



BOUAKÉ **W**ORKSHOP **P**ROJECT

Promotion program for the
vacated sites of Bouké
city center

THE BOUAKÉ WORKSHOP PROJECT

Promotion program for the vacated sites of Bouké city center

Alessandra Zamboni Rodrigues da Cunha

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Supervisor Matteo Robiglio

Co-supervisor Marianna Nigra

External Co-supervisor Alessandro Spitali



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The present thesis contemplates the urge for change in the construction industries of the so-called **Global South** countries. The goal is to qualify architecture as a means of **social ascent**. By enabling the approach of low technology to be used as an educational tool, it aims to result in a project capable of positively impacting the social, economic, and sustainable areas.

The focus is the vacant sites of Bouaké city centre emerging by the Central Market Project for the city of Bouake in Ivory Coast. The report's analysis and studies conclude that the market's project will generate empty spaces due to financial cuts.

The contexts create the opportunity to use **self-construction** as the project principle. Therefore, the research explores vernacular strategies, "appropriate technologies," and bio-based materials life cycle for an ecologically compatible civilization. It creates the ground floor for the intervention.

The project proposes a **Workshop Program** that focuses on two selected neglected areas. According to the most appropriate context, the report defines the project strategy to achieve a fair social project. The project will be realised in two progressive phases according to the area's urgency and the budget.

It receives the name Workshop because it is developed for a selected group of users to learn technical skills related to the construction field during the building realization. The Workshop lessons will be carried out together with its construction. The design is a **bottom-up** process and would give flexibility in the production, assembly and use of the building.

Keywords: **Self-construction, Bouaké, Social architecture**

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I.I INTRODUCTION

GLOBAL SOUTH is the latest denomination for Africa, Latin America, and a big part of Asia. The term relates to nations that face similar social, economic, and political challenges. Such as environmental degradation, human and civil rights abuses, gender inequality, ethnic and regional conflicts, mass displacements of refugees, hunger, and disease. [1]

Recently, the **ECONOMIC GROWTH** of the country in the global south has assumed greater importance for the construction industry. Historically, construction has been related to the process of urbanization by the industrialization and development of countries. [2] The major conurbations of these countries shows that:

-> **The changes in the urban environment**

are directly related to

-> **the changes in production and labor processes.** The workforce has an impact on the city's performance. [3]

Frequently the number of professionals to respond to urban growth is **NOT ENOUGH**. Neither are the social conditions, as they often present issues such as poverty, illiteracy, and high infant mortality. In the literature review, Ofori (2007) states that:

The construction industry is directly related to socio-economic development.

It does so by building the infrastructure and production facilities, transferring technological knowledge to the workers, and creating employment as labor-intensive is available. [4]

Due to the lack of information, structure, and knowledge available to construction industries, actors of the **INFORMAL BUSINESS** tend to perform the urban and constructive necessities in global south countries.[4]

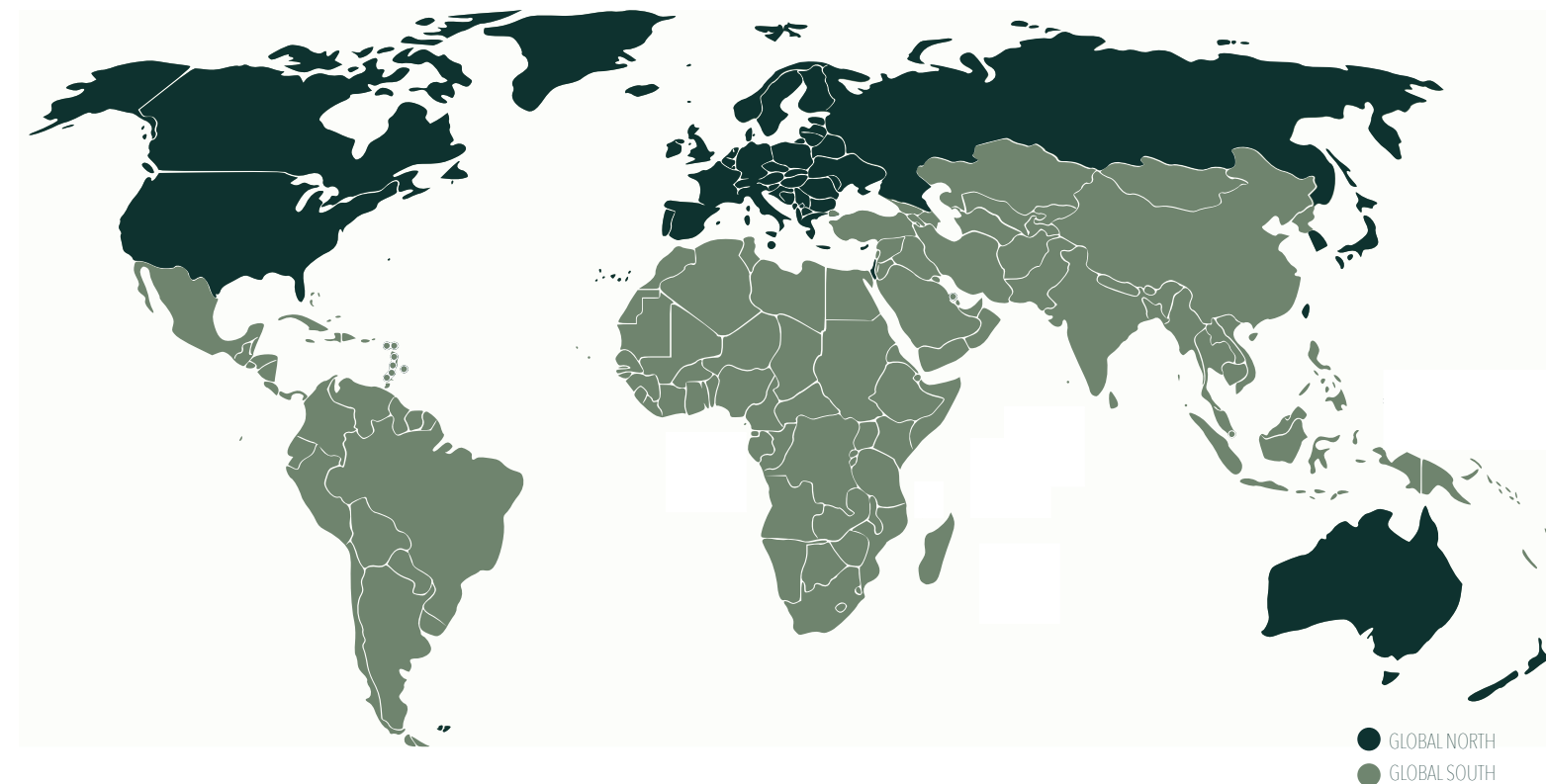


FIGURE1: The global south and north World's Map

I. BACKGROUND

These social-economic characteristics influence the **ARCHITECTURAL STANDPOINT**. The design cannot be based solely on western/colonial strategies. There must be a change in the approach. The design approach needs to take the notion of informality, the industrial application through the building process, and particularly the **SOCIAL IMPACTS** into consideration. [5]

Pathiraja (2012) explains the term “place-based” as an aesthetical language that brings to discussion the root problems of the society. Different from the known term “regionalism,” which relies on highly skilled craft traditions to create a sense of geographic belonging.

->The “PLACE-BASED” concept addresses architecture, including broader social aspects and mainly “labor-intense” principles. [3]

-> The term “LABOUR-INTENSE” defines the technology that prioritizes labor according to the International Labour Organization.

It can reduce the overall cost by 10% to 30% because it decreases the foreign exchange requirements and offers two to four times more employment of unskilled workers. Focusing on local resources, it associates the available material, tools, skills, knowledge, and finance. It is related to creating employment opportunities and skills developments. [6]

The attempt to import construction technology and applications without importing the resources needed and the cultural work structure necessary can probably lead to results that will not be as planned or “relative failures.” [6]

Ross Langdon (2012) reinforce the “place-based” concept by characterizing the ideal design as:

CHAMELEON ARCHITECTURE

Architecture should be born of the place and **adapt** to the local circumstances, as the chameleon does. [7]

Architects must develop **TECHNOLOGICAL STRATEGIES** while taking into consideration the socio-economic conditions of the countries where they work. Pathiraja (2009) advises:

“to recognize the technological contamination and compromises (that) can increase the rate of participation of the labour force to their own progressive training.”

In other words, he proposes that the design strategies should consider the introduction of technologies that are both **flexible** and **adaptable** to local conditions and, mainly, that generate the possibility of creating some teaching and training grounds. [6]

The architect's job from this perspective is to understand, design, and manage the entire building process and production.

The work should fulfil the distance between the **ARCHITECTURAL** production and **INFORMAL** industry. [6]

In order to narrow this gap, the architecture must consider the entire process. Design principles are defined so that they can be related to the **ENHANCEMENT OF THE SOCIO-ECONOMIC** sectors in these countries, which are guaranteed by a bottom-up process. Pathiraja (2012) creates a formula for this method of design with six main principles [3]

I

Value money and time

II

Allow flexibility in production, assembly and use

III

Provide tolerance for human errors of design, manufacture, assembly or use

IV

Allow great adaptability to social circumstance

V

Building workforce capacity

VI

ESTABLISH COOPERATIVE LINKS

FIGURE 2: Camouflaged chameleon

FIGURE 3: Ait Benhaddou, morocan vernacular architecture

The literature review conceptualizes

VERNACULAR ARCHITECTURE

as edifices, of all kinds, built by the relation of the environmental contexts and available resources of the local; it utilizes traditional technologies and local builders (usually the owner or the community). By this definition, the principles of vernacular architecture fit the concept of the

BOTTOM-UP DESIGN PROCESS. [8]

Since it is a social phenomenon, the changes, developments, and modernization in society affect its importance and way of being perceived. Generally,

TRADITIONAL ARCHITECTURE is connected to poverty and backwardness; therefore, modern-looking designs and materials are preferred.

Dioma (2018) argues that architects must preserve traditional architecture; he also supports that it must be infused with

CONTEMPORARY DESIGN for popular acceptancy. [9]

Some of the main heritages relevant to the vernacular tradition are the environmental considerations and the use of local resources and natural materials. Biodegradable materials and traditional structures further enable a natural comfort ambiance; traditional techniques also

ENHANCE SUSTAINABILITY. [9]



local material

local labour

LOCAL KNOWLEDGE

flexible

adaptable



SOCIAL ECONOMIC ASPECTS



I.II OBJECTIVE

The Sustainable Development Goals (SDGs), also known as the Global Goals, were adopted by all United Nations Member States in 2015 as a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030.

The 17 SDGs are integrated, the action in one area will affect others' outcomes, and that development must balance social, economic, and environmental sustainability. The thesis has the purpose of addressing design and the construction sector according to the parameters of the SDGs. [10]

Therefore, the thesis's development was influenced by one goal and several ones that can be connected.

THE GOAL IS TO USE ARCHITECTURE AS A MEAN OF SOCIAL ASCENT.

By enabling the approach of low technology to be used as an educational tool, it aims to result in a project capable of positively impacting the social, economic, and sustainable areas. [11]

Methodologically the thesis explores both contexts raised issues with solutions that can be transformed and used in different contexts and solutions to specific issues but recurrent in several countries so that it can be found a general solution for the problem.

