - ❖ **Ideal for school-level astronomy education**, this dome can use **auxiliary projectors** placed along the periphery to offer a wide variety of projections.
 - ❖ It allows for **excellent representation** of the movement of celestial bodies as viewed from Earth.



- **Tilted Dome Planetarium:**

- ❖ The screen in this type of planetarium is tilted at an angle of **25°-30°** from the horizontal.
- ❖ The **vertical axis** of the projector is placed about **2 meters** above the axis of the screen.
- ❖ **Capacity:** The tilted dome generally has a **smaller capacity** compared to a flat dome of the same size.
- ❖ This setup is suited only for **unidirectional seating arrangements**.



- ❖ It offers **advanced effects** in presentation, giving the feeling of **swimming through space**.
- ❖ It can simulate the movement of celestial bodies both as seen from Earth and from outer space.
- ❖ Domes with **20°-30° tilt** are common in smaller planetariums (40 ft to 50 ft in diameter), while larger systems (512-chamber designs) often feature tilts from **10° to 20°**.

Key Planetarium Projectors and Technologies

1. **Carl Zeiss Jena (Germany)**
 - ❖ Their **Cosmora** is a universal projector that has been widely used.
2. **Splitz Spaces System (USA)**
 - ❖ Known for their **Starball Voyager**, which is a modern projector system capable of simulating a wide range of astronomical scenarios.
3. **Minolta Mitsubishi (Japan)**
 - ❖ Their advanced projector system, the **Infinium**, uses cutting-edge digital operation techniques and technology developed for artificial satellites. This allows for smooth, realistic motions and the ability to visualize past, present, and future skies instantly.
4. **Goto (Japan)**
 - ❖ Offers various types of planetarium projectors in mini, midi, and maxi sizes.
5. **Zeiss (West Germany)**
 - ❖ Known for offering a range of projectors similar to those of Goto.



Figure: 21 planetarium projector

Modern Features of Planetarium Projectors

- **Infinium** uses digital operation techniques, creating highly smooth and realistic projections. The software integrated into the system allows the presentation of the sky in real-time or at various points in time (past, present, future).
- **Starball Voyager** uses three computers to simulate astronomical scenarios and a fourth computer for controlling lighting and special effects. The system allows for easy operation without the need for deep computer programming knowledge. The system constantly monitors the position and orientation of the projectors to ensure precise simulation.

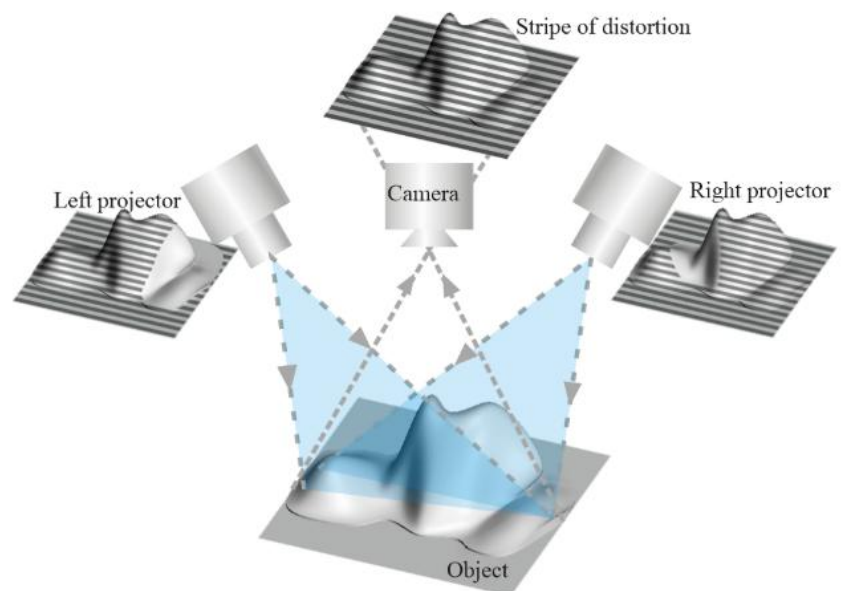


Figure: 22 planetarium projector

With Respect to Seating Arrangements

a) Circular Seating

- **Advantages:** Circular seating provides an **all-around view**, allowing every viewer to have a 360-degree experience of the sky projection.
- **Disadvantages:** Viewing at very sharp angles can cause **neck pain** due to the need for the viewer to constantly turn their head to follow the projections.

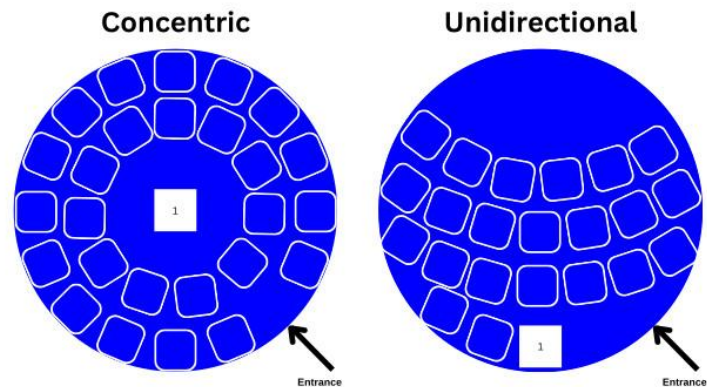


Figure: 23 concentric and unidirectional seating

b) Unidirectional Seating

- **Description:** In unidirectional seating, the seats are usually arranged in a **stepped configuration**, where all viewers face the same direction (the projection screen).
- **Advantages:** This setup is suitable for **lectures and presentations** during off-show hours, as the projection and discussions can be focused in one direction without obstruction.

With Respect to Seating Capacity

The **capacity of the planetarium** is influenced by the **focal length of the projector**:

- **Longer Focal Length:** The **larger the hall** can be, and hence, the higher the seating capacity.
- **Example:** A planetarium can be designed for **80-seat or 210-seat** configurations, depending on the projector's focal length and the size of the hall.

Services in the Sky Theatre Projector

- **Main Projector Placement:** The main projector should be centrally located in the main hall. The area around it, within a **2-meter diameter**, must be perfectly flat to ensure high-quality projections.

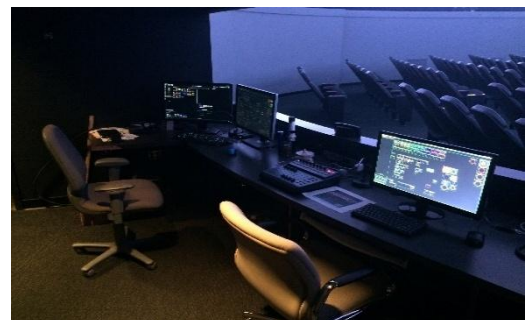


Figure: 24 console and control space

- **Special Effect Projectors:** These are typically placed on the **periphery** of the planetarium, often within a service gallery, to create additional effects that enhance the viewer's experience.
- **Console and Control Space:** A **console** should be available in the hall for the operator's control of the system. If the system is **automatic or remote-controlled**, a separate space must be provided for operators to have a full view of the screen and maintain control over the projections.

Planetarium Lighting

Lighting in a planetarium serves various purposes, from creating a dramatic effect to ensuring visibility for audiences and operators:

- **General Illumination:** It provides general lighting for the planetarium environment, helping the audience navigate when entering or exiting the theatre.
- **Lighting Effects for Presentations:** In theaters without cove lighting, **pit lighting** plays a critical role in projecting effects onto the dome, enhancing the viewing experience. This lighting can also create special effects during presentations, like the **sunrise and sunset** simulation or an **explosion effect**.
- **Pit Lighting:**



Figure: 25 lighting

- ❖ **Red and Blue Flood Lamps:** These lamps are installed along the perimeter of the pit and help create the desired lighting effects.
- ❖ **Controlled by Dimmer Packs:** The lighting can be adjusted with dimmer packs, allowing the operator to control the **brightness and color**.



Figure: 26 pit lighting

- ❖ **Red and Blue Circuits:** The **blue circuit** simulates daylight or ambient light, while the **red circuit** can be used to **simulate sunset** or other dramatic effects, like **explosions**.

seating area and diameter requirements for a sky theatre:

Seating Capacity	Area (sqm)	Diameter of Sky Theatre (m)
80 persons	100 sqm	12 m
150 persons	180 sqm	15 m
270 persons	350 sqm	21 m
350 persons	420 sqm	25 m

Audience Flow

A well-designed **OmniMax theatre** with a steep seating rake requires careful consideration of entrances, exits, and seating arrangements to ensure smooth audience movement. The following factors are crucial for creating a comfortable and safe audience flow:

1. Entrances and Exits:

- ❖ **Best Approach:** Audiences should enter from the **front** and move **upwards** into the seating area. This approach ensures **safe and easy movement**.
- ❖ **Multiple Entry Points:** Ideally, the audience should be able to enter from both sides and move towards the **center of the theatre**, facilitating an efficient flow.

2. Seating Arrangement:

- ❖ The primary factor in seating arrangement is the positioning of **audience's eyes** in relation to the **dome screen**. This alignment requires careful planning of seat positions.
- ❖ **Seat Backs:** The backrests of chairs in different rows should be designed with **tilts** to provide **headrests**, ensuring comfort for the audience.
- ❖ **Comfort and Spacing:** Seats should be well-spaced to allow for comfort and easy movement. The design should ensure that all rows have chairs with backrests that provide adequate support.

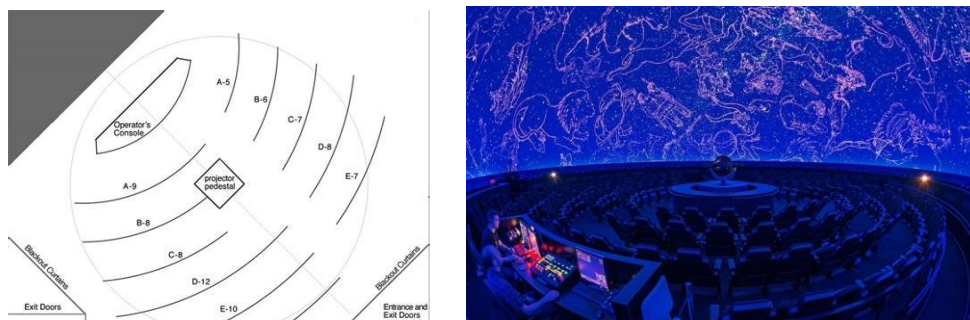


Figure: 27 Audience seating

Projectors

The type of projector used in a planetarium depends on the size and capacity of the dome. Here's a breakdown of the projectors based on different planetarium sizes:

Planetarium Size	Diameter	Seating Capacity	Projector Type	Projected Stars	Motion Axes	Special Features
Small Planetarium	6.8 m	-	Master projector (28 kg)	5800 stars (Magnitude 6.0)	3 axes	Milky way, star clusters, nebula, sun, moon, planets
Medium Planetarium	12.5-15.0 m	120-130 seats	Space Flight Planetarium	8100 stars (Magnitude 6.5)	4 axes	Milky way, star clusters, panorama, special effects
Large Planetarium	20.0-25.0 m	250-600 seats	AGP Cosmorama	9100 stars (Magnitude 6.5)	-	Milky way, star clusters, nebula, laser effects, polar motion, microcomputer control

Screen

The projection screen in a planetarium dome is designed as a hemisphere made from fiber glass or aluminum. The details are as follows:

Material: Aluminum sheets (0.6 mm thickness)

Perforation: Holes with 1.3 mm diameter, spaced 1.3 mm apart in all directions

Finish: The sheets are anodized and coated with an over-dried white primer for reflection.

Dome Dimensions in a Planetarium

The dimensions of the **inner dome**, **outer dome**, and the **seating capacity** are listed below:

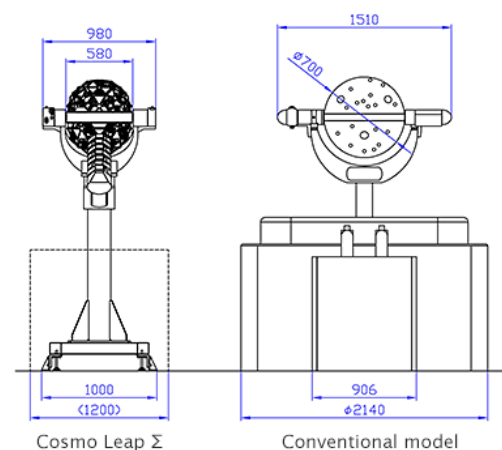


Figure: 28 projector screening

S.no.	Projection Dome	Inner Dome (mm)	Outer Dome (mm)	Dome (mm)	Seating Capacity
1	-	10,000	10,300	12,800	100
2	-	12,500	12,800	15,300	200
3	-	15,000	15,300	17,800	280

S.no.	Projection Dome	Inner Dome (mm)	Outer Dome (mm)	Dome (mm)	Seating Capacity
4	-	17,500	17,800	20,300	350
5	-	20,000	20,300	28,000	425
6	-	23,000	23,300	25,800	600

2.5. science park:

Science parks, also known as research or technology parks, are specialized areas designed to promote research, development, and innovation by fostering collaboration between businesses, academic institutions, and research organizations. They aim to facilitate the growth of knowledge-intensive businesses and startups by providing access to advanced research facilities, collaborative networks, and support services.

Science parks play a significant role in enhancing students' understanding of science and technology by offering:

- **Hands-on Learning:** Students engage in practical experiences that reinforce theoretical knowledge.
- **Exposure to Innovation:** Access to cutting-edge research and development activities inspires creativity and interest in STEM fields.
(<https://ghrpsn.raisoni.net/science-parks-stem-education>)
- **Networking Opportunities:** Interactions with professionals and researchers provide insights into real-world applications of scientific concepts. (<https://www.nsta.org/>)



Figure: 29 hong kong science park

Unlike recreational parks, science parks are specifically designed to support research, development, and commercialization of technology. They are typically affiliated with universities or research institutions and focus on fostering innovation and economic growth. In contrast, recreational parks are designed for leisure and public enjoyment, without an emphasis on technological or scientific advancement.

Cambridge Science Park (UK): Established in 1970, it is the UK's oldest science park, home to over 100 companies in biotech, telecoms, and tech sectors.

Plymouth Science Park (UK): This park has accelerated its carbon reduction plans by receiving research expertise from Low Carbon Devon, showcasing a commitment to sustainability.

Sophia-Antipolis (France): Known as Europe's first science and technology park, it has evolved to include consumption-oriented activities, influencing local planning strategies.



Figure: 30 outdoor stimulator park

some prominent science parks across the globe:

1. **Cambridge Science Park (UK):** Founded in 1970, it's the UK's oldest science park, home to over 100 companies in biotech, telecoms, and tech sectors.
2. **Plymouth Science Park (UK):** This park has accelerated its carbon reduction plans by receiving research expertise from Low Carbon Devon, showcasing a commitment to sustainability.
3. **Sophia-Antipolis (France):** Known as Europe's first science and technology park, it has evolved to include consumption-oriented activities, influencing local planning strategies.



Figure: 31 group learning



Figure: 32 science park activities

2.6. Standard review of basic parameter

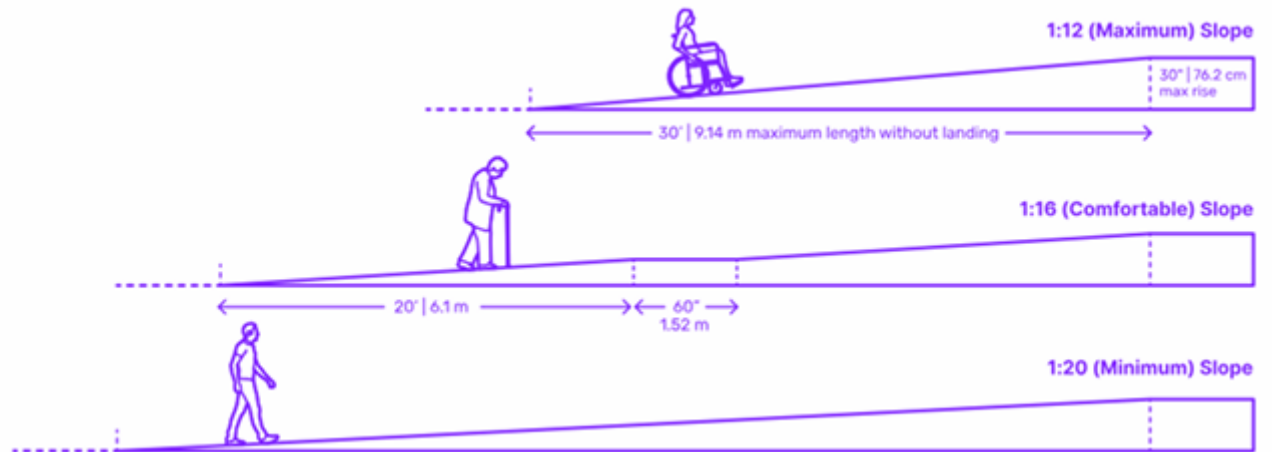


Figure: 33 Walking ramp

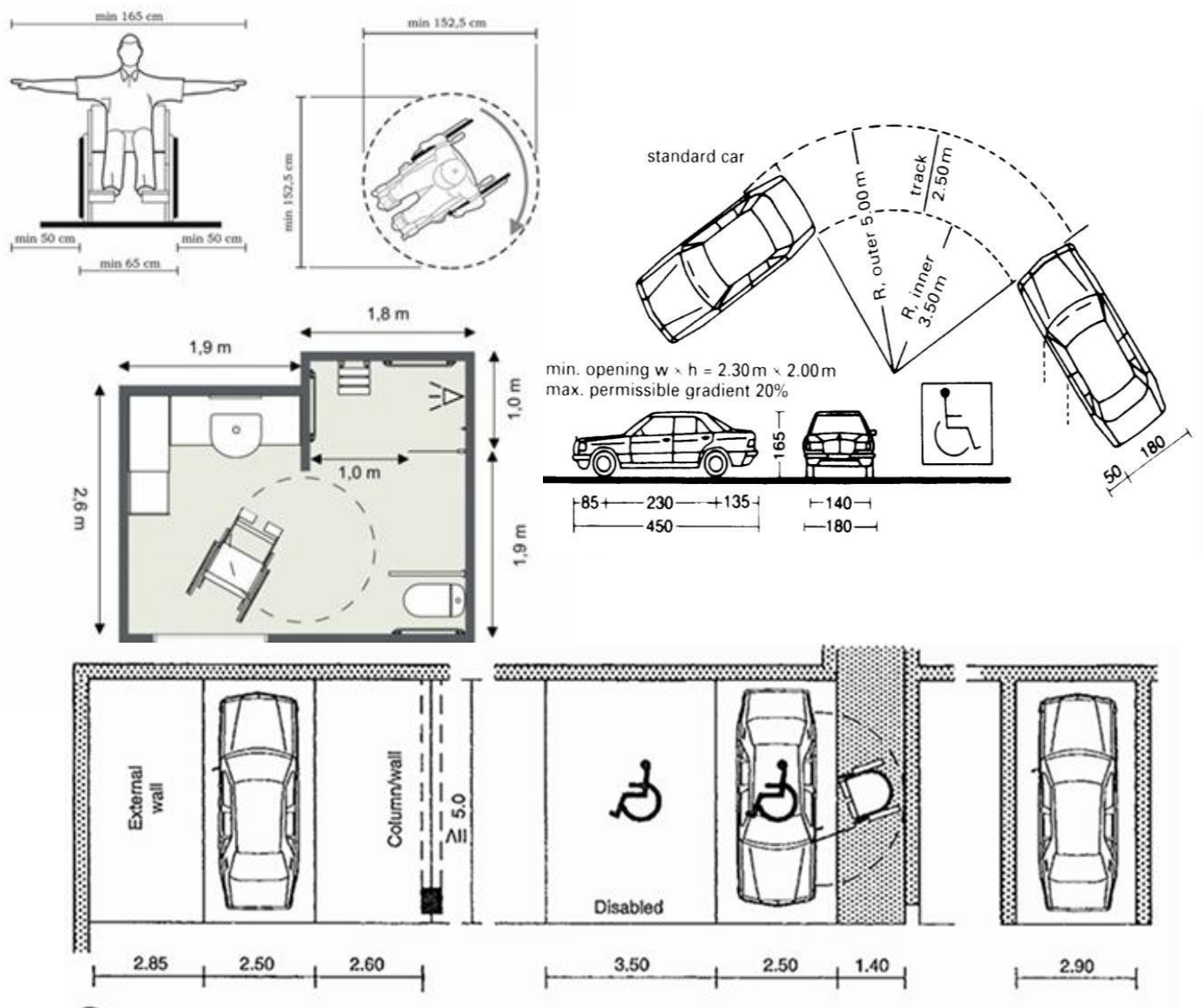


Figure: 34 vehicles circulation

CHAPTER 3

CASE STUDY

3. CASE STUDY

A **case study** involves analyzing a specific building or project to understand its design, structure, and functionality. It provides valuable insights into what worked well and areas for improvement, helping to guide future projects. By studying real-life examples, design choices, materials, and space organization, it aids in making informed decisions, ensuring practical and efficient designs that suit the environment.

3.1 Study Criteria

National		
Name of project	Location	Reason of study
Stimulation science center	kritipur	Science exhibit pattern and program
Bp Koirala memorial science museum	Tu, kritipur	Science exhibit pattern and program

International		
Name of project	Location	Reason of study
Singapore science center	Singapore	- programs and event - World-class interactive exhibits. - Visitor-centric layout for educational engagement.
ESA SUPER NOVA	Germany	- Planetarium study - Focus on space exploration and astronomy. - Integration of advanced technology and immersive exhibits. - Interactive learning experiences.
California science center	USA	- planning - Diverse exhibits including space, technology, and science. - Large-scale educational programs. - Incorporation of practical exhibits.
Science city	India	- Focus on science education for young audiences. - Emphasis on hands-on and interactive displays. - Role in promoting scientific literacy.
Jantar mantar	India	- Integration of astronomy and architecture. - landscaping and as science park - Historical significance in astronomical instruments. - Unique case for combining science and heritage.
Cosmosphere	Kansas usa	- Space Exploration Focus - interactive exhibits - planning

3.2 BP KOIRALA MEMORIAL SCIENCE MUSEUM



Source: <https://www.sciencemuseum.gov.np/en/album>

Location: Kritipur, Kathmandu

Area: 35400 sq m (150 Ropanis)

Orientation: south east entry

Opened: 2019 (inaugurated 1992) still under construction

Building form: star shaped planning (resembling Tu symbol)

Targeted user: students, tourist

No. of user: tentative 1000 during exhibition and 50 on average day

Material and technology: RCC structure

Opening time: 10 am to 5 am every day, closed on Wednesday

Objective of study:

1. Functionality and planning
2. Circulation and flow
3. Layout of spaces
4. Architectural expression utility
5. Site surrounding and its context

Background:

In 1992, government of Nepal had established B.P Koirala memorial planetarium, observatory and science museum development board to conduct research activities and develop the science literacy of nation. The Science Museum was inaugurated by Honorable Minister Giriraj Mani Pokhrel, Ministry of Education, Science, and Technology on May 11, 2019, and since then it has been opened for the general public. IN spite, the construction of museum and planetarium couldn't complete due to funding, it is opened to public in 2019 and still in phase of construction.

The museum is equipped with many educational and interactive exhibits that offer a unique visiting experience. The visitors can immerse themselves into a multitude of disciplines such as Physics, Biology, Geology, Music, Art, Space Science and much more in an entertaining fashion. To add the value of the experience, the museum currently consists of a humanoid robot and a 3D science theatre to make the interaction more interesting and powerful.

Its objective:

- i. To conduct training research and development activities in field of science and space
- ii. To foster the science learning and educating the next generation through Research & Development activities.
- iii. To establish planetarium, observatory and science museum in Nepal and develop the science literacy

Site and its surrounding:

It is Nepal's first and only one Science Museum at the national level located at Kirtipur, Kathmandu, just 3 km away from ring road, in the periphery of Tribhuvan University. The site has unused open land sloping towards north west.



Figure: 35 Aerial view of BP Koirala memorial science museum (Source: promotor Nepal YouTube video)

PLANNING AND CIRCULATION:

Figure: 36 planning and circulation of BP Koirala Museum

Architectural expression

- Three storied building is a star shaped from top view with different functions in its each leg & center as atrium with ramp connecting the floors.
- The building does have enough space in front allowing visitor to enjoy the full view of the building.
- The entrance is provided in between two triangular shapes while make the entrance focused and clear.
- The white color building has the red colored roof in the atrium space with metal truss
- The roof of the triangular part is also sloped towards the center.



Figure: 37 back side arial view of bp Koirala museum

Architectural analysis

- The lobby space is connected to the passage leading to each triangular shape of the star.
- The wide entrance of 10' is provided with the glazed wall all around.
- Two side glaze walls provide enough light and ventilation to the lobby.
- The lobby shape leads to the main museum hall with the atrium in center.
- The whole hall is circulated with the ramp. The display is conceptualized to be exhibit in circulation space.
- The whole building is well ventilated and lighting is appropriate as per need.



Figure: 38 entrance

EXHIBITION HALL

- The exhibit will have the unidirectional circulation pattern.
- The hall is provided in each floor accessible through same exhibition ramp.
- The exit is provided through hall in each floor.
- The hall is uninterrupted and large enough. No permanent partition is provided.
- In the hall in each floor the wide windows are provided for the lighting.
- The central hall is 2'6" below which is accessible to physically challenged people through ramp.
- Most probably, the central hall may contain the model of rocket.



Source:

<https://www.sciencemuseum.gov.np/en/album#lg=1&slide=3>

Figure: 39 exhibition hall

THEATRE ROOM

- It is a trapezoidal in shape with projector room in middle.
- It is in one of the leg/sides of star.
- The emergency exit is provided in the middle of each side.
- It can accommodate around 100 people.
- It has ability to gain total darkness.
- The video related to science (astronomy/space) is shown.



Source:

<https://www.sciencemuseum.gov.np/en/album#lg=1&slide=3>

Figure: 40 Theatre room

LIGHTING

- The natural light is gained from the atrium and the windows at every turning.
- In the hall in each floor the wide windows are provided for the lighting.
- Natural light is seeming to be utilized more than artificial light. For artificial light the use of CFL can be seen.
- The negative space of the triangular part is cut off providing trapezoidal room space. The angular windows are used for the natural lighting.



Figure: 41 center atrium

OTHER EXHIBITS

Exhibits related to different field of science was displayed. They were placed throughout the corridor or circulation of the first floor between the sides of star. As each side had different theme like botanical, astronomy, ancient sculptures etc.

- Water Droplet Movement
- Hand Battery
- Nails Bridge
- Laser Harp
- Reflex Game
- Mirror Cube
- Dancer
- Hand-eye Coordination
- Queue Marching
- Flying Bird in the Cage
- Infrared Vascular Imager
- Sound Standing Wave
- Disappeared Picture
- Varying Landscape
- Granting Animation
- Resonant Ring
- Rotating Metal Egg
- Point Discharge
- Ramp Race
- Music Tesla
- Electromagnetic Accelerator
- Peering in Endlessly
- Magnetic Damping
- Magic Box
- Round or Diamond
- Draw a Straight Line
- Turn out the Pattern
- Dancing Clip
- Bone Conduction
- Rotation Balancer
- Wonderful Letters
- Air Imaging
- Reaction Test
- Bernoulli Suction cup
- Coriolis Force
- Pull Yourself
- Balance Test
- Hyperbolic Curved Groove
- Draw a Star
- Car Window
- Automotive Differential
- Automotive Wiper
- Automobile Clutch
- Car Steering Gear
- Constant Velocity Universal Joint
- The upward rolling of the cone
- Automatic Transmission
- Obedient Ball
- Scientific Performance
- Door-Head
- Dome Theater
- Robot Performance
- 3D Printer
- VR Glasses
- The travel of small



Figure: 42 exhibits display equipment



Figure: 43 biology section



PARKING

- Enough parking space of around 5-6 buses.
- The parking area is also conceptualized as drop off point, allowing visitor to walk and enjoy the landscaping.

LANDSCAPE

- The Musical Fountain, Statue of Scientist of Nepal, Memorial Park, Pond, Picnic Spots, Maze, Cage, Cascade, and Toy Train are to be developed as a landscaping element.
- The paths are hardscape while rest of the area are all softscape.
- The beautiful view of Kirtipur city acts as backdrop landscape of the building.
- Abundance of greeneries & also break out space to the outside with green



Figure: 45 top view

SECURITY

- For fire security purpose, the fire hose is provided two in each floor.
- The whole building is under CCTV coverage. No any emergency staircase is provided.
- Only one entry and exit are provided.

INFERENCES

- Spacious interiors with proper height, lighting & ventilation.
- Building itself designed for museum which is best.
- Utilization of space.
- Circulation pathways.
- Combination of central atrium with functional ramp.



Figure: 46 entrance lobby

References :

<https://www.sciencemuseum.gov.np/en>

3.3 SIMULATION SCIENCE CENTER:



Figure: 47 simulation science centre

- **Location:** Kritipur (previously in Bhaisepti)
- **Area:** Approximately 2490 sq m
- **Owner:** Sudan Basnet (robotic engineer)
- **Opened:** 2018
- **Building Form:** Modern, functional space designed for interactive exhibits
- **Targeted User:** Students, tourists, science enthusiasts
- **Number of Users:** Estimated 150 during special exhibitions, 50 on average days
- **Material and Technology:** metal framing for exhibits with truss roof and interior of ply wood
- **Opening Time:** 10 AM to 5 PM every day, closed on certain public holidays
- **Objective of Study:**
 1. Functionality and planning
 2. utility
 3. Site surrounding and context

Background:

The Simulation Science Center, located in Kirtipur, Kathmandu, was established to promote scientific literacy and education through interactive exhibits by robotic engineer Sudan Basnet. According to him , stimulation (working model) science center was aim to teach & demonstrations book related theory to student based hand on experiences. It is privately own science center and primarily opened to school student.

Robet : 8 rocket model USA and Europe

small observatory:

- Astronomy related film and movies planet study with
- Robot stimulation model
- Vr related demonstrated about planet

Program

- Physics related science model
- Workshop with kit provided to student
- 1 shift 150 student
- Currently design science park



Figure: 48 abonded structure

. It opened in 2018 in Bhaisepati but it was shift to his private resident in kritpur. currently it is closed due to expansion and renovation. The center features a variety of exhibits related to fields like physics, biology, astronomy, and technology, aiming to engage visitors in a hands-on learning experience. It is closed Although it is plan to open in Baishak 2082 and open to all.

Objective:

- To educate school student and help in the curriculum
- To enhance public understanding of science through interactive exhibits
- To foster scientific learning for future generations
- To promote the importance of science education and technological innovation through hand on learning

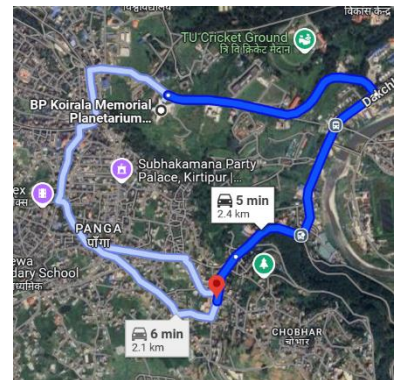


Figure: 49 location map

Site and Its Surroundings:

The center is located near the Tribhuvan University in Kirtipur, Kathmandu, with open land sloping towards the northwest. The area is quiet, with ample space for further development, including landscaping and additional educational facilities.

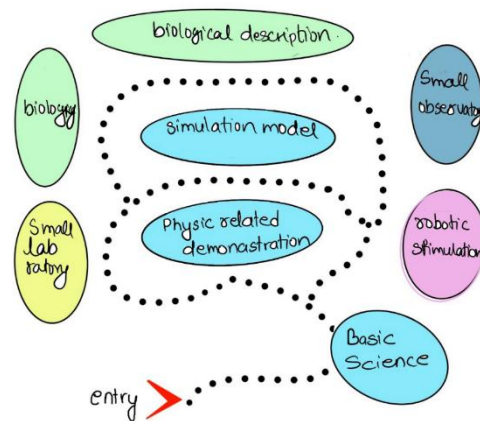


Figure: 50 circulation and planning



Figure: 51 new site

Planning and Circulation:

The center is designed to cater to a wide range of exhibits with a clear, well-organized circulation pattern. Visitors can experience science exhibitions while navigating through different sections seamlessly.

Exhibits:

The center includes a variety of interactive exhibits like:

- Water droplet movement
- Hand battery
- Laser harp
- Infrared vascular imager
- 3D printing demonstrations
- VR Glasses, among others

Theatre Room:

- A space designed for science-related videos, including astronomy and space science
- Accommodates around 100 people and offers full darkness for video presentations

Lighting:

- Natural lighting is emphasized throughout the space, with large windows and strategic placement of glass to allow ample daylight.
- Artificial lighting is provided with energy-efficient CFLs and other sustainable options.

Parking and Landscaping:

- Sufficient parking space is available, including areas for buses.
- The landscaping includes elements like a musical fountain, picnic spots, green spaces, and an area designed for relaxation and learning.

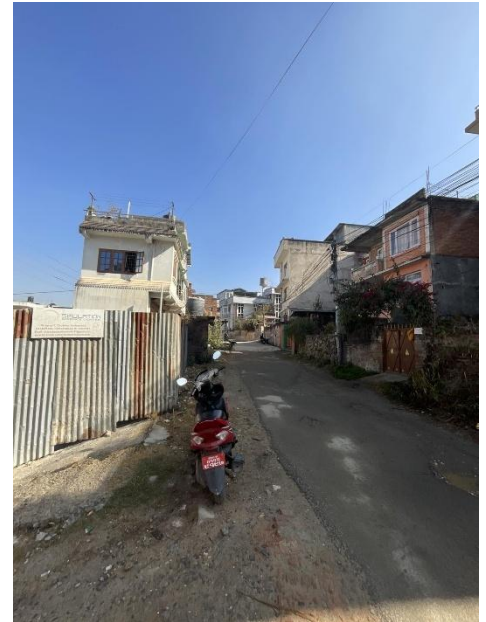


Figure: 52 renovation images of science centre



Figure: 53 activities and student involvement

3.4 JANTAR MANTAR

Location: Jaipur, Rajasthan, India



Figure: 54 arial view of jantar mantar

Area: Approximately 18,700 sq m

Orientation: South-East Entry

Opened: 1728 (completed in 1734)

Building Form: A collection of astronomical instruments and structures in geometric forms

Targeted Users: Astronomers, researchers, students, tourists

Daily Visitors: Approximately 500 (rising to thousands during festivals and special events)

Material and Technology: Primarily constructed from local stone and masonry, showcasing traditional craftsmanship with minimal use of metal

Opening Hours: 9:00 AM to 5:00 PM daily

1. Objective of the Study

1. **Functionality and Planning:**

To understand the purpose of each instrument and how the overall layout facilitates precise astronomical observations.

2. **Circulation and Flow:**

To analyze visitor movement through the site and determine how they interact with the instruments.

3. **Layout of Spaces:**

To examine the spatial organization and assess the accessibility of the instruments.

4. Architectural Expression and Utility:

To investigate how the design embodies scientific principles and reflects cultural significance.

5. Site Surrounding and Context:

To consider the urban context and its impact on the visitor experience.

2. Background

Constructed in the early 18th century by Maharaja Sawai Jai Singh II, Jantar Mantar is an astronomical observatory that exemplifies India's advanced knowledge of astronomy and mathematics. Recognized as a UNESCO World Heritage Site, it houses a unique collection of architectural astronomical instruments designed for:

- Measuring time
- Predicting eclipses
- Tracking stars

The most renowned instrument, the **Samrat Yantra**, is the largest stone sundial in the world—demonstrating a sophisticated understanding of timekeeping and celestial navigation.

3. Site and Surroundings

Location and Urban Context:

- **Historic Core:** Situated in the heart of Jaipur, Jantar Mantar is surrounded by other significant heritage structures, including the City Palace and Hawa Mahal.
- **Open Environment:** Expansive open spaces provide unobstructed views of the instruments and the sky—essential for accurate astronomical observations.
- **Cultural Hub:** The site's integration with vibrant markets and cultural landmarks enhances its appeal as an educational and tourist destination.
- **Celestial Visibility:** Its placement minimizes light pollution, ensuring optimal conditions for observations.

Key Points:

- Acts as an educational and cultural landmark.
- Supports astronomical research and public interest in historical science.
- Enhances visitor experience through linkages with nearby heritage sites.

4. Location & Accessibility

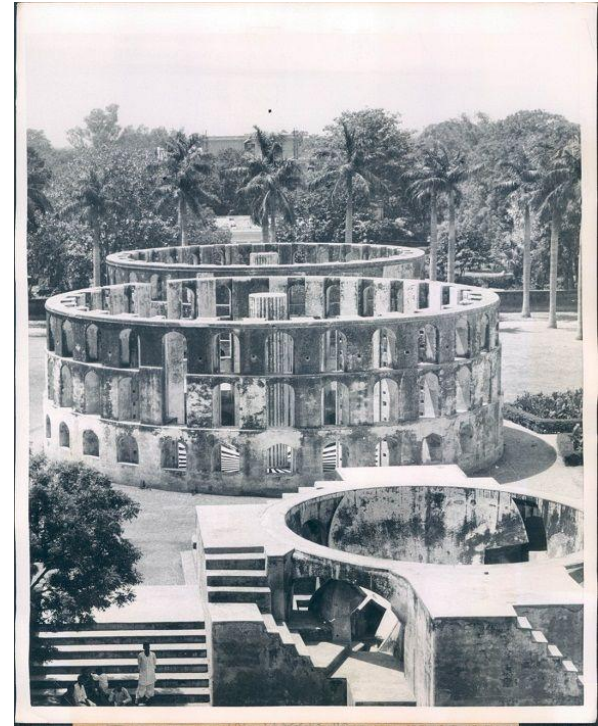


Figure: 55 rama yantra

- **Strategic Position:** Located centrally in Jaipur, near major attractions. **Transport Links:**
 - Jaipur International Airport is 13 km away.
 - Jaipur Junction railway station is 5 km away.
- **Connectivity:**
 - Well-connected by major roads, public transport, and pedestrian pathways.
 - Pedestrian-friendly routes ensure smooth movement while preserving the historical ambiance.
- **Urban Integration:** Although surrounded by urban development, the site retains its significance as a heritage monument.



Figure: 56 location

5. Planning and Circulation

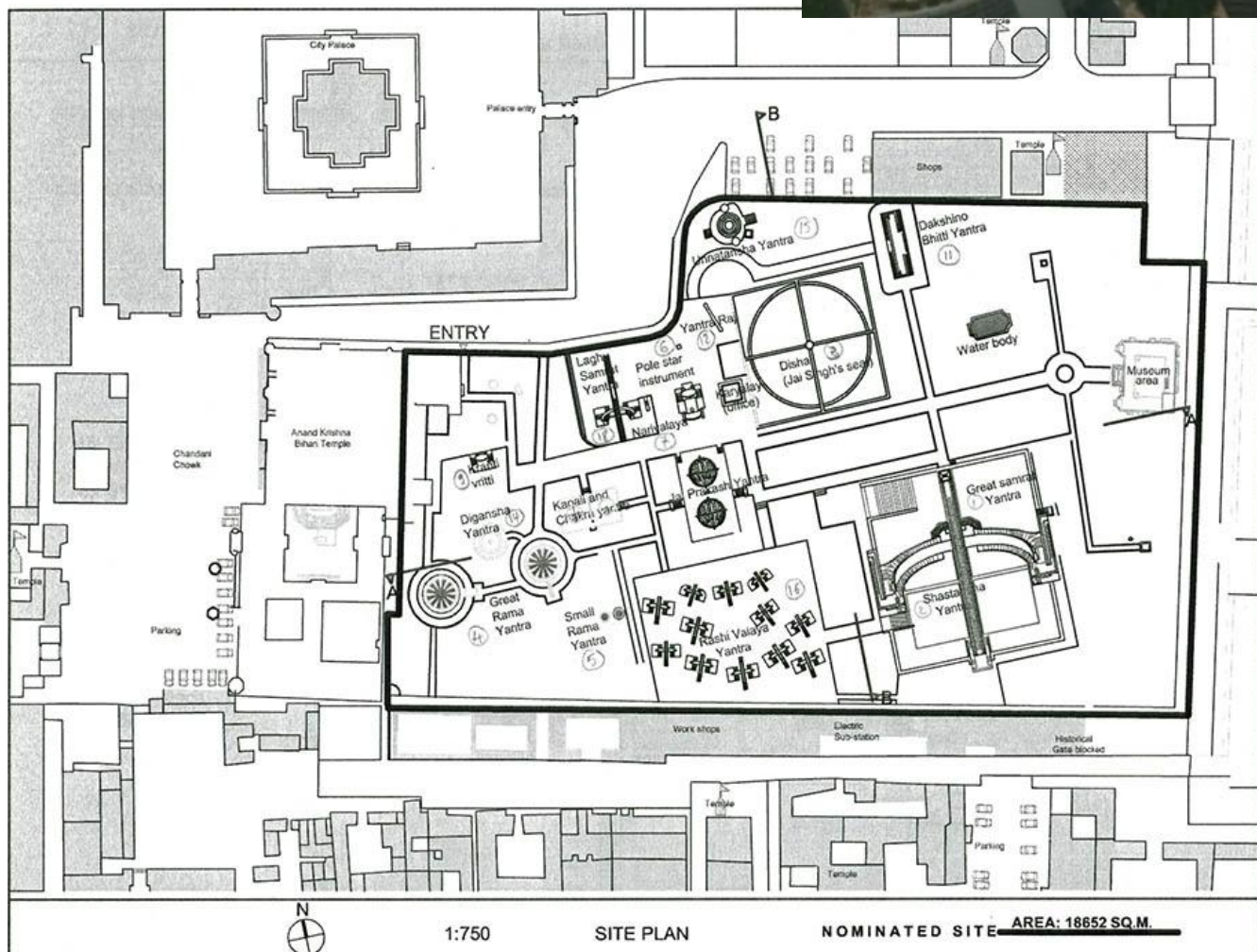


Figure: 57 master plan

- **Radial Layout:** Instruments are arranged in a radial pattern, allowing easy navigation and direct access to each astronomical device.

- **Clear Pathways:**
Marked circulation routes minimize congestion, especially during peak visiting hours.
- **Logical Visitor Flow:**
Visitors begin at a grand entrance and progress to a central courtyard where the most prominent instruments are displayed.

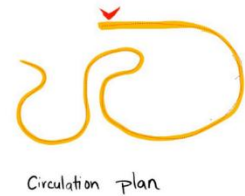
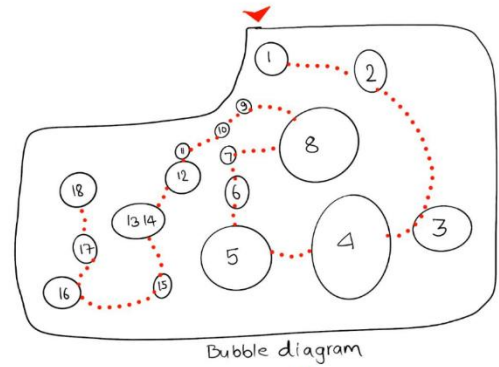


Figure: 58 planning and circulation

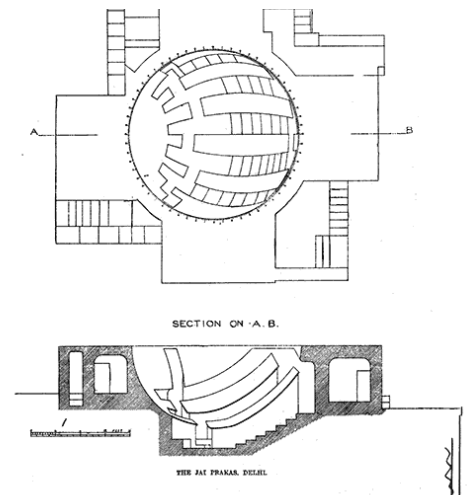


Figure: 59 jai parkash yantra

7. Architectural Analysis

- **Entrance and Visitor Experience:**
A grand, welcoming entrance leads into a spacious courtyard featuring major instruments. Signage and informational panels enhance visitor engagement.
- **Instrument Accessibility:**
Instruments are designed for close-up interaction. Educational plaques provide detailed explanations of each device's function.
- **Lighting and Ventilation:**
Abundant natural light illuminates the site throughout the day, while natural airflow maintains visitor comfort.



Figure: 60 rama and jai parkash yantra

8. Exhibition Hall and Interactive Features

- **Interactive Experience:**
Although there is no formal exhibition hall, the instruments themselves serve as interactive exhibits, inviting hands-on exploration.

- **Thematic Displays:**
Various instruments highlight themes such as timekeeping, celestial navigation, and planetary motion.
- **Guided Tours:**
Regular educational programs and guided tours in the central courtyard provide deeper insights into the history and science of the instruments.

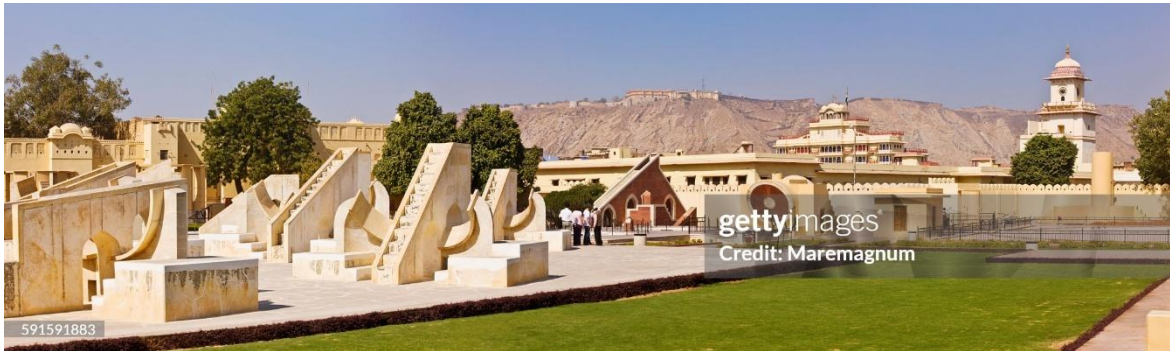


Figure: 61 rashi valaya yantra

9. Climate & Topography

- **Arid Climate:**
Jaipur experiences extreme temperatures—up to 45°C in summer and as low as 5°C in winter.
- **Material Durability:**
The use of local stone and lime plaster ensures resistance to environmental degradation.
- **Flat Terrain:**
A predominantly flat landscape aids in the accurate placement of large-scale instruments.
- **Solar Considerations:**
Instruments are positioned to account for seasonal solar angles, ensuring year-round functionality.



Figure: 62 arial view

10. Zoning & Space Planning

- **Functional Zones:**
The site is divided into distinct zones, each dedicated to specific astronomical calculations.
- **Efficient Spatial Organization:**
 - Clear circulation paths enhance accessibility and minimize obstructions.
 - The radial and geometric masterplan optimizes observational accuracy by reducing shadows and reflections.
- **User-Friendly Layout:**
The open layout ensures seamless movement between observational points.

Figure: 63 master plan

11. Bubble Diagram & Masterplan

- **Spatial Relationships:**
Bubble diagrams illustrate the interconnections between various instruments and the circulation network.
- **Optimized Observational Views:**
The masterplan ensures that every instrument maintains an unobstructed view of the sky.
- **Integrated Pathways:**
Observation decks and clear pathways facilitate both scientific use and visitor movement, aligning with celestial axes for enhanced instrument precision.



12. Pedestrian & Vehicular Circulation and Landscape Design

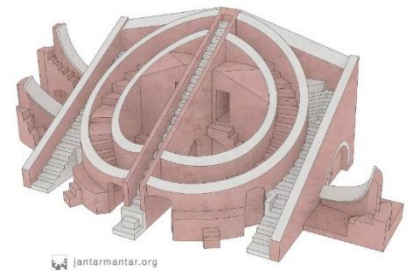
- **Pedestrian Priority:**
Vehicular movement is restricted within the site to maintain a safe, pedestrian-friendly environment.
- **Well-Defined Pathways:**
Clearly marked routes connect the instruments in a logical sequence.
- **Landscaping:**
 - Minimalistic gardens and open courtyards create a serene observational environment.
 - Green spaces and shaded seating areas enhance visitor comfort without detracting from the historical focus.
- **Service Management:**
External roads manage service access, while designated drop-off points facilitate group visits.

13. Legal Considerations

- **Heritage Protection:**
 - Jantar Mantar is protected under UNESCO guidelines and the Archaeological Survey of India (ASI).
 - Strict building regulations prevent high-rise developments in the surrounding area.
- **Conservation Policies:**
Any restoration or maintenance work requires approval from heritage conservation authorities to preserve the site's integrity.

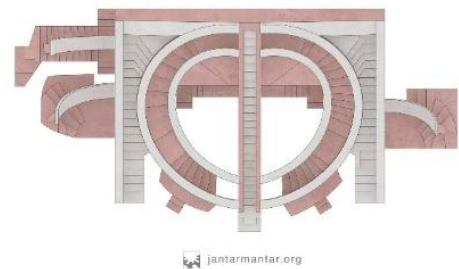
14. Study of Individual Spaces & Spatial Linkages

- **Instrument Arrangement:**
Instruments are strategically positioned to ensure precise measurements based on latitude and other celestial factors.
- **Interconnectivity:**
Staircases, ramps, and open platforms provide accessible linkages between observational points.
- **Notable Instruments:**
 - **Samrat Yantra:** The world's largest sundial, accurate to within two seconds.
 - **Jai Prakash Yantra:** A hemispherical instrument for determining celestial positions.
 - **Rashivalaya Yantra:** Designed for zodiac-based astronomical calculations.
- **Orientation:**
Each instrument's alignment is carefully planned to optimize observational accuracy.



15. Architectural Expression (Detailed)

- **Monumental Scale:**
The observatory's design exudes grandeur with its imposing geometric forms.
- **Material Authenticity:**
Constructed using local sandstone and marble, the site harmonizes with Jaipur's traditional architecture.
- **Visual Identity:**
The integration of scientific precision and cultural symbolism reinforces the site's unique character.
- **Craftsmanship:**
Intricate detailing and precise alignments underscore the historical ingenuity and traditional construction techniques.



16. Sustainability Considerations

- **Passive Design Strategies:**
 - The open-air structure promotes natural ventilation and reduces heat buildup.
 - Locally sourced, durable materials minimize environmental impact.
- **Energy Efficiency:**
Minimal reliance on mechanical systems and artificial lighting underscores the site's sustainability.
- **Cultural Sustainability:**
Ongoing heritage conservation efforts ensure the long-term preservation of the site's scientific and cultural value.
- **Microclimatic Enhancement:**
Integration of green spaces improves the local microclimate and visitor comfort.
- **Solar Alignment:**
Original design considerations for solar movement contribute to the site's enduring efficiency.

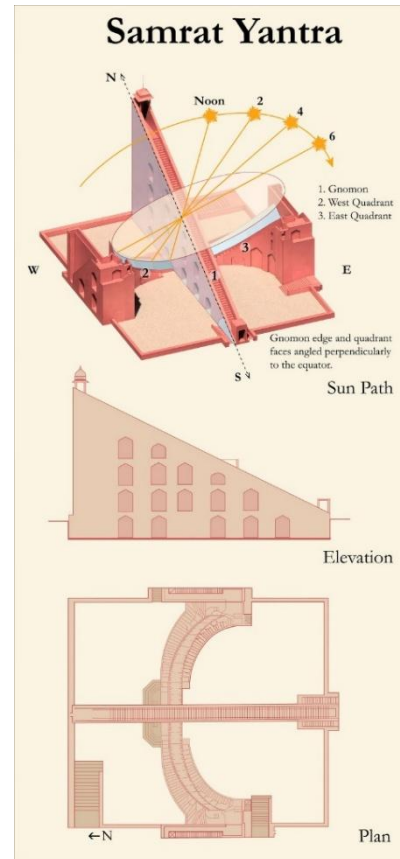


Figure: 64 samtra yantra

17. Universal/Inclusive Design

- **Accessible Pathways:**
Wide, unobstructed pathways facilitate movement for visitors of all ages and abilities.
- **Mobility Considerations:**
Ramps and open spaces are integrated to enhance accessibility for people with disabilities.
- **Enhanced Signage:**
Educational signage, tactile guides, and the potential for Braille adaptations improve accessibility for visually impaired visitors.
- **Inclusive Experience:**
Guided tours and interactive displays cater to diverse audience groups, ensuring equitable access

18. Building Services

- **Basic Amenities:**
Seating, minimal artificial lighting, and security systems are provided.
- **Open-Air Functionality:**
The site requires few modern mechanical systems, preserving its open-air character.



Figure: 65 virat samrat yantra

- **Water Conservation:**
Techniques are implemented to maintain the site with minimal resource consumption.
- **Security Measures:**
Surveillance systems and controlled access ensure the protection of both the heritage instruments and visitors.

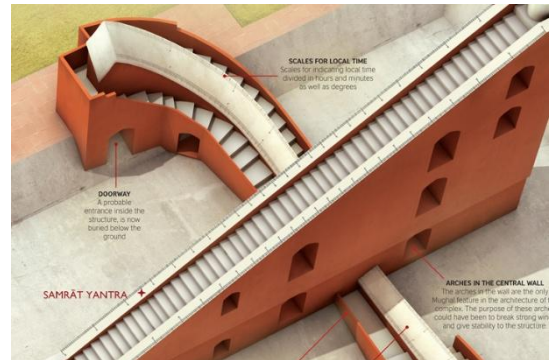


Figure: 66 circulation of samrat yantra

19. Supplementary Facilities Theatre Room / Lecture Space

- **Multi-Use Courtyard:**
Although no dedicated theatre room exists, the central courtyard serves as a space for presentations, lectures, and live demonstrations.
- **Community Engagement:**
The design accommodates large groups, fostering communal learning and interactive educational experiences.

Lighting Design

- **Natural Light Utilization:**
The observatory maximizes natural daylight, reducing reliance on artificial lighting and enhancing the visual appeal.
- **Artistic Effects:**
Carefully placed windows and openings create dynamic lighting effects, particularly during sunrise and sunset.

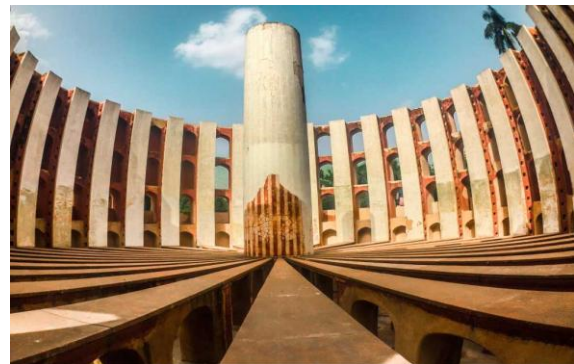


Figure: 67 great ram yantra

Additional Exhibits and Installations

- **Informative Installations:**
Sculptures, historical plaques, and interactive displays provide contextual information about the site's cultural and scientific significance.
- **Thematic Diversity:**
Each instrument is associated with specific themes such as timekeeping, celestial navigation, and astrology, offering a multi-layered educational experience.

Parking and External Access

- **Limited On-Site Parking:**
Due to its central location, parking is limited. Visitors are encouraged to use public transport or nearby facilities.
- **Designated Drop-Off Points:**
Specific areas are provided for buses and taxis, ensuring smooth group access.

20. Landscape and Security

Landscape Design

- **Minimalistic Approach:**
The surrounding landscape is intentionally simple, emphasizing the instruments while providing ample open space for exploration.
- **Green Spaces:**
Integrated gardens and pathways enhance the aesthetic appeal and offer shaded resting areas.

Security Measures

- **Monitoring and Safety:**
Security personnel monitor the site to ensure the safety of both the instruments and visitors.
- **Access Control:**
Limited entry and exit points, along with clear signage, help manage visitor flow and enhance overall security.

21. Inferences and Conclusions

- **Spatial Efficiency:**
The observatory demonstrates an effective balance between functionality and aesthetic appeal through its well-planned spatial organization.
- **Cultural and Scientific Integration:**
Jantar Mantar embodies a unique fusion of cultural heritage and scientific advancement, serving as an invaluable educational resource.
- **Visitor Engagement:**
The thoughtful design and accessible layout promote active engagement with the instruments, fostering a deeper understanding of astronomy.
- **Heritage Preservation:**
Strict legal and conservation measures ensure the long-term preservation of the site's architectural and scientific value, even as modern interventions address accessibility needs.

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3.5 SCIENCE CITY KOLKATA



Figure: 68 science city kolkata

Location : Kolkata , west Bengal

Architect: Ar. Aftab Amin

Director: A. D. Chowdhury

Site Area: 49.7 acres (201,136 sq.m.)

Location: Intersection of Eastern Metropolitan Bypass and Park Circus Road

Completion Year: 1997 (initiated in 1993)

Project Cost: Approx. ₹50 Crores

FAR: 0.34 (permissible: 2.475)

Total Built-Up Area: 68,284 sq.m. (permissible: 497,811.6 sq.m.)

Ground Coverage: 16.62% (33,426.38 sq.m., permissible: 35% or 70,397.6 sq.m.)

Parking: 1000 cars & 25 buses

Visitor Count: 1,573,560 annually (as of 2012), with 4,300 visitors per day

3.7.1 Introduction

Inaugurated on July 1, 1997, Science City was designed to be a prominent destination for both local residents and national/international visitors of Kolkata. Developed by the National Council of Science Museums under the Ministry of Culture, Government of India, the Science City spans approximately 50 acres. It serves as an engaging and educational space, combining elements of science and technology in a captivating environment that entertains as much as it informs.

The Science City comprises two main complexes: the Science Center Complex and the Convention Center Complex. Each area features a variety of exhibits and interactive spaces dedicated to various fields of science, aiming to foster a deeper understanding of scientific principles while providing an enjoyable experience for people of all ages.

Concept:

Designing a complex of this magnitude presents a significant challenge, as it must capture the vastness of science and technology within physical boundaries. To meet this challenge, the project is divided into three main structures—Science Exploration Hall, Dynamotion, and Space Odyssey. These structures are strategically arranged around a central plaza, complemented by outdoor exhibits and landscaping that enhance the experience.



Figure: 69 location

3.1.4 Present Features:

- **Dynamotion:** A vibrant showcase of science in action, offering interactive exhibits that demonstrate scientific principles in an engaging manner.
- **Space Odyssey:** A thrilling journey through the universe, offering visitors an immersive experience of space exploration.
- **Time Machine:** A captivating exhibit that transports visitors through different periods of time.
- **Mirror Magic:** A fascinating exploration of optical illusions and reflections.
- **3D Vision Theatre:** A state-of-the-art theatre offering immersive 3D films and experiences.
- **Space Theatre:** A dedicated space offering an educational journey through outer space.
- **Convention Centers:** Facilities designed to host various events, conferences, and exhibitions related to science and technology.
- **Maritime Centre:** An exhibit showcasing the science of the seas and maritime technology.
- **Earth Exploration Hall:** A space dedicated to exploring the planet's physical processes and natural phenomena.
- **Science Park:** A playful yet educational area featuring scientific installations and activities for visitors of all ages.
- **Picnic Garden:** A relaxing outdoor area where visitors can enjoy nature and leisure activities.

Planning:

SCIENCE CITY

Guide Map

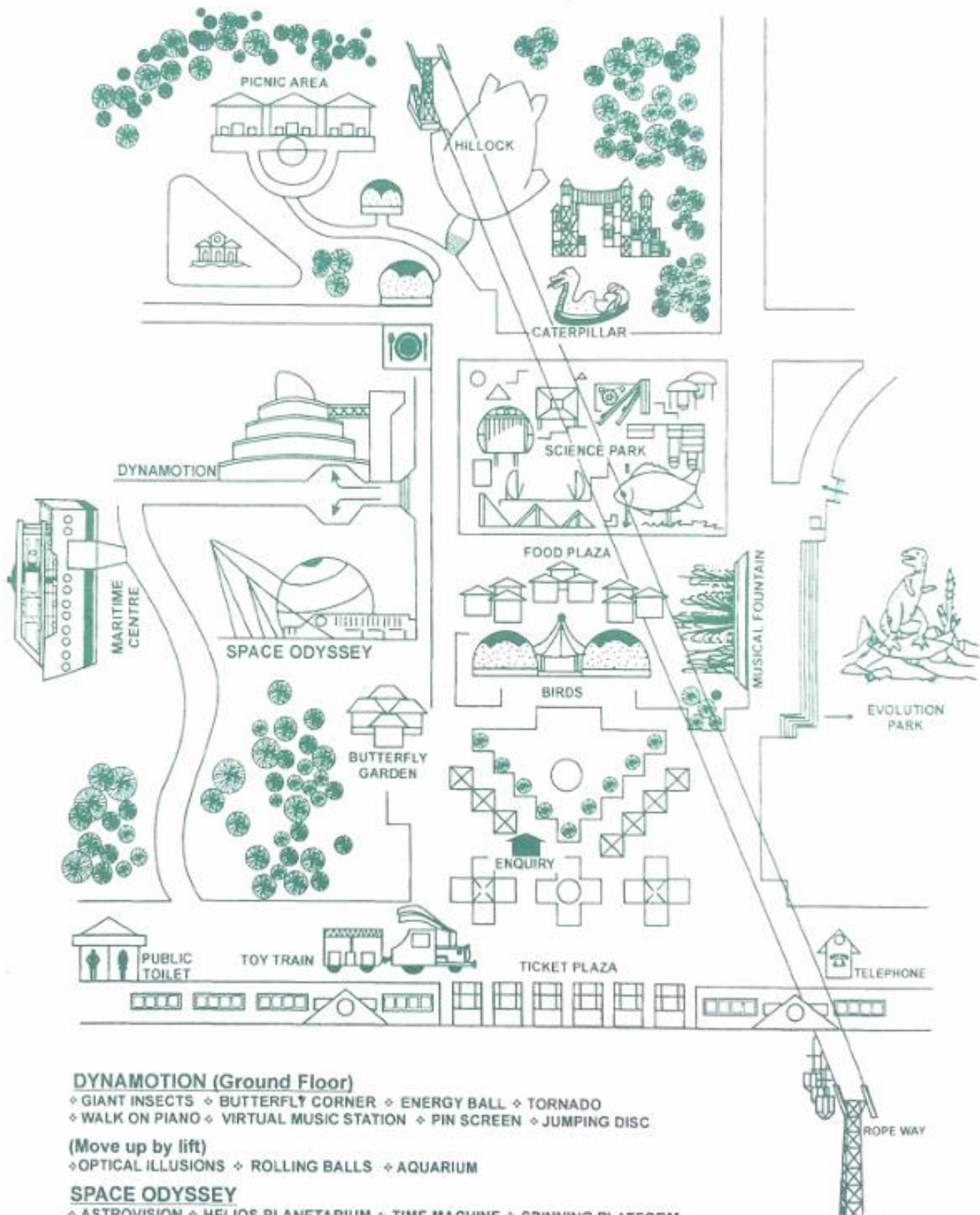


Figure: 70 master plan

Public Zone:

- **Ticket Plaza:** 1,175 sq.m.
- **Space Odyssey:** 4,900 sq.m.
- **Dynamotion:** 5,500 sq.m.
- **Maritime Centre:** 920 sq.m.
- **Earth Exploration Hall:** 980 sq.m.
- **Science Park:** 4,550 sq.m.

Semi-Public Zone:

- **Main Auditorium:** 9,125 sq.m.
- **Mini Auditorium:** 1,337 sq.m.
- **Seminar Hall Building:** 2,261 sq.m.
- **Exhibition Area:** 1,700 sq.m.

Private Zone:

- **Administrative Area**
- **Service Area**

Landscaping

Landscaping is a key highlight of Science City, designed to enhance the visitor experience and integrate nature with the exhibits.

- **Main Plaza:** The expansive plaza features low-growing plants and non-foliage trees. A significant portion is covered by maze hedges that surround open exhibits. Near kiosks, low creeper shrubs provide shade for seating benches. The focal point of the plaza is a musical fountain, which serves as its main attraction. Royal palms are strategically planted near the parking and service lanes to add visual appeal.
- **Convention Centre:** The plaza surrounding the convention center is adorned with potted plants, flower beds, water channels, and fountains. The design incorporates varying levels, including steps and ramps, which enhance both the functionality and aesthetic beauty of the space.
- **Entrance Plaza:** The entrance plaza is a lush green area that surrounds fountains, with pathways formed from sandstone creating intricate patterns.

On-Site Circulation

- **Pedestrian Movement:** Visitors navigate the site through a network of sandstone-paved pathways, varying in width from 3.5m to 1.8m, which lead to various buildings and attractions.
- **Ropeway:** A ropeway system was introduced to offer a panoramic view of the site, connecting the gate complex to the far end of the area.
- **Monorail:** An elevated monorail system runs throughout the site, providing an efficient means of transportation across the complex.

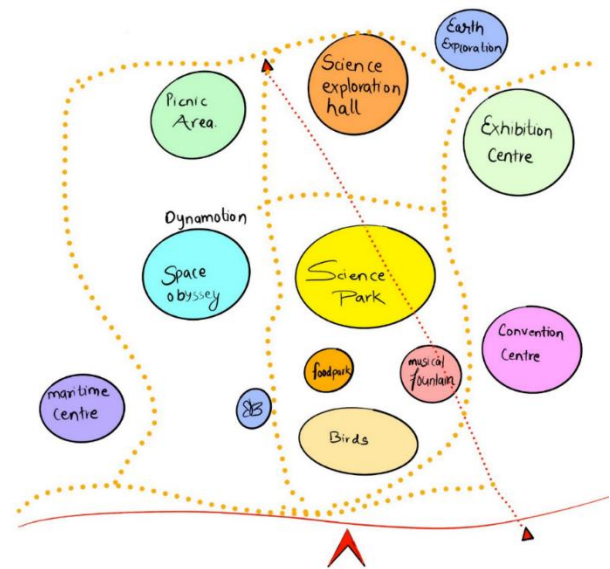


Figure: 71 planning and circulation

- **Toy Train:** A toy train operates across the entire site, offering a convenient alternative for those who prefer not to walk.



Figure: 72 entrance view

Dynamotion Hall

Dynamotion Hall is a striking circular shell structure with unique exterior geometry, standing 38 meters high. The design features a spiral-shaped ramp surrounding a 15-meter-diameter central atrium, extending all the way to the top.

- **Plinth Area:** 3,000 sq.m.
- **Space Distribution by Floor:**
 - **Ground Floor:** 2,500 sq.m. — Features the 28-meter-high exhibit, *Rolling Ball*, which demonstrates the dynamics of multiple rolling balls moving in different trajectories, with water exhibits at the base.
 - **First Floor:** 2,000 sq.m.
 - **Second Floor:** 1,500 sq.m.
 - **Third Floor:** 1,000 sq.m.



Figure: 73 dynamotion hall

The hall includes two symmetrically placed galleries along the building's longitudinal axis. One gallery showcases the *Butterfly Enclave*, while the other focuses on water-based experiments. The opposite corners of the rectangular halls house service areas like electrical rooms and storage. Elevators, located across from the entrance lobby, transport visitors to the top floor.

