UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

NviroClub Lab

UNIF(y)(inno)VATION

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DPD 801 || DESIGN REPORT
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SITE // JAN SHOBA & SOUTH STREET INTERSECTION, HATFIELD, PRETORIA, GP, SOUTH AFRICA
KEYWORDS // INNOVATION, ENVIRONMENT, ENERGY, INTEGRATION, COLLABORATION, CELEBRATION

Today, we are faced with a world that we destroyed ourselves. Innovation can serve as a solution to cultivating a world of renewable environments rather than destructive ones. However, the practice and celebration of innovation should not be limited to experts in their respective fields – the entire community should embrace it. Environmental innovation should become a familiar topic for the everyday citizen who has a practical impact in applying solutions and engaging in dialogue with experts. Experts should guide the development of the solution using their expertise, while the everyday citizen, often referred to as the citizen scientist, identifies practical problems.

The NviroClub Lab collaborates, practises, shares, and celebrates innovation regarding renewable energy, building materials, systems, and designed ecologies. Experts specialising in thermal systems and energy integration collaborate with citizen scientists to workshop and practise innovation. It is this integration of contrasting perspectives that results in the successful application of innovation.

Following the principle of open building architecture, adaptability, flexibility, and sustainable urbanism theory, the NviroClub Lab fosters a social network of collaboration and integration. This innovation laboratory and expo precinct is further characterised as a living building that can adapt to user needs and facilitate the testing of innovation within its structure.

The NviroClub Lab creates a node in the knowledge corridor, bringing innovation to the streets and involving the everyday citizen in the environmental innovation dialogue.

01) BACKGROUND AND INTRODUCTION TO THE PROJECT FOCUS

Embarking on this journey of what to design and what for, Ord (2020) is considered with his argument, "We have the power to destroy ourselves without the wisdom to ensure we don't". A long-termism approach of thinking beyond the present is, therefore, undertaken, with the aim of creating a future of flourishing regenerative environments by using the accumulated knowledge that already exists in our world.

Two primary problems need to be addressed. The first pertains to the environmental destruction we are currently facing, where the global goals that have been set and implemented are evidently not yet performing as required. This issue requires new integrated bodies that are focused on environmental innovation, while emphasising taking a bottom-up approach. The second problem pertains to the concept of innovation. While innovation is understood as the gradual succession of small changes, it can also be seen as the application of inventive solutions to real-world problems. The innovation problem becomes evident when experts are hiding knowledge, leaving our world in a destructed state while the general public remains unaware of the problems we face and the potential solutions that may already exist (Ashton & Jones, 2022; Brodovsky, Jordan & Chamberlain, 2016).

To formulate the design problem, it is imperative to start with the innovation problem, specifically the issue of research institutions retaining knowledge. While the top-down approach focuses on innovation, the accumulation of knowledge is lost and stays unrecorded. This leads to a spatial problem where knowledge is isolated in terms of proximity, creating barriers to accessing knowledge and reinforcing its exclusivity. This finally results in an architectural problem where abstracted buildings render the experience of knowledge indecipherable.

In the process of formulating the design problem, a key question emerges: How can unifying isolated environments, systems and bodies through the implementation of regenerative urbanism create innovative enabling spatial environments?

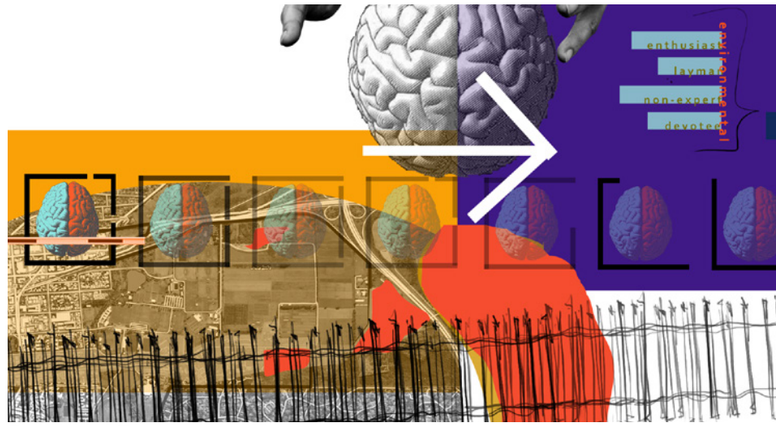


Figure 1: The innovation problem

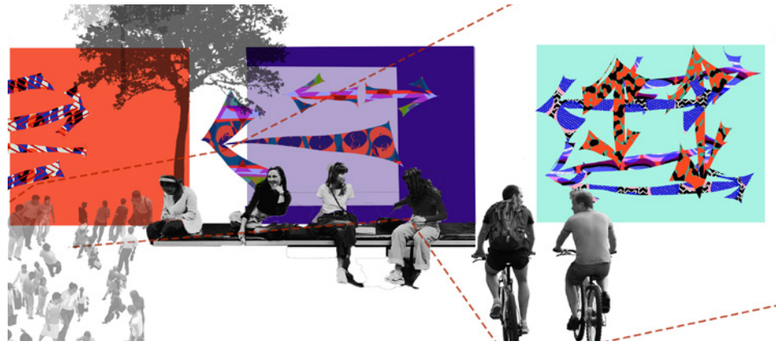


Figure 2: Design objectives

02) AIM AND CONCEPT

The only way that the full potential of innovative solutions will actually be implemented successfully to solve real-world problems is if the general public also buys into these solutions. They need to be involved from the identification of problems to the cultivation of innovative solutions and, most importantly, be informed about the way in which solutions are to be implemented. This way, small-scale interventions in individuals' everyday lives should lead to large-scale change.

The project vision is further conveyed as the curation of accessible spatial experiences, facilitating active engagement and the exchange of diverse perspectives. The emphasis on encouraging non-expert participation from a bottom-up approach focuses the direction of innovation. The integration and connectivity created through this approach shapes spaces of freedom, continuity and collaboration. Moreover, the accumulation of knowledge is catalogued, preserved and recorded for multiplication. Therefore, the NviroClub Lab cultivates a dialogue between the expert and the everyday citizen by integrating multi-use spaces fostering practice, collaboration and celebration in the innovation laboratory and expo precinct.

