RE-HABILITATING BOOSYENS THROUGH COMMUNITY CENTRIC CONSTRUCTION

Exploring Alternative Methods for Informal Settlement Development

ABSTRACT

The United Nations often defines informal settlements as areas of scarcity, framing them as problem zones with limited positive aspects. This project challenges that view, proposing that informal settlements hold the potential to address the shortage of accessible housing in rapidly urbanizing cities. Research by the Unit for Urban Citizenship highlights Melusi as an example of how social networks and grassroots construction practices can help solve urban challenges in Sub-Saharan Africa.

Aligned with Max-Neef's (1991) Human Scale Development Framework and public interest design principles, the project focuses on transforming the Booysens Nursery into a multi-use vocational training and community center. This space will teach residents to work with bamboo, empowering self-sustaining development strategies for future projects. Repurposing much of the site for public use and urban agriculture, the initiative seeks to reconnect Melusi with the city, fostering a collaborative approach to urban renewal.

The use of bamboo introduces a sustainable building material for Melusi residents, setting a precedent for the broader South African construction industry. Designed through extensive community engagement, the center's dynamic program aims to meet residents' needs, creating a hopeful model for informal settlements. This project underscores the critical role architects can play in transforming these areas into thriving, sustainable communities, proving that thoughtful design can bring lasting, positive change.

KEYWORDS
Public-Interest Design; Human Scale Development; Alternative Building Technologies, Informal Settlement Development, Bamboo Architecture

PROJECT DETAILS

RESEARCH FIELD |	**Public Interest Design**
CLIENTS |	**- Department of Agriculture** **- City of Tshwane Municipality** **- Department of Higher Education**
PROGRAMME |	**Vocational Training Centre** **Community Hall** **Bamboo Farm**
STUDY AREA |	**City of Tshwane**
SITE LOCATION |	**Booysens Nursery** **Theo Slabbert Street** **Melusi Informal Settlement** **[a.ka. Malusi; Gomorrah]**
SITE COORDINATES |	**25° 43' 27" S** **28° 07' 06" E**

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Course Coordinator: **Dr Jan Hugo**

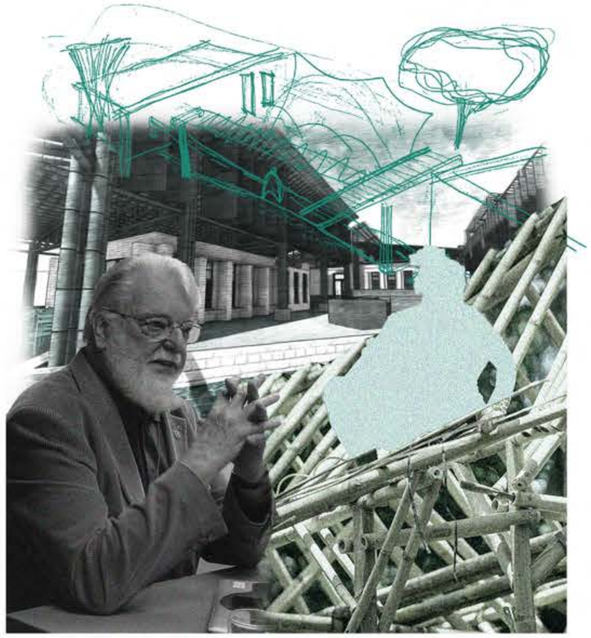
INTRODUCTION

WHAT IS...

SUMMARY

The site of Booysens Nursery exists in a dilapidated state mirroring the fractured relationship between the city of Tshwane and the residents of Melusi, a rapidly expanding informal settlement in the north-west of Pretoria. Having been the subject of conflict between the two parties due to the demands of Melusi residents for fair access to water and electricity as part of the formalisation process of the settlement, the vast site of the nursery sits in a state of purgatory, failing to serve a functional nursery, historically used for the growth and housing of trees for the city of Tshwane while also standing as a testament to the city's inability to satisfy the needs of residents within the settlement. Moreover, the land on which the nursery sits has been shrouded with a sense of fear and hopelessness as residents have reported incidents of violent crime taking place behind the green wall of trees surrounding its interior.

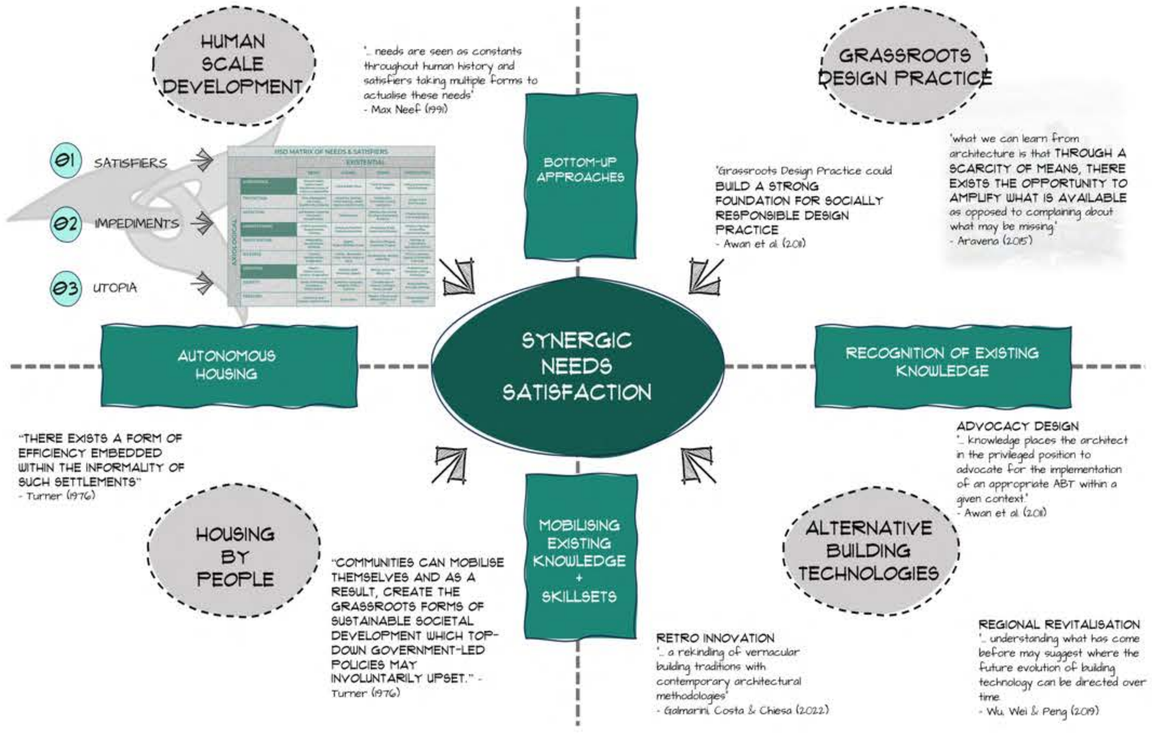
As a part of a response to an extensive community engagement process between the Unit for Urban Citizenship, this project seeks to rehabilitate this nursery, repairing its relationship with the people of Melusi and in effect their relationship with the city of Tshwane.



WHAT CAN BE...

THEORETICAL FRAMEWORK

PUBLIC INTEREST DESIGN



DESIGN INQUIRY

"The project aims to address the ***future development of informal settlements*** *and how architects can* ***strategically implement alternative building technologies*** *informed by meaningful community engagement to* ***synergistically satisfy the fundamental needs of the people of Melusi."***

PROBLEMS AND POLICY SUPPORT

PROBLEM STATEMENT

*The project aims to **address the future development of informal settlements** and how architects can **strategically implement alternative building technologies** informed by meaningful community engagement to **holistically realise the fundamental needs of the people of Melusi**.*

01 RAPID URBANISATION

GROWTH OF MELUSI

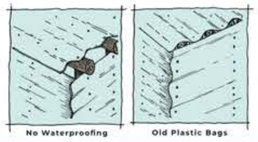
POPULATION GROWTH IN MELUSI

Current & Projected Population Growth in Ward 55, Region 3, Pretoria.
CSIR - The Green Book, 2022

Rapid urbanization in South African cities has led to the significant expansion of informal settlements, as urban areas struggle to accommodate the growing influx of people. With limited affordable housing and inadequate infrastructure, millions of residents live in overcrowded, makeshift homes without access to basic services such as water, sanitation, and electricity. This issue exacerbates poverty, unemployment, and social inequality, placing immense pressure on municipalities to find sustainable solutions for housing, infrastructure, and service delivery in rapidly growing urban spaces.

SUBSTANDARD LIVING CONDITIONS

POOR BUILDING MATERIALS



The dwellings in Melusi for the vast majority make use of substandard building materials such as corrugated sheeting and wattle posts which lack durability to stand up to extreme weather as well as the local climate.

HEAT STRESS

Much of the construction in informal settlements uses substandard materials, requiring constant repair. Melusi, like many settlements, consists mainly of corrugated sheeting and masonry structures. Mabuya & Scholes (2020) note that poor building conditions increase health risks, with material choice affecting vulnerability to heat stress and other natural elements, highlighting the need for alternative building methods (Hugo 2023).

VULNERABILITY TO EXTREME WEATHER

Many residents in Melusi have dwellings that are located within areas vulnerable to flooding as much of the settlement exists within a wetland.

IMPEDED NEED SATISFACTION

SUBSISTENCE

- Unemployment
- Lack of Access to Opportunities
- Financial Limitations

Melusi residents highlight **unemployment as a key issue**, worsening financial struggles. They also note **the settlement's location limits local job opportunities,** making it harder to meet subsistence needs.

CREATION

- Financial Limitations
- Fear of Judgement
- No Neaby Art/Craft Centres

Melusi residents cite **financial struggles and personal insecurities** as barriers to creative expression. While construction isn't an issue, **limited access to spaces and activities, along with transportation costs**, further hinder opportunities.

UNDERSTANDING

- Access to Technology
- Lack of Educational Oppurtunities
- Unemployment

Residents pointed to **limited educational opportunities** as the main barrier to understanding, along with a **lack of jobs**. They stressed the need for self-reliance in creating opportunities. **Inaccessibility to technology** like laptops, phones, and wi-fi further hindered their ability to apply for jobs and higher education.

POLICY SUPPORT

UN SUSTAINABLE DEVELOPMENT GOALS

(United Nations, n.d.)

GLOBAL ACTION PLAN

Aims to accelerate the the transformation of informal settlements by 2030. This ties into the the UN 17 SDG Targets of the right to adequate housing and improvement in the standard of living. (United Nations, n.d.)

UPGRADING INFORMAL SETTLEMENT PROGRAMME (UISP)

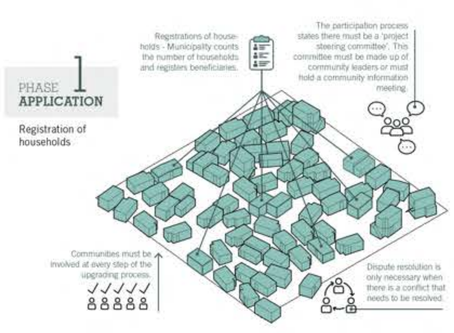
The UISP, established in 2004, aims to include communities in the upgrading processes of informal settlements in order to reduce the disruption of the necessary processes needed to facilitate upgrading. This process takes a phased approach to providing the resident community to achieve tenureship once concluded (Social Justice Coalition, 2017)

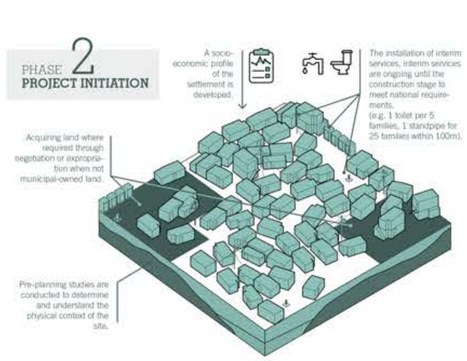
PHASE 01
APPLICATION

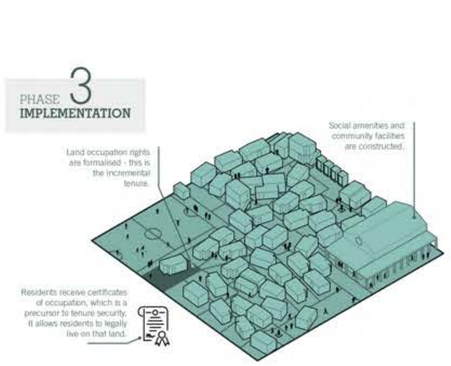
PHASE 02
INITIATION

PHASE 03
IMPLEMENTATION

PHASE 03
CONSOLIDATION







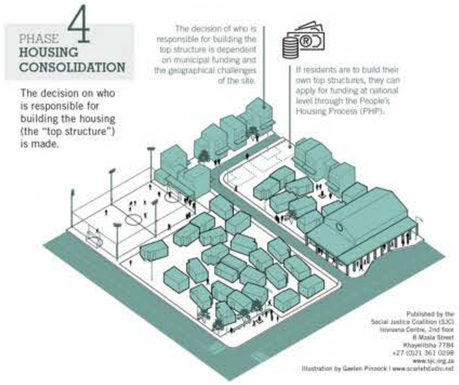


Illustration of UISP phases published through the Social Justice Coalition (Pinnock, 2017)

URBAN CITIZEN

UNIT FOR URBAN CITIZENSHIP

2023 /2024

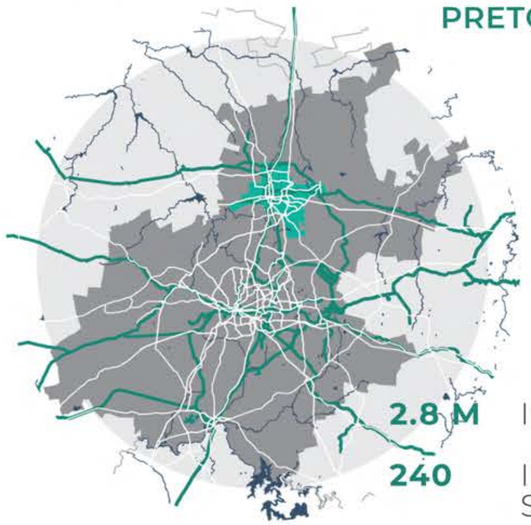
LOCAL CONTEXT

GAUTENG + PRETORIA

South Africa's journey has been shaped by a history of racial segregation and economic challenges that continue to cast long shadows over its urban landscapes. The City of Tshwane reflects this legacy profoundly, with over 240 informal settlements where more than 16% of its residents strive to build their lives. Despite three decades of democracy, meaningful progress in uplifting these communities has been slow.