The exhibition is arranged along a spiral ramp (4.5 meters wide, with a 1:12 slope), guiding visitors past exhibits on the left side and leading them to the podium. The exits are located at the two corners of the podium. The hall consists of three galleries, each dedicated to a unique theme:

- **Illusion** (Third Floor)
- **Power of Ten** (Second Floor)
- **Aquarium** (First Floor)

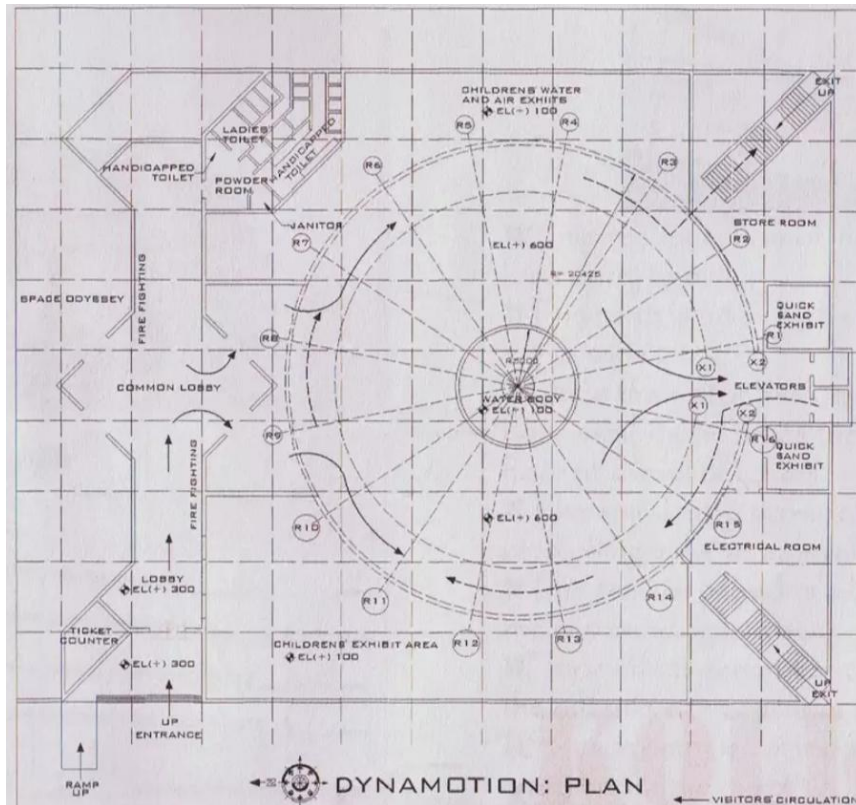


Figure: 74 plan of dynamotion hall

A forced circulation pattern by a unidirectional and spiral ascending circulation ramp 5'-0" wide is followed throughout the exhibition area.

Once the visitors has viewed the ground floor exhibits; he takes the elevator to the top floor at a level of 24.6 m.

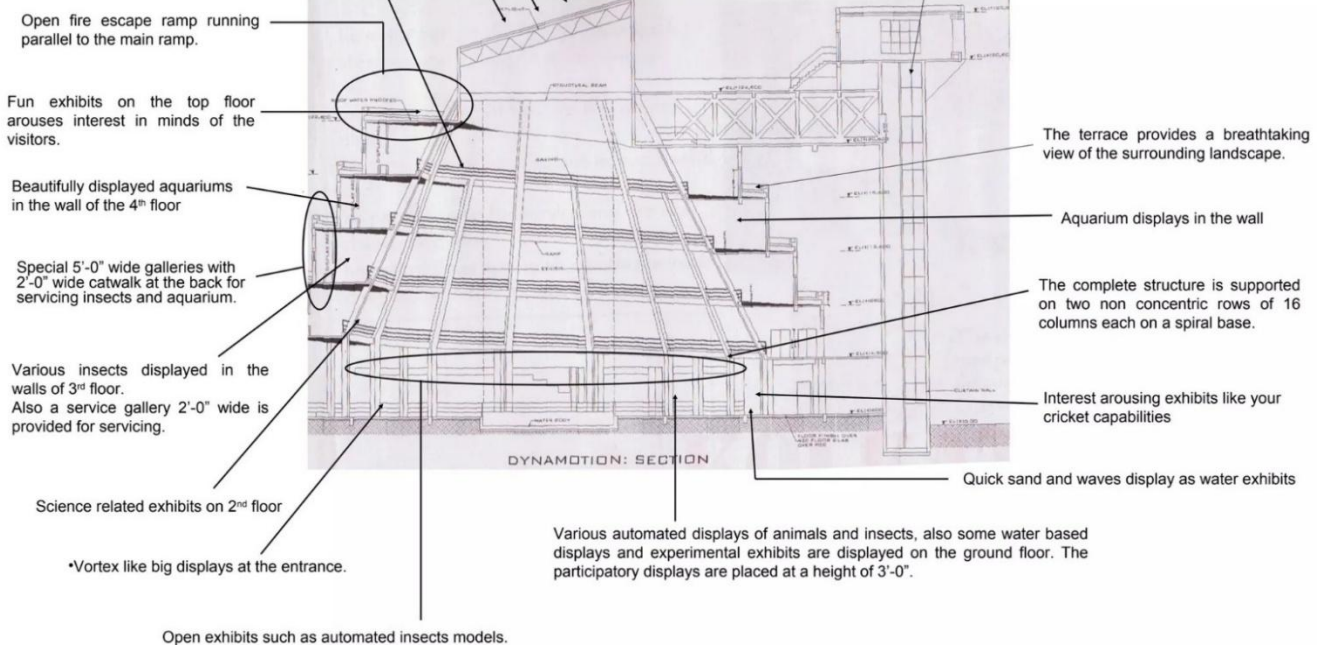


Figure: 75section of dynamotion hall

Circulation in the Exhibition Area

- **Forced Circulation Pattern:** The exhibition area follows a forced circulation pattern, designed to guide visitors through the space in a controlled, unidirectional flow.
- **Spiral Ramp:** A spiral ascending ramp, 4.5 meters wide and 38 meters high, ensures smooth movement throughout the building. It leads visitors from one floor to the next, providing an uninterrupted, continuous path that enhances the experience.
- **Exit Strategy:** Visitors exit through a staircase that leads from the first floor back to the ground floor, maintaining the flow of movement.
- **Service Entry:** The service entry is shared with the visitor's entry, ensuring an efficient operational flow without disrupting the visitor experience.
- **Elevator Access:** After exploring the ground floor exhibits, visitors take the elevator to the top floor, which is positioned at a height of 24.6 meters. This ensures accessibility for everyone, including those who might require alternative access options.
- **Barrier-Free Design:** The building is designed to be barrier-free, promoting inclusivity by accommodating people with various accessibility needs, ensuring that all visitors can move freely within the space.

space Odyssey

The Space Odyssey Hall is accessed through a common sky-lit lobby. The hall features a partially double-height space, with a spherical dome theatre located at its far end. At the center of the hall, an artificial moon surface is displayed, along with space science exhibits on 2-meter-high display panels. The hall is fully air-conditioned.

Space Odyssey consists of the following sections:

- **Mirror Magic Gallery:** A collection of 35 exhibits that explain the physical principles behind mirror images.
- **Space Science Gallery:** A section dedicated to space-related exhibits.
- **3D Theatre:** A hall measuring 5.5m x 11m with a seating capacity of 50 people. It features two side aisles, wooden steps, and a projector room at the back. The theatre screens 3D films.
- **Space Theatre:** A 23-meter-diameter dome theatre that utilizes the Astrovision 70 large-format film projection system. The theatre has a tilted dome and is designed with unidirectional seating for 360 people. It is equipped with separate entry and exit points, featuring double doors and a buffer zone in between. All entries and exits connect to the outdoor ground floor and the upper-floor terrace.

The interior of the Space Theatre is kept dark to ensure high-quality projections. A small stage (3 meters wide and 0.2 meters high) is included for multiple uses of the hall. The seating is symmetrically arranged, with four aisles:

- 1,100mm treads in the front
- 1,000mm treads in the middle

- 900mm treads in the back
The risers are 0.4 meters high, accessible by three intermediate risers, each 0.1 meters high.

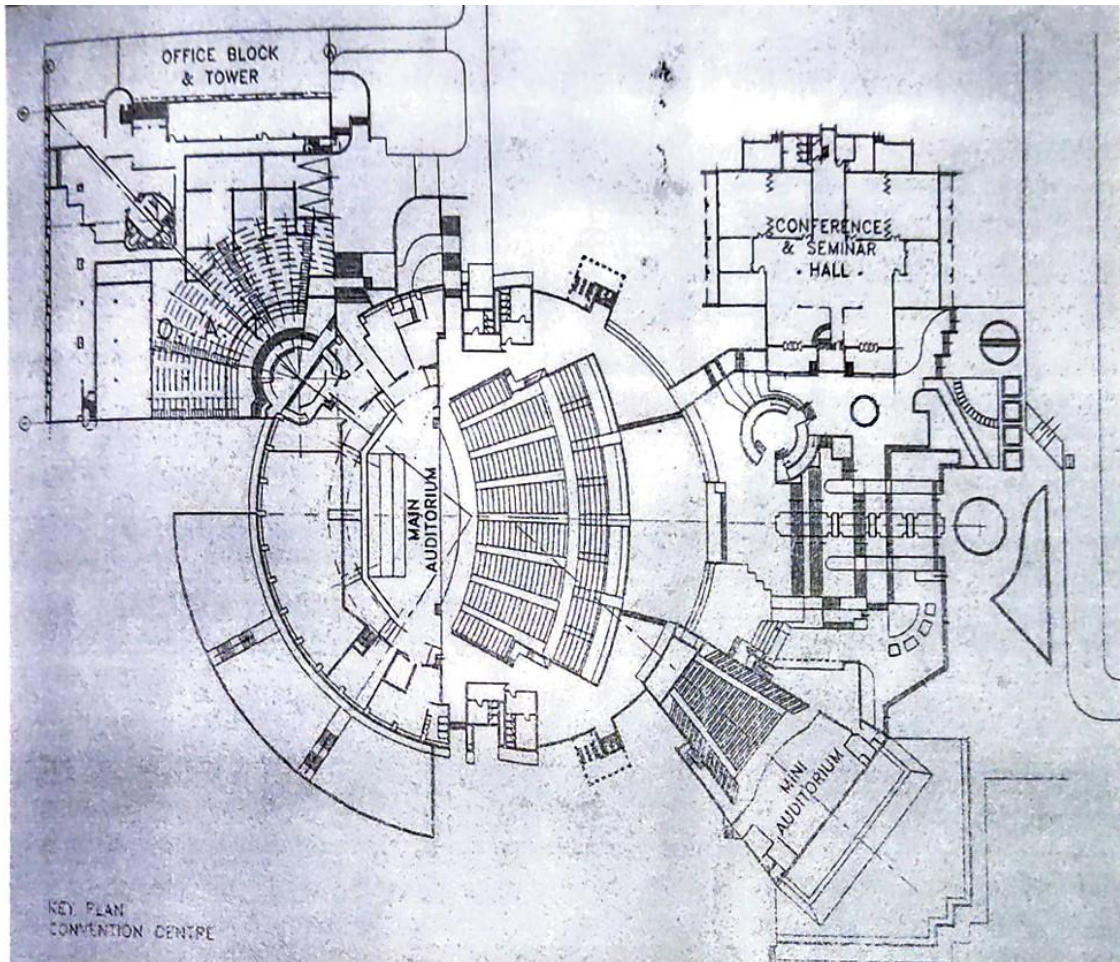


Figure: 76 convention centre

Earth Exploration Hall

- **Exhibition Concept:** The Earth Exploration Hall is a permanent exhibition housed in a two-storied hemispherical building. It displays details of the Southern Hemisphere on the ground floor and the Northern Hemisphere on the first floor.
- **Design and Structure:** The hall consists of two concentric rows of 12 columns each. The dome is 25m in diameter, and a huge Earth globe is positioned at the center of the hall. The entire building is fully air-conditioned and artificially lit.
- **Exhibit Details:** Multimedia presentations are set up around the globe, highlighting all major global issues. Hands-on exhibits further complement the exhibition to explain various physical phenomena of the Earth.

Maritime Centre

- **Exhibition Concept:** The Maritime Centre is a permanent pavilion within the Science City that focuses on maritime history, maritime activity, and related subjects. It has been developed in collaboration with the Kolkata Port Trust.

- **Design and Structure:** The centre is housed in a specially designed two-storied building with a built-up area of around 700 sq.m. The shape of the building resembles a ship, aligning with its maritime theme.
- **Interior Lighting and Cooling:** The interior is lit by 0.5m diameter circular windows, tube lights, and light bulbs. This building is not air-conditioned; instead, ceiling fans are provided for ventilation.



Figure: 77 evolution theme park

Evolution Theme Park

- **Exhibition Concept:** The Evolution Theme Park is a 1300 sq.m. area that features seven large walk-through pathways showcasing 71 robotic prehistoric animals and 26 dinosaurs. The park portrays the story of the evolution of animal life, focusing on extinct species.
- **Design and Structure:** The park is fully air-conditioned and artificially lit to create an immersive experience for visitors.

Science Park

Science Park offers visitors the opportunity to engage with plants, animals, and other natural objects, while also learning the fundamental principles of science in an open-air environment. The park's interactive exhibits are designed to withstand all types of weather conditions. Covering an area of 4,550 sq.m., the park includes a variety of attractions such as the Caterpillar Ride, Gravity Coaster, Musical Fountain, Road Train, Cable Cars, Monorail Cycle, Butterfly Nursery, and several exhibits focused on physical and life sciences. Additionally, the park features a maze surrounded by lush green hedges.

Convention Centre

The Convention Centre is a self-contained complex designed to host national and international conventions for up to 3,000 people. It includes a Main Auditorium, Mini Auditorium, and Conference & Seminar Hall Building.

The convention center's shell structure is a notable architectural achievement, supported by a massive steel skeleton that forms the base for the entire shell. The individual structures are arranged around a central plaza, which is accessible via a series of steps, small water channels, and connecting bridges.

The expansive horizontal landscaping within the court enhances movement, contributing to a lively and dynamic atmosphere.

Main Auditorium

The Main Auditorium is designed as a multipurpose venue, capable of hosting events such as film festivals, performances, ballets, and live orchestras. It has a seating capacity of 2,232 people and a spacious stage measuring 27m x 16m, designed to accommodate up to 100 performers, with a hydraulic moving platform. The total height of the structure is 42 meters. The lower-level houses essential services, such as the kitchen, canteen, and air-conditioning plant.

The auditorium is covered by two curved shells: the higher shell contains the stage and service areas, while the lower shell houses the seating and projection room. The auditorium is fully air-conditioned, with a 340-ton central air conditioning system installed in the basement. Additionally, the auditorium includes separate VIP entry and 50 green rooms (25 for men and 25 for women).



Figure: 78 mini auditorium

Mini Auditorium

The Mini Auditorium is designed for smaller audience performances, including seminars and screen projections, with a seating capacity of 392 people. The building's form complements the main auditorium, rising to a height of 24 meters. It is fully air-conditioned and includes a stage size of 15m x 10m for approximately 30 performers, with 16 green rooms for men and 14 for women.

Conference & Seminar Hall Building

This building houses several halls, ideal for conferences, seminars, meetings, and workshops. It includes:

- 4 Lecture Halls, each with a capacity of 96 people
- 2 Lecture Halls, each with a capacity of 40 people
- 2 Round Table Halls, each with a capacity of 30 people

All halls are fully air-conditioned and are equipped with toilets for men, women, children, and physically challenged individuals.

Services

- **Electricity:** The total power consumption of the entire project is approximately 4.5 MVA, drawn from the Kolkata power supply at an 11kV voltage level. The main power distribution system is supported by three substations. In case of an emergency, diesel generators are in place, and solar energy is utilized for water heating and street lighting throughout Science City.
- **HVAC:** The complex incorporates an effective air conditioning system due to various architectural innovations. Around 900 sq.m. of sheet metal ducting is installed in the auditorium building. The HVAC system has a total capacity of 340 tons, with an additional 40-ton backup/emergency system. For the seminar halls, 140 tons of cooling capacity is provided, while the convention center is supported with 460 tons.
- **Fire Fighting:** Fire and smoke detection systems are installed in all sensitive areas, including projector rooms, service areas, and dark galleries. Detectors and sprinklers are installed at critical points, including the stage area. Additionally, a water tank with a capacity of 200,000 gallons is located near the auditorium for emergency use.

Observations

Several observations were made after a thorough examination of the Science City:

- **Design Harmony:** The Science City features a variety of abstract shapes and forms aimed at creating a visual impact and acting as landmarks to astonish visitors. However, these designs lack harmony, as some imposing forms

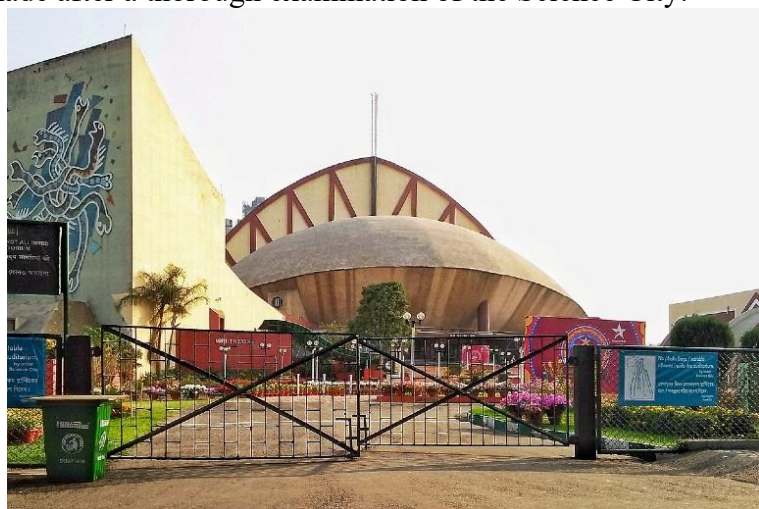


Figure: 79 back entrance

disrupt the overall aesthetic. There is no common element that unites the complex.

- **Landscaping:** The overall planning of the complex is impressive, with ample space for open-air exhibits, enhanced by numerous gardens and trees throughout the site.

- **Material and Finish:** The finishes of the structures vary widely, with no common color scheme. For example, the Dynamotion and Space Odyssey halls have a brown grit finish, while the dome is painted pink with dark brown strips. The steel pipes around the dome are red, and the convention center is finished with small brown and white tiles.
- **Exhibit Flow and Safety:** The movement pattern in the Dynamotion Hall is well-designed, with a sequential flow that creates an effective museum experience. The parallel ramp along the exhibits reflects the architects' concern for fire safety. However, in the Space Theatre, the movement pattern inside the hall is not well defined, and the layout lacks a careful sequential movement arrangement.
- **Spatial Issues:** Halls like the 3D Theatre are separated from the main hall, which disrupts the required circulation and diminishes the grandeur of the overall space.
- **Natural Light:** Skylights in various parts of the building provide ample natural light, especially for large exhibits.

Inferences

Based on the observations, several inferences can be applied to similar projects:



Figure: 80 mini auditorium



Figure: 81 dynamotion hall

- **Zoning & Segregation:** The overall zoning and segregation of entries should be carefully planned for large public movements. Controlled circulation should be used to unify the complex. The circulation pattern of the main museum should be a primary focus to ensure smooth visitor flow.
- **Landscaping:** Landscaping plays a crucial role in such complexes, especially when large parts of the site are left vacant or green.
- **Exhibit Placement:** Facilities and open-air exhibits should be strategically placed to ensure that play areas for children and relaxation areas for adults are nearby, offering spaces for both groups.
- **Lighting Solutions:** Skylights are an effective solution for areas where direct sunlight is not needed, providing ample natural light while maintaining a comfortable environment.

Reference:

<https://sciencecitykolkata.org.in/>

3.6 CALIFORNIA SCIENCE CENTER

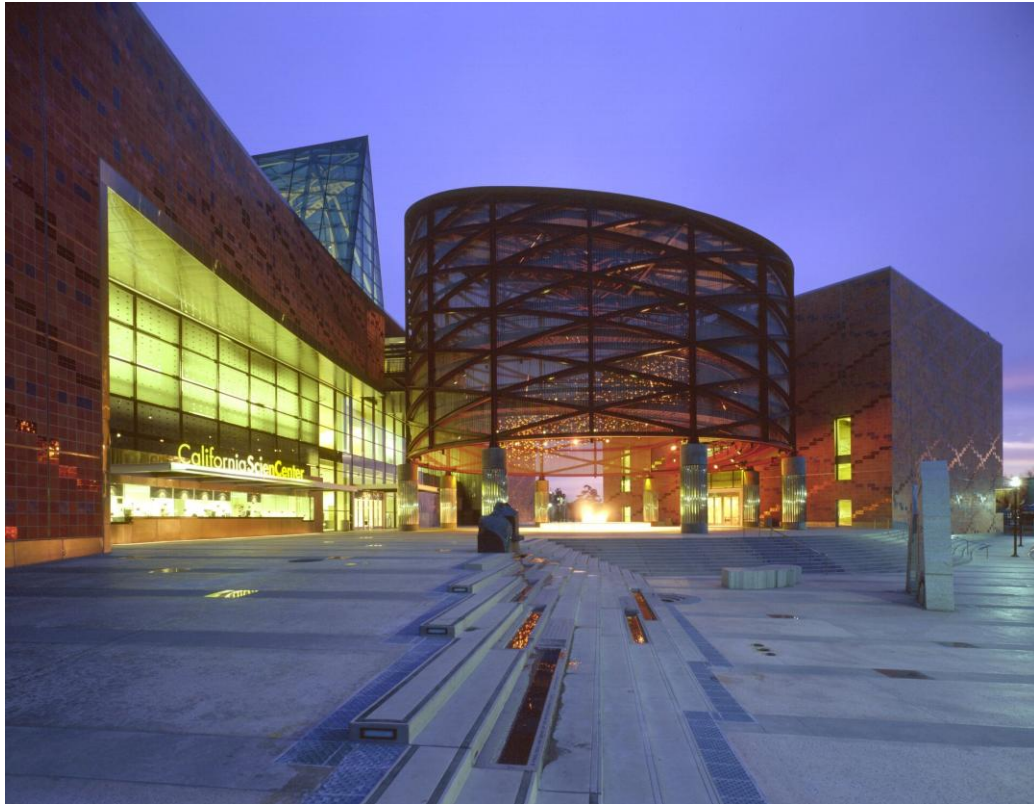


Figure: 82 California science center

Location: Los Angeles, California, USA

Architect: Richard D. Green, FAIA, and the California Science Center Design Team

Site Area: 400,000 sq. ft.

Completion Year: 2010 (Renovation of existing building and the opening of new areas)

Project Cost: \$150 million (for major renovation)

Total Built-Up Area: 200,000 sq. ft.

Parking: 2,000 parking spaces

Visitor Count: 1.5 million annually (as of 2023)

Circulation Strategy:

- **Public Zones:**

- **Entry Plaza and Lobby:** Upon entering, visitors are greeted with an open plaza and a large lobby area that serves as the starting point. From here, visitors are directed to different exhibits based on their preferences. The circulation begins here, offering clear directions to different exhibition areas.
- **Core Spaces:** The key exhibition spaces such as the Space Odyssey Hall, Exposition Hall, and Dynamic Earth Hall are designed around the central atrium and are connected by wide walkways. The circulation in these areas is linear, providing a natural flow from one exhibit to the next.
- **Interactive Exhibits and Themed Areas:** The layout encourages visitor interaction by leading them through hands-on exhibits and immersive

environments. Paths are clearly marked and designed for both individual visitors and large groups.

- **Service and Semi-Public Zones:**

- These zones are mainly located at the periphery or in the upper floors, ensuring that visitors are not disturbed by service activities.
- Administrative and maintenance areas are discreetly located, out of sight from the public areas to maintain the aesthetic and interactive qualities of the experience.

- **Circulation System:**

- The center is equipped with efficient vertical circulation using escalators and elevators for easier access to different floors.
- **Elevators and Escalators** ensure accessibility to all areas, especially to the upper floors where large exhibit halls like the Space Odyssey and the Air and Space Hall are located.
- **Exit Strategy:** There are clear exit points from each space, allowing for a smooth and stress-free experience when leaving the exhibitions.

The program for the California Science Center is split into educational, interactive, and functional zones, ensuring a well-rounded experience that caters to a diverse audience. Below is a breakdown of the programs featured in the center:



Figure: 83 site plan

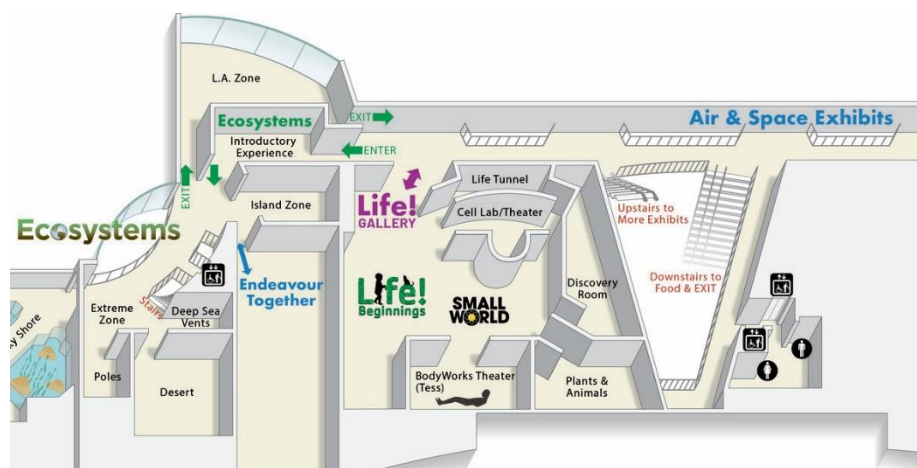


Figure: 84 Ground floor plan



Figure: 85 first floor plan

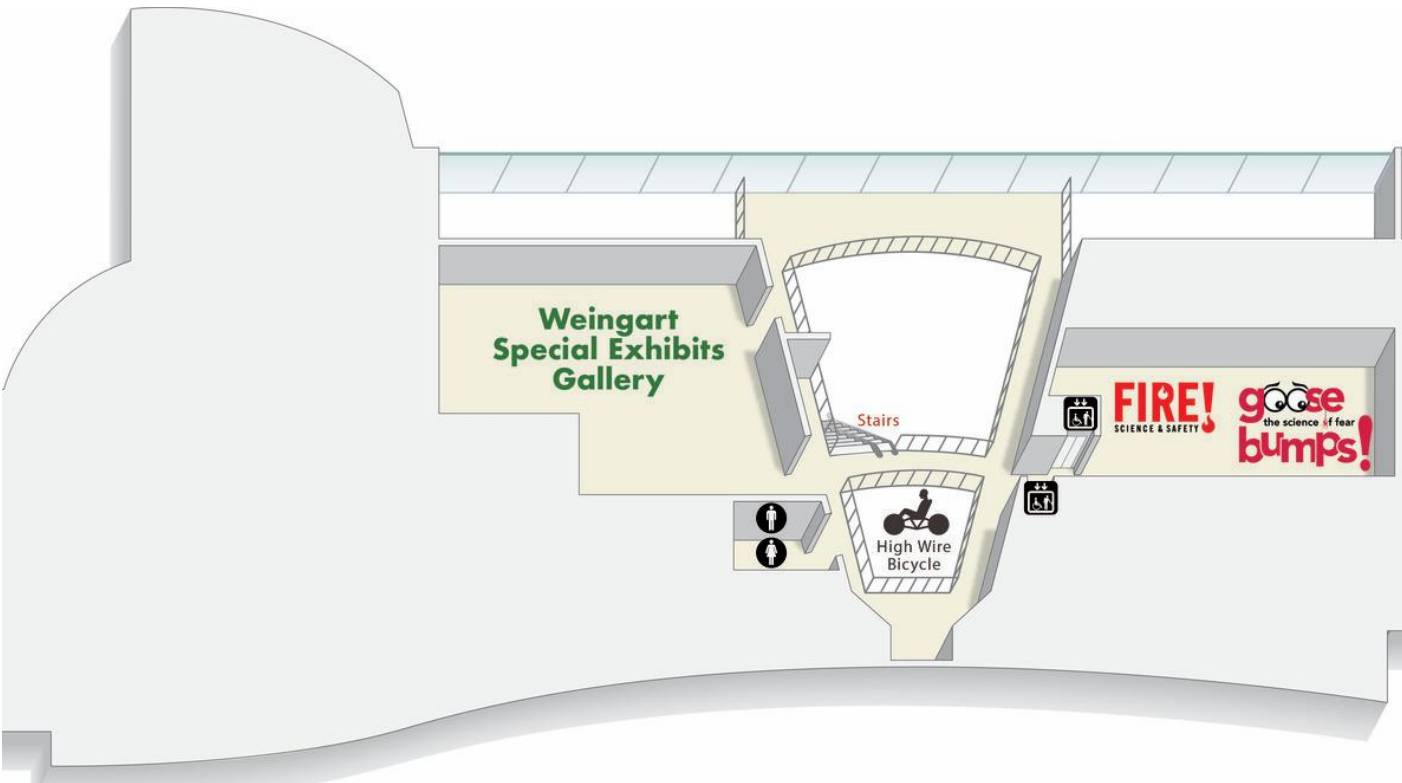


Figure: 86 second floor plan

Educational Programs:

- **Permanent Exhibitions:**

- These exhibits are related to space exploration, physics, biology, and environmental sciences, and are arranged in a series of interactive galleries.
- For example, in the **Space Odyssey** exhibit, visitors explore the wonders of space and the history of human spaceflight. The center also features exhibitions on energy and the environment, with a focus on sustainable practices.



Figure: 87 exhibits activites

- **Temporary Exhibitions:**

- These rotating exhibits are designed to showcase the latest advancements in science, technology, and innovation. They keep the content fresh and engaging, often featuring major scientific discoveries and breakthroughs.

- **Educational and Hands-On Experiences:**

- The **Creative Discovery Zone** and interactive exhibits like the **IMAX Theater** and **Touch Pools** provide guests with an opportunity to learn through direct interaction.
- These interactive experiences are a crucial component of the California Science Center's mission to make science fun, approachable, and educational for visitors of all ages.

Interactive and Fun Programs:

- **Themed Experience Areas:**

- Specific areas within the Science Center are themed to be engaging and fun. These areas are intended to attract younger audiences and families by including features like puzzles, quizzes, and games. These areas help in making the visitor experience more immersive.

- **Discovery Rooms:**

- Designed for both children and adults, these rooms allow for hands-on learning where visitors can participate in experiments, discover new concepts, and engage in creative activities.

Visitor Amenities:

- **Cafes and Retail Stores:** To cater to visitors, the center includes cafes and retail stores. These spaces are carefully placed along the main circulation paths, ensuring convenience while not disrupting the overall experience.



Figure: 88 high wire bicycle

- **Lecture and Auditorium Spaces:**
 - The **Wallis Annenberg Building** houses several auditoriums that are used for lectures, events, and live demonstrations related to science and technology. These spaces are flexible, accommodating a variety of activities ranging from educational talks to special events.
- **Multimedia and Theater Spaces:**
 - The **IMAX Theater** in the Science Center allows visitors to experience large-scale documentaries related to science and nature in an immersive format.
 - The **Air and Space Hall** features a series of multimedia exhibits that highlight significant moments in aviation history, including interactive displays and educational videos.

The overall planning of the California Science Center is centered around providing an immersive, educational, and enjoyable experience. The following strategies have been implemented in the design:

- **Spatial Zoning:**
 - The center is divided into thematic zones with specific visitor experiences in mind. These zones are organized around the central atrium, allowing for a natural flow of people through different exhibitions and spaces.
- **Wayfinding and Signage:**
 - The architecture has been designed with clear wayfinding in mind. Each space is strategically placed, ensuring that visitors can easily follow the signage or even follow the design elements, which visually guide them to their next destination.
- **Sustainability:**
 - The planning also incorporates sustainable building practices, including natural ventilation in certain areas, energy-efficient lighting, and the use of recycled materials.
- **Separation of Service Areas:**
 - Non-public spaces, such as mechanical rooms, storage, and staff offices, are located in separate zones or are subtly integrated into the building's design. This ensures that visitors can focus on the exhibits without distraction.
- **Multi-Use Spaces:**
 - Flexible spaces are designed throughout the center to support a variety of activities, from educational workshops to public lectures and special exhibitions. The planning ensures that spaces can easily be adapted to accommodate different types of programs.

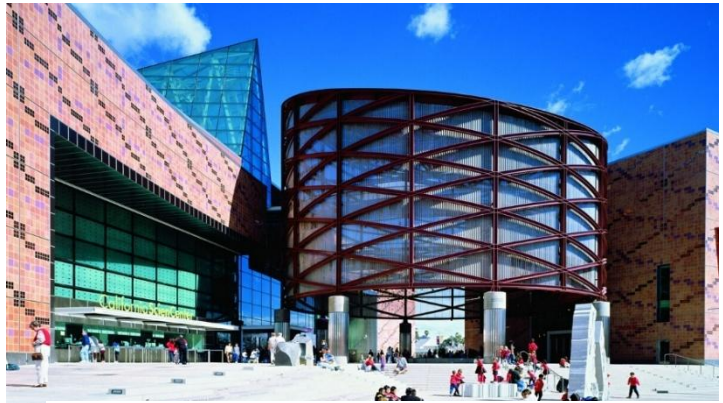


Figure: 89 plaza view

3. Key Spaces and Architectural Features

. Entry and Central Atrium

- **Size:** 35,000 sq. ft.
- **Design Features:** The entryway and central atrium serve as the primary circulation hub, offering visitors access to the main galleries. This space is characterized by soaring ceilings and abundant natural light. The atrium also functions as an exhibition space, where temporary exhibits are often showcased.
- **Architectural Highlights:** A massive glass skylight covers the atrium, flooding the space with light, while suspended exhibits and dynamic installations create a visually engaging environment.

Space Shuttle Endeavour Exhibit

- **Size:** 10,000 sq. ft.
- **Design Features:** The iconic Space Shuttle Endeavour exhibit is housed in a dedicated gallery. The exhibit's design emphasizes the grandeur of the shuttle, with raised platforms allowing visitors to view it from multiple angles. The space is designed to handle large crowds, with careful attention given to the flow of movement.
- **Architectural Highlights:** The gallery's high ceilings and open structure make it possible to display the shuttle in a way that highlights its scale and significance.

Ecosystems Exhibit

- **Size:** 13,000 sq. ft.
- **Design Features:** This exhibit showcases various ecosystems, from deserts to rainforests, through both live displays and interactive installations. The space is designed to provide an immersive experience, allowing visitors to step into recreated environments.
- **Architectural Highlights:** The exhibit is housed within a series of interconnected, flexible spaces that can be reconfigured to accommodate new exhibits and changing thematic content.

Air and Space Exhibits

- **Size:** 15,000 sq. ft.
- **Design Features:** Dedicated to air and space exploration, this exhibit includes a variety of aircraft, spacecraft, and historical artifacts. The space is arranged to give visitors the sense of stepping into an aircraft hangar or space mission control room.
- **Architectural Highlights:** The high, open ceilings and industrial-style design give the space an authentic, functional feel, with large open areas to showcase larger aircraft and rockets.



Figure: 90 Space shuttle endeavour

Creative World Exhibit

- **Size:** 18,000 sq. ft.
- **Design Features:** This exhibit encourages hands-on exploration of the principles of engineering and invention, featuring interactive displays and creative challenges. The space is designed to be flexible, with open-plan galleries that accommodate a wide variety of exhibits.
- **Architectural Highlights:** The architecture here is dynamic, with colorful walls, movable partitions, and tactile elements that invite engagement from visitors of all ages.



Figure: 91 Underwater world

IMAX Theater

- **Size:** 10,000 sq. ft.
- **Design Features:** The IMAX Theater provides visitors with an immersive cinematic experience. The theater is designed with cutting-edge projection technology, providing stunning visuals and sound.
- **Architectural Highlights:** The design focuses on acoustics and visual optimization, ensuring that visitors can experience films in an optimal environment. The curved walls and seating layout enhance the immersive experience.



Figure: 92 outdoor exhibits and garden

Outdoor Gardens and Exhibits

- **Size:** 20,000 sq. ft.
- **Design Features:** Outside the main building, there are a variety of gardens and outdoor exhibits, including a Butterfly Pavilion, Waterworks Park, and the Center

for Earth and Space Science. These spaces are designed to engage visitors with nature while continuing the educational themes of the center.

- **Architectural Highlights:** The landscaping is carefully curated, with native plants and interactive water features designed to both beautify the space and provide learning opportunities.

INFERENCE:

- **Visitor-Centered Design:** Focuses on engaging and interactive exhibits for all ages.
- **Learning and Entertainment:** Blends educational content with entertainment, such as the Space Shuttle Endeavour.
- **Functional Use of Space:** Efficient layout supporting exhibits, theaters, and events.
- **Transparency and Openness:** Large glass windows create openness and connection to the outside.
- **Connection to Environment:** Outdoor spaces enhance interaction with nature.
- **Technological Innovation:** Incorporates cutting-edge technology seamlessly in exhibits.
- **Sustainability:** Energy-efficient systems and eco-friendly materials.
- **Iconic Design:** Memorable architecture, especially around the Space Shuttle display.
- **Community Engagement:** Includes spaces for cultural programs, outreach, and events.



Figure: 93 Explora store

3.7 Michigan science center



Figure: 94 Michigan science center

- **Location:** Detroit, Michigan, USA
- **Year Established:** 2012
- **Building Completion:** 2012 (Renovation and expansion from the Detroit Science Center)
- **Area:** 132,000 square feet (approximately 12,250 square meters)
- **Architectural Style:** Modern, Contemporary, Industrial
- **Program:** Museum, Science Center, Educational Facility, Planetarium, IMAX Theater, Interactive Exhibits, Event Space, Research Laboratories
- **Purpose:**
 - ❖ To inspire a passion for science, technology, engineering, and mathematics (STEM) through engaging and hands-on exhibits.
 - ❖ To provide an interactive learning space where visitors can explore science concepts through discovery-based learning.
 - ❖ To house specialized exhibits on health, technology, space exploration, and sustainability.
- **Key Spaces/Programs:**
 - ❖ **Exhibit Galleries:** Permanent and temporary exhibits focusing on STEM subjects like space, health, and energy.
 - ❖ **IMAX Theater:** A large-format theater showing educational films on science and nature.
 - ❖ **Planetarium:** A facility for astronomical shows and immersive learning about space and the universe.
 - ❖ **Interactive Learning Spaces:** Hands-on exhibits, educational labs, and scientific demonstrations.
 - ❖ **Event and Conference Spaces:** Areas designed for educational programs, special events, and workshops.

Notable Collections:

- Exhibits related to the history of science and technology.
- Interactive displays on robotics, sustainability, energy, and space science.

Architectural Features:

- **Design Philosophy:** The Michigan Science Center combines a modern architectural style with an industrial aesthetic, mirroring the technological and scientific themes presented within.
- **Materials:** A mix of steel, glass, and concrete with an emphasis on transparency and openness to invite natural light and create a connection with the outside world.
- **Form:** The building has a dynamic, angular form, with glass facades and steel elements, highlighting its futuristic and scientific identity.



Figure: 95 hand on fun activities

Design and Form:

- **Exterior Design:** The Michigan Science Center's exterior combines sleek, sharp lines with open glass panels, evoking a sense of technological advancement and inviting curiosity about the future.
- **Spatial Design:** The interior incorporates large exhibit halls and educational spaces designed for active engagement. The exhibits are flexible and capable of adapting to new educational themes and traveling exhibitions.

Spatial Organization and Circulation:

- **Entrance and Lobby:**
 - ❖ The grand lobby serves as the first point of interaction for visitors. It provides an introduction to the center's educational themes with interactive displays and exhibits.
 - ❖ The design emphasizes openness, with high ceilings and transparent walls giving a sense of arrival into a world of scientific discovery.
- **Exhibit Halls and Galleries:**
 - ❖ The center is divided into multiple galleries dedicated to STEM topics such as space, energy, and technology.
 - ❖ Each gallery is designed with high ceilings and large, flexible spaces to accommodate various exhibits, from small artifacts to large interactive installations.
- **Theater and Planetarium:**
 - ❖ The IMAX Theater and Planetarium offer immersive experiences to explore the wonders of science, space, and nature.
- **Interactive Learning Spaces:**
 - ❖ Hands-on exhibits and interactive displays allow visitors to engage directly with scientific concepts.
 - ❖ These spaces are designed with tactile and visual elements to simplify complex ideas and make learning fun.
- **Event and Conference Spaces:**
 - ❖ The center includes areas designed for lectures, workshops, and conferences. These spaces are flexible and modular, able to accommodate various types of events and programs.
- **Visitor Amenities:**
 - ❖ The center offers gift shops, cafes, restrooms, and lounges to enhance the visitor experience without detracting from the educational focus of the museum.

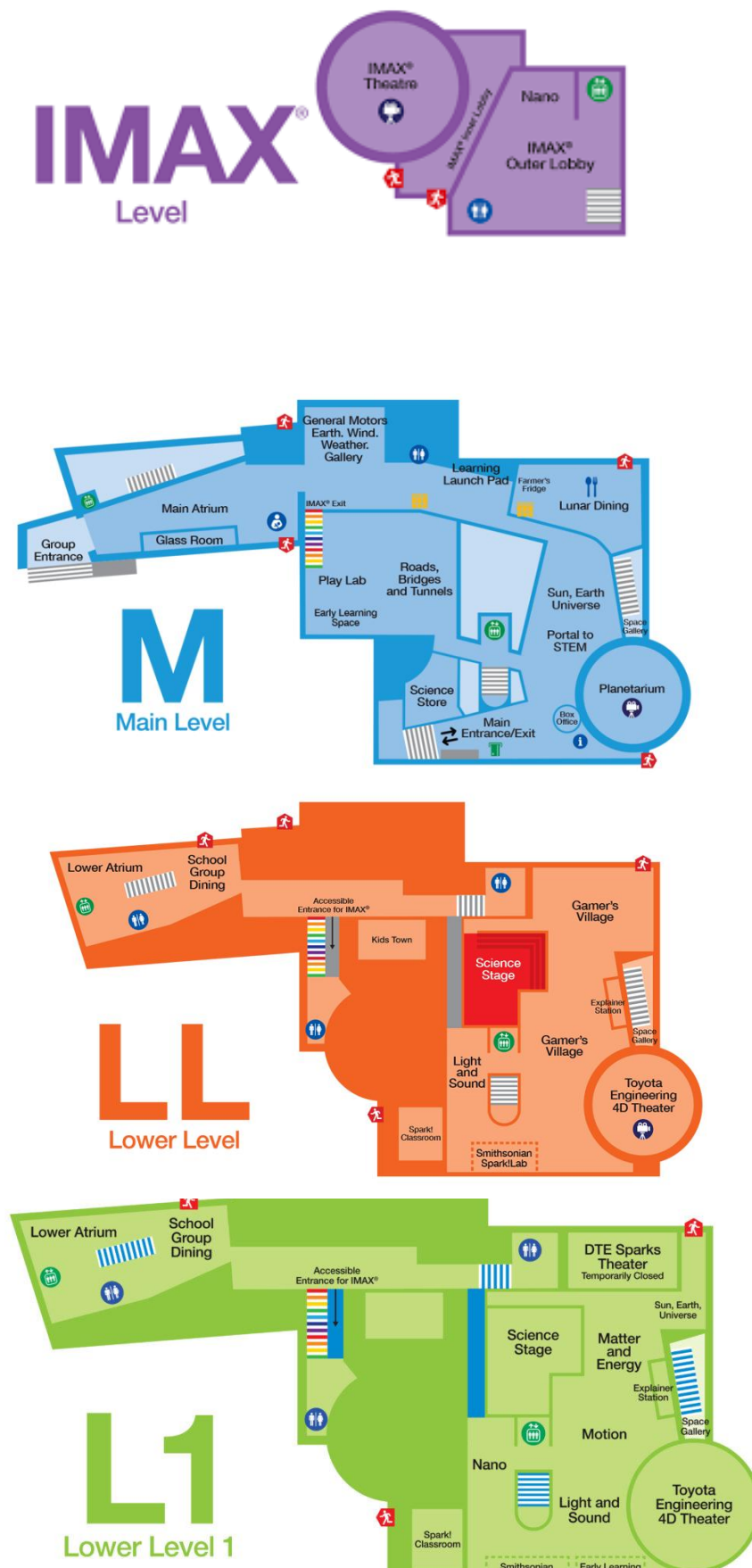


Figure: 96 plan of different level

Design Considerations for Functionality and Learning:

- **Accessibility:**

- ❖ The building is designed to be accessible for all visitors, with wide corridors, elevators, and ramps ensuring ease of movement for people with disabilities.
- ❖ The exhibit spaces are organized to promote easy navigation, with clear signage and intuitive pathways.



Figure: 97 Entrance

- **Lighting and Acoustics:**

- ❖ Strategic lighting is used to highlight key exhibits and create different moods in the galleries.
- ❖ The planetarium and IMAX theater feature advanced acoustics to enhance the audio-visual experience, while other spaces have noise control to ensure comfort.

- **Sustainability:**

- ❖ The Michigan Science Center emphasizes sustainability with energy-efficient building systems, green roofs, and water-saving technologies.
- ❖ The large windows allow for natural light, reducing the need for artificial lighting and lowering energy consumption.



Figure: 98 kids friendly water ways discovery

Inferences:

- **Integration of Function and Aesthetics:**

- ❖ A modern and industrial design reflecting STEM themes.
- ❖ Use of steel, glass, and concrete to emphasize technological progress and scientific discovery.

- **Visitor-Centered Design:**

- ❖ Clear and intuitive flow for easy navigation.
- ❖ Designed for engagement, interaction, and educational learning.

- **Educational Engagement:**

- ❖ Hands-on, interactive exhibits that promote active learning.
- ❖ Focus on STEM subjects with a variety of immersive experiences.

- **Flexibility of Spaces:**

- ❖ Modular spaces for changing exhibits and events.
- ❖ Adaptability for different educational programs and special events.

- **Technology and Sustainability:**

- ❖ State-of-the-art IMAX Theater and Planetarium.
- ❖ Sustainable design with energy-efficient systems and eco-friendly features.

- **Immersive Experience:**

- ❖ Dynamic lighting and sound enhance the educational experience.
- ❖ Incorporates technology to create awe-inspiring environments for learning.

3.8 ESO Supernova Planetarium, Germany



Figure: 99 ESA Super nova

Location: Garching, near Munich, Germany

Area: Approximately 7,500 m² of total built-up space

Orientation: Designed to maximize natural light and enhance astronomical views; the main entrance faces a public square.

Opened: 2018

Building Form: A dynamic structure with a striking spherical form that symbolizes the universe; represents a blend of architecture and science communication.

Targeted Users: Families, students, astronomers, researchers, and space enthusiasts

Daily Visitors: Approximately 500 on regular days, increasing during special events and educational programs

Material and Technology:

Constructed with reinforced concrete, glass, and aluminum cladding; features state-of-the-art planetarium technology and sustainable building practices.

Client: European Southern Observatory (ESO)

Objective: To provide an immersive space that educates the public about astronomy and the



Figure: 100 arial view

European Southern Observatory's scientific endeavors.

Opening Hours: Typically, 10:00 AM to 6:00 PM (subject to seasonal variations)

1. Site and Context:

- **Location Context:** The ESO Supernova is situated on the campus of the European Southern Observatory in Garching, Germany, near Munich. The site is in a science and research zone, which reflects the center's focus on astronomy and scientific discovery.
- **Urban Integration:** The building is carefully integrated with its surroundings, positioning itself as a bridge between scientific research and public engagement.



Figure: 101 top view of site

2. Concept and Design:

- **Architectural Concept:** The design concept revolves around the fusion of scientific discovery and public interaction. The use of minimalist forms with dynamic geometries symbolizes the forward-thinking nature of scientific research.
- **Design Inspiration:** The circular, dynamic form of the building is inspired by the cosmos, reflecting the curvatures and expansiveness of space. This creates an inviting atmosphere for visitors to experience the vastness of the universe.

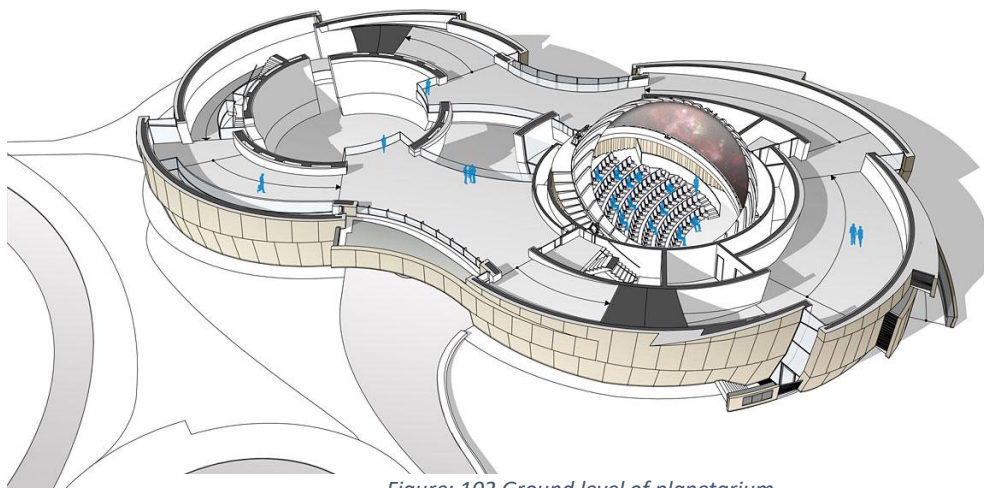


Figure: 102 Ground level of planetarium

3. Space Organization:

- **Planetarium (Main Feature):** The centerpiece of the design is the planetarium. Its spherical shape offers an immersive experience, where visitors can engage with the cosmos through advanced projection systems.
- **Exhibition Spaces:** These are spread throughout the building, featuring interactive exhibits and displays related to astronomy and space science. The exhibits are modular, allowing for flexible curation and visitor interaction.
- **Auditorium and Lecture Rooms:** These spaces are designed for talks, educational programs, and film screenings. The auditorium is centrally located to facilitate easy access from all areas of the building.
- **Visitor Center and Café:** These spaces offer relaxation and reflection, with modern furnishings that complement the scientific theme. The café also provides a space for visitors to gather and discuss what they've learned.
- **Offices and Administrative Areas:** Positioned away from the public spaces, ensuring smooth operation without disrupting the visitor experience.



Figure: 103 space around the site

4. Circulation and Flow:

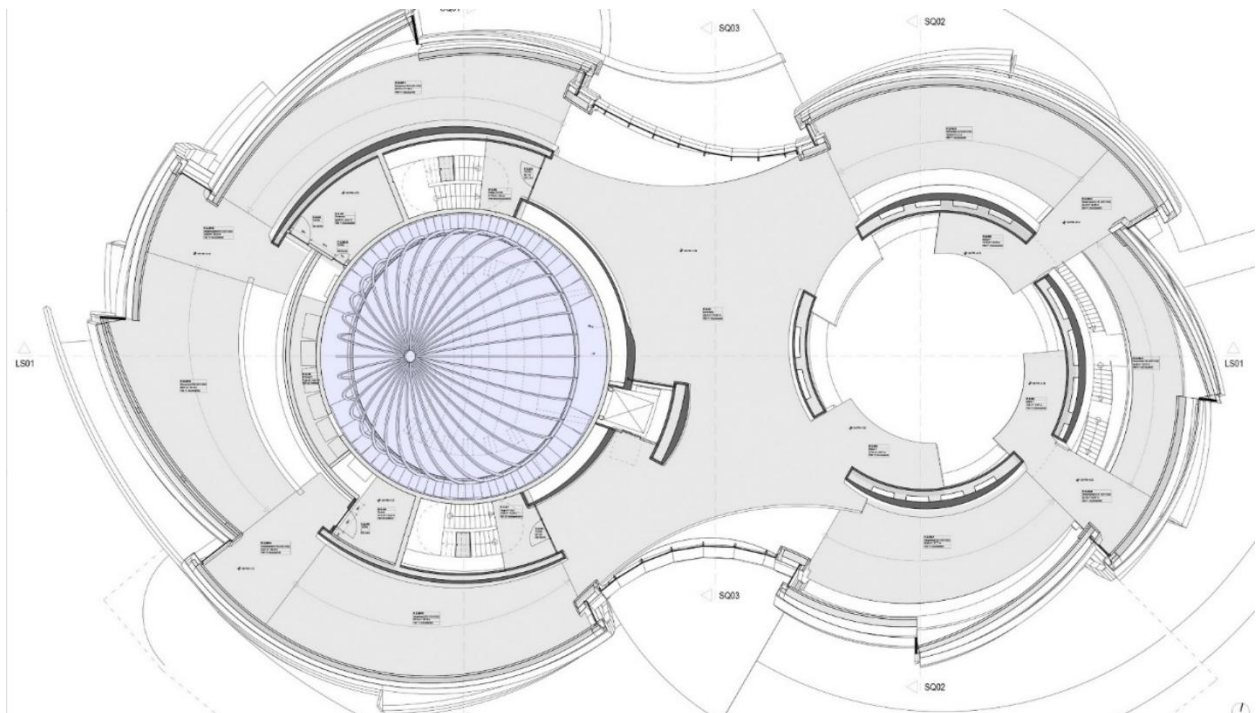


Figure: 104 plan

- **Visitor Flow:** The layout emphasizes a natural flow, guiding visitors from one space to the next, starting with the exhibition spaces, moving to the planetarium, and ending at the café for contemplation. The central circulation core allows access to all spaces, creating an intuitive visitor experience.
- **Accessibility:** Careful attention is given to making the space fully accessible, with ramps, wide corridors, and ADA-compliant facilities throughout.

5. Materiality and Construction:

- **Exterior Materials:** The exterior features a combination of concrete, glass, and metal. The use of reflective glass enhances the building's connection with the cosmos, reflecting the sky and surrounding environment.
- **Interior Materials:** The interior uses light-colored woods, concrete, and sleek finishes, creating a modern, clean environment that emphasizes the scientific nature of the center.
- **Sustainability:** The building is designed with energy efficiency in mind, featuring passive solar design, energy-efficient insulation, and sustainable materials. The integration of green roofs and solar panels helps reduce energy consumption.

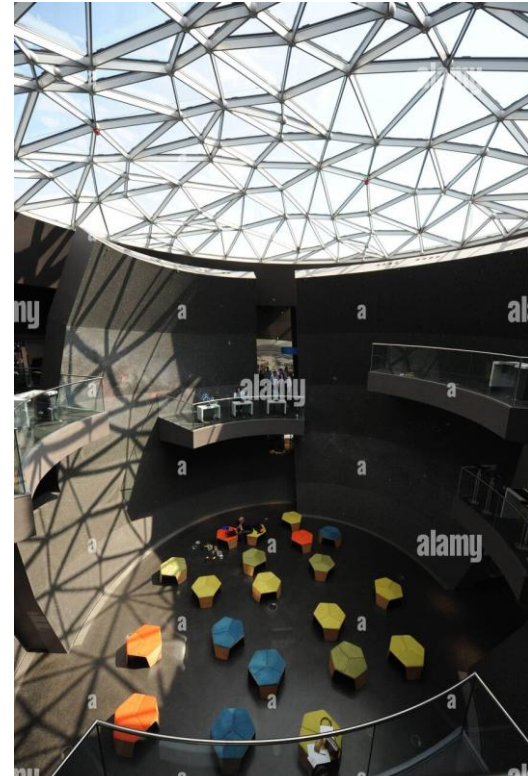


Figure: 105 exhibits space with atrium

6. Lighting and Acoustics:

- **Natural Light:** The building makes effective use of natural light, especially in the exhibition spaces, where light is used to create an ever-changing ambiance that simulates different times of day and cosmic phenomena.



Figure: 106 internal exhibits halls

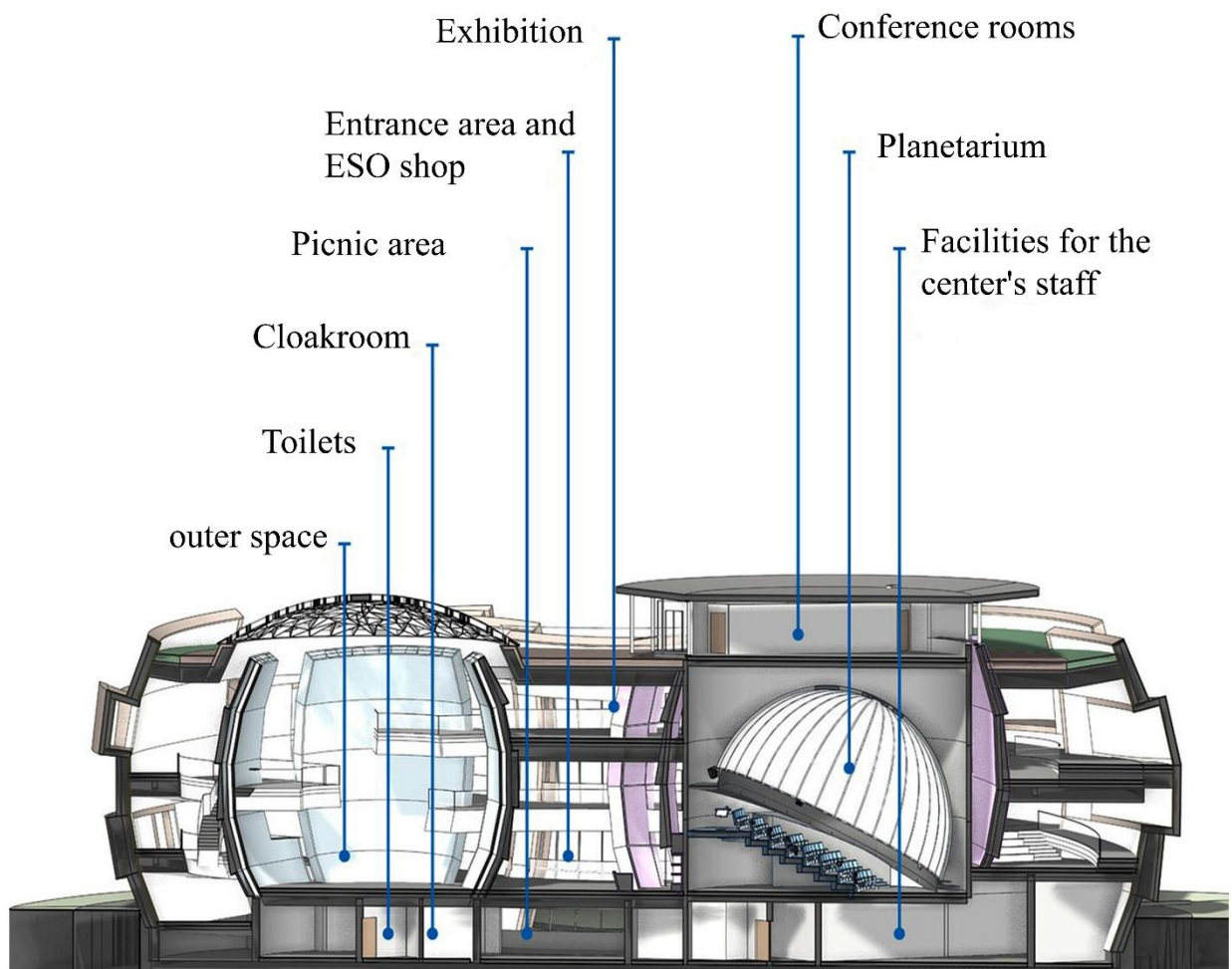
- **Artificial Lighting:** Dynamic lighting strategies are employed to adjust according to time and programming needs, with a focus on creating an immersive environment in the planetarium.
- **Acoustics:** Special care has been taken to control acoustics in the planetarium, auditorium, and exhibition spaces, ensuring optimal sound quality for multimedia presentations and lectures.

7. Technological Integration:

- **Projection Systems:** The planetarium uses state-of-the-art digital projection systems, offering high-definition displays that create an immersive experience for visitors.
- **Interactive Exhibits:** Interactive touchscreens and augmented reality (AR) systems are integrated into the exhibition spaces, encouraging hands-on learning.
- **Virtual Astronomy Tools:** The center provides access to virtual telescopes and interactive software that allows visitors to explore the universe digitally.



Figure: 107 planetarium



Section

Figure: 108 section

Inferences

- **Integration of Function and Aesthetics:**

The design effectively combines functionality with aesthetic appeal. The angular, futuristic exterior reflects the themes of exploration and the unknown, while the interior is designed to enhance the visitor's educational experience.

- **Visitor-Centered Design:**

The building is designed with the visitor in mind, ensuring a smooth flow of circulation through the exhibition spaces and providing opportunities for interaction and engagement. The logical arrangement of spaces ensures that visitors can easily navigate the building while learning about astronomy and space exploration.

- **Interactive and Educational Engagement:**

The emphasis on interactive exhibits and immersive experiences in the planetarium and exhibition halls helps visitors learn in an engaging and memorable way. This focus on hands-on learning aligns with the center's educational goals.

- **Flexibility and Adaptability of Spaces:**

The building is designed to be flexible, allowing for changing exhibits and temporary installations. The movable partitions and open layouts in the exhibition areas ensure that the space can accommodate different types of events and exhibitions.

- **Sustainability and Technology:**

The integration of sustainable building practices, combined with cutting-edge technologies in the planetarium and exhibitions, positions the ESO Supernova as a modern, environmentally-conscious educational facility.

- **Immersive Experience:**

The use of dramatic lighting, sound, and interactive elements ensures that visitors experience the awe and wonder of space exploration. The architectural design plays a key role in enhancing this emotional and educational impact.

3.9 COSMOSPHERE



Figure: 109 cosmosphere

Name: Kansas Cosmosphere and Space Center (commonly known as the Cosmosphere)

Location: Hutchinson, Kansas, USA

Year Established: 1962

Building Completion: The main building was expanded and renovated in 2004.

Area: 60,000 square feet (approximately 5,574 square meters)

Architectural Style: Modern, Futuristic, Industrial

Program: Museum, Science Center, Educational Facility, IMAX Theater, Planetarium, Interactive Exhibits, Event Space

Purpose:

- To educate the public about the history and science of space exploration.
- To display rare and authentic space artifacts, including spacecraft from the Apollo missions, space suits, and various space equipment.
- To serve as an interactive and immersive learning experience through exhibits and shows.

Key Spaces/Programs:

Exhibit Galleries: Permanent and temporary exhibits related to space history, including artifacts from the U.S. space program.

IMAX Theater: A large-format cinema that showcases space-related documentaries and films.

Planetarium: A state-of-the-art facility for astronomical shows and educational experiences.

Interactive Learning Spaces: Hands-on exhibits, flight simulators, and learning zones for visitors to explore space science.

Event and Conference Spaces: Areas for lectures, workshops, and events related to science and space exploration.

Notable Collections:

- Apollo 13 Command Module
- Gemini IX Capsule
- Various spacecraft and space artifacts

Architectural Features:

- The Cosmosphere blends modern architectural elements with cutting-edge technology to reflect its scientific and educational purpose.
- The structure uses steel, glass, and concrete materials, with a focus on openness and transparency to evoke a sense of space exploration.

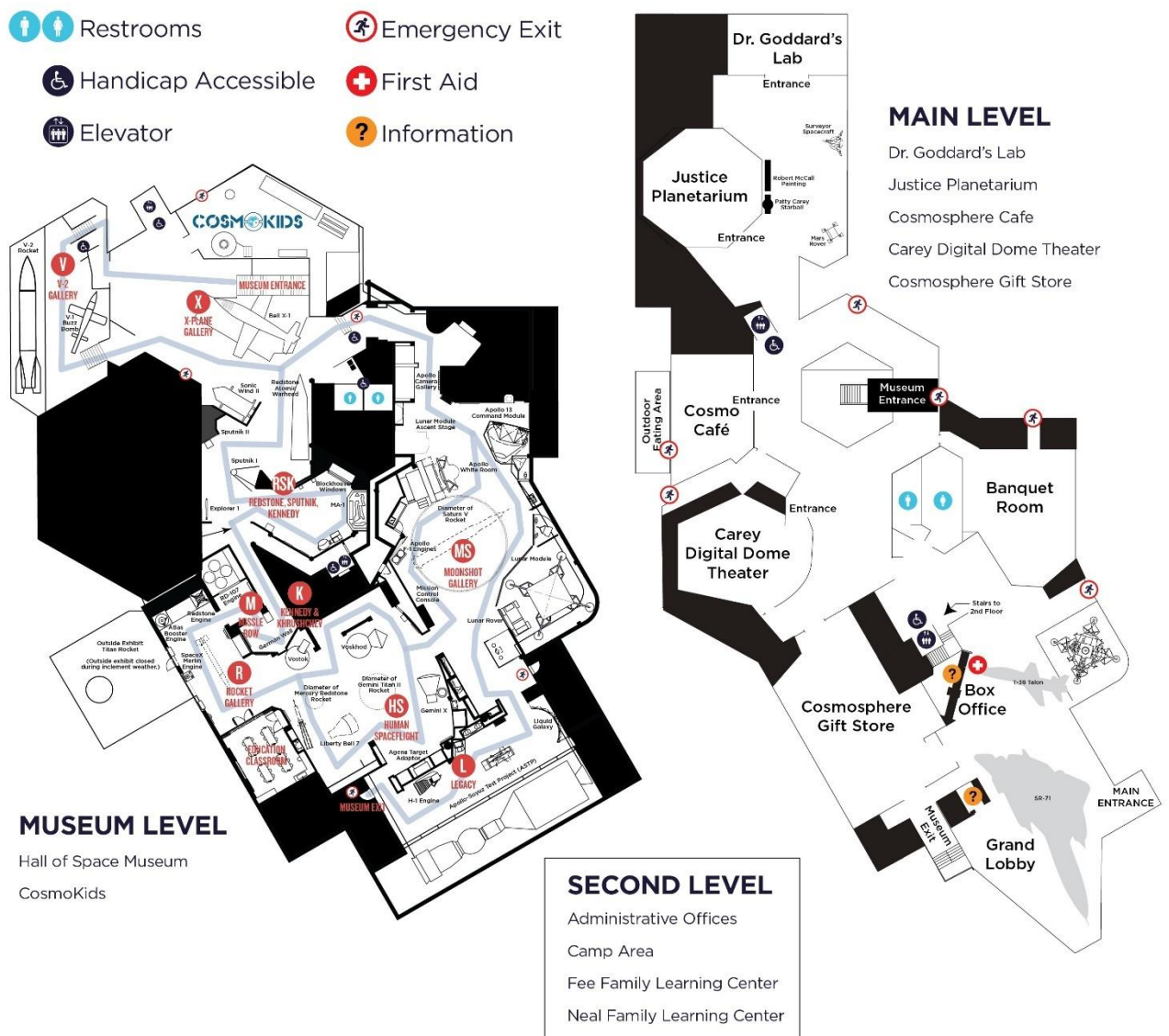


Figure: 110 plan

Design and Form:

The exterior design of the Cosmosphere is characterized by a combination of sleek, modern lines and geometric shapes. The structure itself is primarily steel and glass, allowing for a futuristic look while maintaining a strong connection with the technological themes the museum aims to represent.

The building integrates functional exhibition spaces with educational zones, which are designed to engage visitors interactively.

Materials:

- The materials used in the construction of the Cosmosphere are chosen for their durability and contemporary aesthetic. Steel framing, glass panels, and concrete are used extensively throughout the building.
- The design emphasizes transparency and openness, allowing natural light to flood the exhibition spaces. The facade features dynamic, angular elements, invoking a sense of movement and modernity in keeping with the theme of space exploration.

Spatial Organization and Circulation

The Cosmosphere's design takes into account the flow of visitors and the varied experiences they will encounter. The following key spaces are central to its architectural function:

Entrance and Lobby:

- Upon entering the Cosmosphere, visitors are greeted with an expansive lobby that serves as both a circulation hub and an introductory area to the museum's themes. The lobby features large displays and interactive stations to engage visitors right from the start.
- The lobby is designed to be spacious, with a grand ceiling and large windows, giving visitors a sense of the vastness of space.

Exhibit Halls and Galleries:



Figure: 111 entrance



Figure: 112 3d interior (space and circulation)

- The Cosmosphere is divided into several galleries that showcase different aspects of space history, such as the Apollo missions, early space exploration, and futuristic technologies.
- The Apollo Gallery houses actual spacecrafts, including the Apollo 13 command module, and numerous space-related artifacts. The exhibit halls are designed with high ceilings and flexible layouts to accommodate various exhibits, from small artifacts to large spacecraft and rockets. The gallery is designed with a clear visual hierarchy to guide visitors through the exhibits in a logical and educational sequence.



Figure: 113 exhibits hall

Theater and Planetarium:

- The Cosmosphere features a state-of-the-art IMAX Theater that offers immersive space documentaries, and a planetarium with a modern projection system for educational shows about the cosmos.
- The theater and planetarium are integrated into the building's design to offer both a learning experience and an immersive journey through space.