Figure 3: Project concept

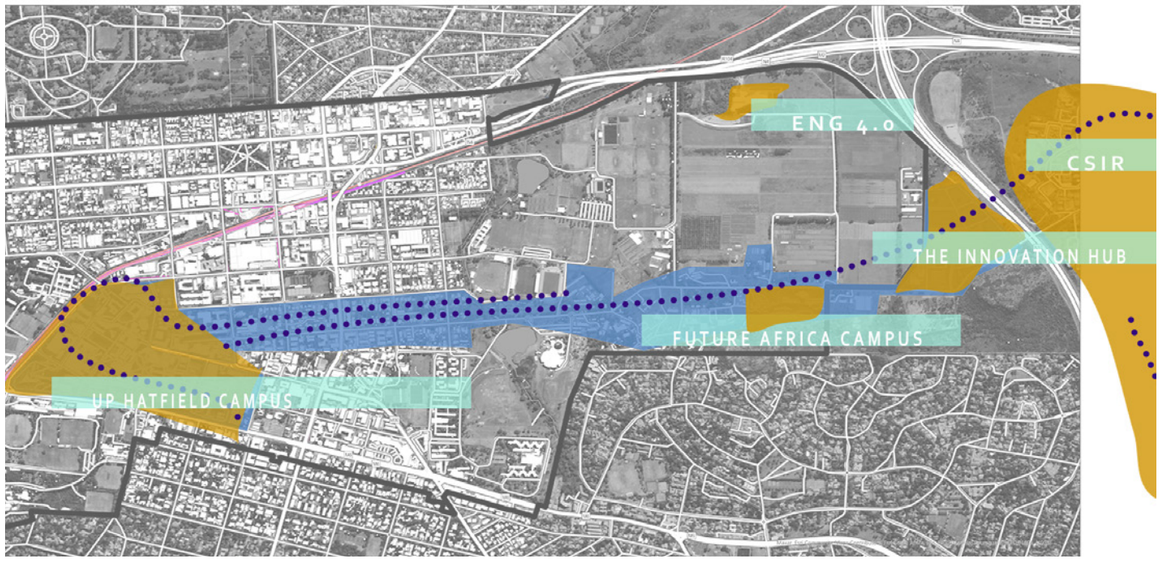


Figure 4: Institutional contextual connection

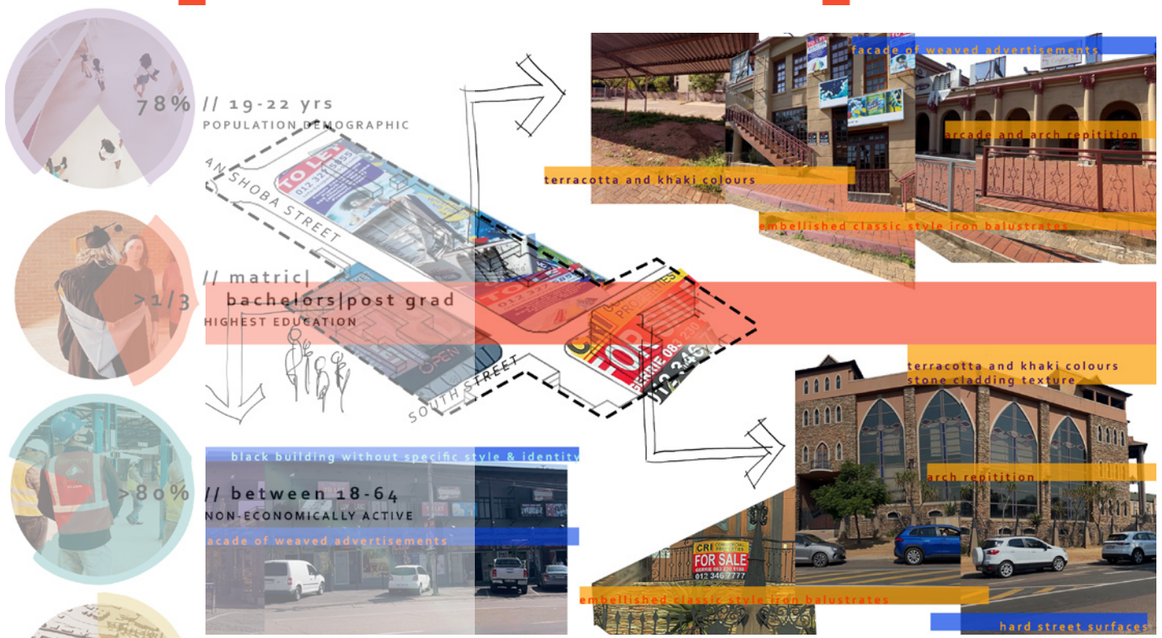


Figure 5: Contextual site demographic and character

03) CONTEXT

Considering the Hatfield context and its socio-economic characteristics, 78% of the dominating population demographic are between the ages of 19 and 22 years, indicating a student population as the main character within Hatfield. Considering the meso-site market connection between knowledge and innovation institutions, the University of Pretoria with its Hatfield Campus, Future Africa Campus, and Eng 4.0 are found unconnected and highly isolated from the Innovation Hub and the CSIR to the eastern boundary.

The project aims to integrate the student population with the urban-scale knowledge institutions by using the South Street connection through a knowledge corridor (Habitat Landscape Architects, 2020; Statistics South Africa, 2011). Considering the South Street connection and the micro-site context, the building typologies and their accessibility, non-permeable edge conditions and buildings living inwards with their backs to the streets leave buildings with their entrances withdrawn for privacy purposes.

It can be argued that this extremely important South Street connection lacks the identity or character of an active and vibrant movement and transportation space. It does not celebrate the dominant student demographic by being closed off to pedestrian activity (City of Tshwane, 2020; 2023; Habitat Landscape Architects, 2020). Further considering the micro-site area's hard data features, Jan Shoba, as a high-speed street, acts as a noise generator with no natural physical features acting as noise buffers, a significant amount of build-up space, and very little functional public space.

When considering the identity and character of the site, it can be described as desolate and 'to let'. The only programmatic activators are bars and clubs, with limited additional food and drink activity, including restaurants and supermarkets, which barely support the minimal existing activity. In this case, integration is entirely lacking. However, this challenge becomes an opportunity when considering my Design Investigation Treatise (DIT) research results. From an engagement analysis in my DIT research, it is argued that the social and cultural urban dynamics of Hatfield indicate that the social activation and the integration of users and programmes are extremely important as the activator and necessity for successful community or economic systems engagement.

The urban framework vision, aligned with the project's objectives of integration and connectivity, celebrates the principles of interchanging uses across and within public spaces. This is achieved by activating inter-use across boundaries, focusing on pedestrian and active transport-oriented intersections, and integrating the green network spine with green infrastructure public nodes.

04) STAKEHOLDERS

In cultivating a dialogue between the expert and the everyday citizen, the precinct accommodates opportunities that promote the innovation of solutions for the built environment. This includes a diverse spectrum of users, ranging from expert biochemist scientists and mechanical engineers to solar businessmen and grandmothers who are looking for alternative energy solutions for South Africa.

This leads us to curate a future condition where all stakeholders are innovating for the built environment, where the user archetype can be described as a lifelong learner of and for our environment. These users consequently take on the role of activators, including retired academics, young and established professionals, students to, most importantly, citizen scientists, including everyday persons such as young entrepreneurs, craftsmen, and tradesmen.

The investing stakeholders would include innovation institutions, the University of Pretoria, and professional bodies such as the Pretoria Institute of Architects – all with the agenda of integration at the forefront of their mission and vision statements. Two of the investing stakeholders are the University of Pretoria and The Innovation Hub Management Company. The University of Pretoria is a driver of impactful research institutions that address world-pressing issues, whereas The Innovation Hub Management Company is an agency of the government in the Department of Economic Development focusing on innovation and Entrepreneurship (CSIR, 2023; The Innovation Hub, no date). The investor system would bring established professionals and the citizen scientist together, for example by instilling monthly continuing professional development workshop sessions for innovation in the built environment.

Figure 6: Project users and stakeholders

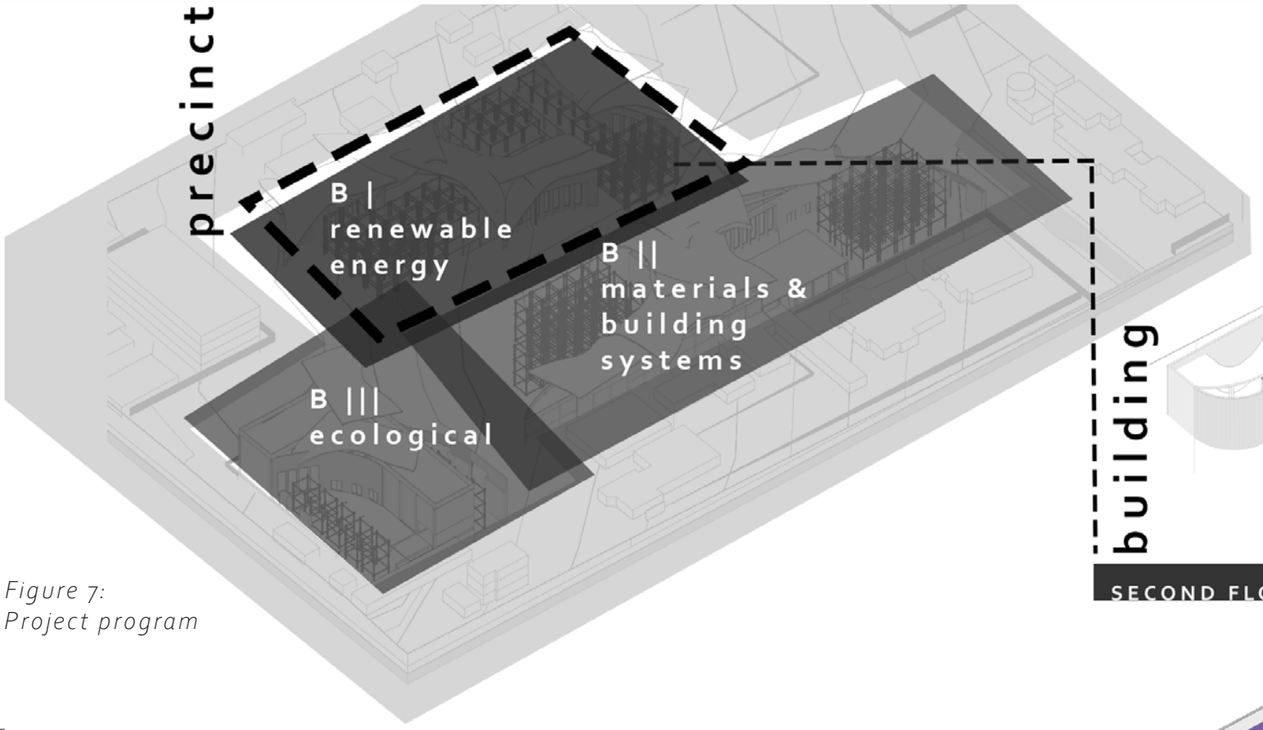
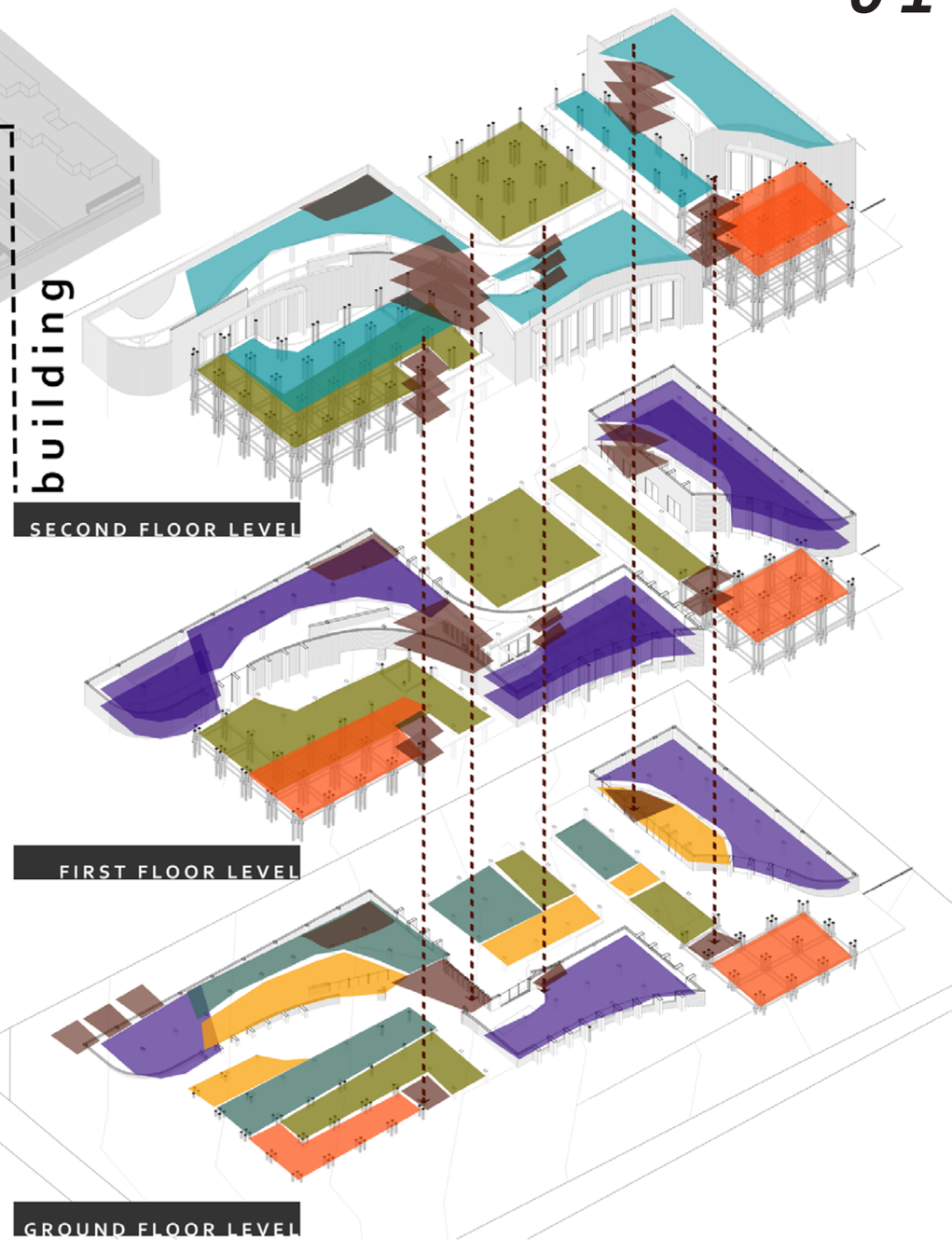