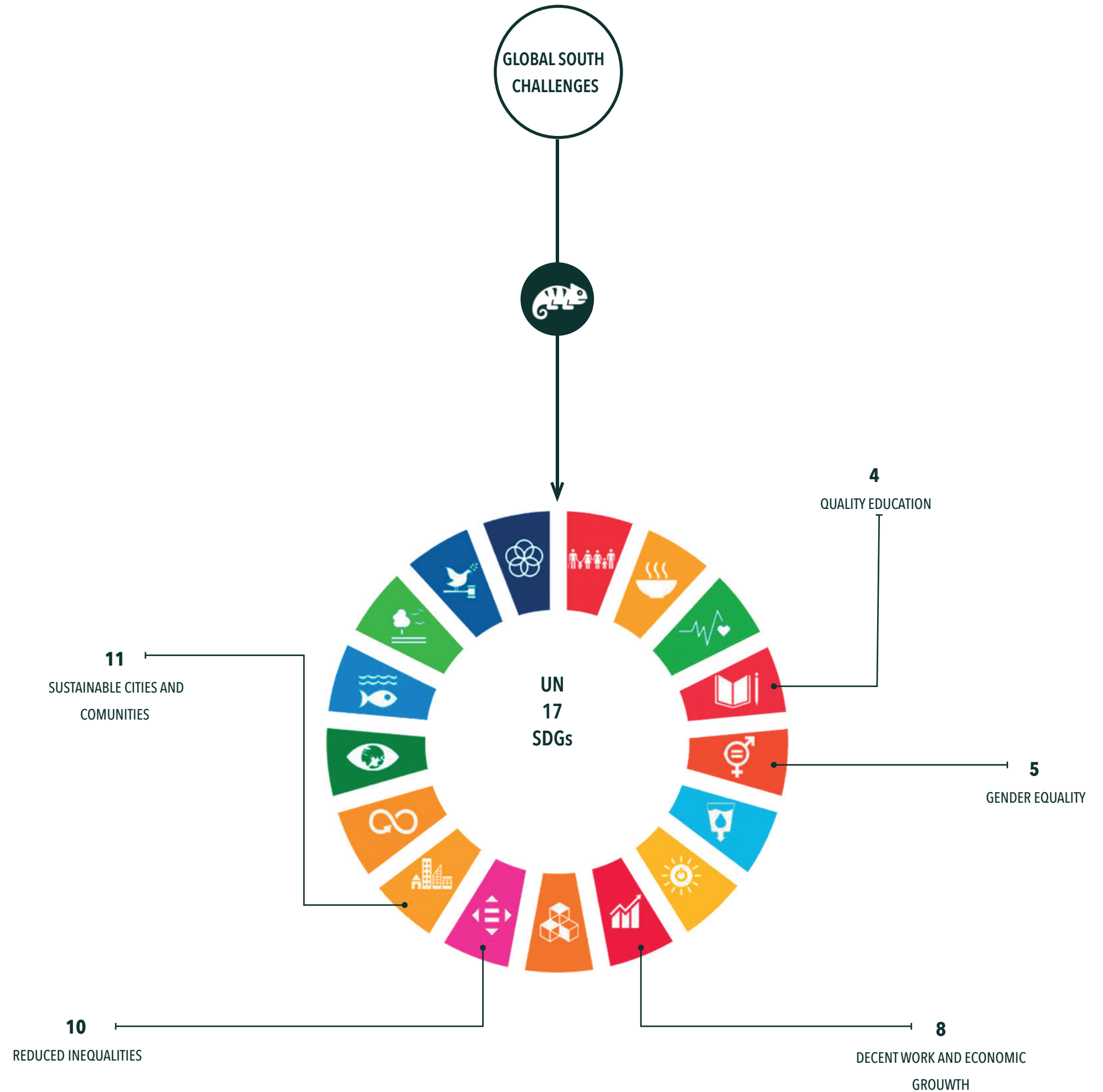
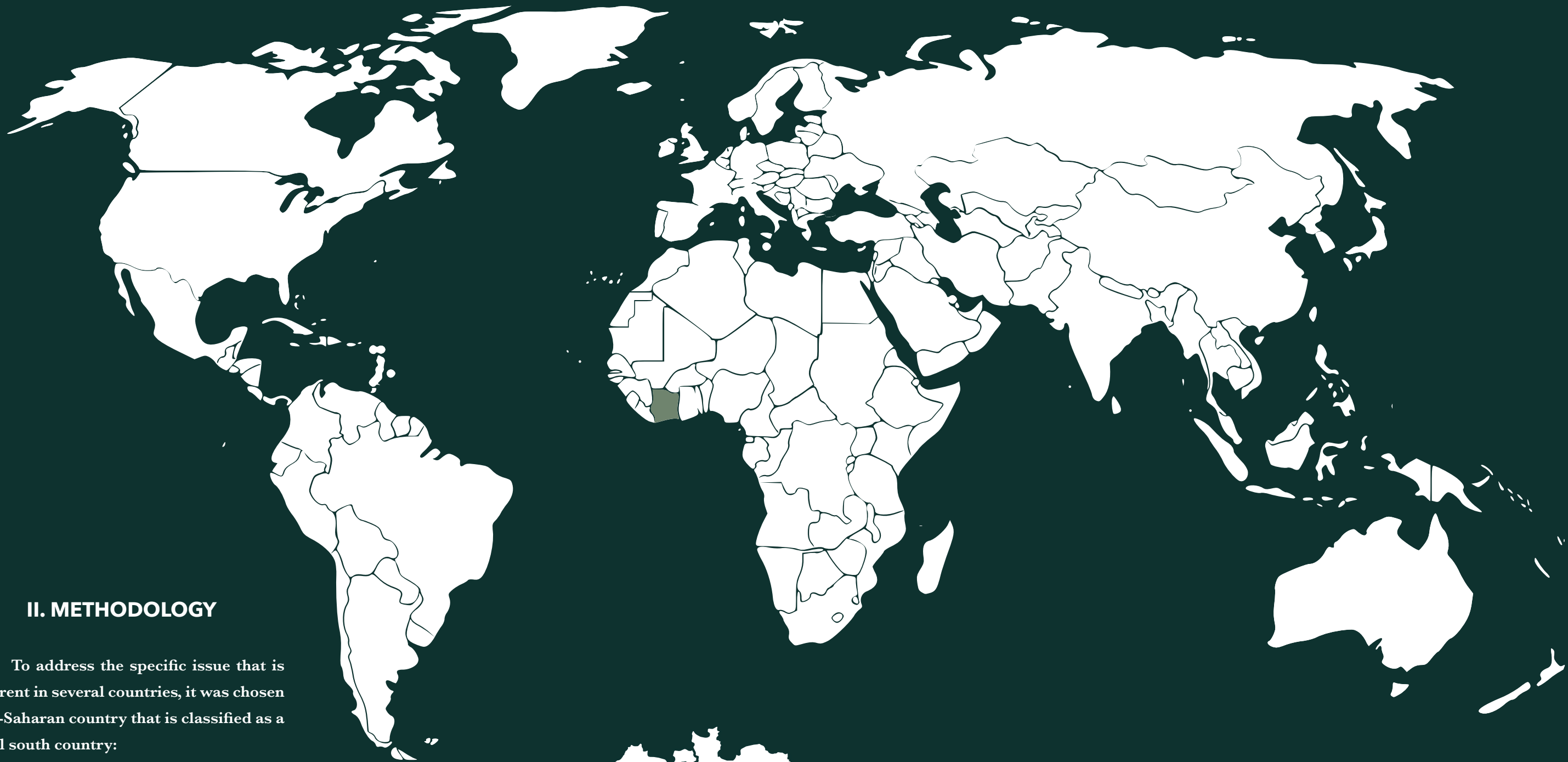


FIGURE 4: UN 17 SDGs



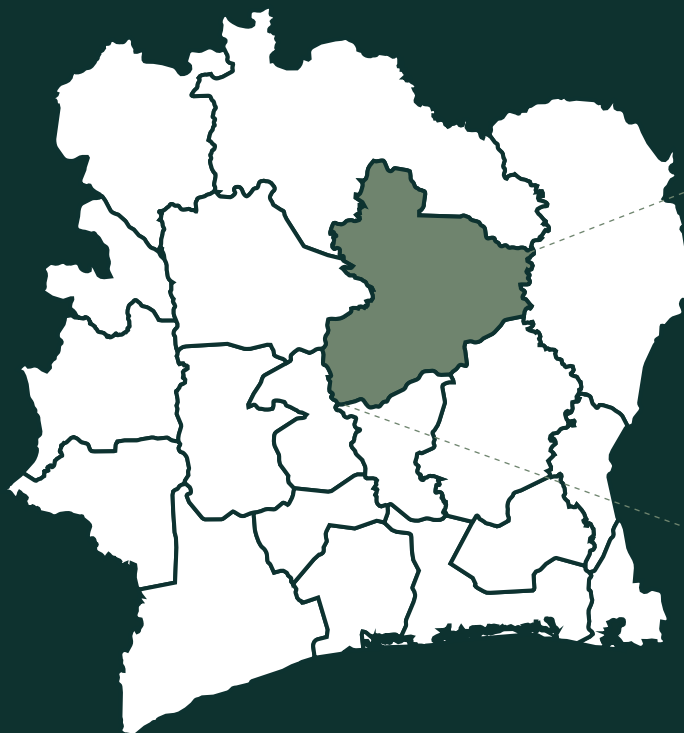
II. METHODOLOGY

To address the specific issue that is recurrent in several countries, it was chosen a sub-Saharan country that is classified as a global south country:
IVORY COAST.

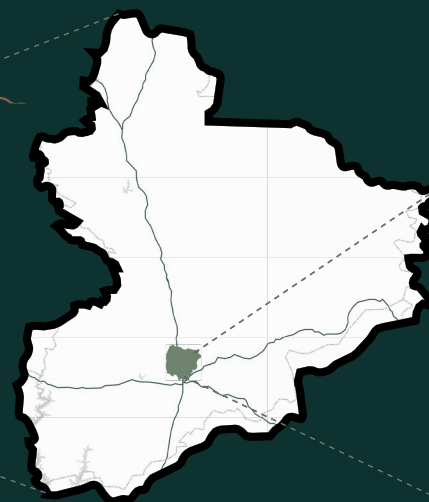
With the privilege to be advised by Alessandro Spitili, it was defined specifically the case study:

THE CENTRAL MARKET PROJECT FOR THE CITY OF BOUAKE IN IVORY COAST.

The Project defines the context raised issues, and it was chosen for the advantages of having an inside view and Project information, documentation, conception process and report from the architect Spiti-li.



IVORY COAST



VALLÉE DU BANDAMA DISTRICT



CITY OF BOAKÉ

II.1 DIAGNOSIS

1. COUNTRY CONTEXTUALIZATION

Ivory Coast is considered by The World Bank overview of 2020 an **ECONOMIC HUB**. It is one of the world's fastest-growing economies and the leading producer and exporter of cocoa beans and cashew nuts. Over two-thirds of the population are employed in the agriculture sector. [12]

Despite the economic ascent and recent efforts, Ivory Coast's HDI (Developing Human Index) value for 2018 is 0.516. It put the country in the **LOW HUMAN DEVELOPMENT CATEGORY**—positioning it at 165 out of 189 countries and territories. The 2010 HDR introduced the GII (Gender Inequality Index), which reflects gender-based inequalities in three dimensions – reproductive health, empowerment, and economic activity. Côte d'Ivoire, having one of the highest GII value of 0.657, is ranked in 157 out of 162 countries in the 2018 index. [13]

From that database, it can be highlighted that as of 2015, only 53% of men and 33% of women were literate. Ivory Coast population is relatively young, with about two-fifths under age 15. The lack of educational attainment contributes to high rates of **UNSKILLED LABOUR**. [14]