Interactive Learning Spaces:

- The museum offers hands-on exhibits where visitors can engage with science through tactile learning. These spaces are designed with interactive displays, including flight simulators, touchscreens, and mechanical devices that explain complex concepts in an easy-to-understand manner.
- Educational spaces like classrooms, lecture halls, and learning labs are designed to encourage group activities, workshops, and presentations.

Space for Events and Special Exhibitions:

- The Cosmosphere includes event spaces for temporary exhibits, conferences, and other educational activities. These spaces are adaptable, with movable partitions and modular elements to accommodate different types of events.

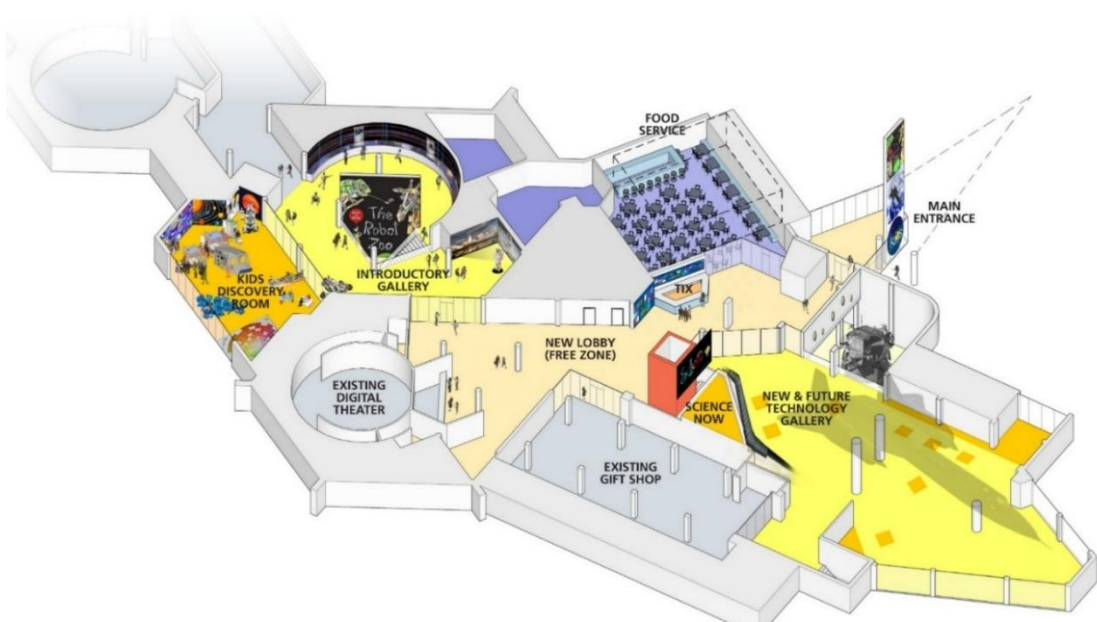


Figure: 114 functionalities and learning

Visitor Amenities:

The building also includes necessary amenities such as a gift shop, café, restrooms, and lounges for visitors. These spaces are carefully integrated into the overall spatial organization without disrupting the flow of the educational experience. Design Considerations for Functionality and Learning:

Accessibility:

- The building is designed to be fully accessible, with ramps, elevators, and wide corridors ensuring that visitors with disabilities can comfortably navigate the museum.
- The exhibit spaces are arranged to encourage easy movement, with clear signage and pathways guiding visitors through the galleries and displays.

Lighting and Acoustics:

- Lighting plays a key role in setting the mood of the exhibits. Adjustable lighting is used to create dramatic effects for key displays, while soft ambient lighting is used for other areas.
- Acoustics are considered throughout the museum. The IMAX theater and planetarium feature acoustically treated spaces to enhance the experience, while other exhibit spaces are designed with noise control to allow for an undistracted visit.

Sustainability:

- The Cosmosphere incorporates sustainable building practices, including energy-efficient HVAC systems, solar panels, and water-saving technologies.
- Large windows and open spaces reduce the need for artificial lighting during the day, minimizing energy consumption.

Inferences:

- **Integration of Function and Aesthetics:**
 - ❖ Modern, futuristic design with materials like steel and glass.
 - ❖ Reflects space exploration themes.
- **Visitor-Centered Design:**
 - ❖ Logical space flow guiding visitors through exhibits.
 - ❖ Easy navigation and accessible design.
- **Educational Engagement:**
 - ❖ Hands-on, interactive exhibits like simulators and touchscreens.
 - ❖ Encourages active learning and exploration.
- **Flexibility of Spaces:**
 - ❖ Modular and adaptable spaces for temporary exhibits and events.
 - ❖ Allows for changing exhibitions and educational programs.
- **Technology and Sustainability:**
 - ❖ State-of-the-art IMAX Theater and planetarium.
 - ❖ Incorporates sustainable building practices and energy-efficient systems.
- **Immersive Experience:**
 - ❖ Dramatic lighting, sound, and multimedia for an awe-inspiring atmosphere.
 - ❖ Creates emotional and educational impact.



Figure: 115 mezzanine event halls

3.10 CASE STUDY COMPARISON

Criteria	BP Koirala Planetarium, Kirtipur	Simulation Science Center	Jantar Mantar	Science City	California Science Center	Michigan Science Center	ESA Supernova	Cosmosphere
Location	Kirtipur, Nepal	Kathmandu, Nepal	India	India	Los Angeles, USA	Detroit, USA	Germany	Kansas, USA
Established Year	(2019)	2018	1724	1997	1951	1970	2018	1962
Area (Total)	35400 sq m (150 Ropanis)	2490 sq m	Varies	50 acres	400,000 sq ft	110,000 sq ft	2,500 sq m	105,000 sq ft
Main Purpose	Astronomy & Space Education	Science Education & Simulation	Astronomical Calculations	Science & Tech Education	Science & Space Exploration	STEM Education	Astronomy & Space Science	Space Exploration & STEM
Architectural Style	Modern with Digital Simulation	Modern Interactive Spaces	mughal & Rajput	Contemporary	Modern	Modern	Futuristic	Modern
Key Features	Digital Planetarium, VR Simulation	Interactive Science Exhibits, Robotics	Sundials, Celestial Instruments	IMAX Theatre, Digital Planetarium	IMAX, Space Shuttle Exhibit	Digital Dome Theater	360-Degree Cinema	Apollo Artifacts, Lunar Samples
Technology Used	VR, 3D Projection, Digital Displays	Robotics, Interactive Simulations	Manual Instruments	Interactive Exhibits, IMAX	3D & 4D Theaters, Space Shuttle Endeavour	3D Planetarium, STEM Labs	High-Resolution Projection	Space Flight Simulators
Research & Education	Astronomy & Space Research	TEM Workshops, Educational Programs	Historic Astronomy Studies	Science & Tech Workshops	NASA-Related Programs	School & Public STEM Programs	Astrophysics Research	Space History Education
Public Accessibility	Open to Public & Schools	Open to Public & Schools	Heritage Site	Public & School Programs	Public Museum & Research Facility	Public & Student Programs	Public & School Programs	Open for Public & Researchers
Notable Exhibits	Space Simulation, VR Astronomy	Robotics Projects, Interactive Displays	Large Sundials, Astronomical Alignments	Space & Science Shows	Space Shuttle Endeavour, Mars Rover	Lunar Rocks, STEM Labs	Supernova & Galaxies Display	Apollo 13 Capsule, Lunar Rovers
Type of Exhibits	Interactive Digital & VR	Hands-on Science & Technology	Stone & Brass Astronomical Tools	Hands-on Science & Tech	Space Artifacts, STEM Labs	Planetarium & STEM Activities	Digital Astronomy & Space	Space Missions, Moon Rocks
Programs & Spaces	Planetarium, VR Rooms, Lecture Halls	Science Exhibitions, Robotics Workshops	Open-air Observation, Heritage Tours	IMAX Theater, Exhibition Halls	IMAX, Space Shuttle Gallery	Dome Theater, STEM Labs	Astronomy Workshops, Cinema	Space Camp, Lunar Labs
Visitor Experience	Interactive & Digital Learning	Engaging STEM Activities	Historic & Educational	Interactive Science & Tech	Hands-on Science & Space Exploration	STEM Learning	Digital & Immersive Astronomy	Space & Flight Simulations

CHAPTER **4**

SITE ANALYSIS

4. SITE ANALYSIS

4.1 Site Selection Criteria

The selection of a site for the Science Center in Teku Dovan is based on multiple factors including accessibility, environmental significance, historical and cultural relevance, and feasibility. The site meets the following criteria:

- **Strategic Location:** Situated at the confluence of the **Bagmati and Bishnumati rivers**, a historically and environmentally significant site.
- **Urban Connectivity:** Proximity to **Kathmandu's core**, ensuring accessibility for students, researchers, and tourists.
- **Educational & Research Potential:** Scope for **science outreach programs** due to urban placement and nearby institutions.
- **Environmental Restoration Opportunity:** Chance to **revitalize a degraded site** near the waste transfer station, promoting sustainability.
- **Public Engagement:** Being close to residential, commercial, and institutional zones enhances community interaction with science and sustainability initiatives.
- **Sustainability Considerations:** The site allows for an **eco-friendly approach**, integrating river conservation, green spaces, and renewable energy.

4.2 Site Introduction

Location & General Information

- **Location:** Teku Dovan, Kathmandu, Nepal
- **Area:** 15,270.92 m² (30.02 Ropanis)
- **Elevation:** ~1,280 meters above sea level
- **Latitude:** 27.6950° N
- **Longitude:** 85.3086° E
- **Current Land Use:** Waste Transfer Station
- **Surroundings:**
 - **North:** Urban residential and commercial areas
 - **South:** Bagmati River
 - **East:** Bishnumati River
 - **West:** Industrial and waste management facilities

The site is currently used as a **waste transfer station**, impacting the local environment and public perception. However, with appropriate planning and environmental management, it presents an opportunity for **urban revitalization and scientific engagement**.

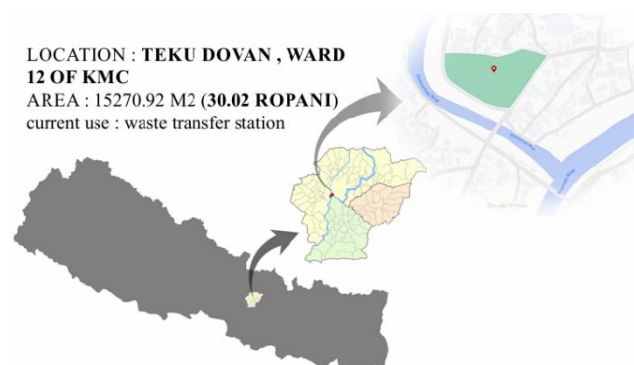


Figure: 116 site location map

4.3 Location & Significance

Teku Dovan – Its Importance & Potential

Teku Dovan is a historically and geographically significant location in Kathmandu. It serves as a **natural junction of the Bagmati and Bishnumati rivers**, making it a **symbolic site for scientific and ecological discourse**. The site has been traditionally associated with religious activities and rituals. The transformation of this space into a Science Center aligns with the need for urban renewal while respecting its heritage.

The neighborhood includes:

- **To the North:** Mixed commercial and residential developments.
- **To the South:** Riverbanks and green buffer zones.
- **To the East:** Government offices, including the Environmental Management Department.
- **To the West:** Industrial and mixed-use areas.

Neighborhood Context

The site is surrounded by:

- **Educational Institutions** – Schools, colleges, and research centers.
- **Residential & Commercial Zones** – Mixed-use developments, including housing and markets.
- **Religious Landmarks** – Numerous temples and ghats (riverbanks) used for rituals and festivals.
- **Industrial & Waste Management Facilities** – Nearby waste transfer station and commercial units.

Environmental & Urban Relevance

- **Urban Redevelopment Opportunity:** The current state of **waste transfer and environmental degradation** presents a chance for **eco-restoration and public awareness**.
- **Sustainability & River Conservation:** The Science Center can contribute to water quality monitoring, environmental education, and hydrological studies.
- **Green Corridor Development:** Establishing **parks, ecological zones, and green spaces** to enhance biodiversity and urban aesthetics.

View to the Site



NORTH VIEW



SOUTH VIEW



WEST VIEW



EAST VIEW

Why Teku Dovan is an Ideal Location for the Science Center

- **Water-Related Research & Awareness:** Given its riverside setting, the center can promote **water conservation, hydrology, and sustainability studies.**
- **Science and Community Engagement:** Being centrally located, it can act as a **knowledge hub for students, researchers, and general visitors.**
- **Architectural & Urban Innovation:** The site's existing challenges necessitate **flood-resilient, sustainable, and context-sensitive architecture.**

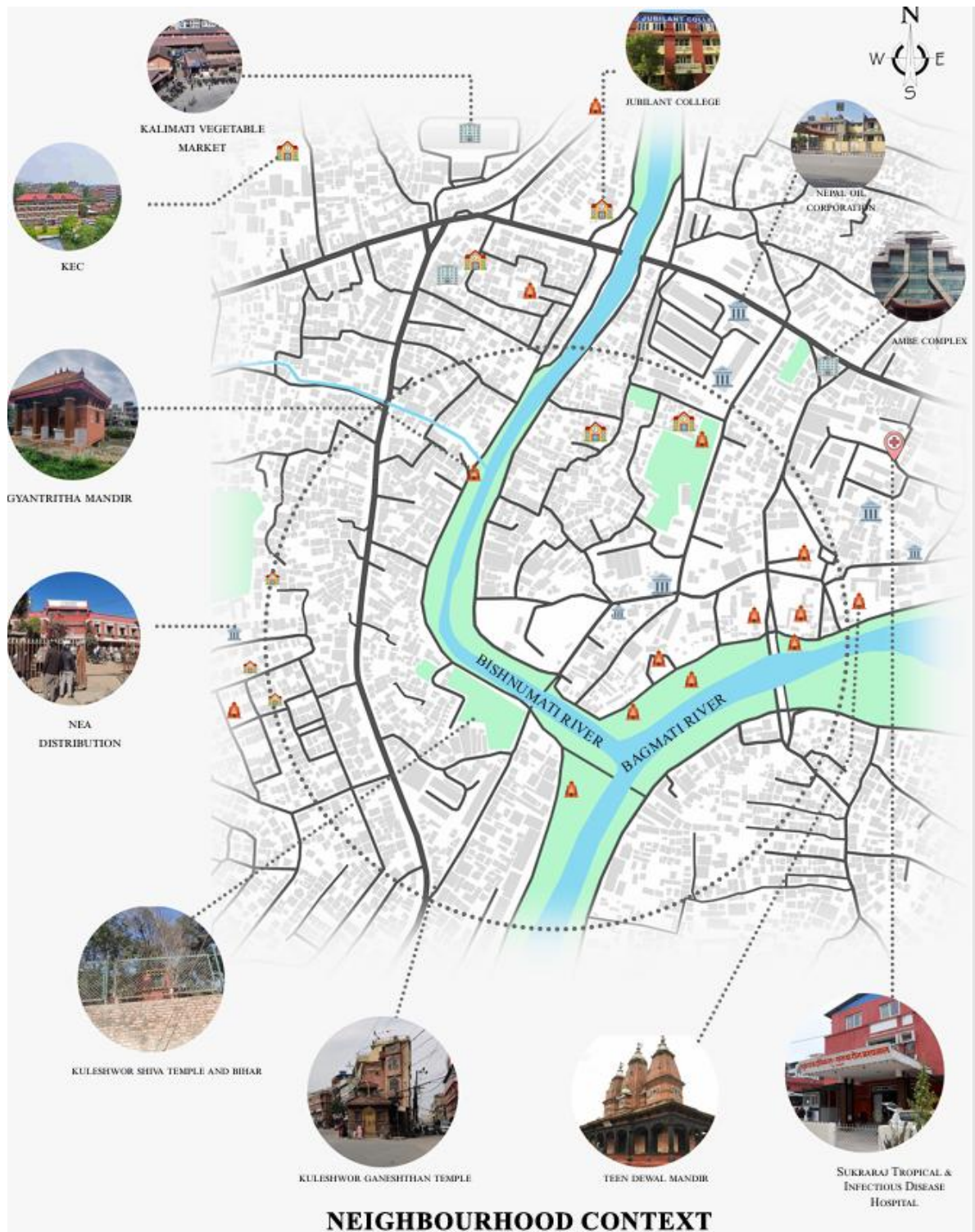


Figure: 117 neighborhood context

4.4 Historical, Religious, and Cultural Significance

Teku Dovan has been historically significant, with references in ancient texts and local folklore. The confluence of the Bagmati and Bishnumati rivers is considered sacred in Hindu and Buddhist traditions. Historically, it served as a location for ritual baths, cremations, and religious ceremonies.

Teku Dovan holds deep-rooted cultural and religious importance. The confluence of the two rivers has been revered for centuries, with temples such as Pachali Bhairav,



Figure: 118 historical timeline of site

Kuleshwor Shiva Temple, and Gyantritha Temple attracting pilgrims and devotees. Several prominent festivals, including Indra Jatra, Pachali Bhairav Jatra, and Mha Puja, are celebrated in this area, showcasing its cultural vitality.

From a historical perspective, Teku has witnessed significant transformations over time. During the Malla and Rana periods, it functioned as an essential trade hub, facilitating commerce and settlement expansion. In more recent decades, urbanization and industrialization have altered its landscape, leading to environmental degradation and infrastructural congestion. Despite these challenges, Teku remains a historically rich site that can be revitalized to merge scientific exploration with cultural heritage.

4.5 Access and Approach

- **Road Connectivity:** The site is directly accessible via Teku Road, which connects to major parts of Kathmandu.
- **Distance from Major Landmarks:**
 - **From Tribhuvan International Airport:** 6.5 km (~25 minutes by car in normal traffic)
 - **From Kathmandu Durbar Square:** 2 km (~10 minutes by car, 25 minutes on foot)
 - **From Thamel (Tourist Hub):** 3.5 km (~15 minutes by car)
 - **From Patan Durbar Square:** 4 km (~15 minutes by car)

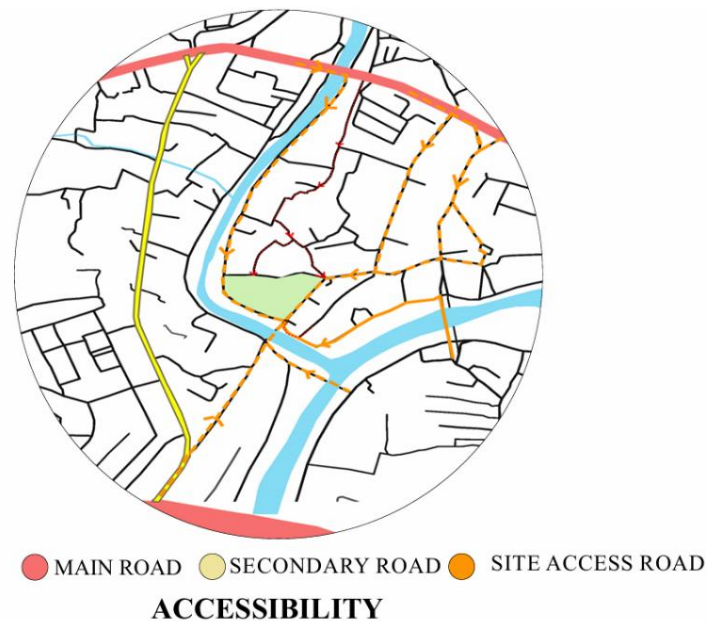


Figure: 119 Accessibility

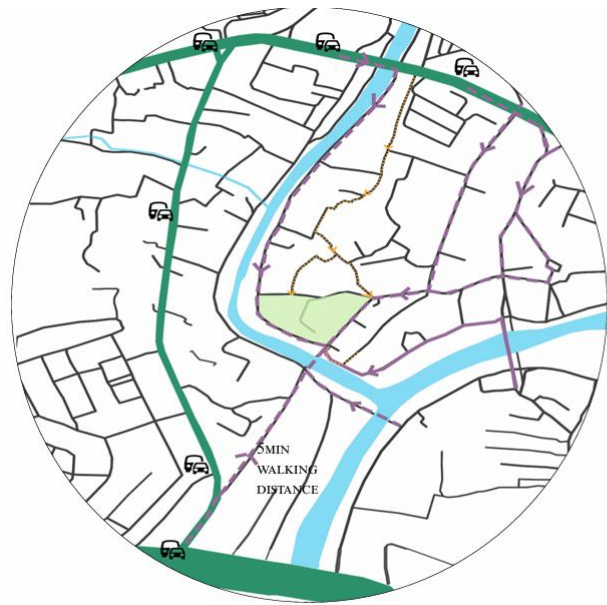
- **Public Transport:** The site is serviced by multiple minibuses, tempos, and city buses, ensuring easy access for visitors.
- **Pedestrian and Cycling Accessibility:** The site currently lacks proper pedestrian and cycling infrastructure, which should be integrated into the redevelopment plan.

Approach Roads

- **Main Road Access:** Teku Road, linking to Kalimati, Tripureshwor, and Thapathali.
- **Secondary Road Access:** Small streets and pathways connect the site to surrounding areas.

4.6 Transportation Analysis

- **Road Network:** The site is well-connected to the city center and Ring Road, allowing smooth movement of visitors.
- **Traffic Conditions:** Peak-hour congestion is a challenge due to the existing waste transfer station.



● PUBLIC VEHICLE EXCESS ● PRIVATE VEHICLE ROUTE

TRANSPORTATION ANALYSIS

Figure: 120 Transportation analysis

Future traffic management plans will be needed.

Public Transport

- Frequent bus services along **Ring Road and Teku Road**.
- Close to **Tripureshwor Bus Park** (a major transit hub).

Private & Pedestrian Access

- Well-developed road network supports vehicular access.
- Nearby pedestrian bridges connect the site across the river.

4.7 Land Use Analysis (Past to Present)

Historically, Teku was an important trade and cultural center. Over the years, the site transitioned into a semi-industrial zone with the establishment of warehouses and waste management facilities. Currently, it functions as a waste transfer station. The proposed redevelopment into a Science Center aims to revitalize the area, offering educational, environmental, and social benefits.



● EDUCATION ● INSTITUTION ● RELIGIOUS
● MIX USE RESIDENTIAL ● COMMERCIAL

LAND USE ZONING

Figure: 121 land use zoning

- **Ancient Period:** Trade and settlement zone.
- **Malla & Rana Eras:** Market area with religious functions.
- **Post-Modern Era:** Industrial growth and urbanization.
- **Present:** Functions as a waste transfer station, with redevelopment potential for a science center.

4.8 Ecological Analysis



Figure: 122 flooding

Sun Path Analysis

- The site receives **maximum sunlight from the south**, making it suitable for passive solar design.
- Shadows from surrounding structures are minimal due to the open nature of the riverside.

Wind Patterns

- **Prevailing Wind:** Southwest to northeast.
- The proximity to the rivers allows natural cooling effects, which can be utilized for ventilation strategies.

Climatic Conditions

- **Average Temperature:** 10°C (winter) – 30°C (summer).
- **Annual Rainfall:** ~1,400 mm, with peak monsoon from **June to September**.

Flood Risk Analysis

- **High Flood Risk** – Teku Dovan is prone to flooding during heavy monsoons due to the confluence of two rivers.
- **Mitigation Measures:** Raised plinth levels, flood-resistant materials, and proper drainage design are necessary.



ECOLOGICAL ANALYSIS

Figure: 123 site plan

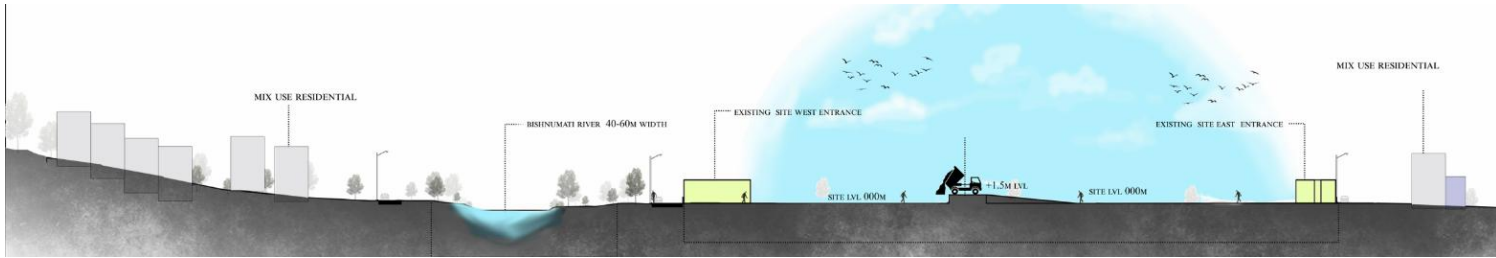


Figure: 124 site section

4.9 Vegetation Analysis

The vegetation in and around Teku Dovan is sparse, with remnants of native riverbank flora. Key tree species include Peepal (*Ficus religiosa*), Bar (Banyan), and floodplain shrubs. The redevelopment should integrate urban forestry elements and green buffers to enhance the ecosystem.

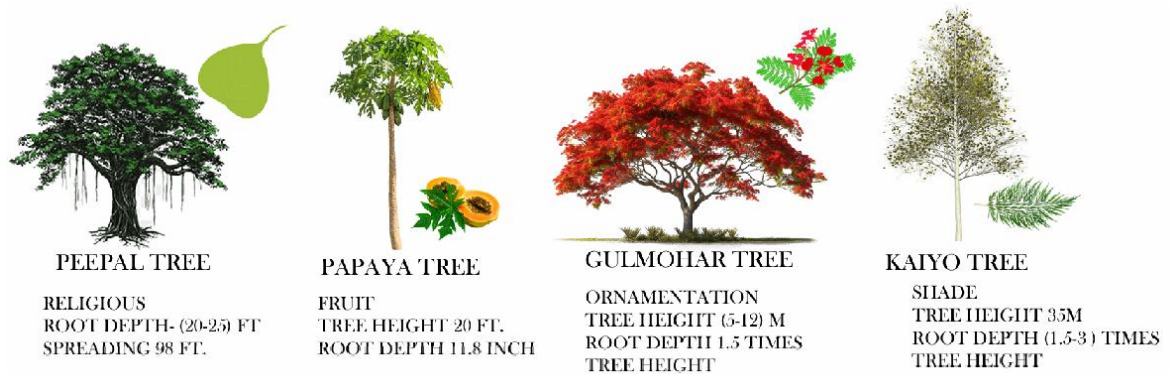


Figure: 125 Vegetation analysis

- **Peepal Tree (*Ficus religiosa*)** – Deep-rooted, holds religious importance.
- **Papaya Tree (*Carica papaya*)** – Fruit-bearing, shallow-rooted.
- **Gulmohar Tree (*Delonix regia*)** – Ornamental tree providing shade.
- **Kaiyo Tree (*Albizia lebbbeck*)** – Medium-root depth, effective for shading and cooling.

4.10 Building By-Laws (Kathmandu Institutional Buildings)

- **Ground Coverage Ratio (GCR):** 40% of the total land area.
- **Floor Area Ratio (FAR):** 3 (Maximum built-up area = 3 × site area).
- **Setback Requirements:**
 - 3m setback (for buildings under 17m height).
 - 5m setback (for buildings over 17m height).
- **Right of Way (ROW):**
 - 14m for secondary roads.
 - 20m buffer zone for Teku riverbanks.
- **Parking Requirement:** 15 % of the total site area to be allocated for parking.

4.11 SWOT Analysis

Strengths:

- ✓ Strategic location with high accessibility.
- ✓ Proximity to schools and institutions.
- ✓ Cultural and religious significance.
- ✓ Large site area allows flexible planning.

Weaknesses:

- ⚠ Pollution from existing waste transfer station.
- ⚠ Flooding risk during monsoons.
- ⚠ Urban congestion and environmental degradation.

Opportunities:

- 🌱 Potential for environmental sustainability and green redevelopment.
- 🏫 Educational tourism and research hub possibilities.
- 🏛️ Government and policy support for urban redevelopment..

Threats:

- 🌪️ Climate change and increasing flood risks.
- 💰 Budget constraints for large-scale infrastructure.
- 🌍 Seismic activity, as Kathmandu lies in an earthquake-prone zone.

CHAPTER 5

PROGRAM FORMULATION

5. PROGRAM FORMULATION

DAILY VISITORS		
TOTAL STUDENT POPULATION (KATHMANDU VALLEY)	700,000 – 800,000	APPROX. 60% OF TOTAL POPULATION
ESTIMATED SCIENCE ENTHUSIASTS (20%)	140000	20% OF STUDENT POPULATION
MONTHLY VISITORS (10% OF ENTHUSIASTS)	14000	10% OF 140,000
DAILY VISITORS ON WEEKDAYS (60% WEEKDAYS)	420 STUDENTS / DAY	8,400 ÷ 20 WEEKDAYS
DAILY VISITORS ON WEEKENDS (40% WEEKENDS)	700 STUDENTS / DAY	5,600 ÷ 8 WEEKEND DAYS
PEAK SEASON ADJUSTMENT (+20-30%)	2000 -2500 STUDENTS / DAY	DURING HOLIDAYS AND EVENTS

1. ENTRANCE AND RECEPTION AREA			
SPACE	Unit Area (sqm)	No. of Units	Total Area (sqm)
Main entrance lobby	100	1	100
Reception/Info Desk	20	1	20
Ticket counter	25	2	50
Security/Baggage Check	15	2	30
Gift shop/Bookstore	40	1	40
Guard House / Services	20	1	20
Visitor's Lounge/Waiting	150	1	150
Total (Entrance Area)	USER (100)		410SQM

2. EXHIBITION GALLERIES (CORE SCIENCE ZONES)			
SPACE	Unit Area (sqm)	No. of Units	Total Area (sqm)
PHYSICS ZONE (energy, motion, and forces)	200	2	400
CHEMISTRY ZONE (molecular interactions and reactions)	200	2	400
BIOLOGY ZONE (evolution, ecosystems, and life processes)	200	2	400
GEOLOGY ZONE (earth's formation, minerals, and tectonic studies)	200	2	400
ASTRONOMY ZONE (celestial bodies, space exploration, and cosmic phenomena)	200	2	400
Total (learning spaces)	USER (500-1000)		1800SQM

3. RESEARCH AND INNOVATION HALL			
SPACE	Unit Area (sqm)	No. of Units	Total Area (sqm)
STEM LAB	100	2	200
ROBOTICS & CODING LAB	80	1	80
VR/AR SIMULATION ROOM	40	4	160
SCIENCE QUIZ/ACTIVITY ZONE	60	5	300
RESEARCH LABS	60	2	120
LIBRARY & DIGITAL RESOURCE	80	1	80
INVENTION AND DISCOVERY (5 EACH)	80	5	400
Total (learning spaces)	USER (150)		1340sQM

4. EVENT AND WORKSHOPS HALLS			
SPACE	Unit Area (sqm)	No. of Units	Total Area (sqm)
MAIN EVENT (200 SEATS)	250	2	500
WORKSHOPS (60 SEATS)	150	2	300
MULTIPURPOSE HALL	100	1	100
PLANETARIUM (100)	400	1	400
TOTAL (LARGE GATHERING AREA)	USER (300)		1300sQM

5. OUTDOOR SCIENCE PARK			
SPACE	Unit Area (sqm)	No. of Units	Total Area (sqm)
PHYSICS PLAYGROUND (gravity exhibits like pendulum swings and inclined plane experiments)	150	1	150
BOTANICAL GARDEN (plant and evolutionary -dinosaurs park)	200	2	400
WEATHER OBSERVATION STATION	50	1	50
ASTRONOMY PARK (sundial with traditional Newari design)	100	2	200
WASTE MANAGEMENT PARK	50	1	50
TOTAL (OUTDOOR PARK)	USER (200)		850sQM

6. ADMINISTRATIVE BLOCK			
SPACE	Unit Area (sqm)	No. of Units	Total Area (sqm)
DIRECTOR'S OFFICE	20	1	20
STAFF ROOM	40	3	120
MEETING ROOM	40	1	40
STORAGE/ARCHIVE	30	1	30
MAINTENANCE ROOM	30	1	30
ACCOUNT	30	1	30
ADMINISTRATION	30	1	30
EVENT MANAGER	30	1	30
EDUCATOR ROOM (4)	30	4	120
RESEARCHER ROOM (3)	20	3	60
TOTAL (ADMIN BLOCK)	USER (25)		510SQM

7. CAFETERIA & DINING AREA			
SPACE	Unit Area (sqm)	No. of Units	Total Area (sqm)
KITCHEN	50	1	50
DINING AREA (INDOOR)	100	1	100
DINING AREA (OUT DOOR)	50	1	50
KITCHEN GARDEN AND LEARNING	50	1	50
TOTAL (CAFETERIA)	USER (100)		250SQM

8. PARKING & SERVICE AREA			
SPACE	Unit Area (sqm)	No. of Units	Total Area (sqm)
VISITOR PARKING (45 CARS)	15	45	675
STAFF PARKING (15 CARS)	15	15	225
STAFF PARKING (75 BIKE)	3	75	225
VISITOR PARKING (150 BIKE)	3	150	450
BUS (5)	40	5	200
TOTAL (CAFETERIA)	USER (100)		1775SQM

FINAL AREA SUMMARY	
SPACE CATEGORY	Total Area (sqm)
1. ENTRANCE & RECEPTION AREA	410
2. EXHIBITION GALLERIES	1800
3. RESEARCH & INNOVATION HALLS	1340
4. AUDITORIUM & SEMINAR HALLS	1300
5. OUTDOOR SCIENCE PARK	850
6. ADMINISTRATIVE BLOCK	510
7. CAFETERIA & DINING AREA	250
8. PARKING & SERVICE AREA	1775
TOTAL	8235SQM
BUILDING SERVICES (10%) + 5% TOILETS	1235.25 SQM (9470.75M2)
CIRCULATION AREA (30% OF TOTAL AREA)	2841.07sqm
TOTAL AREA INCLUDING CIRCULATION	12,311.37sqm

AREA CALCULATION:

TOTAL SITE AREA: 15270.29 SQ M
 VISITOR UPPTO 2000 TO 3000 ON EVENT DAYS
 NORMAL DAYS :500 TO 1000 ON WEEKEND

FINANCIAL CALCULATION:**FOR SCIENCE EXHIBITS**

1. FOR STUDENT: RS 50
2. FOR OTHER: RS75

FOR PLANETERIUM SHOWS

1. FOR STUDENT = RS 150
2. FOR OTHER = RS 200

EVENTS ARE FREE FOR ORGANIZER AND GENERAL PUBLIC
 WORK CONDUCTED ON BASIS OF MODULES

CHAPTER 6

CONCEPT

6. CONCEPT

The design concept for the Science Center is rooted deeply in the **site's context, cultural memory, and environmental realities**. Located at **Teku Dovan**, the confluence of the Bagmati and Bishnumati rivers, the site holds not only **spiritual significance** but also presents unique design opportunities and challenges. The proposed concept is a synthesis of four interconnected design ideas:

1. Axis Toward Teku Dovan – Flow of Knowledge

◆ Concept Essence:

Teku Dovan is the **sacred confluence of the Bagmati and Bishnumati rivers**, historically significant as a ritual and spiritual site. This confluence symbolizes **unity, transition, and energy flow**, paralleling the convergence of scientific disciplines in the center.

✚ Design Response:

- A **primary axial alignment** runs from the entrance toward Teku Dovan.
- Major programmatic blocks (Planetarium, interactive Halls, science park) are **oriented along this axis**.
- Architectural volumes open toward the axis to frame river views and create a processional spatial narrative.

📍 Circulation & Spatial Experience:

- Visitors are guided along a **central pathway**, mimicking a ritual journey from mundane to sacred, from curiosity to understanding.
- **Visual anchors and open nodes** along the axis reinforce directionality and spatial rhythm.

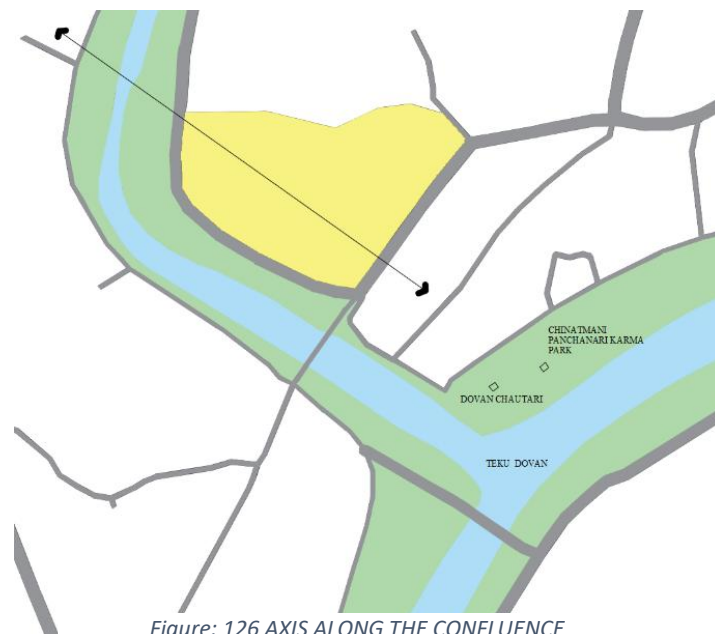


Figure: 126 AXIS ALONG THE CONFLUENCE

2. Flood Resilience – Elevated Platforms

Given the **flood-prone nature** of the riverfront site, a strategic **landscape-based flood mitigation** approach is adopted. The entire built form is raised on **elevated platforms (first-floor plinth level)**, allowing for safe occupancy while the ground plane functions as a **flood-absorbing buffer**. This elevation also enhances visibility, ventilation, and creates a dynamic architectural form that rises above water and flows with the terrain.

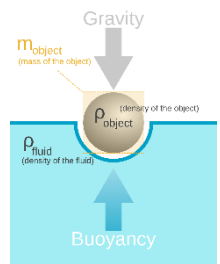


Figure: 127 Buoyancy

- **Amphibious & Floating Structures**
some parts of the Science Center, such as pavilions or visitor spaces, can be designed as floating or amphibious structures that rise with floodwaters.
- **Elevation & Land Grading**
Raise the Site Level: Elevate key building areas using earth fill or raised platforms to keep them above the highest recorded flood level.
- **Wetland Restoration & Retention Ponds**
- **Green Roofs & Rain Gardens**
- **Vegetation Barriers & Riverbank Reforestation**



Figure: 128 Wetland Restoration

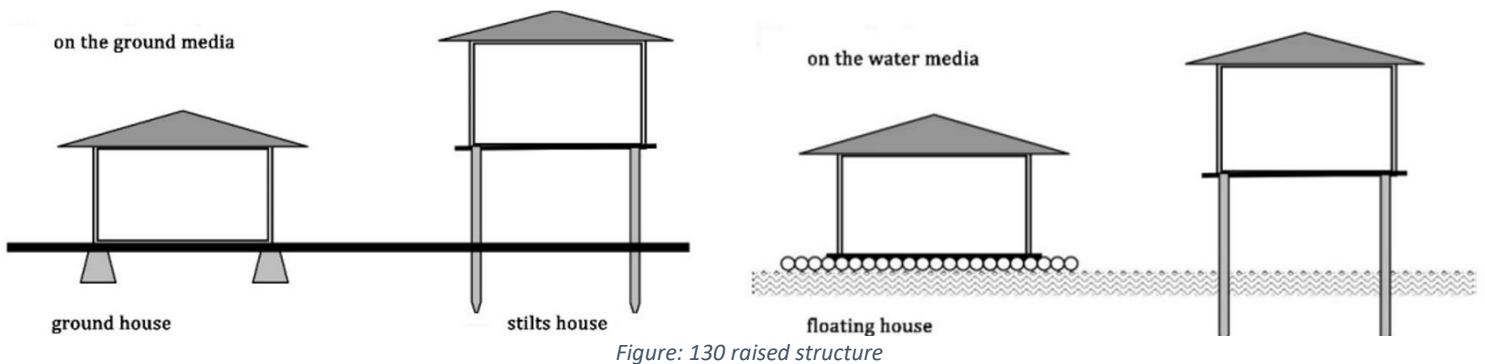


Figure: 130 raised structure



Figure: 129 raised ground level

3. Curriculum-Based Spatial Learning

The fifth conceptual layer draws directly from the **Nepalese school science curriculum (Grades 4–10)** to shape the **circulation and zoning** of the Science Center. The idea is to mimic the **progressive nature of scientific education** in Nepal, allowing students and visitors to **"walk through the syllabus"** spatially—from basic phenomena to advanced principles.

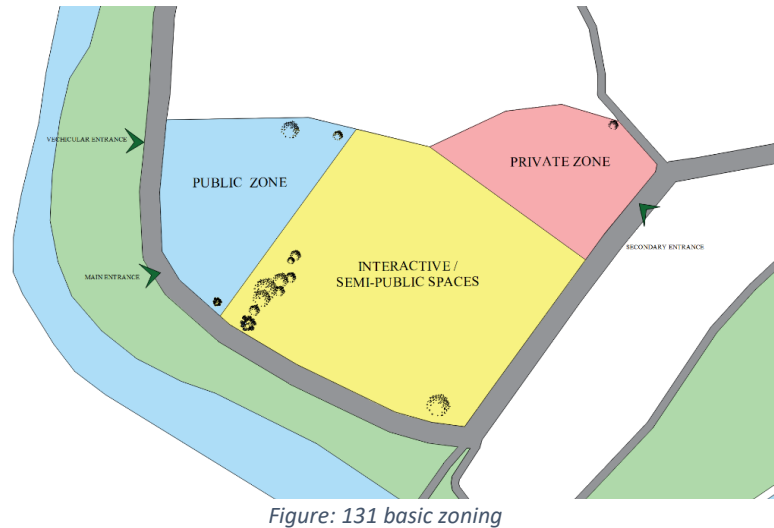


Figure: 131 basic zoning

This ensures the building is not only architecturally meaningful but **pedagogically aligned**—making the Science Center a **powerful educational tool**.

Design Response:

- The **spatial layout follows a logical academic progression**, from simple environmental and natural concepts to complex scientific systems.
- **Circulation paths act like a timeline or a journey**—representing the journey of a student growing through the science curriculum.
- Zoning includes:
 - **Introductory Science Garden** (Grades 4–5): nature, senses, fun experiments.
 - **Life Science Zone** (Grades 6–7): plants, animals, the human body.
 - **Physical Science Zone** (Grade 8): matter, energy, sound, force.
 - **Earth & Space Zone** (Grade 9): astronomy, geology, magnetism.
 - **Future Innovation Zone** (Grade 10): robotics, tech, applied science.
- **Color coding, wall graphics, and floor patterns** enhance the grade-wise feel of each zone.
- **Interactivity increases with grade level**, showing how scientific understanding deepens over time.
- This circulation style makes it easier for **school groups to engage systematically**, in sync with what they learn in classrooms.

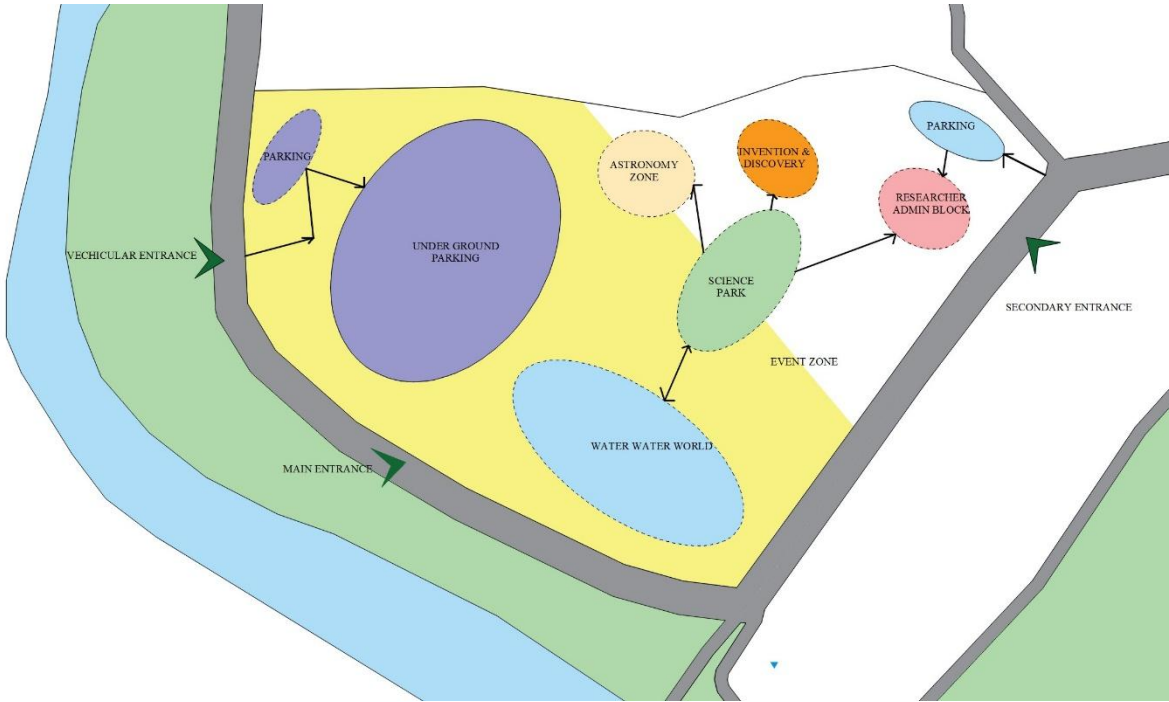


Figure: 132 program for ground floor

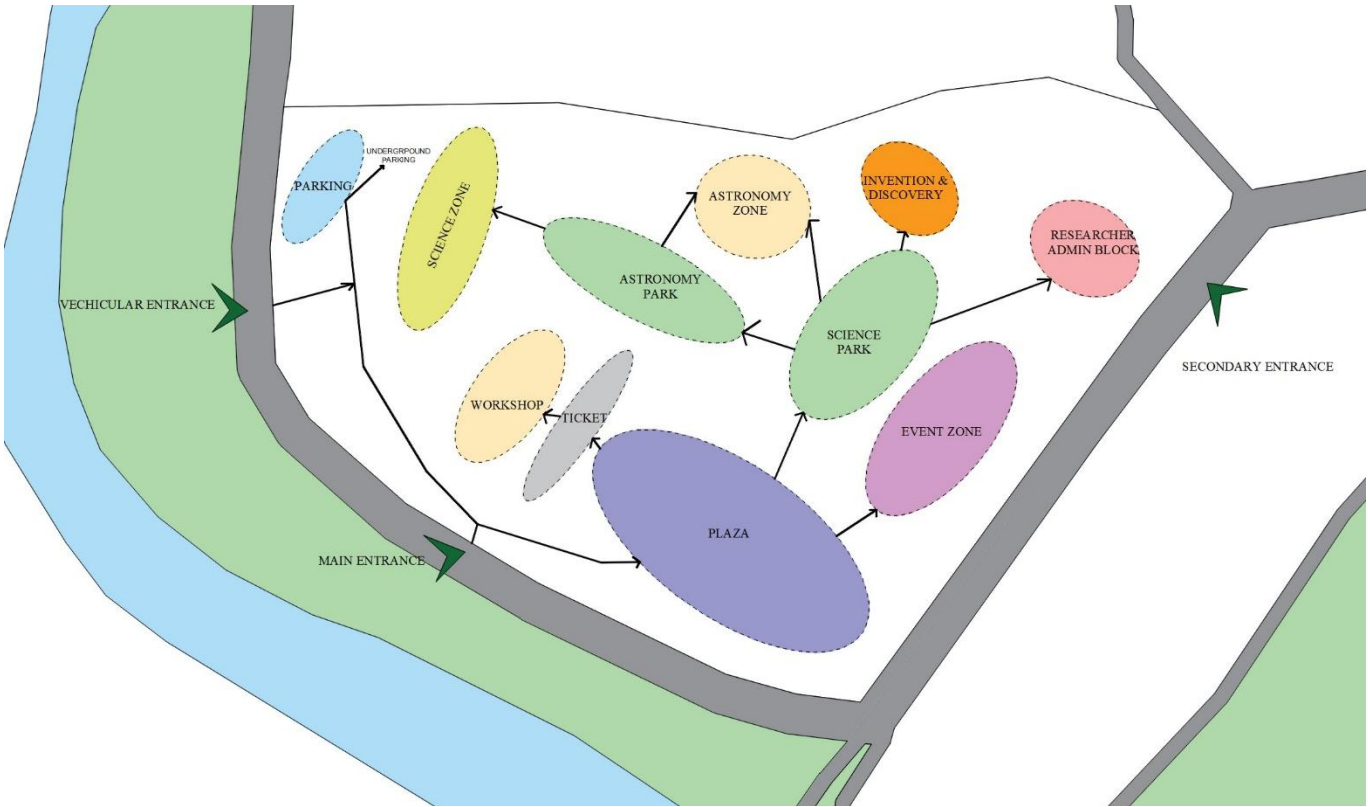


Figure: 133 program for first Floor (main floor)

4. Newar Courtyard Typology – Surprise & Curiosity

Inspired by the **traditional Newar settlement pattern**, the layout integrates a **series of small courtyards** hidden within narrow transitional paths. These **compressed-to-expanded spaces** evoke **surprise and curiosity**, mirroring the process of scientific exploration. As in historic Kathmandu neighborhoods, these courtyard voids serve as breathing spaces, gathering points, and orientation nodes—enhancing visitor experience while maintaining cultural continuity.

Design Response:

Traditional Newar settlements use narrow alleys (gallis) that suddenly open into spacious courtyards (bahals/bahils). This sequence of compression and expansion creates mystery, discovery, and drama.

Design Response:

- Approach routes designed as compressed corridors that lead to sudden expansive gallery courts or science plazas.
- Courtyard spaces are layered vertically and horizontally, forming breathing voids between built forms.
- Visitors experience gradual spatial revelation, reflecting how science reveals hidden truths.

Circulation & Spatial Experience:

- The journey through the Science Center is **immersive**, encouraging **exploration**.
- Visitors encounter **unexpected reveals**, fostering emotional engagement and deeper memory retention.
- Encourages **pause, interaction, and storytelling**, much like wandering through a historic Newar neighborhood.

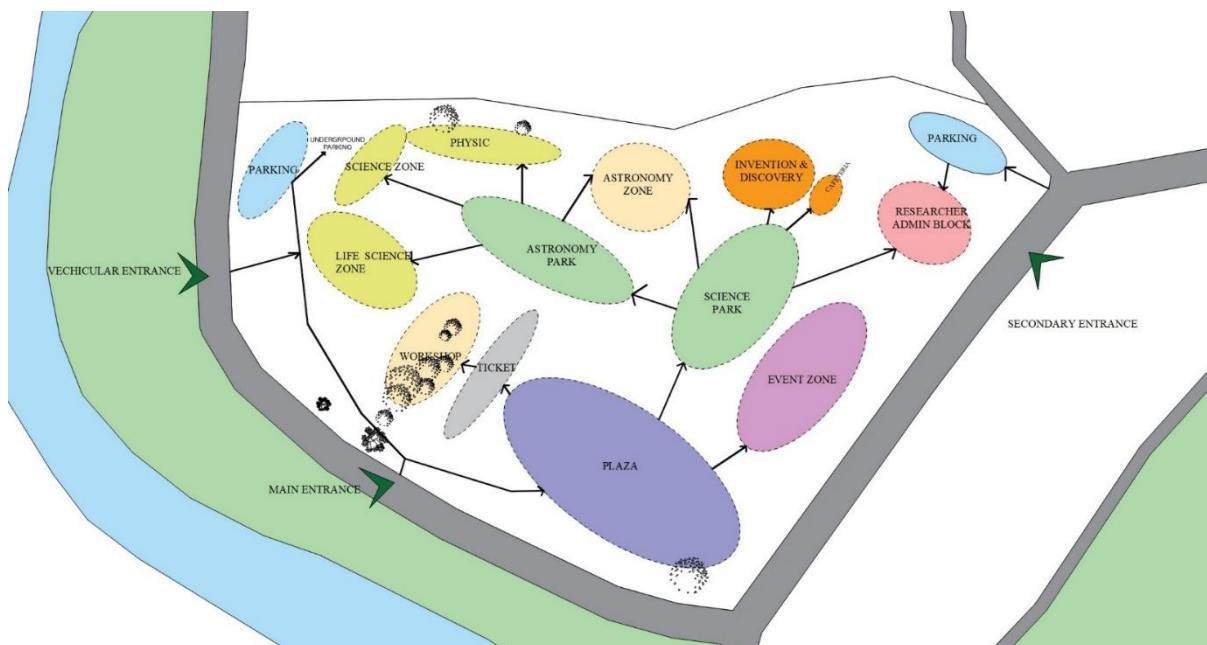


Figure: 134 planning layout

5. Natural Landscape Integration – Designing with the Site

The design **respects and incorporates existing natural features**—particularly mature trees and the site’s natural topography. Instead of clearing the site, the architecture is **woven around the landscape**, allowing the natural elements to shape movement, shading, and gathering spaces. Green pockets, bioswales, and open-air science gardens further embed the building into its environment.

◆ Design Response:

- The design respects and **preserves existing mature trees**, integrating them into courtyards, walkways, and public gathering spaces to provide **natural shade, character, and ecological value**.
- Buildings are **strategically placed around tree clusters**, creating **green buffers** that enhance microclimate and reduce heat gain.
- The layout encourages **visual and physical continuity with the landscape**, using **open-air science gardens**, green pockets, and water-absorbing surfaces to soften the built form.
- Circulation paths are **organic and responsive to tree positions**, encouraging **slower movement and natural interaction** with the environment.

Major integration:

- Existing series of trees is incorporated in to life science block
- Previously site is used as waster transfer station and have energy bin on it, so use and implementation of existing bin for demonstration and study.



Figure: 135 integration of natural vegetation

CHAPTER 7

DESIGN DEVELOPMENT

7. DESIGN DEVELOPMENT

The design is further develop based on the following conceptual layering of site and context.

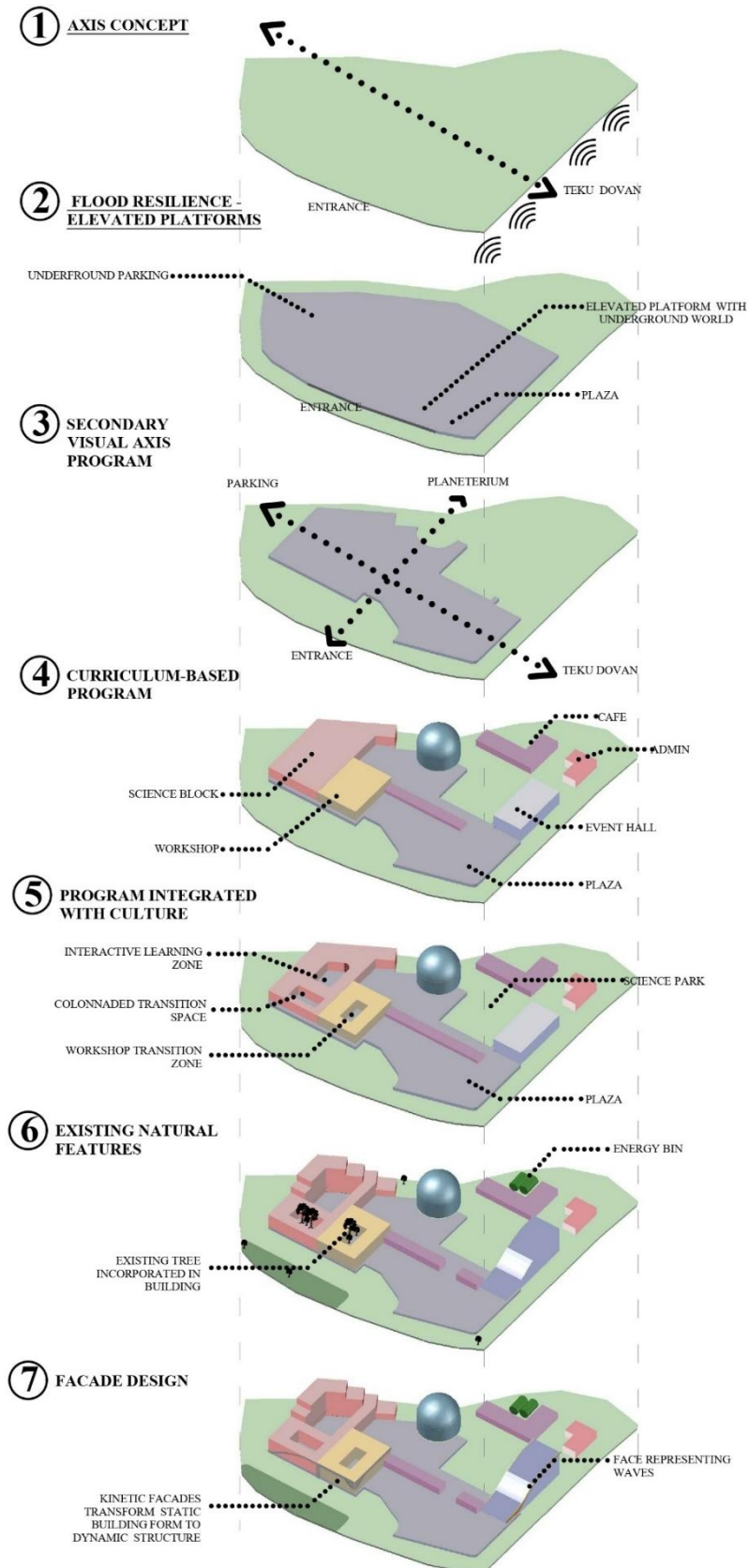


Figure: 136 design development

CONCLUSION:

The Science Center at Teku is envisioned not merely as a building, but as a **catalyst for scientific curiosity, environmental awareness, and community transformation**.

Situated at the sacred confluence of the Bagmati and Bishnumati rivers—once a site of waste and neglect—the center reclaims this land to inspire **learning, innovation, and sustainability**.

Designed with inclusivity, flexibility, and environmental sensitivity, the center serves as a platform for all ages to **explore Physics, Chemistry, Biology, Astronomy, and Geology** through immersive exhibits, open learning environments, and outdoor science parks. Its architecture celebrates **Nepali materials and identity**, while embracing modern sustainability strategies like **flood resilience, passive design, and green roofs**.

In essence, the Science Center stands as a **beacon of hope**, turning a once-overlooked site into a vibrant **hub of knowledge**, a **model of ecological regeneration**, and a **landmark for Nepal's scientific future**

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Salina Shrestha, Thesis on Center for Science and Planetarium

Ramesh Karki, Thesis on Science Center

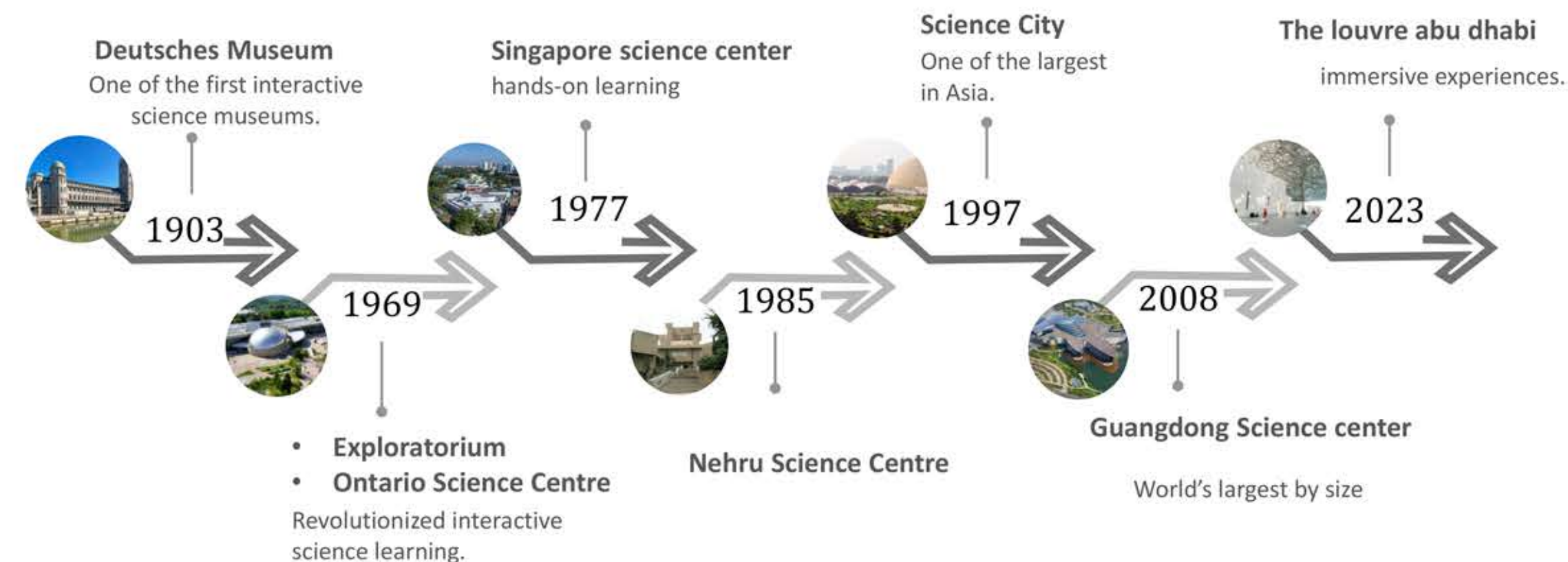
ANNEX:



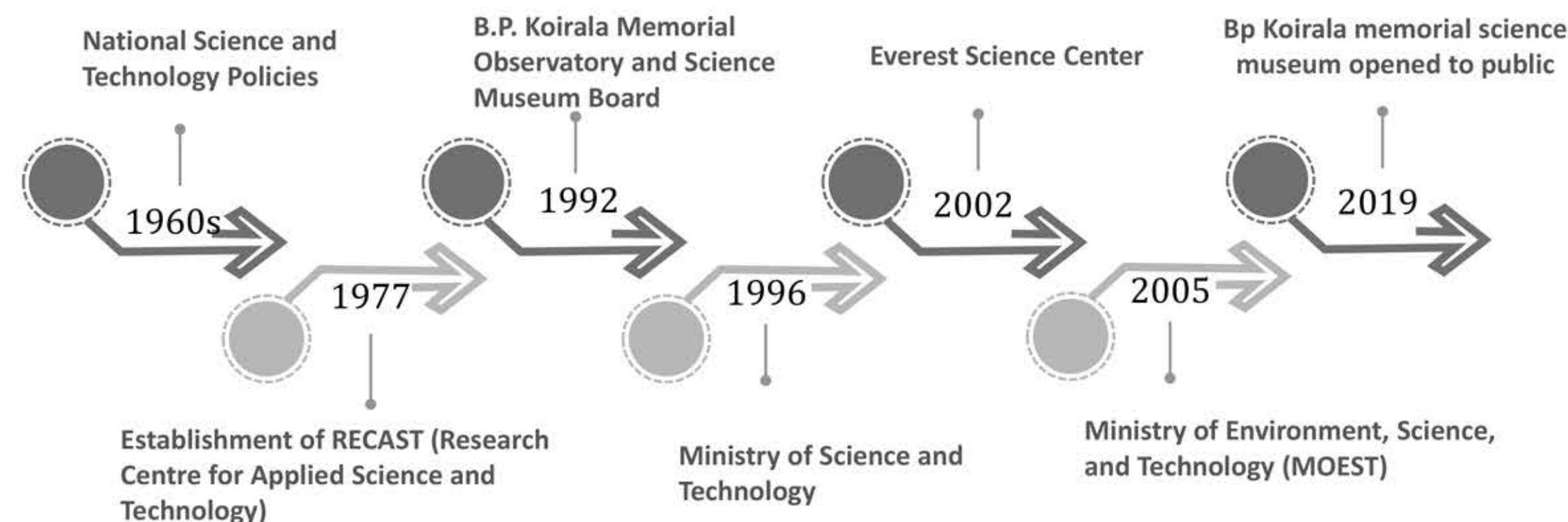
INTRODUCTION :

Science, derived from the Latin term scientia, meaning "**knowledge**," is a methodical endeavor that constructs and organizes knowledge in the form of testable explanations and predictions about the universe. Far beyond being a mere collection of facts, science is a process of understanding the world through observation, experimentation, and logical reasoning (*Hawking, 1988*). A **Science Center** is an interactive learning hub where individuals of all ages can explore, experiment, and engage with scientific concepts in a fun and immersive environment.

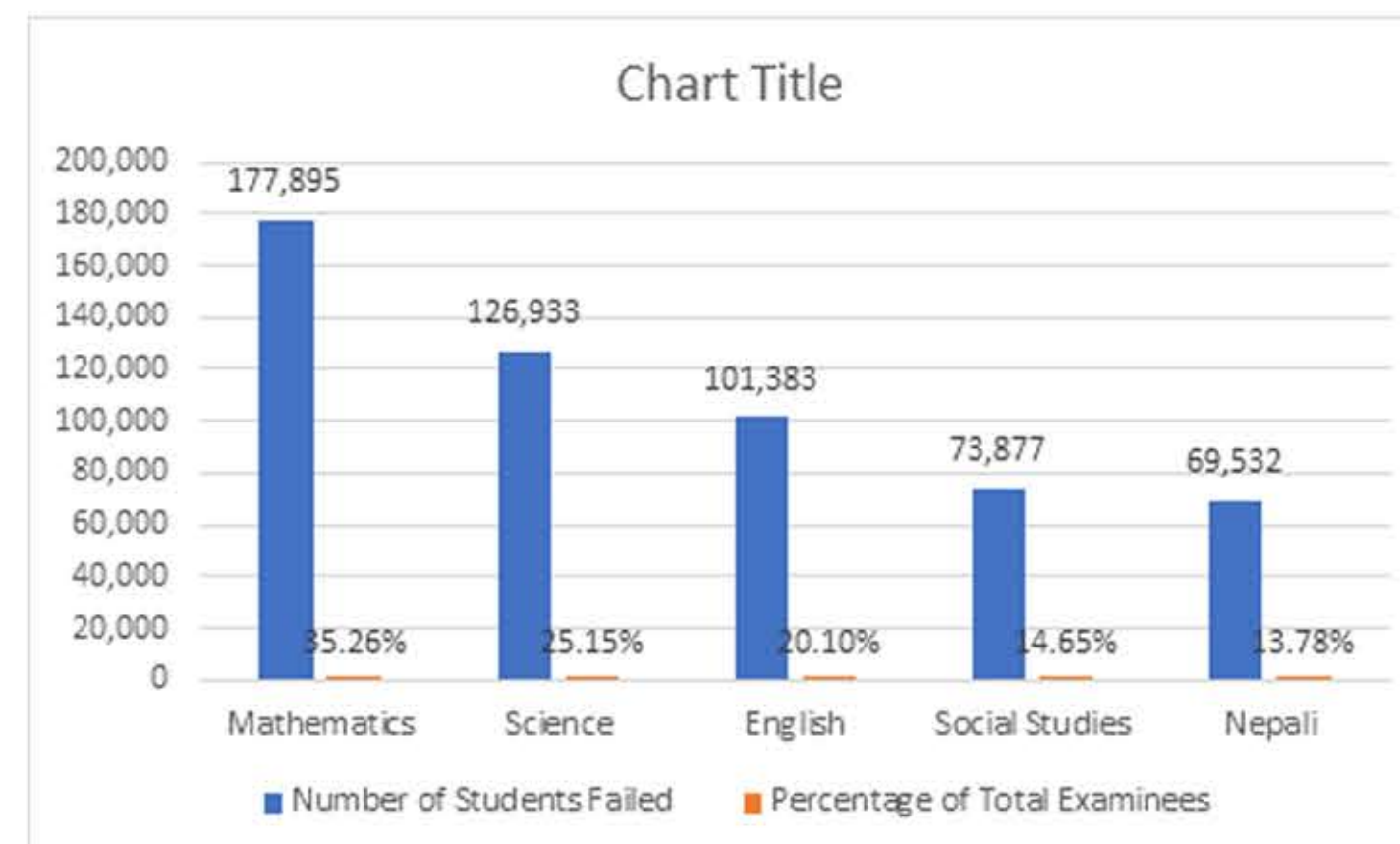
HISTORY OF WORLD:



NEPALESE SCENARIOS :



2080 SECONDARY EDUCATION EXAMINATION (SEE) SOURCE : NEB



Establishing a Science Center and Planetarium in Nepal is imperative, given the current state of science education and student performance in the country. In the 2023 Grade 12 examinations in Nepal, a significant number of students failed in science subjects. Out of 390,868 students who appeared for the exams, 187,021 were categorized as non-graded, indicating they did not achieve the minimum required marks in at least one subject. (SOURCE: NEB)

SCOPE OF SCIENCE CENTER :

1. Interactive demonstrative knowledge of science curriculum.
2. synonym of development and directly measure of country's prosperity
3. can contribute internal school tourism
4. destination for all the science enthusiasts
5. Research and Innovation for current and also future generation of scientific

PROJECT AIMS :

1. To support the urban regeneration of Teku by repurposing a waste transfer site into a civic landmark grounded in ecological, cultural, and scientific relevance.
2. Responds sensitively to the site's flooding risks, cultural importance, and ecological context.
3. To design a multidisciplinary Science Center that promotes science communication, learning, and exploration through thoughtfully designed spaces such as exhibition galleries, planetarium, workshops, and outdoor science parks — making science accessible, experiential, and enjoyable for the wider public.