Figure 7:
Project program



05) PROGRAM

Bringing the University's built environment-specific research topics of renewable energy, building performance and designed ecologies to the streets, the NviroClub Lab serves as a hub for innovation. The space is dedicated to workshopping, practising, sharing, and celebrating innovation. It encompasses specialised labs, fabrication workshop spaces, collaborative sharing sessions, and social energy celebration events. The various innovation programmes to be housed within the precinct and, more specifically, the Renewable Energy NviroClub Lab, are visually illustrated as implemented through a layering of integrating programmes.

The programmatic spatial layout is structured to accommodate various user experiences. As a user approaches the building, the space starts with cafes and nightclubs, which create a lively nighttime atmosphere. From there, the layout transitions into meeting spaces, offering a variety of options, from open and collaborative to more closed and private. Just before entering the building, workspaces for assembly and fabrication are found. The entrance thresholds celebrate innovation through active and passive exhibiting of active innovation being practised. As you move further inside, there are more specialised and controlled access fabrication workshop spaces and, finally, the highly specialised fully authorised accessed energy laboratories. These labs, strategically positioned in between, offer visual permeability and act as double-storey stage platforms. Further, more private programmes filter vertically where IT labs, libraries and study spaces are found on the second and third floors.

01) THEORETICAL ARCHITECTURAL PREMISE

The spatial design development of the NviroClub Lab is inspired by the open building theoretical perspective, which categorises systems into tissue, support and infill systems. This architectural principle enables the building to adapt to changing needs in terms of organisational, technical or user requirements (Cuperus, 2001; Dale, 2020).

02) PRECEDENT STUDIES

When examining the first level of tissue that encompasses the town fabric, Farr's architectural theory of sustainable urbanism is considered with the intention of implementing proximity and integrating utility to create a finite social network within the neighbourhood (Douglas, 2012). Considering the next level of support, or the base building, the Fun Palace shows interchangeability based on a modular structural support system and the open application of services being exposed and easily accessible. These design precedents inform the principles of togetherness tools and circulation, and a kit of parts guide the articulation of spaces (Canadian Centre for Architecture, no date; Mathews, 2016).

International and local precedents were considered to promote user interaction and activation of innovation and knowledge sharing. Like the Fun Palace, the NviroClub Lab can be modified through user participation, allowing it to become a living building that adapts to the needs of users or operators to promote the practice and celebration of innovation (Fakharanay, 2023; Mathews, 2016).

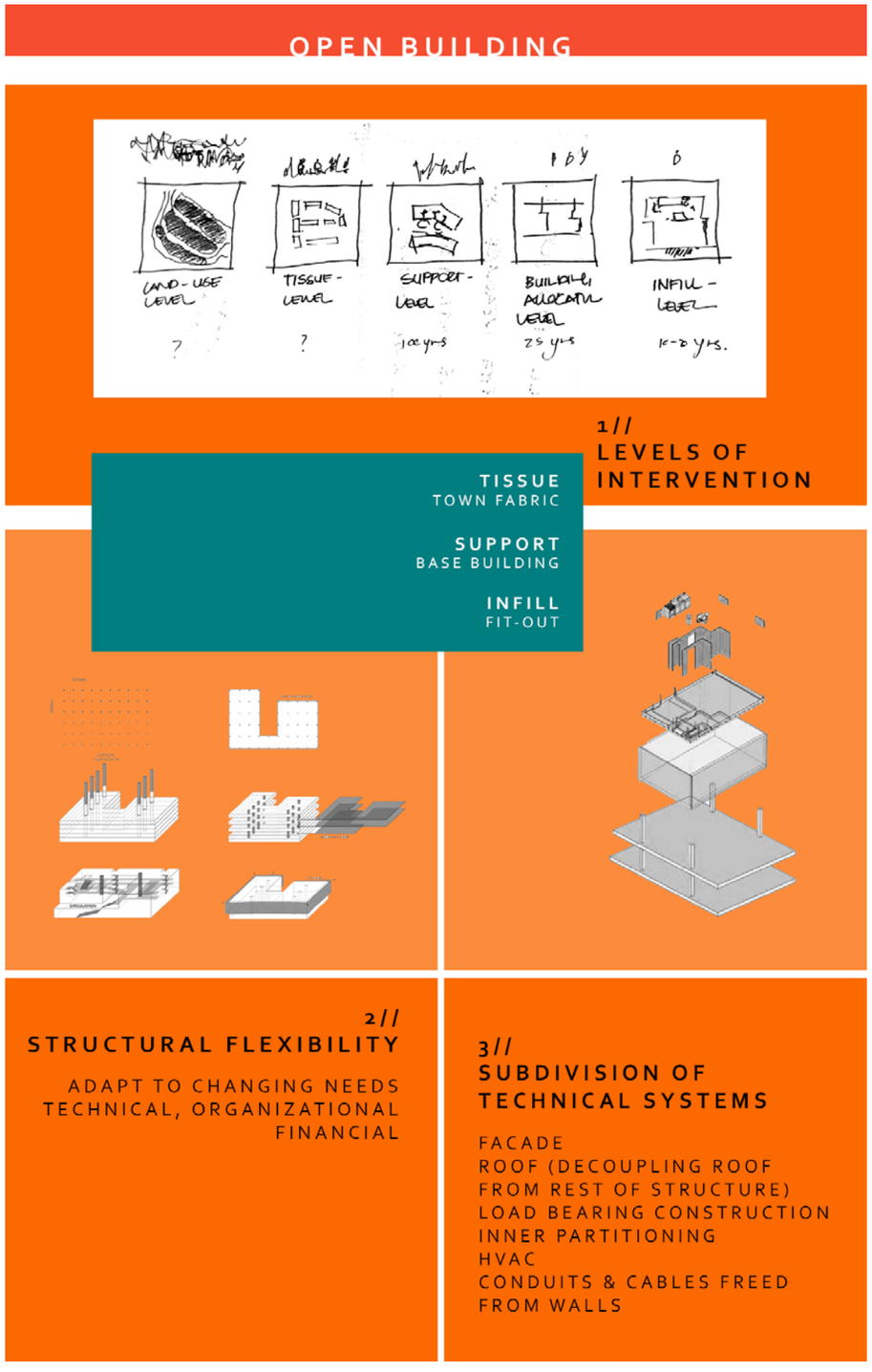
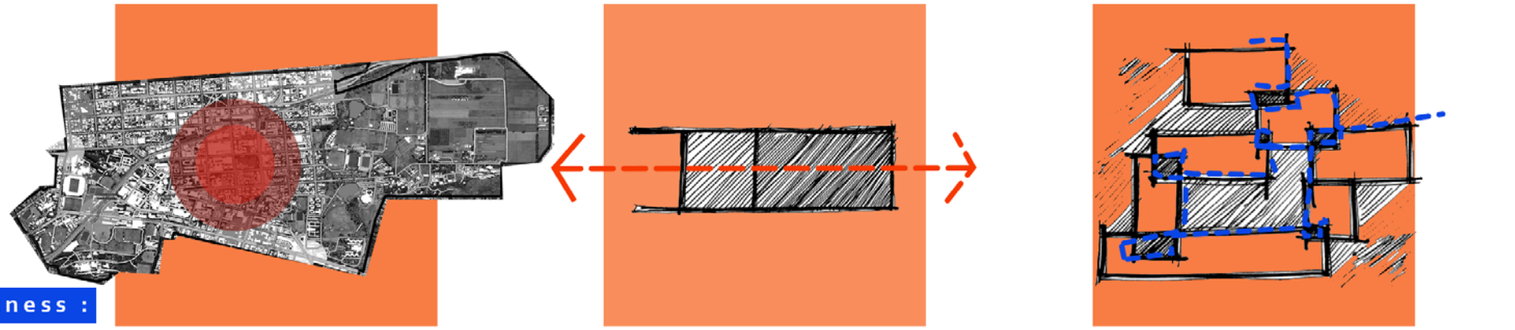