The persistence of informal settlements speaks to the enduring impact of exclusionary practices from the past. Yet, these areas also tell a story of resilience and hope—of people moving from distant, economically strained regions to seek opportunity and a better future. These settlements, while emblematic of deep systemic challenges, are also a testament to the determination of individuals to rise above adversity in pursuit of opportunity.

PRETORIA



2.8 M Inhabitants

240 Informal Settlements

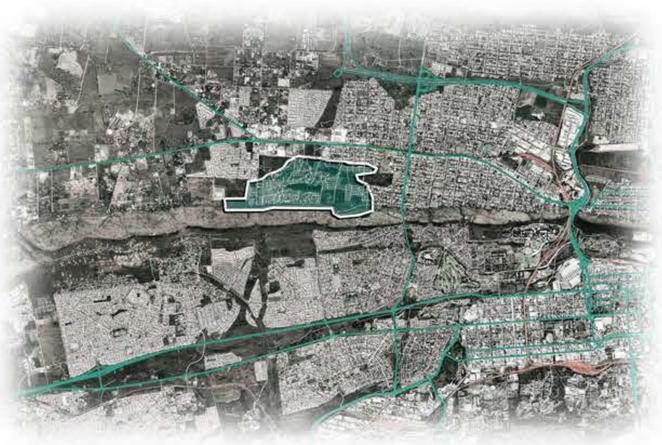
16.4 % Informal Settlement Inhabitants

Spread of Informal settlements in Gauteng

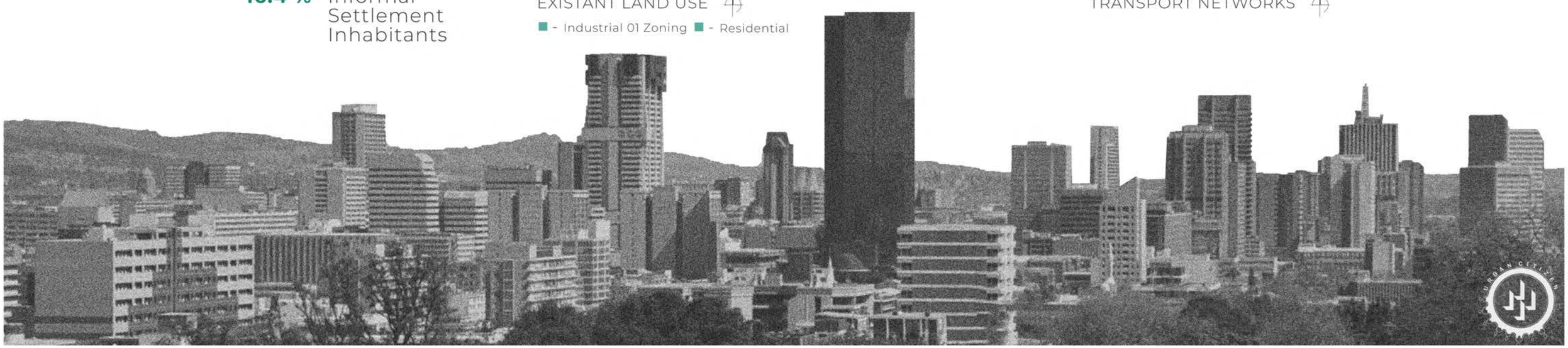
MAIN ACTIVITIES

EXISTANT LAND USE

■ - Industrial 01 Zoning ■ - Residential



TRANSPORT NETWORKS



2023 CO-CREATING WELLNESS STUDIO

OVERVIEW

WHAT HAPPENED...

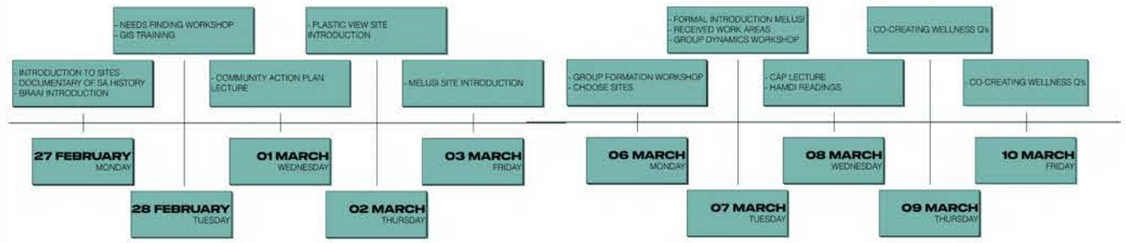
In a joint effort by the UUC (UP) and Reality Studio (Chalmers University) a partnership with local stakeholders and Melusi residents enabled the mapping of lived in conditions and experiences of the settlement. This information created a shared vision, enabling the CoT to better address residents' needs. The studio also assisted in the pre-feasibility stage of the UISP required before applying for provincial funding, helping to streamline the process and avoiding delays

METHODOLOGY

UKUDOBA METHOD

- RESEARCH DESIGN
- QUESTIONNAIRE DESIGN
- DATA COLLECTION
- DATA CONVERSION
- DATA ANALYSIS + INTERPRETATION
- DATA WAREHOUSE

PROJECT TIMELINE



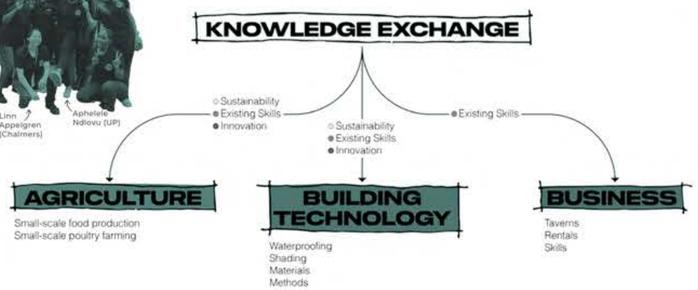
FOCUS GROUPS

01 KNOWLEDGE EXCHANGE

MELUSI
KNOWLEDGE EXCHANGE

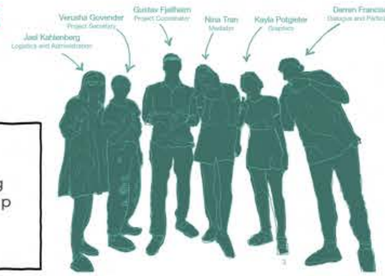
AIMS

Stimulate the **RELATIONSHIPS** between residents, the broader community and the surrounding environment through **MUTUAL** participation in knowledge spread.



02 SKILLS + BUSINESS

SKILLS & BUSINESS
MELUSI



AIMS

Document and improve the understanding the role of skills building and entreneurship efforts in **fostering hope, ambition and, co-development** in Melusi.

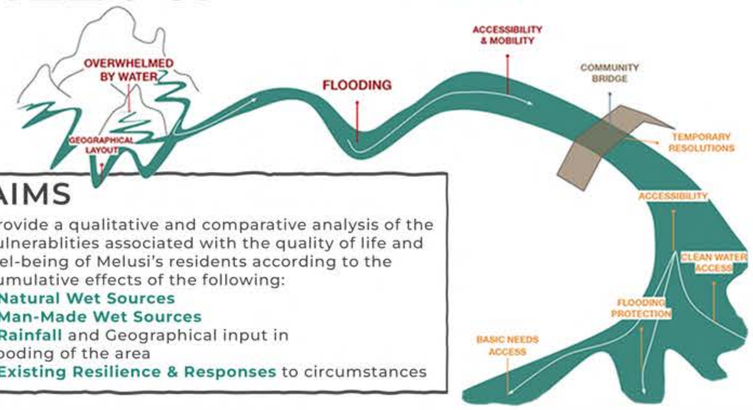
HOPE
- Amplifying Voices
- Stories from the Community
- Communication

AMBITION
- Common Goals
- Uplifting Businesses
- Fostering Dreams

CO-DEVELOPMENT
- Community Involvement
- NGO Collaboration
- Expanding Existing Networks

03 BRIDGING MELUSI

BRIDGING MELUSI



AIMS

Provide a qualitative and comparative analysis of the vulnerablities associated with the quality of life and wel-being of Melusi's residents according to the cumulative effects of the following:
- **Natural Wet Sources**
- **Man-Made Wet Sources**
- **Rainfall** and Geographical input in flooding of the area
- **Existing Resilience & Responses** to circumstances

OUTCOMES

KEY FINDINGS:

The group found that **HOPE** is present in the stories of Melusi's residents having a wilingness to reinvest in comunity efforts. **AMBITION** was cited in the willness to expand local businesses and evolve the community.

	AGRICULTURE	BUILDING TECHNOLOGY	BUSINESS
NEEDS	Lack of **GARDENS** Garden as **FOOD SOURCE** [24,4% dependant on garden for food]	Lack of effective **CONSTRUCTION METHODS** Lack of preparation for **EXTREME WEATHER** [33,2% expressed incapacity to deal]	**UNEMPLOYMENT** Lacking **FINANCIAL STABILITY** [42,5% expressed financial worries]
KNOWLEDGE EXCHANGE OPPORTUNITY	Existing knowledge about: Small-scale **FOOD PRODUCTION** Small-scale poultry **FARMING**	Existing knowledge about: **WATERPROOFING TECHNIQUES** Sustainable **CONSTRUCTION TECHNIQUES** Innovative use of **CONSTRUCTION MATERIAL**	Existing small **BUSINESS SKILLS** Willingness to **TEACH** & **LEARN** business oriented skills

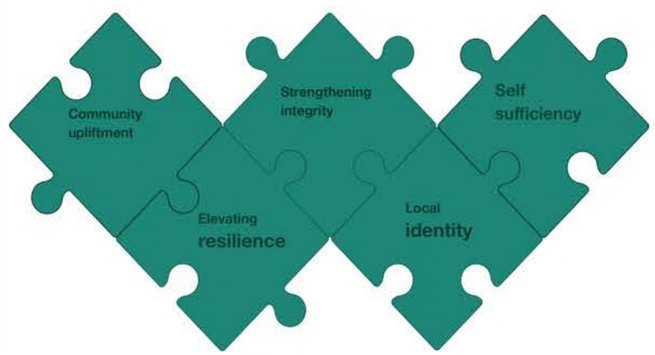
LIFTING LOCAL BUSINES BY FACILITATING CONNECTIONS

KEY FINDINGS:

The group found that **HOPE** is present in the stories of Melusi's residents having a wilingness to reinvest in comunity efforts. **AMBITION** was cited in the willness to expand local businesses and evolve the community.

KEY FINDINGS:

The Bridging Melusi group observed that the Melusi community demonstrated a **strong willingness to learn and grow**. Based on their findings, they recommended **fostering a self-sufficient and integrated community**, characterized by resilience and a strong sense of local identity.

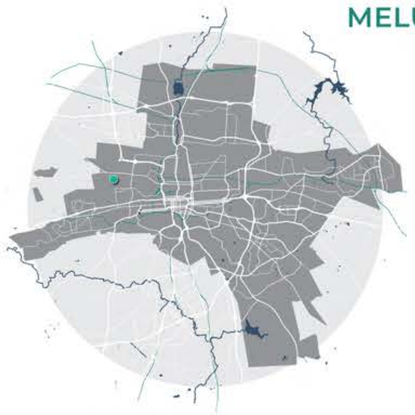


SITE CONTEXT

MELUSI

Melusi, located west of Tshwane and bordered by Clarens and Booysens, partially falls within Kirkney suburb, framed by the Witwatersberg Ridge to the south. Established around 2008, its history is under-documented, though its formation is often attributed to the availability of vacant land.

Since then, Melusi has grown exponentially, now housing over 27,000 residents (Hugo 2023). It comprises three regions varying in density, service access, and formalisation, with Melusi 2 being the most formalised, providing the best access to water and electricity (Unit for Urban Citizenship 2023). Like many informal settlements in South Africa, many homes are built from materials like corrugated sheeting and wattle poles.



USER PROFILES

RESIDENTS OF MELUSI

DEMOGRAPHIC:
Men + Women of Working Age

AGE GROUP:
18 -65 Years

IN SEARCH OF THE FOLLOWING:
- Job Oppurtunities
- Opportunities to learn New Skills
- Knowledge Exchange

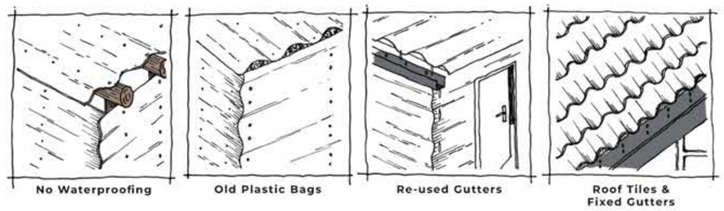
CHILDREN + ADOLESCENTS

DEMOGRAPHIC:
Primary + High School Scholars

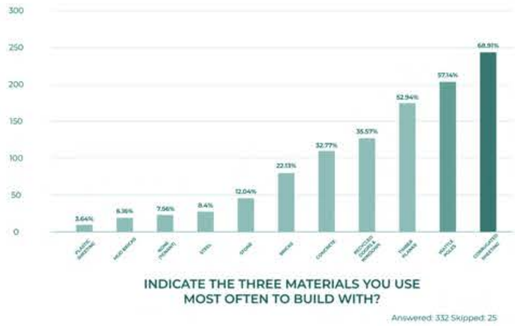
AGE GROUP:
7 - 18 Years

IN SEARCH OF THE FOLLOWING:
- New Learning Oppurtunities
- After School Programmes
Alternatives to University Education

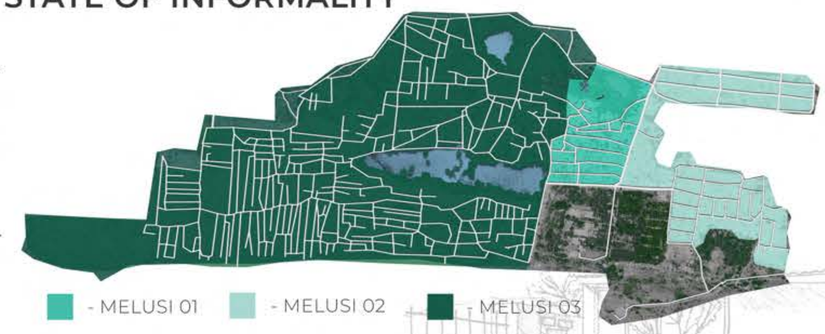
EXISTING BUILDING KNOWLEDGE



Sketches of Observations made on waterproofing methods used by Melusi Residents
(UUC 2023)