PROJECT JUSTIFICATION

Despite being the capital city, Kathmandu lacks accessible and impactful platforms for public science learning. Science literacy in Nepal remains low, particularly among the general population. The existing institutions — such as the B.P. Koirala Memorial Planetarium, Observatory and Science Museum and the Simulation Science Center at Kirtipur — are limited in scope, scale, accessibility, and public engagement.

B.P. Koirala Science Center, though important, is centrally controlled, rarely upgraded, and largely observational rather than interactive. The Simulation Science Center primarily supports academic institutions, and is in small scale not publicly focused nor highly visible in urban life.

Nepal's education system shows systemic challenges in science learning.

Recent SEE (Secondary Education Examination) results highlight:

1. A significant portion of students fail science and mathematics,
2. Over 50% of SEE graduates avoid science streams due to fear or lack of exposure,
3. disparities between rural and urban science education environments continue to widen.

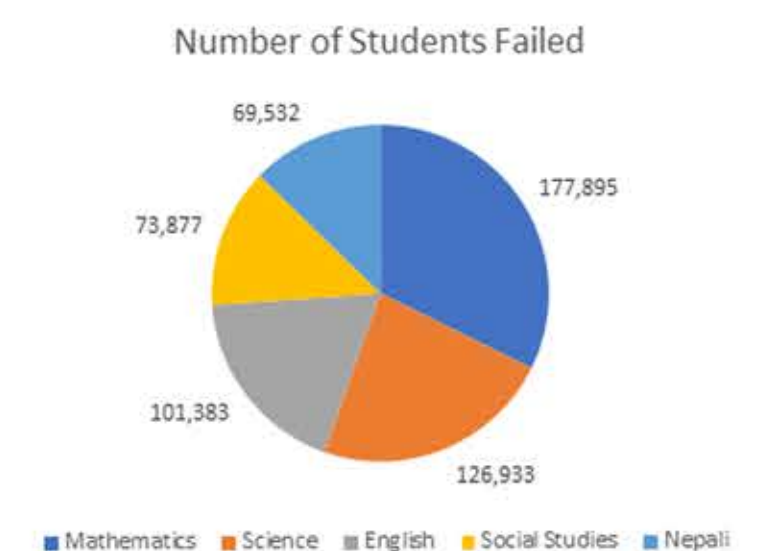


TOTAL STUDENT (SEE 2024) = 504,414
FAILED IN SCIENCE = 126,933

NATIONAL +2 SCIENCE ENROLL = 37,026
STEM ENROLL IN UNIVERSITY = 17,942

PROJECT OBJECTIVE:

- The proposed Science Center at Teku fills this gap by offering:
1. A public-facing, inclusive, and interactive learning environment,
 2. Integration of planetarium, exhibition halls, workshops, science parks, and live demonstration zones,
 3. Easy urban accessibility at the heart of Kathmandu near Teku Dovan.
 4. To promote hands-on learning and emphasize learning by doing concept
 5. To assist school curriculum practically by providing social venue
 6. To foster public interest in science and technology



MAIN USERS



SCHOOL



STUDENT



LOCALS & TOURISTS



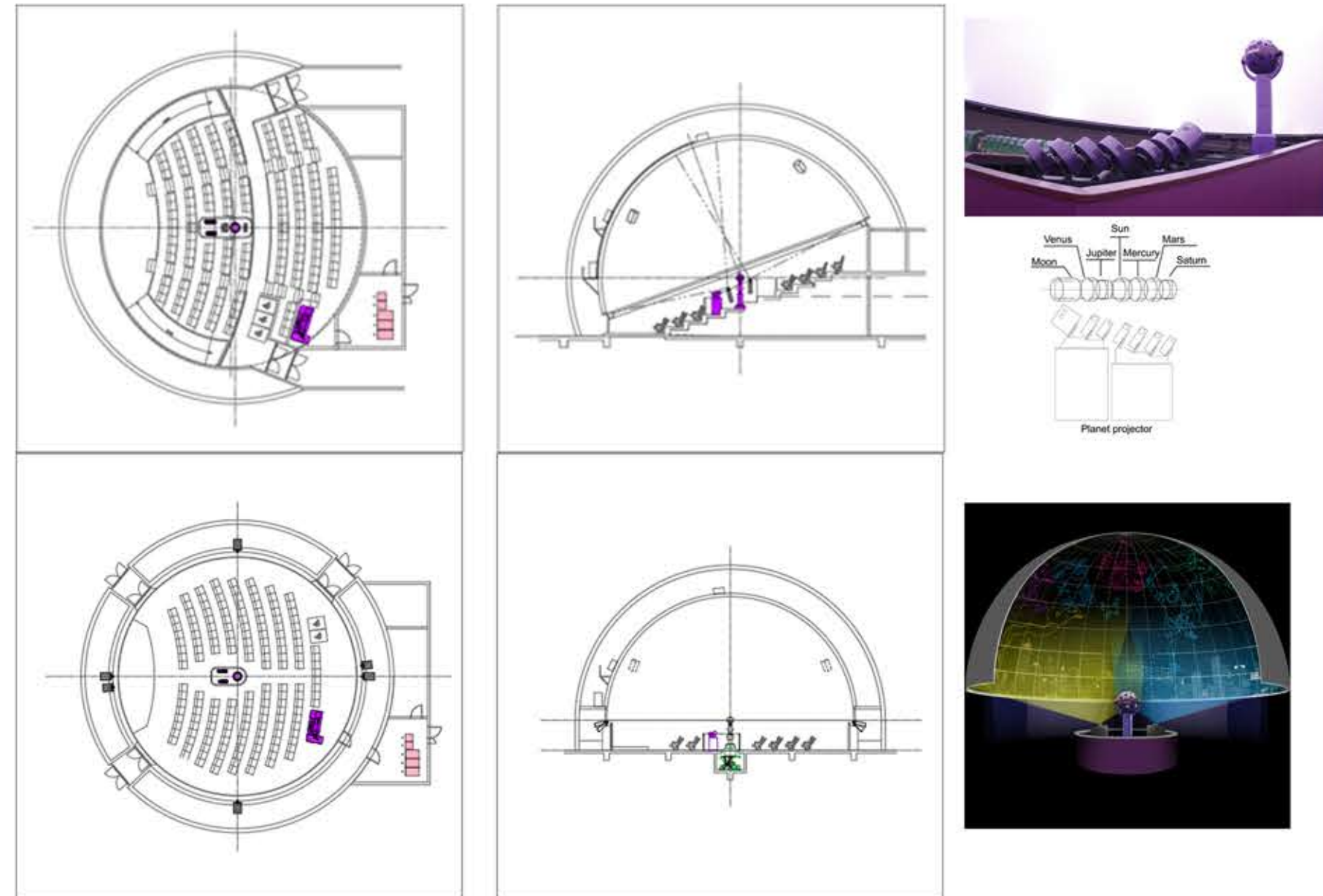
PROFESSIONALS





PLANETARIUM :

A planetarium is a facility designed to simulate the sky and provide educational and interactive experiences related to astronomy. The most common feature of a planetarium is its large hemispherical dome, where projections of celestial bodies like the sun, moon, planets, and stars are displayed. The planetarium in Teku, **Nepal**, should have a dome tilted at **27.7°** to the horizontal to align with the site's latitude. The dome should face **north**, with the zenith pointing towards the north celestial pole.



Planetarium Size	Diameter	Seating Capacity	Projector Type	Projected Stars	Motion Axes	Special Features	Seating Capacity	Area (sqm)	Diameter of Sky Theatre (m)
Small Planetarium	6.8 m	-	Master projector (28 kg)	5800 stars (Magnitude 6.0)	3 axes	Milky way, star clusters, nebula, sun, moon, planets	80 persons	100 sqm	12 m
Medium Planetarium	12.5-15.0 m	120-130 seats	Space Flight Planetarium	8100 stars (Magnitude 6.5)	4 axes	Milky way, star clusters, panorama, special effects	150 persons	180 sqm	15 m
Large Planetarium	20.0-25.0 m	250-600 seats	AGP Cosmorama	9100 stars (Magnitude 6.5)	-	Milky way, star clusters, nebula, laser effects, polar motion, microcomputer control	270 persons	350 sqm	21 m
							350 persons	420 sqm	25 m

WORKSHOP

Workshops in science centers are interactive, hands-on learning sessions designed to make science fun, practical, and understandable. They target students, teachers, and the public, encouraging experiential learning and curiosity

Types of Science Workshops

Physics & Engineering – Build bridges, balloon cars, marble runs

Chemistry – Slime making, volcano eruptions, color mixing

Biology & Environment – DNA extraction, mini-biospheres, composting

Astronomy – Solar system models, constellation viewers

Technology & Robotics – Coding basics, Arduino, simple robots

Art + Science (STEAM) – Sound crafts, kaleidoscopes, science with art

Teacher Training – Science kit use, curriculum-based STEM workshops

Academic Backing

Bevan et al. (2015): Hands-on workshops help develop creativity and deeper science understanding.

Bell et al. (2009): Science centers are effective platforms for both public and teacher education.



SCIENCE CENTER :

Physics: The Science of Matter and Energy

demonstrate laws of motion, gravity, electromagnetism, and energy transformation, Experiential Spaces

Learning Experience: Focus on making abstract concepts tangible (e.g., visitors can feel forces at play or manipulate simple machines).

Biology: The Study of Life and Living Organisms

Biology examines living organisms, their structure, function, evolution, and ecology. It encompasses everything from cellular biology to ecosystems

Learning Experience: Encourage hands-on exploration, such as studying microorganisms under a microscope or exploring ecological processes in a life-sized habitat. Living exhibits like aquariums

Chemistry: The Science of Substances and Reactions

Interactive Chemical Labs for visible reactions

Learning Experience: Allow visitors to experiment with safe chemical reactions or witness chemical changes in a visually engaging way (e.g., color changes or foaming reactions).

Geology: The Study of Earth's Structure and Materials

Rock and Mineral Exhibits, Interactive Earth Model, Geological Timelines

Learning Experience: Visitors can interact with Earth models, simulate seismic events, or learn about geological forces through touchable rock samples or VR experiences.

Astronomy: The Study of the Universe Beyond Earth

Planetarium, IMAX THEATRE, Sun Dial (History)

Learning Experience: Provide a fully immersive experience, where visitors can engage with celestial phenomena (e.g., observing planets, stars, and galaxies via telescopes or digital simulations).

EVENT

The **Event Hall** in a Science Center is a multipurpose space that serves as the intellectual and cultural hub of science outreach. It is flexible and dynamic, adapting to events that blend education, communication, performance, and public participation. Events held here not only align with STEM learning but also advance public engagement, social inclusion, and scientific culture.

various types of event :

1. Science Festivals – Attracting thousands of visitors over several days.
2. After Dark / Lates Events – Making science fun for adults.
3. Live Science Demonstrations – popular with children and families.
4. Astronomy Nights – Planetarium and telescope events.
5. Maker & Innovation Fairs – Promoting STEM, creativity, and engineering.



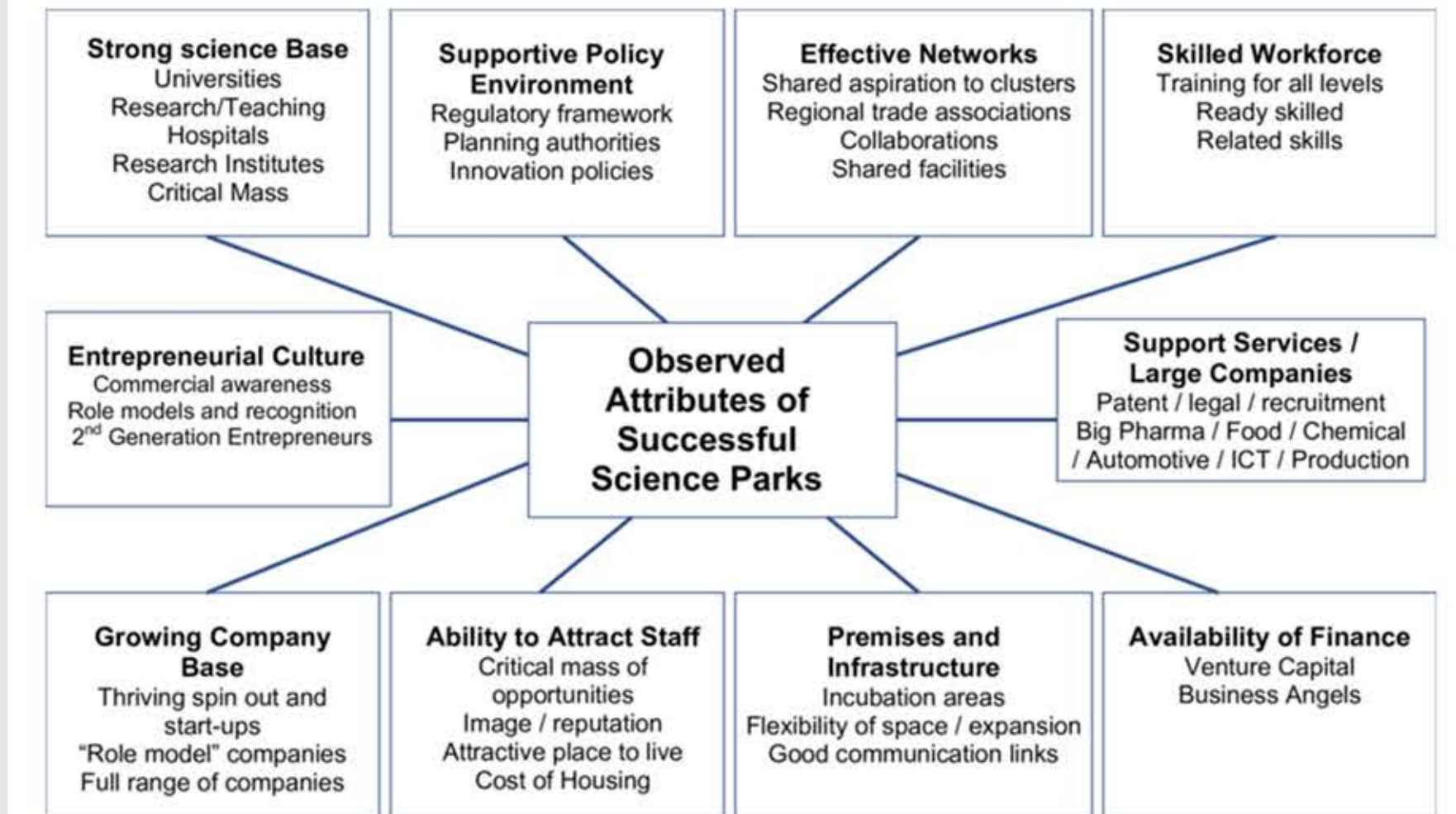
Academic Backing

Falk & Dierking (2010): Informal events extend science learning beyond school



SCIENCE PARK :

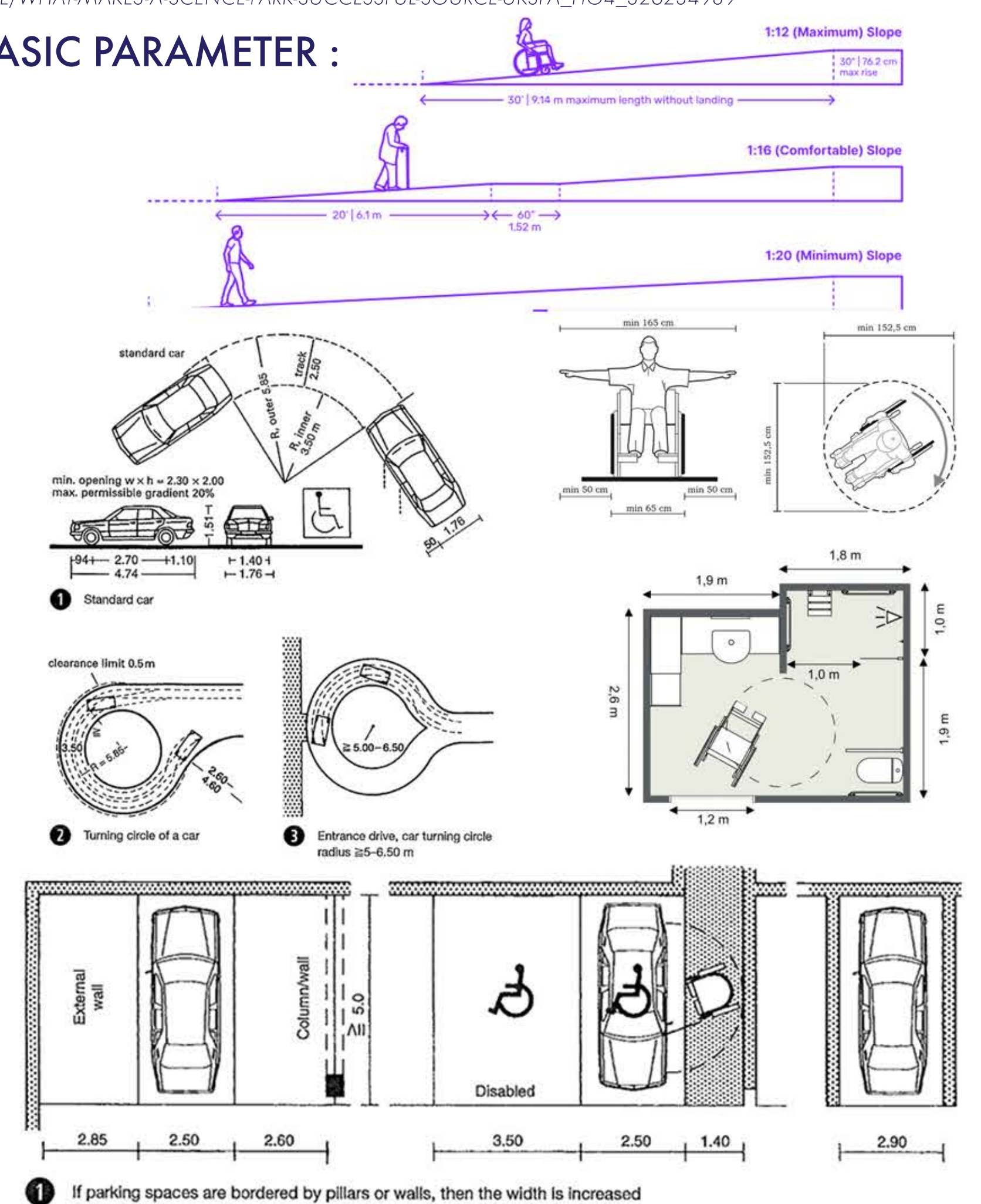
Science parks, also known as research or technology parks, are specialized areas designed to promote research, development, and innovation by fostering collaboration between businesses, academic institutions, and research organizations



SOURCE:

https://www.researchgate.net/figure/WHAT-MAKES-A-SCIENCE-PARK-SUCCESSFUL-SOURCE-UKSPA-FIG4_326234989

BASIC PARAMETER :



TEKU SCIENCE CENTER



CASE STUDY

BP KOIRALA MEMORIAL SCIENCE MUSEUM

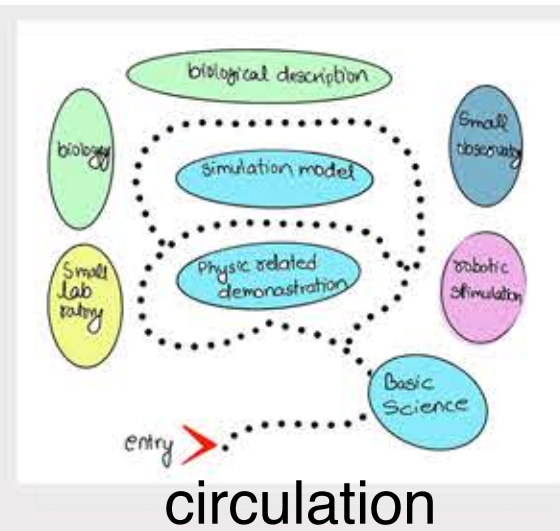
Location: Kritipur, Kathmandu
 Area: 35400 sq m (150 Ropanis)
 Orientation: south east entry
 Opened: 2019 (inaugurated 1992) still under construction
 Building form: star shaped planning (resembling Tu symbol)
 Targeted user: students, tourist
 No. of user: tentative 1000 during exhibition and 50 on average day
 Material and technology: RCC structure
 Opening time: 10 am to 5 am every day, closed on Wednesday
INFERENCES:
 •Spacious interiors with proper height, lighting & ventilation.
 future for expansion.
 delay in operation and no public vehicle excess



Site surrounding and its context



spacious interior with centrally place atrium for exhibition

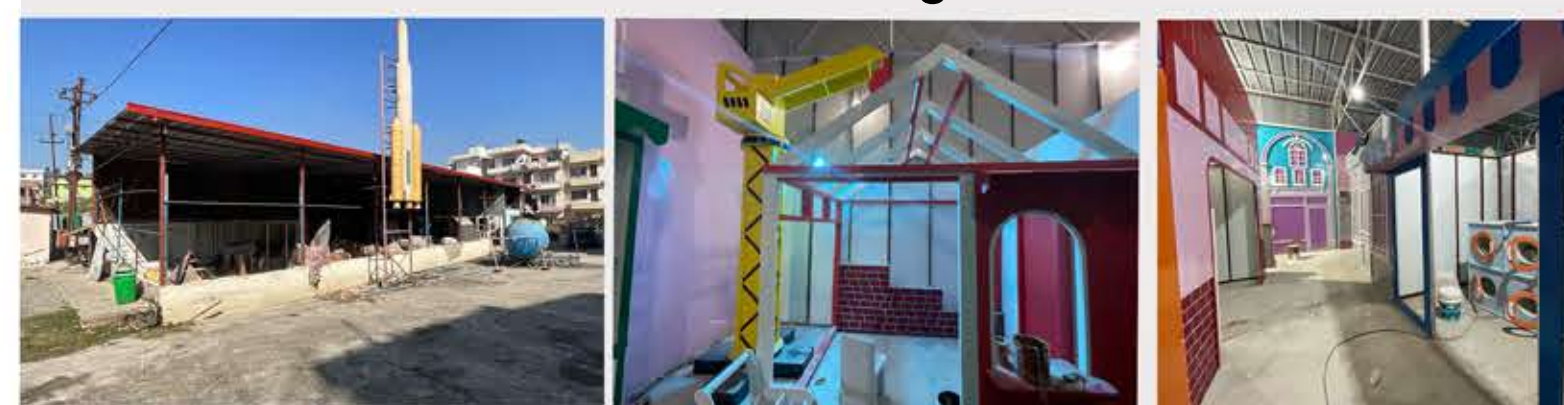


SIMULATION SCIENCE CENTER

•Location: Kritipur periously in Bhaisepti
 •Area: Approximately 2490 sq m
 •Owner: Sudan Basnet (robotic engineer)
 •Opened: 2018
 •program :
 8 simulation model , vr related demobnastration about planet , physic basic prinicple , biology related animal and planet preservation for display .
 •Targeted User: Students, science enthusiasts
 •Number of Users: Estimated 150 during special exhibitions, 50 on average days
 •Material and Technology: metal framing for exhibits with truss roof and interior of ply wood
 current status : closed due to renovation and expansion



student learning



Current Situation

Ongoing Expansion work

INFERENCES:

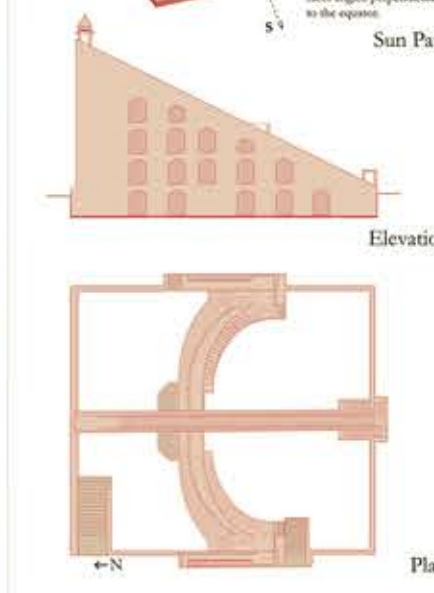
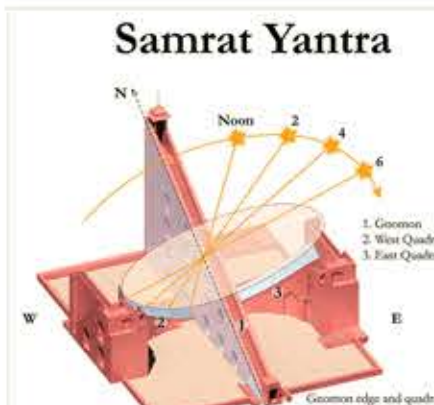
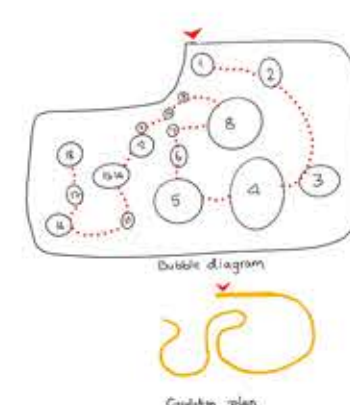
1. anthropometric consideration for small children
2. interactive learning through various intrument and demonastraion
3. less space for demoastraion of science physical model &childern learning thus , need of such science center

JANTAR MANTAR

Area: Approximately 18,700 sq m
 Opened: 1728 (completed in 1734)
 Daily Visitors: Approximately 500
 Material and Technology: Primarily constructed from local stone and masonry,
 Opening Hours: 9:00 AM to 5:00 PM daily

INFERENCES :

1. Astronomic park
2. Use of Local Materials
- 3.Blend of Indian & Islamic styles
4. Site-oriented celestial planning



CALIFORNIA SCIENCE CENTER

Location: Los Angeles, California, USA
 Architect: Richard D. Green, FAIA, and the California Science Center Design Team
 Site Area: 400,000 sq. ft.
 Completion Year: 2010 (Renovation of existing building and the opening of new areas)
 Project Cost: \$150 million (for major renovation)
 Total Built-Up Area: 200,000 sq. ft.
 Parking: 2,000 parking spaces

INFERENCES:

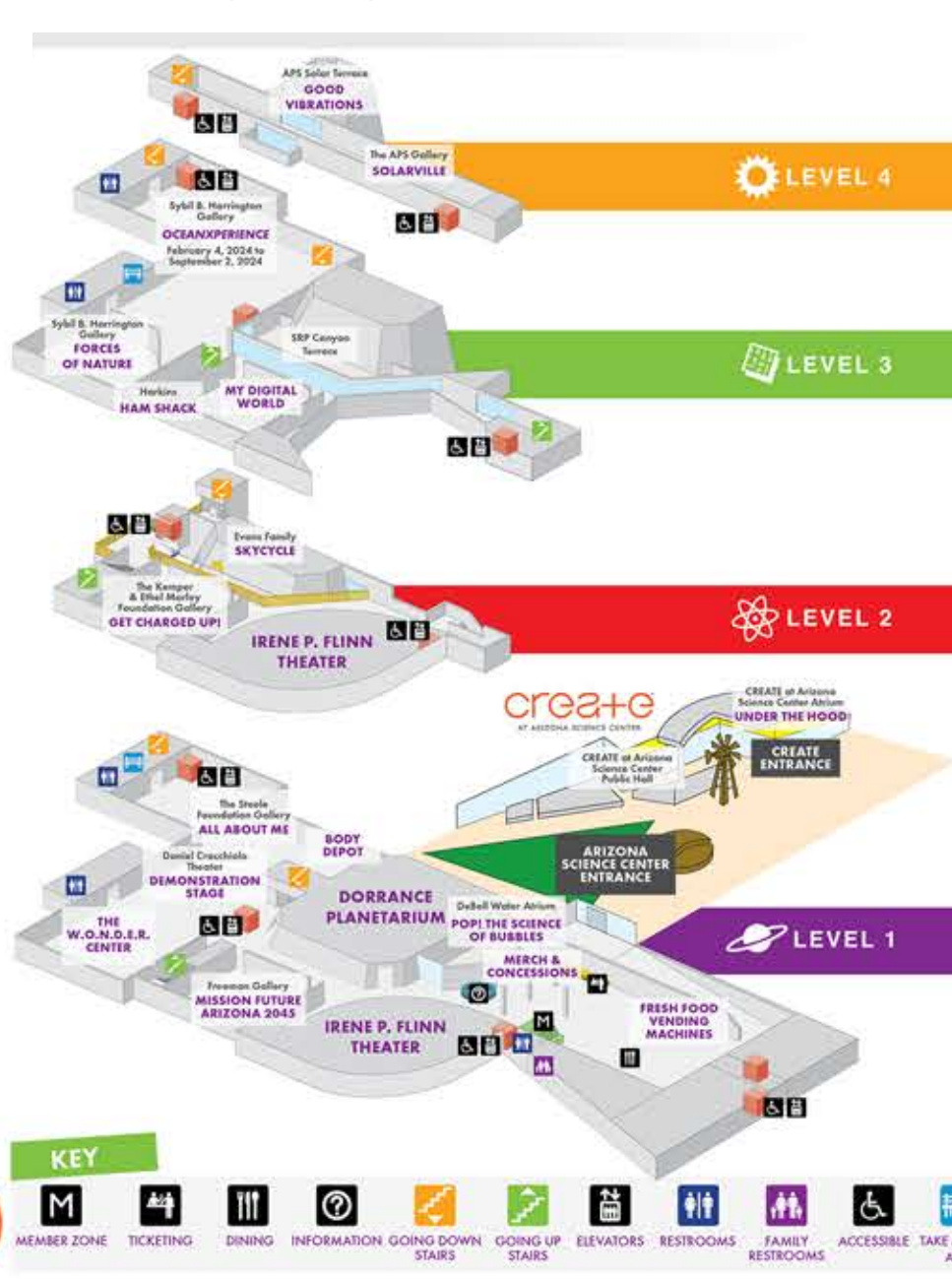
Space & Astronomy –Space Endeavour, planets, stars, and space missions.
 Ecosystems & Environment – Biomes, ocean life, climate change, and sustainability.
 Human Body & Medicine – Anatomy, and medical advancements.
 Physics & Engineering – Motion, forces, robotics, AI, and future tech.
 Live Demonstrations – Hands-on experiments in chemistry, physics, and STEM.



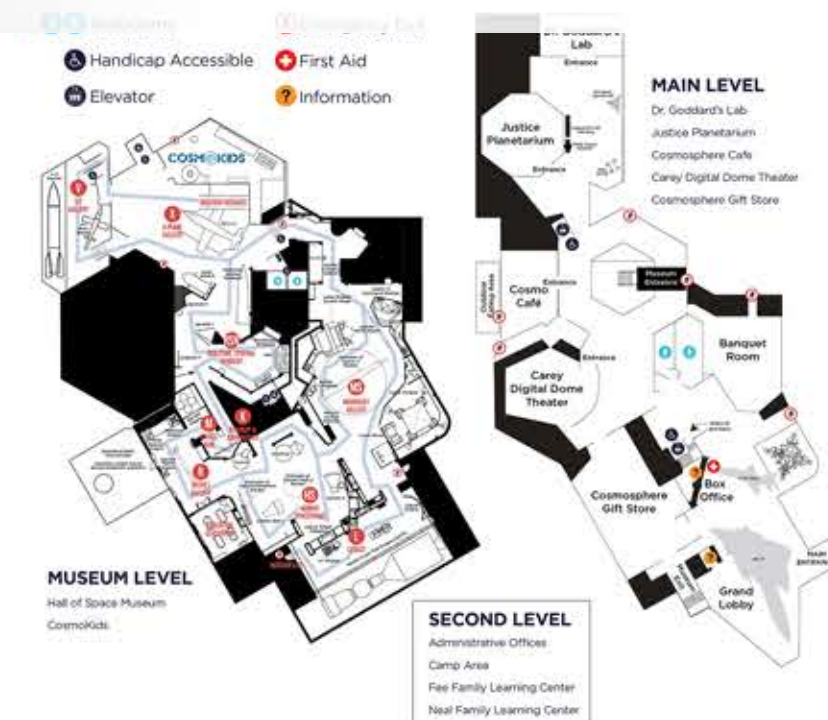
MIGHIGAN SCIECNC E CENTER



ARIZONA SCIENCE CENTER



COSMOSPHERE



INFERENCES:

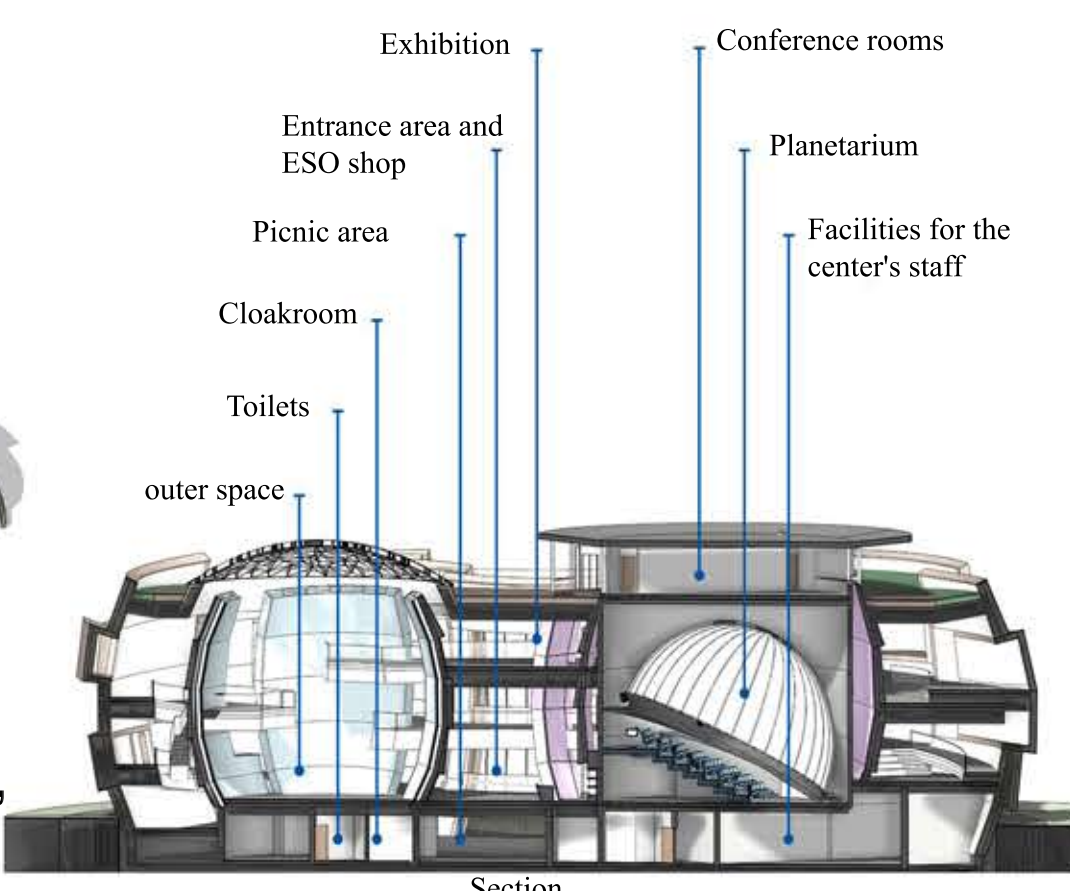
Industrial Materials – Steel, concrete for durability.
 Interior-Exterior Contrast – Thematic exterior, immersive interior.
 Visitor-Focused – Guided space exploration journey.
 Iconic Elements – Domed roof, angular forms for space symbolism.

ESO SUPERNOVA PLANETERIUM

Location: Garching, near Munich, Germany
 Area: Approximately 7,500 m² of total built-up
 14 Metres diameter planetarium dome
 25° Planetarium inclination (109 seat)
 17.4 Metres building height
 28. April 2018 Opening date

INFERENCES:

Astronomy & Space Science – Stars, galaxies, and cosmic Supernovae & Stellar Life Cycle – How stars are born, live, and explode as supernovae.



B. ARCH THESIS ON
TEKU SCIENCE CENTRE

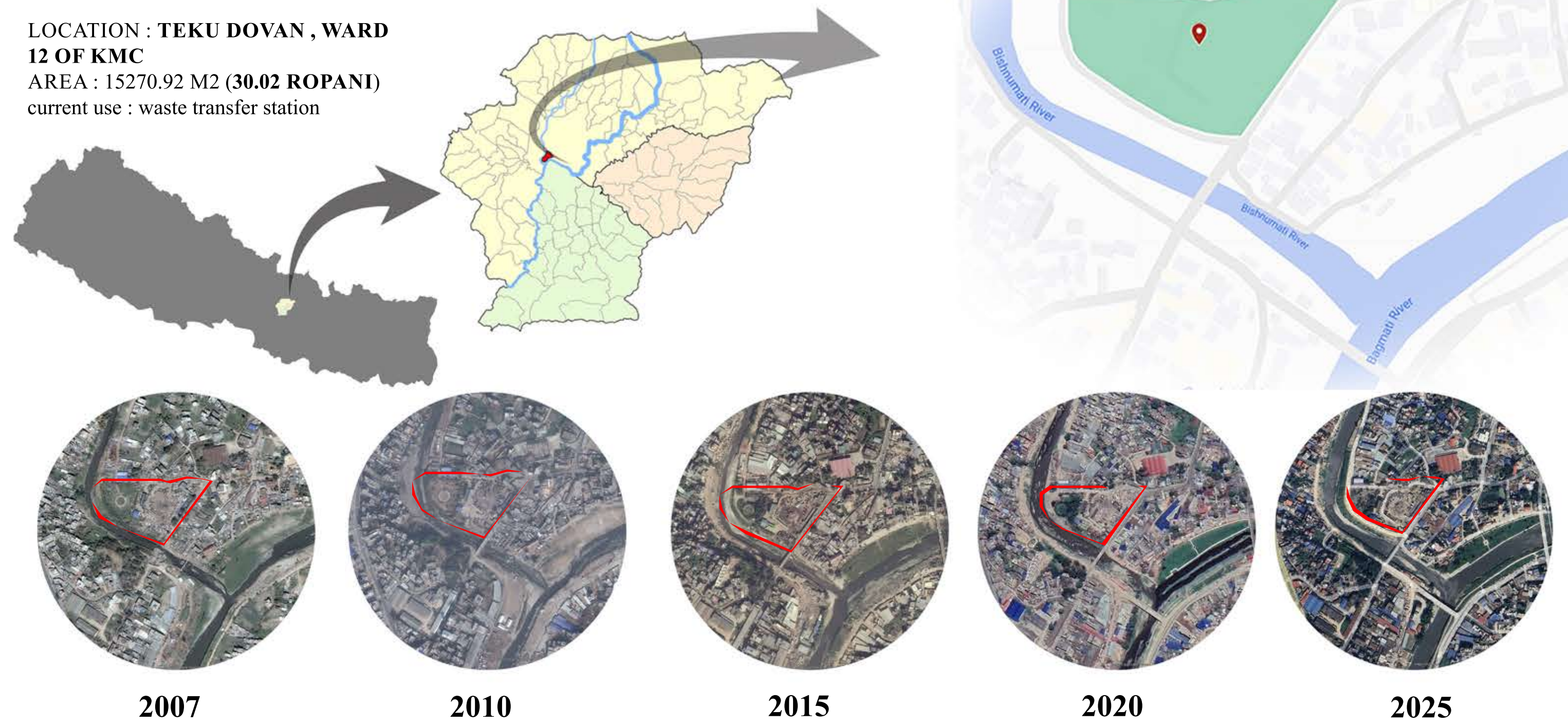
TITLE: CASE STUDY

RINA THAPA (760132)

SUPERVISOR : AR. RIKESH SHRESTHA

03

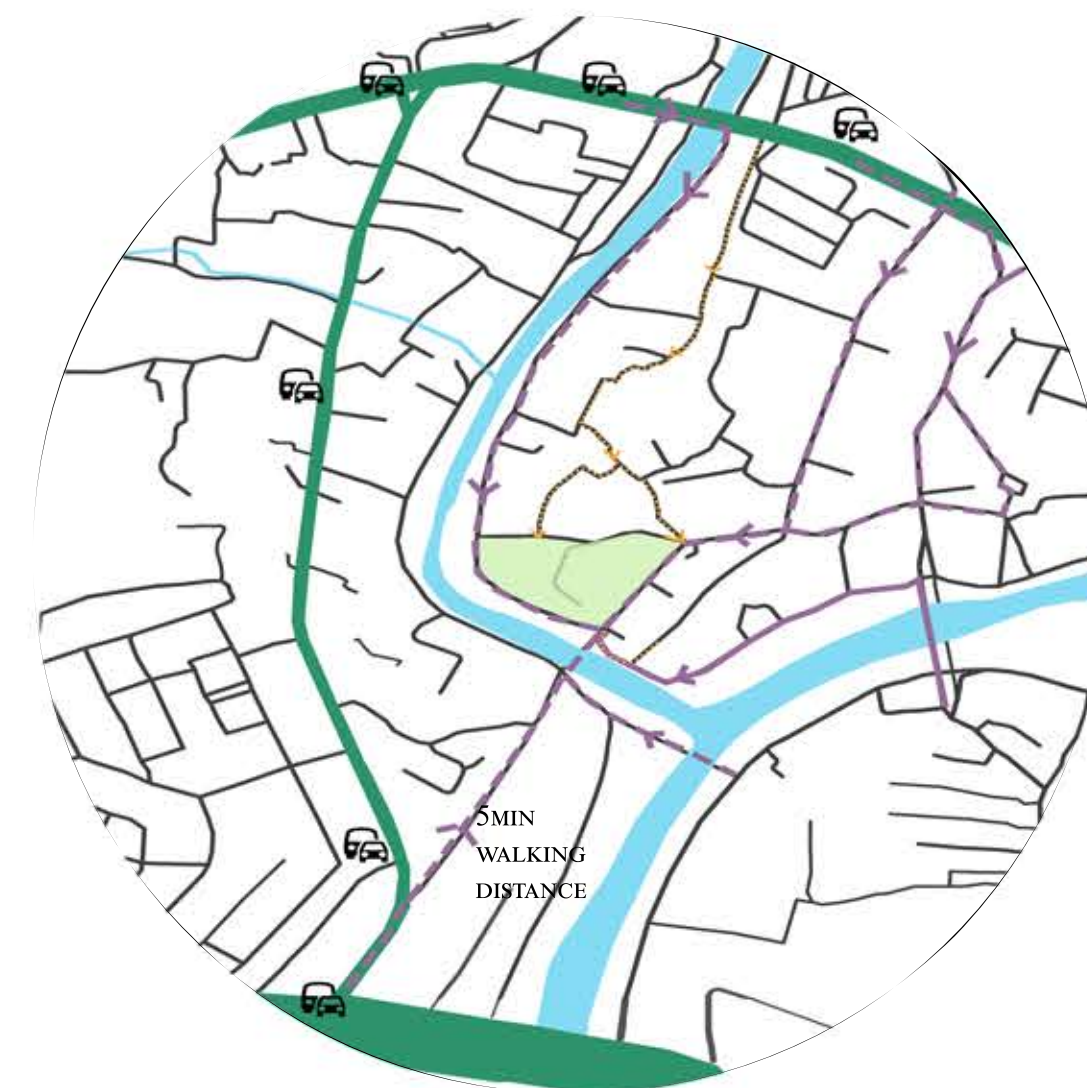
LOCATION : TEKUN DOVAN , WARD
12 OF KMC
AREA : 15270.92 M2 (30.02 ROPANI)
current use : waste transfer station



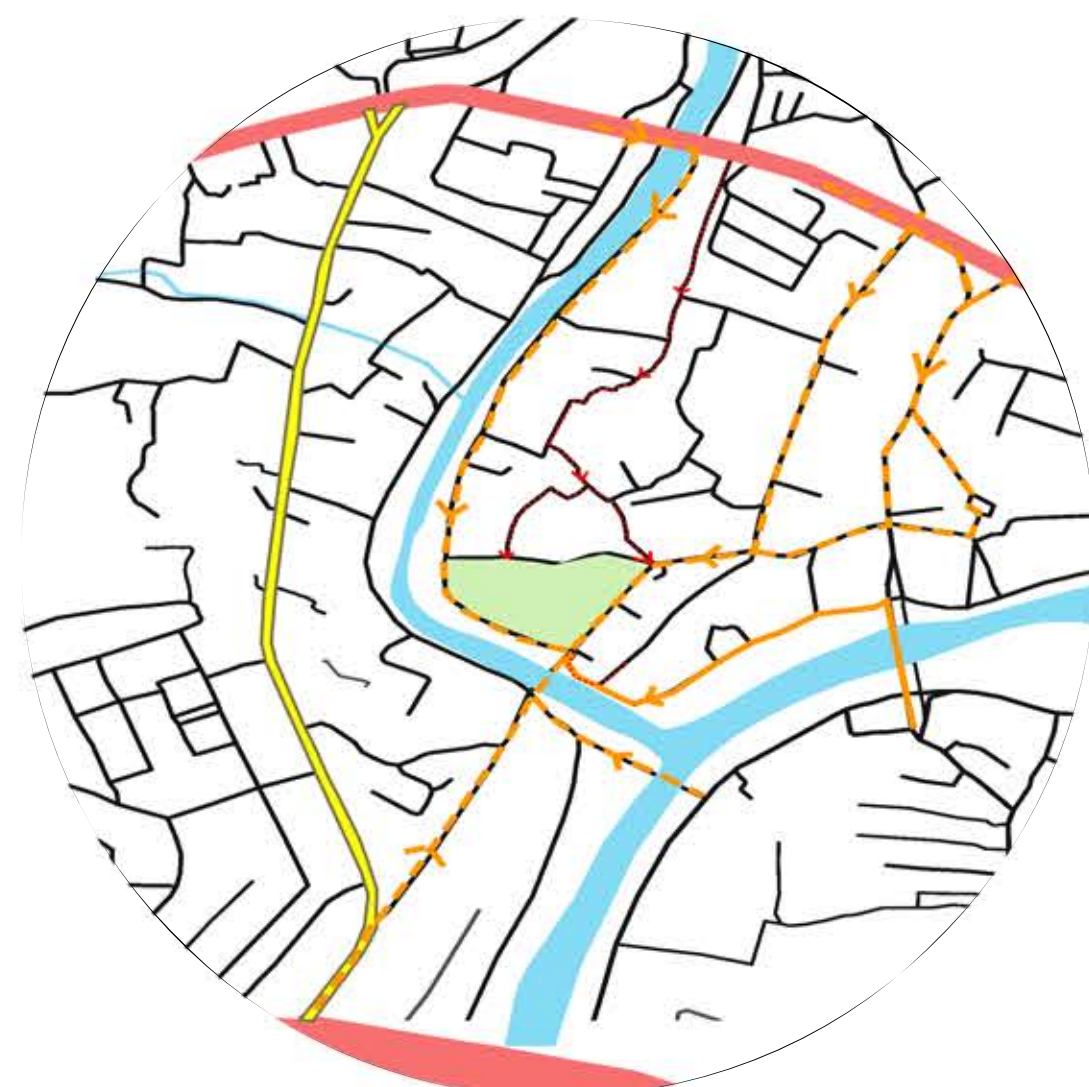
HISTORICAL TIMELINE OF SITE CONDITION



FIGURE GROUND



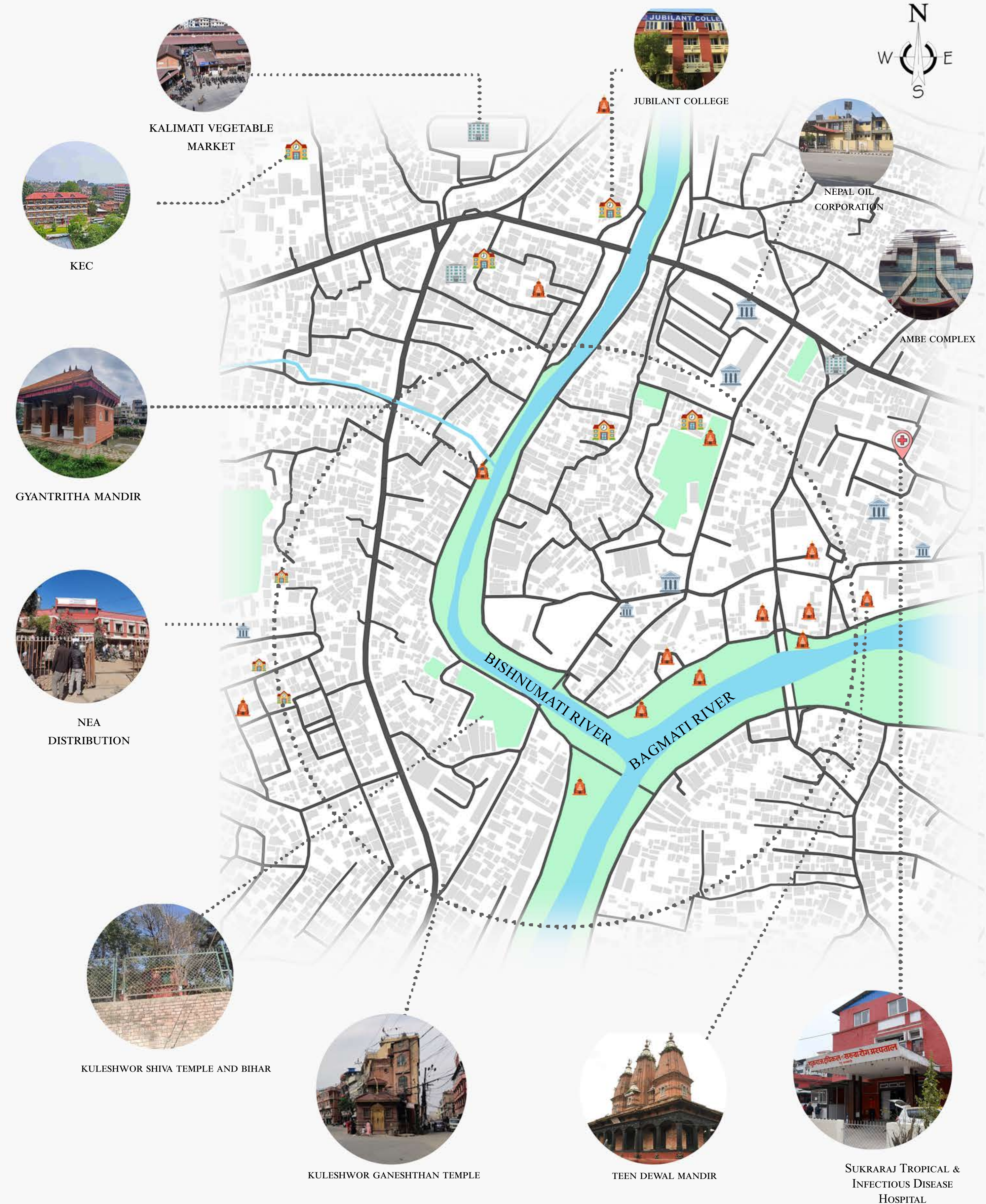
TRANSPORTATION ANALYSIS
PUBLIC VEHICLE EXCESS PRIVATE VEHICLE ROUTE



ACCESSIBILITY
MAIN ROAD SECONDARY ROAD SITE ACCESS ROAD



LAND USE ZONING
EDUCATION INSTITUTION RELIGIOUS
MIX USE RESIDENTIAL COMMERCIAL



NEIGHBOURHOOD CONTEXT



B. ARCH THESIS ON
TEKU SCIENCE CENTRE

TITLE:
SITE ANALYSIS

RINA THAPA (760132)
SUPERVISOR : AR. RIKESH SHRESTHA

View to the Site



NORTH VIEW



SOUTH VIEW



WEST VIEW



EAST VIEW

View from the Site



NORTH VIEW



SOUTH VIEW



WEST VIEW

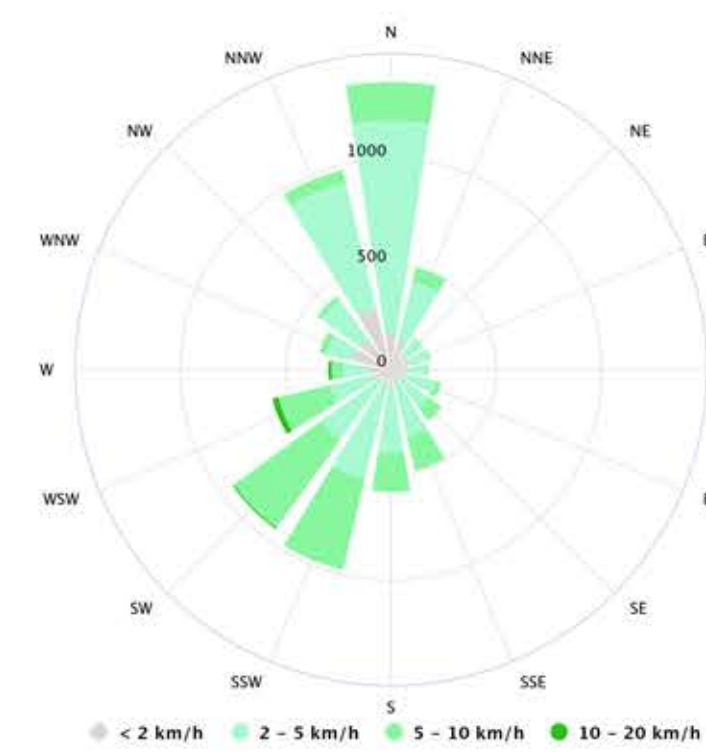


EAST VIEW

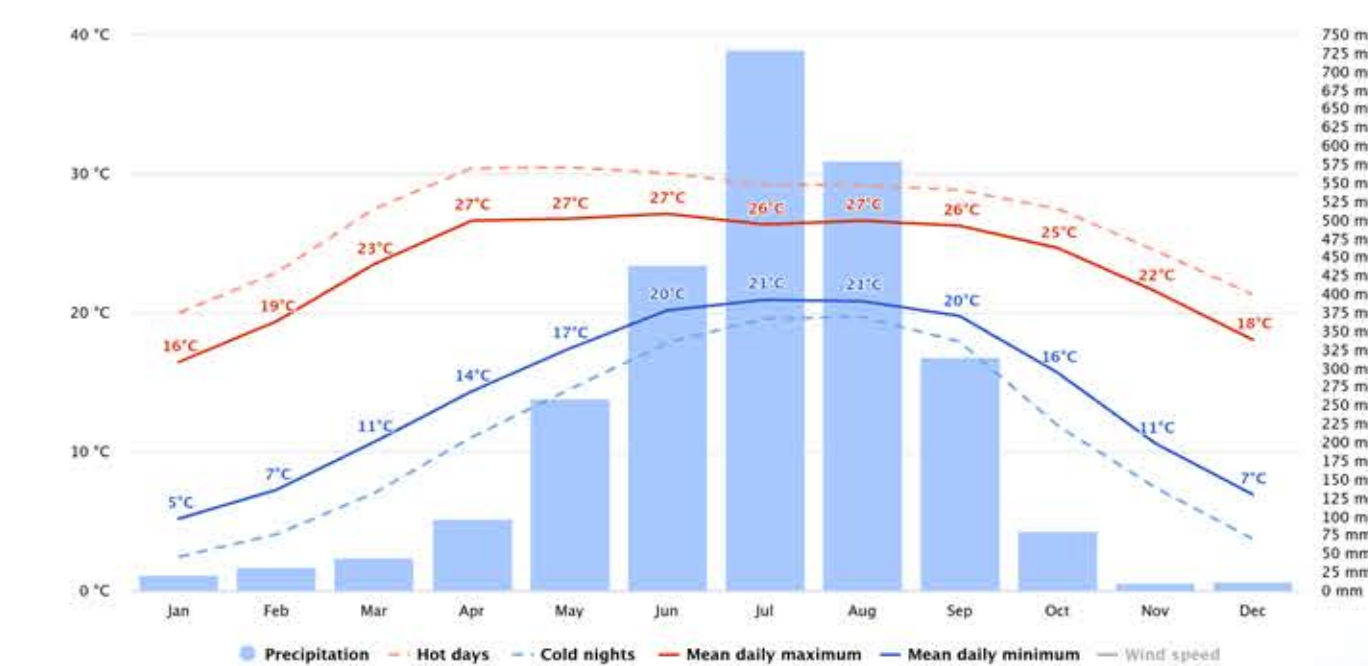
FLOODING ANALYSIS



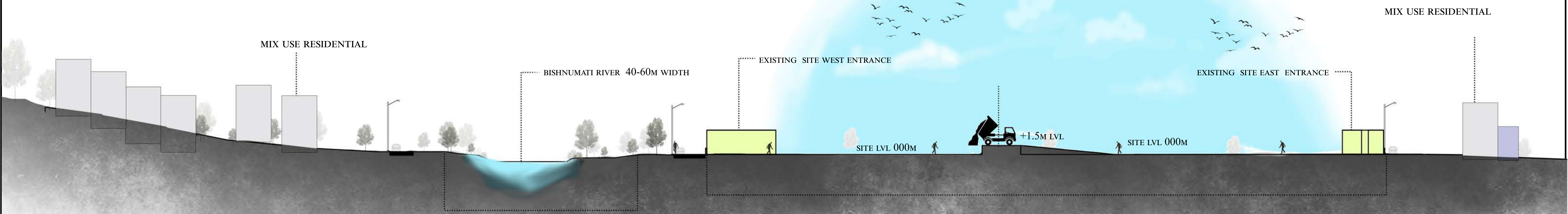
BY LAWS :
GROUND COVERAGE : 40 % of total land
FAR : 3
SET BACK : 3 M, (5 M for >17m height)
ROW : 14 meter secondary road
20 m buffer zone for tekun
15% of the total site area for parking



Kathmandu
27.70°N, 85.32°E (1317 m asl)
Model: ERA5



ECOLOGICAL ANALYSIS



SECTION AT X-X

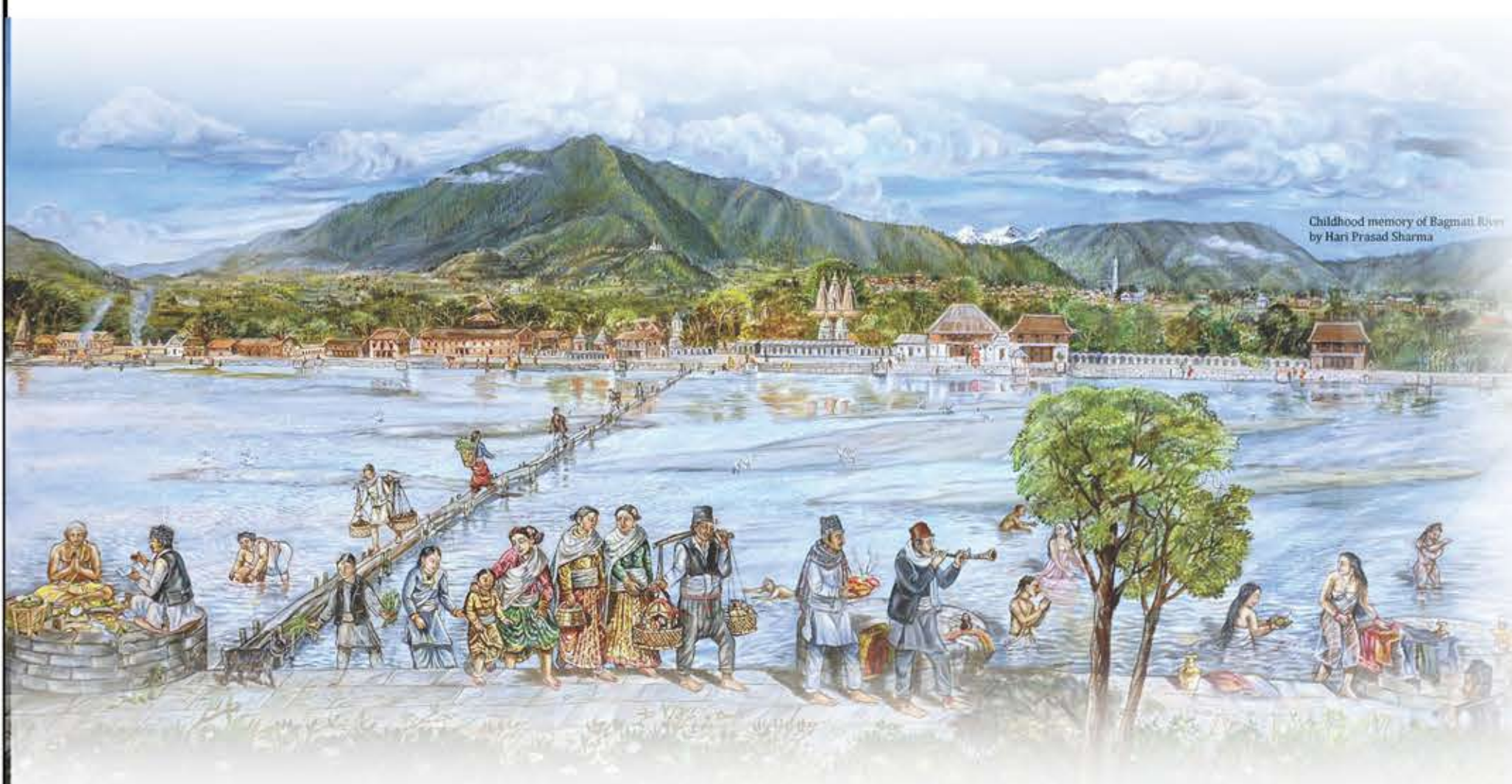


B. ARCH THESIS ON
TEKU SCIENCE CENTRE

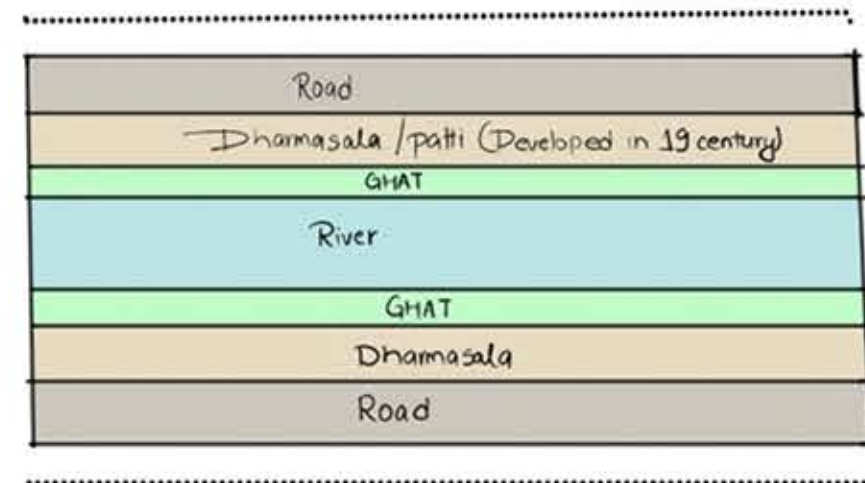
TITLE: SITE ANALYSIS

RINA THAPA (760132)
SUPERVISOR : AR. RIKESH SHRESTHA

RELIGIOUS AND CULTURAL ANALYSIS



RIVER AS A HOLY PLACES TO PERFORM RITUALS FROM CENTURY IN HINDU PRACTICES. MANY TEMPLE NEARBY DEVELOPED AND HAVE GHATS WHERE PILGRIMS PERFORM LAST RITUALS.



HISTORY :
TEKU DOVAN IS A HISTORICAL LANDMARK THAT HAS WITNESSED THE EVOLUTION OF KATHMANDU'S CIVILIZATION, RELIGIOUS TRADITIONS, AND TRADE NETWORKS. THE NEWAR COMMUNITY HAS LONG REGARDED TEKU AS A SACRED SITE, WITH MHA PUJA, INDRA JATRA, AND PACHALI BHAIKAV JATRA CLOSELY CONNECTED TO THE REGION.

VEGETATION ANALYSIS



PEEPAL TREE
RELIGIOUS
ROOT DEPTH- (20-25) FT
SPREADING 98 FT.