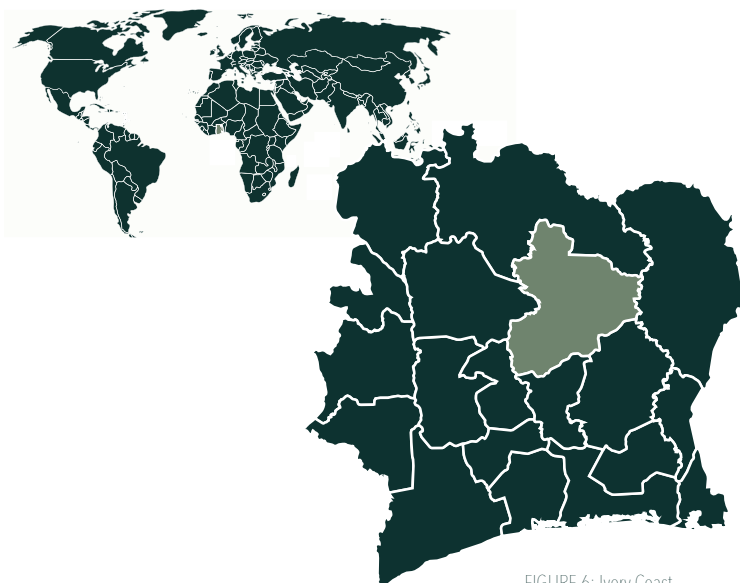
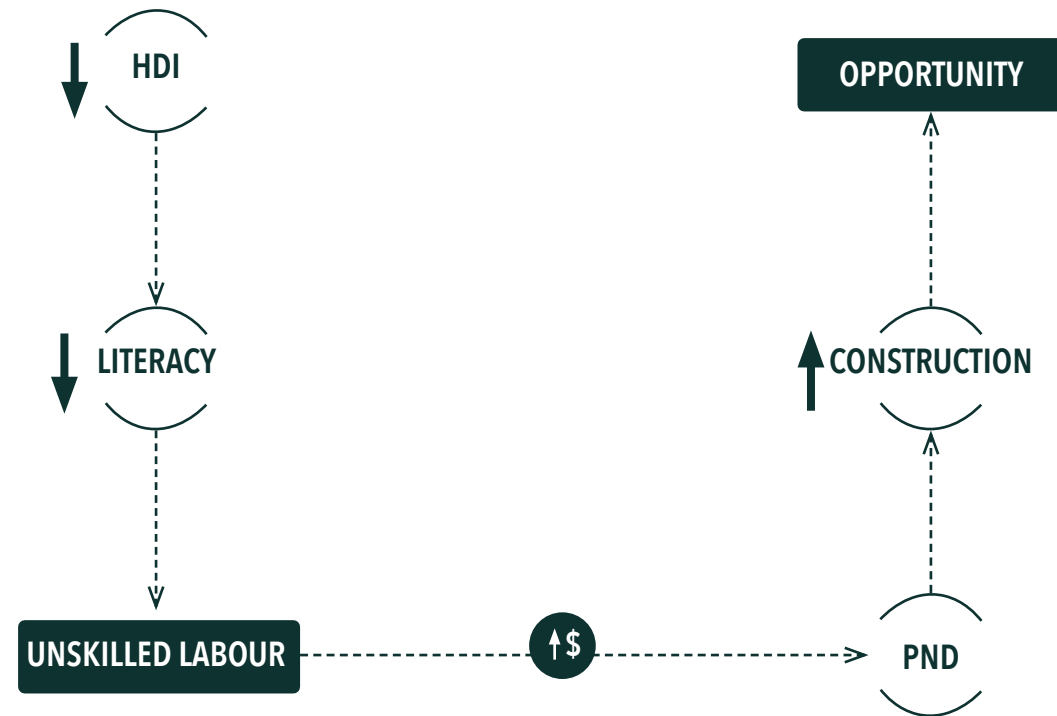


FIGURE 6: Ivory Coast



Construction is the third-largest **SOURCE OF EMPLOYMENT** in Côte d'Ivoire, with 10% of the workforce involved in the sector, behind 31% in trade and 15% in manufacturing. Much of recent performance was driven by **NATIONAL DEVELOPMENT PLAN** (Plan National de Développement, PND) 2016-20, Côte d'Ivoire's medium-term economic development agenda. Infrastructure and public works projects were a key focal point of the strategy. [15]

In recent years, the government has made efforts to improve the regulations governing the construction sector. Steps taken include the Ministry of Construction, Housing, and Urban Planning publishing its building regulations online, creating a one-stop-shop for construction permits, and reinforced quality controls. [15]

In terms of labor, the construction and public works sector is experiencing a **shortage of supervisors and specialized workers**, particularly site managers, machine operators, and field managers. The GIBTP (Ivorian Building and Public Works Group) helps reduce this deficit by working closely with the Millennium Challenge Corporation to provide technical and financial assistance to build education and training centers in public works. [15]

It is possible to relate Ivory Coast with the most sub-Saharan country situations. Within this context, the thesis uses the **Nubian Vault Association** program: "A roof, a skill, a Market" as the main reference to associate the country contextualization with the local community impact. The program is not present in the country yet, but it has proven to increase the social conditions from the places that it act on it. [16]



FIGURE 7: Nubian Vault Association

2. CITY OF BOUAKÉ

Bouaké is the **second-largest** city in terms of population in Ivory Coast after Abidjan. It is considered privileged by its location. A **crossroads** on the major axes leading to the Ivory Coast to Guinea, Liberia, Mali, Burkina Faso, and Ghana. located at the intersection of two major roads mainly paved: North-South and East-West. [17]

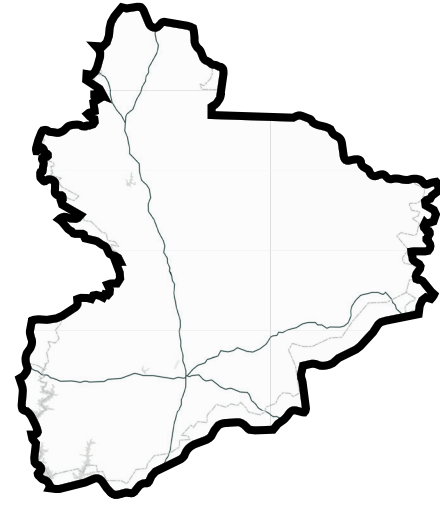


FIGURE 8: Bouake Map

The city constitutes the third economic pole of the country, and the area of influence of its center vastly exceeds the limits of the commune and extends to the Region of Gbêkê but also beyond to neighboring countries like Mali and Burkina Faso, for which it is the first service center after entering Ivory Coast. [17]

In the 1960s, the city hosted a large share of urban dwellers. Therefore, the main buildings and architecture traces that can be identified are **modernists**. [18]

In 1998, the main central market completely burned down, causing heavy **ECONOMIC LOSSES** and desolation among traders and authorities. This disaster led to anarchic occupation by traders initially operating in the Great Empty Space Market from the neighborhood. [17]



FIGURE 9: Building develop in the 60ties



FIGURE 10: Bouake Stadium



FIGURE 11: Central of Bouake City before 1998

The market's destruction increased the

INFORMALITY

that is strongly present in the center. Additionally, Bouaké was the stronghold of the rebellion caused by the military-political crisis that the country experienced from 1999 to 2011.

The city experienced a massive displacement of its population and its industries to Abidjan. Due to that, the city's commercial framework has deteriorated sharply. The shopping area consists of a plurality of wholesale, semi-wholesale, and retail sales areas, and artisanal production activities scattered around the grip of the old burnt market remained free, as well as the wholesale market. [17]



FIGURE 12: Boauke Informal Site



FIGURE 13: Boauke Vacate site

In recent years the cultivation of cashew has boosted the agricultural production of the area, offering the perspective of economic growth to the region. The development of the “food crop merchant” characterized by the new generation of young men and women farmers, made the city’s role stand out economically. **Been the only wholesale market in Ivory Coast.** Its geographical position and has allowed Bouaké to become a leading food platform in the country. [17]

In this context, the city of Bouaké **SUITS** the requirements of the **National Development Plan** to execute Infrastructure and public works projects in the center.

On the report made by EIES (Environmental and social impact study) the Bouaké project is classified in **category A**

- > financial scope
- > technical complexity
- > social and political sensitivity of its implementation. [17]

The shopping area development project aims to help **RESTORE** the town's place in the urban and commercial framework of the country. On a more local scale, the shopping area's urban development should also better connect the Commerce and Dougouba districts and make the city more inclusive. [17]

As for the infrastructure of the city, it is predicted the articulation of the Project's developments with one programmed by the State for the **ROAD A3** or avenue de Katiola. Bypassing the city by the Abidjan-Ouagadougou highway should not further isolate the city but contribute to its attractiveness by making its city center a real center of services. [17]

The report of feasibility had proposed to retain three objectives for the Development Project of the Bouaké City Centre Commercial Zone: Modernize the city center, Upgrade the commercial functions which make Bouaké rich, Develop the Project in partnership with economic operators. [17]

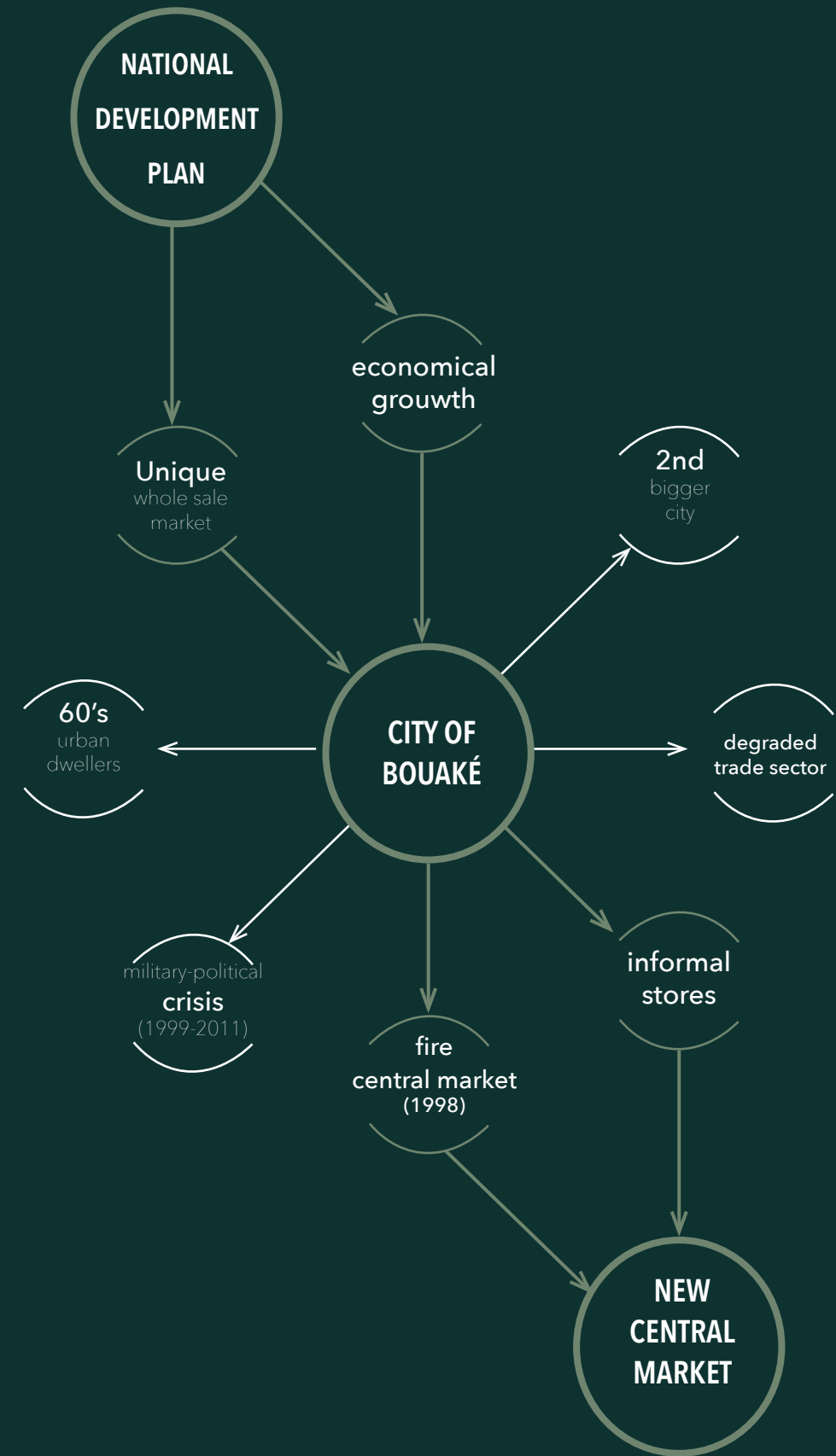


FIGURE 14: Bouake Centre

II.II PROJECT OF BOUAKE CITY CENTRE COMMERCIAL ZONE

Three complementary sub-projects compose the scope of the Project of the Bouaké City Centre Commercial zone:

PHASE 1. THE INFRASTRUCTURE (roads, drainage, parking, and head of lines) programmed in the Project are strictly linked to the facilities' service and operation.

Phase 2. The development of the central market called the **GRAND MARCHÉ OF BOUAKÉ** distributed in five plots of land.

Phase 3. Development of the **EXTENSION AREAS**

- MGB extension
- CNRA-bois at the northern exit of the city
- Transversal support on the valorization of different liberated sites.

These facilities are expected to generate positive impacts on economic and urban development.

According to the social studies, the Project is expected to provide: a **real estate valuation** of sites vacated by traders who have found a place in the central market and in the two other reception sites (MGB extension and CNRA bois).