STATE OF INFORMALITY



MELUSI 01
ACCESS TO ELECTRICITY
ACCESS TO WATER

MELUSI 02
ACCESS TO ELECTRICITY
ACCESS TO WATER

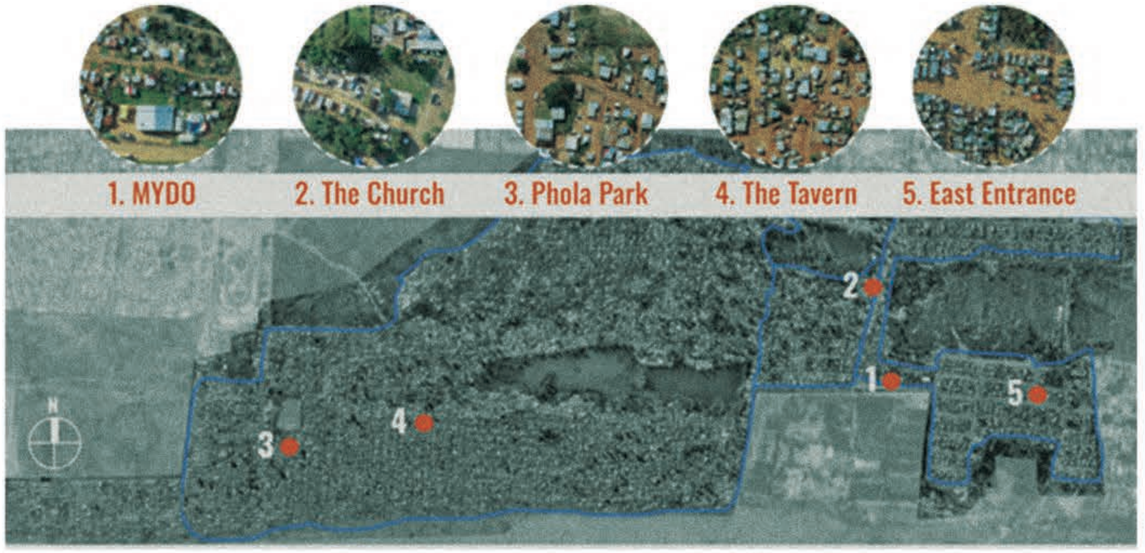
MELUSI 03
ACCESS TO ELECTRICITY
ACCESS TO WATER

2024 CO-CREATING WELLNESS STUDIO

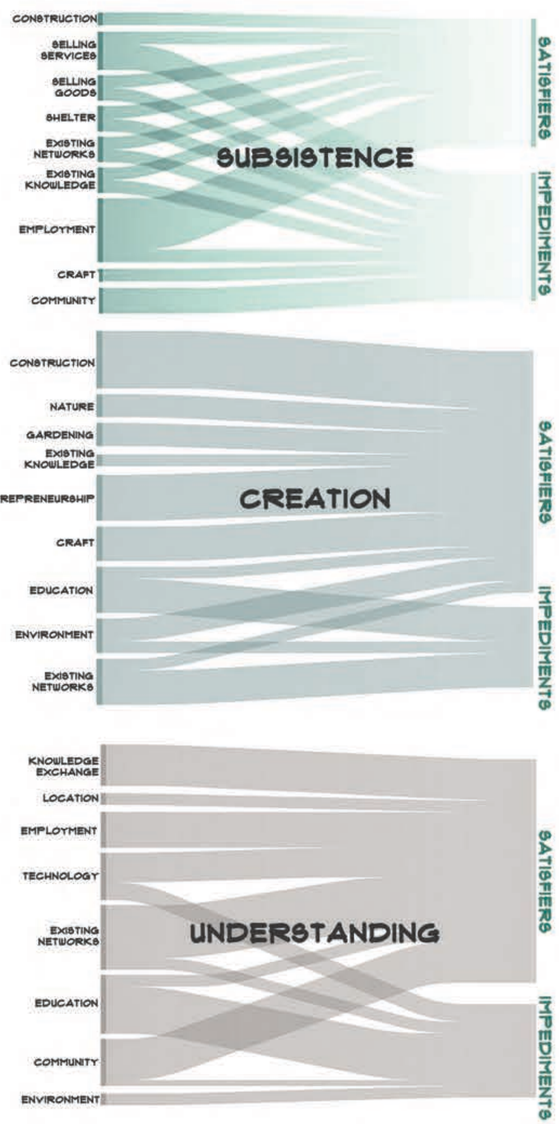
OVERVIEW

In order to achieve a greater understanding of the fundamental needs of residents in Melusi, five master's students from the University of Pretoria designed games to engage Melusi community members and gather data on their needs. These games, inspired by activities like football, Jenga™, and drawing, encouraged discussions.

After trial runs and adjustments, fieldwork over three days focused on satisfiers, impediments, and utopia. Data collected was analyzed and consolidated into matrices using Miro™, providing a clear view of Melusi's needs.



Location of Data Collection Points as part of the 2024 Co Creating Wellness Studio **(UUC 2023)**



Sketches from Knoweldge Exchange Group **(UUC 2023)**

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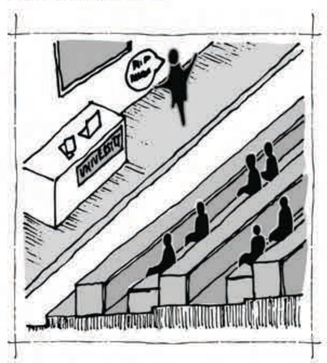


HSD MATRIX OF NEEDS & SATISFIERS					
		EXISTENTIAL			
		BEING	HAVING	DOING	INTERACTING
AXIOLOGICAL	SUBSISTENCE	Physical health, mental health, Equilibrium, Sense of humour, Adaptability	Food, Shelter Work	Food, Procreation, Rest, Work	Living Environment, Social Settings
	PROTECTION	Care, Adaptability, Autonomy, Equilibrium, Solidarity	Insurance, Savings, Social Security, Health Systems. Rights Family	Cooperation, Prevention, Caring, Assistance	Living / Social Environment
	AFFECTION	Self-Esteem, Solidarity, Generosity, Receptiveness	Relationships	Making Love, Caring for others, Expressing Emotions	Privacy, Intimacy, Communal Space
	UNDERSTANING	Critical conscience, Receptiveness, Curiosity	Literature, Teachers, Educational policies	Investigate, Study, Experiment, Educate	Schools, Churches, Universities, Communal Spaces
	PARTICIPATION	Adaptability, Receptiveness, Solidarity	Rights, Responsibilities, Duties	Become Affiliated, Cooperate, Propose	Settings of Participative Interaction, Parties
	IDLENESS	Curiosity, Receptiveness, imagination	Games , Spectacles, Clubs, Parties, Peace of Mind	Daydreaming , Resting, Reflecting	Privacy, Intimacy, Spaces of closeness, Free time
	CREATION	Passion, Determination, Intuition, Imagination	Abilities, Skills, Workings, Objects	Making, Inventing, Designing	Productive and Feedback settings, Workshops
	IDENTITY	Sense of belonging, Consistency, Differentiation	Symbiose, Language, Religion, Habits, Customs	Commitment to Oneself, Getting to know yourself	Social rhythms, Everyday settings
	FREEDOM	Autonomy, Self-Esteem, Determination	Equal rights	Dissent, Choose to be different from, Run risks	Temporal/spatial plasticity

Matrix of Needs and Satisfiers **(Max-Neef 1991)**

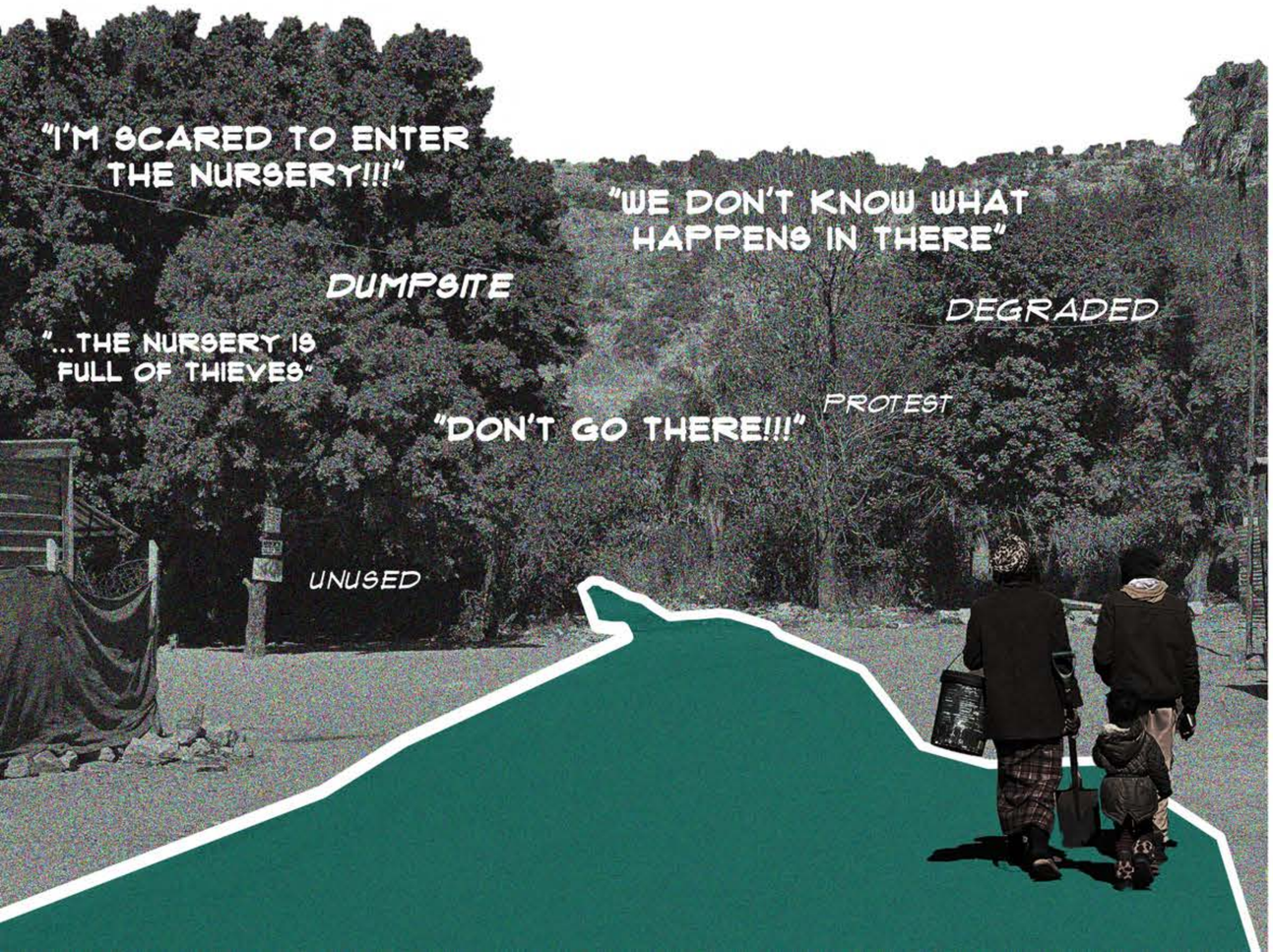
SITE CONTEXT

BOOYSENS NURSERY

The Booysens Nursery, nestled at the heart of Melusi, is a crossroads for the community's diverse segments, yet it stands frozen in a liminal state—brimming with untapped promise. Once a vibrant hub, it is now overshadowed by its reputation as a "no-go zone," a label etched by years of neglect and underuse. But beneath this veneer of desolation lies an oasis, a sanctuary of trees and untold possibilities, waiting to be reclaimed by the community it was meant to serve.

This site is more than just a relic; it is a canvas for transformation. Its inherent potential as a catalyst for future development through civic architecture and productive landscaping shines through the shadows of its current state. Existing informal uses whisper of an alternate reality, one where the space becomes a thriving nucleus of activity. Imagine a building programme that bridges unmet needs, fostering connection, empowerment, and vitality. Booysens Nursery could rise again as a beacon of hope and revitalisation, uniting Melusi with a shared vision for a better future.

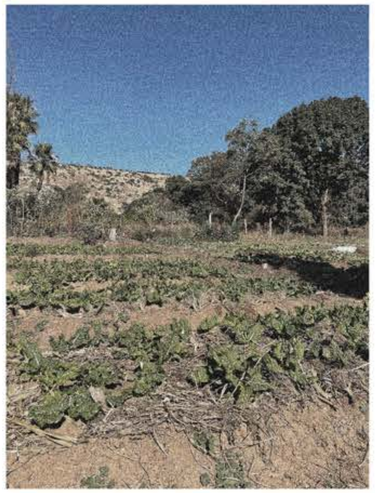
THE NEED TO REHABILITATE



EXISTANT ACTIVITIES ON SITE

SPORTS FACILITIES

SUBSISTENCE FARMING



PROGRAMMATIC RESPONSE

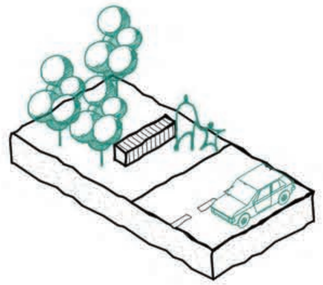
SYNERGIC SATISFACTION OF NEEDS ANALYSIS

VOCATIONAL TRAINING

The building programme aims to respond to needs by highlighting which needs have most regularly been cited by the residents of Melusi. The community engagement process determined that **THE NEEDS FOR SUBSISTENCE, CREATION AND UNDERSTANDING HAD THE WIDEST REACHING CONCERN AMONGST RESPONDENTS**.

The final proposal aims to address these needs through a single, integrated intervention: a flexible building program that includes a vocational training center constructed from locally sourced materials and a revitalized public space. This space repurposes a neglected nursery for productive land use, supporting bamboo growth and small-scale subsistence farming, ultimately fostering public wellness and **ENHANCING SPATIAL AGENCY.**

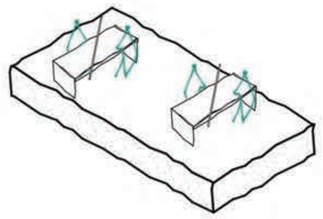
Hardware Stores and Brick Manufacturing Facilities in Melusi (Author 2024)



RESTING

IDLENESS; IDENTITY

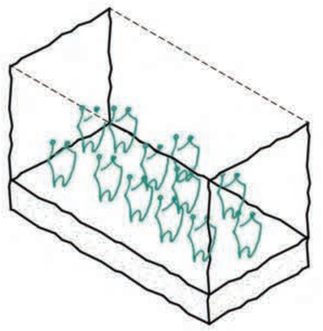
Rest spaces fulfill fundamental needs by supporting subsistence through rejuvenation, fostering protection via safety and comfort, and nurturing identity through personal reflection. They promote well-being, aligning with Max-Neef's synergistic needs satisfaction.