PAPAYA TREE
FRUIT
TREE HEIGHT 20 FT.
ROOT DEPTH 11.8 INCH



GULMOHAR TREE
ORNAMENTATION
TREE HEIGHT (5-12) M
ROOT DEPTH 1.5 TIMES
TREE HEIGHT



KAIYO TREE
SHADE
TREE HEIGHT 35M
ROOT DEPTH (1.5-3) TIMES
TREE HEIGHT



KULESHWOR TEMPLE



GYANTIRTHA TEMPLE



RADHA KRISHNA TEMPLE



GHAT AREA



JAGGANNATH TEMPLE



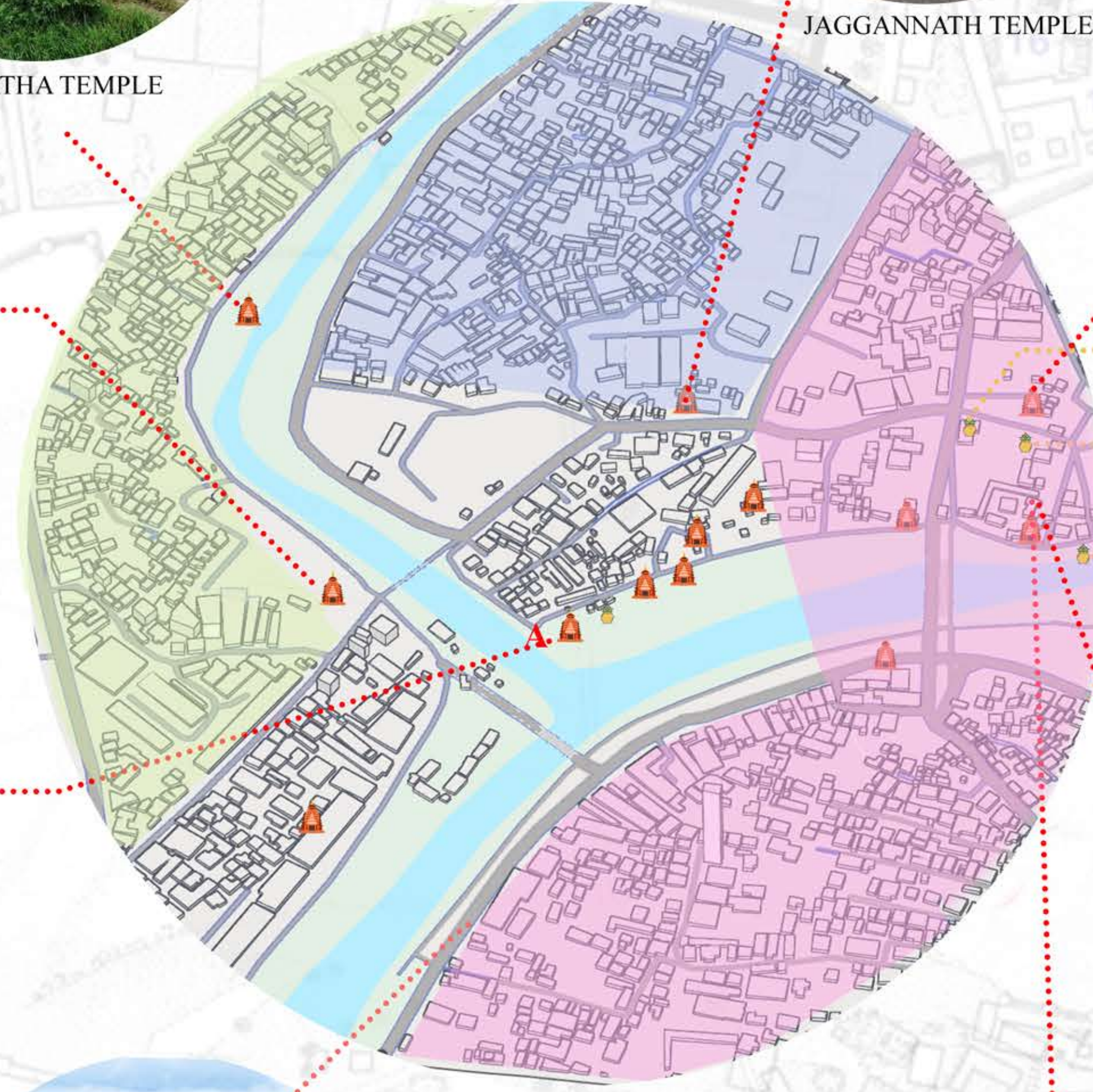
PACHALI BHAIKAV



LAXMISHWOR MAHADEV



TEEN DEWAL MANDIR



INDEX

- TRADE ROUTE
- INSTITUTIONAL ZONE
- OLD SETTLEMENT ZONE
- GHAT
- TEMPLE

S

W

O

T

- ✓ Strategic Location
- ✓ Proximity to Educational Institutions
- ✓ Large Site Area
- ✓ Urban Regeneration
- ✓ Educational and Cultural Importance:
- ✓ Potential for Sustainability:

- ⚠ Pollution & Contamination Risks
- ⚠ Flooding Risk
- ⚠ bad odors, attracts pests
- ⚠ Urban Congestion (🚗):

- 🌍 Urban Redevelopment Potential
- 🌿 Environmental Awareness & Conservation
- 🎓 Educational Tourism & Research Growth
- 🏛️ Government & Policy Support
- 💰 Public-Private Partnership (PPP) Opportunities

- ⚡ Flooding and Climate Change budget constraints
- ⚡ Seismic Activity and Natural Disasters



B. ARCH THESIS ON
TEKU SCIENCE CENTRE

TITLE: SITE ANALYSIS

RINA THAPA (760132)
SUPERVISOR : AR. RIKESH SHRESTHA

DAILY VISITORS		
TOTAL STUDENT POPULATION (KATHMANDU VALLEY)	700,000 – 800,000	APPROX. 60% OF TOTALPOPULATION
ESTIMATED SCIENCE ENTHUSIASTS (20%)	140000	20% OF STUDENT POPULATION
MONTHLY VISITORS (10% OF ENTHUSIASTS)	14000	10% OF 140,000
DAILY VISITORS ON WEEKDAYS (60% WEEKDAYS)	420 STUDENTS / DAY	8,400 ÷ 20 WEEKDAYS
DAILY VISITORS ON WEEKENDS (40% WEEKENDS)	700 STUDENTS/ DAY	5,600 ÷ 8 WEEKEND DAYS
PEAK SEASON ADJUSTMENT (+20-30%)	2000 -2500 STUDENTS / DAY	DURING HOLIDAYS AND EVENTS

1. ENTRANCE AND RECEPTION AREA			
SPACE	Unit Area (sqm)	No. of Units	Total Area (sqm)
Main entrance lobby	100	1	100
Reception/Info Desk	20	1	20
Ticket counter	25	2	50
Security/Baggage Check	15	2	30
Gift shop/Bookstore	40	1	40
Guard House / Services	20	1	20
Visitor’s Lounge/Waiting	150	1	150
Total (Entrance Area)	USER (100)		410SQM

2. EXHIBITION GALLERIES (CORE SCIENCE ZONES)			
SPACE	Unit Area (sqm)	No. of Units	Total Area (sqm)
PHYSICS ZONE (energy, motion, and forces)	200	2	400
CHEMISTRY ZONE (molecular interactions and reactions)	200	2	400
BIOLOGY ZONE (evolution, ecosystems, and life processes)	200	2	400
GEOLOGY ZONE (earth’s formation, minerals, and tectonic studies)	200	2	400
ASTRONOMY ZONE (celestial bodies, space exploration, and cosmic phenomena)	200	2	400
Total (learning spaces)	USER (500-1000)		1800SQM

3. RESEARCH AND INNOVATION HALL			
SPACE	Unit Area (sqm)	No. of Units	Total Area (sqm)
STEM LAB	100	2	200
ROBOTICS & CODING LAB	80	1	80
VR/AR SIMULATION ROOM	40	4	160
SCIENCE QUIZ/ACTIVITY ZONE	60	5	300
RESEARCH LABS	60	2	120
LIBRARY & DIGITAL RESOURCE	80	1	80
INVENTION AND DISCOVERY (5 EACH)	80	5	400
Total (learning spaces)	USER (150)		1340SQM

4. EVENT AND WORKSHOPS HALLS			
SPACE	Unit Area (sqm)	No. of Units	Total Area (sqm)
MAIN EVENT (200 SEATS)	250	2	500
WORKSHOPS (60 SEATS)	150	2	300
MULTIPURPOSE HALL	100	1	100
PLANETARIUM (100)	400	1	400
TOTAL (LARGE GATHERING AREA)	USER (300)		1300SQM

5. OUTDOOR SCIENCE PARK			
SPACE	Unit Area (sqm)	No. of Units	Total Area (sqm)
PHYSICS PLAYGROUND (gravity exhibits like pendulum swings and inclined plane experiments)	150	1	150
BOTANICAL GARDEN (plant and evolutionary -dinosaurs park)	200	2	400
WEATHER OBSERVATION STATION	50	1	50
ASTRONOMY PARK (sundial with traditional Newari design)	100	2	200
WASTE MANAGEMENT PARK	50	1	50
TOTAL (OUTDOOR PARK)	USER (200)		850SQM

6. ADMINISTRATIVE BLOCK			
SPACE	Unit Area (sqm)	No. of Units	Total Area (sqm)
DIRECTOR’S OFFICE	20	1	20
STAFF ROOM	40	3	120
MEETING ROOM	40	1	40
STORAGE/ARCHIVE	30	1	30
MAINTENANCE ROOM	30	1	30
ACCOUNT	30	1	30
ADMINISTRATION	30	1	30
EVENT MANAGER	30	1	30
EDUCATOR ROOM (4)	30	4	120
RESEARCHER ROOM (3)	20	3	60
TOTAL (ADMIN BLOCK)	USER (25)		510SQM

7. CAFETERIA & DINING AREA			
SPACE	Unit Area (sqm)	No. of Units	Total Area (sqm)
KITCHEN	50	1	50
DINING AREA (INDOOR)	100	1	100
DINING AREA (OUT DOOR)	50	1	50
KITCHEN GARDEN AND LEARNING	50	1	50
TOTAL (CAFETERIA)	USER (100)		250sqm

8. PARKING & SERVICE AREA			
SPACE	Unit Area (sqm)	No. of Units	Total Area (sqm)
VISITOR PARKING (45 CARS)	15	45	675
STAFF PARKING (15 CARS)	15	15	225
STAFF PARKING (75 BIKE)	3	75	225
VISITOR PARKING (150 BIKE)	3	150	450
BUS (5)	40	5	200
TOTAL (CAFETERIA)	USER (100)		1775SQM

FINAL AREA SUMMARY	
SPACE CATEGORY	Total Area (sqm)
1. ENTRANCE & RECEPTION AREA	410
2. EXHIBITION GALLERIES	1800
3. RESEARCH & INNOVATION HALLS	1340
4. AUDITORIUM & SEMINAR HALLS	1300
5. OUTDOOR SCIENCE PARK	850
6.ADMINISTRATIVE BLOCK	510
7. CAFETERIA & DINING AREA	250
8. PARKING & SERVICE AREA	1775
TOTAL	8235SQM
BUILDING SERVICES (10%) + 5% TOILETS	1235.25 SQM (9470.75M2)
CIRCULATION AREA (30% OF TOTAL AREA)	2841.07sqm
TOTAL AREA INCLUDING CIRCULATION	12,311.37sqm

AREA CALCULATION :
TOTAL SITE AREA : 15270.29 SQ M
VISITOR UPPTO 2000 TO 3000 ON EVENT DAYS
NORMAL DAYS :500 TO 1000 ON WEEKEND

FINANCIAL CALCUATION :

FOR SCIENCE EXHIBITS
1. FOR STUDENT : RS 50
2. FOR OTHER : RS75

FOR PLANETERIUM SHOWS
1. FOR STUDENT = RS 150
2. FOR OTHER = RS 200

EVENTS ARE FREE FOR ORGANIZER AND GENERAL PUBLIC
WORK CONDUCTED ON BASIS OF MODULES

SYNCRETISM:

SITE'S CONTEXT, CULTURAL MEMORY, AND ENVIRONMENTAL REALITIES.

The design concept for the Science Center is rooted deeply in the site's context, cultural memory, and environmental realities. Located at Teku Dovan, the confluence of the Bagmati and Bishnumati rivers, the site holds not only spiritual significance but also presents unique design opportunities and challenges. The proposed concept is a synthesis of five interconnected design ideas. This confluence symbolizes unity, transition, and energy flow, paralleling the convergence of scientific disciplines in the center.

DESIGN PROBLEM

FLOOD RISK

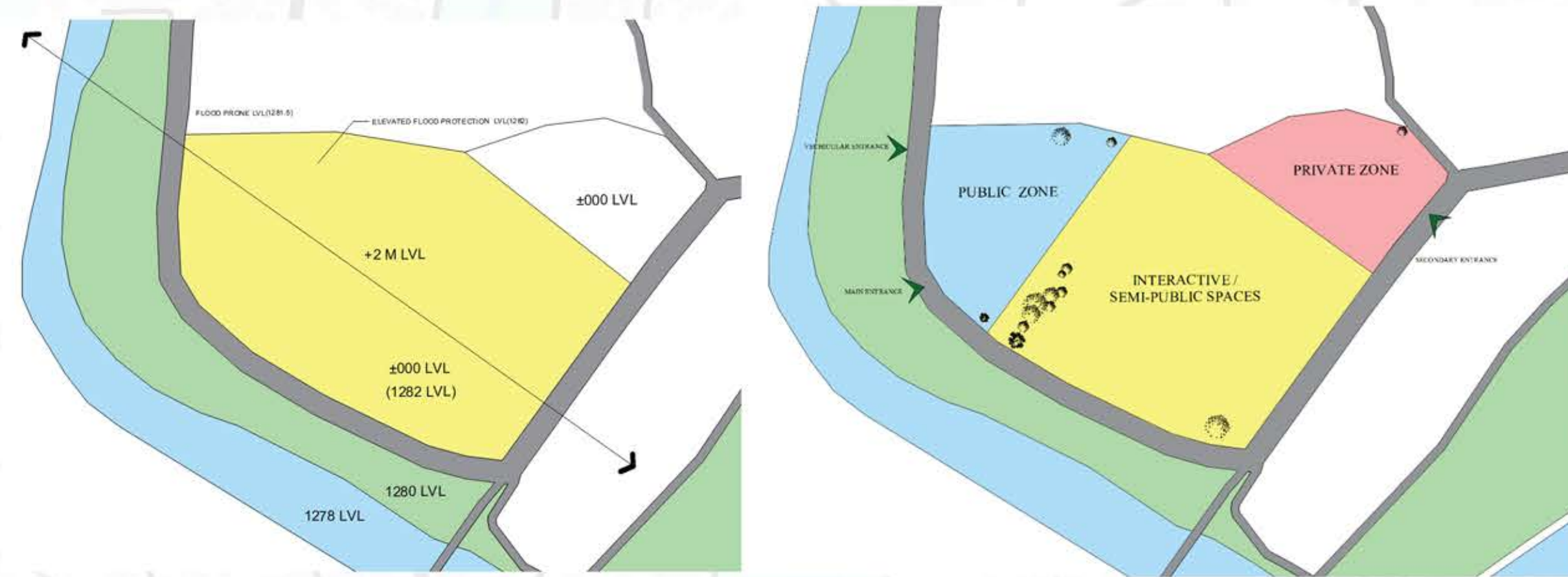
CULTURAL INTEGRATION

SCIENCE CENTER

DESIGN SOLUTION

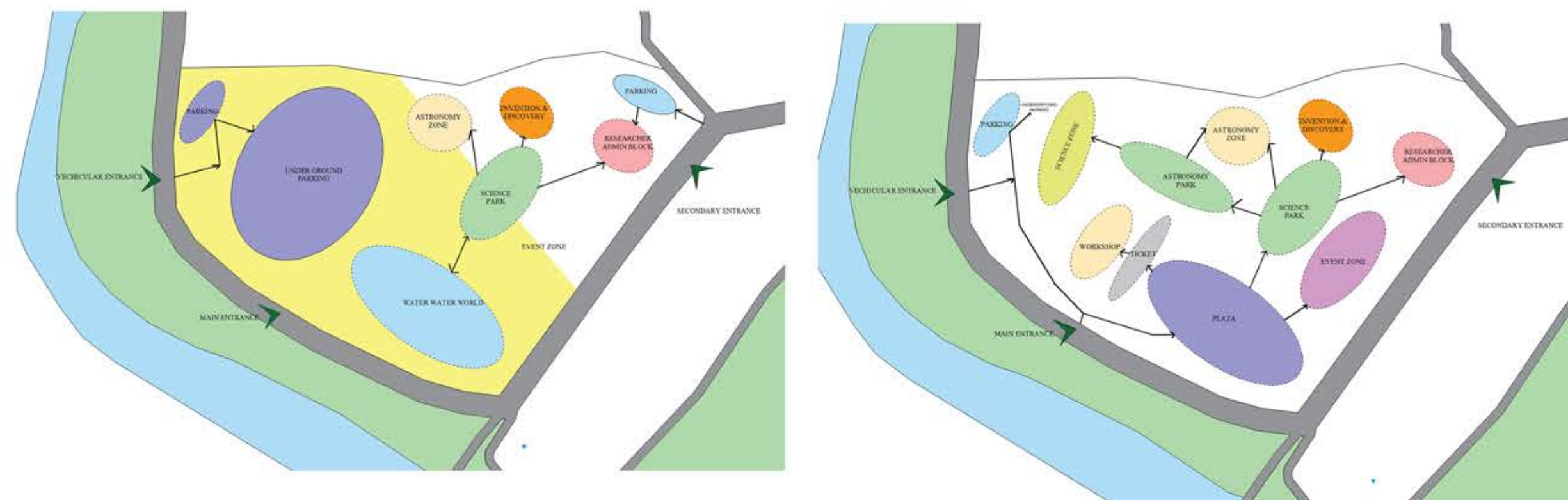
Raising platform
Stilted Design / Bouyant st.
Science park with wetland
ecosystem porous landscape

circulation based in newari
settlement
Cultural facade / material use
Vegational preference



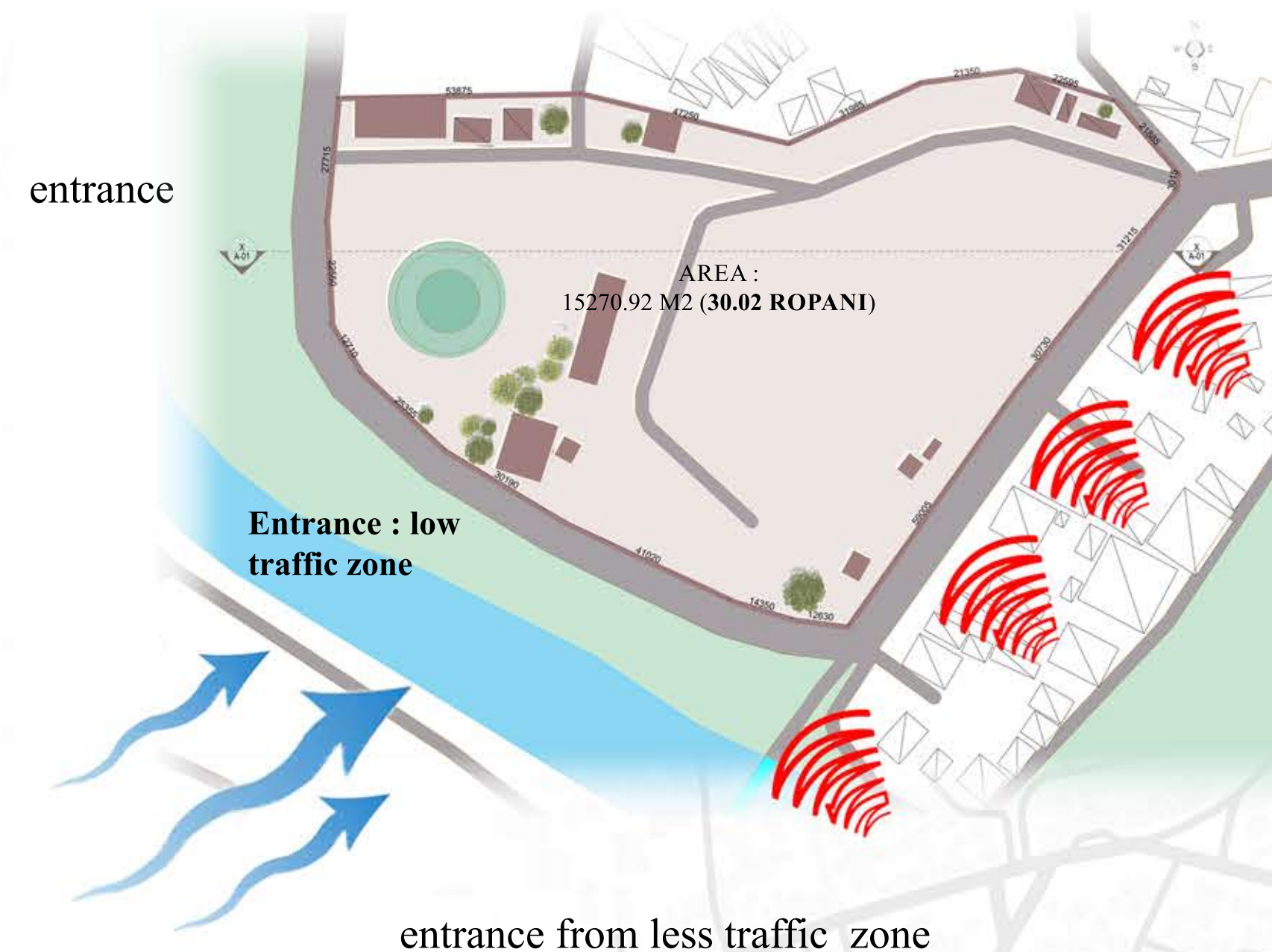
Flood Resilience – Elevated Platforms

Given the flood-prone nature of the riverfront site, a strategic landscape-based flood mitigation approach is adopted. The entire built form is raised on elevated platforms (first-floor plinth level), allowing for safe occupancy while the ground plane functions as a flood-absorbing buffer



Curriculum-Based Spatial Learning

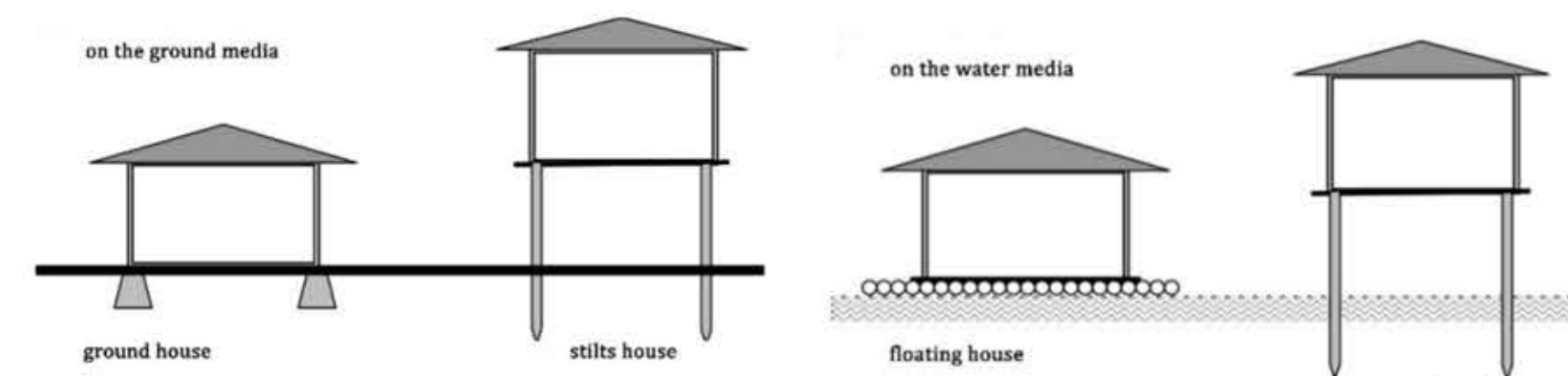
The idea is to mimic the progressive nature of scientific education in Nepal, allowing students and visitors to "walk through the syllabus" spatially—from basic phenomena to advanced principles.



entrance from less traffic zone

SITE DRIVEN

Structural Flood Mitigation Strategies

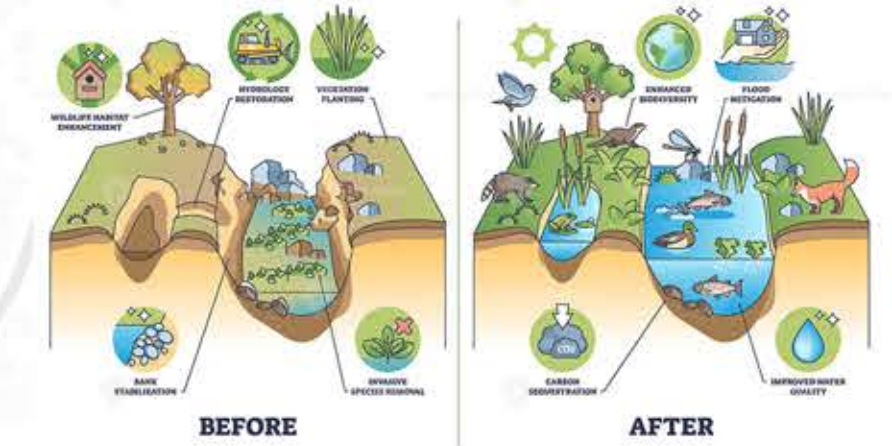
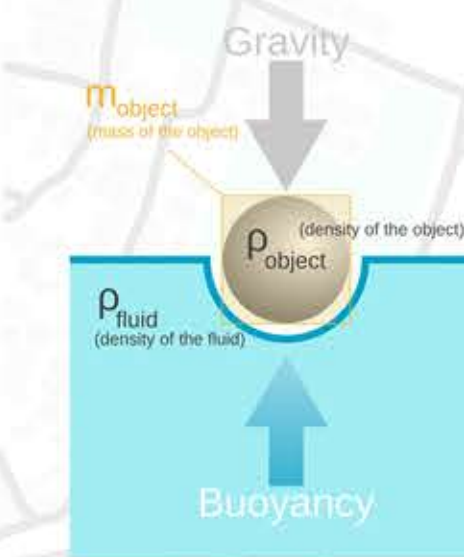


Amphibious & Floating Structure
Elevation & Land Grading
Vegetation Barriers & Riverbank Reforestation

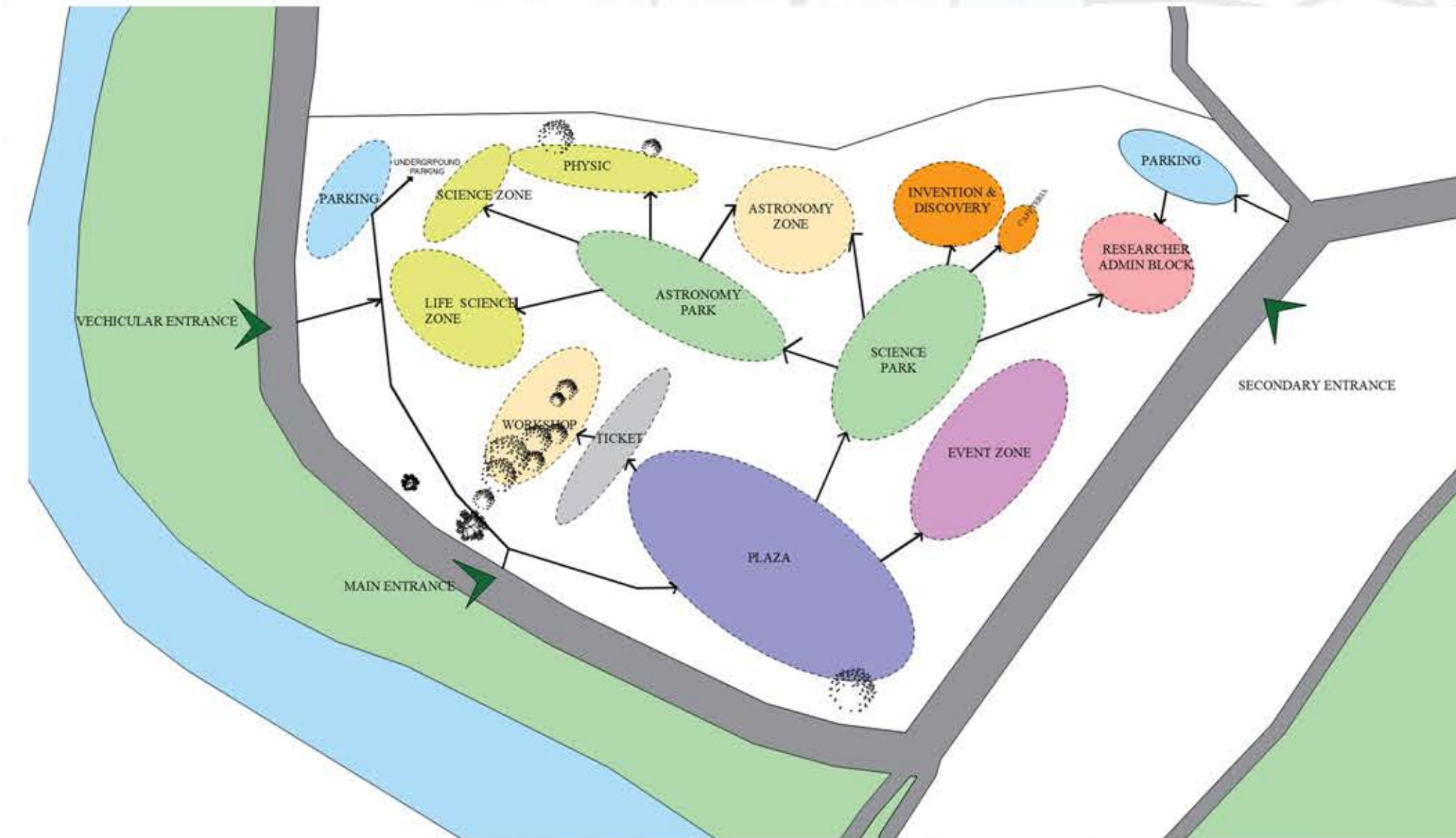


A primary axial alignment runs from the entrance toward Teku Dovan.

AXIS CONCEPT



Wetland
Green Roofs & Rain Gardens



CULTURAL BASED

Cultural and Site-Based Inspiration

Inspired by the traditional Newari settlement pattern, the layout integrates a series of small courtyards hidden within narrow transitional paths. These compressed-to-expanded spaces evoke surprise and curiosity, mirroring the process of scientific exploration

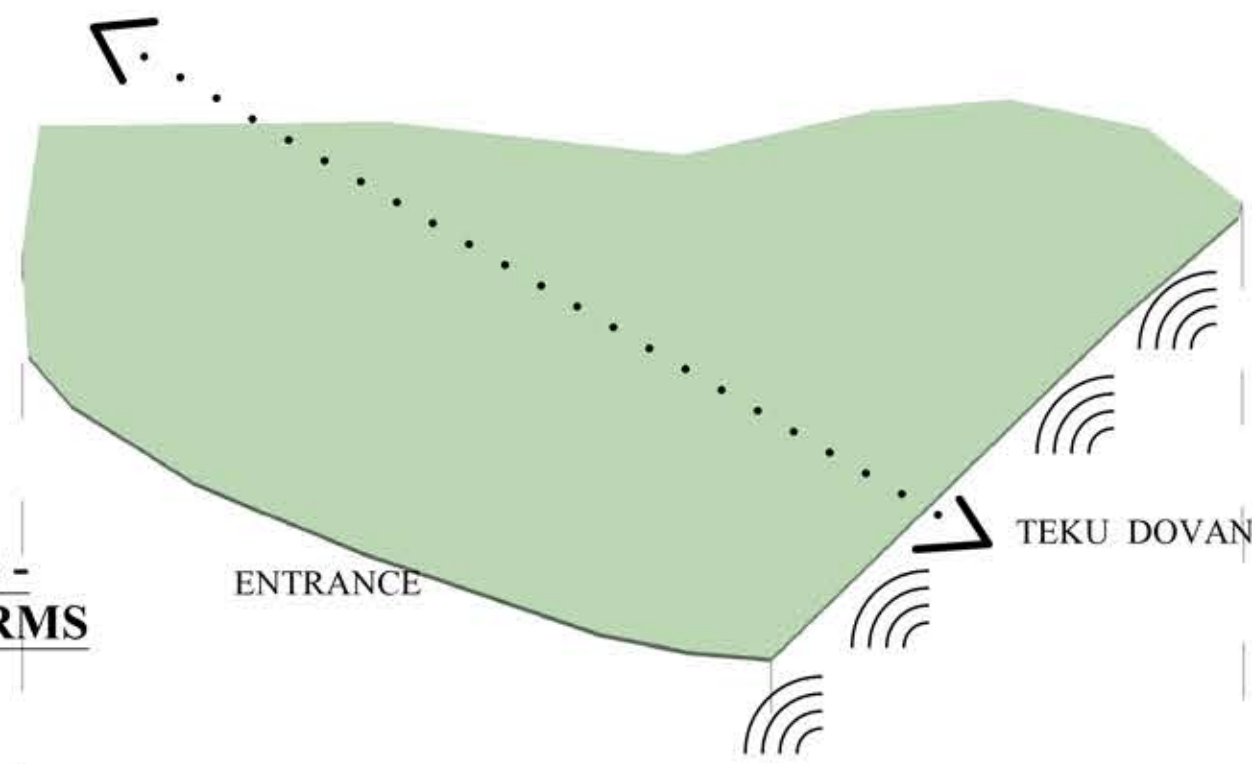


NATURAL BASED

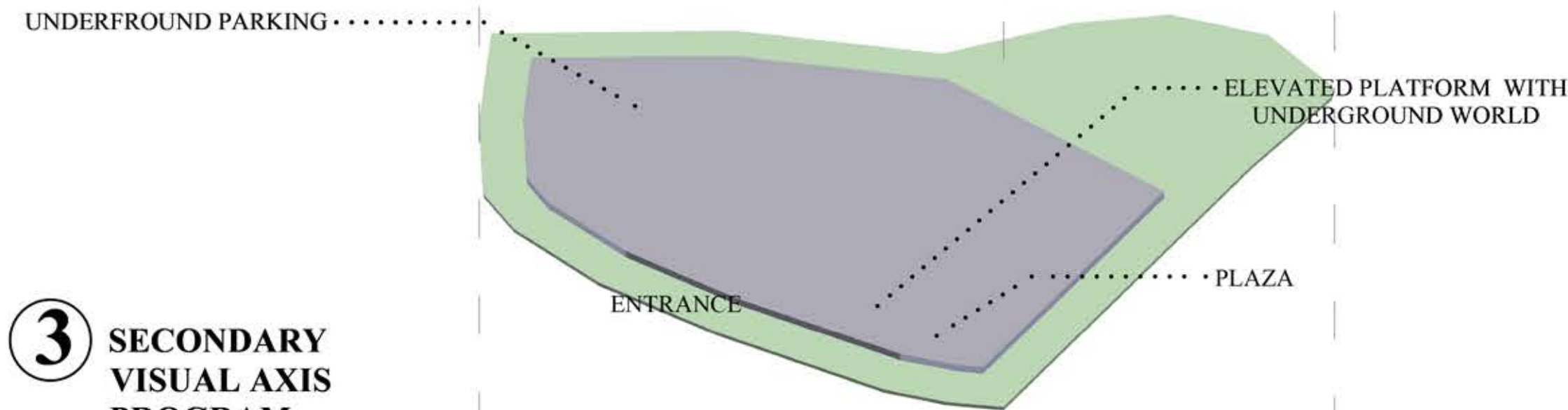
The design respects and preserves existing mature trees, integrating them into courtyards, walkways, and public gathering spaces to provide natural shade, character, and ecological value



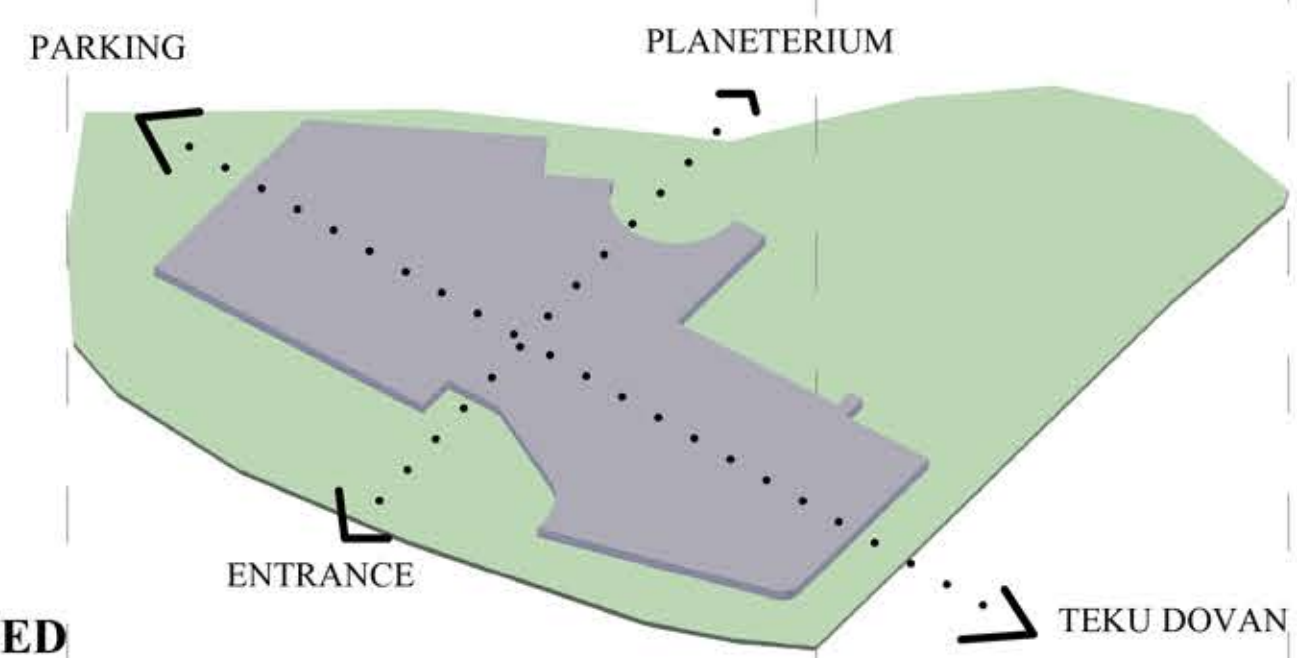
1 AXIS CONCEPT



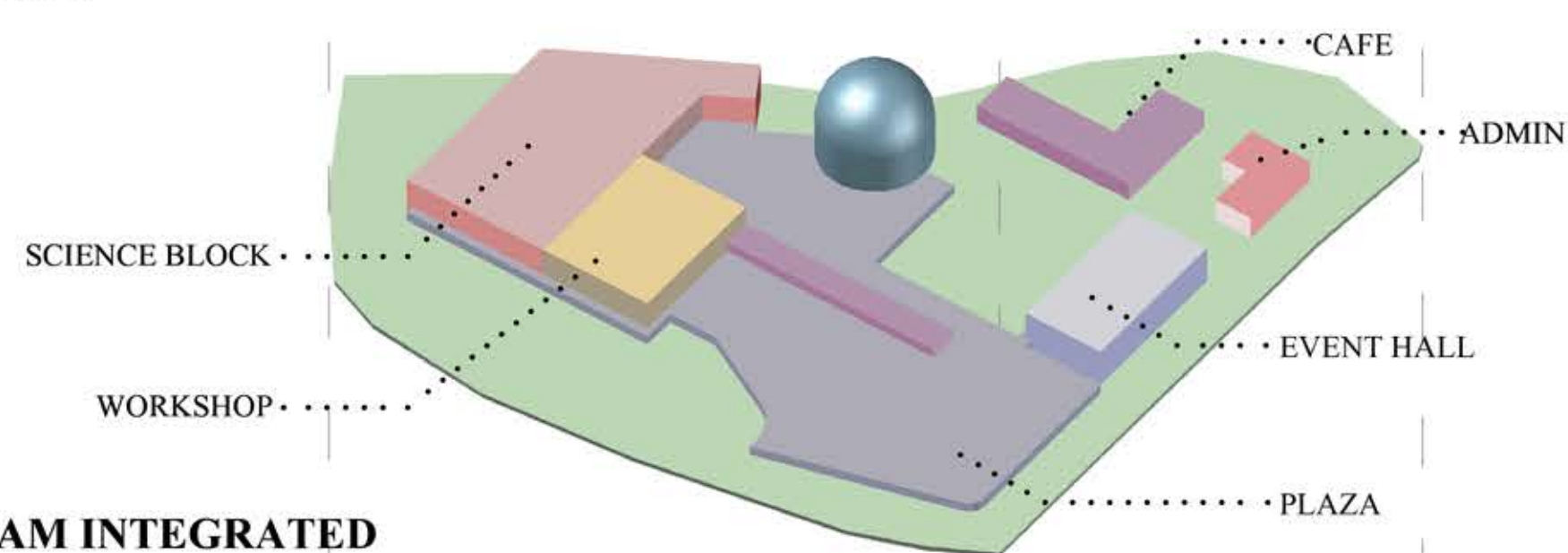
2 FLOOD RESILIENCE - ELEVATED PLATFORMS



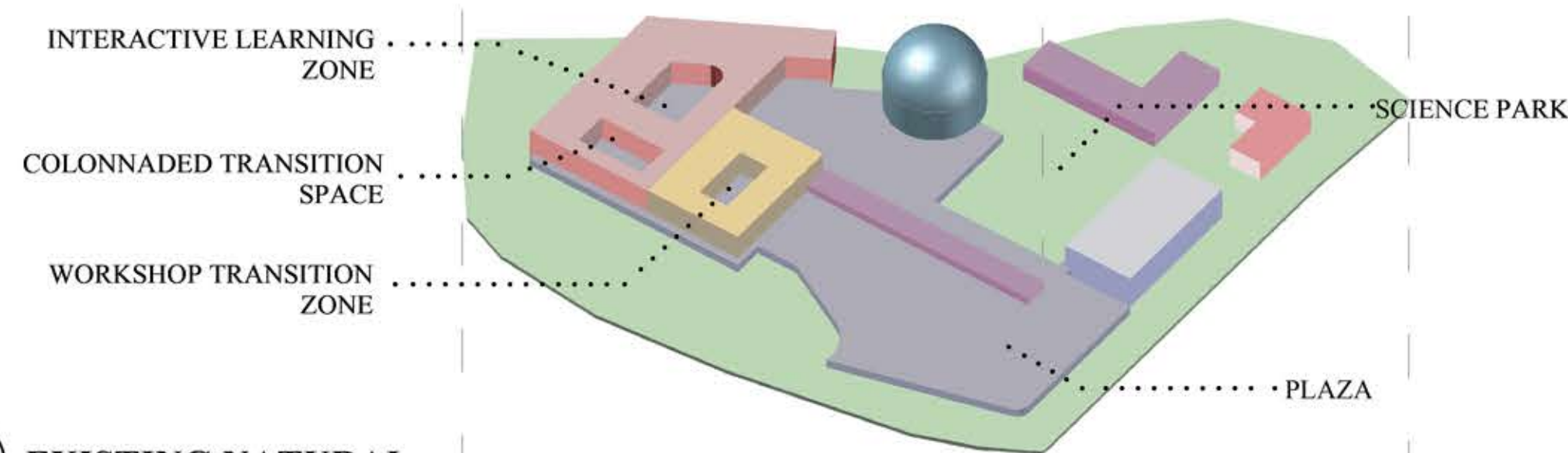
3 SECONDARY VISUAL AXIS PROGRAM



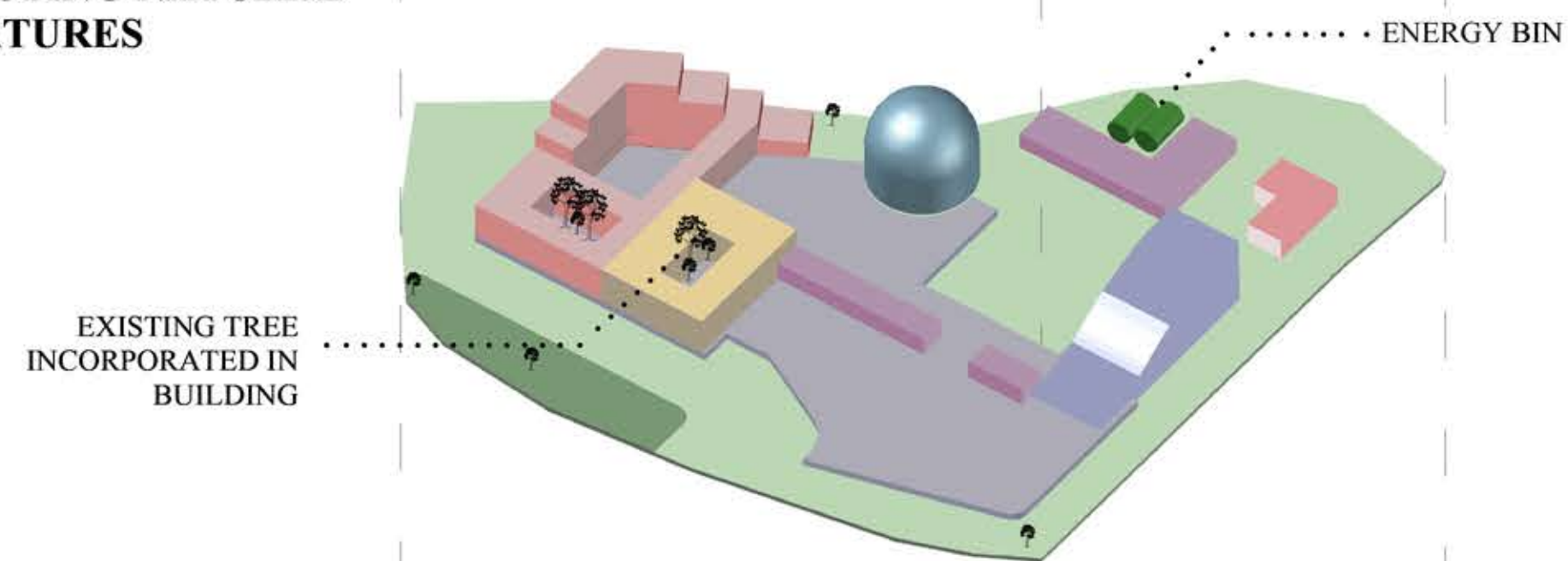
4 CURRICULUM-BASED PROGRAM



5 PROGRAM INTEGRATED WITH CULTURE



6 EXISTING NATURAL FEATURES



FACADE AND DESIGN

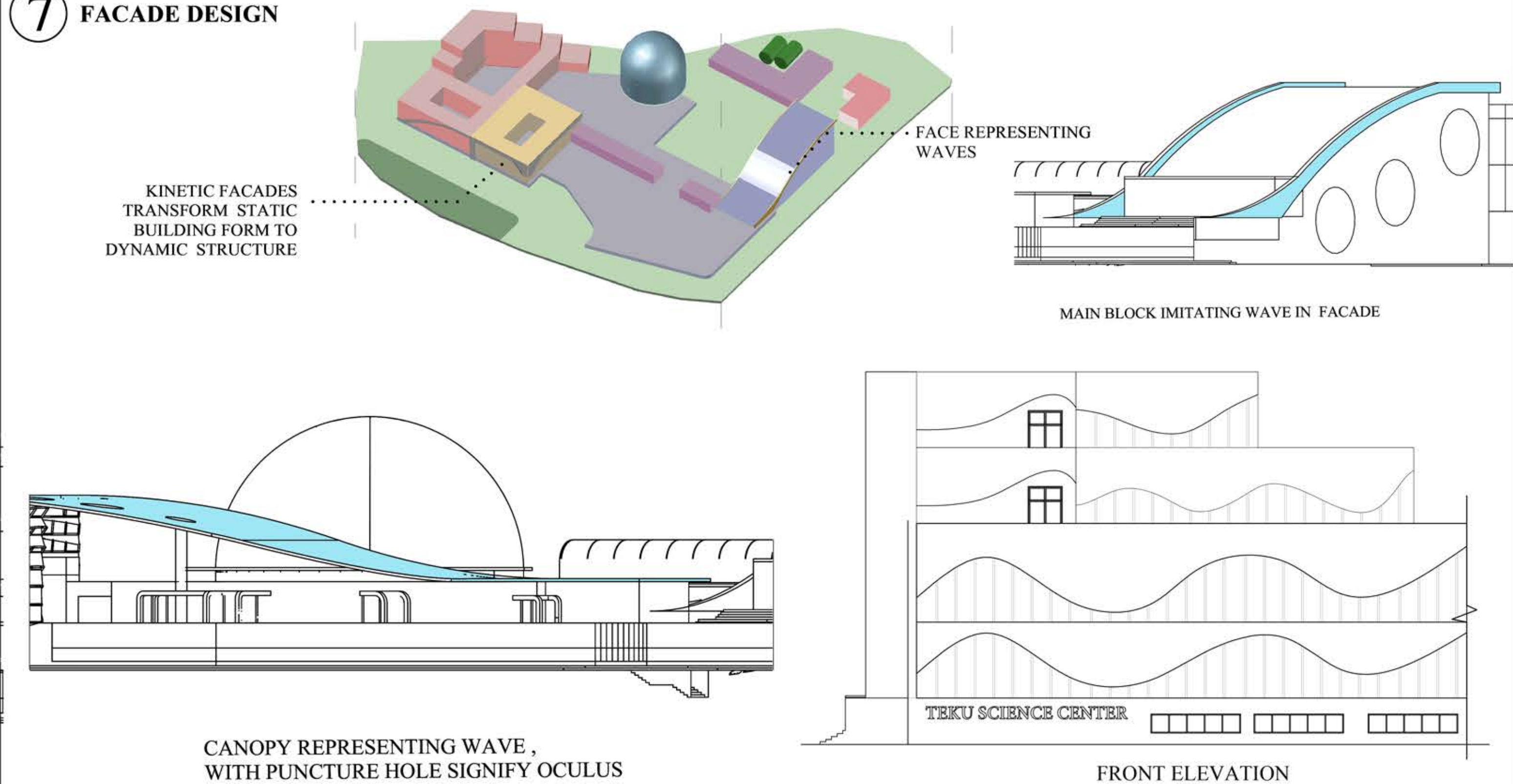
The Teku Science Center, located at the sacred confluence of the Bagmati and Bishnumati Rivers, draws its architectural inspiration from the natural wave motion of the rivers. These flowing waves symbolize energy, knowledge, and continuity—core principles of science and discovery.

To express this dynamic idea architecturally, the facade is designed as a kinetic system, mimicking the rhythmic movement of river waves. This kinetic facade uses lightweight, responsive panels that shift with wind or light, creating a living, breathing skin for the building. Just as the river is never static, the building also never appears the same—symbolizing the ever-evolving nature of science.



IMITATIONS OF WAVE

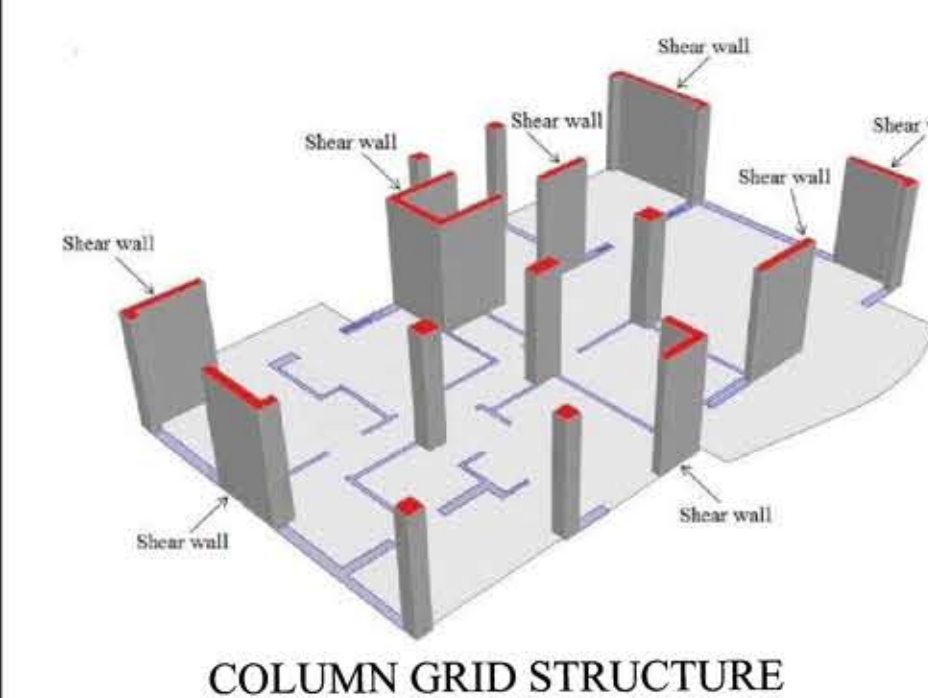
7 FACADE DESIGN



MATERIAL AND TECHNOLOGY

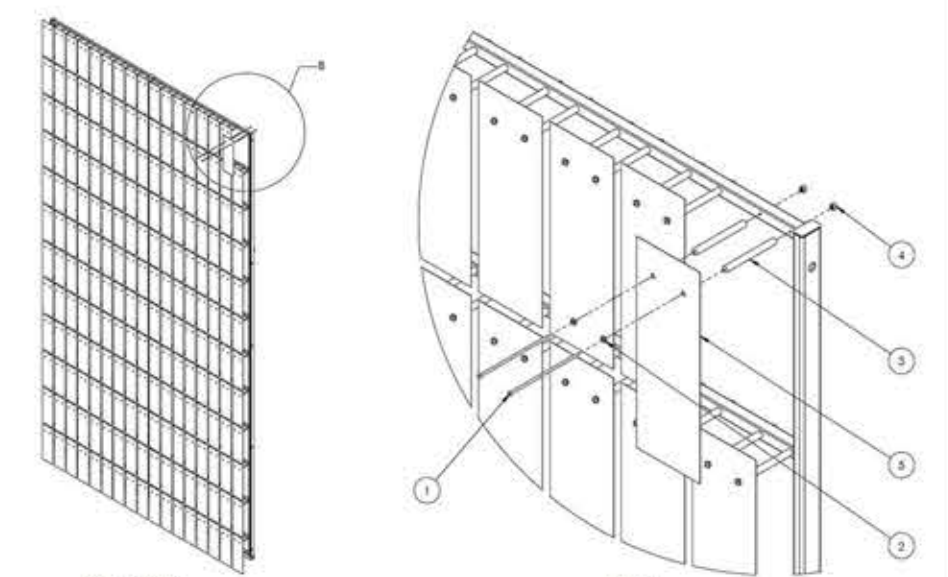
KINETIC FACADE

The kinetic elements help in passive cooling, shading, and ventilation, blending sustainable design with a strong contextual narrative rooted in local geography and motion of water.



TUBE

PVC SHEET



PILER WITH SHEAR WALL IN PLAZA



Bricks

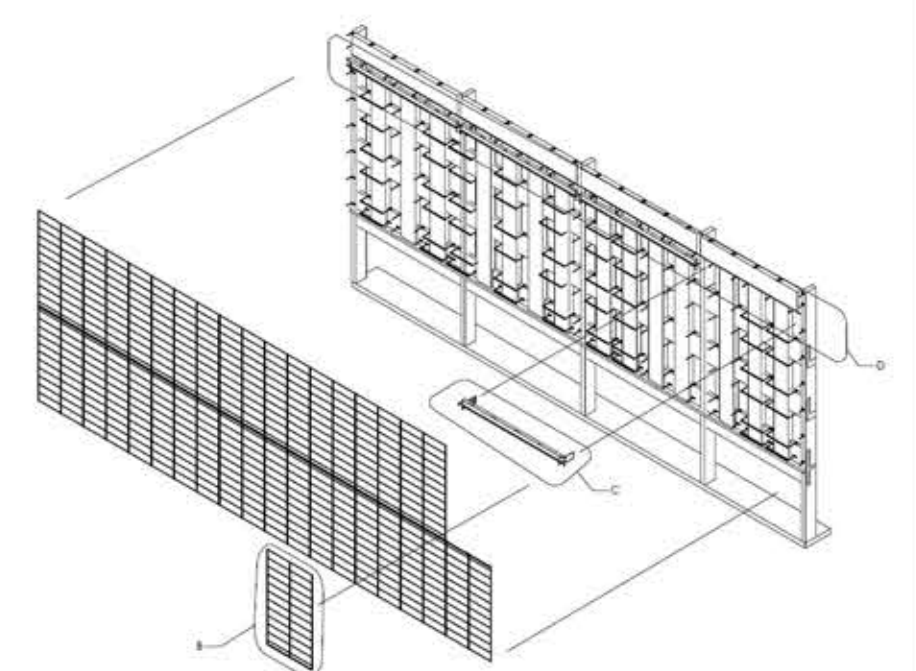
Cement

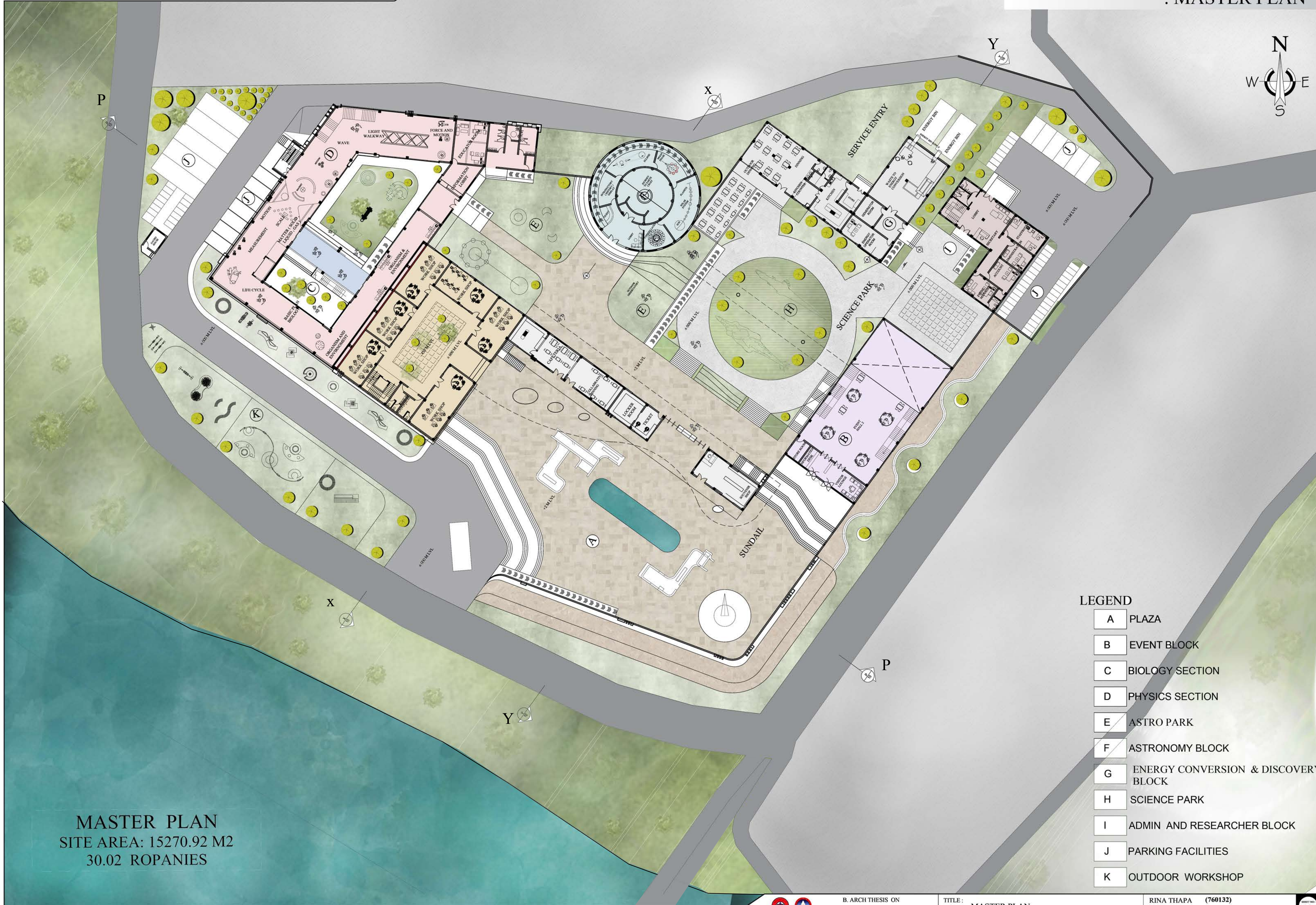
Concrete

Sand

Reinforcement

Glass

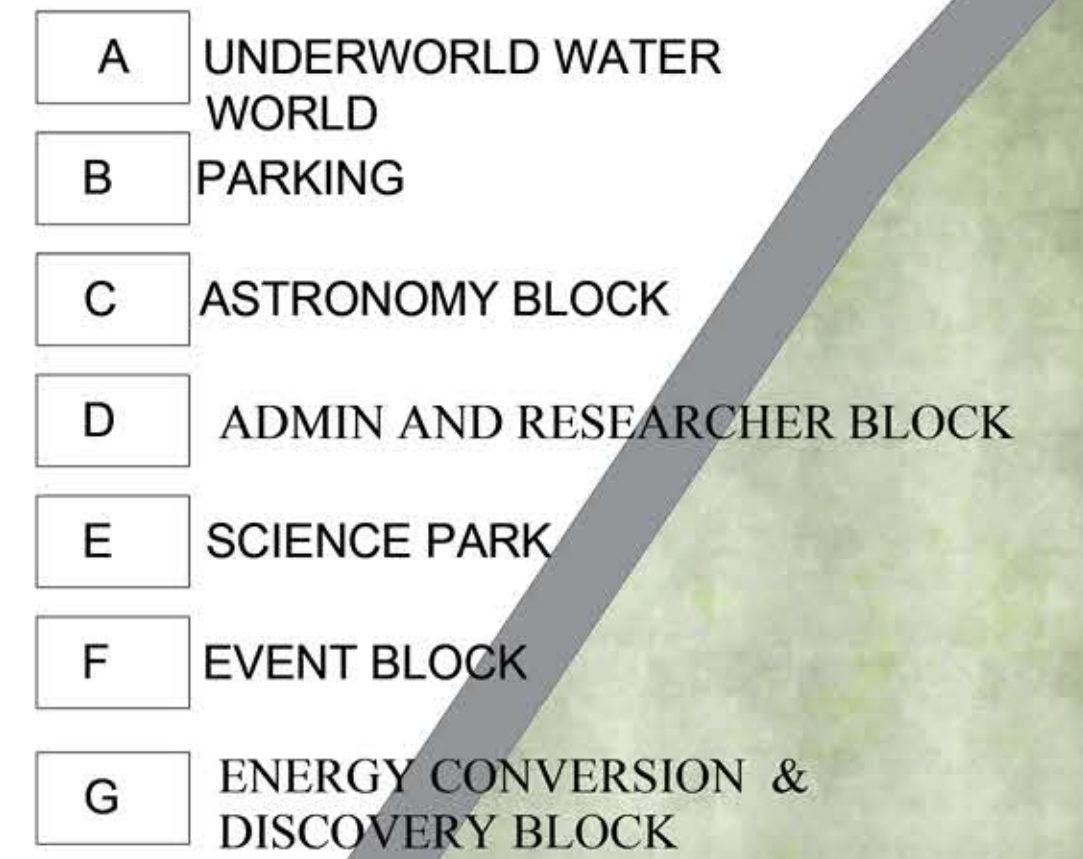




MASTER PLAN
SITE AREA: 15270.92 M2
30.02 ROPANIES

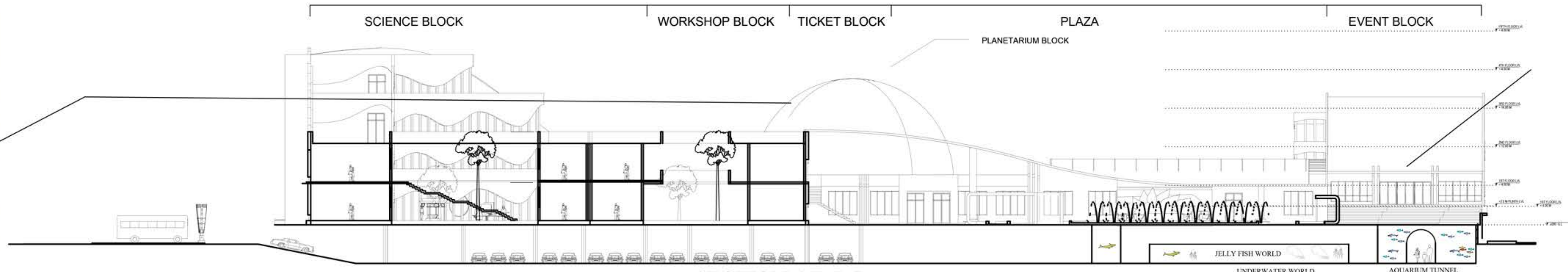
- LEGEND
- A PLAZA
 - B EVENT BLOCK
 - C BIOLOGY SECTION
 - D PHYSICS SECTION
 - E ASTRO PARK
 - F ASTRONOMY BLOCK
 - G ENERGY CONVERSION & DISCOVERY BLOCK
 - H SCIENCE PARK
 - I ADMIN AND RESEARCHER BLOCK
 - J PARKING FACILITIES
 - K OUTDOOR WORKSHOP







SITE PLAN





EAST SIDE PROFILE SECTIONAL ELEVATION



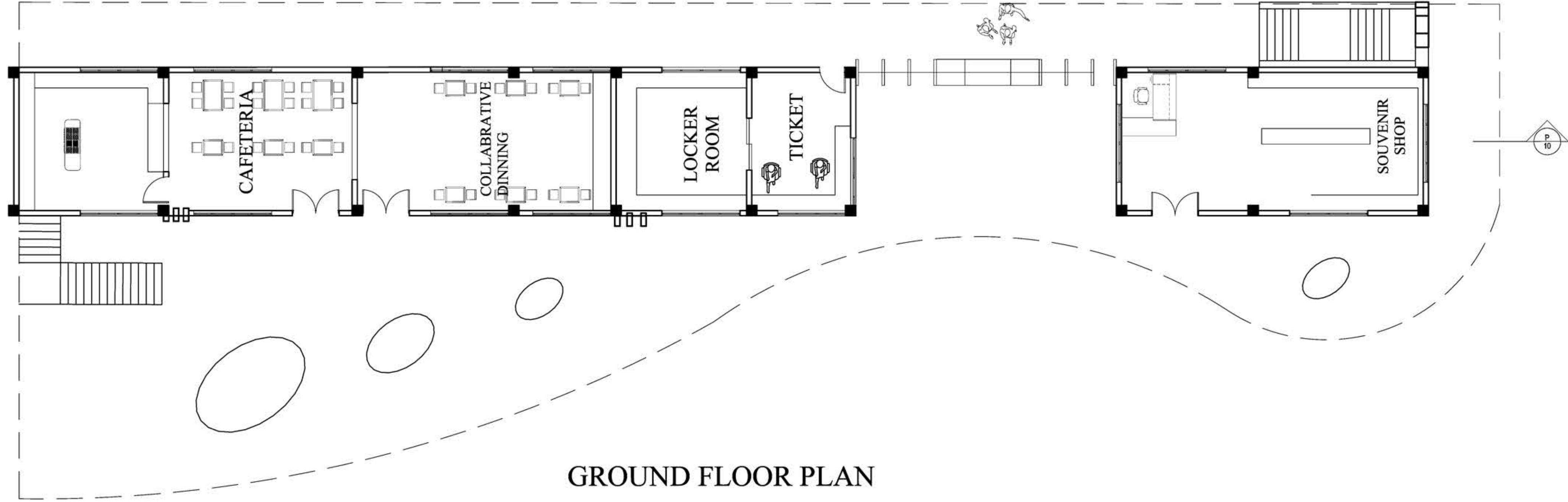
SOUTH PROFILE SECTIONAL ELEVATION



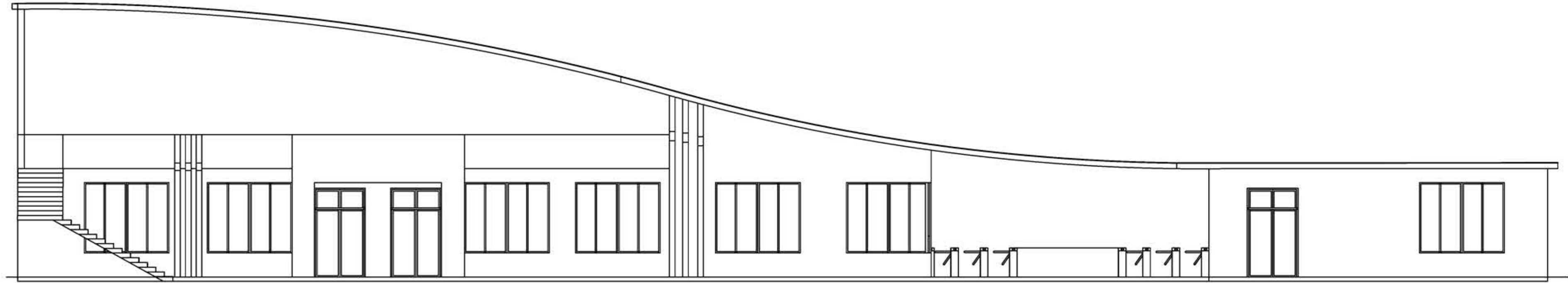
SOUTH WEST PROFILE SECTIONAL ELEVATION ELEVATION