Figure 8: Open building theory

urbanism sustainable across
tripple bottom line : SOCIAL | ENVIRONMENTAL | ECONOMIC

SUSTAINABLE URBANISM



compactness :

DENSIFY AT CORE

INTEGRATING
WORK AND STAY

interfaces creates
VITALITY AND
PEDESTRIAN POWER

connectedness :

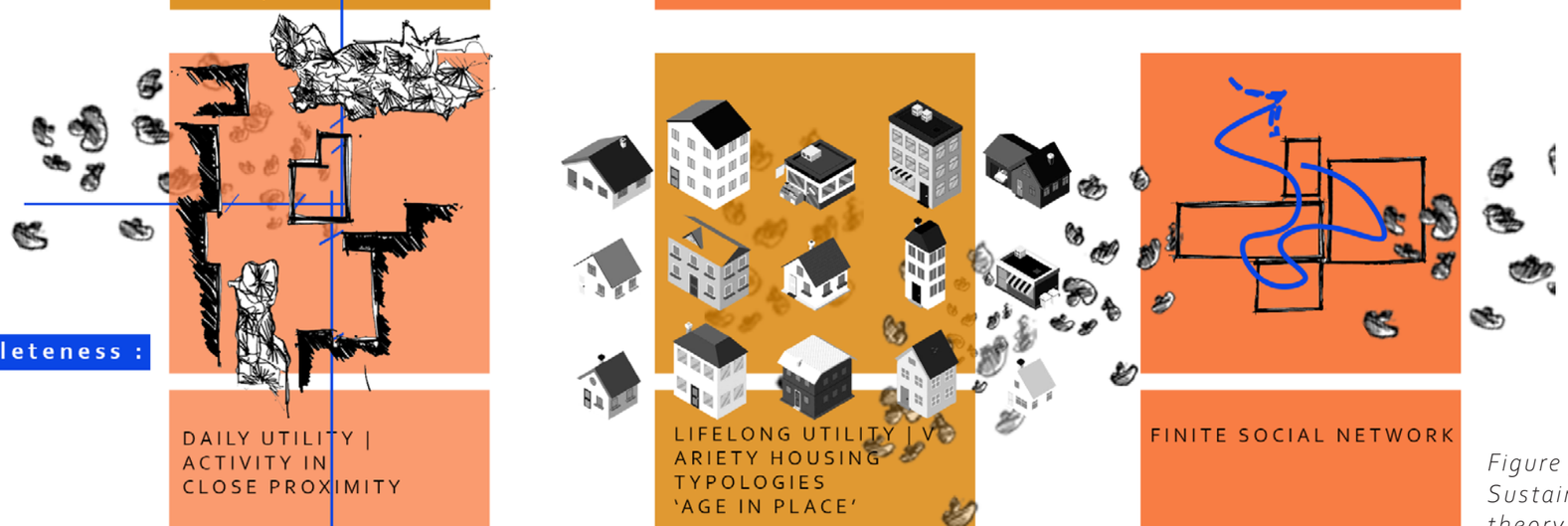
UTILITY INTEGRATION
(transport & land use)

proximity

integrated design

high-performance buildings // infrastructure

SUSTAINABLE CORRIDORS (low speed streets)
bounded neighbourhood CREATES OWNERSHIP AND PRIDE



completeness :

DAILY UTILITY |
ACTIVITY IN
CLOSE PROXIMITY

LIFELONG UTILITY | V
ARIETY HOUSING
TYPOLOGIES
'AGE IN PLACE'

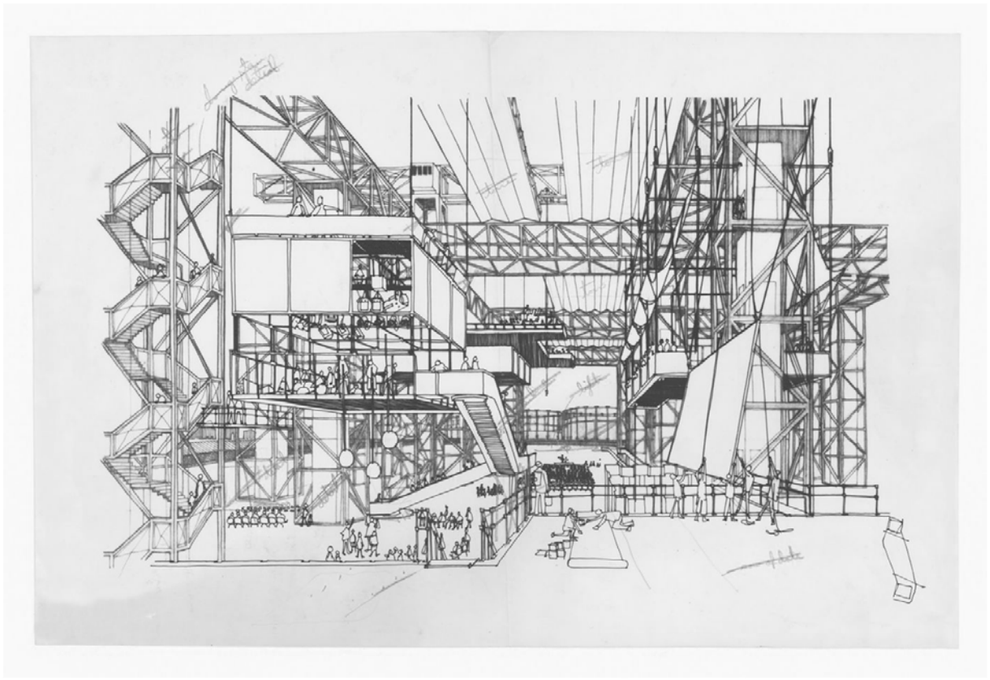
FINITE SOCIAL NETWORK

Figure 9:
Sustainable urbanism theory

tech

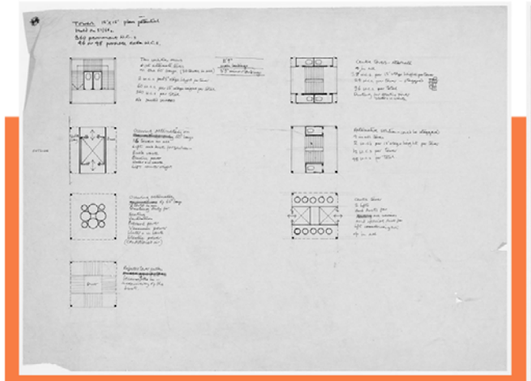
FUN PALACE
by CEDRIC PRICE

1//
PROGRAM SPACE INTEGRATION
RECONCEIVED AS A SITE OF PRODUCTION & REPRODUCTION
FRAMEWORK INTO WHICH PROGRAMMABLE SPACES COULD BE PLUGGED,
USERS COLLECTIVELY DEFINE THE SPACE



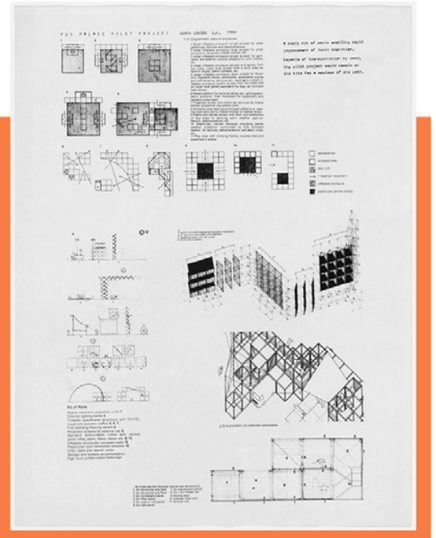
lifts, ducts for services of bulk waste, electronic and power

2//
STRUCTURE FLEXIBILITY
FLEXIBLE FRAMEWORK WITH MOVEABLE PRE-FAB KIT OF PARTS



STRUCTURE & SERVICE TOWERS

protection screens and freestanding floor panels & canopies for partial weather protection



KIT OF PARTS INFILL

design

INNOVATION PARK ARTIFICIAL INTELLIGENCE CAMPUS
@HEILBRON, GERMANY by MVRDV

1//
CAMPUS INTENTIONS
INTER-USE CAMPUS DRIVING
INNOVATION OF THE EVOLUTION OF
FUTURE CITIES THROUGH AI TECHNOLOGIES

3//
CONTEXT CONNECTION
PEDESTRIAN FOCUSED ENTRANCES THAT
INTEGRATES WITH PUBLIC SURROUNDING
CONTEXT

4//
PROGRAM SPACE INTEGRATION
FOSTER INTEGRATION THROUGH PRINCIPLES OF USER INTERACTION,
POROSITY AND PERMEABILITYAS WELL AS TOGETHERNESS TOOLS OF CO-EXISTENCE
AND INTERACTIVE TOUCHPOINT TO EXPERIENCE DEVELOPMENT OF KNOWLEDGE

micro-habitats

visual awareness

vertical circulation

Figure 10:
Design and technical precedents

WONDERDAL EDUTAINMENT CENTRE
@ HAZENDAL, WC by FORMULA D _interactive & TeamArchitects

2//
CENTRE INTENTIONS
DIGITAL EDUTAINMENT CENTRE FOR CHILDREN,
EDUCATING ON THE ENVIRONMENT

03) DESIGN INFORMANTS

These spatial design strategies focus on implementing accessibility and integration, fostering collaboration, and sharing and celebrating innovation within this living building, the NviroClub Lab.