MAKING

CREATION; UNDERSTANDING; SUBSISTENCE

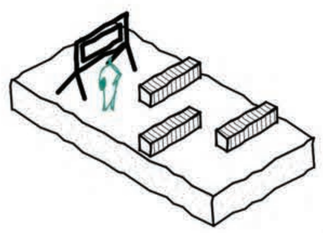
Makers spaces fulfill fundamental needs by fostering understanding through learning, enabling creation via skill-building, and encouraging participation in collaborative activities. They empower individuals and communities, aligning with Max-Neef's synergistic needs satisfaction model.



GATHERING

PARTICIPATION; UNDERSTANDING; PROTECTION

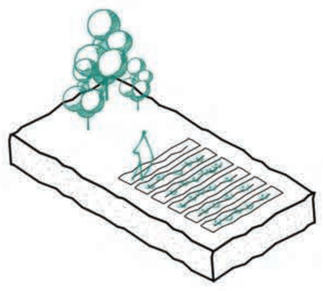
Gathering spaces fulfill fundamental needs by fostering participation through social connection, enabling creativity via collaboration, and nurturing identity through shared culture. They support sustainable development, aligning with Max-Neef's synergistic needs satisfaction.



TEACHING

UNDERSTANDING; CREATION, PARTICIPATION

Teaching fulfills fundamental needs by fostering understanding, enabling creation through skill development, and encouraging participation in learning, empowering individuals and communities in line with Max-Neef's sustainable development model.



HARVESTING

SUBSISTENCE; CREATION, UNDERSTANDING

Harvesting Bamboo synergistically fulfills fundamental needs in Max-Neef's theory. It provides subsistence through food, fosters participation in communities, nurtures understanding through its teachings and ultimately promotes freedom via land stewardship, all supporting sustainable human development.

Programmatic Sketches (Author 2024)

CONCEPTUAL APPROACH

DESIGN CONCEPTS

EXPERIENTIAL PUBLIC SPACE

The space surrounding the building programme has been designed to create a journey that leads visitors through an experience of discovery through the architecture and landscaping. Immersing users in all things bamboo from growth of the material to building.

e1

PUBLIC ACTIVITY NODES

In finding ways to promote agency and community building around the design proposal, common communal activities like subsistence farming have been introduced along high traffic areas bordering the site, to encourage placemaking.

e2

EXTENSION OF HIGH STREET

The proposed urban framework of the project extends the high street into Booysens Nursery. Through taking notes of the informants of the existing space usage surrounding the site, the new proposal reactivates the nursery as a high active public node facilitating passive surveillance within the site.

e3

PRODUCTIVE LANDSCAPING

The effective use of productive landscaping along the site perimeter responds directly to the resident's need for subsistence and participation. Along the site itself to give back directly to the community through locally organised efforts of managing crops and land use.

e4

CIVIC ARCHITECTURE IN MELUSI

The proposal aims to grant residents a new architectural sense of identity balanced with a strong appreciation of local methods of construction alongside novel approaches to material and building technology.

e5

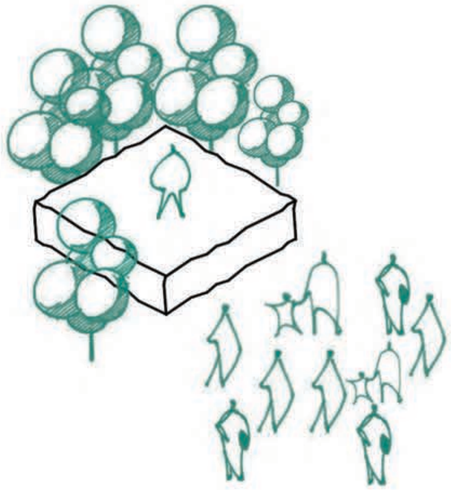
PERFORMATIVE WORKSHOP SPACES

Makers spaces and workshops are designed facing the main streets with high activity to create learning experiences for passers-by and familiarise locals with the building techniques as well as the material of bamboo.

e6

Concept Diagrams of Design Approach and Goals **(Author 2024)**

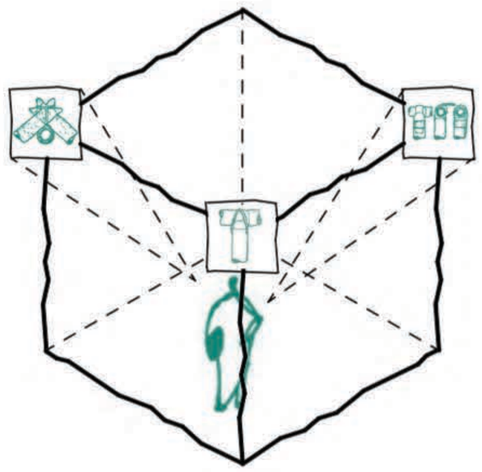
SPATIAL CONCEPTS



Workspaces designed as performative action environments prioritise adaptability and interaction.

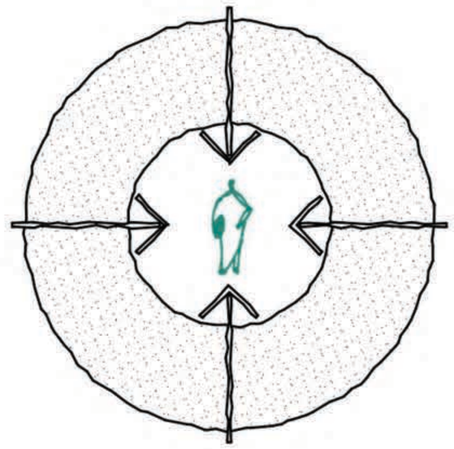
Facilitatin user's needs of understanding, participation and creation

These spaces encourage creativity, productivity, and engagement, making the workspace an active participant in enhancing work processes.



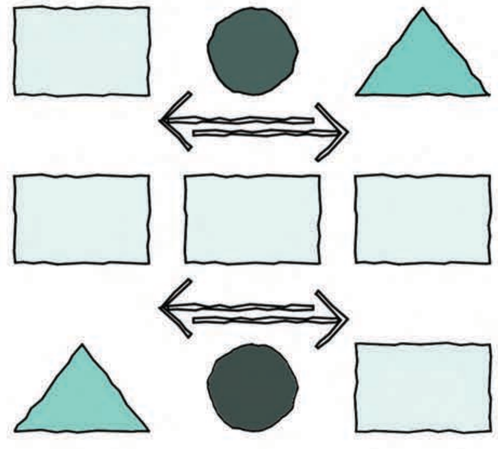
The project visualises **didactics spaces that aim to teach users through the design itself**

Through exposing structural elements and intricate connection details, the architecture becomes a hands-on learning tool, **encouraging occupants to explore and understand its construction directly from the space itself.**



The concept of **immersive architecture uses material choice and key touchpoints to create a sensory-rich experience for end-users.**

Practically, bamboo textures and finishes that engage both senses and spaces become more than functional—they evoke emotional connections, **drawing end-users deeper into the building programme and creating more enriching learning experiences.**



Flexible building programs and adaptive capacity allow structures to respond to changing needs over time.

By incorporating modular layouts, movable partitions, and multipurpose spaces, buildings can evolve with their users, **extending their lifespan and functionality.**

This adaptability supports sustainable development and reduces the need for frequent, resource-intensive renovations.

URBAN FRAMEWORK DESIGN PROCESS

RE-ZONING BOOYSENS NURSERY

THEORY

SPATIAL AGENCY

Awan, Schneider, Till (2011)

Spatial agency in architecture is the ability to shape spaces, emphasizing collaboration, adaptability, and empowering communities to create socially impactful environments beyond the architect's sole control.

EVERYDAY LIFE

Henri Lefebvre (1974)
Michel De Certeau (1984)

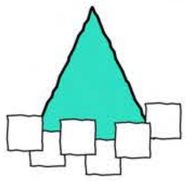
Henri Lefebvre's concept of everyday life critiques modern society's alienation, emphasizing mundane activities shaped by capitalism. He explores how rhythms, spaces, and resistance in daily life embody political and cultural struggles.

HUMAN SCALE DEVELOPMENT

Manfred Max-Neef (1991)

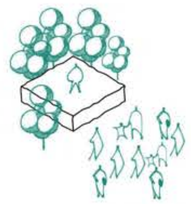
Max-Neef's model can guide urban planning by prioritizing participatory design, mixed-use spaces, equitable services, public spaces, affordable housing, sustainability, and cultural opportunities, aligning urban environments with fundamental human needs like subsistence, participation, and identity.

CONCEPTUAL APPROACH



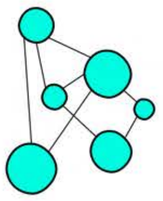
ALEXANDRA INTERPRETATION CENTRE | Johannesburg
PETER RICH ARCHITECTS (2010)

CREATION OF IDENTITY THROUGH CIVIC ARCHITECTURE



WATERSHED | Cape Town
WOLFF ARCHITECTS (2014)

ENHANCED PUBLIC SPACES PROMOTING PERFORMATIVE ACTIONS



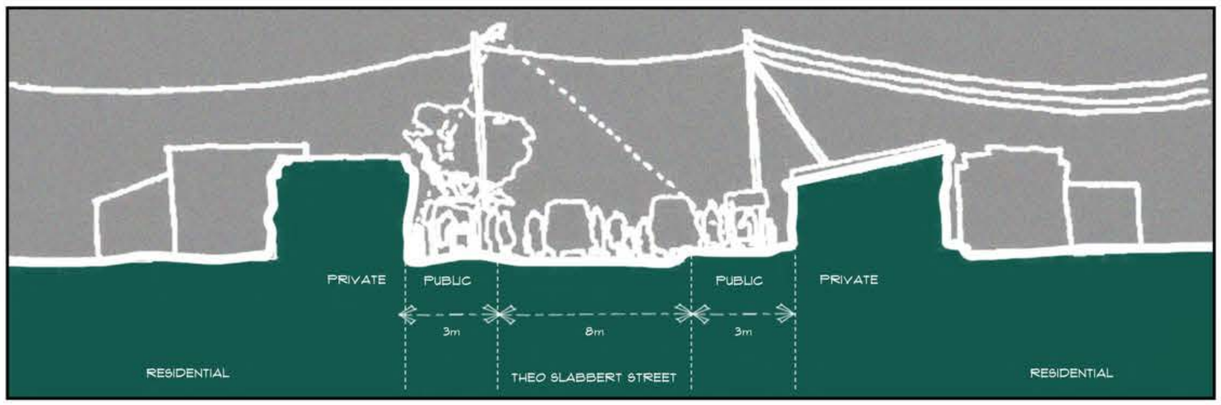
ECOBOX | La Chapelle, Paris
ATELIER D'ARCHITECTURE AUTOGÉRÉE

PROMOTION OF SELF-RELIANCE AND SPATIAL AGENCY

KEY INFORMANTS

The existance of communal subistence farming and other taking place throughout Melusi shows that residents have already taken up agency in creating employment oppurtunities through the action of gardening and productive landscaping.

In addition the mixed nature of activities on Theo Slabbert street promt suitable response in facilitating existing knowledge and skills ecosystems.



PROCESS

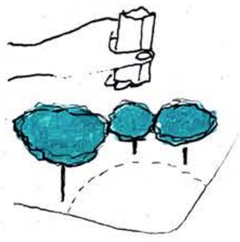
URBAN FRAMEWORK DESIGN PROCESS

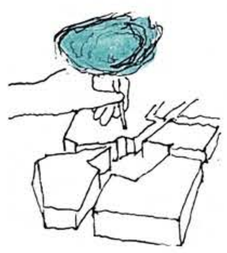
RE-ZONING BOOYSENS NURSERY

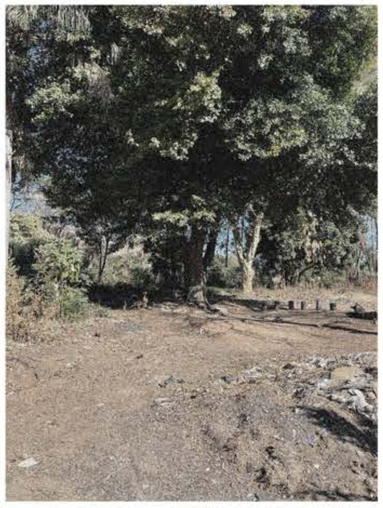
INFORMANT ANALYSIS

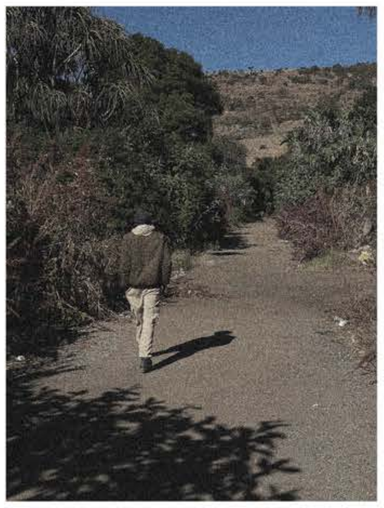
The design intervention on Booysens aims at preservering the majority of the existing nursery orchads.

These orchads therefore become a part of the overall master plan of the new re-zoned site. Tying into the wellness promotion aspects of the proposed area.









ITERATIONS

ITERATION 01

the initial plans of rezoning the booysens nursery came about with the mission of RESPECTING EXISTING SYSTEMS OF KNOWLEDGE AND SKILLS, while synergistically responsing to the needs of the residents.

In latter iteration this was extended toward the facilitation of wlellness and synergistic needs satisfaction.