TEKU SCIENCE CENTER

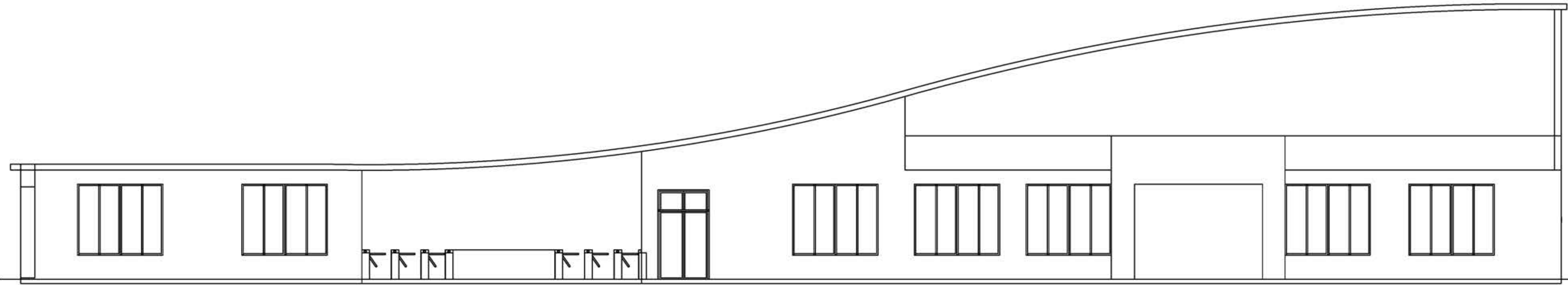
ENTRY BLOCK



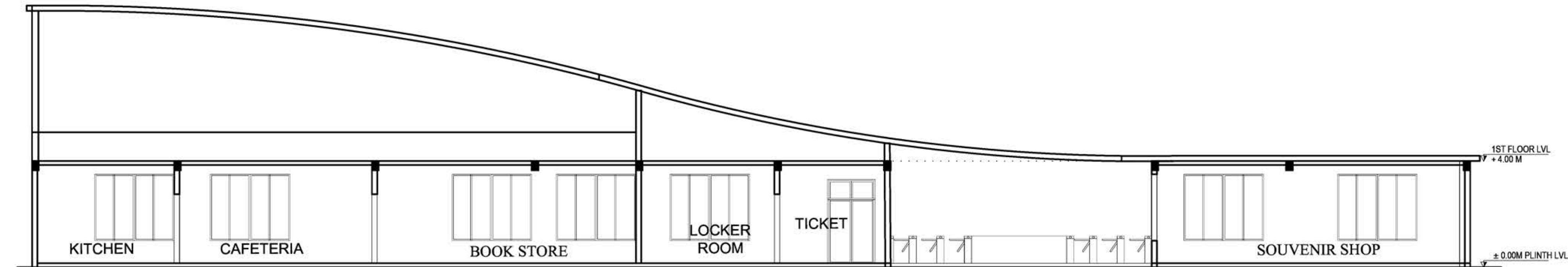
GROUND FLOOR PLAN



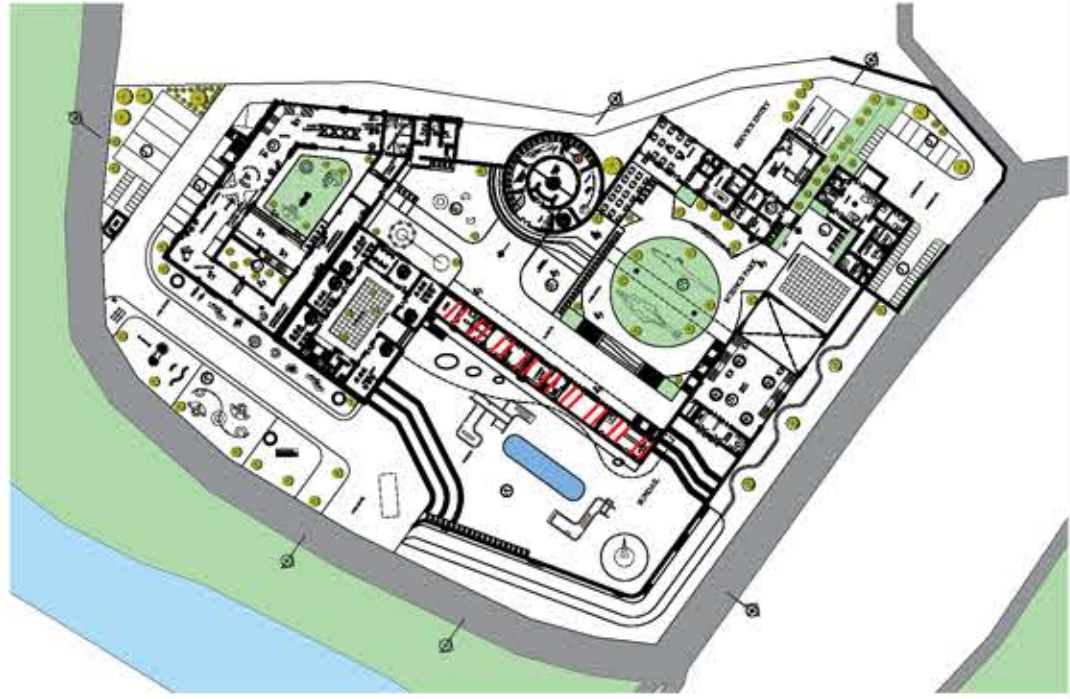
FRONT ELEVATION



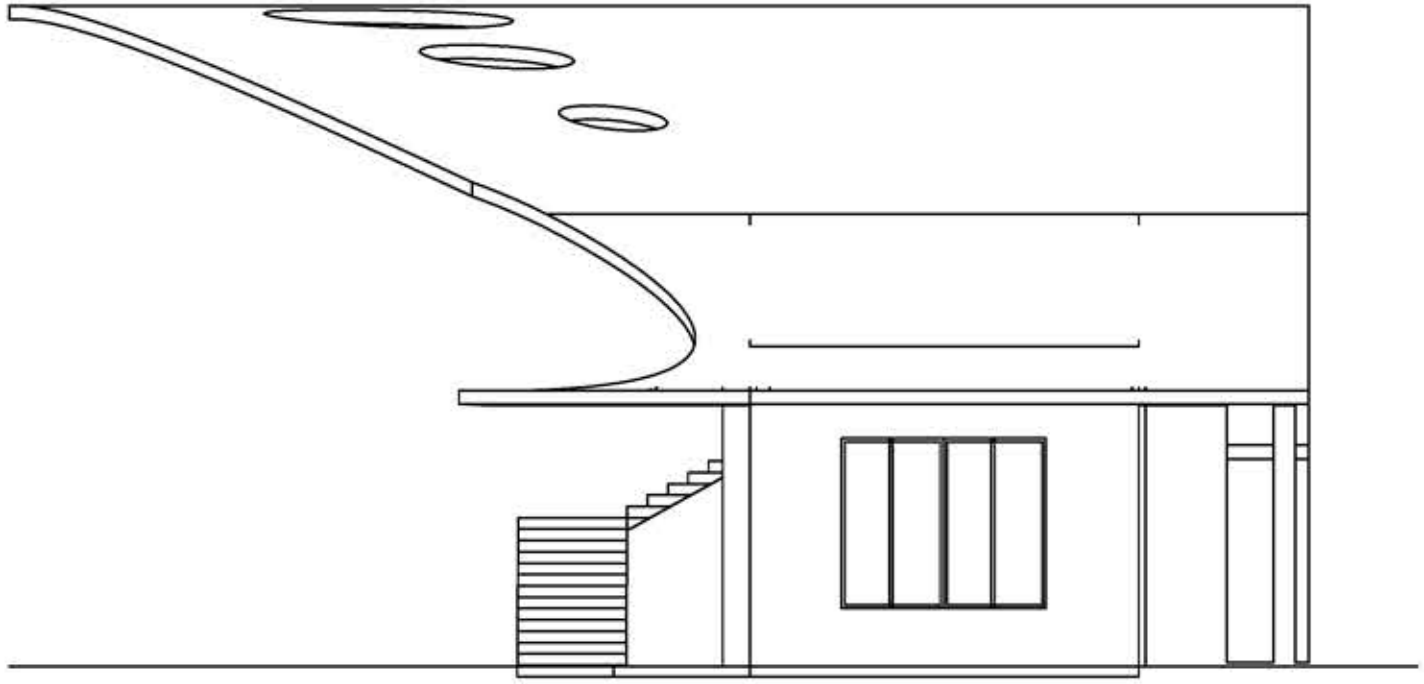
BACK ELEVATION



SECTION AT P-P



KEY PLAN

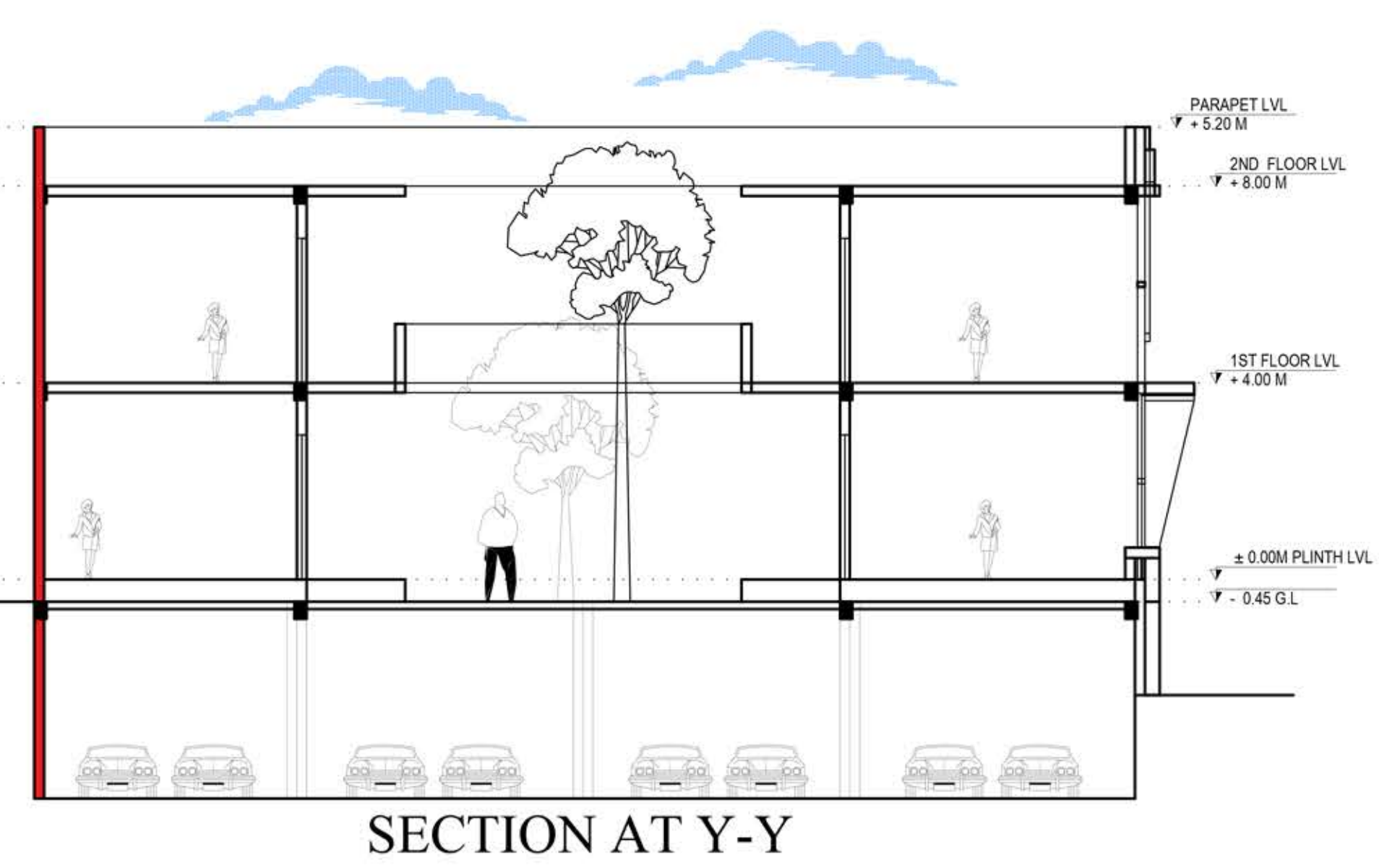
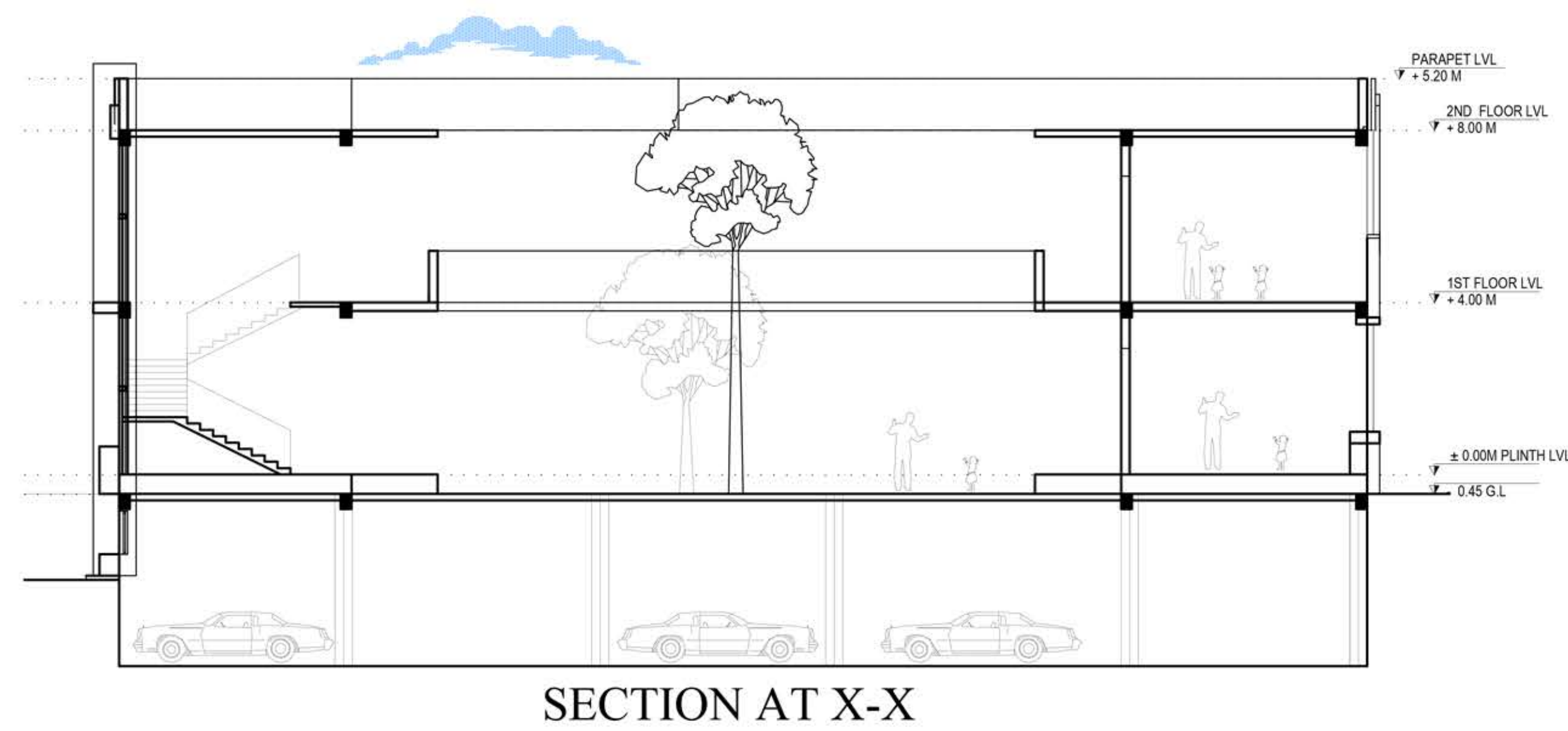
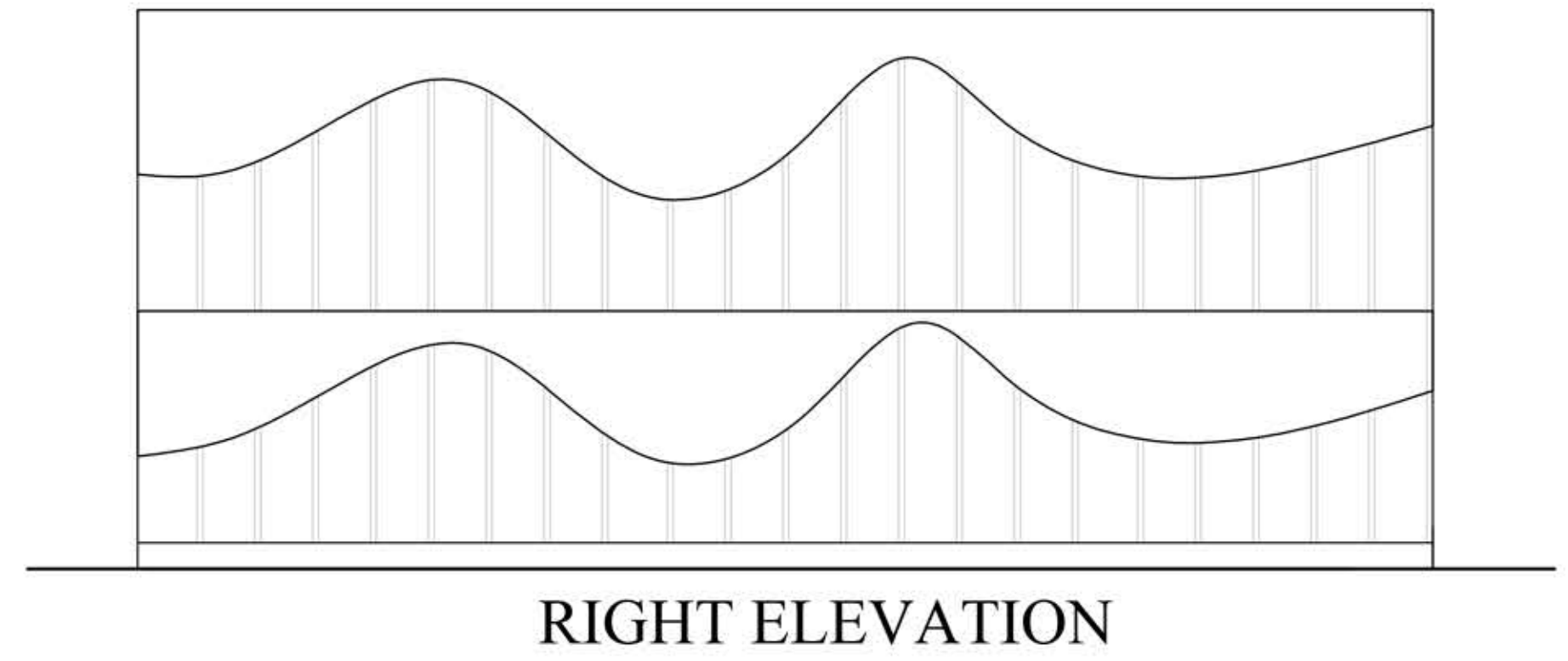
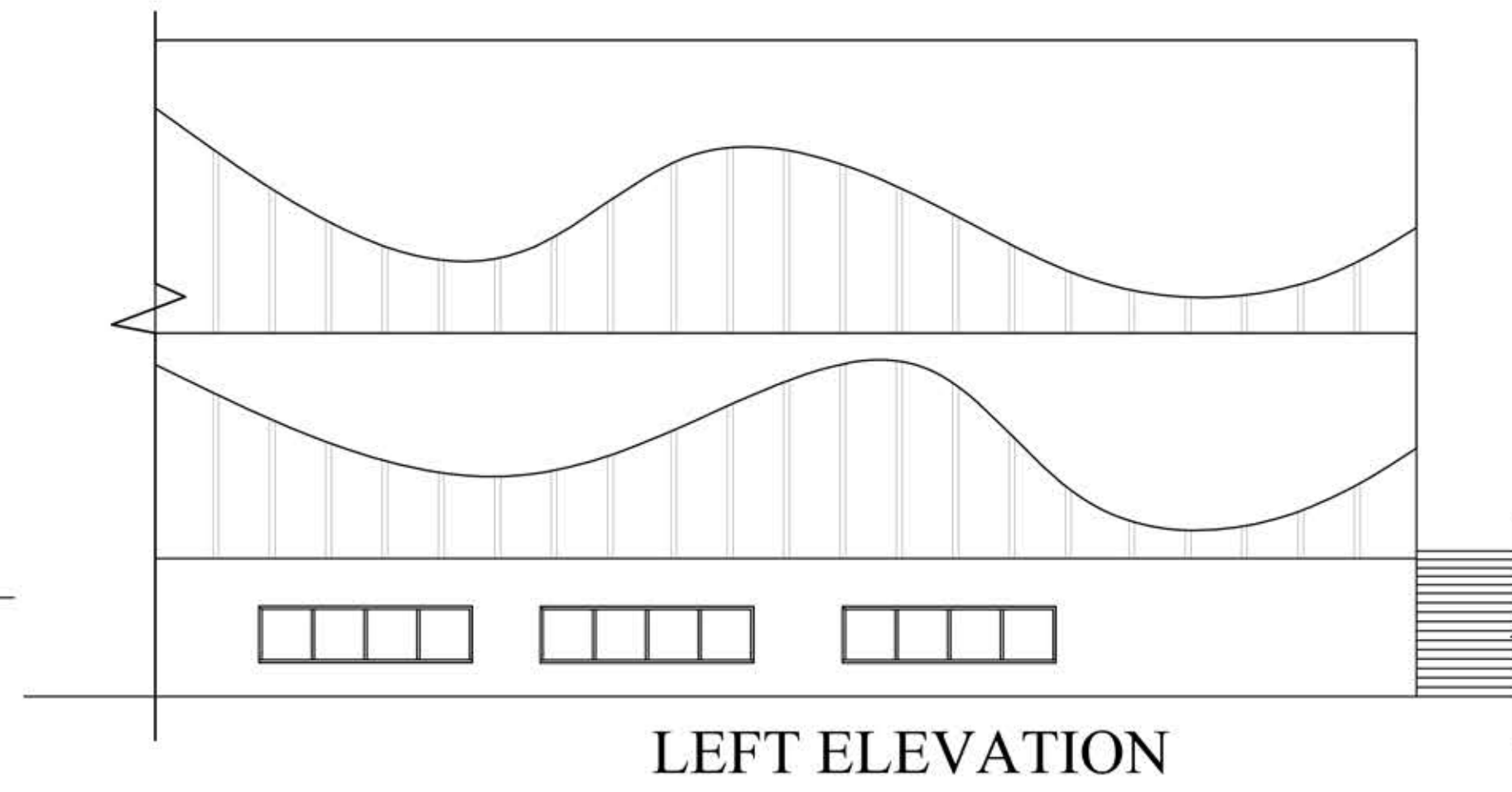
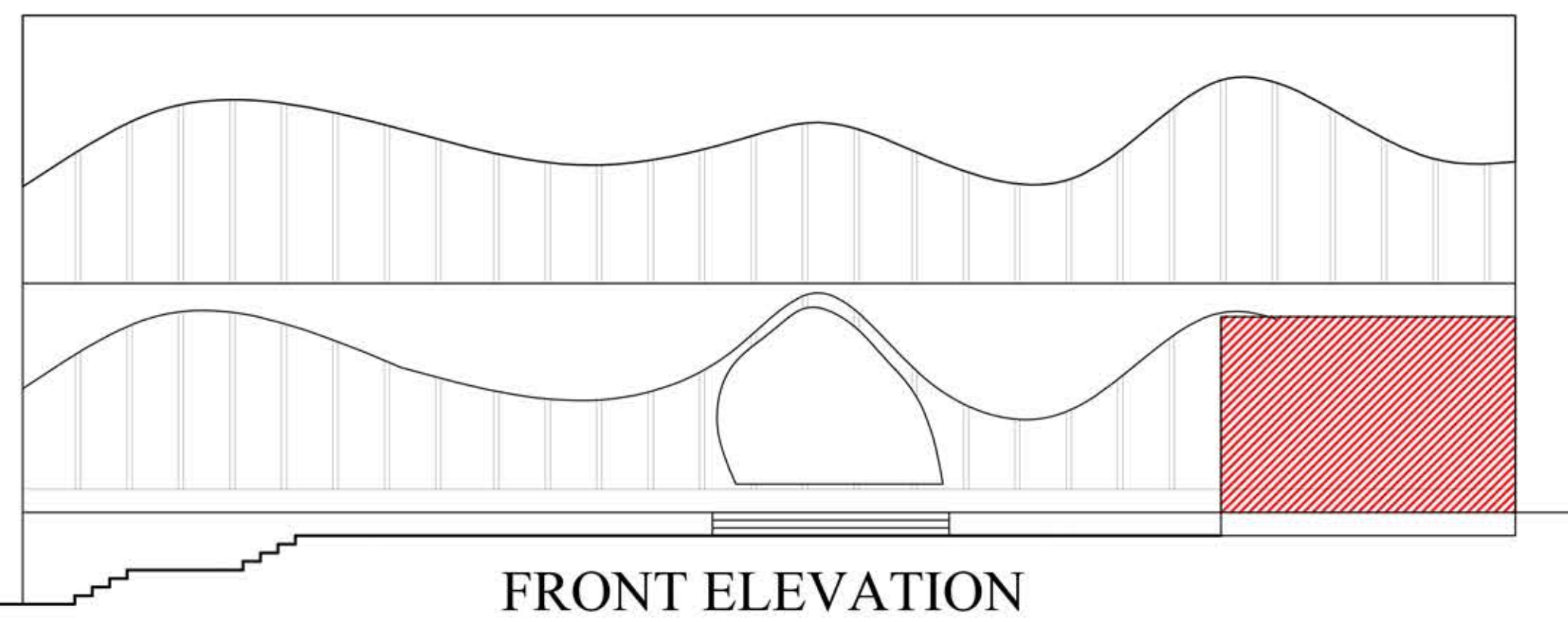
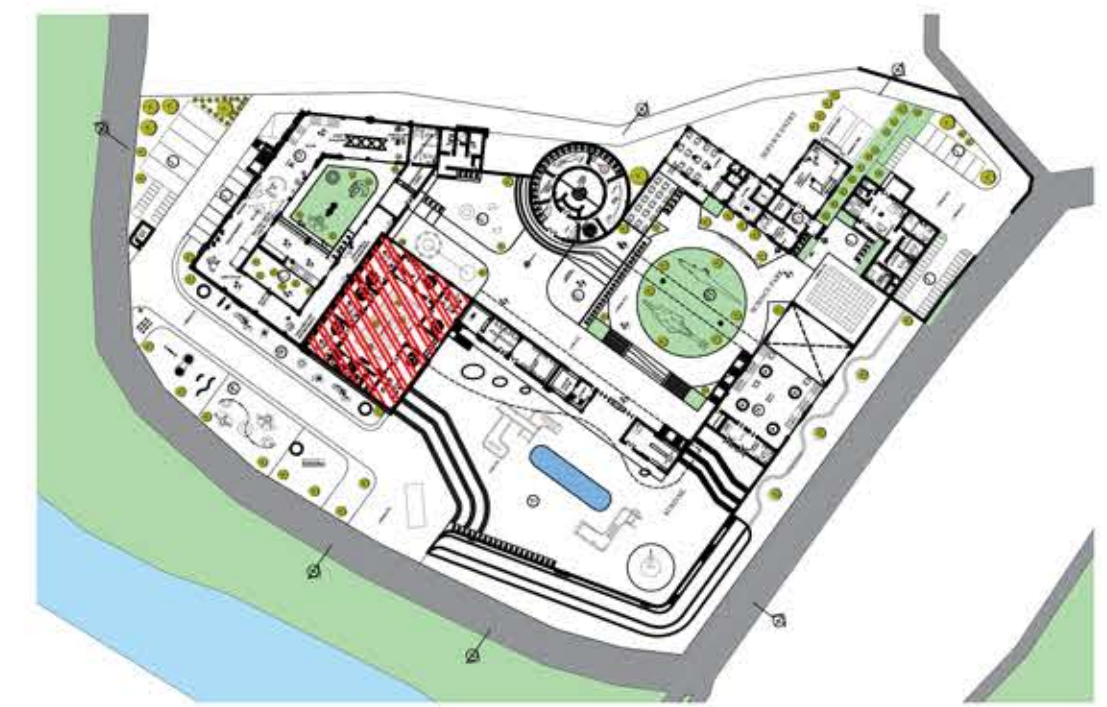
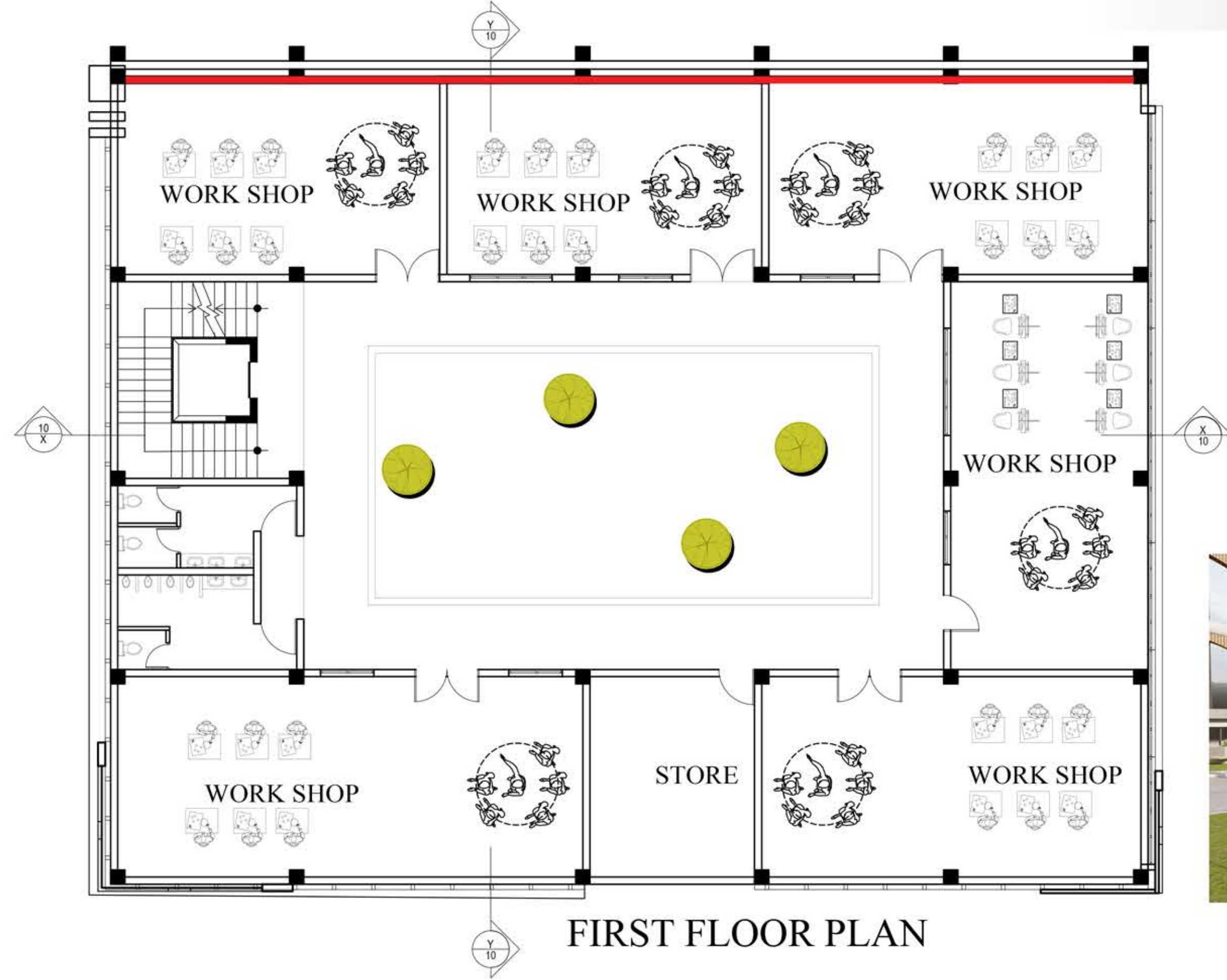
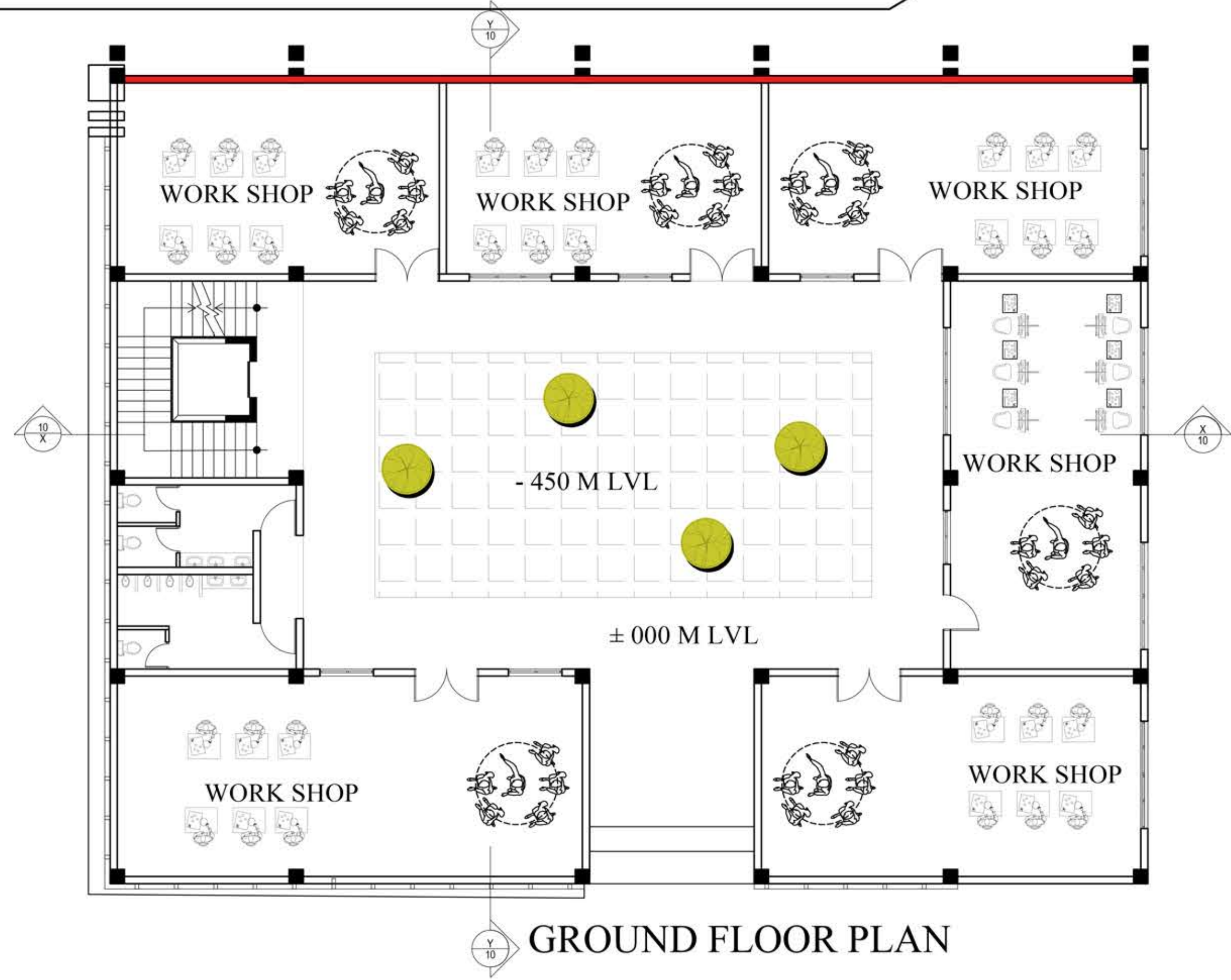


SIDE ELEVATION



TEKU SCIENCE CENTER

WORK SHOP BLOCK



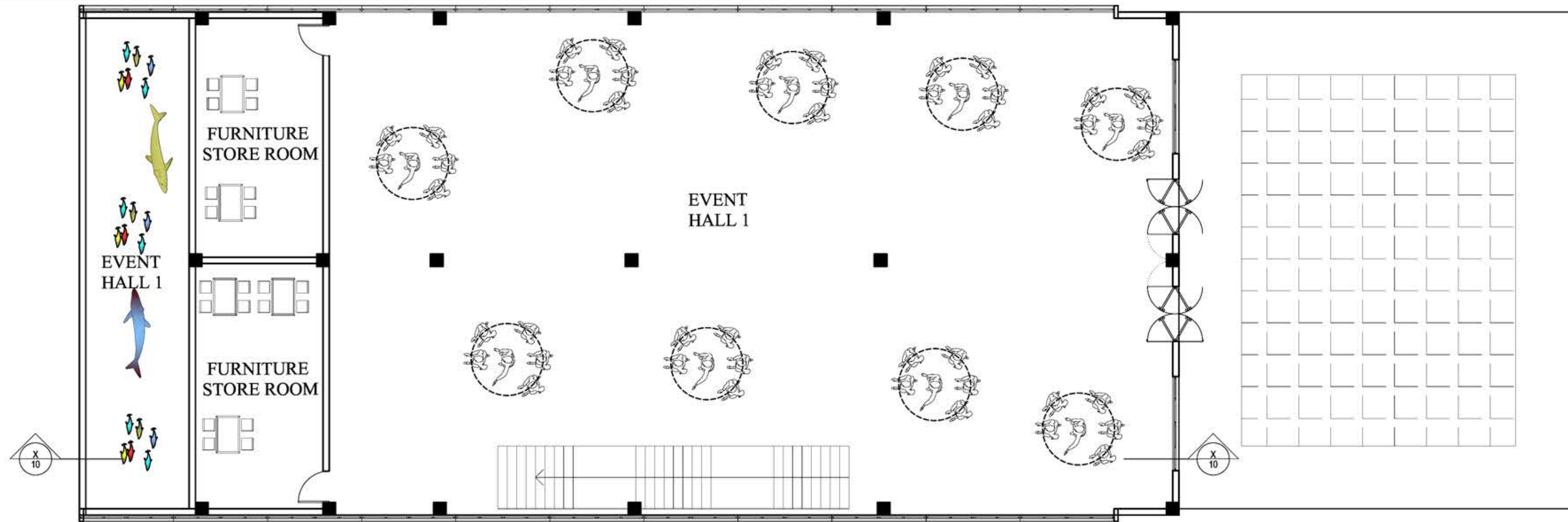
B. ARCH THESIS ON
TEKU SCIENCE CENTRE

TITLE: WORK SHOP BLOCK

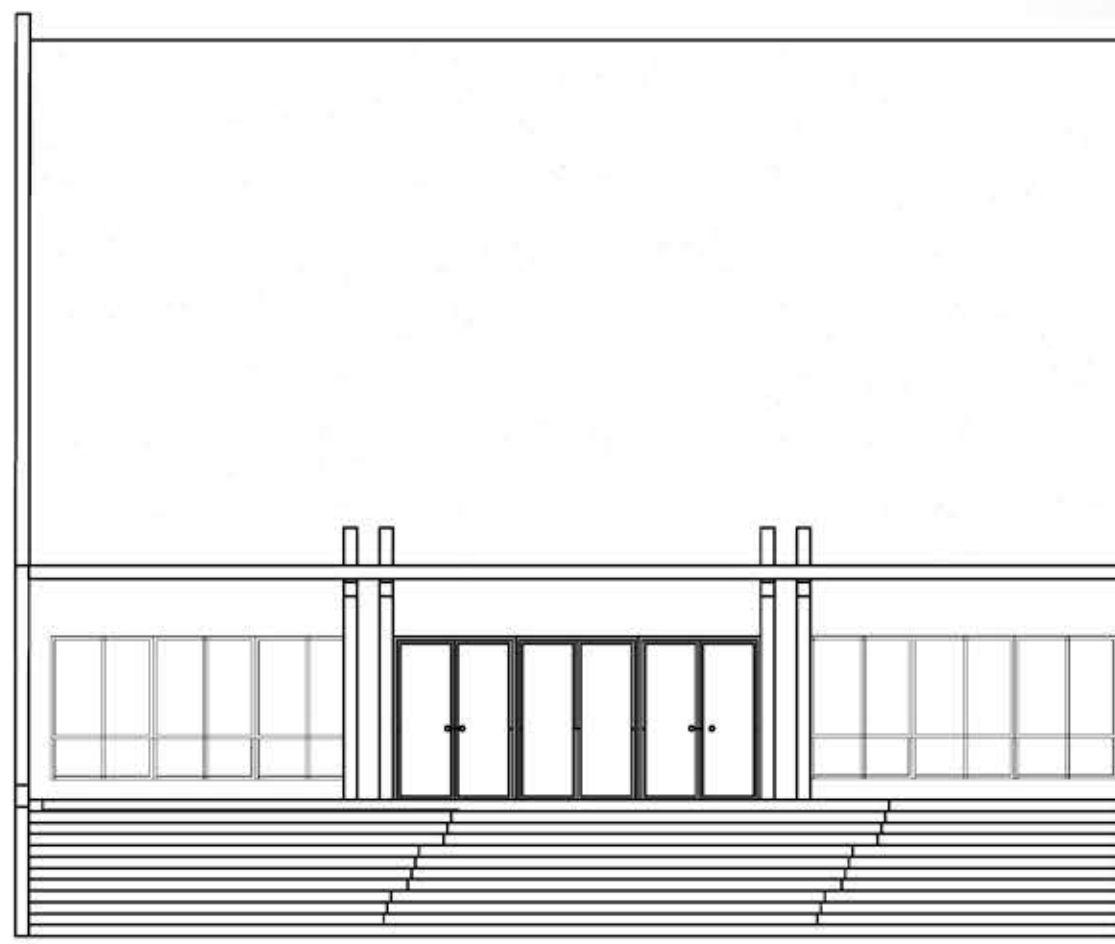
RINA THAPA (760132)
SUPERVISOR: AR. RIKESH SHRESTHA