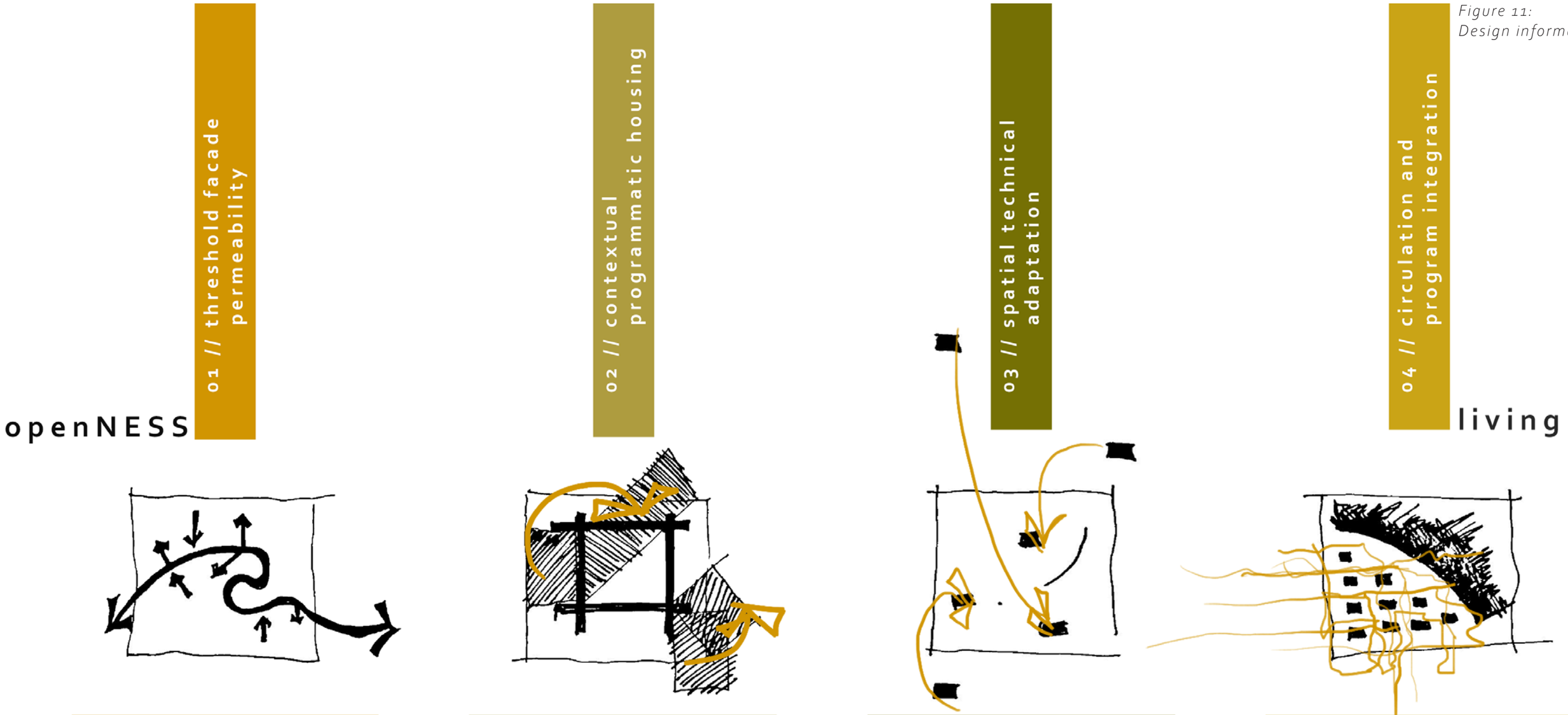
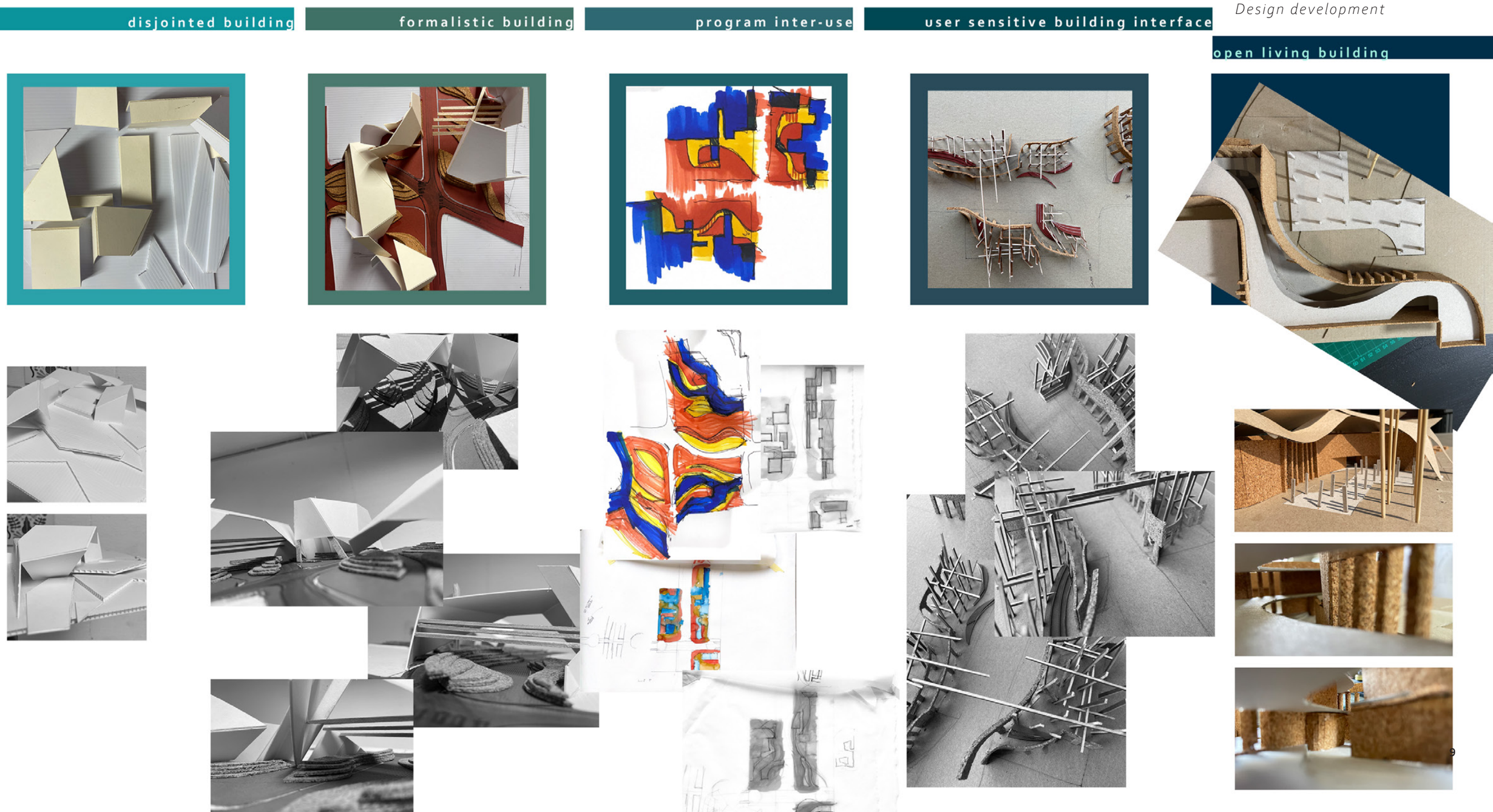


Figure 11: Design informants

01) SPATIAL DESIGN DEVELOPMENT

The spatial design development of the NviroClub Lab started with a disjointed building that counteracted the spatial intention. It led to a highly formalistic building – again counteracting the initial intentions by being monumental, abstracted, indecipherable, and uninviting. Thereafter, the focus shifted to integrating movement and circulation patterns and instilling inter-use between programmes. The result was a more desirable user-sensitive pedestrian-focused accessible interface. After critically reflecting on whether integration was achieved in the building, a few iterations led to the final design.