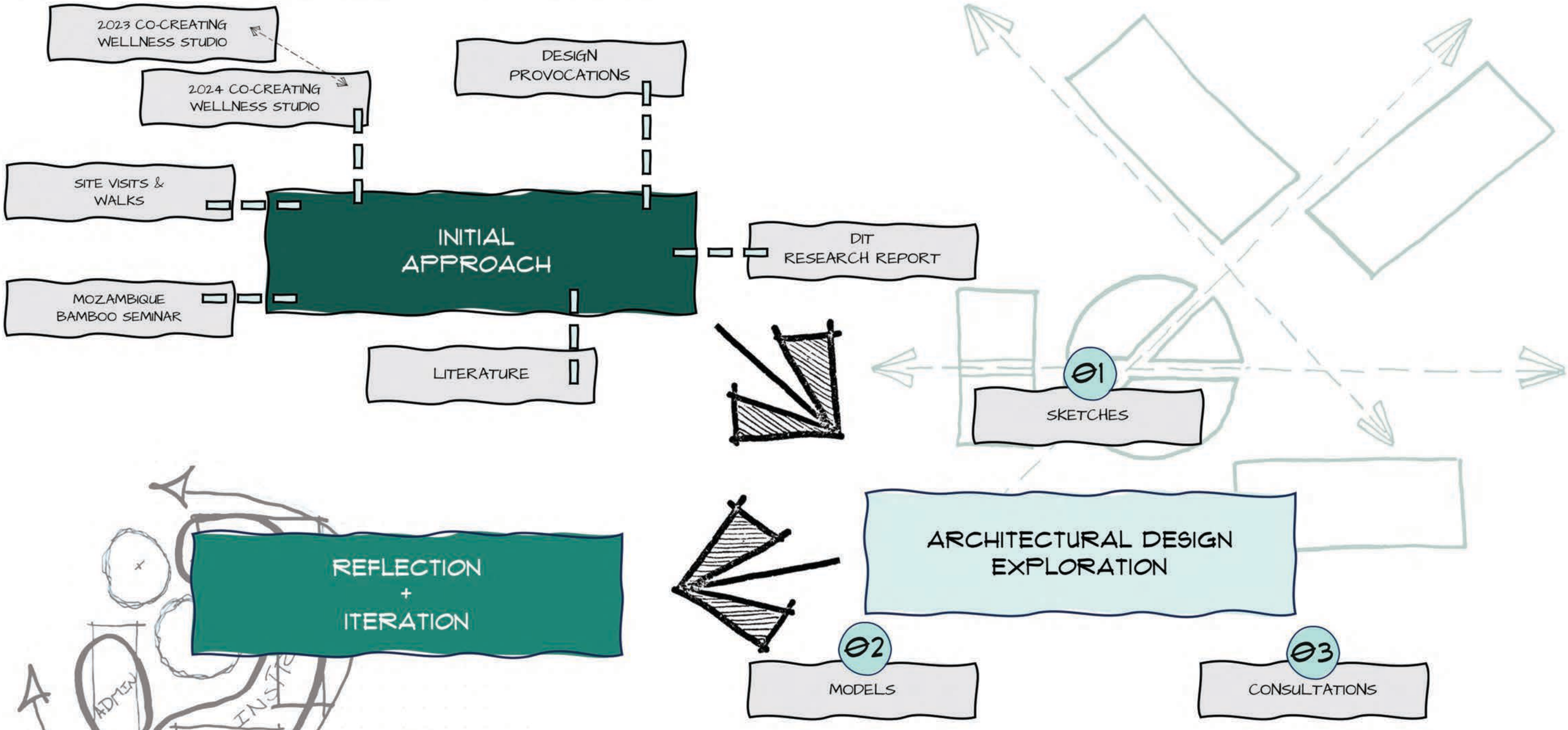
ITERATION 02

MASTER PLAN

SCALE 1 : 1000

DESIGN PROCESS

PROCESS, DEVELOPMENT + REFLECTION



ITERATION PROCESS + FEEDBACK LOOP

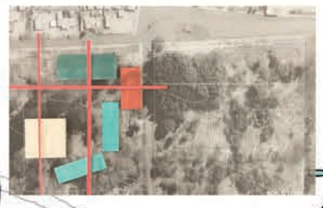
The iterative design process unfolded in three key steps, with each step carefully evaluated and refined throughout the development of each new iteration. Drawing on literature, model-making, conceptual sketching, and consultations, this explorative approach enabled a thoughtful progression toward the final design. Self-critique and continuous evaluation were central to this journey, ensuring each phase was deeply considered.

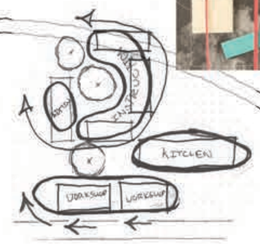
DESIGN PROCESS

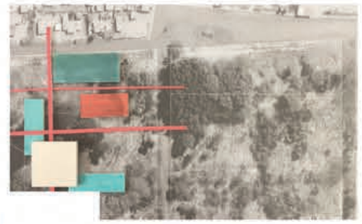
ITERATIVE DEVELOPMENT

ITERATION 01

ITERATION 02

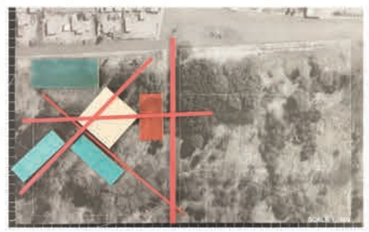


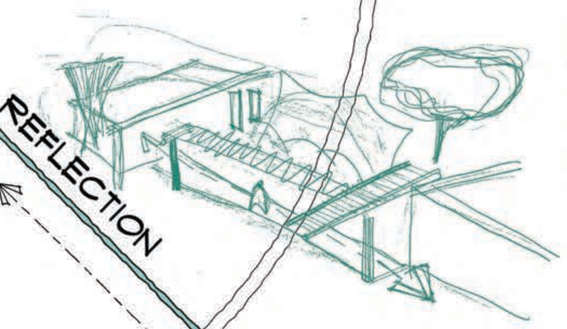




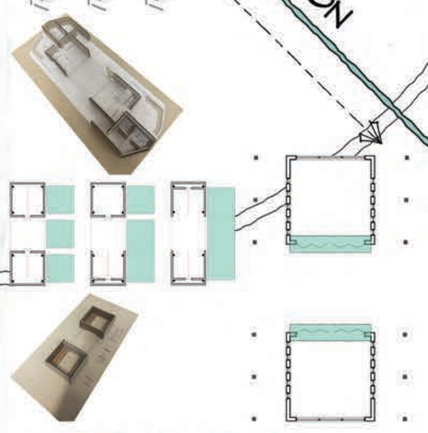
ITERATION 03

ITERATION 04

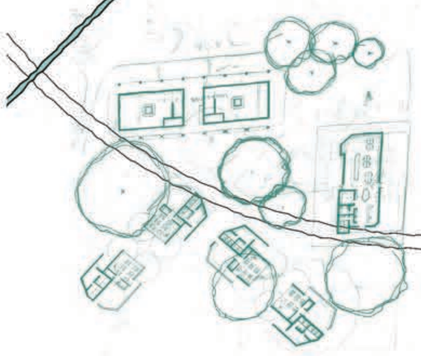




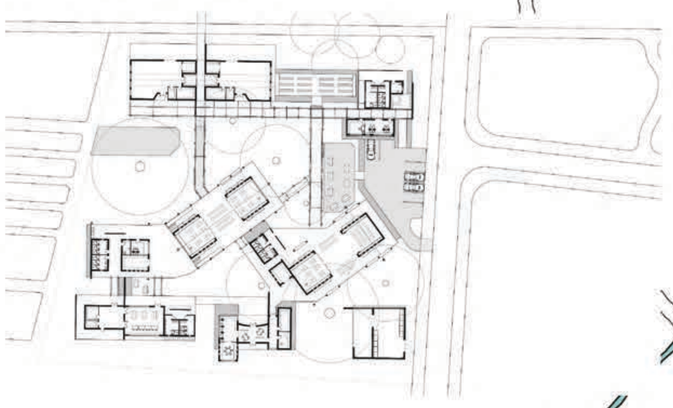
ITERATION 05



ITERATION 06



ITERATION 07



ITERATION 08

REFLECTION

REFLECTION

REFLECTION

REFLECTION

FOCUS BAMBOO SUMMIT

MOZAMBIQUE 2024

INBAR
INTERNATIONAL BAMBOO AND RATTAN ORGANISATION

DAAD

BAMBOO + TECHNICAL INQUIRY

TECHNICAL INQUIRY

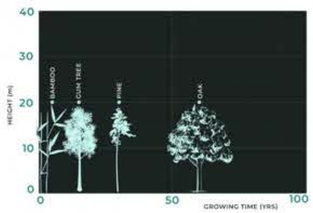
How can bamboo as a material be utilised in creating a didactic learning environment for the synergic satisfaction of users fundamental needs of understanding, creativity and subsistence.

The project aims to explore how spaces can showcase material limits and connections to aid users in understanding its intrinsic qualities and multi-faceted nature.

BENEFITS OF BAMBOO

SUSTAINABILITY

Bamboo encourages sustainable building practices as an alternative material to that of mass timber. By introducing such a material within an informal context through not only cultivating but providing a noteworthy precedent for construction through a vocational training centre. This encourages residents to make use of the material through knowledge exchange and close interaction.



GROWTH RATE OF BAMBOO COMPARED TO OTHER FORMS OF TIMBER

VERSATILITY

SUBSISTENCE

CREATIVITY

UNDERSTANDING

SYNERGIC SATISFIERS SIMULTANEOUSLY AND FULFILL OTHERS.

In line with the project's targets of synergic needs satisfaction, bamboos multi-faceted potential for use in various forms strengthens its case for its use within the project.

STRENGTH + DURABILITY

Conventional materials such as steel and timber have been compared in terms of their structural performance to bamboo.
With Bamboo its inherent structural properties allow it to perform incredibly well under tension. Its hollow nature also allows for a better strength to weight ratio especially when compared with steel frame construction.

BAMBOO IN SOUTH AFRICA

LOCAL SPECIES AVAILABLE IN SOUTH AFRICA

BAMBUSA BALCOA

LOCATION: Found mainly at high altitude such as the Drakensburg and other mountainous areas.

DESCRIPTION: A hardy, evergreen bamboo that grows in clumps

GROWTH: Height: 3-5 meters

USES: Primarily used in Gardens as decor and soil stabilisation.

SUITABLE FOR CONSTRUCTION

THAMNOCALAMUS TESSELLATUS

LOCATION: Found mainly at high altitude such as the Drakensburg and other mountainous areas.

DESCRIPTION: A hardy, evergreen bamboo that grows in clumps

GROWTH: Height: 3-5 meters

USES: Primarily used in Gardens as decor and soil stabilisation.

*NOT SUITABLE FOR CONSTRUCTION**

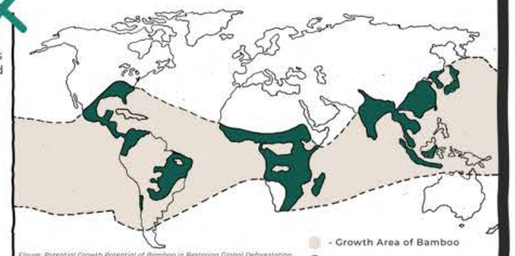


Figure: Potential Growth Potential of Bamboo in Restoring Global Deforestation (van der Lugt, 2018)

OTHER SPECIES FOUND IN SOUTH AFRICA:
- **Bambusa** *vulgaris (Not enough research published as to feasibility in South Africa)*
- **Dendrocalamus** *asper **
- **Phyllostachys** *edulis **

BAMBOO AS A VIABLE BUILDING MATERIAL

"The limitations for bamboo design and construction are not unique to South Africa but are common to other countries involved in bamboo construction. ***Their experience in overcoming these limitations can be transferred to the use of bamboo in South Africa, making bamboo construction a viable building technology in South Africa.***"
- Alexander & Ross (2022)

BAMBOO MARKET IN SOUTH AFRICA

Map of commercial bamboo projects and activities in South Africa (Sheba et al. 2017)

ecoplanet™ bamboo

A GROWING INDUSTRY..

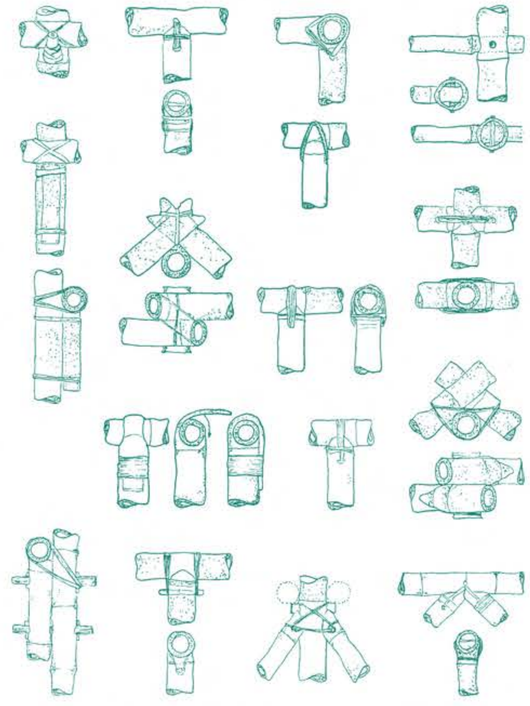
EARLY 2000'S
- Bamboo gained attention for its sustainability and potential in construction, crafts, and environmental projects.
- Early experimental plantations and small-scale projects began emerging.

2010 - 2015
- Increased focus on bamboo as the government and private sector recognized its agroforestry potential.
- Projects initiated in provinces like KwaZulu-Natal and the Eastern Cape, especially for soil erosion control and rural development.

2016 - 2020
- Growth in commercial bamboo farming, with the establishment of large-scale plantations.
- Projects focused on bamboo's applications in construction, furniture, and biofuels.
- The Bamboo Southern Africa Organisation (BSA) became key in expanding and mapping bamboo activities

2021 - PRESENT
- Further expansion of bamboo projects across South Africa, especially in the Eastern Cape, KwaZulu-Natal, and Limpopo.
- Increased focus on sustainability, job creation, and climate change mitigation through bamboo industries.

JOINT CONNECTIONS



Bamboo construction **relies on strong joints to transfer forces between elements.** Due to bamboo's hollow structure, nails or screws can cause splitting without pre-drilling, and bolt holes must be well-aligned. Anti-corrosive materials are essential for outdoor joints. To prevent splitting, internodes near joints should be filled with cement mortar or epoxy. Traditional bindings have been replaced by synthetic fibers or wire. **Force transfer is optimized with cuts like "fish mouth" or by using wooden or palm pins**, such as termite-resistant "chonta." Concrete filling can strengthen joints, but a coarse mix is recommended to minimize contraction.