TEKU SCIENCE CENTER

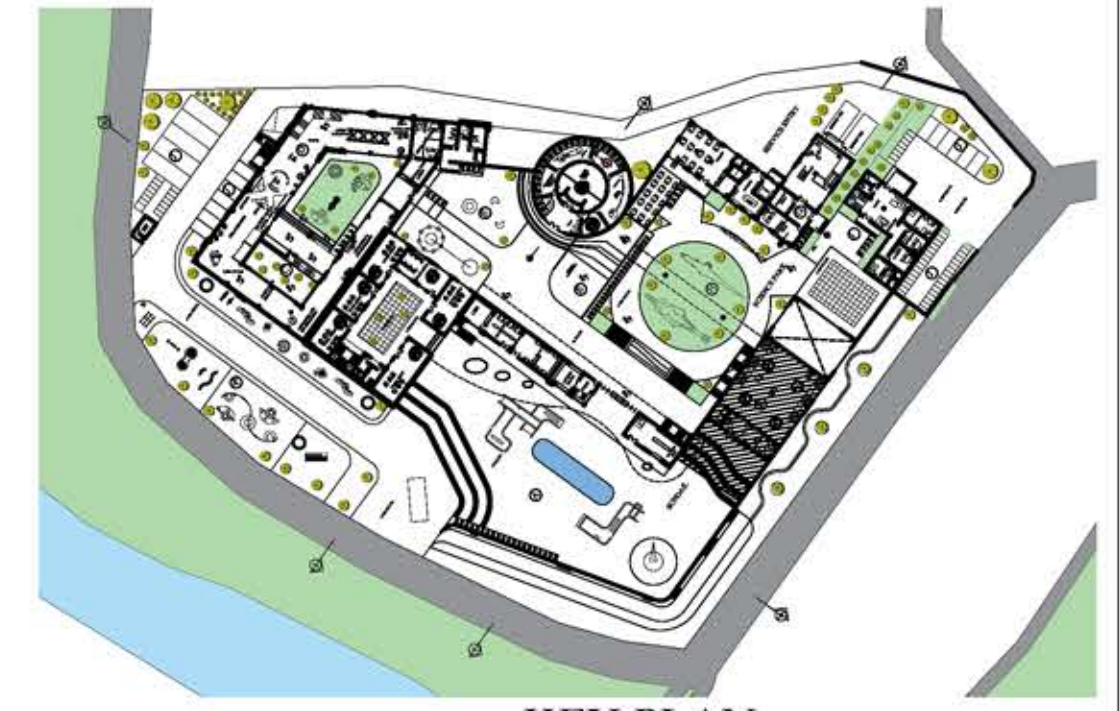
EVENT BLOCK



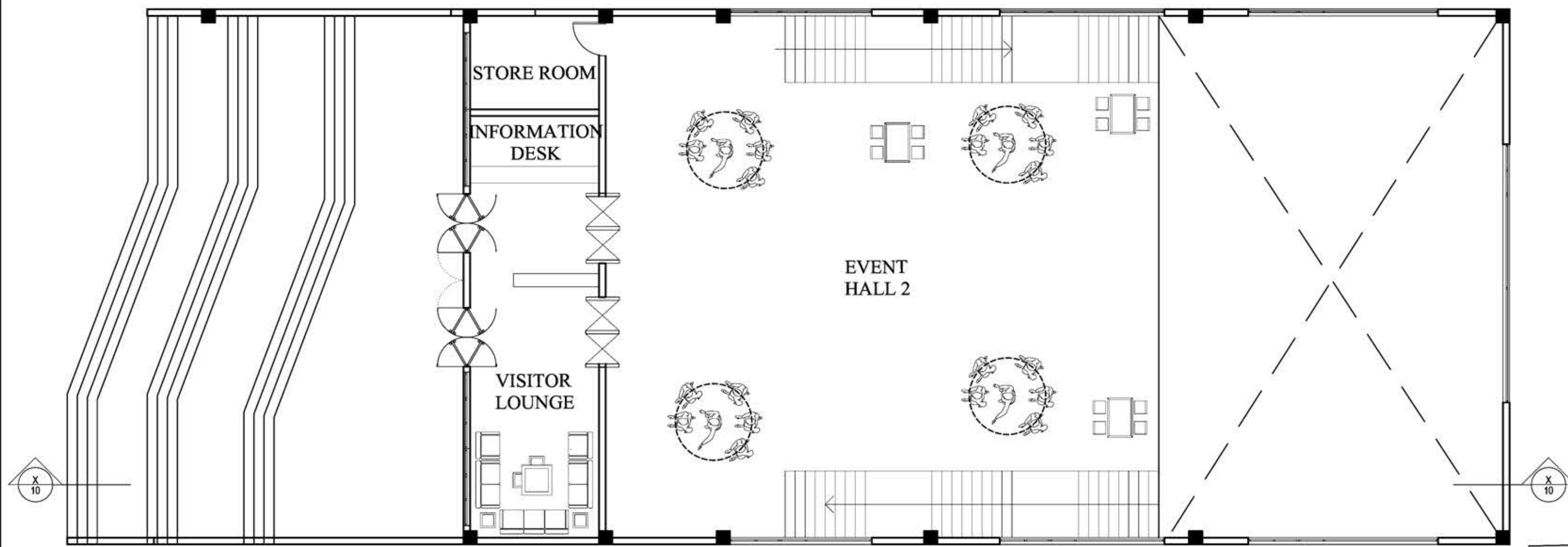
GROUND FLOOR PLAN



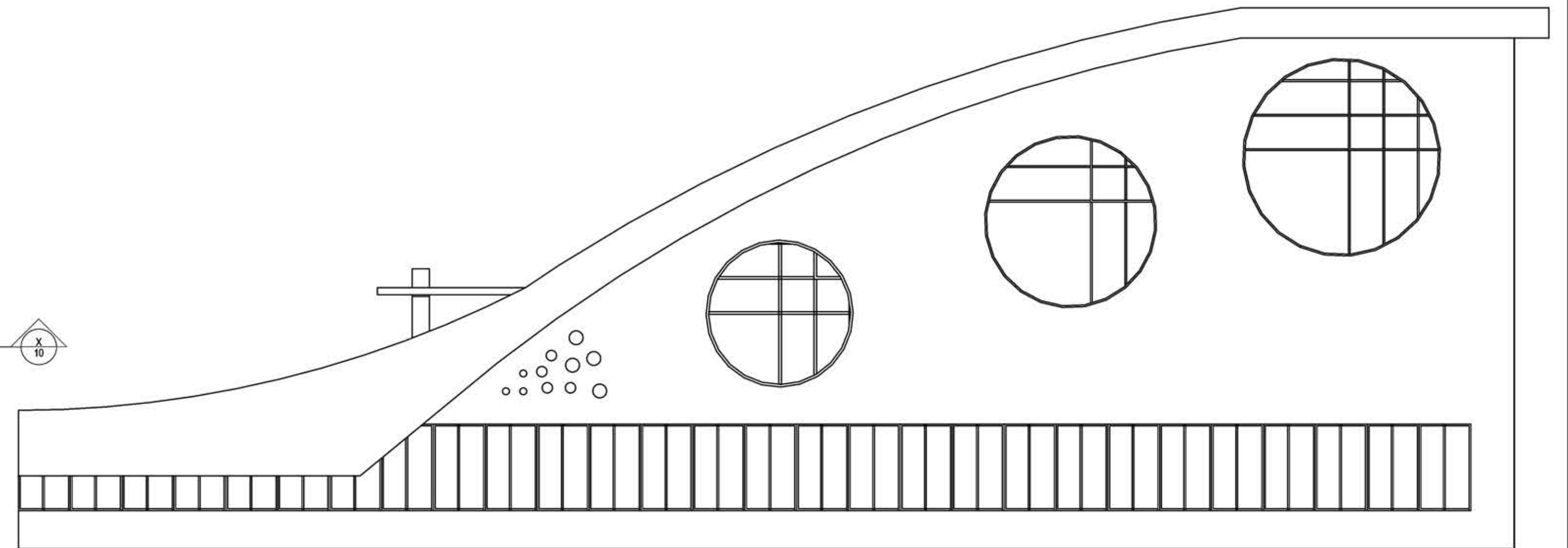
FRONT ELEVATION



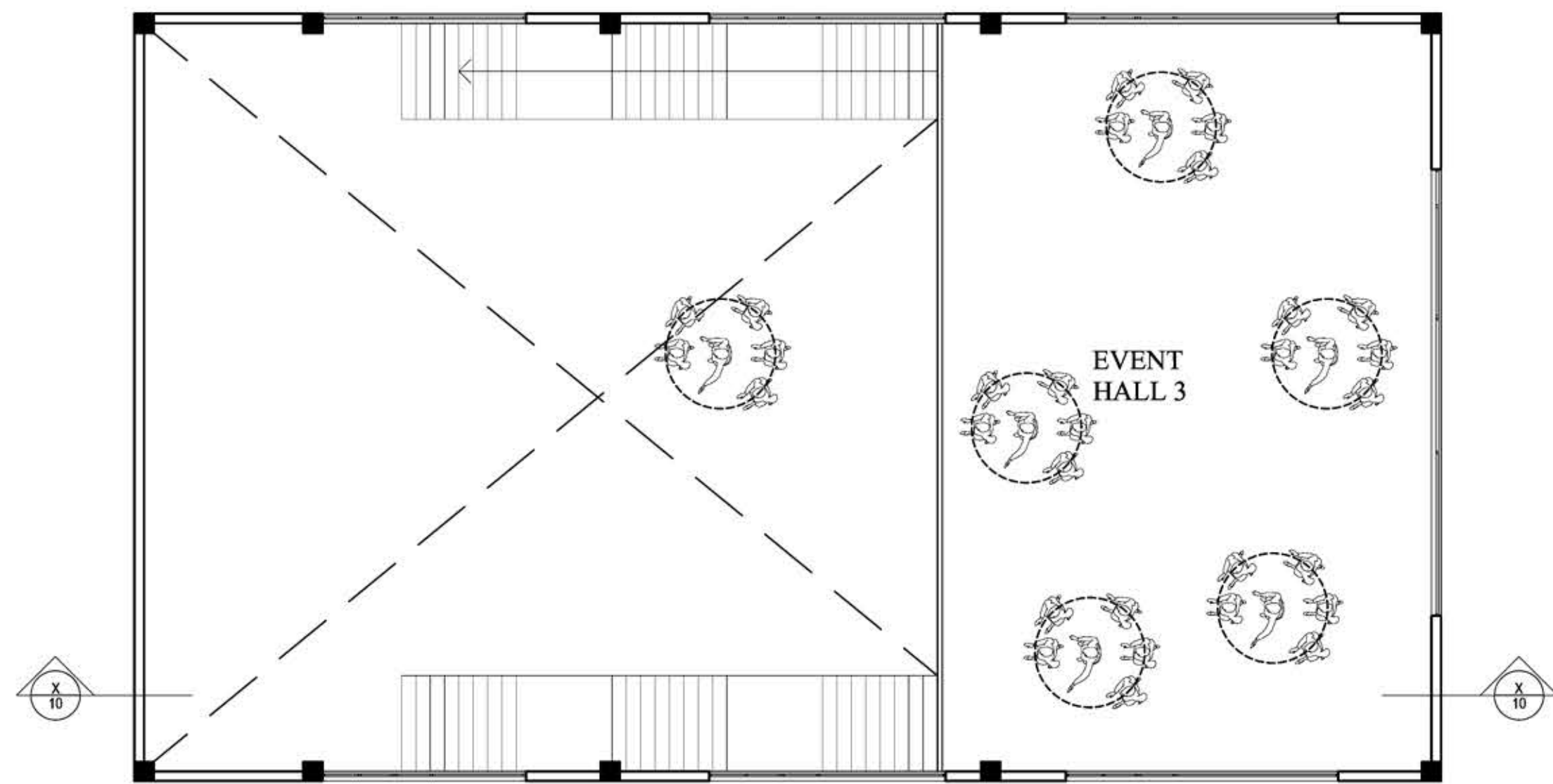
KEY PLAN



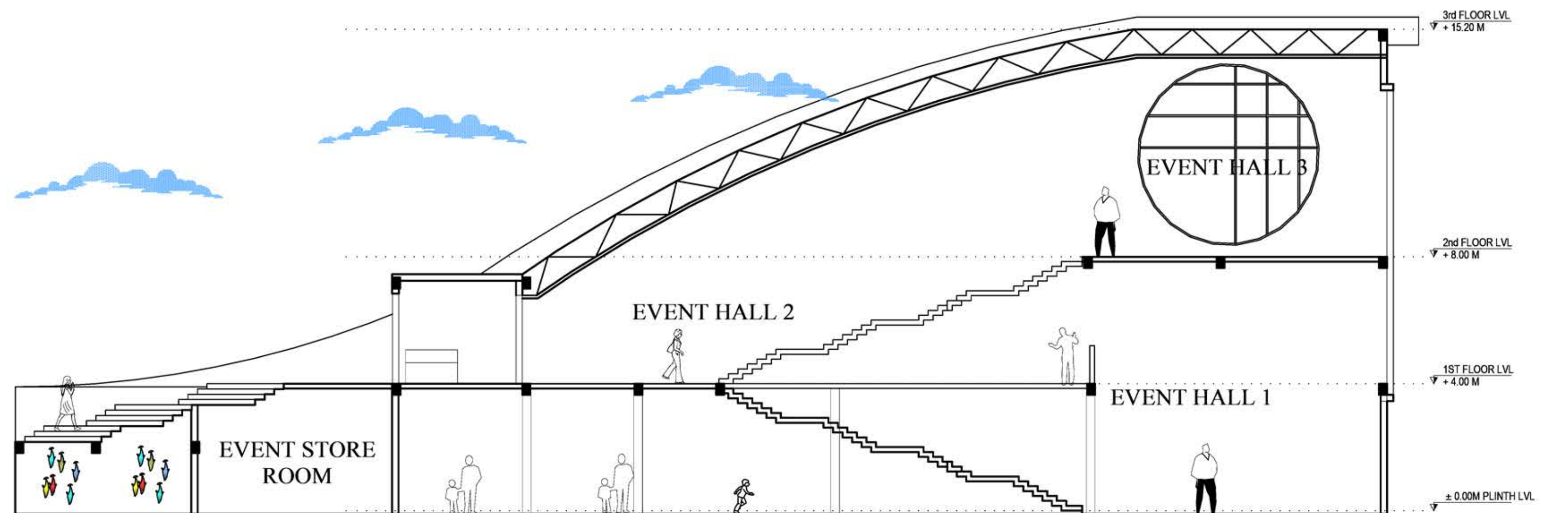
FIRST FLOOR PLAN



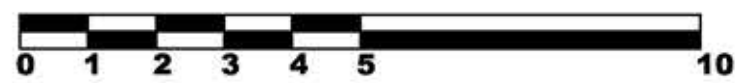
SIDE ELEVATION



SECOND FLOOR PLAN



SECTION AT X-X

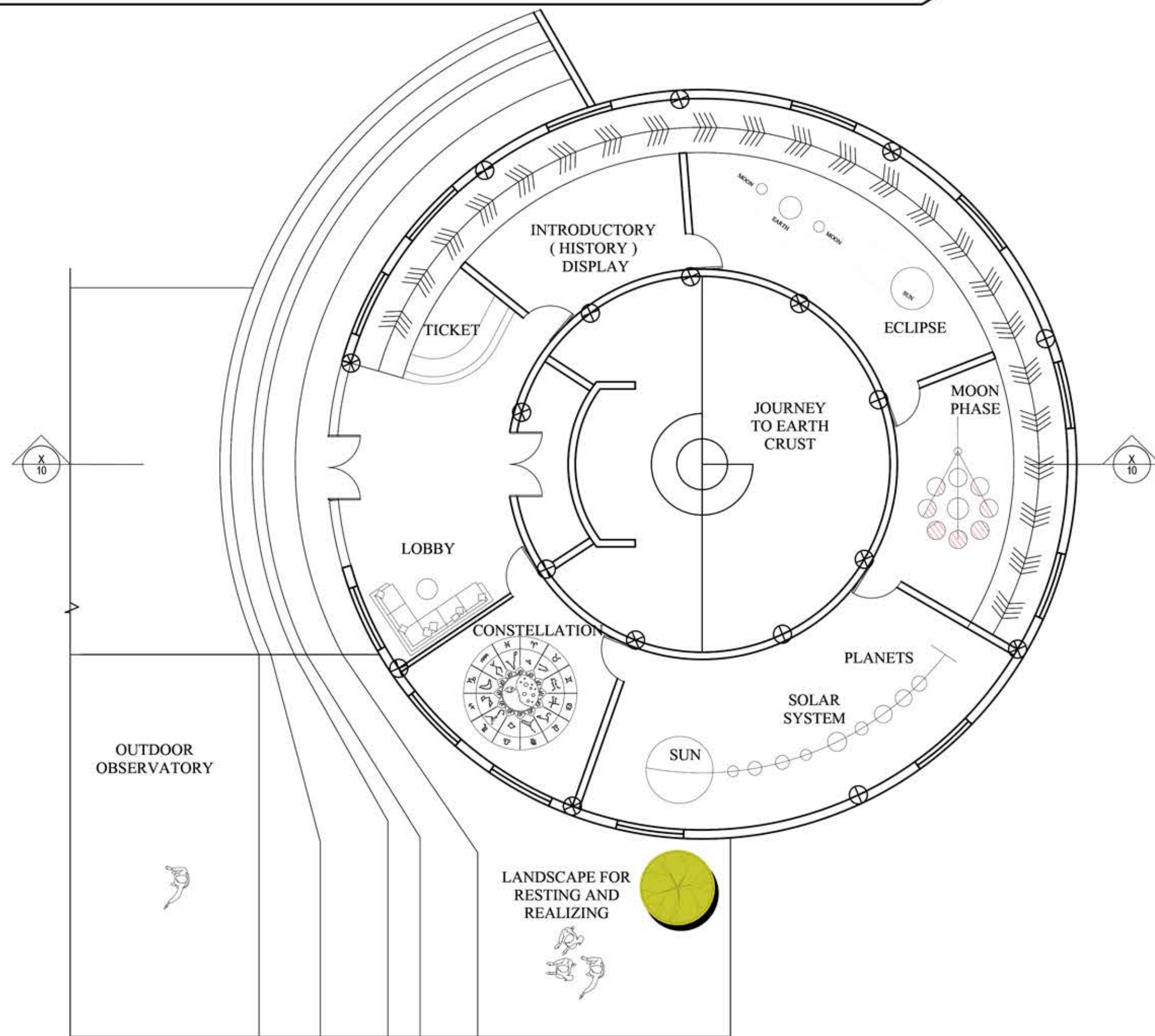


B. ARCH THESIS ON
TEKU SCIENCE CENTRE

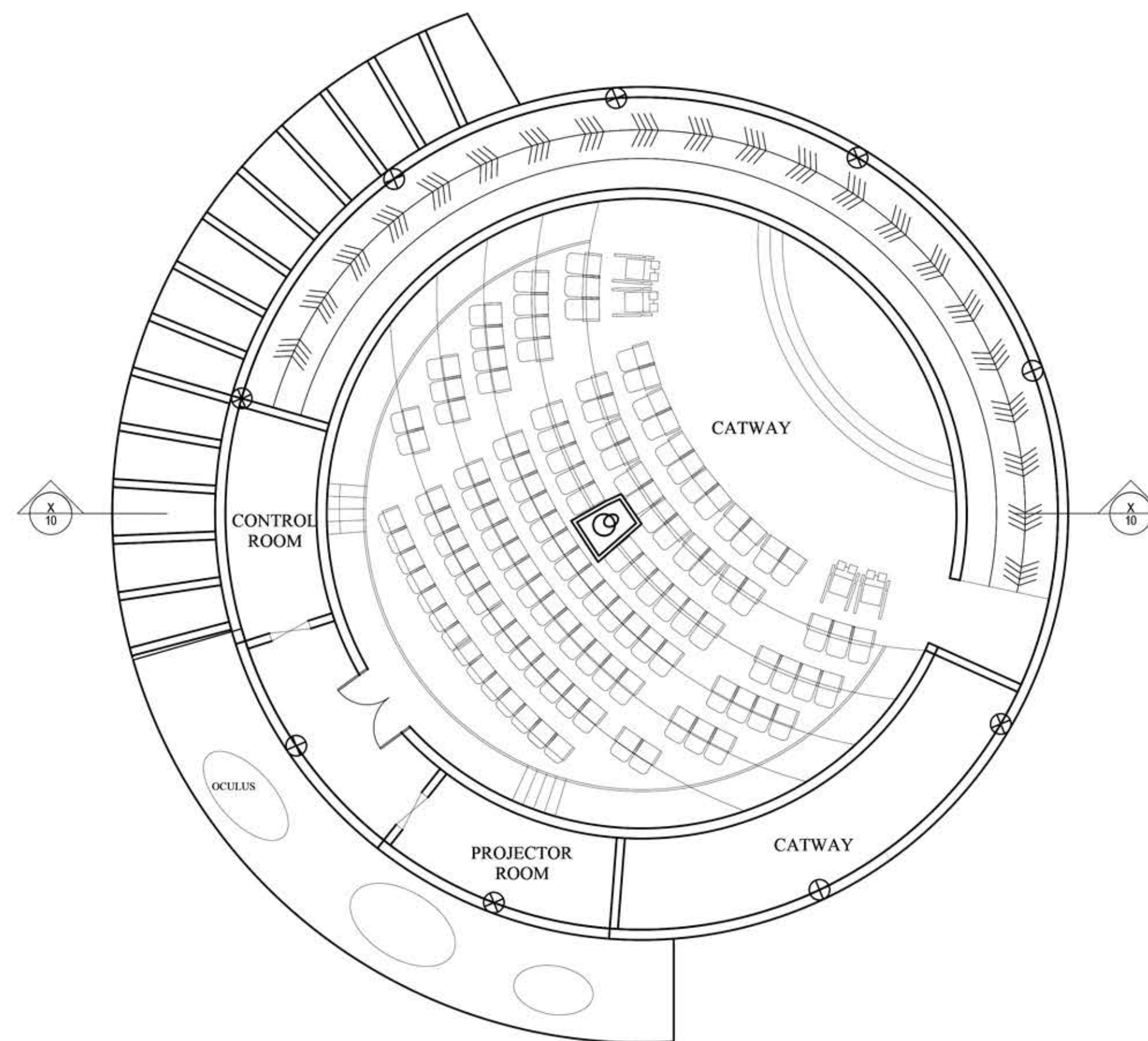
TITLE: EVENT BLOCK

SCALE: 1:100

RINA THAPA (760132)
SUPERVISOR: AR. RIKESH SHRESTHA



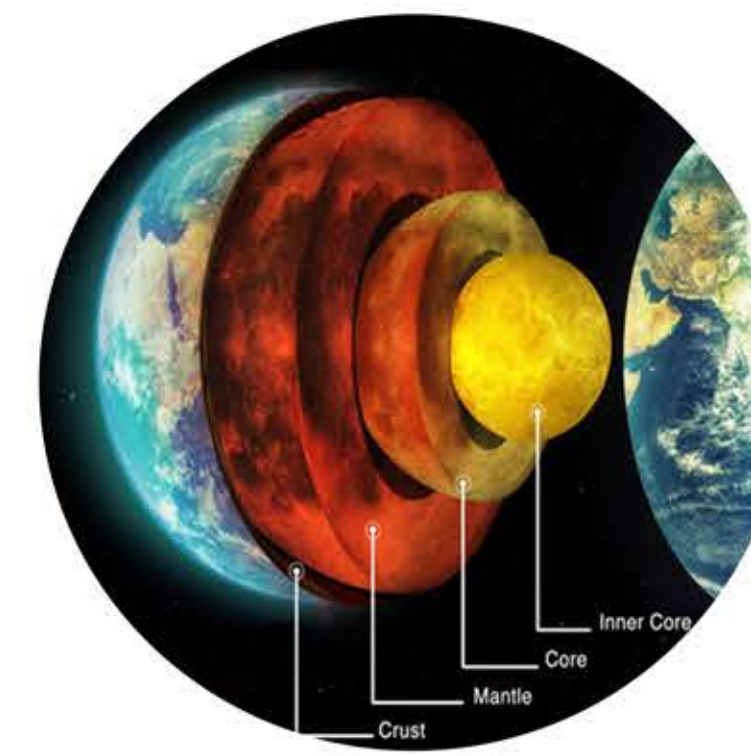
GROUND FLOOR PLAN



FIRST FLOOR PLAN



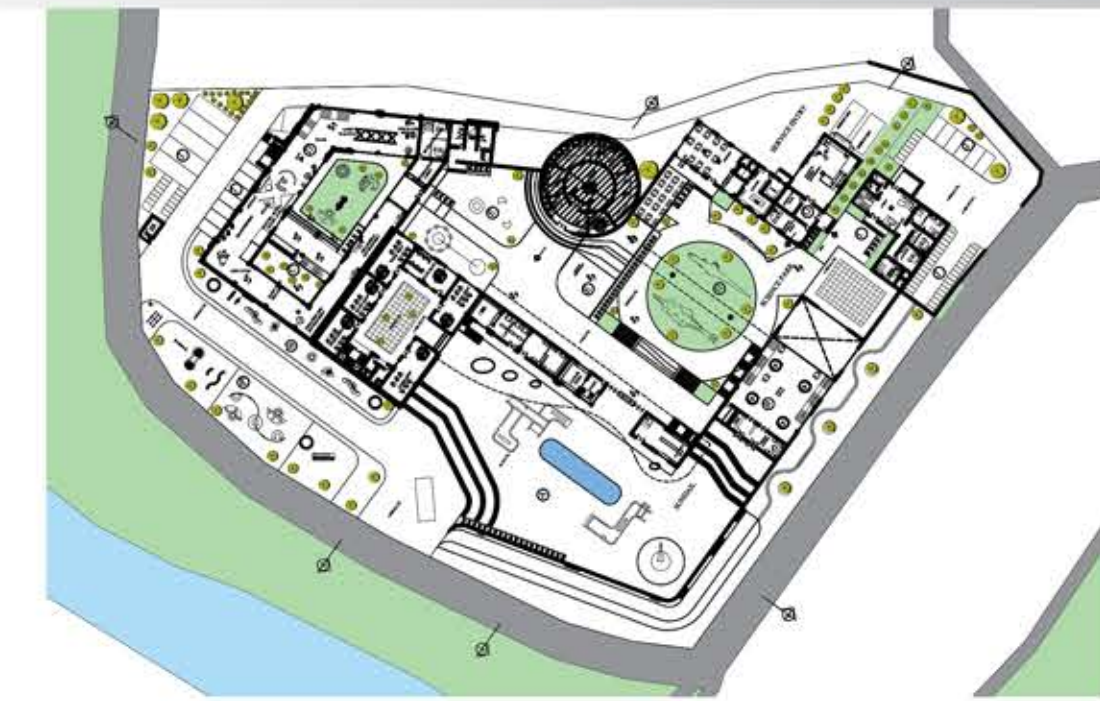
INTRODUCTION



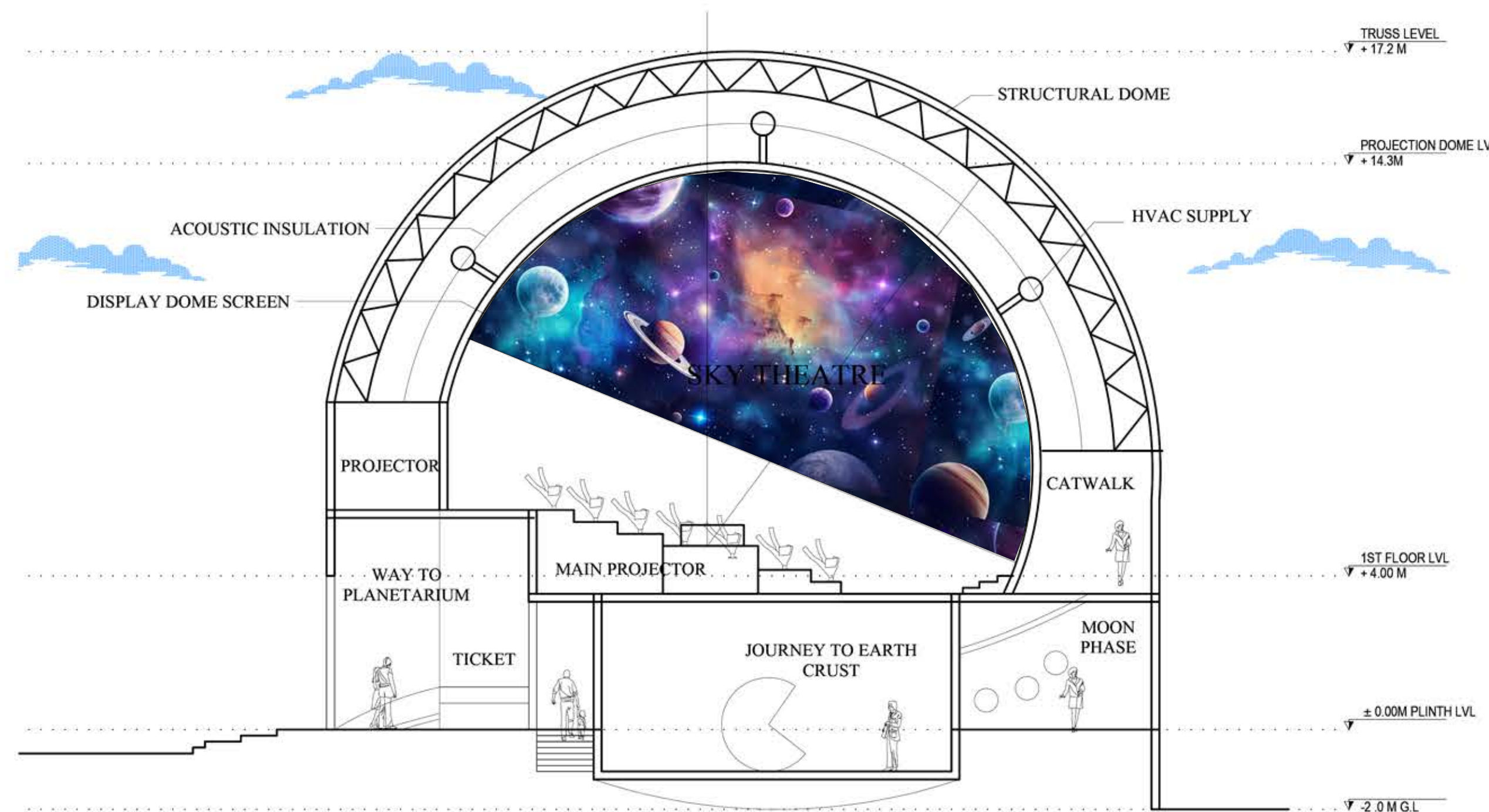
JOURNEY TO EARTH CRUST



MOON PHASE



KEY PLAN



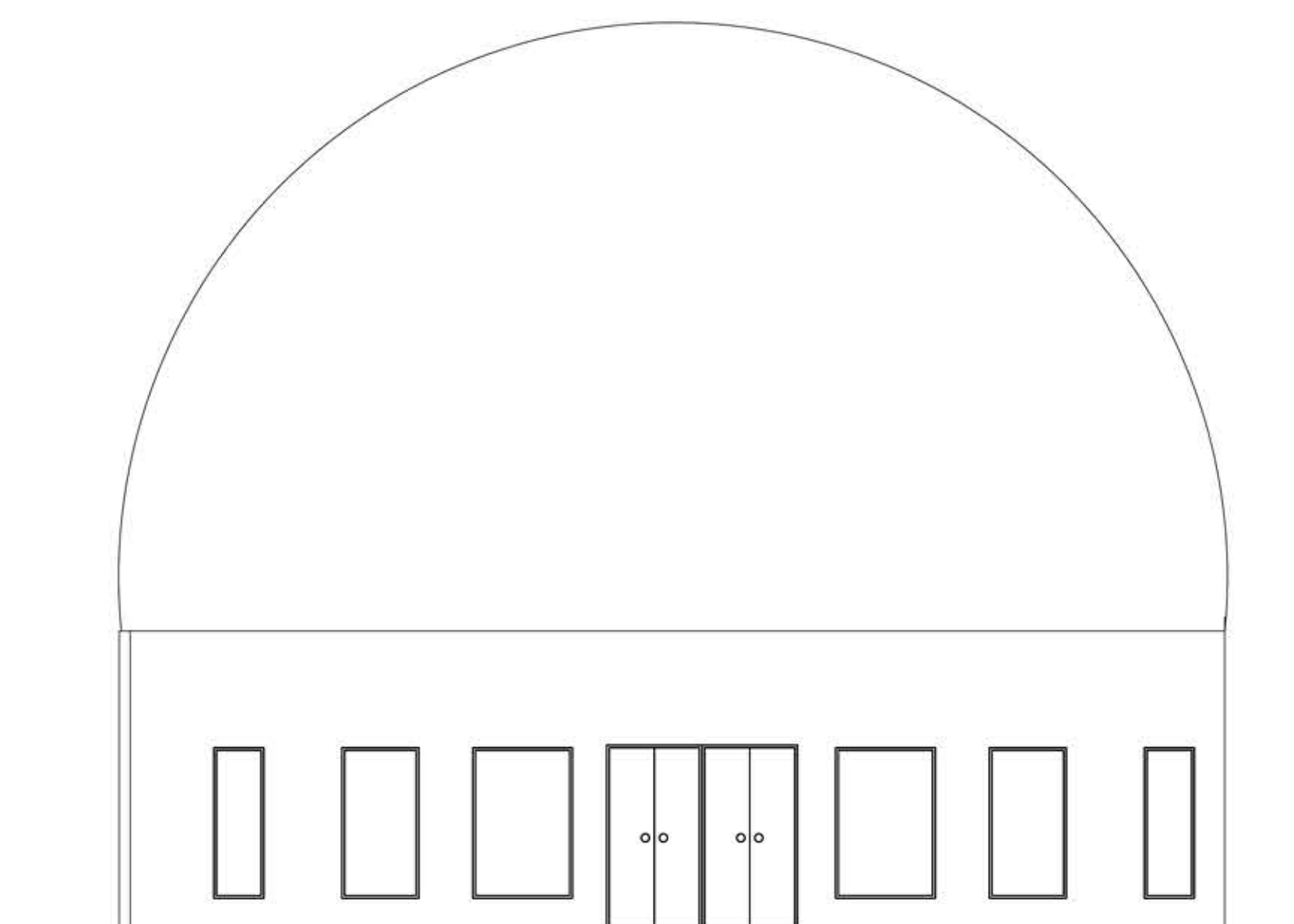
SECTION AT X-X



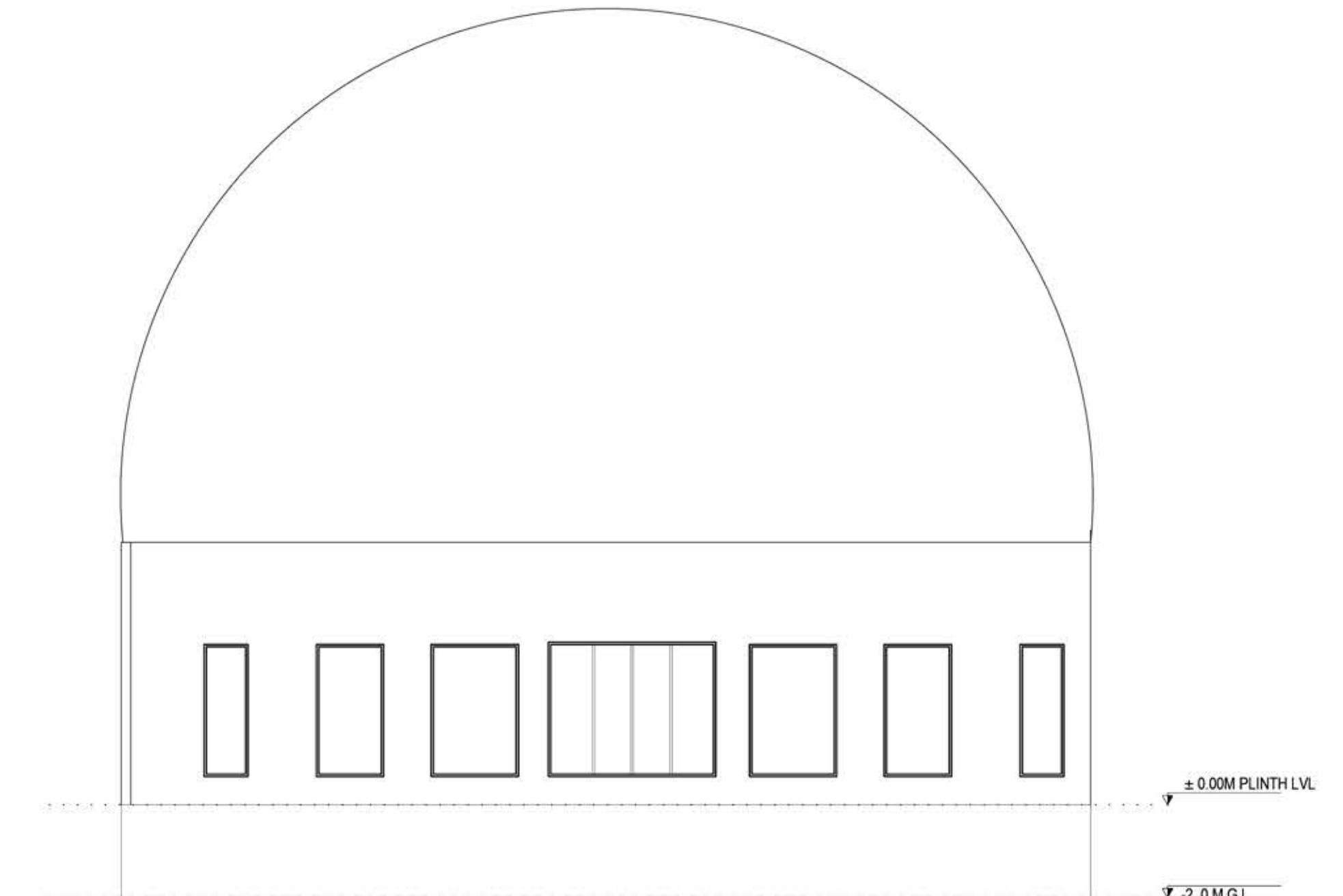
PLANETARIUM EXPERIENCE



PLANET SHOWS



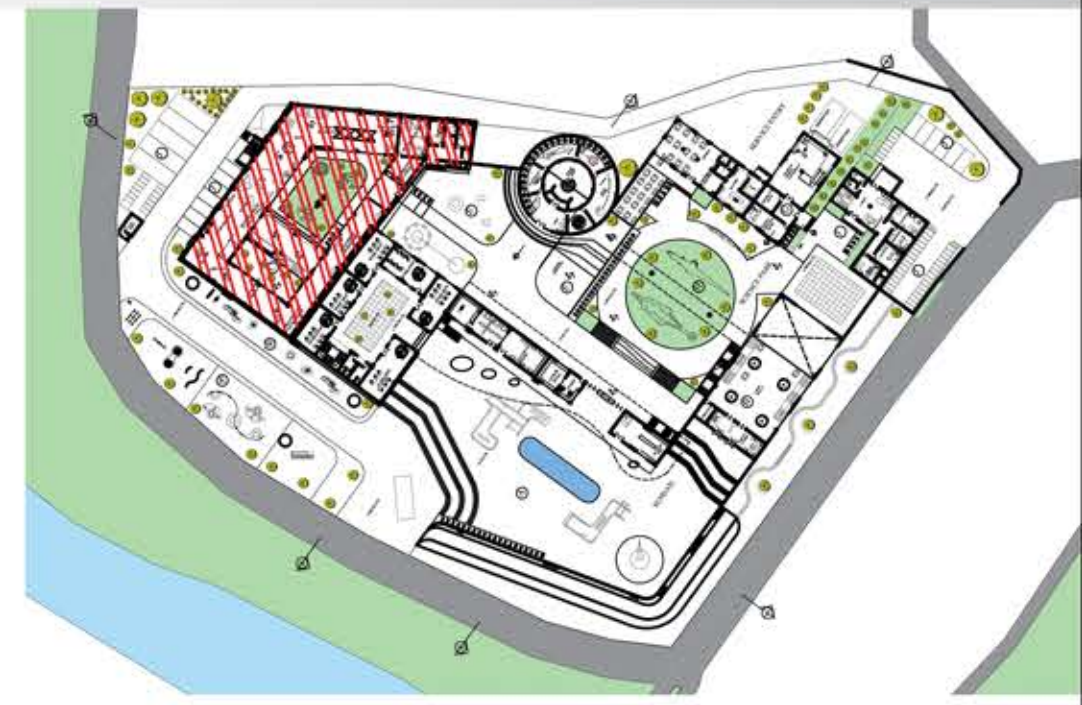
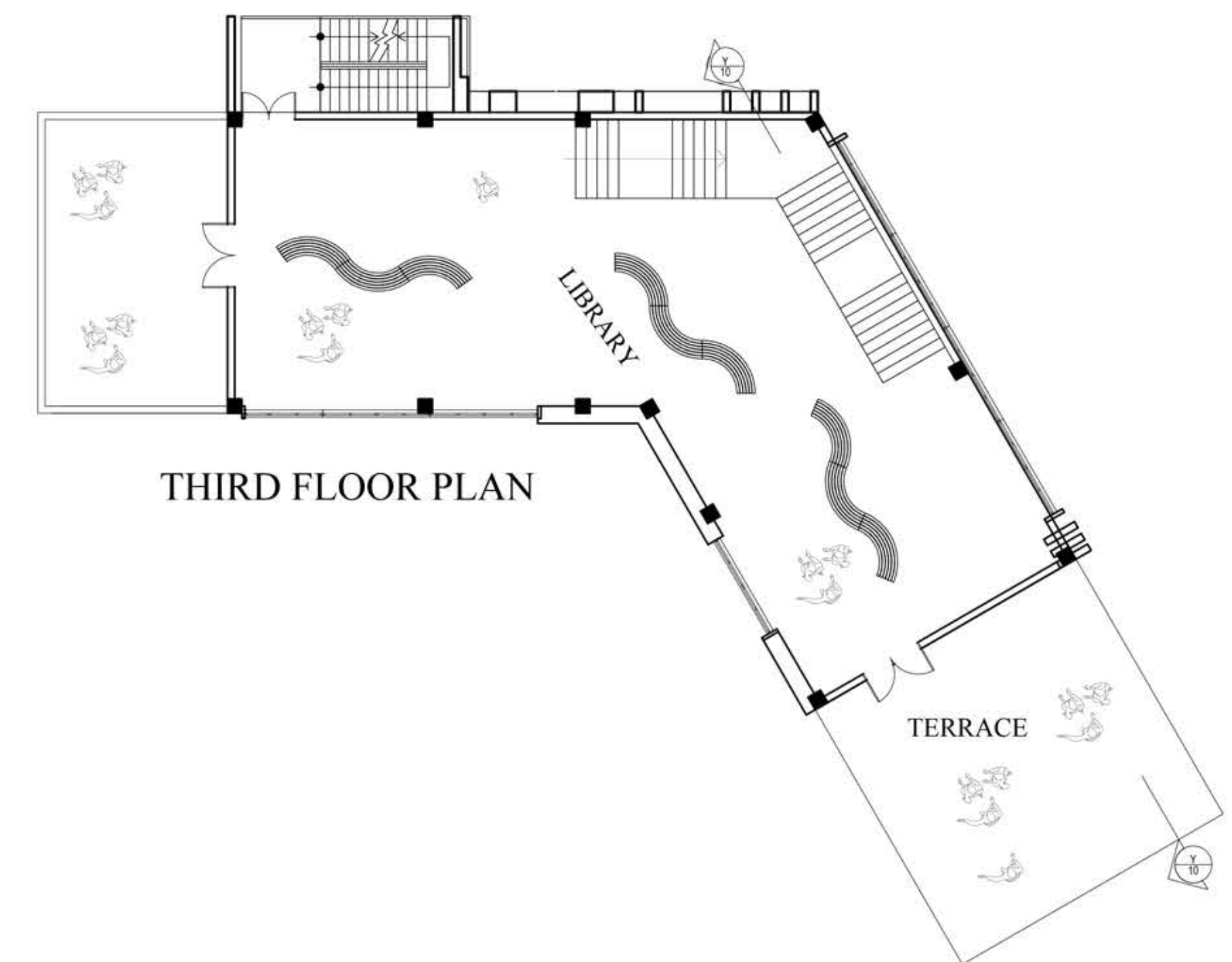
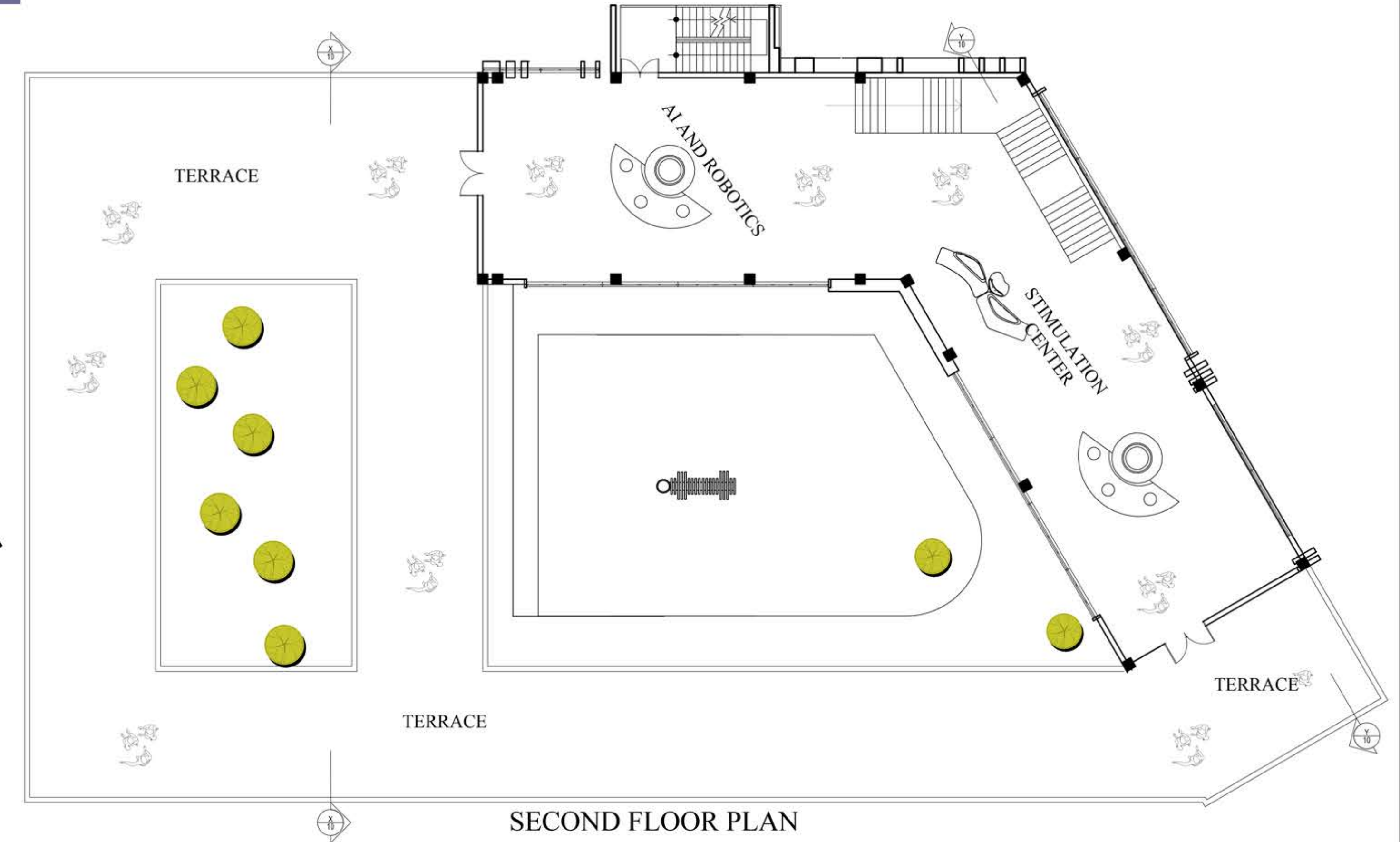
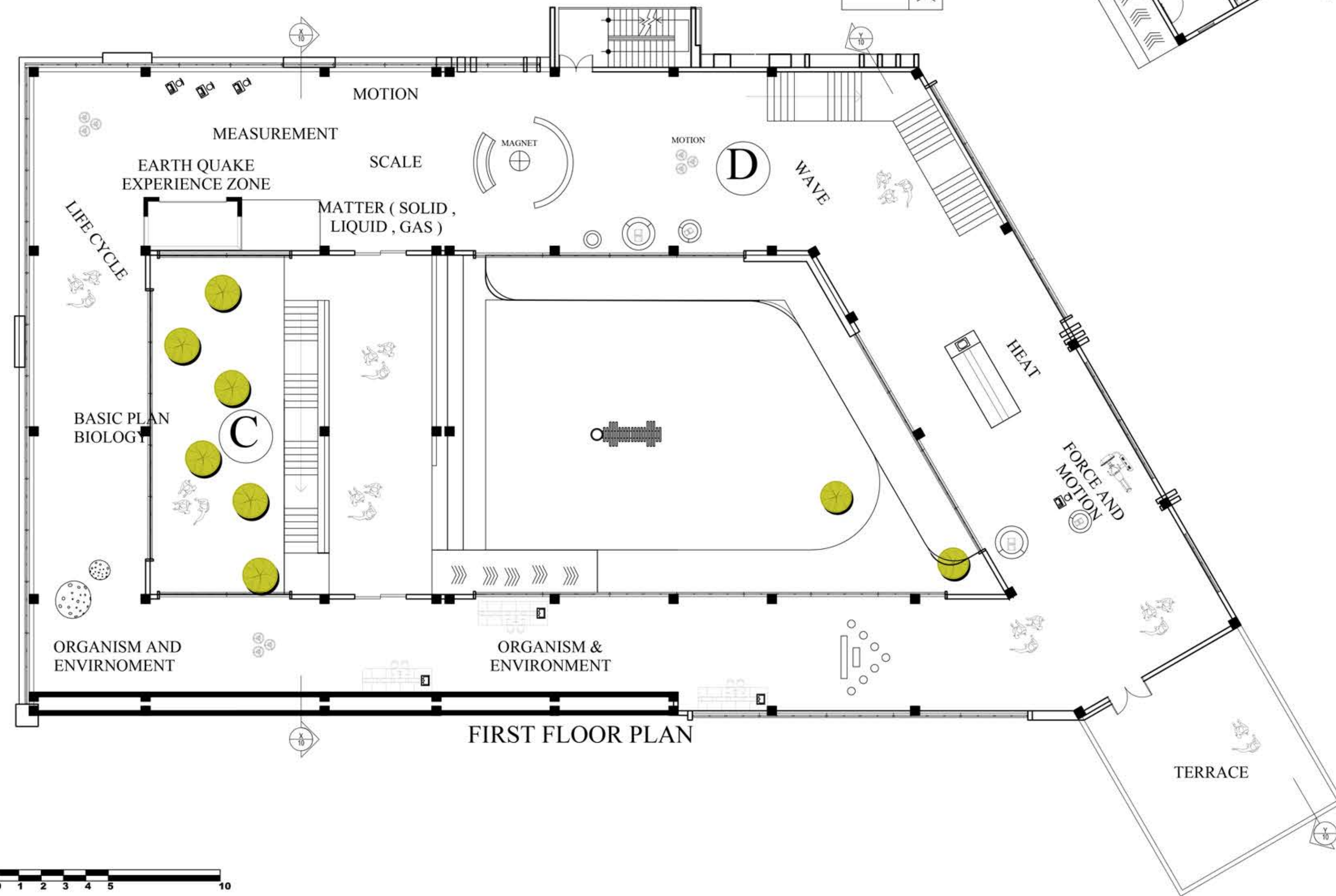
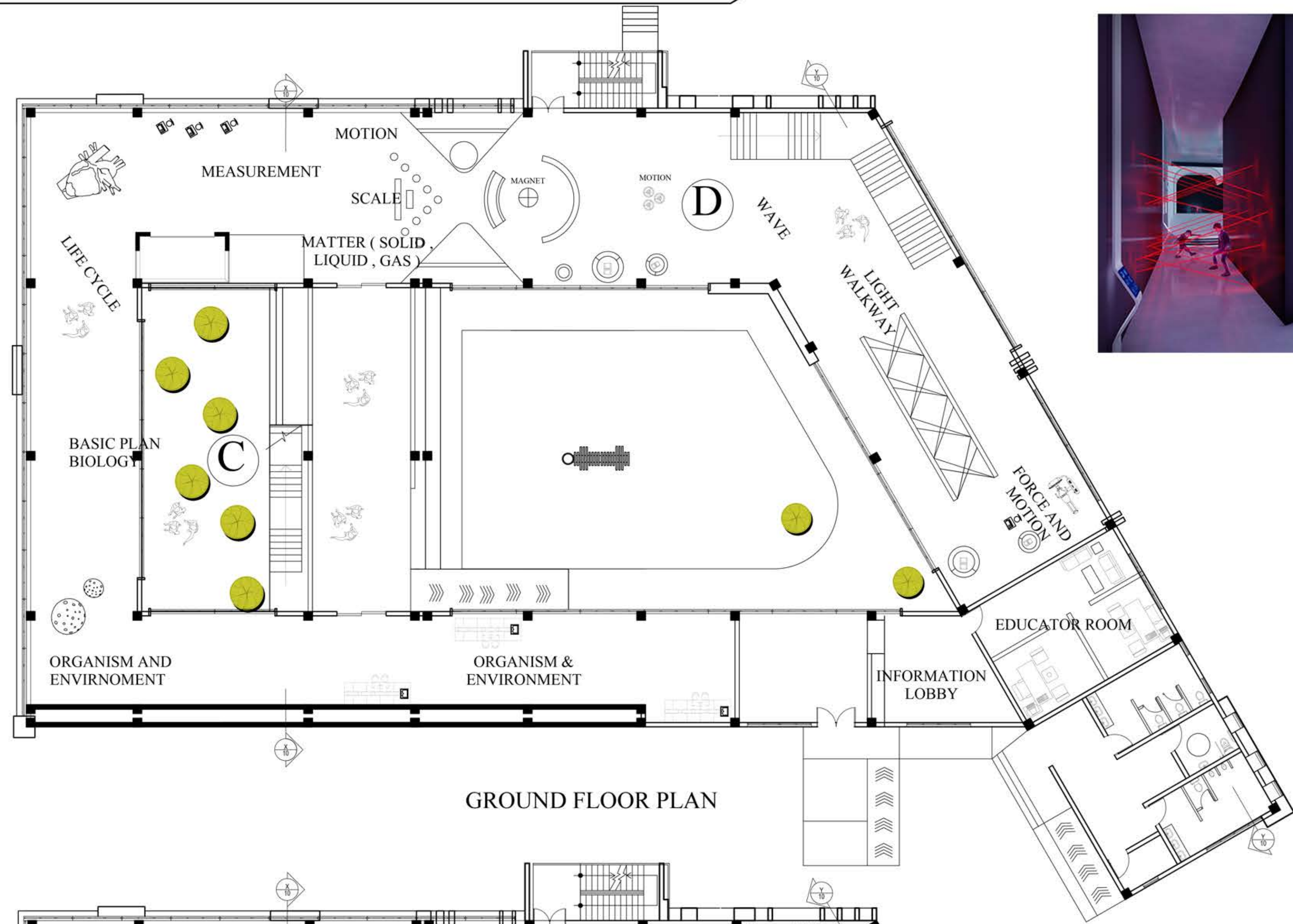
FRONT ELEVATION

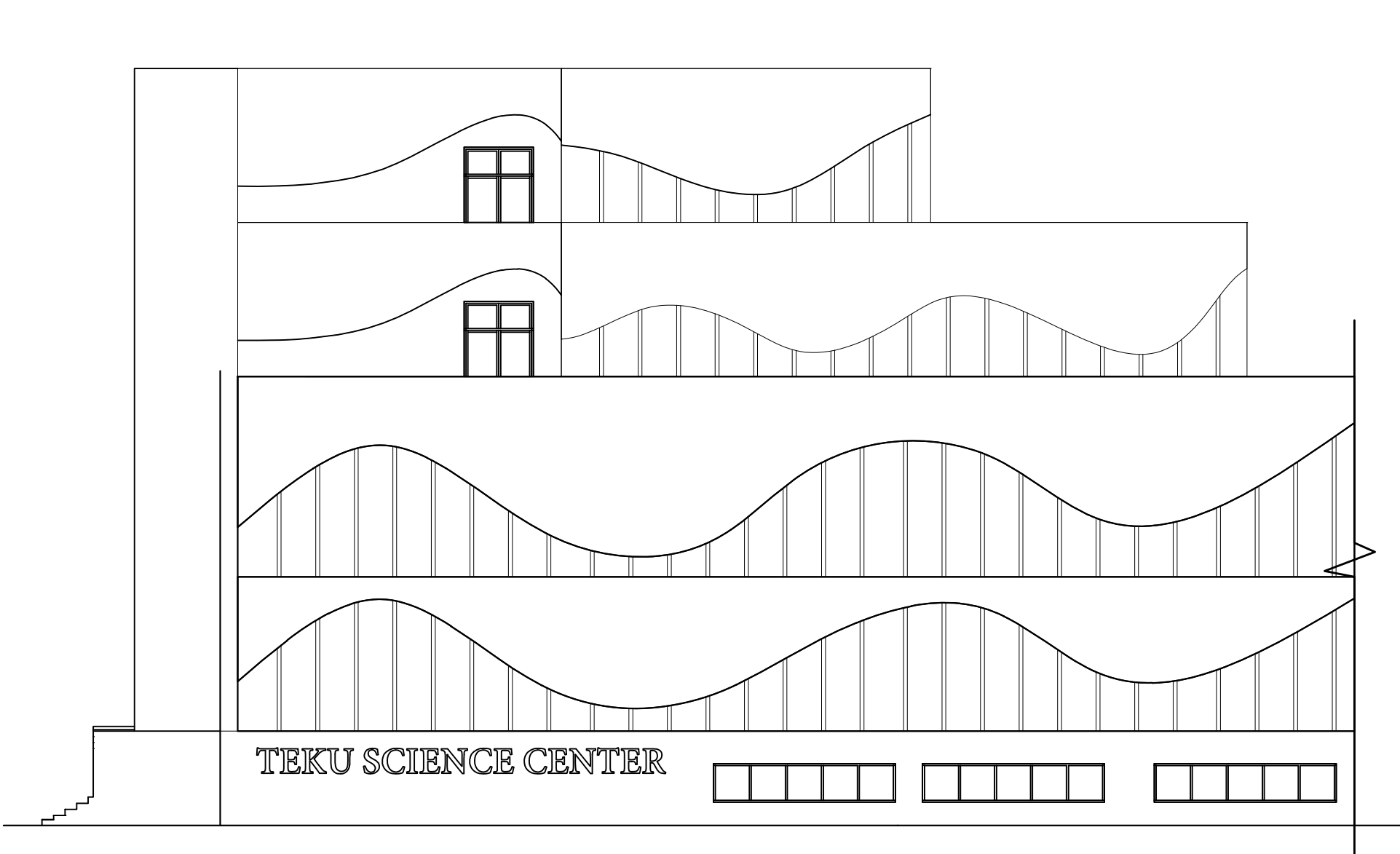


BACK ELEVATION

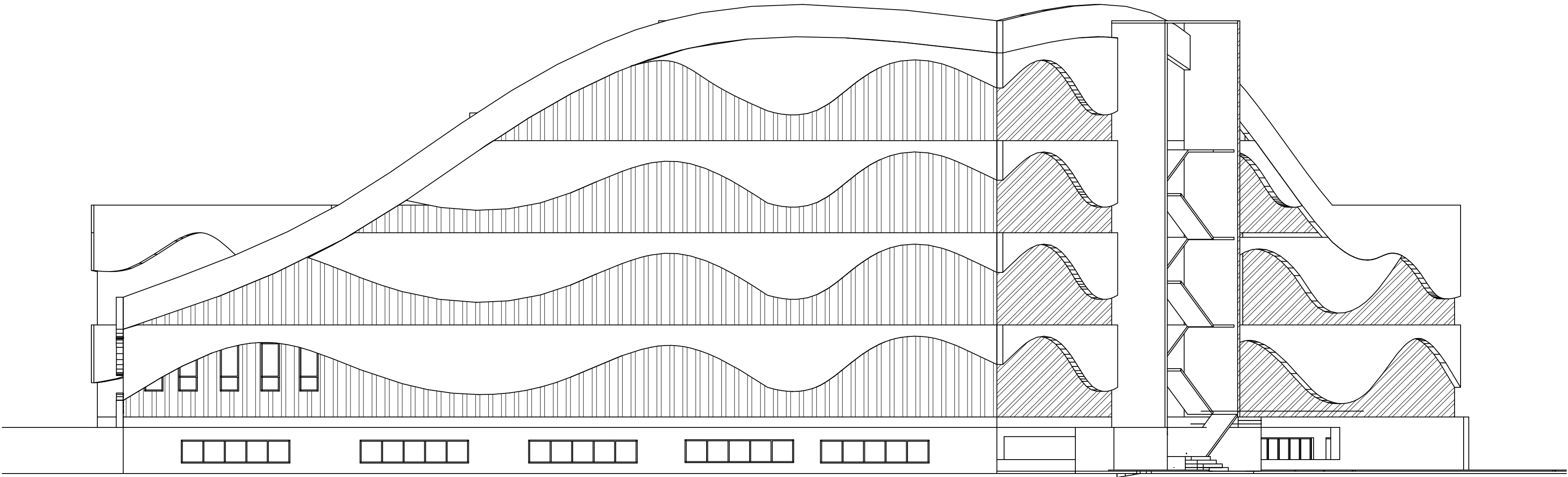
TEKU SCIENCE CENTER

SCIENCE BLOCK

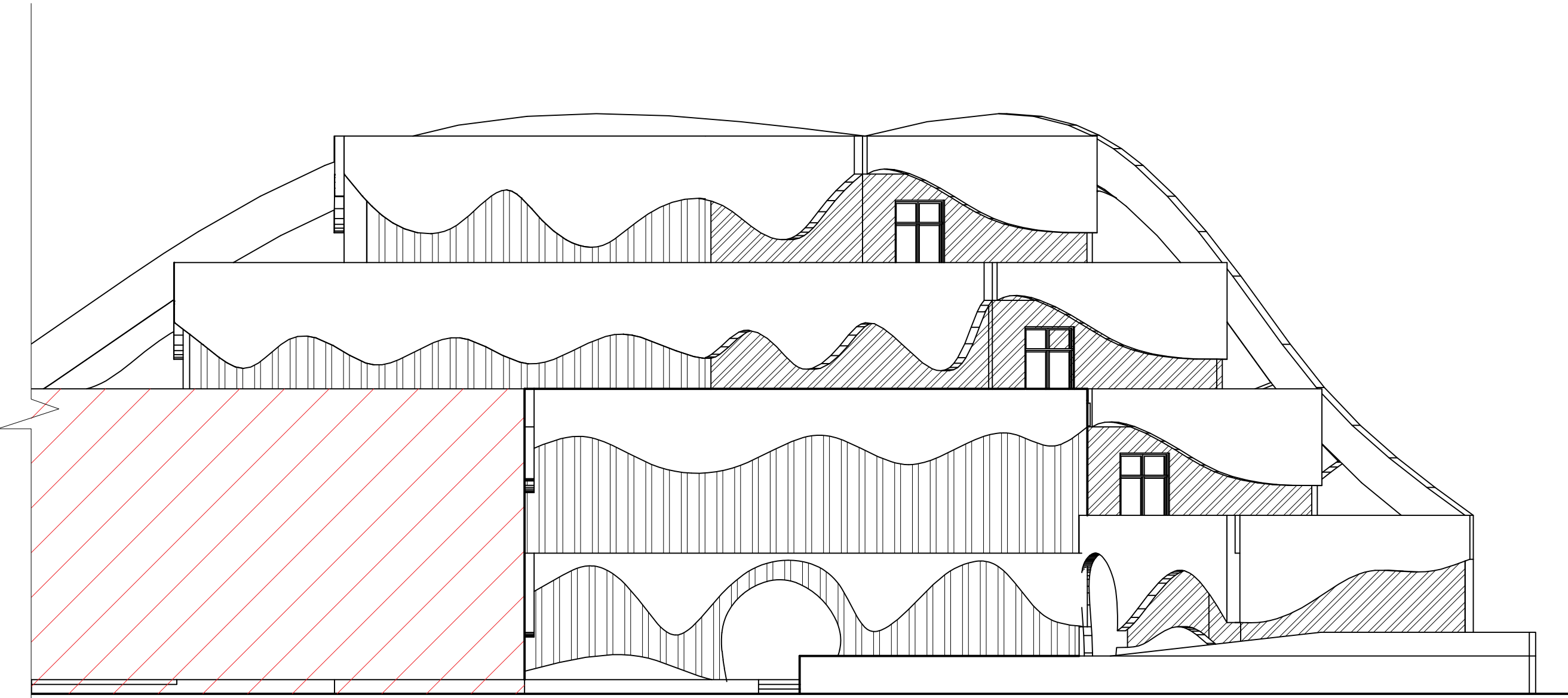




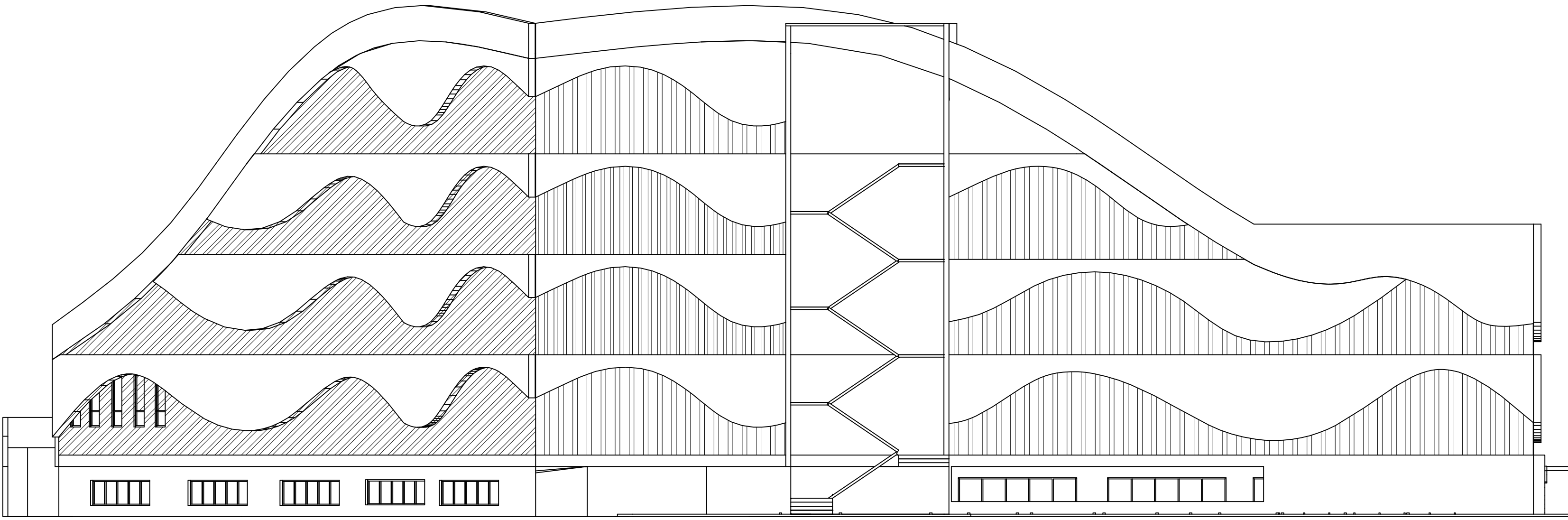
FRONT ELEVATION



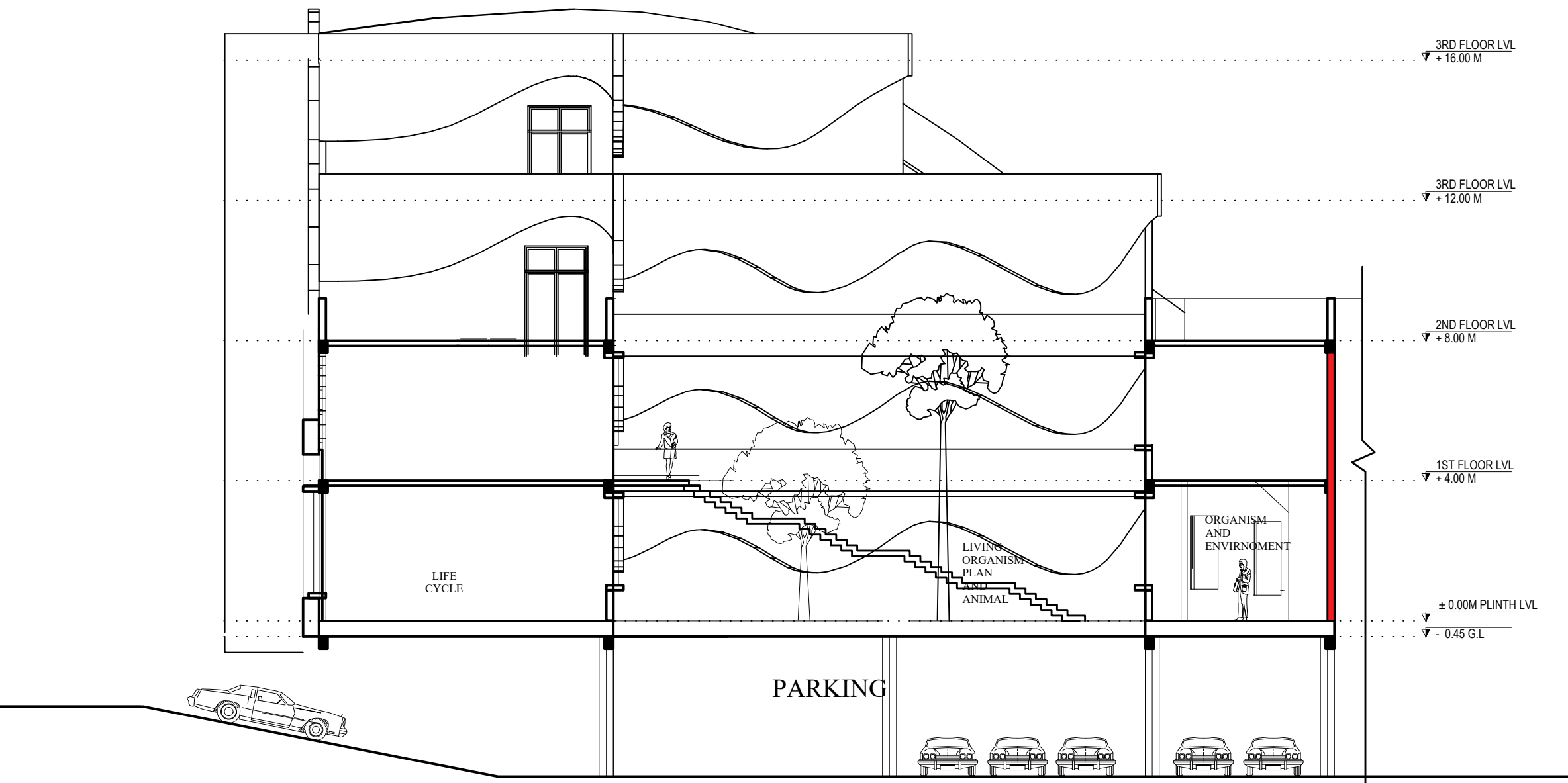
BACK ELEVATION



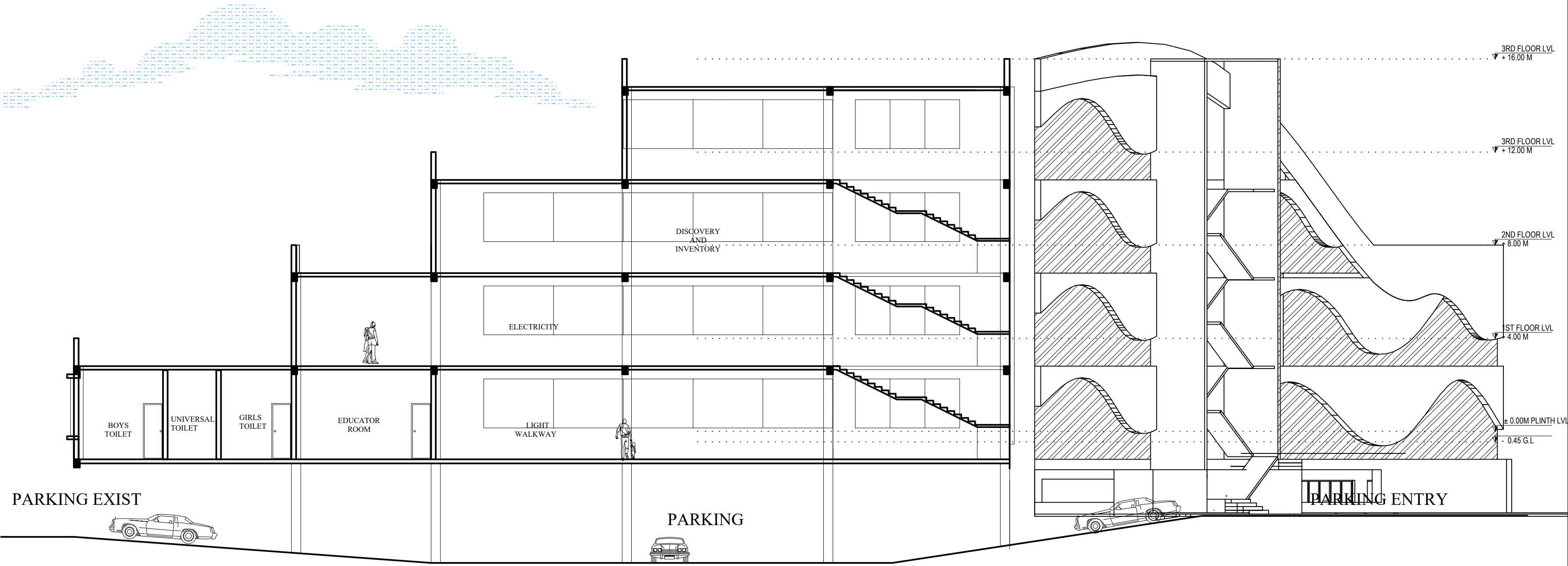
SIDE ELEVATION



BACK ELEVATION



SECTION AT X-X



SECTION AT Y-Y

TEKU SCIENCE CENTER

INNER EXHIBIT INCLUDE:
(BIOLOGY)

BUTTERFLY ENCLAVE
HISTORY OF HUMAN EVOLUTION
DNA FORMATION
ENDANGERED BIRDS AND ANIMAL
FLORA AND FAUNA

PHYSIC SECTION

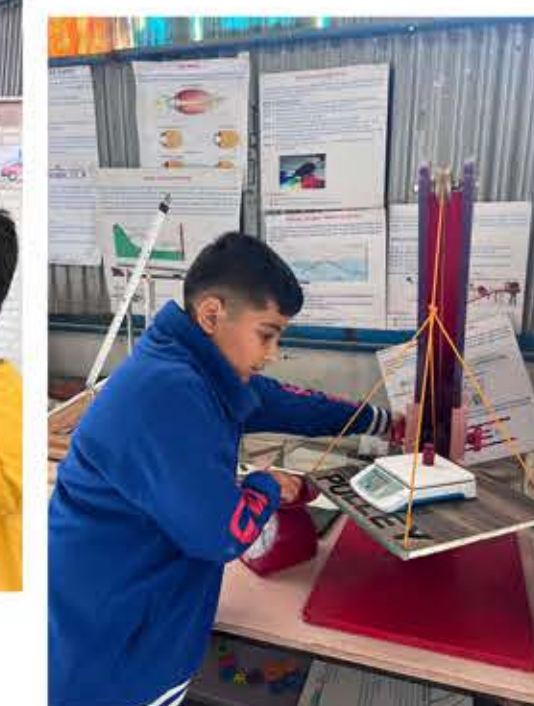
MOTION
FORCE
LIGHT WALKWAYS
COLOR SHADOW
AMAZING MIRROR
VIBRATION AND WAVE
STALL ON CYCLONES, HURRICANE AND
EARTHQUAKE EXPERIENCE ZONE
GLASS DISPLAYING OF VOLCANOES
MAGNETIC WALL
DELAY HEARING
CHEMICAL REACTION
FLOATING ILLUSION
PENDULUM
WHISPER AT DISTANCE
BUBBLES
ELECTRIC DISCHARGE
TRANSFORMATION MIRROR CONCAVE AND
CONVEX
WALKING PIANO
ATOMIC MISTER
SHADOW