Figure 12:
Design development



01) SPATIAL DESIGN

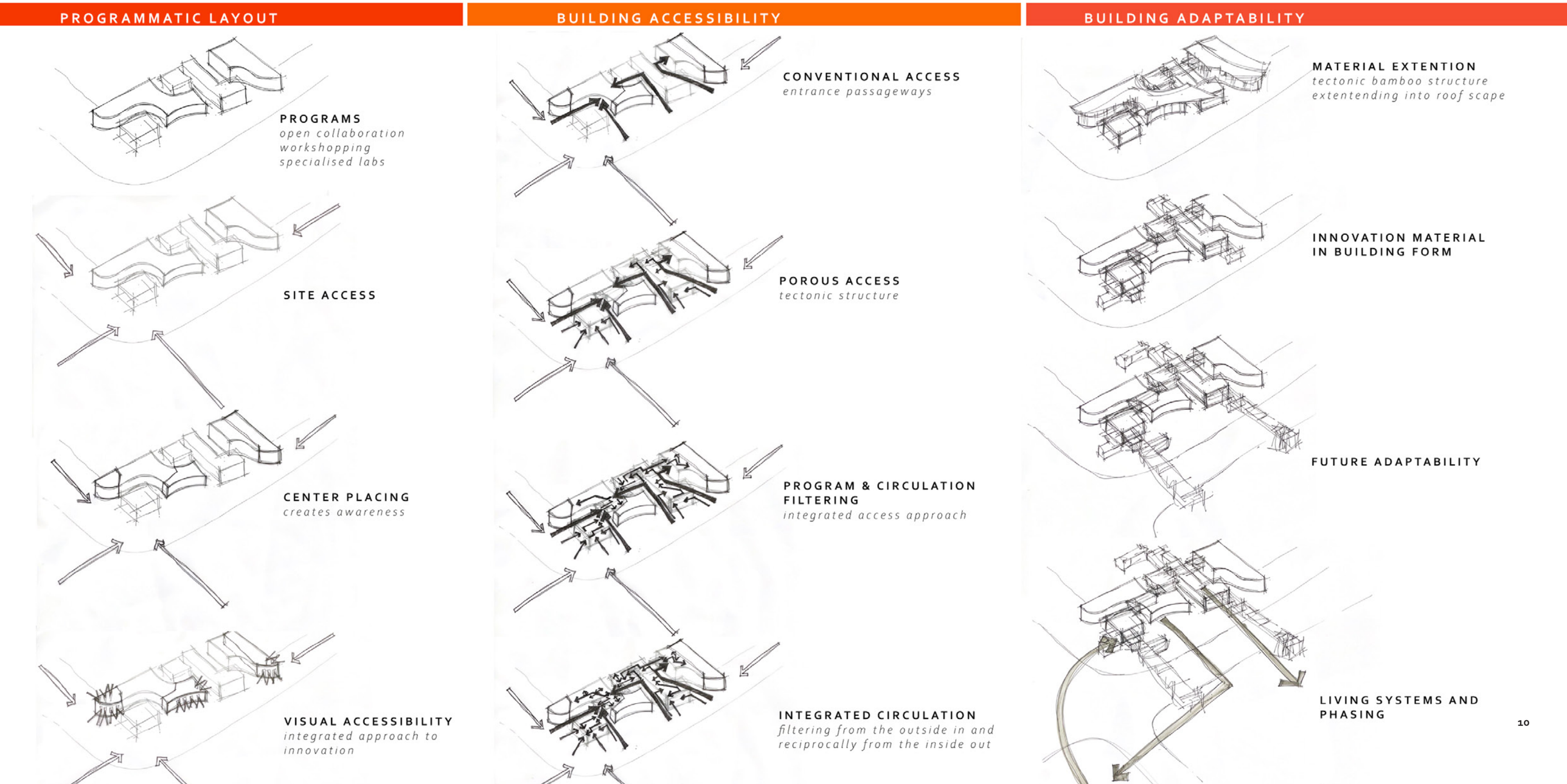
The iterative design process led to the establishment of the spatial design systems, including circulation and movement patterns and the layout design to be integrated with the technical systems, consisting of the structural support systems, envelope systems, and mechanical service systems.

The project intentions led to the integration of two technical building systems.

The intentions included designing for adaptive capacity and flexibility that further built on the concept of a living building. This was achieved by using a bamboo structure, reusing the existing structure, and using established methods of brick masonry building and further building on that.

The construction and building phasing in terms of life cycle and temporal elements of the support and envelope system is visually represented. Bamboo was chosen as a building material after exploring the possibility of its use. It was grown, tested, and applied as a building material in the Ecological NviroClub Lab.

Figure 13: Spatial design diagrams



precinct

building

movement | site access

EXISTING VEHICULAR &
PEDESTRIAN MOVEMENT

SITE ACCESS POINTS

JAN SHOBA STREET

SOUTH STREET

circulation | entrance thresholds

SOUTH STREET

JAN SHOBA STREET

TRANSPORTATION NETWORKS

1st POINT OF ENTRANCE

2nd POINT OF ENTRANCE

Figure 14: Access, circulation and entrance threshold

02) SPATIAL LAYOUT

The spatial layout firstly considers access into the precinct by using existing pedestrian movement corridors. These corridors lead to the access thresholds that communicate subtly with the more tectonic perforated and open modular bamboo structure and façade system. It simultaneously defines the momentousness of the programmatic and spatial intent of the NviroClub Lab with the more stereotomic volumes punching through to the pedestrian threshold. The stereotomic volumes further spatially guide the circulation of the user to entrance thresholds.

Figure 15: Structural support and envelope systems

SUPPORT SYSTEM

SYSTEM # 1

SYSTEM # 2

exist

1// PRIMARY STRUCTURE
concrete framed structure with exposed aggregate concrete floors

new

1// PRIMARY STRUCTURE
concrete framed structure with exposed aggregate concrete floors

new

1// PRIMARY STRUCTURE
bamboo column towers connected to existing frame structure and concrete slabs

03) STRUCTURAL SUPPORT SYSTEM

The structural technical system consists of two building systems, with the primary support systems using the existing framed concrete structure of the building. The first building system houses the support system of the controlled environment programme. It builds onto the existing concrete framed structure by further filling in the support structure with the additionally required support concrete framed structure. The second building system houses the collaboration programme. It consists of a bamboo column and beam structure built on the existing concrete framed structure.

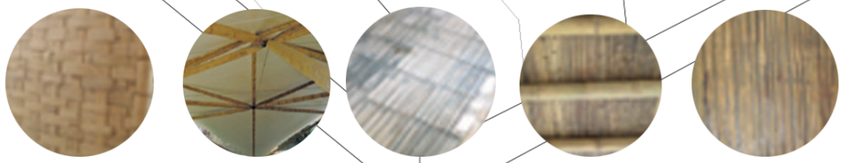
04) ENVELOPE AND INFILL SYSTEM

The envelope system consists of a recycled brick skin and infill walls with steel windows and doors. Following the open building principle, the roof structure is decoupled from the rest of the building structure. The envelope and infill for the flexible second system are built from a kit of parts. The wall panels include a thermal and waterproof bamboo composite wall panel and a woven bamboo panel for visual protection. The roof panels consist of a bamboo frame covered with a tensile roofing membrane.

ENVELOPE SYSTEM

2// SKIN
masonry recycled brick infil walls
steel windows and doors

3// SECONDARY ROOF STRUCTURE
bamboo roof shell truss structure with bamboo roof skin



2// SKIN AND INFILL
kit of parts acting as infill consisting of bamboo floor panels weaved bamboo wall panels and textile tensile fabrics