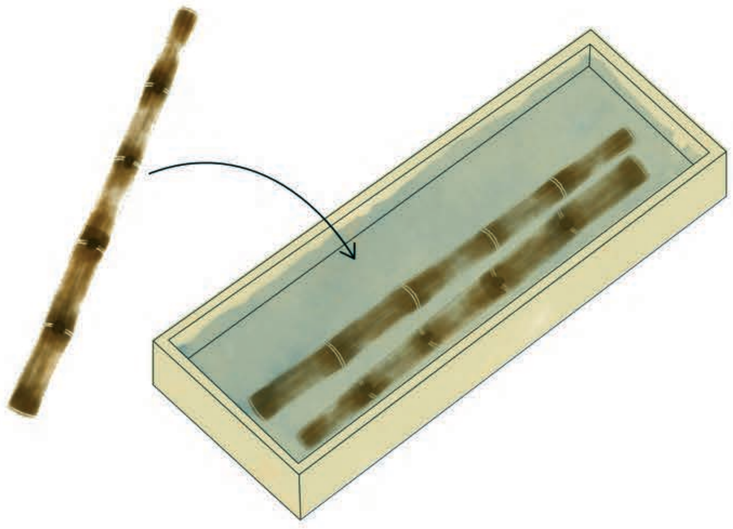
MATERIALITY

BAMBOO CULTIVATION ON SITE

HARVESTING

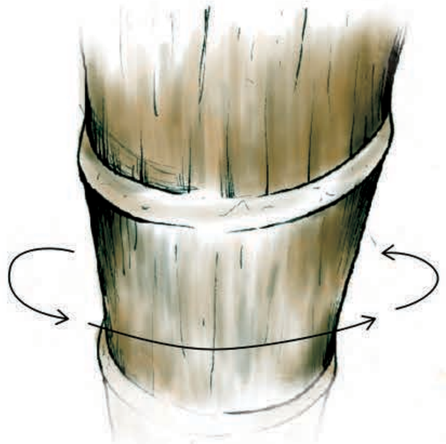
Bamboo is farmed and harvested on site ensuring that a local employement is generated offering a means of employement for in **REALISING THE NEED OF SUBSISTENCE.**

TREATMENT



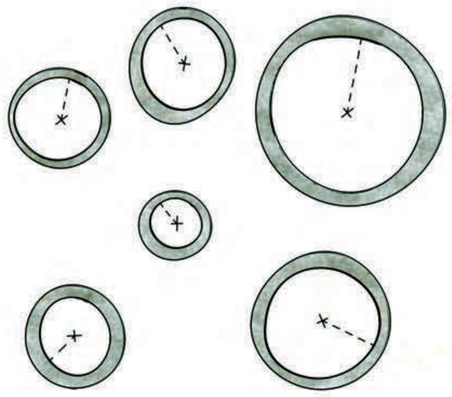
The bamboo is treatred by submerging the culms in boiling water along with a mixture of **BORAX AND BORIC ACID.** This protects them against termites and other insects.

DRYING



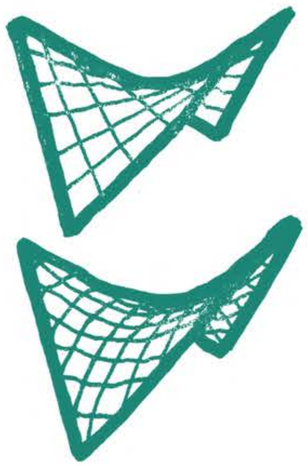
The treated bamboo stalks must be placed in a well ventilated area in order to dry properly, these are then rotated regularly in order to ensure even drying of the material, and prevent overheating, which could cause cracking.

SORTING



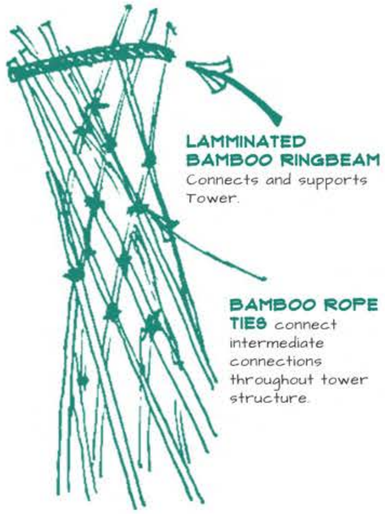
The dried bambo culm are thereafter sorted according to diameter size and straightness for ease of use in construction. They are then stored in a suitable location until use.

STRUCTURAL CONCEPT



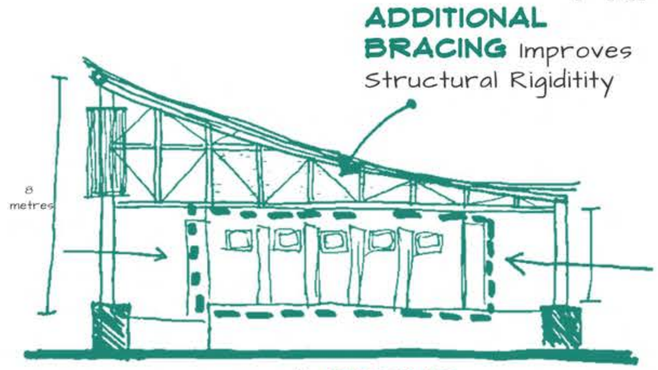
HYPERBOLIC PARABOLOIDS

The **DOUBLY CURVED** shape of hyperbolic paraboloids **DISPERSES FORCES EFFICIENTLY BY REDIRECTING THEM ALONG BOTH CURVES**, providing stiffness and strength with minimal material.



RECIPROCAL TOWER

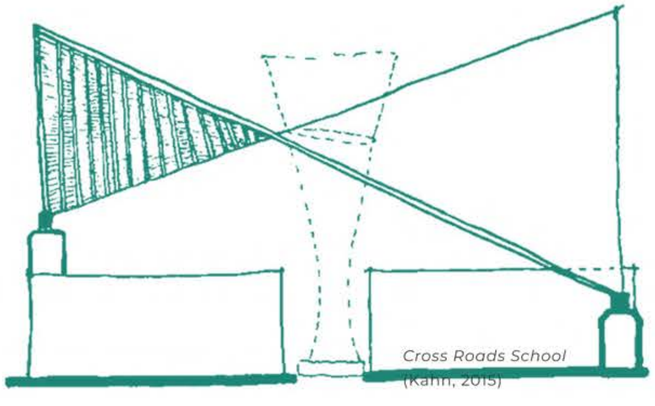
PORTAL FRAMES



Creation of **AEDICULAR** space within Structure

Building Process of Hyperbolic Paraboloid
(Bamboo U, 2022)

Bamboo U Study Hall
(Bamboo U, 2022)

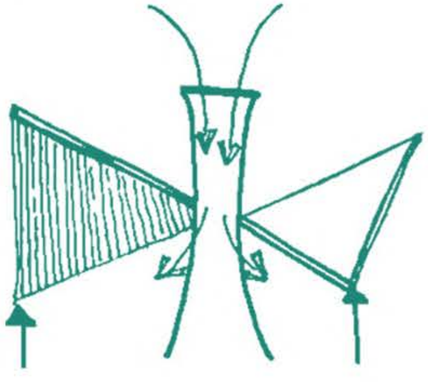


Cross Roads School
(Kahn, 2015)

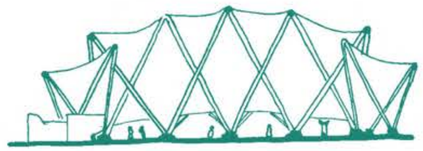
In bamboo architecture, reciprocal towers are essential for large structures like villas, schools, and bridges. They complement bamboo's natural strength and beauty, creating striking designs often used as focal points. The combination of reciprocal towers with hyperbolic paraboloid roofs enhances both structural integrity and visual appeal in bamboo projects (Schlüter, 2022).

A reciprocal tower uses straight elements to form a doubly-curved hyperboloid, balancing opposing curves for strength. Unlike hyperbolic paraboloids, it rotates a hyperbola around an axis. Combining reciprocal structure principles with triangulated intersection points creates resilience, while reinforcement rings enhance load-bearing capacity.

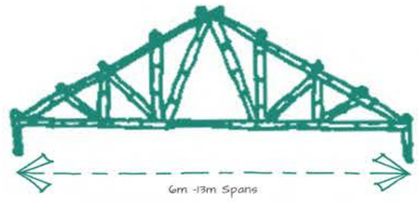
Reciprocal Tower acts as **LIGHTWELL WITHIN THE WORKSHOP** spaces. whilst acting as support for the hyperbolic paraboloid roof structure.



Tower acting as Light Well (Bamboo u 2021)



Bamboo can **CREATE LARGE VOLUMNOUS SPACES** through the use of portal frame structures such as those seen in the ARC Hall by iBUKU architects in Bali.



Drawing on traditional timber framing, the construction method uses vertical posts and horizontal beams, echoing the techniques of classic wooden house building. Stability is achieved through three key elements: vertical posts, horizontal beams, and cross-bracings for triangulation. In bamboo architecture, round bamboo poles serve as structural elements, with trusses supporting the roof (Goutham, 2021)

The training centres flexible classroom spaces make use of these structural principles to **aid in the programmes flexibility.** Furthermore due to the extensive use of mudbrick walls throughout the building, this exterior structure protects the fragile walls by **provding coverage from harsher weather.**

DESIGN PERFORMANCE ANALYSIS

ANALYSING THE ADAPTIVE CAPACITY OF INSTRUCTIONAL SPACES
AS A MEANS TO ACHIEVE SYNERGIC NEEDS SATISFACTION

BACKGROUND

Adaptive capacity refers to a building's ability to remain functional amid changing needs throughout its life cycle (Geraedts & Prins, 2016). Manfred Max Neef's (1991) human-scale development model, which focuses on meeting fundamental human needs, informs this project. The FLEX framework is used to assess and enhance the adaptability of the building's learning spaces.

HSD MATRIX OF NEEDS & SATISFIERS

		EXISTENTIAL			
		BEING	HAVING	DOING	INTERACTING
AXIOLOGICAL	SUBSISTENCE	Physical Health, mental health, Equilibrium, Sense of humour, Adaptability	Food, Shelter Work	Feed, Procreate, Rest, Work	Living Environment, Social Settings
	PROTECTION	Care, Adaptability, Autonomy, Equilibrium, Solidarity	Insurance, Savings, Social Security, Health Systems, Rights Family	Cooperation, Prevention, Caring, Assistance	Living / Social Environment
	AFFECTION	Self-Esteem, Solidarity, Generosity, Receptiveness	Relationships	Making Love, Caring for others, Expressing Emotions	Privacy, Intimacy, Communal Spaces
	UNDERSTANDING	Critical consciences, Receptiveness, Curiosity	Literature, Teachers, Educational policies	Investigate, Study, Experiment, Educate	Schools, Churches, Universities, Communal Spaces
	PARTICIPATION	Adaptability, Receptiveness, Solidarity	Rights, Responsibilities, Duties	Become Affiliated, Cooperate, Propose	Settings of Participative Interaction, Parties
	IDLENESS	Curiosity, Receptiveness, Imagination	Games, Spectacles, Clubs, Parties, Peace of Mind	Daydreaming, Resting, Reflecting	Privacy, Intimacy, Spaces of closeness, Free time
	CREATION	Passion, Determination, Intuition, Imagination	Abilities, Skills, Workings, Objects	Making, Inventing, Designing	Productive and Feedback settings, Workshops
	IDENTITY	Sense of belonging, Consistency, Differentiation	Symbols, Languages, Religion, Habits, Customs	Commitment to Oneself, Getting to know yourself	Social rhythms, Everyday settings
	FREEDOM	Autonomy, Self-Esteem, Determination	Equal rights	Dissent, Choose to be different from, Run risks	Temporal/spatial plasticity

FLEX 4.0

PROJECT FOCUS

The project focuses on addressing fundamental human needs, identified through a detailed area needs analysis, using Manfred Max Neef's Human Scale Development Framework (1991). It aims to create adaptable spaces that serve as both learning environments and gathering areas. The design seeks to maximize adaptivity, following the FLEX 4.0 model by Geraedts (2016).

SYNERGIC NEEDS SATISFACTION

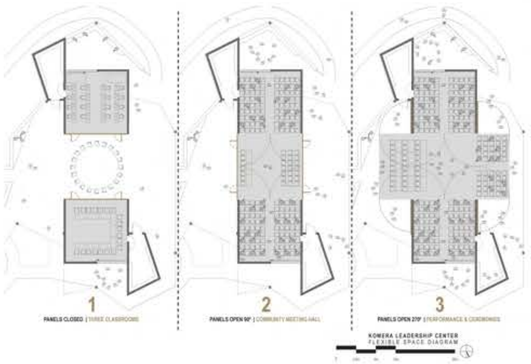
AREA OF ASSESSMENT

The area of assessment focused on the classroom/instruction spaces on site. Informed by the precedent (Figure XX) developed by BE Design (2022), the base case analysing the instruction spaces was established as a benchmark to meet the desired outcome. To meet this requirement the classrooms are designed following SANS 10400 requirements of class A3 (Places of Instruction) but have been analysed further under the A1 (Entertainment and Public Assembly) class of occupancy to measure its adaptability as a larger gathering space.

A1 - Entertainment and Public Assembly

A3 - (Places of Instruction)

ESTABLISHING A BASE CASE



The Komera Leadership Centre in Rwanda's eastern province features a modular design that supports health, education, and family development programs for young women. The classroom spaces were analyzed as a versatile model, accommodating both smaller classes and larger community gatherings.

FLEX 4.0 FRAMEWORK

FLEX 4.0												
LAYER	SUBLAYER	Nr.	Flexibility Performance Indicator	Weighting	Assessment Value				SCORE			
					BAD	NORMAL	BETTER	BEST				
SITE/ LOCATION		01	Surplus of site space									
STRUCTURE	2.1. Measurements	02	Surplus of building space/ floor space									
		03	Surplus free of floor height									
	2.2. Access	04	Access to building: location of stairs/ core									
	2.3. Construction	05	Positioning of columns									
SKIN	3.1. Facade	06	Openable Façade Windows									
		07	Daylight Facilities									
FACILITIES	4.1. Measurement & Control	08	Customisability and controllability of facilities									
	4.2. Dimensions	09	Surplus capacity of facilities									
		10	Modularity of Facilities									
SPACE PLAN/ FINISHING	5.1. Function	11	Distinction between support and infill									
	5.2. Access	12	Access to building: horizontal movement									

SCORING ADAPTIVE CAPACITY

WEIGHTING X ASSESSMENT VALUE = TOTAL ADAPTIVITY SCORE

1 = LEAST IMPORTANT
2 = IMPORTANT
3 = VERY IMPORTANT

X

1 = BAD
2 = NORMAL
3 = BETTER
4 = BEST

= TOTAL ADAPTIVITY SCORE

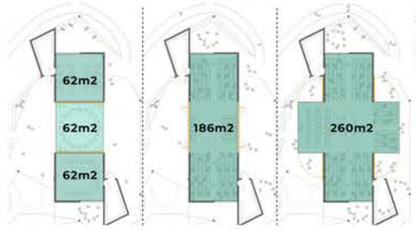
CLASS TABLE ADAPTIVITY SCORES	SCORE RANGE
Class 01: Not Adaptive	20 - 37
Class 02: Hardly Adaptive	38 - 55
Class 03: Limited Adaptive	56 – 73
Class 04: Good Adaptive	74 – 90
Class 05: Excellent Adaptive	91 – 108

TARGET

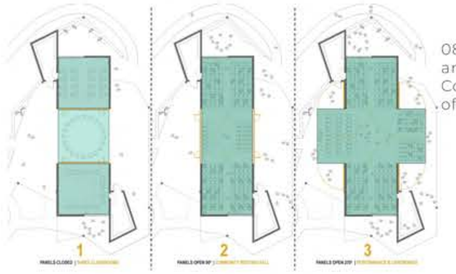
DESIGN PERFORMANCE ANALYSIS

ANALYSING OF DESIGN ITERATIONS

BASE CASE ANALYSIS

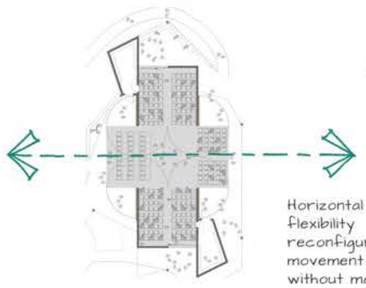


02 Surplus of Floor Space



08 Customisability and Controllability of Facilities

A3 - Place of Instruction ✓ | A2 - Theatrical and Indoor Sport ✓ | A1 - Entertainment and Public Assembly ✓



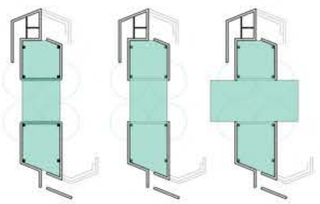
12 Access to building: Horizontal Movement

Horizontal access improves building flexibility by allowing easier reconfiguration of spaces, enabling movement between different areas without major structural changes.