ASTRONOMY SECTION

PLANET & SOLAR SYSTEM
MOON PHASE
OCULUS
CONSTELLATION STIMULATION MODEL
HOROSCOPE DEMONSTRATION
LIGHTING EARTH CRUST

OTHER .
VR AND AR STIMULATION MODEL ROOM
ROCKET LAUNCHER AND EXPERIMENTAL
ROOM
STEM LAB

SCIENCE BLOCK



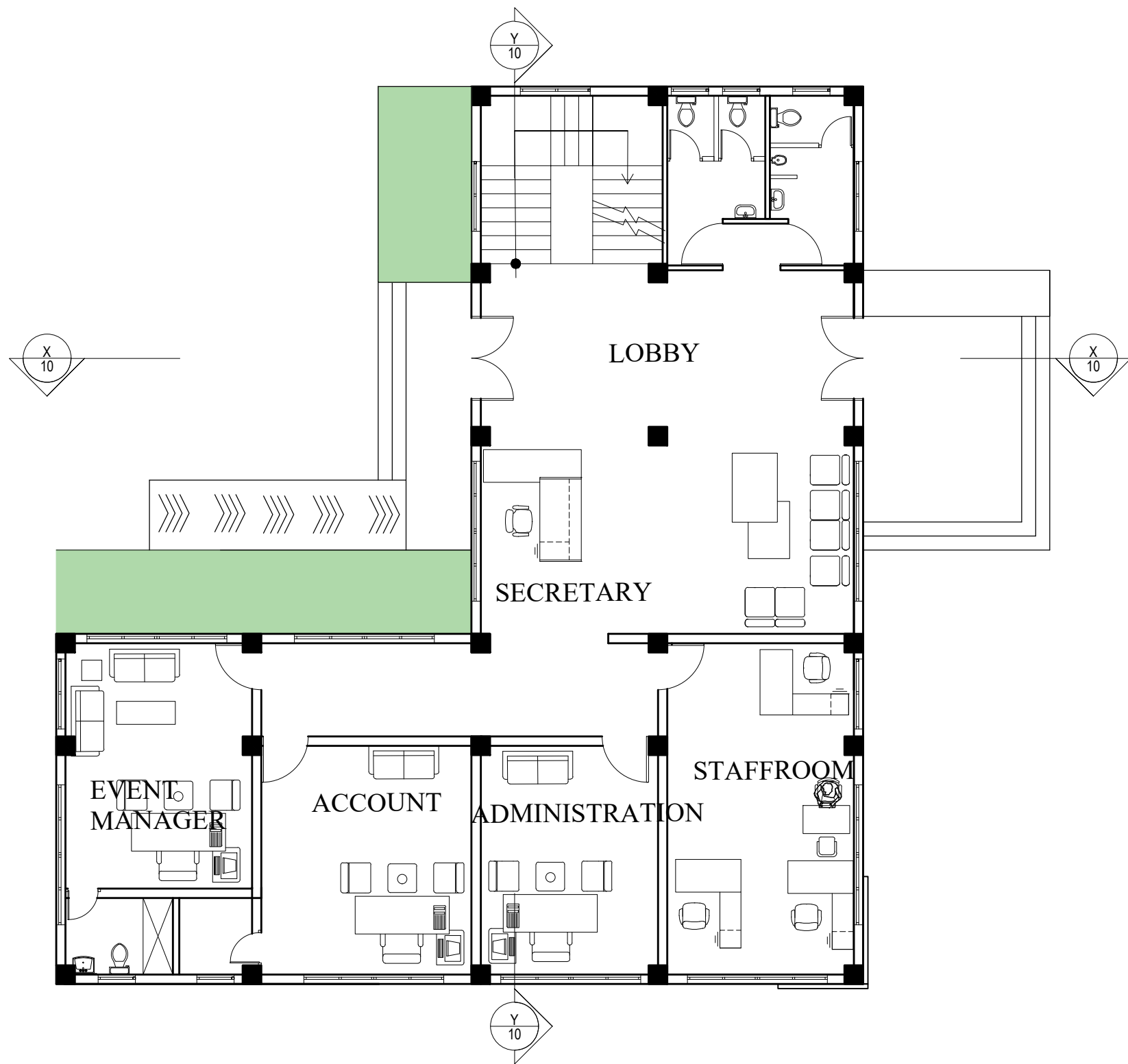
EXUINOX
SEPT 23

WINTER SOLSTICE
DEC 22

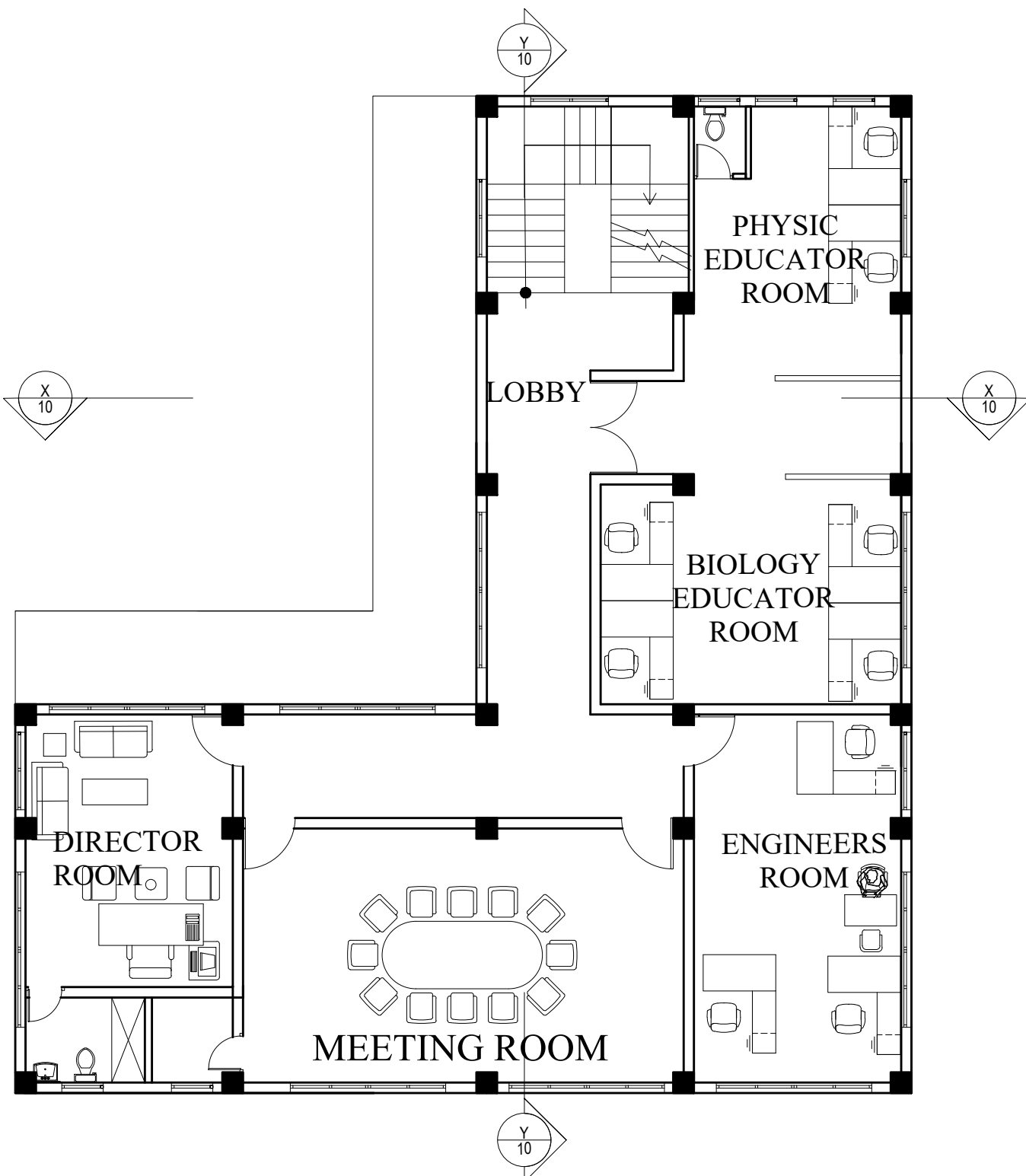
SUMMER SOLSTICE
JUNE 21

TEKU SCIENCE CENTER

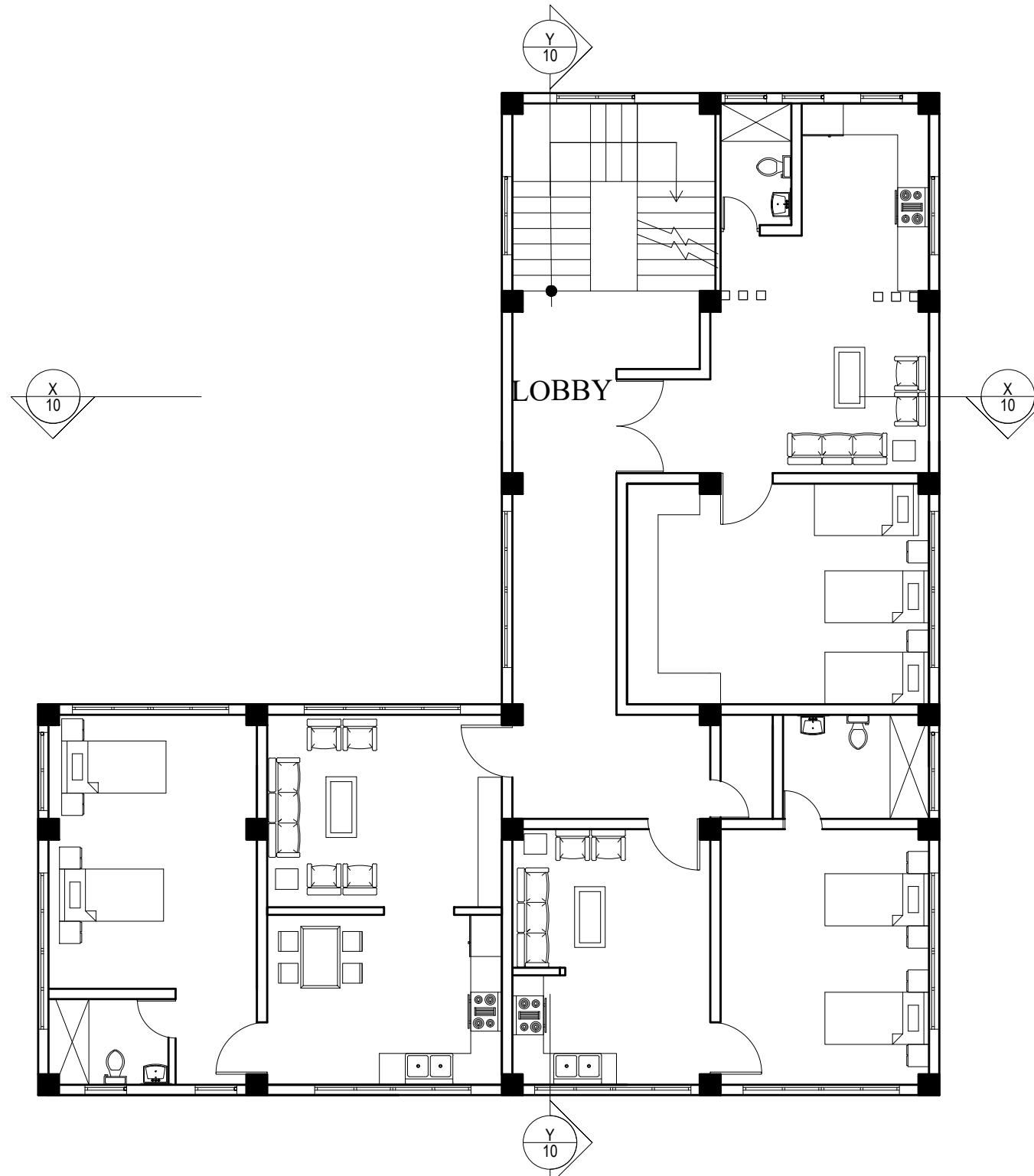
ADMIN BLOCK



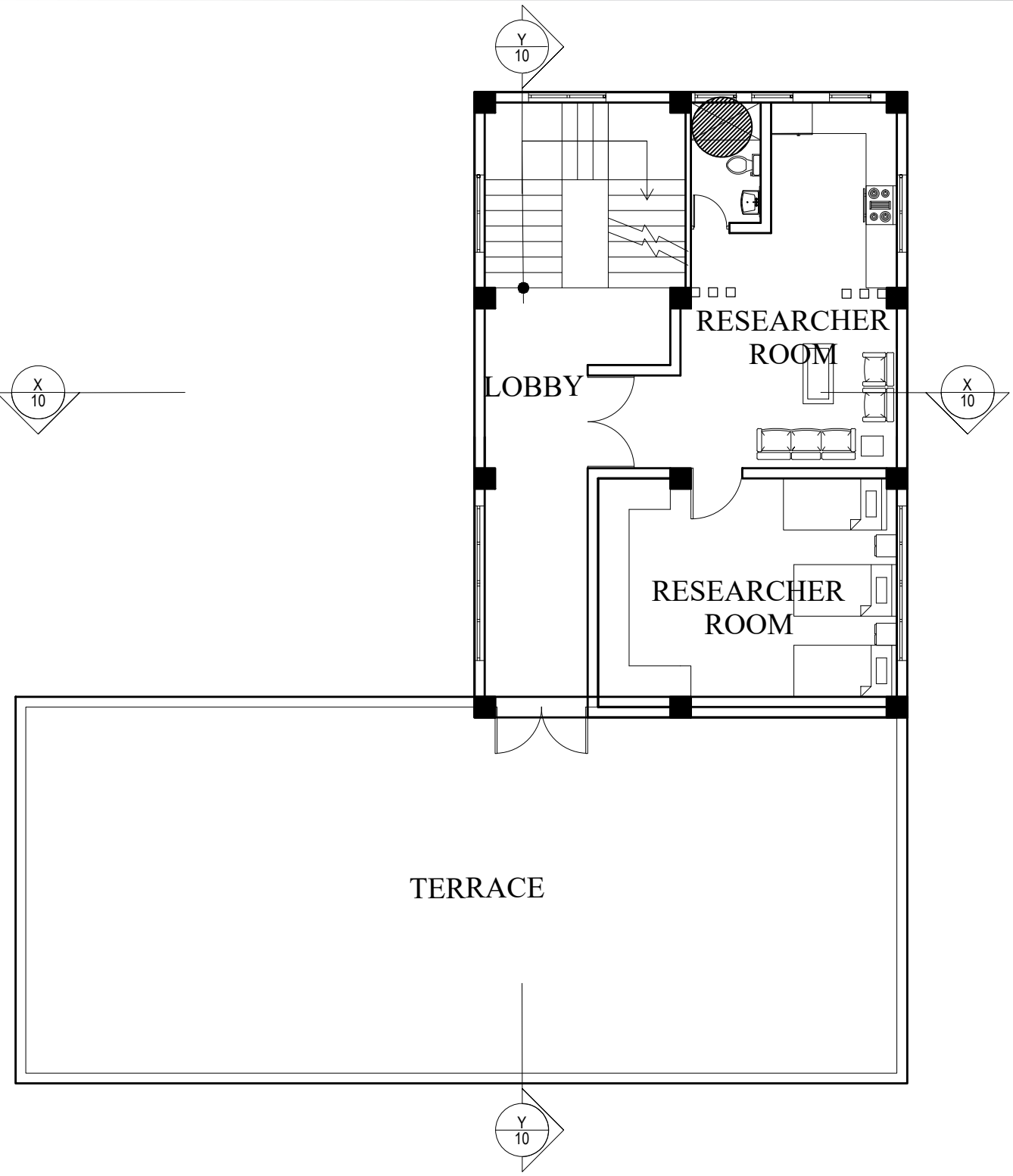
GROUND FLOOR PLAN



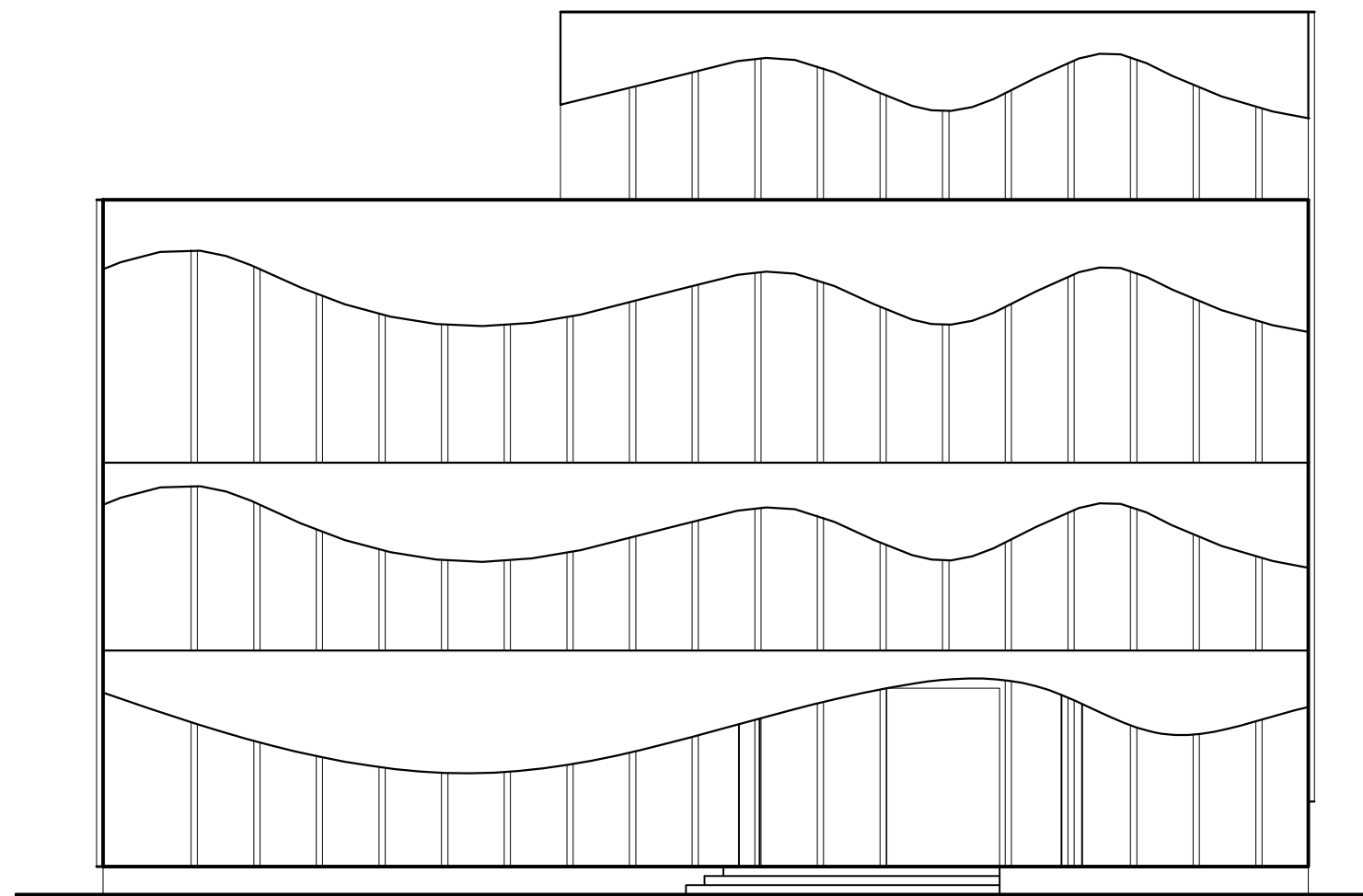
FIRST FLOOR PLAN



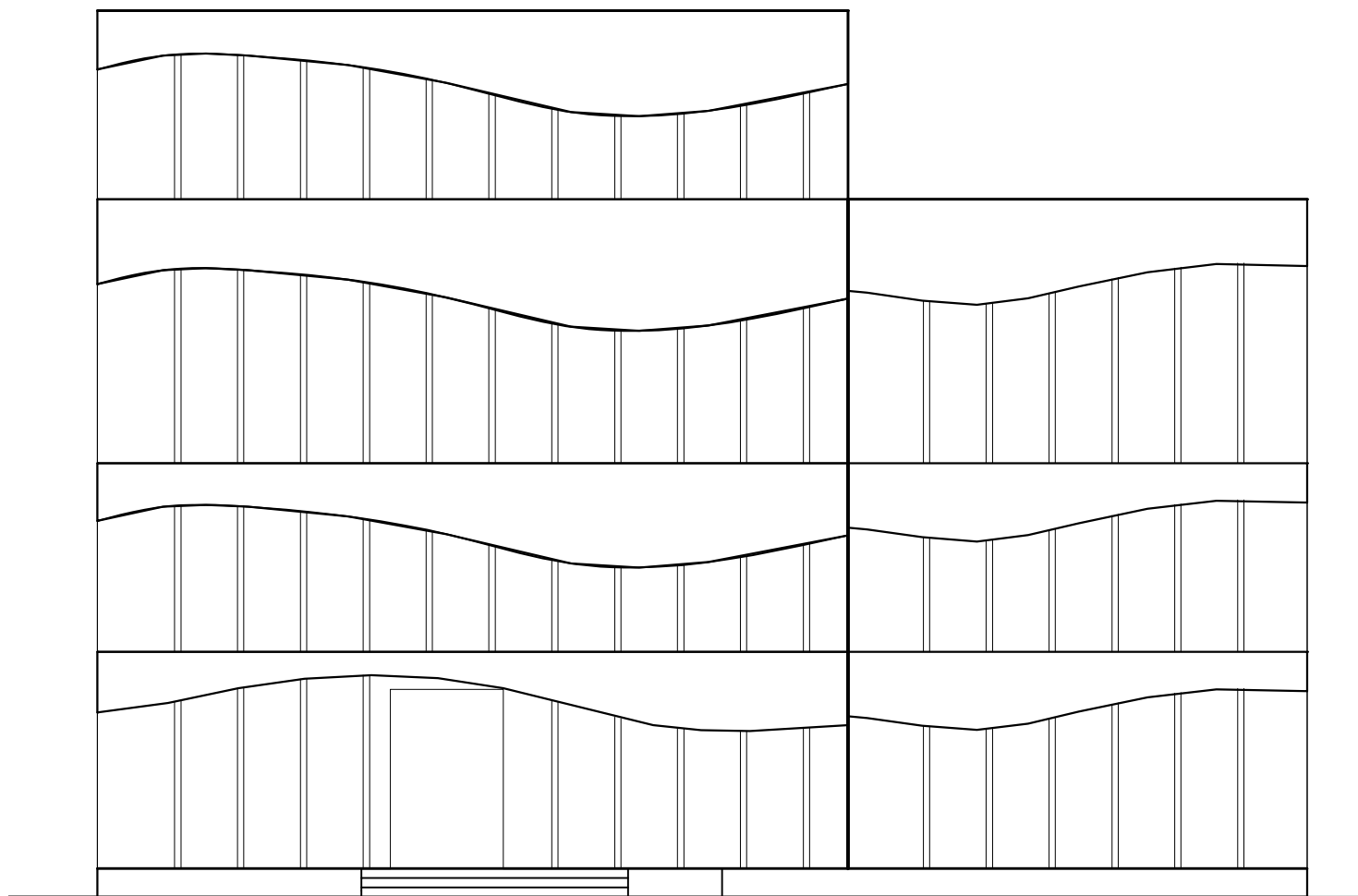
SECOND FLOOR PLAN



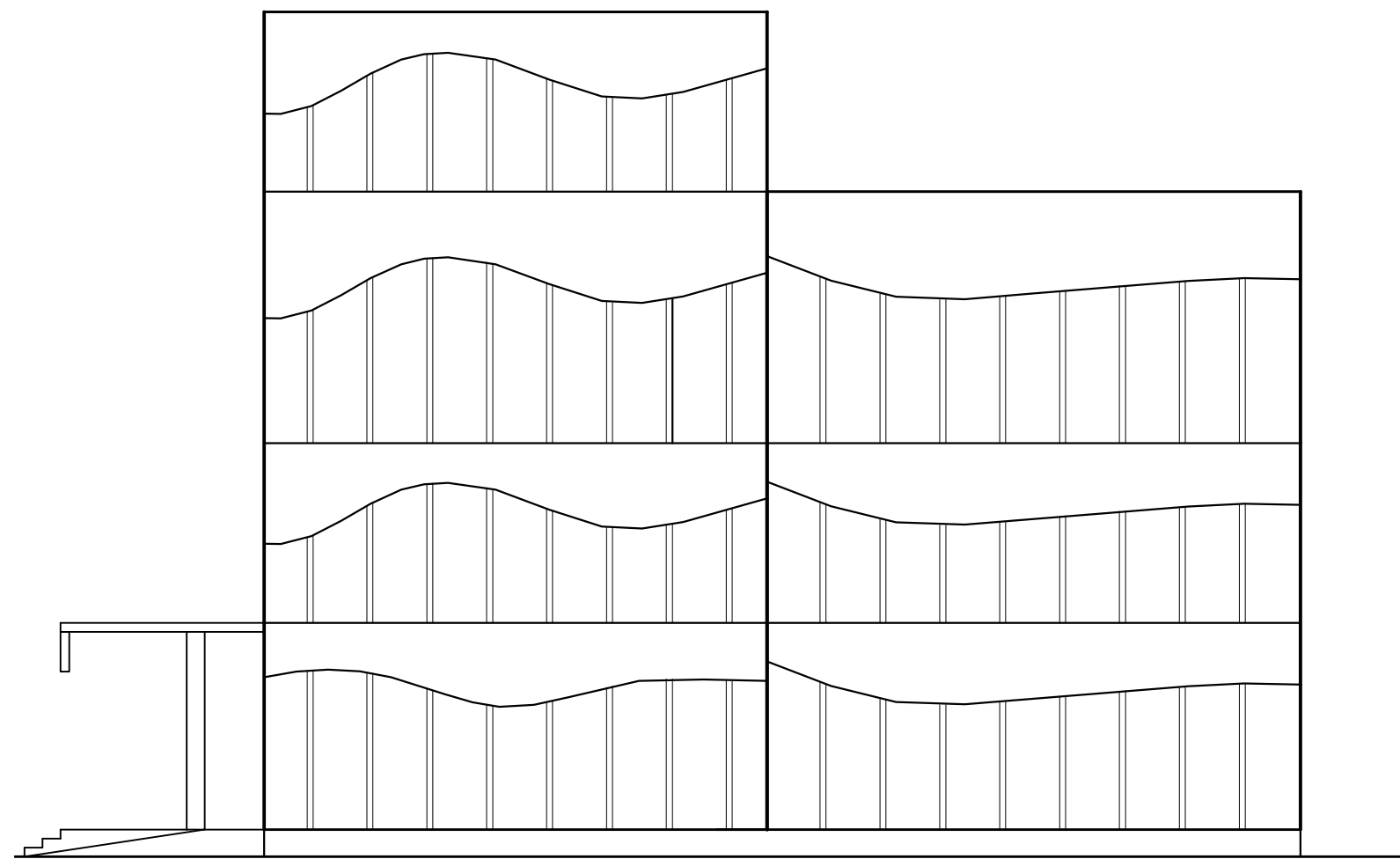
TOP FLOOR PLAN



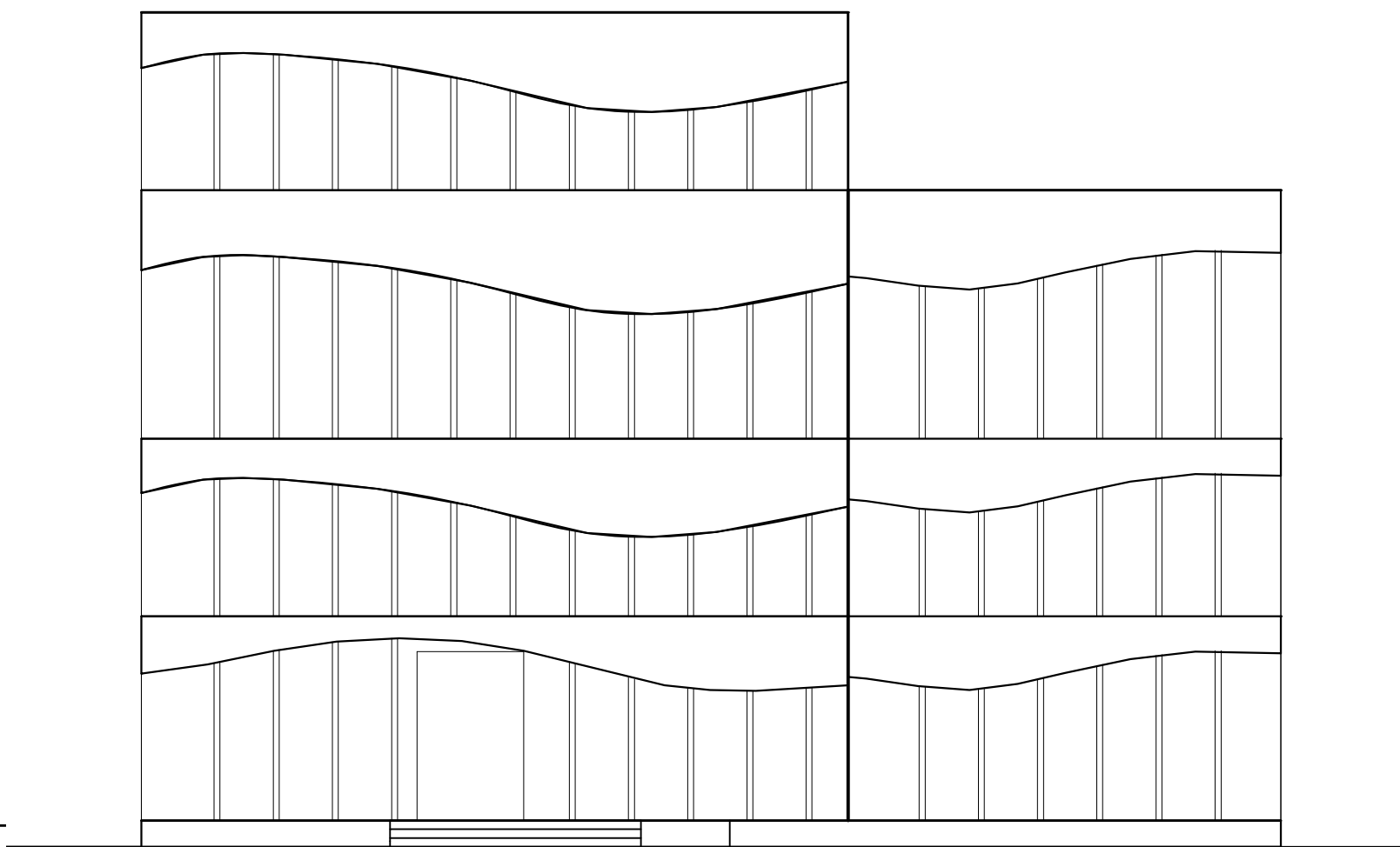
FRONT ELEVATION



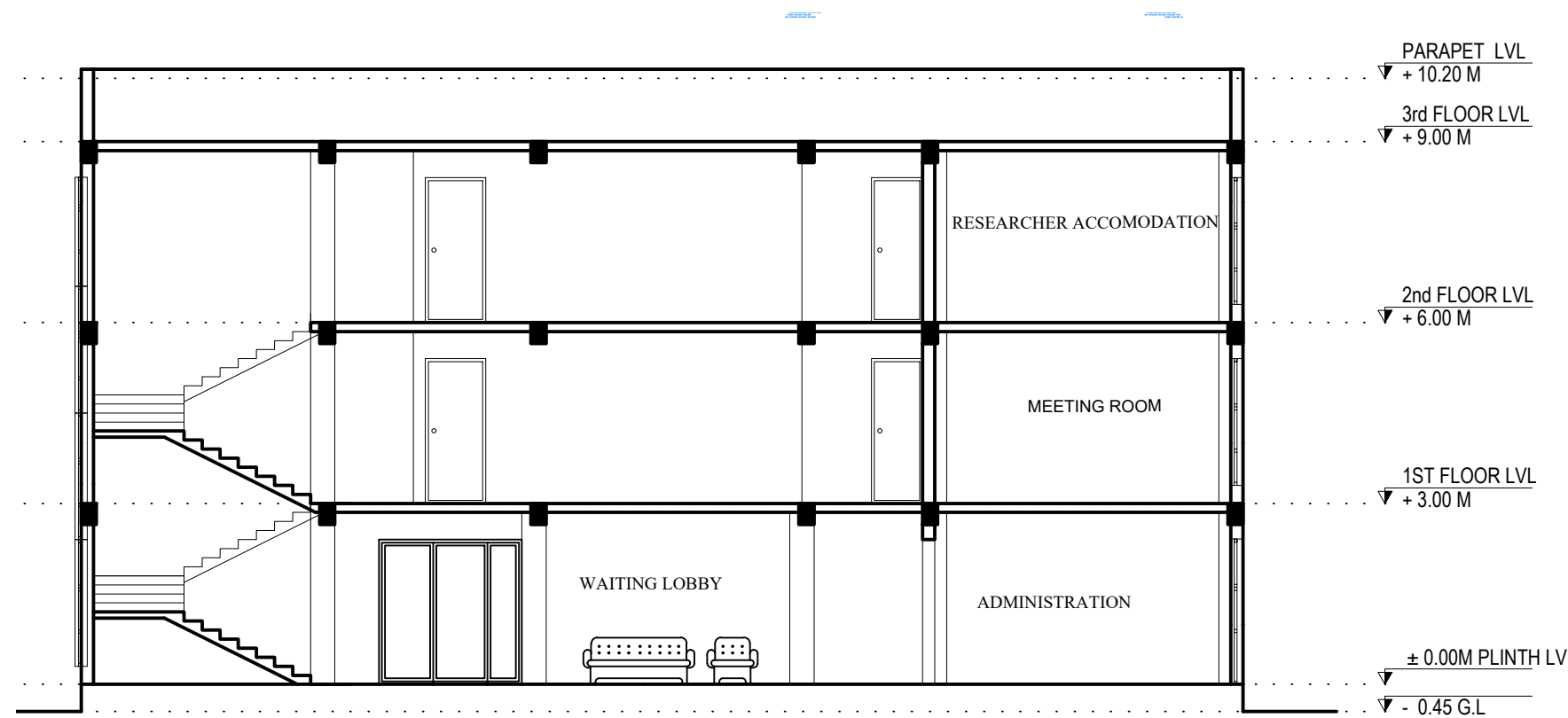
BACK ELEVATION



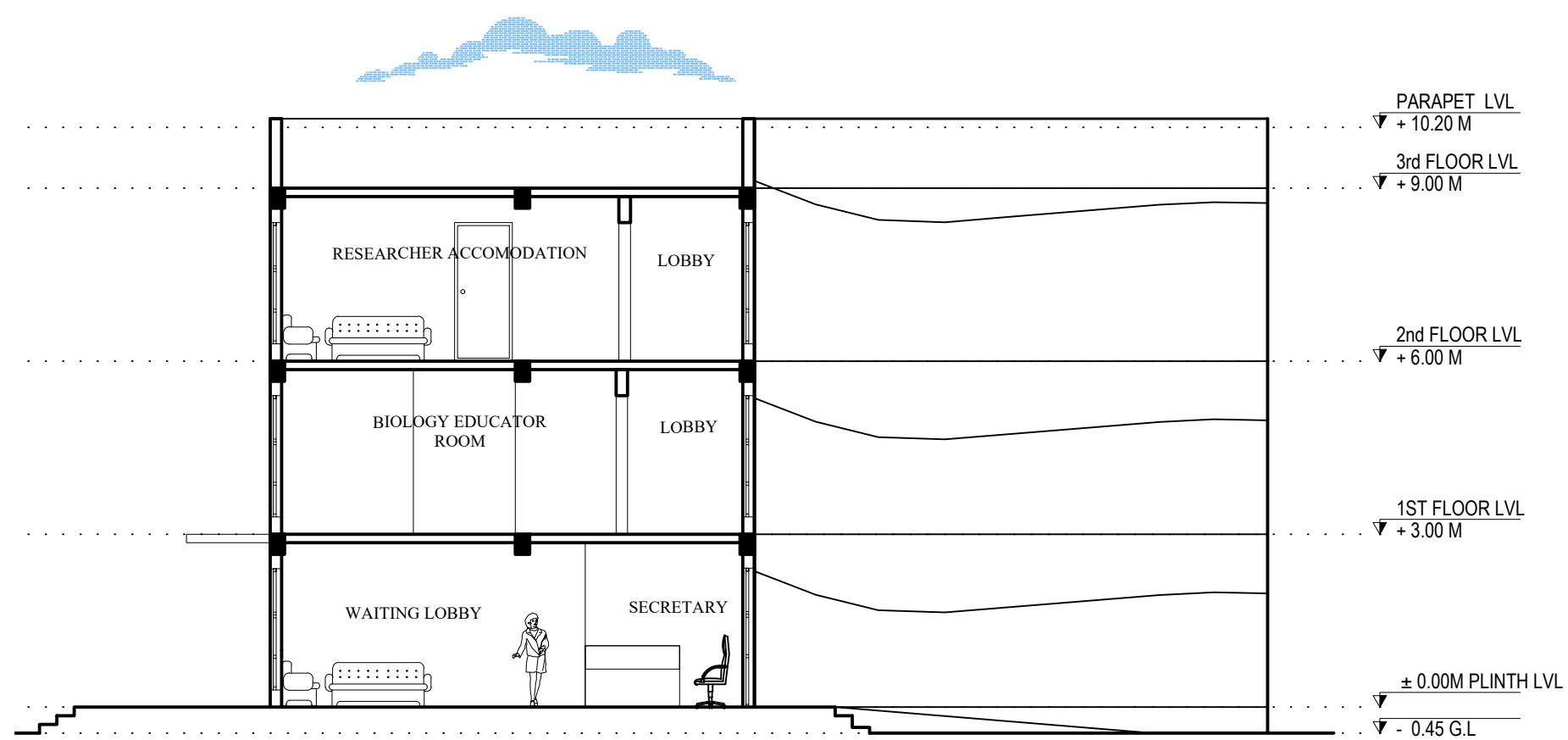
RIGHT ELEVATION



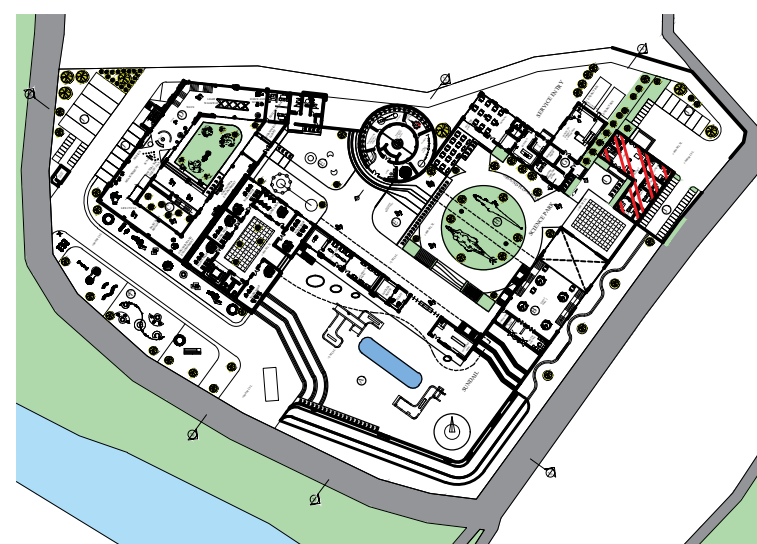
BACK ELEVATION



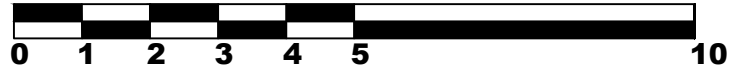
SECTION AT X-X

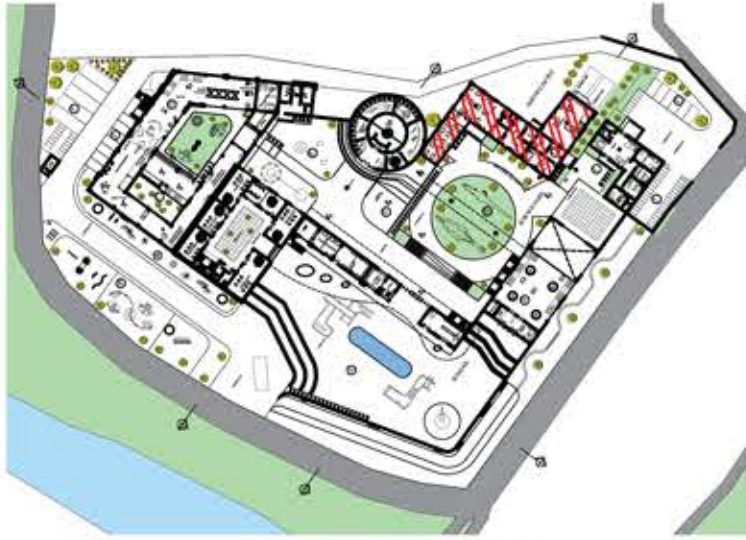


SECTION AT Y-Y

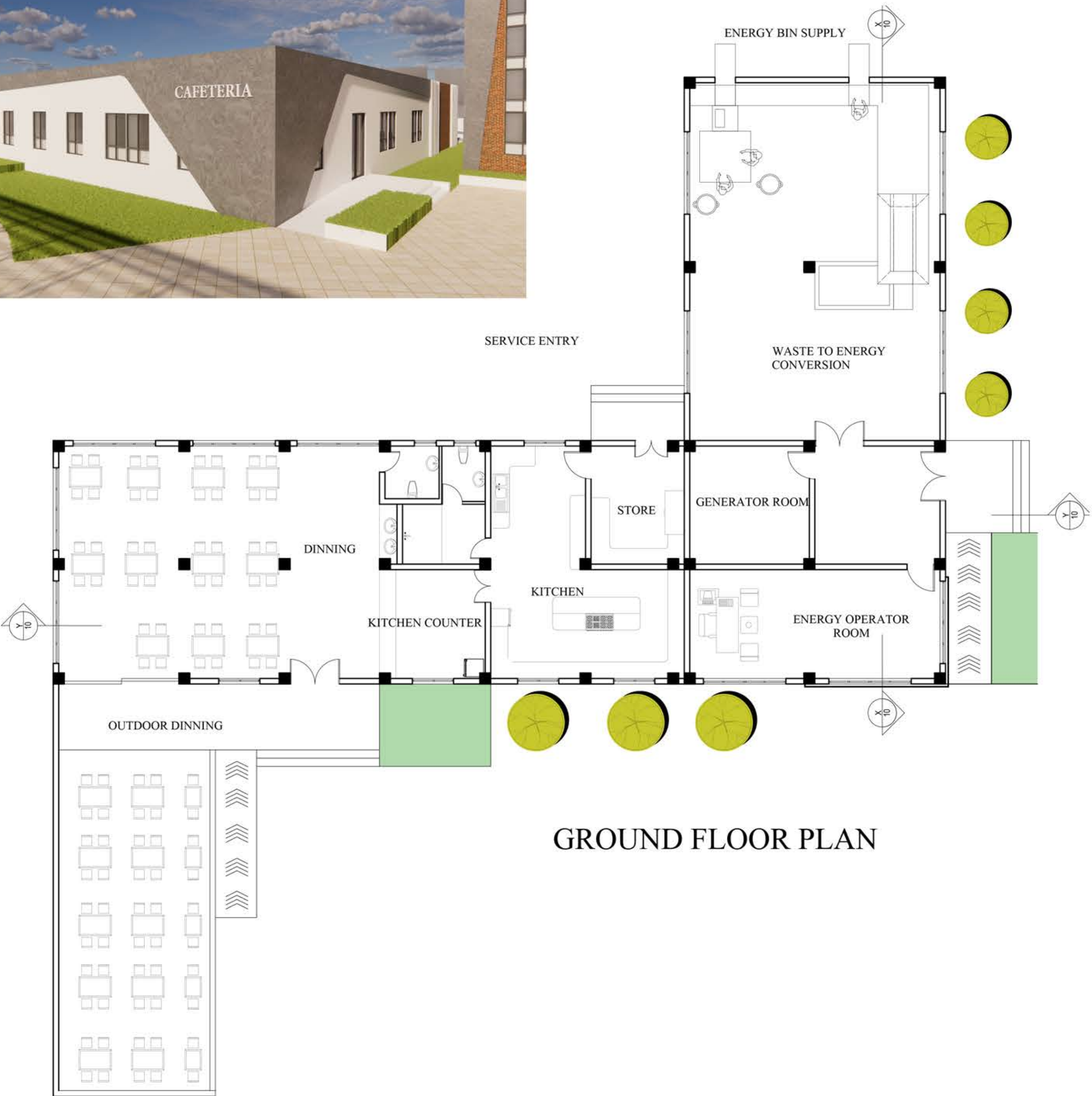


KEY PLAN

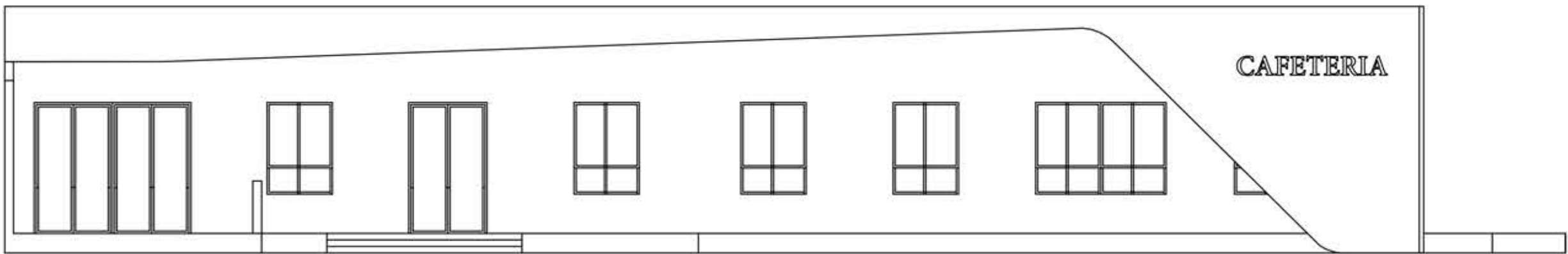




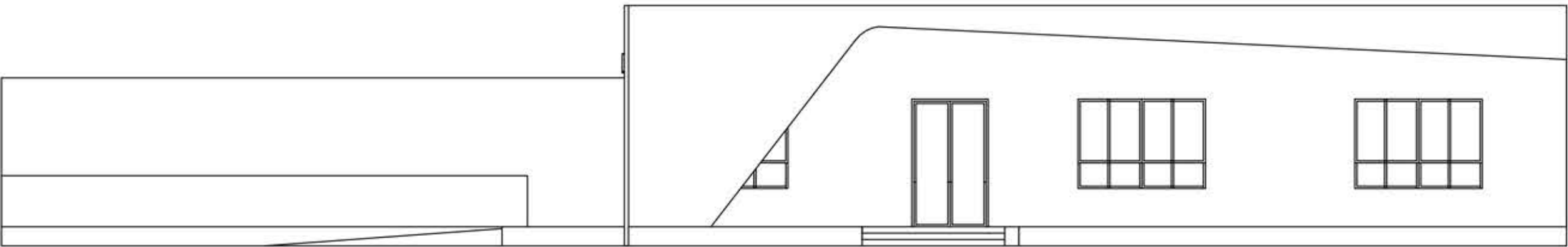
KEY PLAN



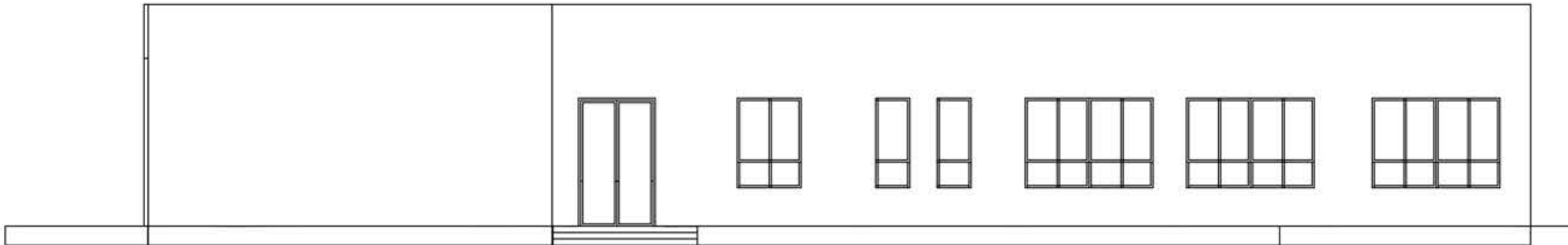
GROUND FLOOR PLAN



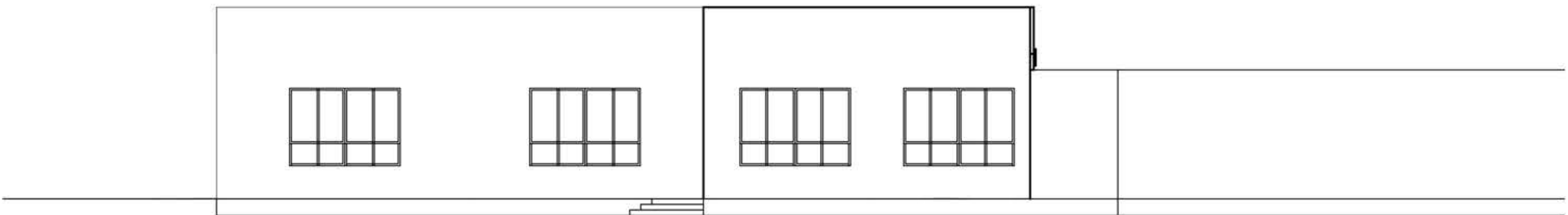
FRONT ELEVATION



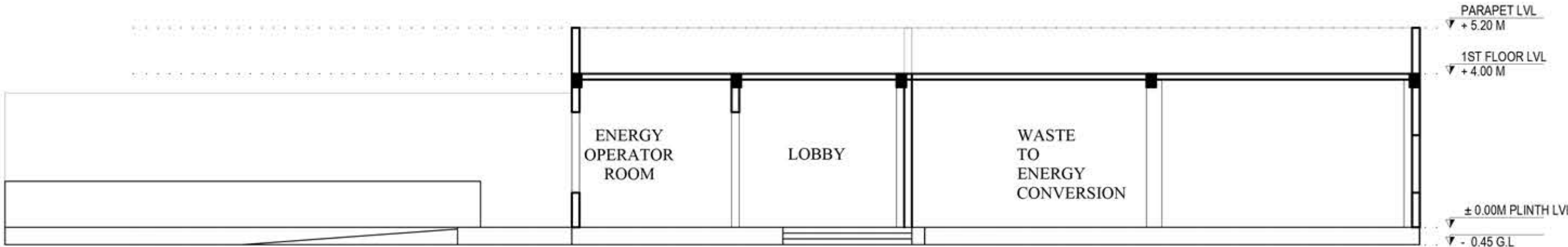
RIGHT ELEVATION



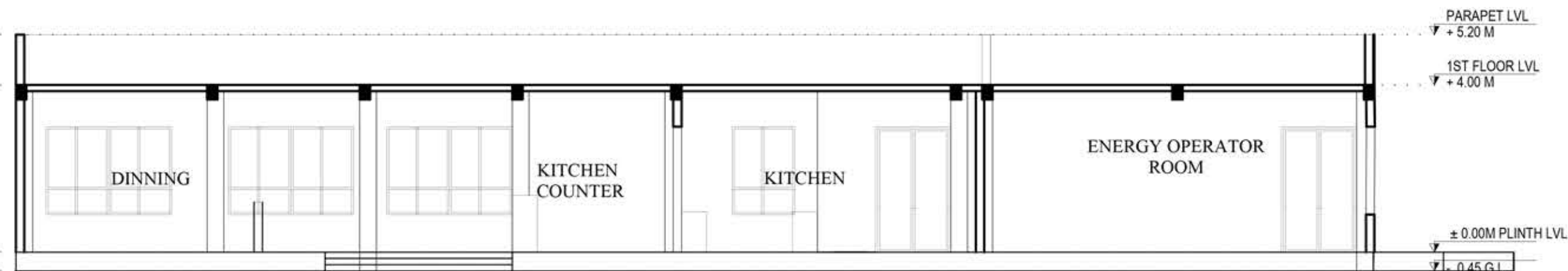
BACK ELEVATION



LEFT ELEVATION

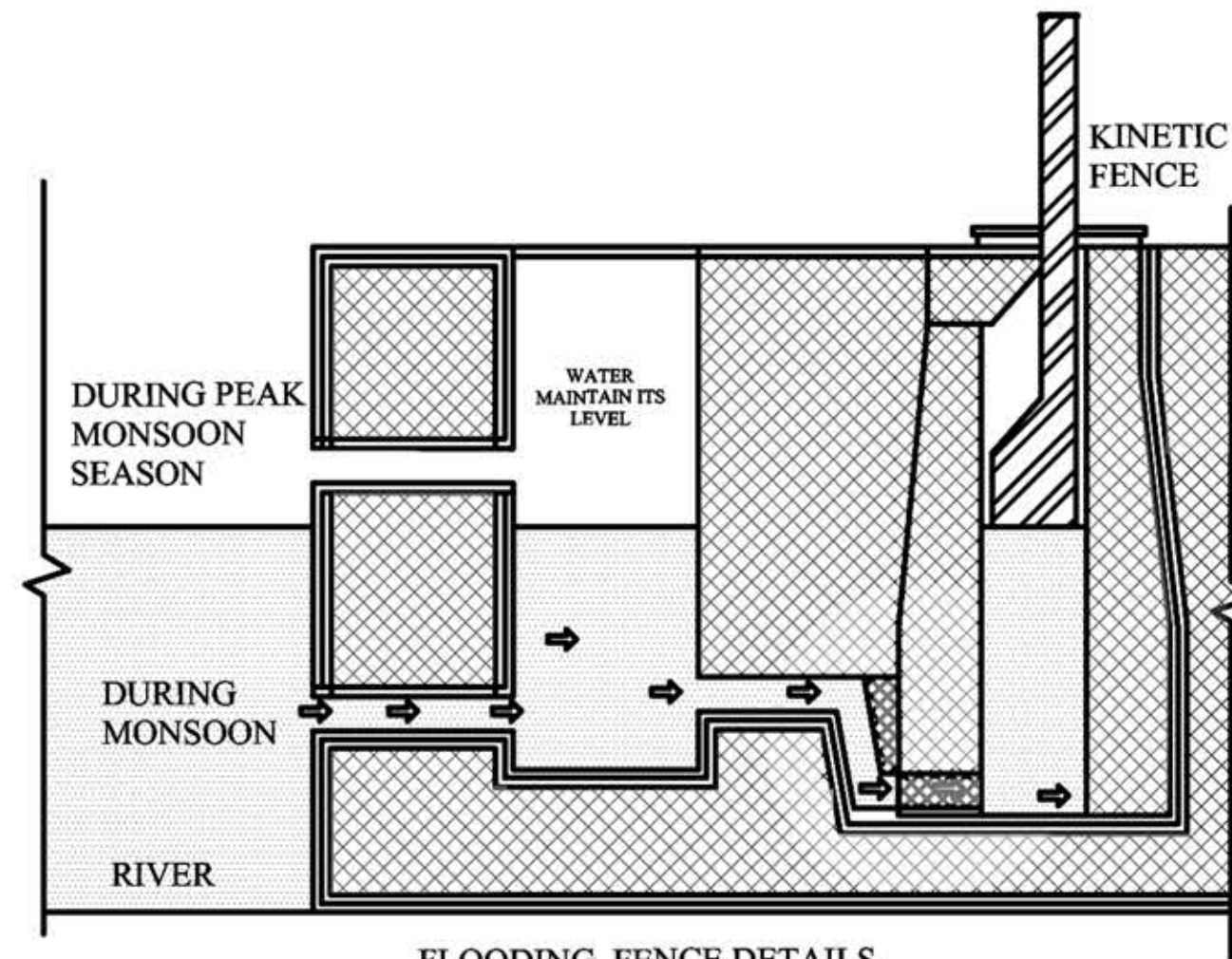


SECTION AT Y-Y

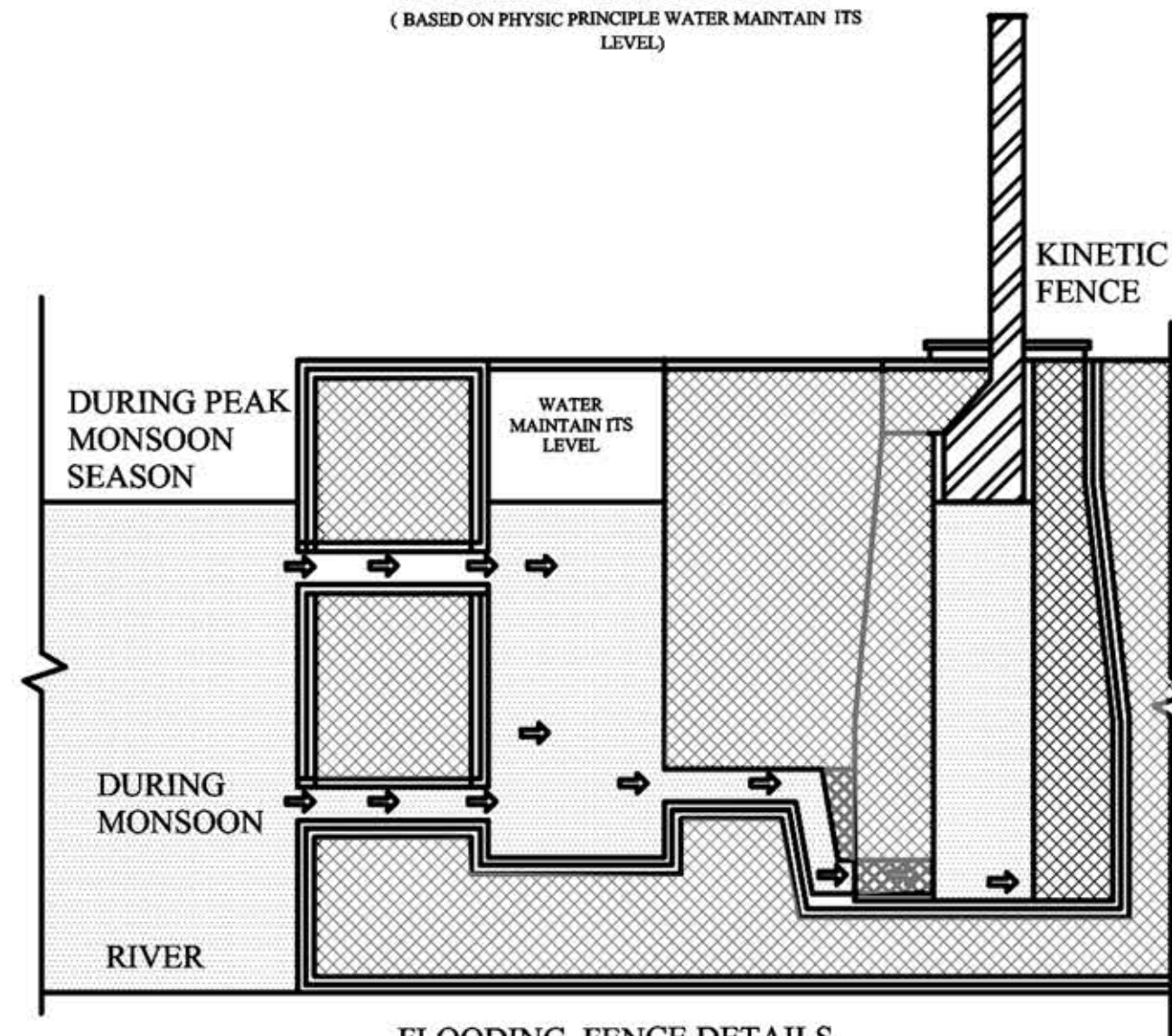


SECTION AT X-X

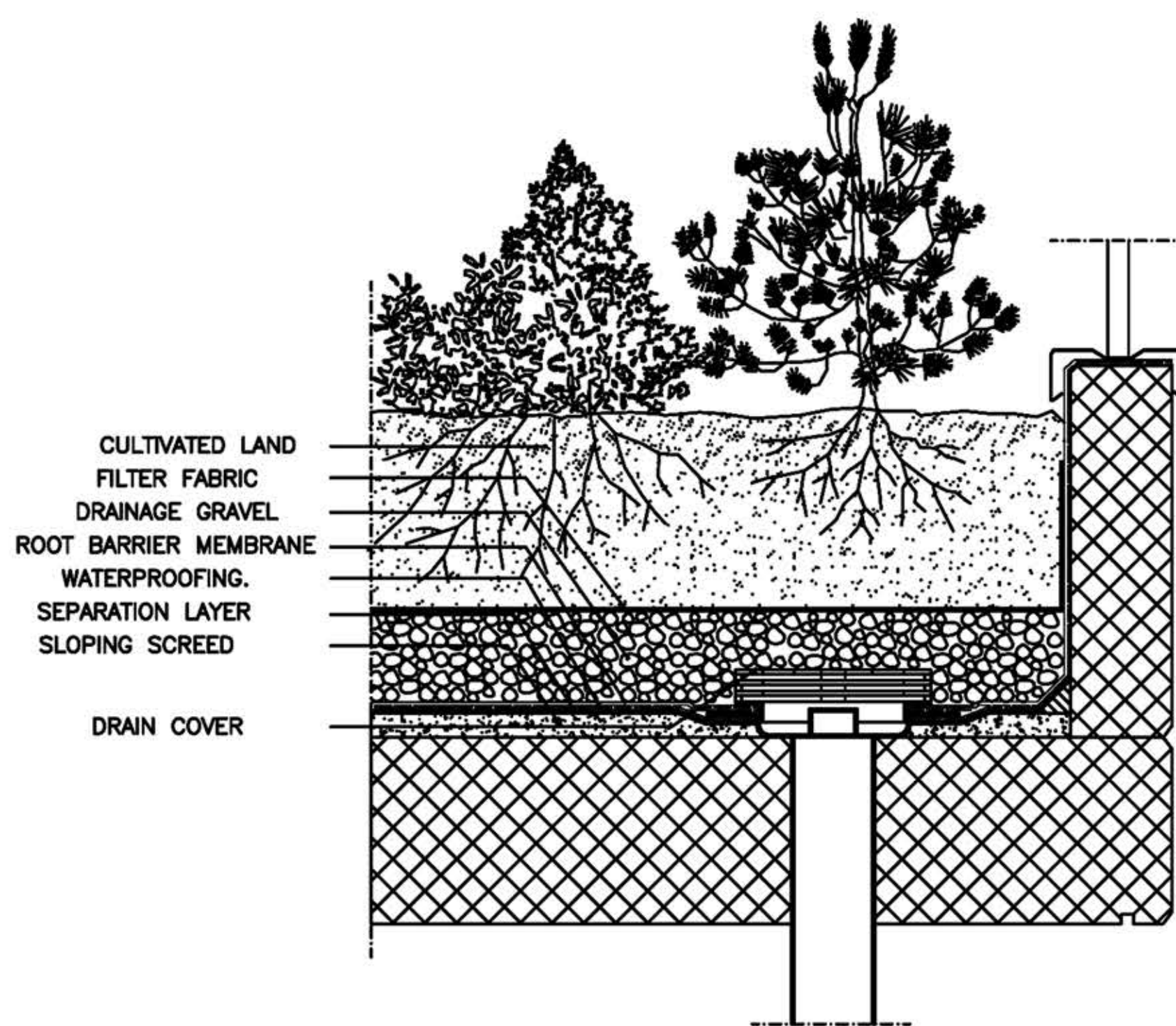




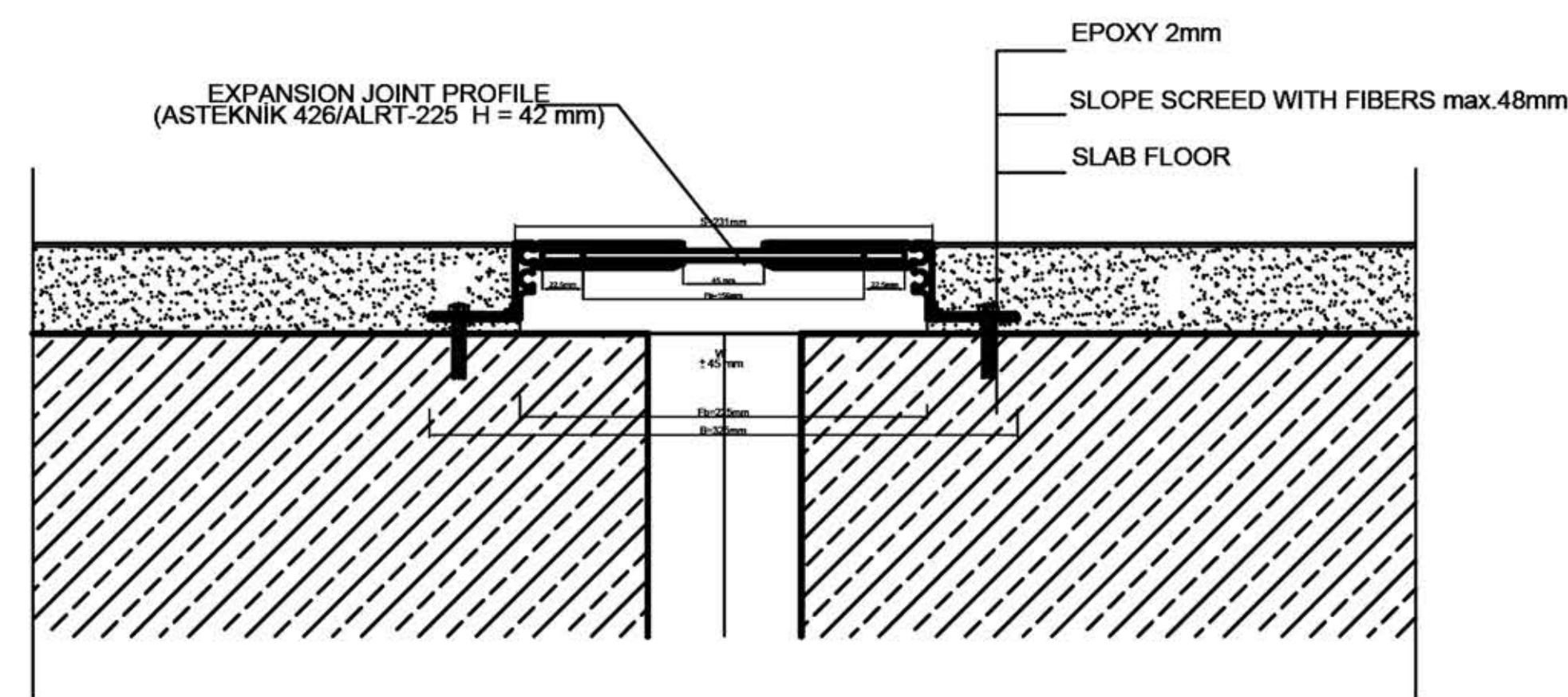
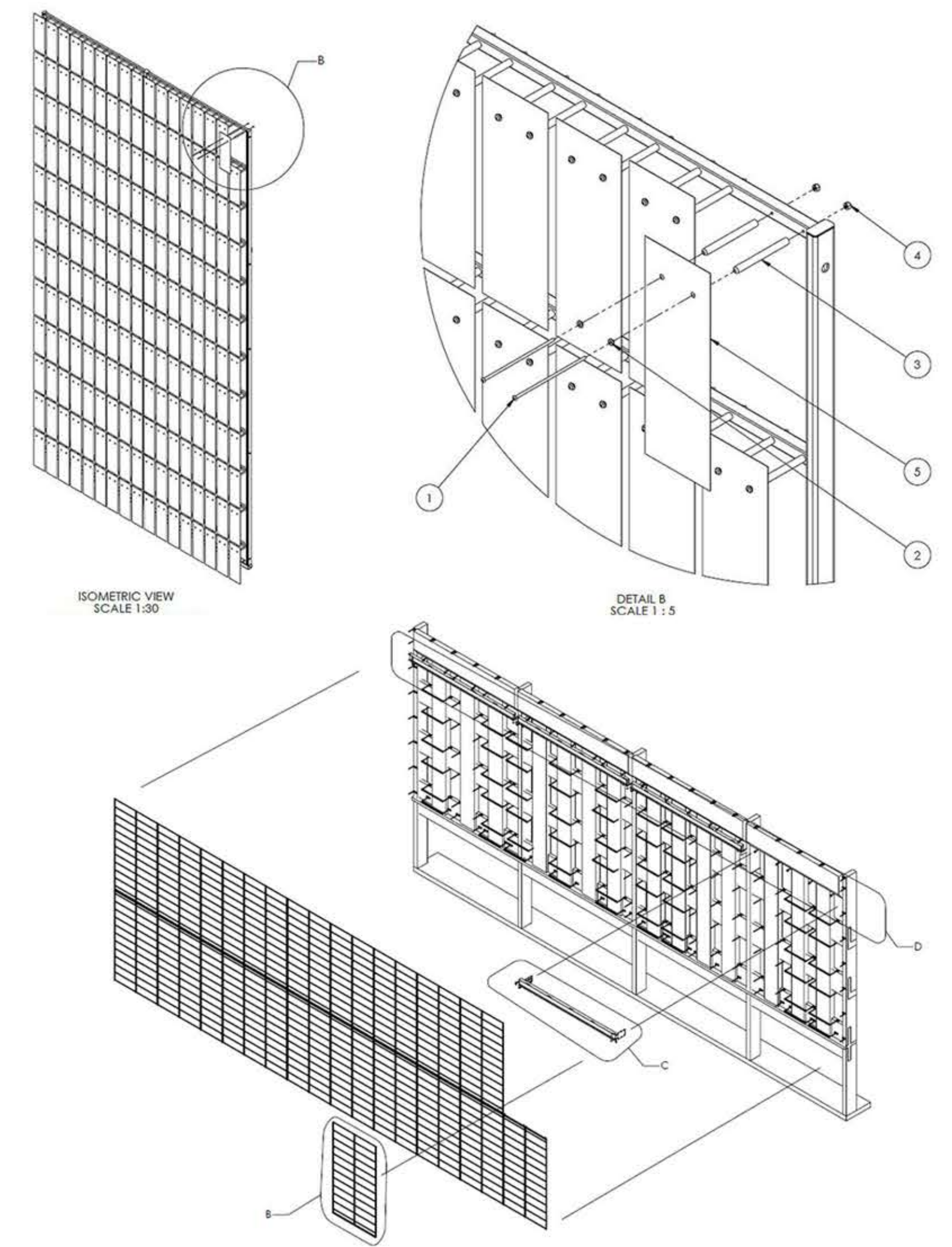
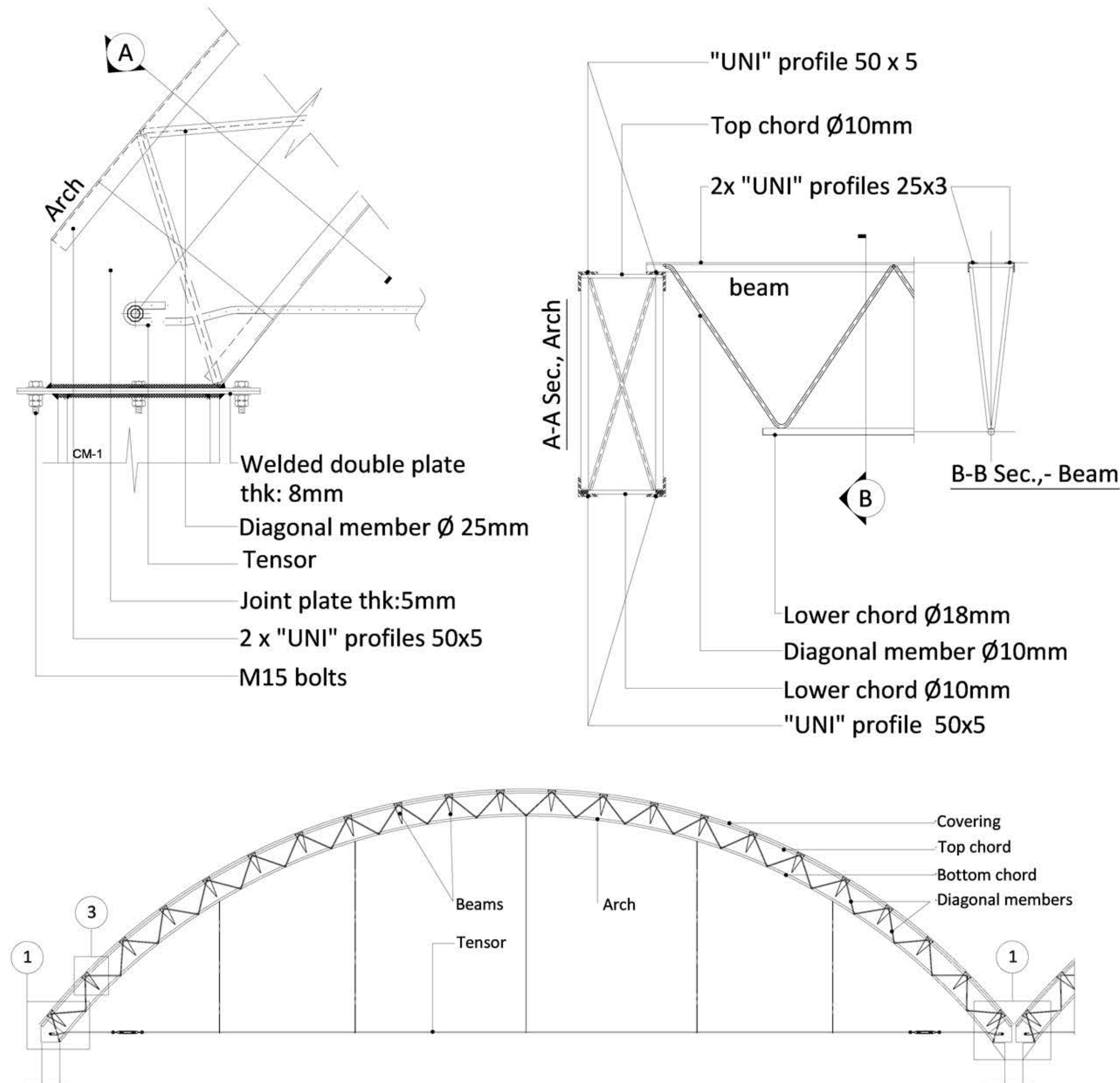
FLOODING FENCE DETAILS
(BASED ON PHYSIC PRINCIPLE WATER MAINTAIN ITS LEVEL)



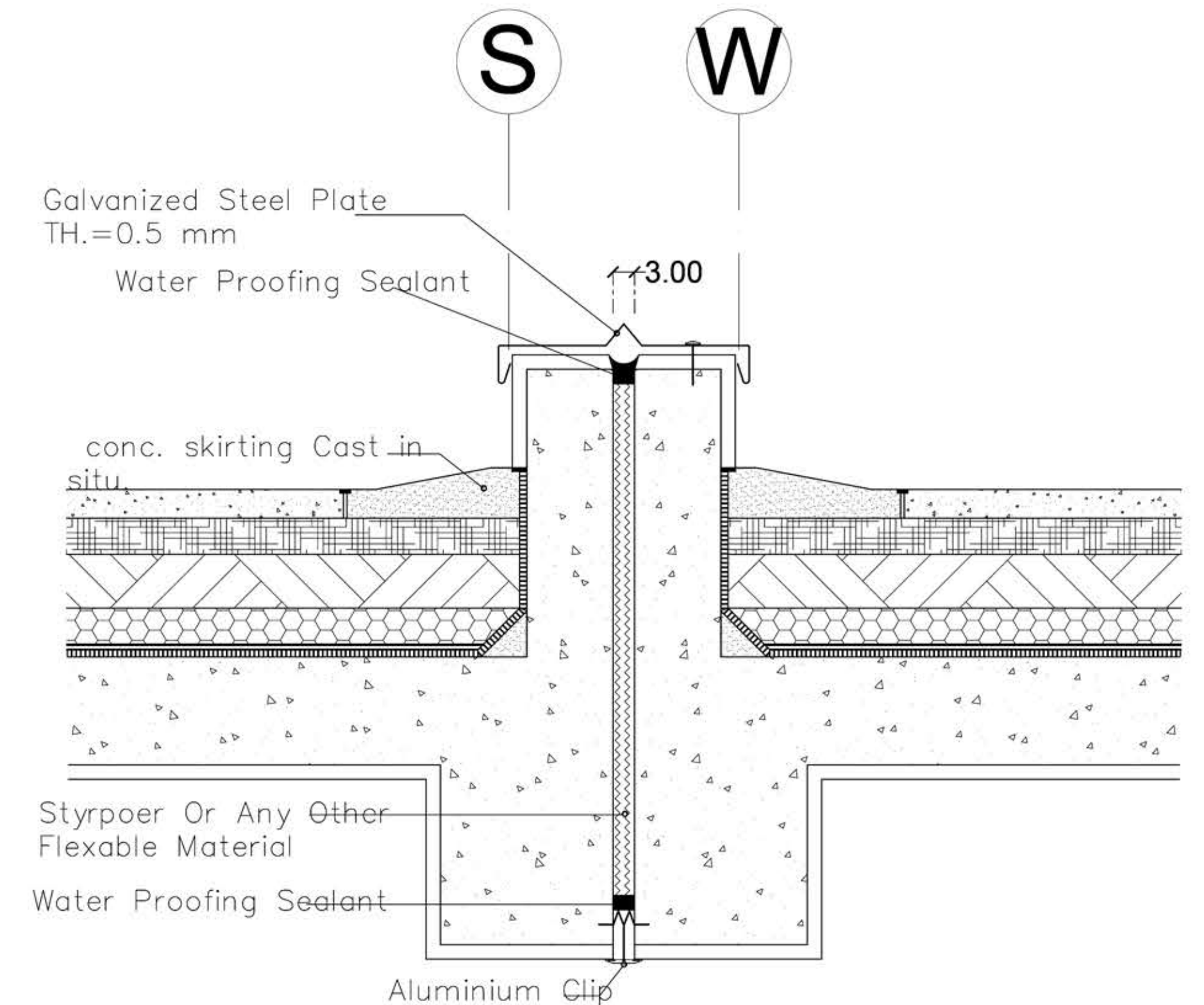
FLOODING FENCE DETAILS
(BASED ON PHYSIC PRINCIPLE WATER MAINTAIN ITS LEVEL)



GREEN ROOF



DETAIL A : FLOOR EXPANSION JOINT DETAIL FOR CONCOURSE



Expansion Joint At Roof
Detail -1



OVERALL VIEW



OUTDOOR WORKSHOP



ENTRY POINT



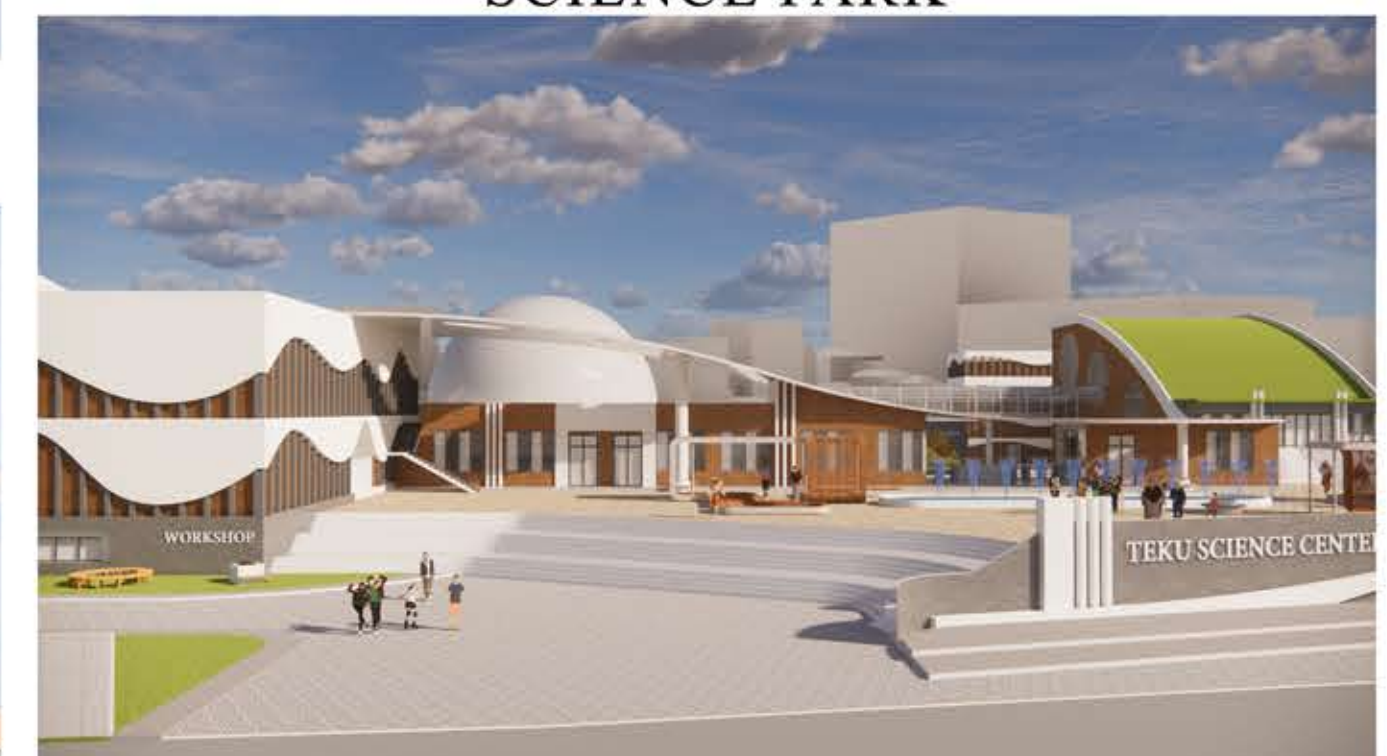
SCIENCE PARK



PLAZA



EVENT HALL



MAIN ENTRANCE



EXIT VIEW WITH OUTDOOR WORKSHOP

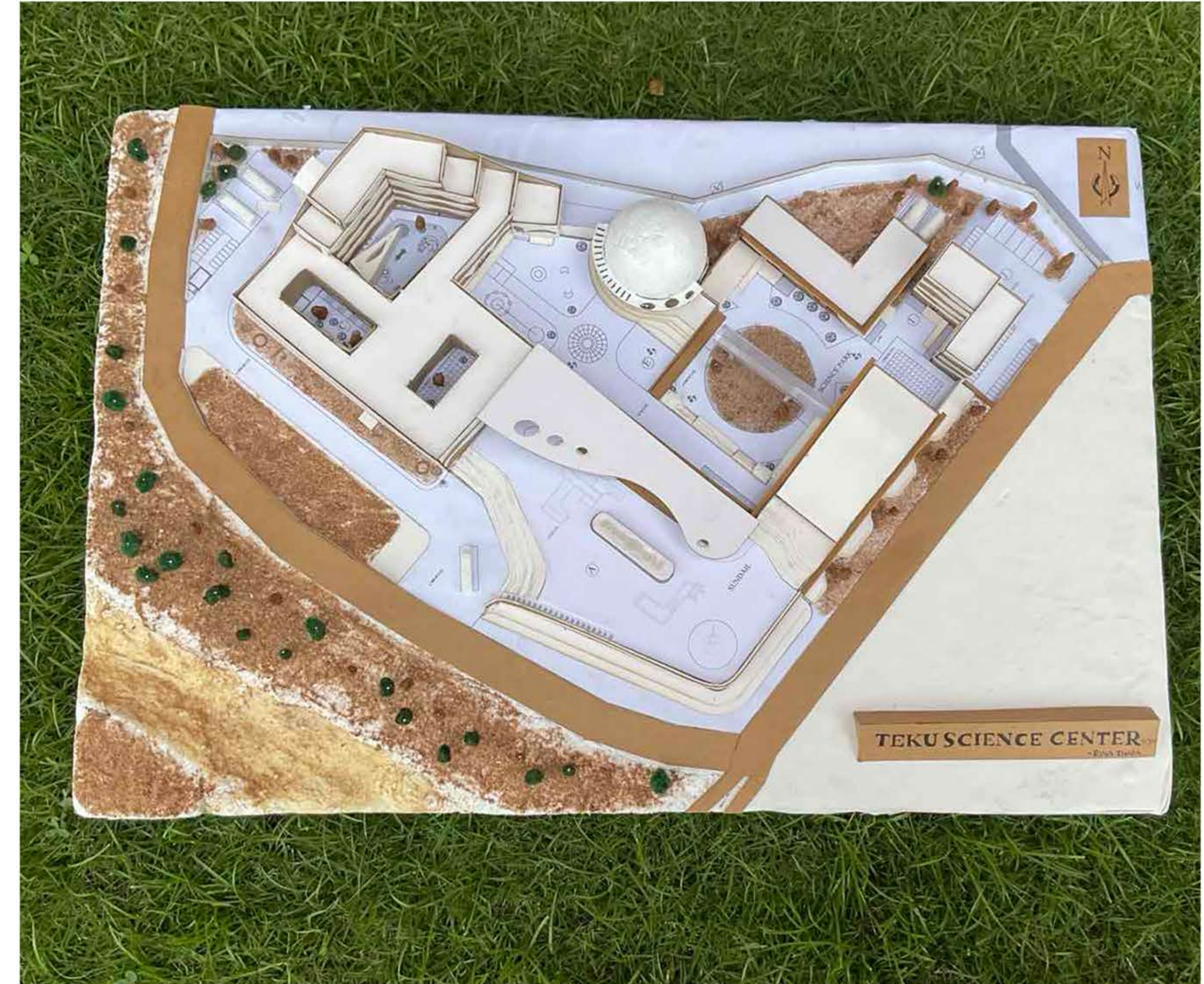




PLAZA VIEW



EXIST VIEW



OVERALL TOP VIEW



EXHIBITION POSTER



FRONT VIEW



BACK SIDE MODEL



OVERALL MAIN VIEW