Project goals:

- The return to the original vocation of sites in the city center
- The clearance of roads and public spaces
- The contribution to the revitalization of the MGB
- Valuation under control of the CNRA area at the northern exit of the city. [17]

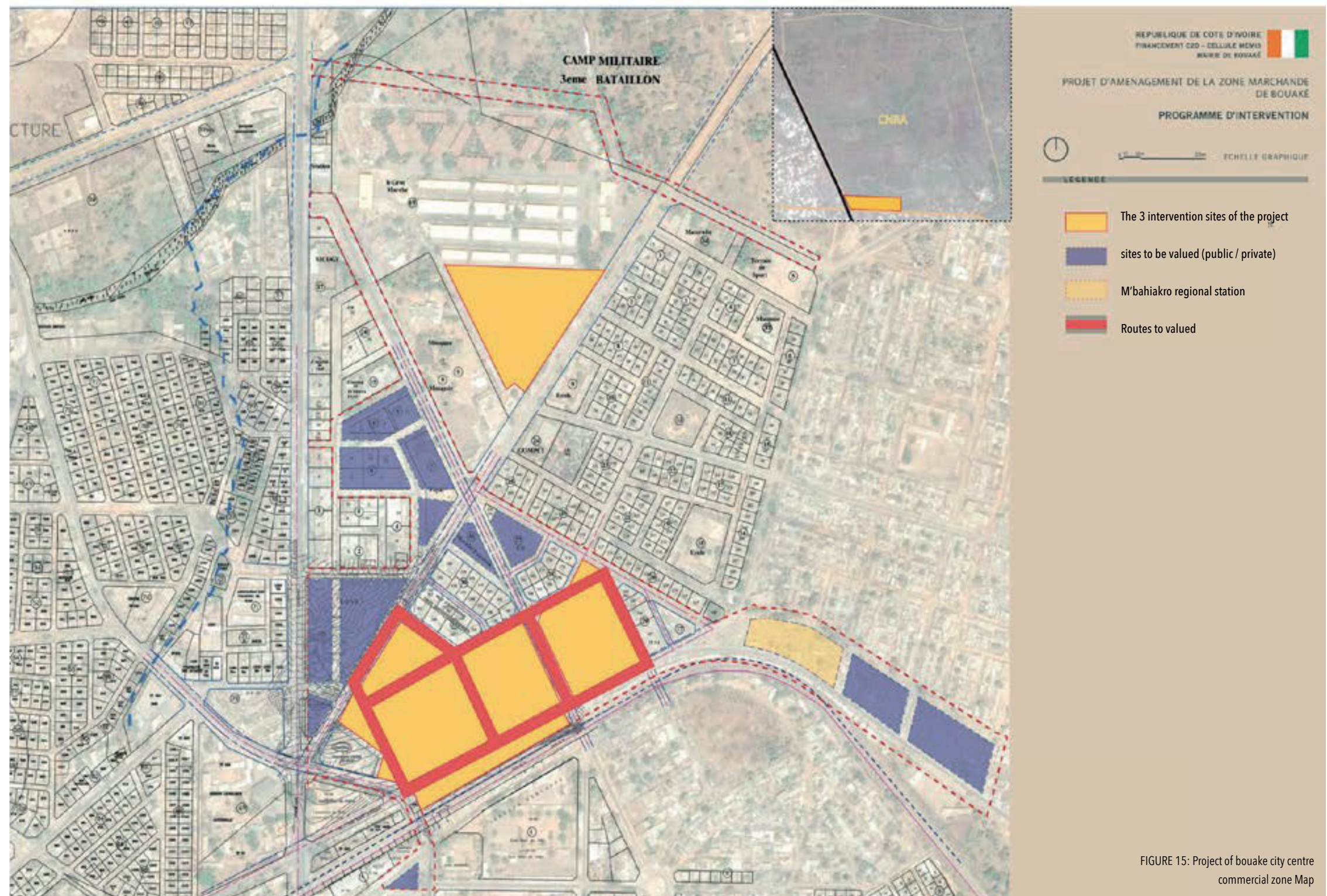


FIGURE 15: Project of bouake city centre commercial zone Map

1. INFRASTRUCTURE

The **CONNECTION** between the market and the city center will be improved and complemented by the infrastructure project.

The Project covers the drainage of the area regarding both the rainwater and the Sewage.

-> **Rainwater:** the rainwater arriving on the big market site (roofed or roadway) will be collected in a network of gutters and directed towards the Aboliba canal. Part of the rainwater will be used to fill the cisterns' fires.

-> **Sewage:** An independent sanitation network (sewer) is to be created in the periphery of each market area.

The infrastructure project also includes the **ROADS** and **URBANIZATION** area around the market. The gauge of the tracks will be different on the approaches to the market. A consequent place will be preserved for pedestrian traffic, on both sides of the roads. It is predicted:



-THE GBAKAS: 3 heads of lines will be provided for unloading the Gbakas on the market's outskirts.

- PARKING FOR CARS: Places of parking lots have therefore been provided for this purpose. Width of 2m, they also take the form of "pockets" inserted into the sidewalk.

- MIXED PARKING: Depending on the type of roadway, mixed parking spaces have been created.

- TWO WHEELS PARKING: Pitches there were dedicated to the market's edges to limit wild parking. [17]

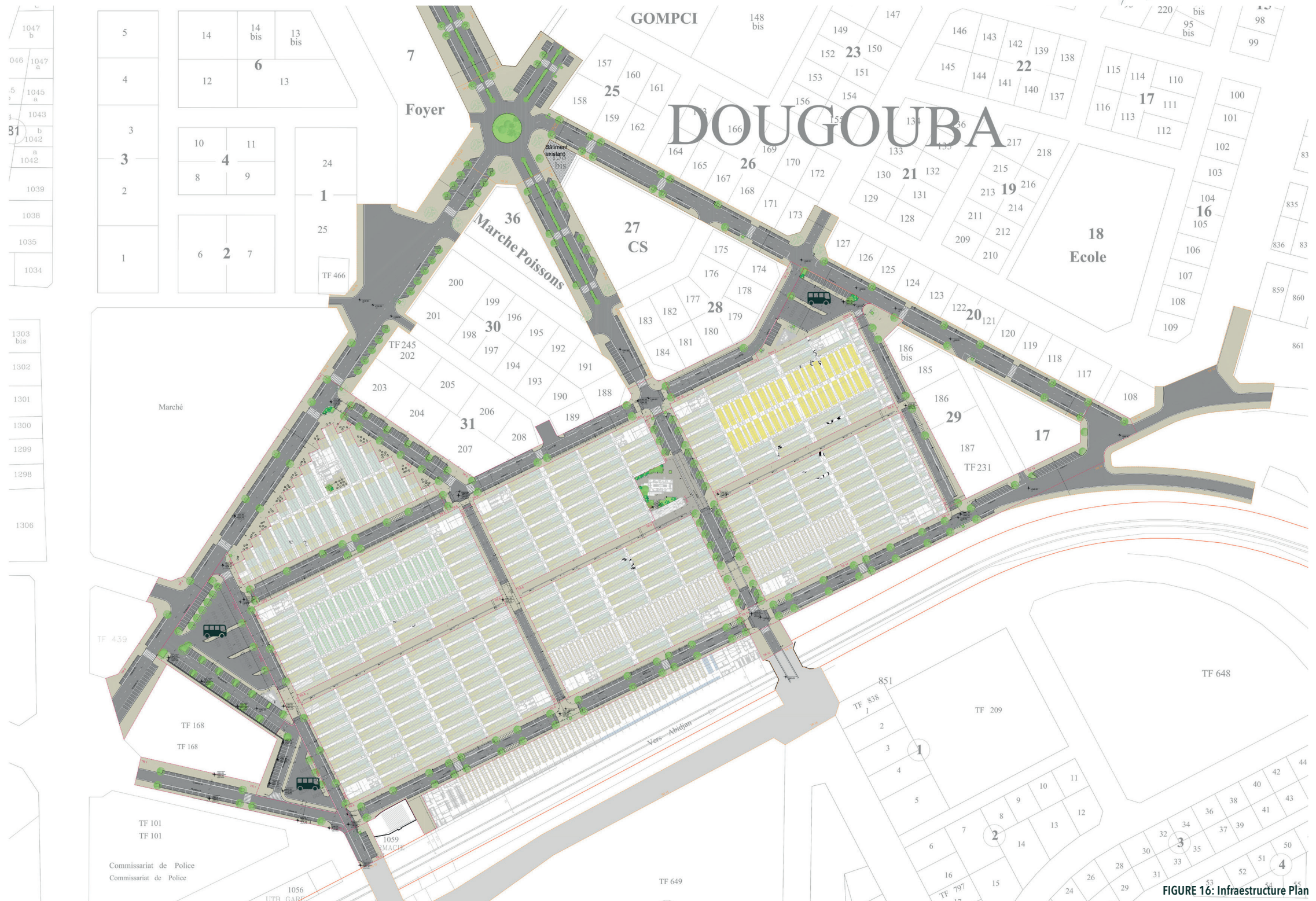
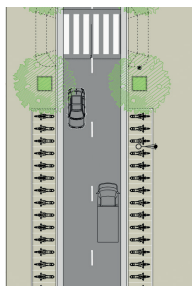
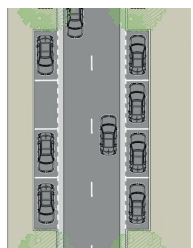


FIGURE 16: Infrastructure Plan

2. CENTRAL MARKET

According to the indications and preliminary studies of the teams AMOES-Marie de Bouaké, the Grand Marché is designed by Lots, each intended to accommodate different products.

- > Lot 1 (Fabrics and Dressmakers Market) 28.000m²
- > Lot 2 (General market and dry food crop) 24.000m²
- > Lot 3 (Tiles and Miscellaneous) 25.000m²
- > Lot 4 (Services and Restaurants) 8.000m²
- > Lot 5 (Fresh food and butchers) 6.000 m²

The 5 Lots of the Grand Marché de Bouaké operate in an independent and autonomous, and the Project's design is so that the public can freely access it from anywhere which side.

Around the lots, the suggested urban routes by the preliminary study of AMOES have been respected and constitute the site's main accesses. The typology of routes and functions is thus developed:

- > Primary circulations
- > Main circulation
- > Secondary circulation
- > Public latrines
- > Worship spaces
- > Technical rooms
- > Restaurants
- > Waste
- > Wheelbarrows rental

THE GRAND MARCHÉ IS AN INTRICATE DESIGN THAT EN-GLOBES THE SOCIAL, SUSTAINABLE, AND FUNCTIONAL FIELD.