FLEX 4.0									
LAYER	SUBLAYER	Nr.	Flexibility Performance Indicator	Weighting	Assessment Value				SCORE
					BAD	NORMAL	BETTER	BEST	
SITE/ LOCATION		01	Surplus of site space **[NOT APPLICABLE]**	1					0
STRUCTURE SKIN	2.1. Measurements	02	Surplus of building space/ floor space	3				4	12
		03	Surplus free of floor height	2			3		6
	2.2. Access	04	Access to building: location of stairs/ core	1			3		3
	2.3. Construction 3.1. Facade	05	Positioning of columns	1		2			2
		06	Openable Façade Windows	2			3		6
		07	Daylight Facilities **[NOT APPLICABLE]**	1					0
FACILITIES	4.1. Measurement & Control	08	Customisability and controllability of facilities	3				4	12
SPACE PLAN/ FINISHING	4.2. Dimensions	09	Surplus capacity of facilities **[NOT APPLICABLE]**	1					0
	5.1. Function 5.2. Access	10	Modularity of Facilities	3				4	12
		11	Distinction between support and infill	3				4	12
		12	Access to building: horizontal movement	3				4	12

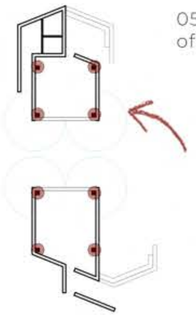
Total Score:	77
Adaptivity Class:	4

ITERATION 01 ANALYSIS



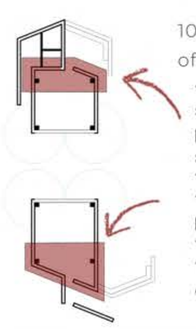
08 Customisability and Controllability of Facilities

CUSTOMISABILITY REMAINED RELATIVELY HIGH WITHIN THE INTERIOR



05 Positioning of Columns

THE POSITIONING OF THE COLUMNS ON THE INTERIOR, MAKE USE OF VALUEBLE FLOOR SPACE, LOWERING THE OVERALL ADAPTIVITY OF THE INTERIOR SPACE.



10 Modularity of Facilities

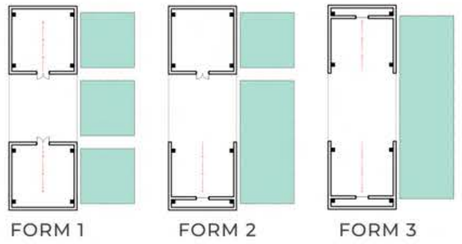
THE SPACE FEATURED IRREGULARLY SIZED SPACES THAT MAKE THE POSE ISSUES FOR THE MODULARITY OF THE

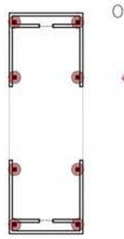
FLEX 4.0									
LAYER	SUBLAYER	Nr.	Flexibility Performance Indicator	Weighting	Assessment Value				SCORE
					BAD	NORMAL	BETTER	BEST	
SITE/ LOCATION		01	Surplus of site space **[NOT APPLICABLE]**	1					0
STRUCTURE SKIN	2.1. Measurements	02	Surplus of building space/ floor space	3				4	12
		03	Surplus free of floor height	2		2			4
	2.2. Access	04	Access to building: location of stairs/ core	1			3		3
	2.3. Construction 3.1. Facade	05	Positioning of columns	1				4	
		06	Openable Façade Windows	2		2			4
		07	Daylight Facilities **[NOT APPLICABLE]**	1					0
FACILITIES	4.1. Measurement & Control	08	Customisability and controllability of facilities	3			3		9
SPACE PLAN/ FINISHING	4.2. Dimensions	09	Surplus capacity of facilities **[NOT APPLICABLE]**	1					0
	5.1. Function 5.2. Access	10	Modularity of Facilities	3		2			6
		11	Distinction between support and infill	3			3		9
		12	Access to building: horizontal movement	3				4	12

Total Score:	63
Adaptivity Class:	3

ITERATION 02 ANALYSIS

08 Customisability and Controllability of Facilities



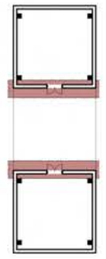


05 Positioning of Columns

ONCE AGAIN, THE INTERIOR PLACEMENT OF THE STRUCTURAL SYSTEM EMPLOYED PROVED HAZARDOUS TO THE BUILDING PROGRAMME.

10 Modularity of Facilities

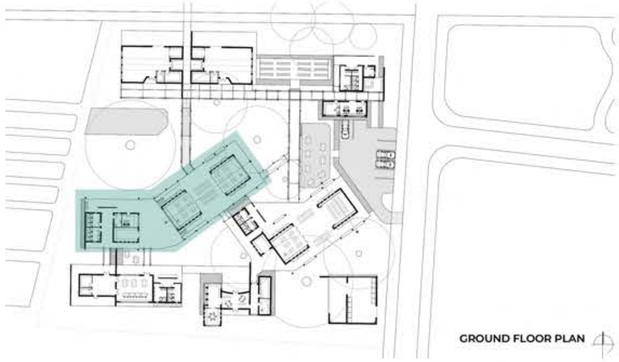
THE USE OF MOVABLE WALLS UNNECESSARILY COMPLICATED THE MODULARITY OF OF THE INTERNAL SPACES.



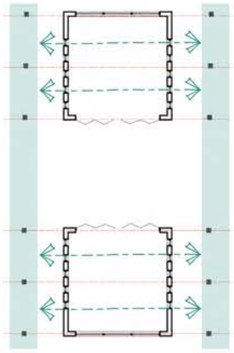
FLEX 4.0									
LAYER	SUBLAYER	Nr.	Flexibility Performance Indicator	Weighting	Assessment Value				SCORE
					BAD	NORMAL	BETTER	BEST	
SITE/ LOCATION		01	Surplus of site space **[NOT APPLICABLE]**	1					0
STRUCTURE SKIN	2.1. Measurements	02	Surplus of building space/ floor space	3			3		9
		03	Surplus free of floor height	2		2			4
	2.2. Access	04	Access to building: location of stairs/ core	1			3		3
	2.3. Construction 3.1. Facade	05	Positioning of columns	1			3		3
		06	Openable Façade Windows	2		2			4
		07	Daylight Facilities **[NOT APPLICABLE]**	1					0
FACILITIES	4.1. Measurement & Control	08	Customisability and controllability of facilities	3		2			6
SPACE PLAN/ FINISHING	4.2. Dimensions	09	Surplus capacity of facilities **[NOT APPLICABLE]**	1					0
	5.1. Function 5.2. Access	10	Modularity of Facilities	3				4	12
		11	Distinction between support and infill	3				4	12
		12	Access to building: horizontal movement	3				4	12

Total Score:	65
Adaptivity Class:	3

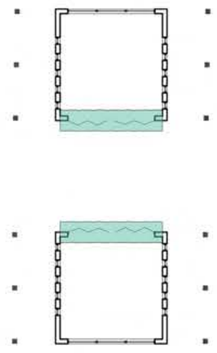
FINAL ITERATION ANALYSIS



GROUND FLOOR PLAN



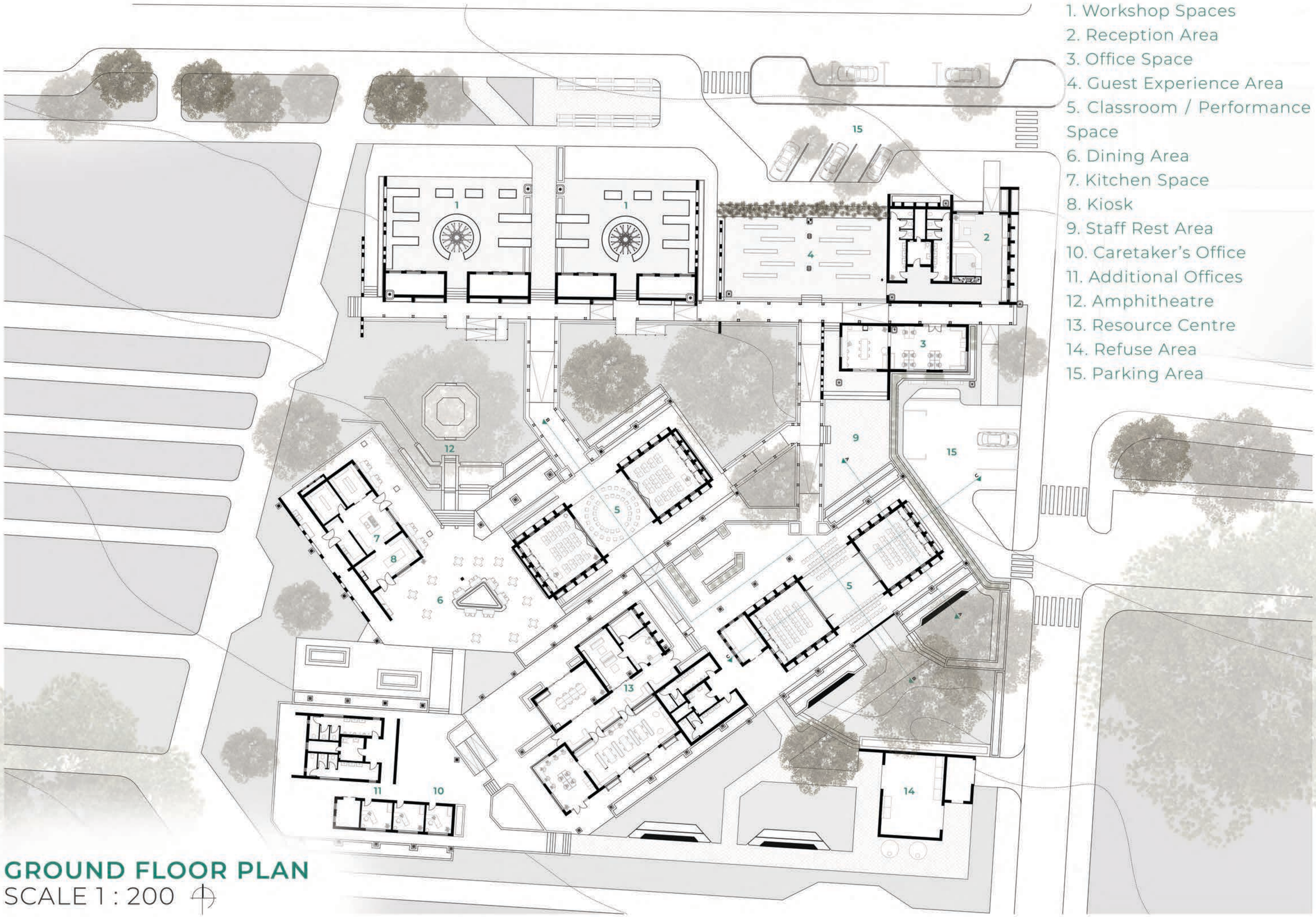
COLUMNS WERE MOVED TO THE BUILDINGS EXTERIOR MAXIMISING THE INTERIOR SPACE



FOLDABLE DOORS ALLOWED FOR MORE EFFICIENT CHANGINGING OF SPACE.

FLEX 4.0									
LAYER	SUBLAYER	Nr.	Flexibility Performance Indicator	Weighting	Assessment Value				SCORE
					BAD	NORMAL	BETTER	BEST	
SITE/ LOCATION		01	Surplus of site space **[NOT APPLICABLE]**	1					0
STRUCTURE SKIN	2.1. Measurements	02	Surplus of building space/ floor space	3				4	12
		03	Surplus free of floor height	2			3		6
	2.2. Access	04	Access to building: location of stairs/ core	1			3		3
	2.3. Construction 3.1. Facade	05	Positioning of columns	2				4	8
		06	Openable Façade Windows	2		2			4
		07	Daylight Facilities **[NOT APPLICABLE]**	1					0
FACILITIES	4.1. Measurement & Control	08	Customisability and controllability of facilities	3				4	12
SPACE PLAN/ FINISHING	4.2. Dimensions	09	Surplus capacity of facilities **[NOT APPLICABLE]**	1					0
	5.1. Function 5.2. Access	10	Modularity of Facilities	3				4	12
		11	Distinction between support and infill	3				4	12
		12	Access to building: horizontal movement	3				4	12

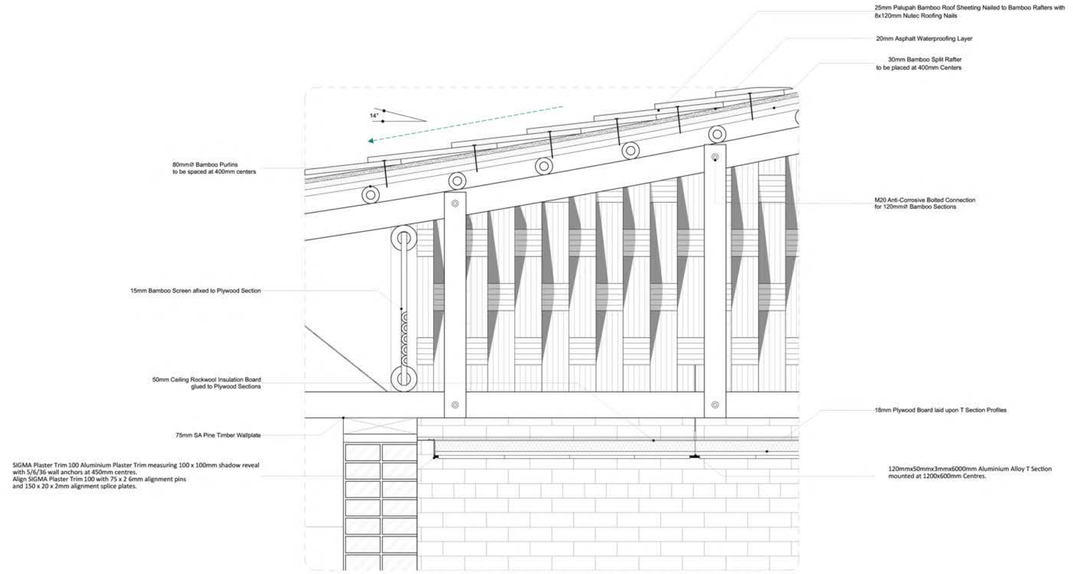
Total Score:	81
Adaptivity Class:	4



1. Workshop Spaces
2. Reception Area
3. Office Space
4. Guest Experience Area
5. Classroom / Performance Space
6. Dining Area
7. Kitchen Space
8. Kiosk
9. Staff Rest Area
10. Caretaker's Office
11. Additional Offices
12. Amphitheatre
13. Resource Centre
14. Refuse Area
15. Parking Area