new

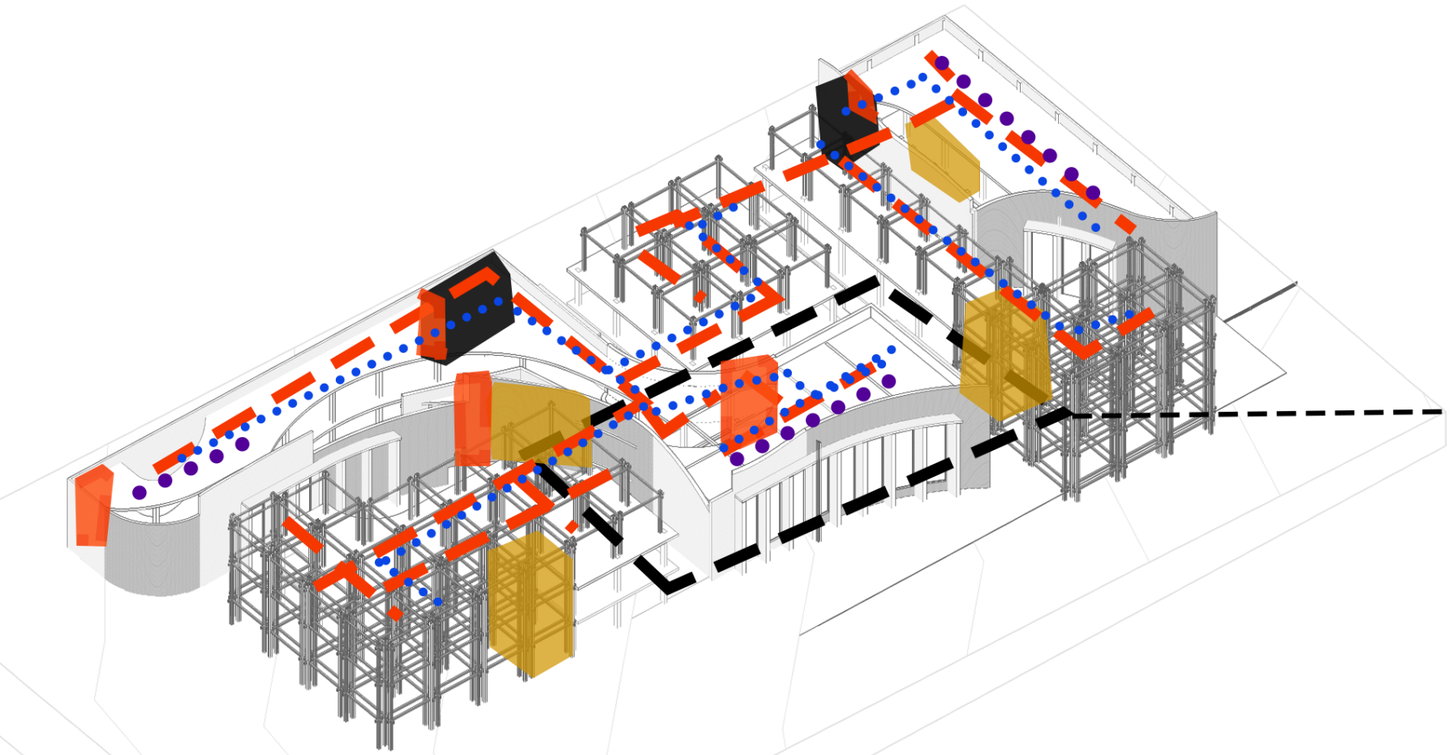
new

SYSTEM # 1

SYSTEM # 2

WHOLE BUILDING DOMESTIC SERVICES

cable trays | exposed services
service ducts | covered but accessible



VERTICAL CIRCULATION

WET SERIVES DUCTS
sewage waste removal

ELECTRICAL SUPPLY & DISTRIBUTION

WATER SUPPLY

VENTILATION
HVAC lab mini-environments
passive/ natural ventilation

LABORATORY SPECIFIC SYSTEMS

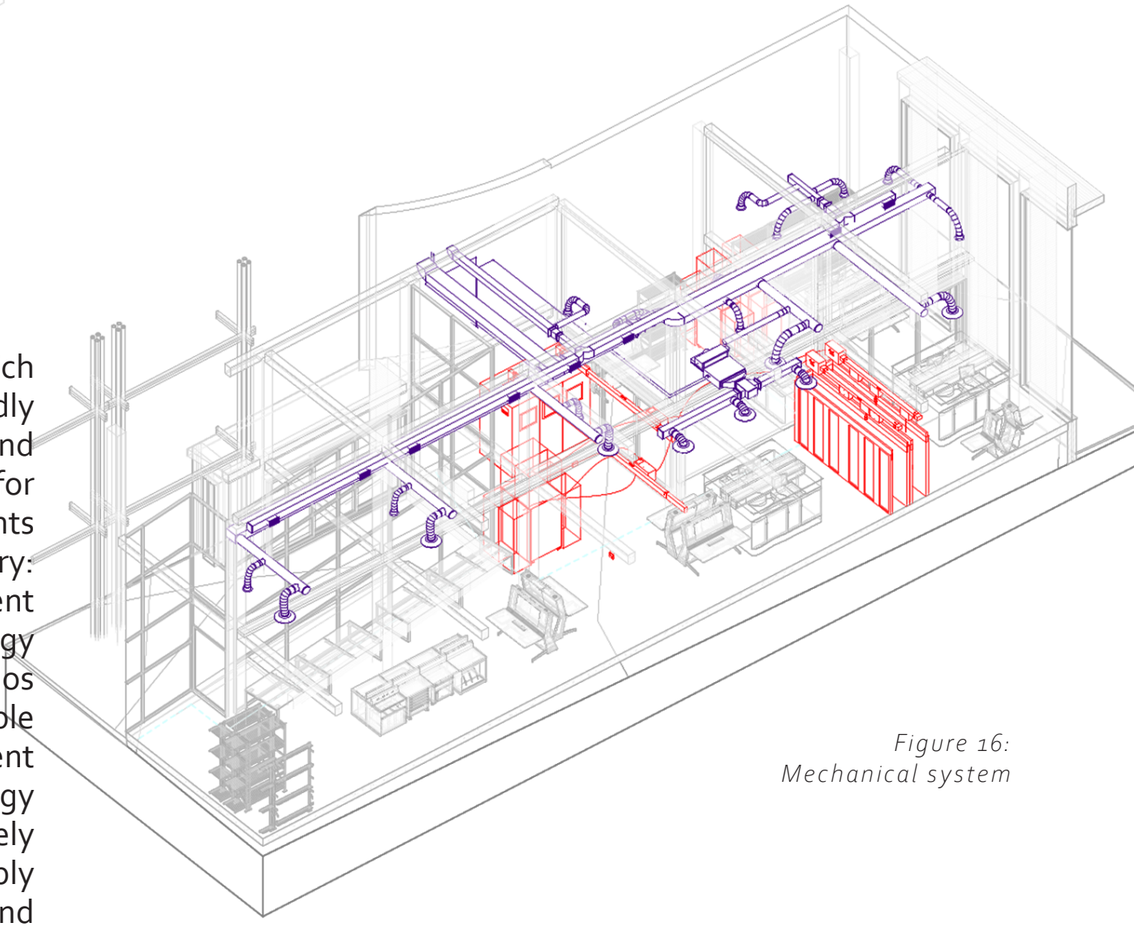


Figure 16:
Mechanical system

05) MECHANICAL ENVIRONMENTAL CONTROL SYSTEM

The mechanical technical system again consists of two systems, which firstly service controlled laboratory and workshop spaces and secondly domestic systems. The National Renewable Energy Laboratory and the Energy Systems Integration Facility were used as precedent for establishing the electrical, mechanical, and spatial design requirements for the energy laboratory designs. The Laboratory for the 21st Century: An Introduction to Low-Energy Design, compiled by the US Department of Energy's Energy Efficiency and Renewable Energy Federal Energy Management Program, was used as a guide to establish scenarios for improving the design in terms of energy efficiency and adaptable capacity (National Renewable Energy Laboratory 2008; US Department of Energy, 2012). The first mechanical system servicing the energy laboratory requires highly specific mechanical systems that cannot rely on a local renewable energy supply and need a stable energy supply from the grid. Therefore, it is vitally important to use daylight and natural ventilation. The non-laboratory systems, however, use a solar and thermal heat energy supply. All services are exposed via cable trays, wall and soffit, or column application.

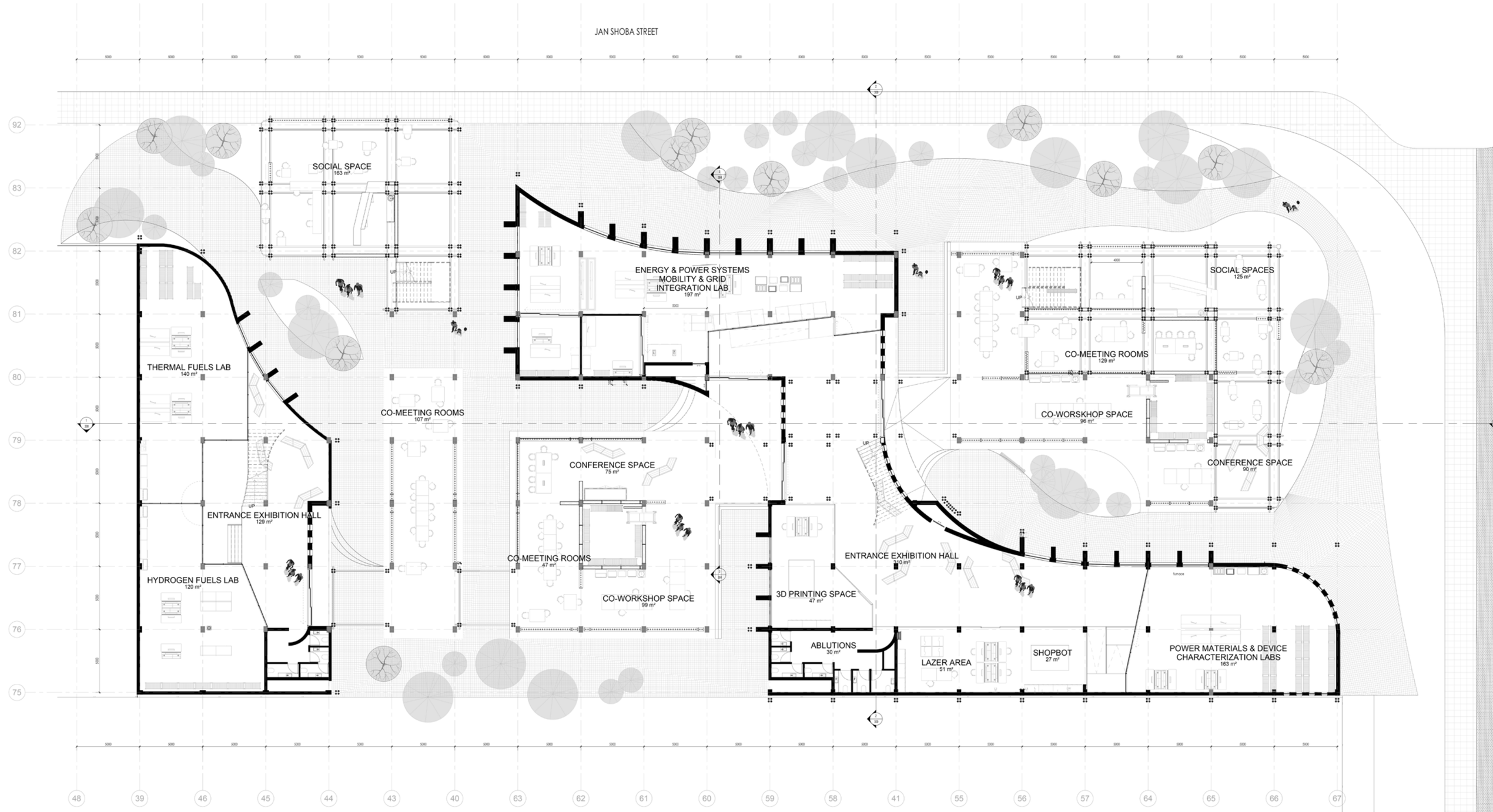
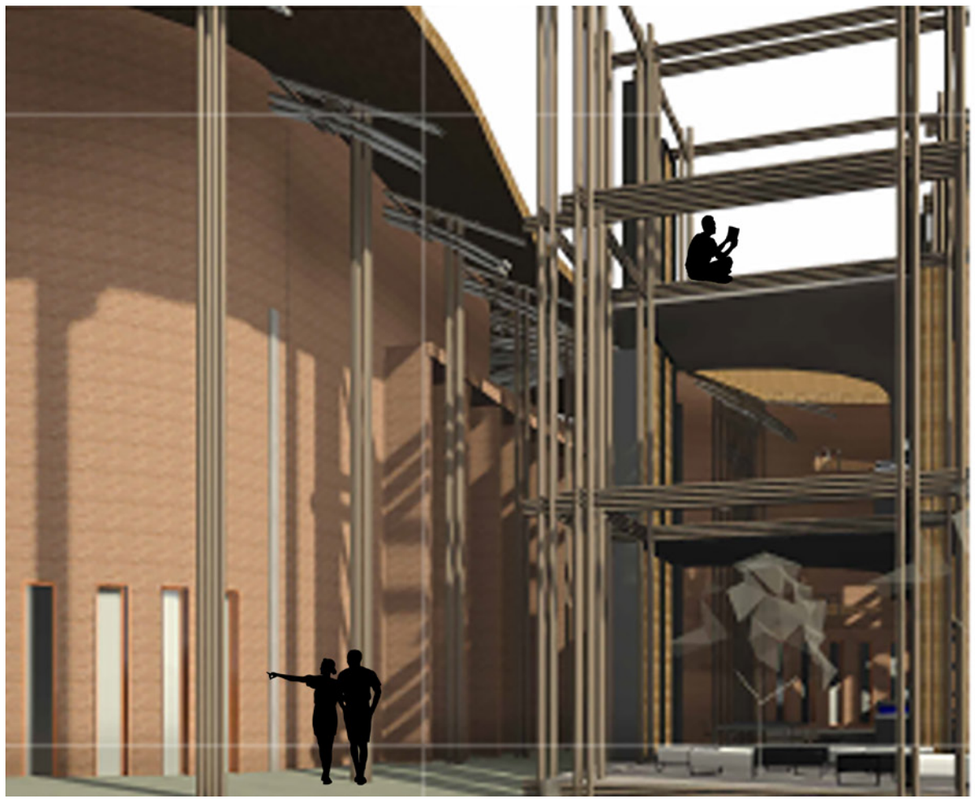