It is integrated with the context and can be characterized as a “roof project” where the main technologies are presented by the **ROOF** design. [17]

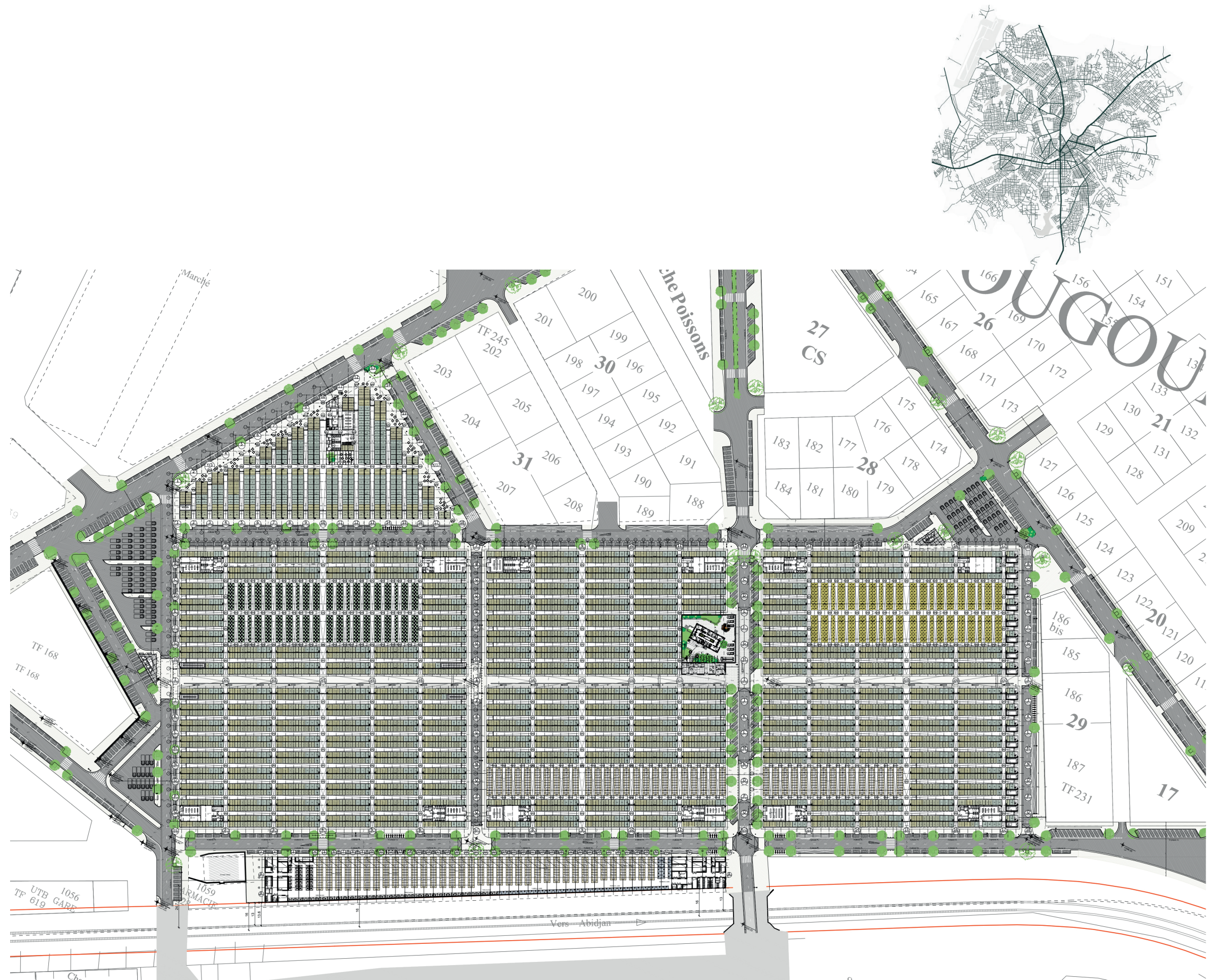


FIGURE 17: New Market's Plan



FIGURE 18: New Market's Render - Bloc 5



FIGURE 19: New Market's Render - Bloc 2



FIGURE 20: New Market's Render - outside view

3. EXTENSION AREAS

The Market Project's impact on the reorganization of the trading area predicts the requirement of establishing procedures that will allow **transparent and fair regulation** of conditions for the release of sites occupied today informally by businesses and to re-open the market under the best conditions.

With the sellers' re-location, a dozen sites in the city center will be freed from informal occupation.

The transversal support on the valorization of different liberated sites was defined as the last phase. Each intervention for use and occupation were proposed according to the **SOCIAL AND ECONOMIC NEEDS IDENTIFIED** by the studies and reports. [17]

Since there many vacant places, it was necessary to study and create a ranking to prioritize each place.

1ST. EXTENSION MGB: has emerged from the sanitary necessity to separate the fresh food market from the other market activities.

2ND. CNRA - BOIS: hat is identified as an essential and complex part of the Project since it will relocate the so-called Bulky activities outside the city center.

3RD. TRANSVERSAL SUPPORT ON THE VALORISATION OF DIFFERENT LIBERATED SITES.

It the support includes

- The Gare de Belleville that is designated for the Women's House and Associations
- The area of the Marché Bromakoté that is designated for the M'Bahiakro Station
- The area of the Poisson Marché that is designated for the Municipal Media Library
- The Marché Indigo and the Marché Boucherie that is designated for a future extension for the market. [Annex 1]

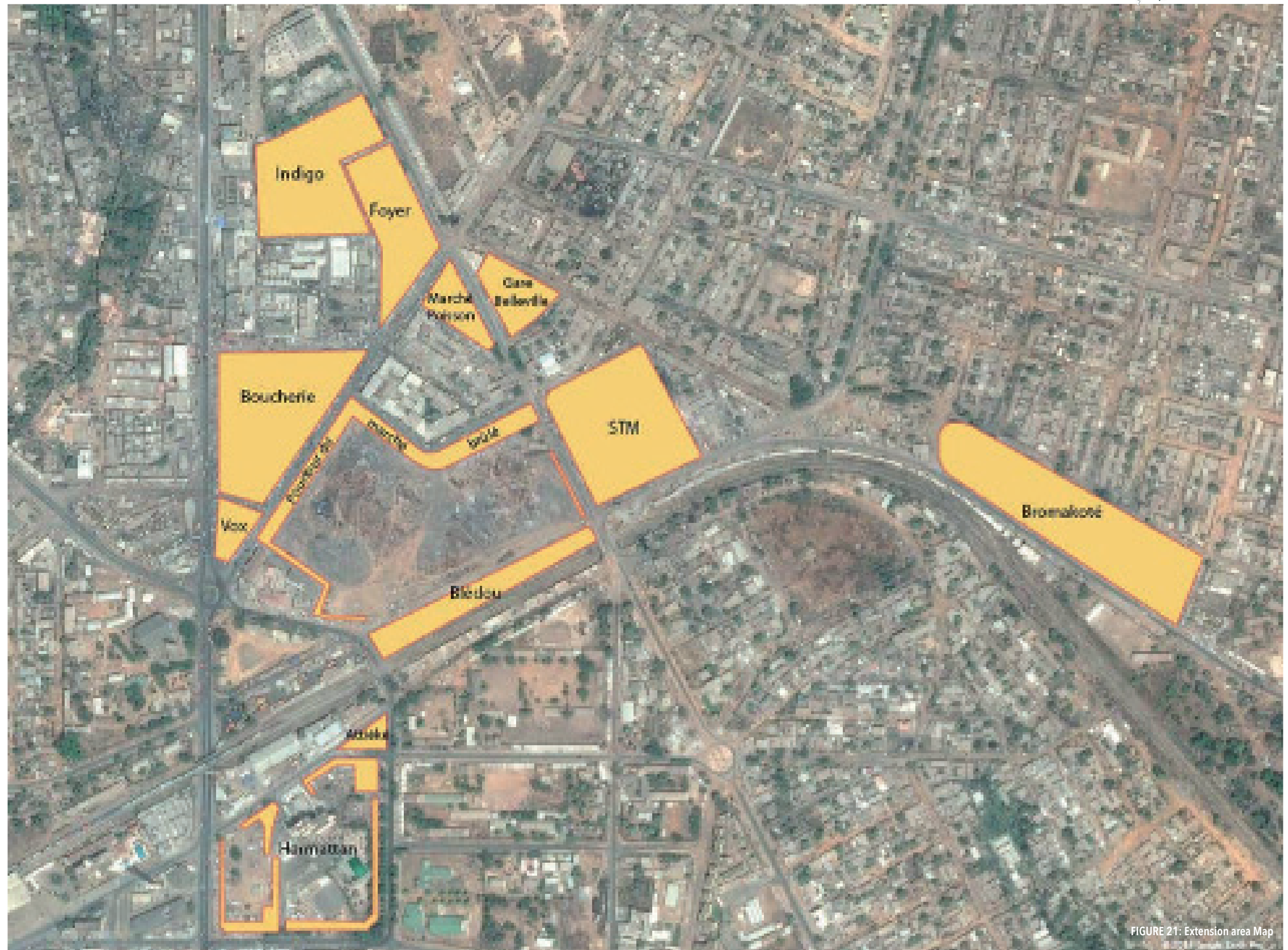


FIGURE 21: Extension area Map

The financial strategies divided the project in **3 PHASES**

The phases were defined by order of priority and level of **influence** of each intervention