GROUND FLOOR PLAN

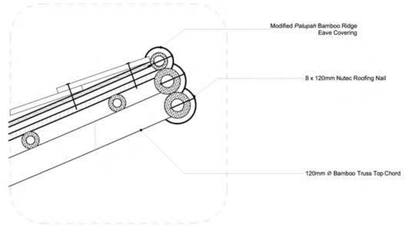
SCALE 1 : 200



DETAIL 01

Wall to Ceiling Connection

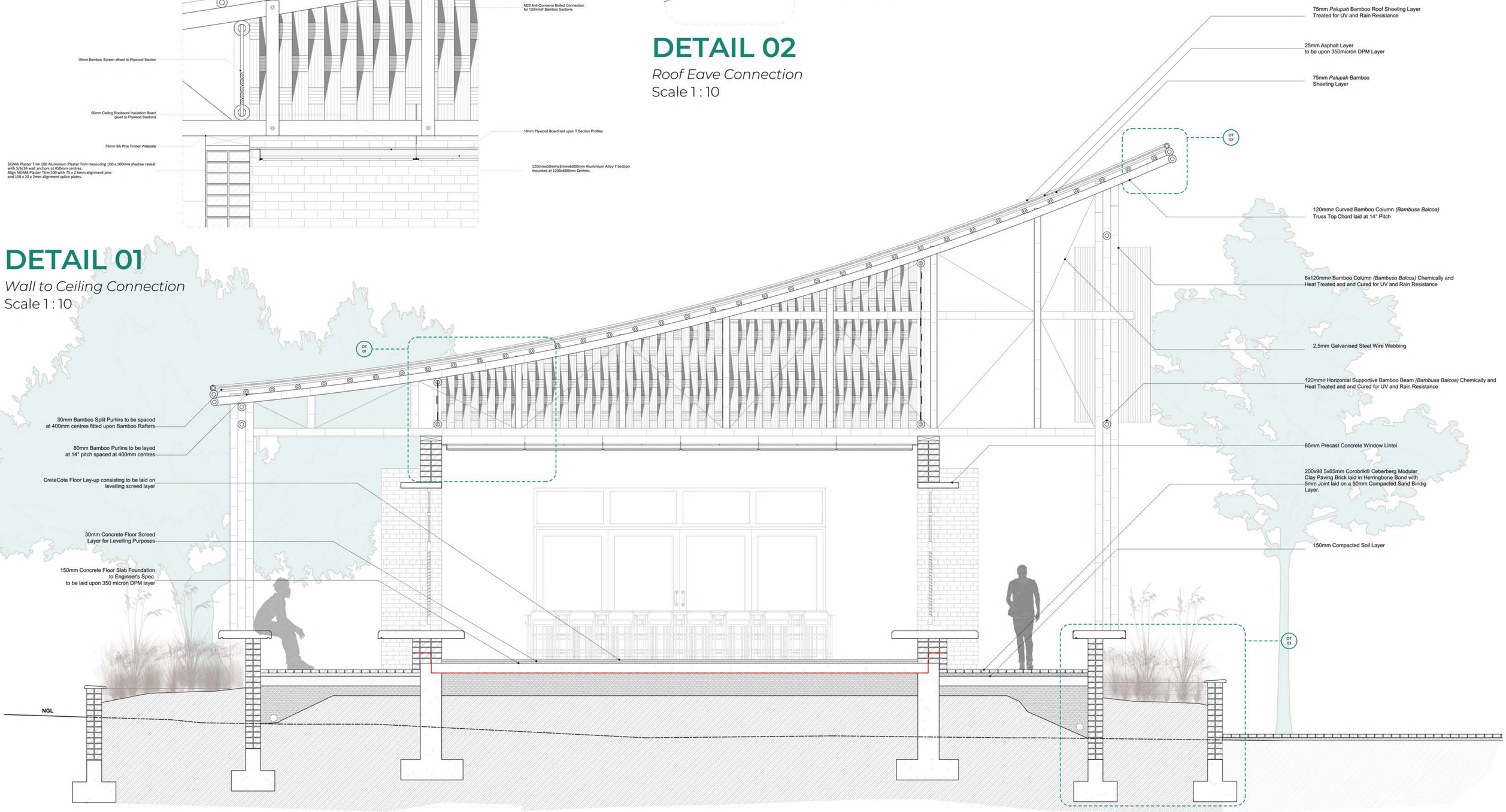
Scale 1 : 10



DETAIL 02

Roof Eave Connection

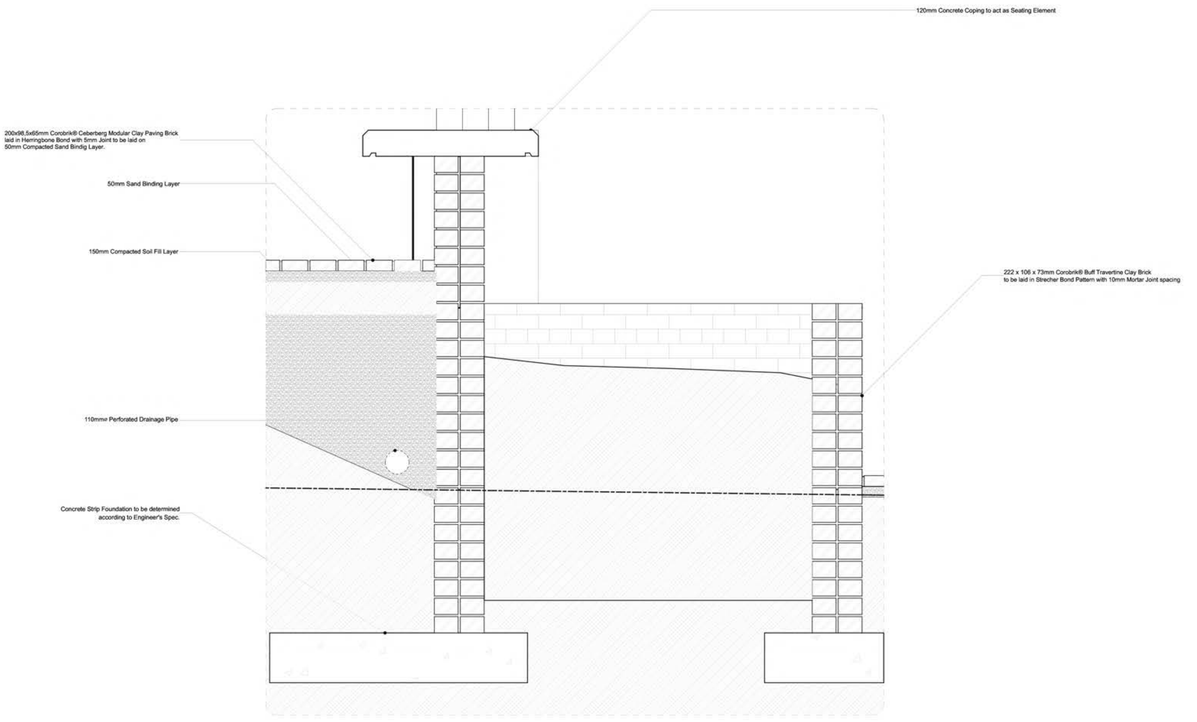
Scale 1 : 10



SECTION A-A

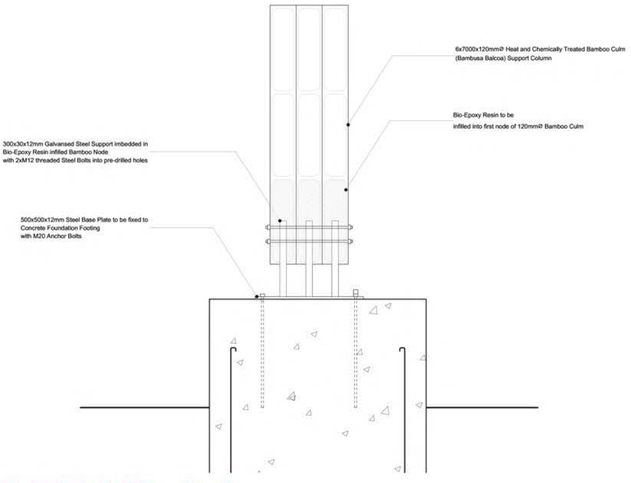
Scale 1 : 20

TECHNICAL DETAILS



DETAIL 03

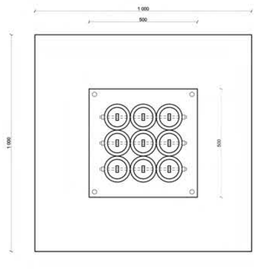
SCALE 1 : 10



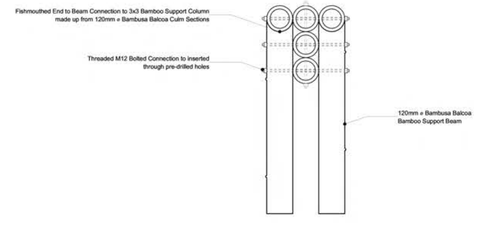
DETAIL 04

Bamboo Column Support Footing

SCALE 1 : 10



*Plan View**



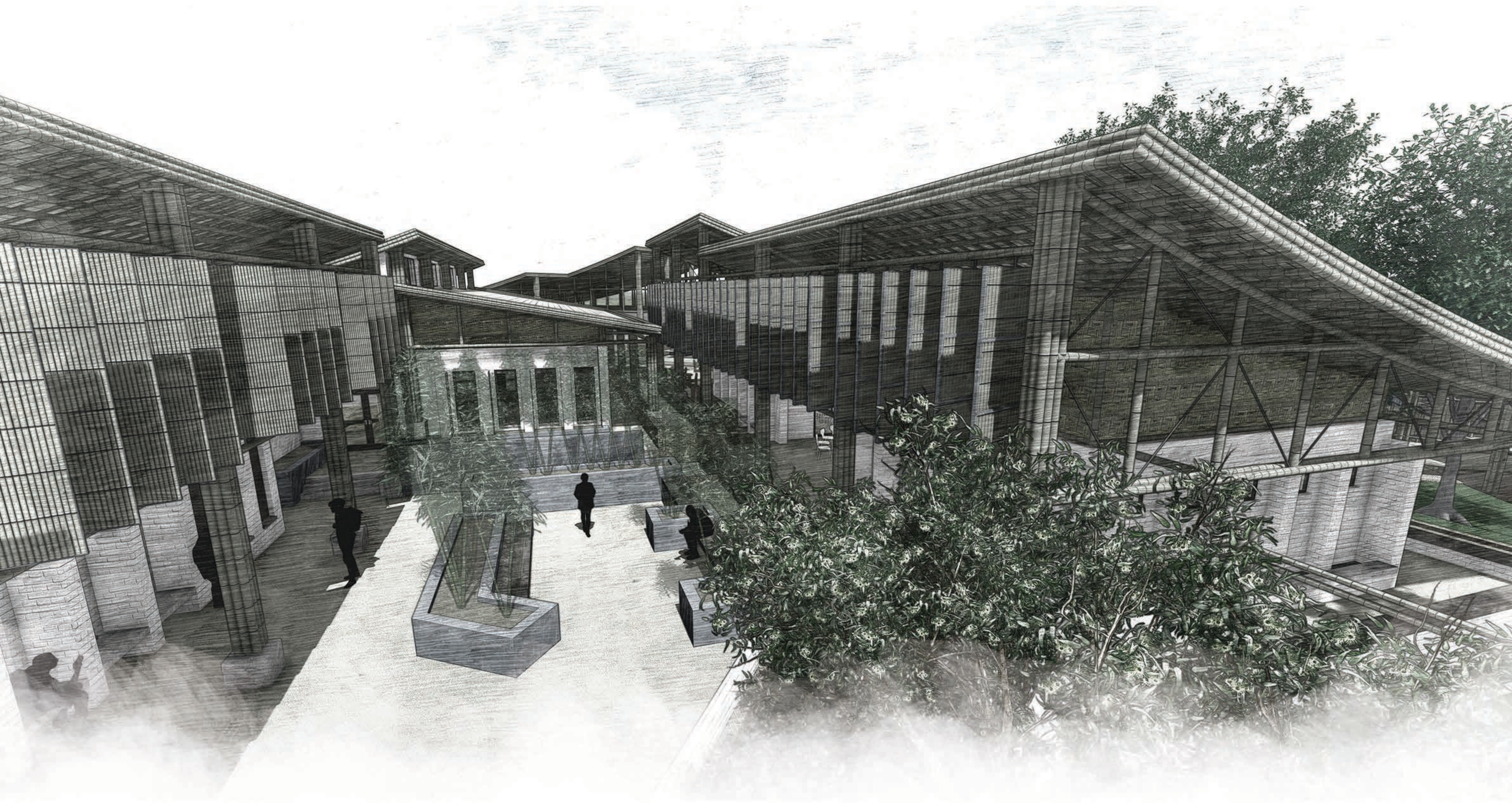
DETAIL 05

Bamboo Column to Beam Connection

SCALE 1 : 10

IMMERSIVE EXPERIENCE

| CLASSROOM SPACES



PERFORMATIVE SPACES

| AMPHITHEATRE

NORTHERN ELEVATION
SCALE 1 :100

CLASSROOM NORTHERN ELEVATION
SCALE 1 :100

WORKSHOPS SOUTHERN ELEVATION
SCALE 1 :100

CLASSROOM EASTERN ELEVATION
SCALE 1 :100

ADAPTIVE CAPACITY + FLEXIBILITY

| CLASSROOM SPACES

DIDACTIC LEARNING SPACES

| Guest Experience Area