Figure 17: Ground floor plan layout

01)
SPATIAL EXPERIENCE

The spatial experience communicates the design intentions of applying the dynamic layers of knowledge, ideas, problem-solving, and inventions. The living lab facilitates and cultivates the dynamic movement of people and projects through flexibility and integration. The principle of integration is further implemented by layering the spaces from public to private with permeable walls, level differences, and visual porosity into spaces where innovation is exhibited. The principle of flexibility curates a dynamic spatial experience of possibility, directly accessible to the user, which activates innovation within the Nviro Club Lab.

Figure 18: Northern elevation



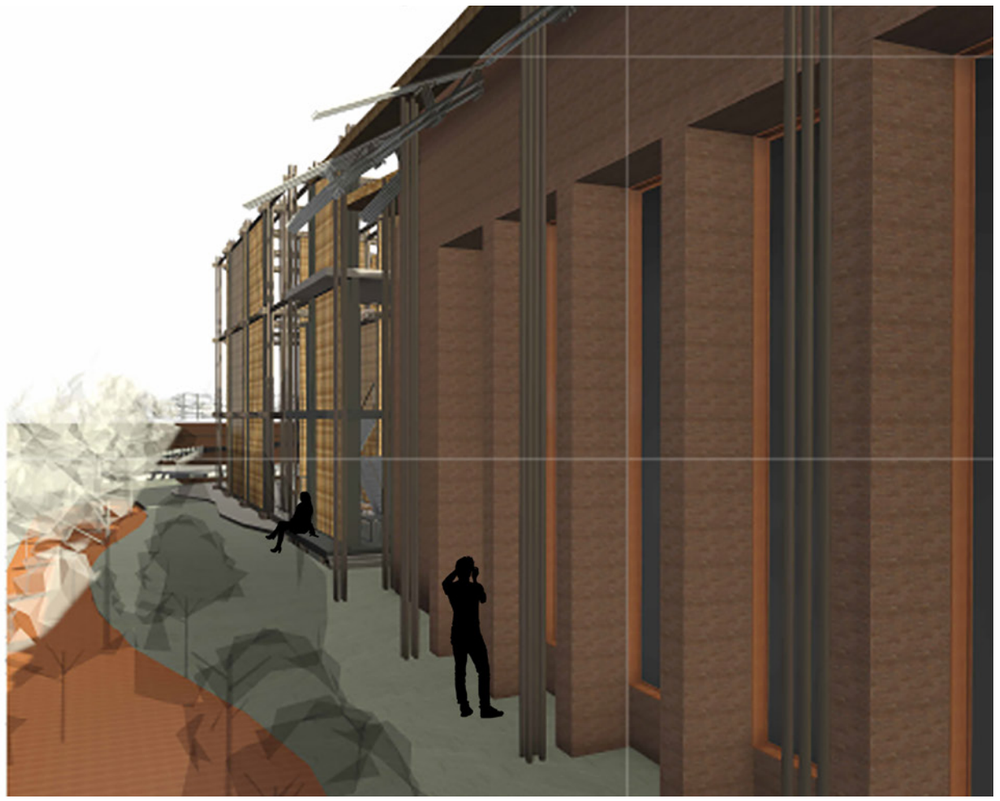


Figure 19: Spatial perspectives

Figure 20:
Mini design project object

01)
CRITICAL REFLECTION

Theoretician | Craftsman | Problem solver | Designer | Systems tinker | Builder and all of this makes an ARCHITECT.

The project was initiated from a viewpoint that emphasised that not one problem, factor, principle, or issue that would consequently induce neighbourhood, city, urban, national or worldwide scale resolution can be addressed in isolation. By using the concept of sustainable urbanism and designing for resiliency, various factors in different spheres are considered by intertwining and interrelating the existing, established and developing measures of different spheres. Ultimately, it creates a connection point that can induce change as a catalyst that allows systems and energies to flow.

We, as designers and systems thinkers, believe that we can shape the future of the environment and the built fabric around us by using urbanisation and improving the thermal performance of buildings in terms of climate change to create a sustainable urbanism future. The vision includes adopting circular construction, circular economies and the circularity of resources.

I greatly believe in the importance of harnessing the capabilities and opportunities presented by the digital built environment in the 21st century. Utilising data-driven urban management and design is essential for managing the practical aspects of city systems, while also revealing the real-time societal patterns that emerge and drive real real-time collaboration. It should guide us in successfully curating and constructing a smart city and neighbourhood of sustainable urbanism.

In the design, construction and cultivation of this project, my departure point is wide and inclusive. It follows an intuitive, abstract explorative approach, with different parts being broken down to their sense and, subsequently, interrelations arise. Cultivating the spatial intent through theoretical thinking and applied thinking with the aim of altering the vitality of our 'home', meaning what is around us – the public space, urban infrastructure, the built fabric enclosure, the environment and the social beings within it. The integrated parts of sustainability, in a broad sense – encompassing social, economic and environmental sustainability – all form part of regenerating and cultivating resilient cities and neighbourhoods.

01)
CRITICAL REFLECTION
MINI DESIGN PROJECT

I believe that this initial exploration has guided me to create a space that entrusts a phenomenological experience. The space curates reciprocal interaction, where individuals can learn from one another, enabling and educating through exposure and the further trading of perspectives.

02) CRITICAL REFLECTION MAJOR DESIGN PROJECT

Undoubtedly, the process of creating this highly theoretically and conceptually informed project and simultaneously developing a technically sound building presented a significant challenge. Determining whether a theoretical or technical resolution is the most appropriate, and to what extent, is what makes this master's project so fascinating. Throughout the immersive design process, technical resolutions were informed by the conceptual objectives. For example, bamboo was used as the subject of study and innovation for building material experimentation and, in the same way, the energy system as a living system in the building was studied. Similarly, identifying the relation and inclusion of the contrasting grounded architectural practices and mediums in juxtaposition to the digital technology practices and mediums posed another challenge and opportunity.

The ultimate goal is to find the perfect balance between these elements and everything in between. I aspire to have reached the most appropriate and well-implemented resolution.

03) MAJOR DESIGN PROJECT CONTRIBUTION ON OUR WAY OF THINKING AND LIVING

The concept of innovation, as something that should be applied and become part of our everyday lives, is a mindset that is critically needed today when thinking about creating regenerative environments for ourselves and the ones to come. Firstly, it begins with grounding our thinking of contributing to the creation of regenerative environments today. Thereafter, we must realise that you, and all of us, are responsible for creating our regenerative environments. You are required to take part in creating our world – and we can choose to contribute positively in any way we can.

This project communicates innovation as something intended and envisaged not only for the expert specialist but for citizen scientists as well. It emphasises that innovation is something mundane and humanly possible to all. Even if you are an expert, there is always someone who knows even more than you. Finally, embracing the challenges of creating renewable energy, building systems and ecologies, and embracing the unknown of our digital world and using it as a tool in our process of innovation.

This project most importantly contributes to the initiation of creating or adopting a mindset of celebration: celebrating our ability to innovate, celebrating the possibility of collaboration, and celebrating the accessibility to highly developed technologies that can be used in our process of human development. In conjunction with the mindset of celebration, the project highlights how a building or the built form can be the body housing and promoting the human – innovating, developing, and improving. It emphasises the social responsibility of architecture, portraying it as unpretentiously accepting and at the same time exhilaratingly inspirational.

Figure 21: Process

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