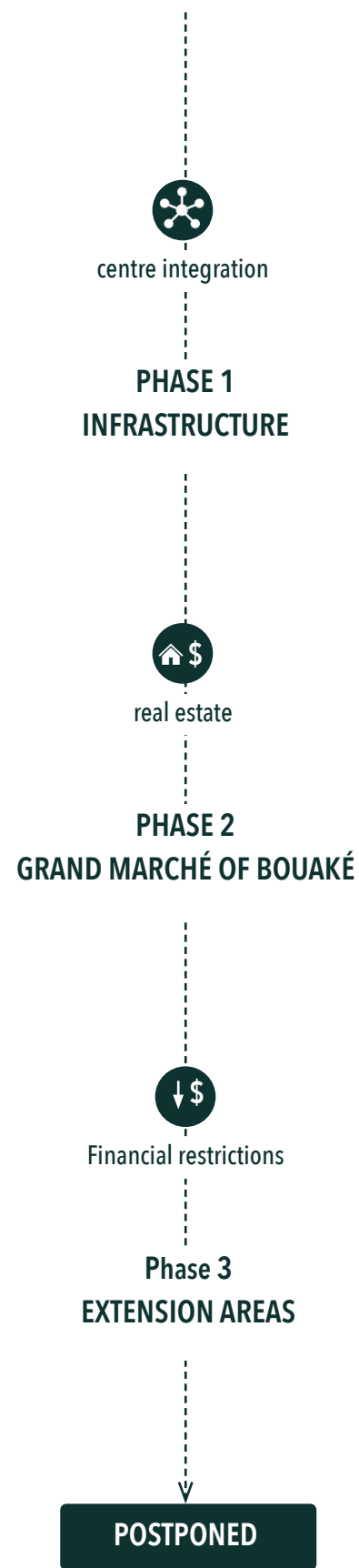


FIGURE 22: Phase 1 - Central Market project



FIGURE 23: Phase 2 - Central Market project



FIGURE 24: Phase 3 - Central Market project

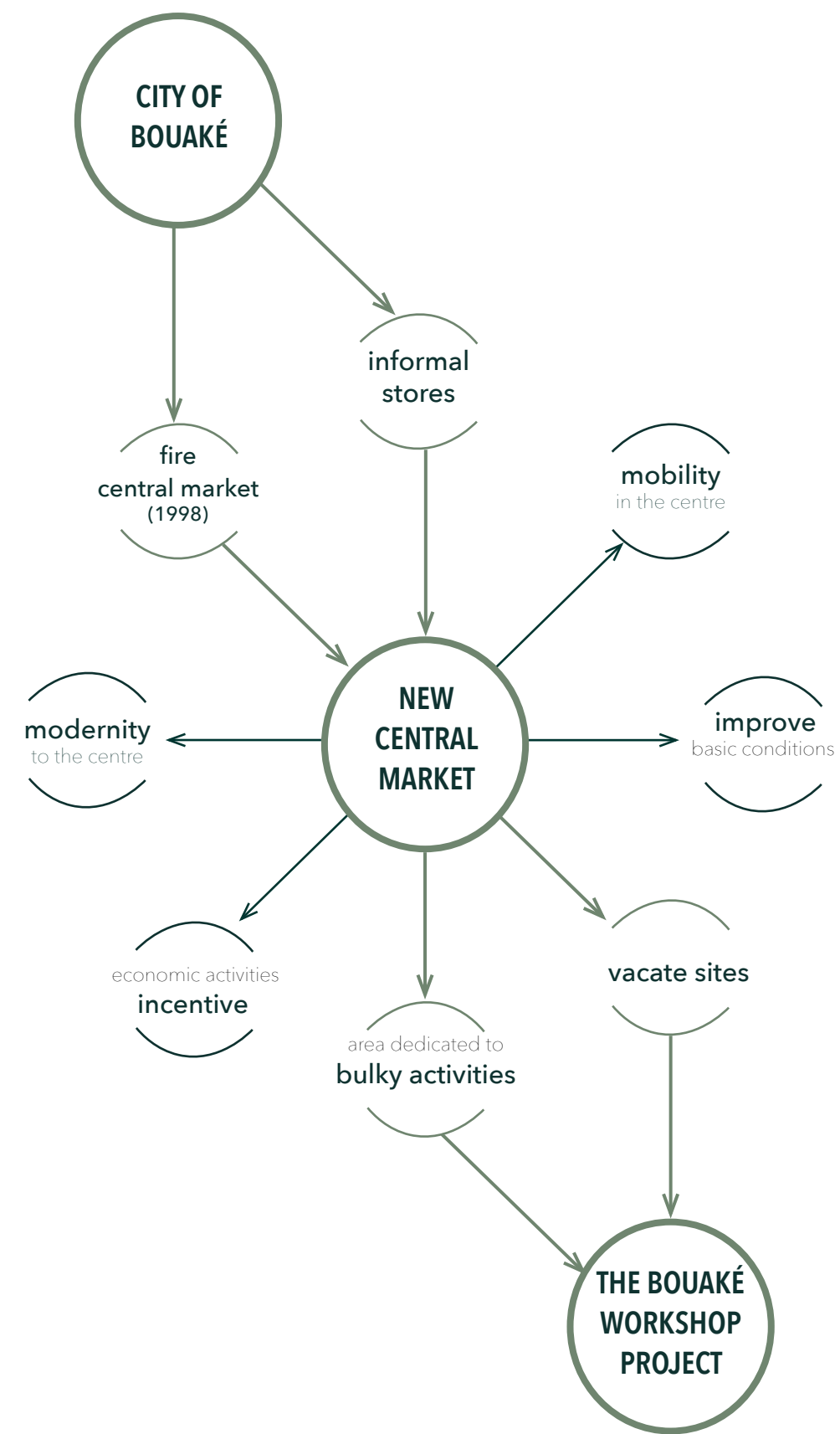


FIGURE 25: Phases Map

III. APPROACH

PROJECT



feasibility studies



divide in
2 PHASES

PHASE

1

site: CNRA - bois

funciton: Bulky activities
market

PHASE

2

site: Gare de Belleville

funciton: Women's house
and associations





The intervention was developed with the guidance of the architect Alessandro Spitilli, representing the architecture office Richez Associes. The office is responsible for the Project of the New Market of Bouaké. In the meetings with Spitilli, all the documents about the socio-economic analysis from AMO, AMOES were provided together with the Project of the market's documents and the opportunity to interview the representative of ALLNEXT, Anne Sinet. [Annex 1]

The CNRA-bois project and transversal support on different liberated sites' valorization had to be **POSTPONED** for the lack of budget. Therefore, the intervention focuses on two selected neglected areas.

The design project strategy was defined according to the most appropriate approach for the context raised issues to achieve a **SOCIAL FAIR PROJECT**. It will be done in two progressive phases according to the urgency of the area and the budget to be easily financed. [5]

1

On the first phase the project will address the **CNRA SITE**

2

On the second phase it will address the **GARE DE BELLEVILLE SITE**.

PHASE

1

The CNRA site was chosen as the first intervention because of its **PRIORITY**. The Central Market project plans and reports address the site as an indispensable solution to bulky activities in the city center.

Bulky activities include carpentry and wood marketing activities, repair and sale of motorized two-wheeler spare parts, and sale hardware materials.

The establishment of these activities within the market sector of downtown is stated as problematic. The AMOES report shows that the bulky activities **outside the city center** are the best alternative for the intervention. The social studies confirm that the bulky activities' sellers are on board with this change if it is made in the fairest and equal way possible, providing a place for each seller that will be relocated.

Due to **economic restrictions**, it is foreseen in the report that the intervention will be mainly for the **INFRASTRUCTURE OF THE AREA**.

The infrastructure includes the financing of:

- **The mobility plan:** revitalization of A3 road and the creation of a ring road in the for the access to the new market "CNRA-bois"
- **The terrain treatment** for the construction of the market
- **The construction of the toilets and activities block.**

The report already predicts the responsibility of building market itself - the roof and stores- for the sellers, in other words, it is predicted a **SELF-BUILT MARKET**.



FIGURE 27: bulky activities

PHASE

2

The following place for the intervention was chosen because it is located on one of the main to be vacated areas of the **CITY CENTER**: Gare de Belleville site

Also the function of the building is directly connected to:

- > education
- > the community

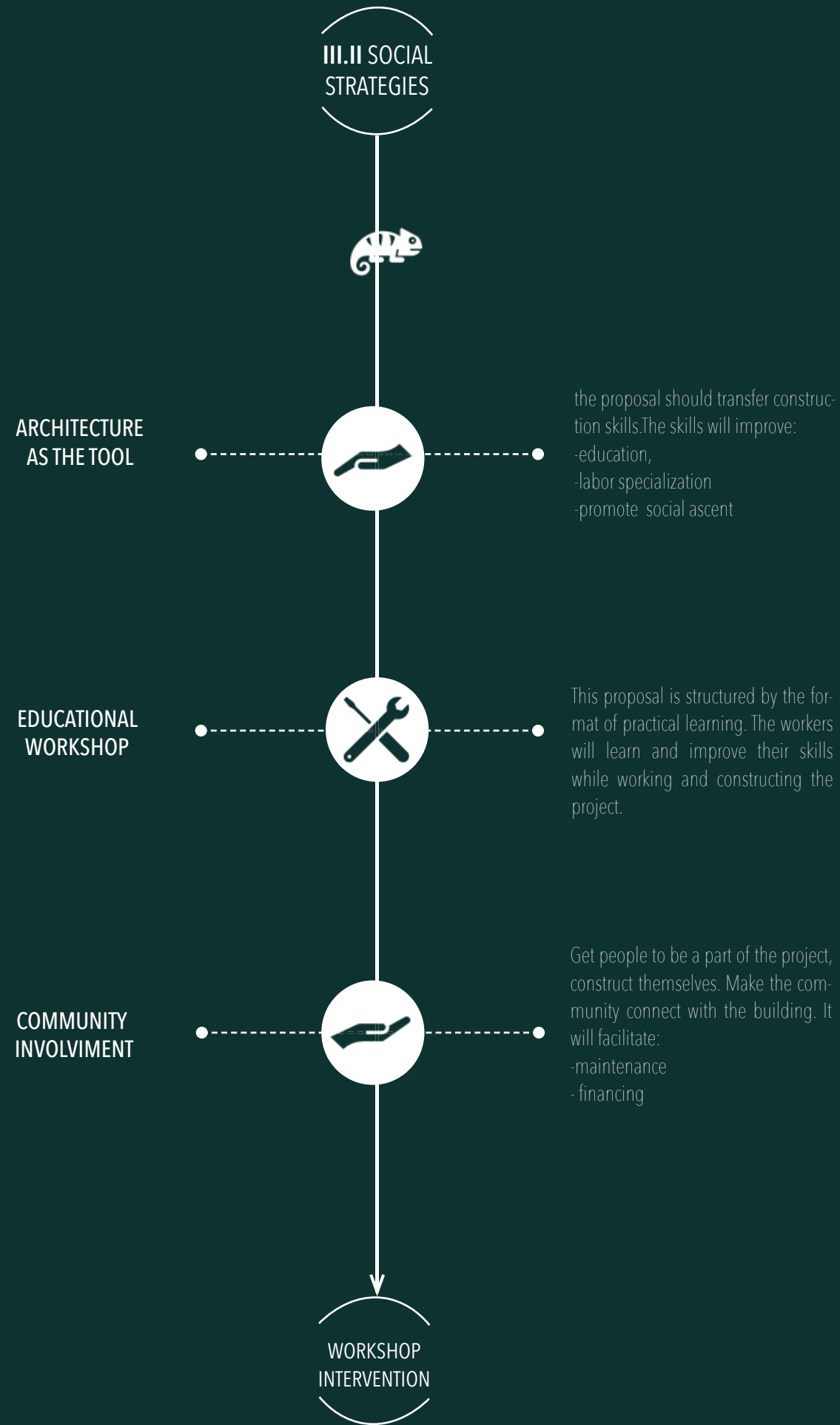
The report considers that the site should host the **Women's House and Associations** that would be composed by the Women's House, Social Centre and a Nursery and Kindergarten School. AMO predict that the place should offer **educational activities**, and other specific training, as well as **socio-sanitary missions**. [17]



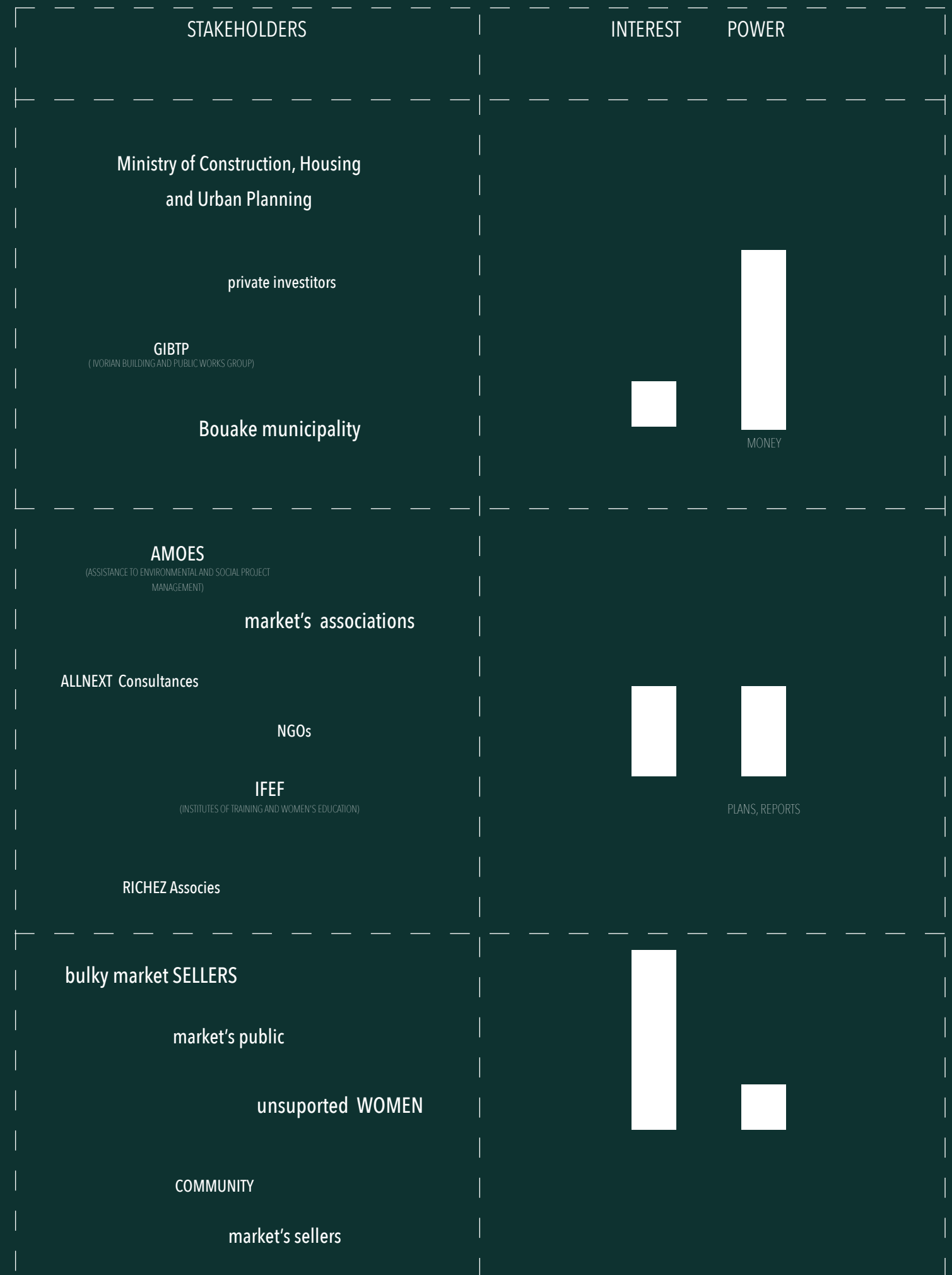
FIGURE 28: Currently market present in Gare de Belleville

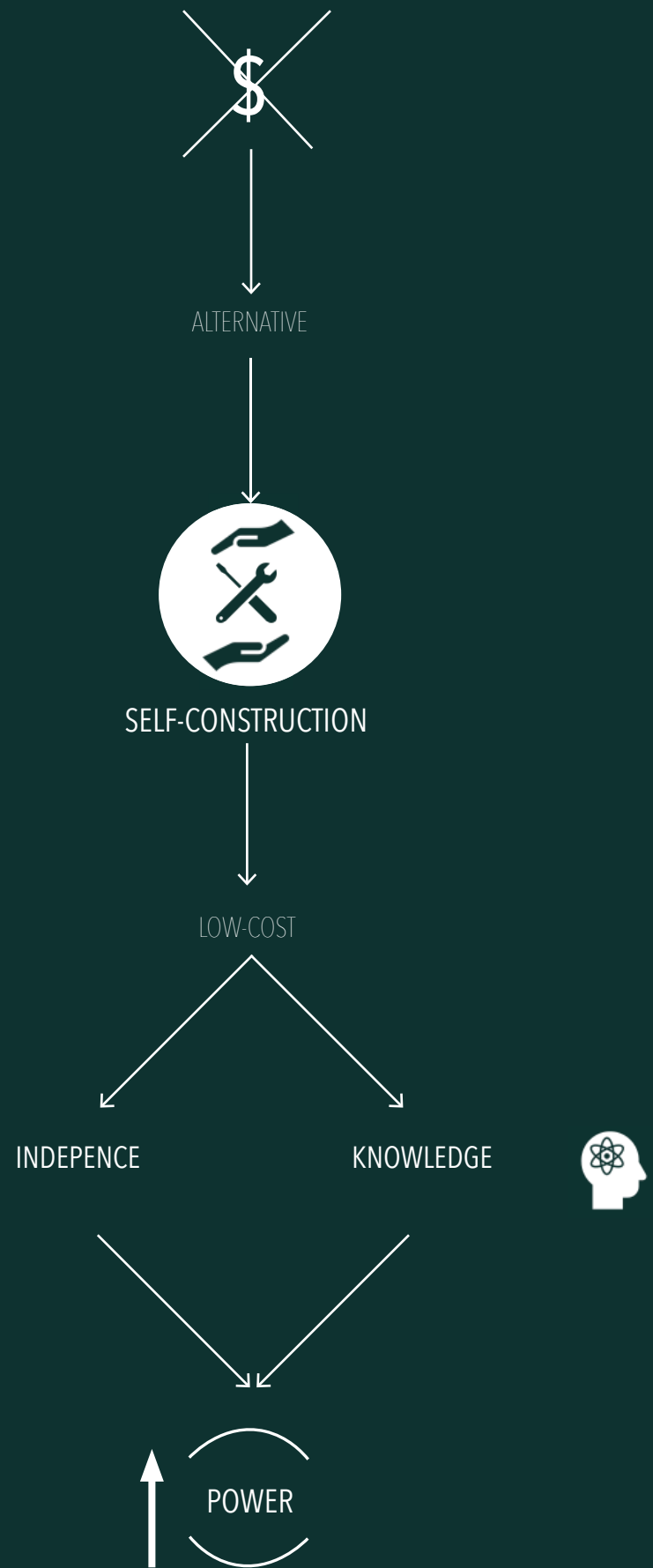


FIGURE 29: Informal Market view roof view

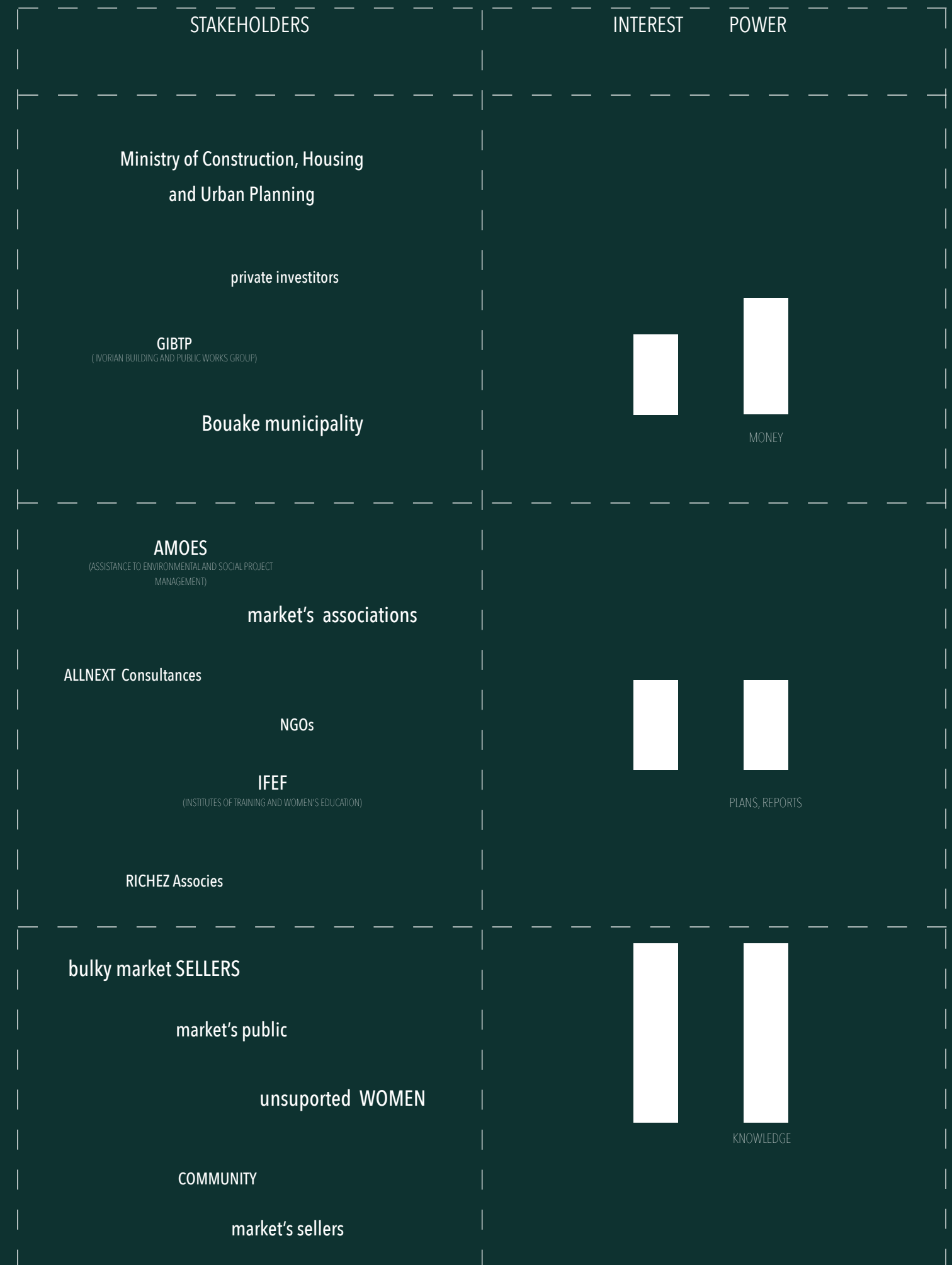


Before the intervention...





After the intervention...



From the social point of view, the design strategy applied should be a **BOTTOM-UP PROCESS** that would give flexibility in the production, assembly, and use of the building.

The idea is to develop a **WORKSHOP** for a selected group of building users to learn technical skills related to the construction field during the building development.

it is a workshop program that will be carried out together with the construction of the building. [2]

Two groups defined the users with the assumptions of the potential interest in participating in the program.

GROUP

1

VOLUNTEERS TRADERS OF THE CNRA AREA.

They were identified as a potential interest group because:

- They already work with constructions **raw materials**, such as timber
- They have access to simple **machinery required**, such as cutting machines, basic protection equipment and experience with the material.

From the studies it was possible to assume that it would be from their interest to connect the sales of timber and wood with the labour in the construction area. [19]

GROUP

2

VOLUNTEERS WOMEN GROUP HELPED FROM THE WOMEN'S CENTRE HOUSE

The women group were also identified as a potential interest group because the workshop would connect the architecture with the education activities promoted by the Institutes of Training and Women's Education (IFE) that promotes:

- **educational**
- **professionalizing activities**

To illiterate or out-of-school female population. The women of Bouaké are very active in the community world through several local associations. [17]

The market has many **women's traders' corporations**, particularly in the sewing, the sale of loincloth, and in the fresh food. So, one of the activities promoted by the Women's house will be:

THE PRODUCTION OF MASONRY

The Project can promote **EQUALITY** between men and women by also inserting women into the construction market.

The idea is to approach and maximize people's interest and the maximum sellers of CRNA-bois with the simplest techniques. **The techniques will get more complex through the construction phases, and the workshop group would get more specialized and reduced to a more selected number of people.**

FIGURE 30: Timber seller



FIGURE 31: Woman and child



III.III SUSTAINABLE STRATEGY

III.IV ECONOMIC STRATEGY

From the sustainable point of view, the main strategy applied was to consider the

LOCAL CIRCUMSTANCES.

The city of Bouaké is 365m above sea level. It has a **tropical climate**. There is much more rainfall in the summer than in the winter. The climate is classified as Aw -tropical climate with a dry season in the period when the sun is lower, winter- according to Köppen and Geiger. The average annual temperature in Bouaké is 26.2 ° C. The average annual rainfall is 1139 mm. [20]

The approach to constructing a **PASSIVE BUILDING** should consider the sun exposure, local humid and rain frequency.

Defined by Mumford, the “**biotechnics**” is the definition of an ecologically compatible civilization. The biotechnical economy would foster modes of production, transportation, and human settlement that would deliberately reduce the amount of non-organic energy required to the lowest possible level. an economy of plenitude would prudently seek only the optimum amount for daily use and store surplus power for particular uses or emergencies. [21]

The approach built by a Workshop program considers the **LOCAL SOURCES OF LABOUR.**

The intention is not to import knowledge but to **create it.**

Bocco lists the ideal characteristics that the materials in construction should present:

- renewable materials, sustainably produced
- abundant materials
- local production
- low embodied energy
- re-usable
- recycled / recyclable
- non-toxic
- avoid petrol-chemical materials
- order just what is needed [21]

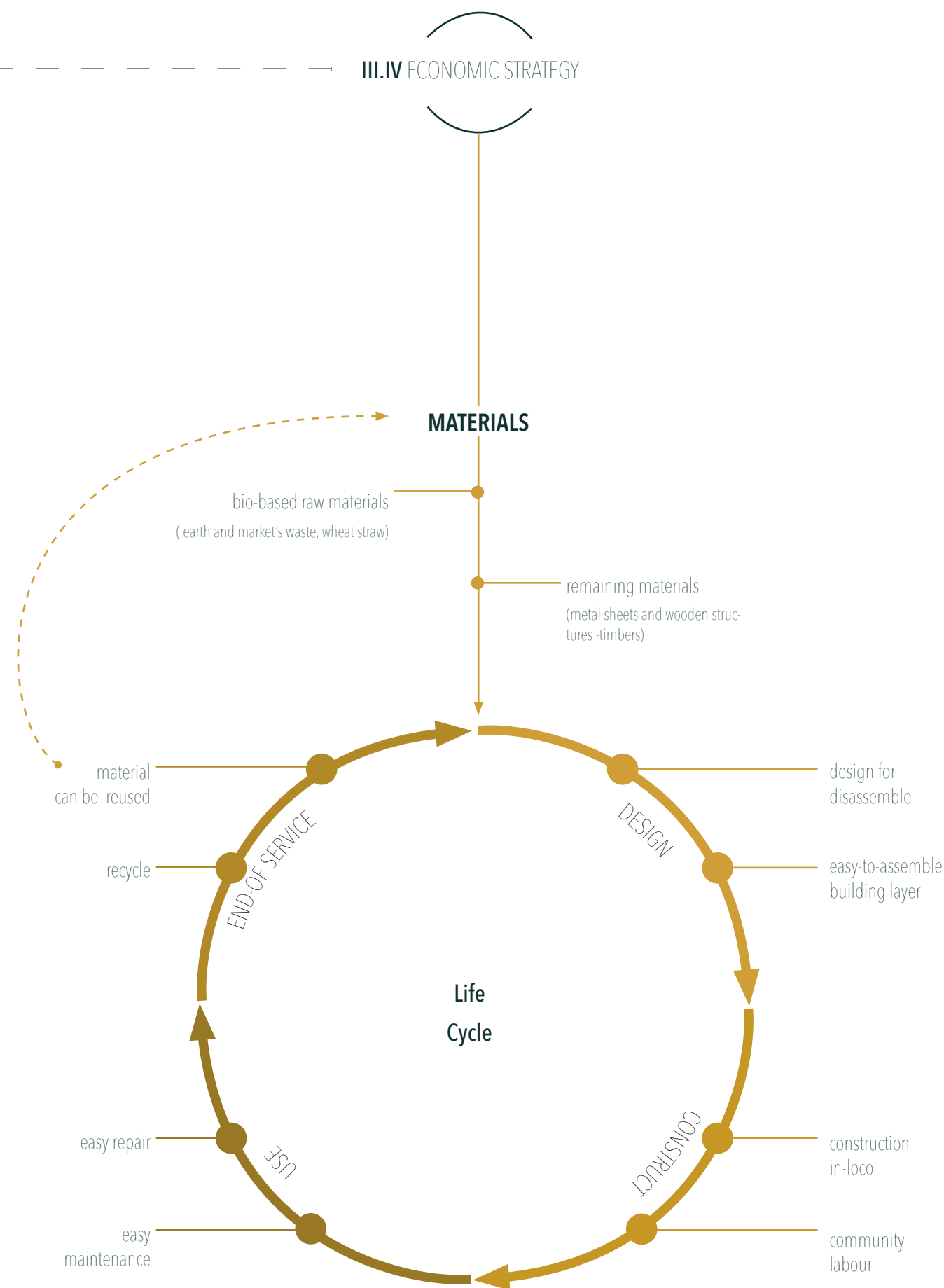
The approach is to focus on the first step of the construction chain:

MATERIALS.

The materials create a direct relationship between sustainable and economic strategies.

The economic approach consists of taking local, natural sources of raw material to study the **circular economy (CE)** application in the building. The principles of CE are many times connect to the industrialization world. Most efforts and studies are being made related to the design, assembly, and manufacture of the products. [22]

The strategy consists in to apply the circular concept in bio-based materials. Analyzing their life cycle is possible to see that, by nature, it is already circular. [23]



The Portuguese research shows that the use of earthen building elements can reduce the potential **ENVIRONMENTAL IMPACTS** by about 50% compared to conventional ones. Additionally, the advantages of using earthen materials are also discussed for the different building life-cycle stages, focusing on the possibility to recycle these materials in a closed-loop approach. [24]

The materials were selected according to the study of its **LIFE CYCLE** and the **LOCAL SOURCES**. The fact that it is abundant in the area and often neglected by the construction industry turns these materials' choices the most appropriate for the Project.

(a) WOOD

(b) EARTH



"APPROPRIATE TECHNOLOGY"

Is an ideological movement and its manifestations, originally articulated as intermediate technology by the economist Ernst Friedrich "fritz" Schumacher. Bocco (2020) defines it as: encompassing technological choice and application that is small scale, **labour intensive**, energy efficient, environmentally sound, **locally controlled**, and **people centered**. [21]



FIGURE 32: Wood texture



FIGURE 33: Earth texture

III.V CATALOG OF APPROPRIATE TECHNOLOGY



Bocco (2020) defines the 3 questions to analyze if the technology is appropriate:

1 Does the technology provide the goods and services it must at a reasonable cost, including long-term costs?

2 Does it have a desirable influence on the local culture now and will it in the future?

3 Does it promote a healthy lifestyle for the individual? [21]

Oliver described all forms of **VERNACULAR ARCHITECTURE** as built to meet specific needs, accommodating the values, economies, and ways of living of the cultures that produce them. [25]

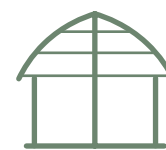
The following **catalog** represents the initial studies and evaluation about the **SELF-BUILT TECHNICAL KNOWLEDGE** of the chosen materials by exploring mostly vernacular architecture.

(a) **WOOD**



Glued laminated timber Glulam [26]

- Raw material:
 - **softwood**
(possibility to reuse the timber remains off the market)
 - adhesives of high strength
- Technique:
 - The manufacture of GLULAM brings together two old techniques: **the technique of gluing and the technique of lamination**. The blades of wood should be glued, so that its fibers are parallel to each other.
 - When it comes to glulam connections, they typically feature **steel bolts, dowels, and plates**.
 - Generally the process are made by machines that: tests the strength of wood, laminated the timber and press the laminas together to join them.
- Service life:
 - Over 60 years with proper maintenance



Yomata House Building Technique [27]

- Raw material:
 - **wooden poles**
 - **grass thatch**
 - **natural fiber**
 - **bamboo**
- Technique:
 - For the roof, a **large central pole** is placed at the centre and embedded into the ground to receive **sloping members** that act as rafters spanning to outer round perimeter walls. Then it receive horizontal smaller members that acts as purlins placed at 30 cm centres top and bottom and tied by bark strings. The pitch is generally not less than 20 degrees.
- Roofing:
 - The grass thickness varies but is in the region of 10 cm plus forming a thatch. The **grass is pressed onto the timber skeleton** by three rows of fine timber members placed at the eaves level, mid-way and top tied by bark strings.



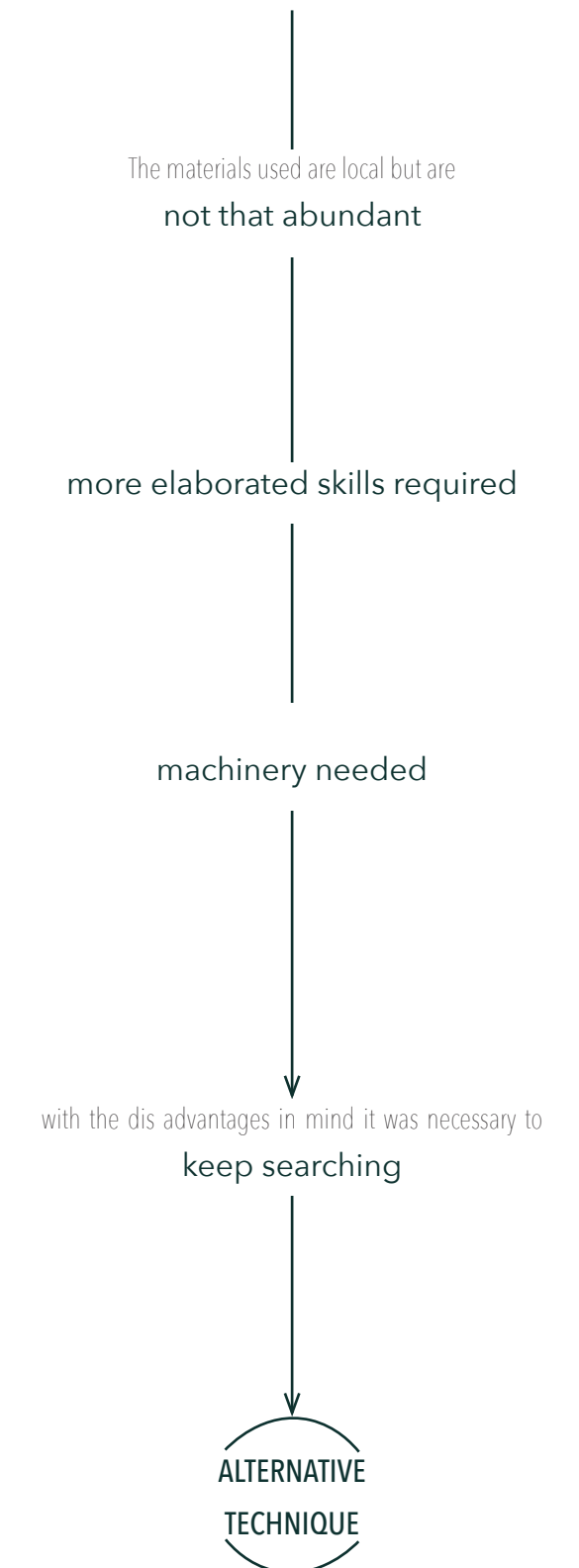
Bamboo nodes technique [28]

- Raw material:
 - **bamboo**
 - **rope**
(fabrication of the rope from the organic fibers from the market)
- Technique:
 - The bamboo structure of a roof can comprise "cut" components - **purlins, rafters and laths or battens, or triangulated (trussed) assemblies**.
- Roofing:
 - Bamboo, in a variety of forms, is also used as a roof covering and for **ceilings**. As with cut roofs, truss configurations are many and various. Janssen truss(1995) has achieved an 8m span using improved jointing.
- Service life:
 - Treated bamboo poles 50 years. assuming that they are kept from direct contact with sun, rain or soil.

EVALUATION

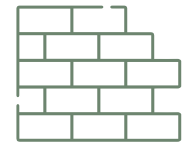
TECHNIQUES	ADVANTAGES	DIS-ADVANTAGES
 <p>Glued laminated timber Glulam</p>	<ul style="list-style-type: none"> - Reuse Timber possibility to reuse timber as a raw material - New Skills the technique can enhance the already existing timber market - Multiple function applicable in different structure elements 	<ul style="list-style-type: none"> - Manufactured process Not certain that the manufactured process would work and be trustable manually. - Tools requirement The tools and machines required for the production are specific and difficult to access
 <p>Yomata House Building</p>	<ul style="list-style-type: none"> - Combined materials uses both timber and bamboo for the structural part - Natural roof uses grass and bio raw materials for the roof - Vernacular Technique easy to build and teach 	<ul style="list-style-type: none"> - Small span It is a simple technique and does not support big spans, fits better for small constructions - Durability Because the roofing material is bio-based the maintenance required is bigger and the material life service smaller
 <p>Bamboo nodes technique</p>	<ul style="list-style-type: none"> - Tensile strength bear the load of large roof structures - Good Elasticity enable more options for design - Low weight easier to carry, good for man-force - Fire Resistance enhance the durability - Bamboo Production The country already have a bamboo production and exportation market 	<ul style="list-style-type: none"> - Require preservation For durability it needs to be kept from direct contact with sun, rain or soil. - Shrinkage Bamboo shrinks much greater than any other type of timber - Durability The treatment against insect or fungus attack is difficult and it needs to be well made. - Jointing Despite prevalence of various techniques of jointing, structural reliability of bamboo is questionable.

RESULTS





(b) EARTH

**Mud Bricks (adobe)** [29]

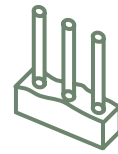
WALLS AND FLOOR

Raw material: -mud

Technique: It is produced **manually**, the earth mix is poured in open molds and are allowed to dry. Blocks are kept covered with air tight poly-thene sheets for 48hrs.

The water must be sprinkle during 28 days. Then it must be covered with leaves to avoid direct sunlights. They are **sun-dried**.

These bricks are **fixed** on the wall by utilizing the **mortar of earth** and finished walls are softened before they are dried out of it. Even the clay render is often applied as a surface coating.

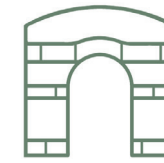
**Yomata House Building Technique** [27]

FOUNDATIONS AND WALLS

Raw material: - wooden poles
- mud

Technique: These foundation provides **continuity with the wall**. Timber poles of up to 10 cm diameter are cut to 2.5 m length; holes of 30 cm depth are dug in the ground to receive the poles;

- poles are then placed in the holes but not firmly back filled;
- horizontal members of about 2.5 cm are tied to the vertical poles at 30 cm centres to provide continuity matrix of the wall;
- and the vertical poles are firmly embedded into the ground ensuring that the poles are vertical.
- The mud is now plastered on both sides of the pole walls matrix.

**Vault-Nubian (VN) technique** [30]

FOUNDATIONS AND WALLS

Foundations: Are **filled with rocks**, bound with an ordinary earth mortar. In sites where there may be strong flows of surface water during the rainy season, the foundations may be raised 10 – 15 cm above ground level.

Walls: Gable walls are built with courses of **bricks** laid in header, and are around 40 cm thick. They are raised to lean slightly inwards (by around 1.5 cm for each metre of height).

Openings: The courses are built with an alternate bond pattern of stretcher and headers. **Recesses and openings are built into the thickness** of the walls, for doors, windows, cupboards, alcoves, and shelving. These are headed with arched lintels (built over oil drums as a temporary support). These are built before construction of the main vaults starts.

ROOF (VAULTS)

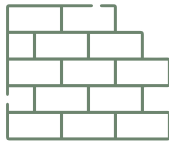
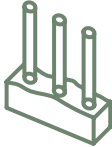

Technique: Vaults are built without any shuttering. The adobe bricks which are used to build the vault are very **flat**. The bricklayer, using a mortar made from the same earth, starts the vault by **laying the first courses against one of the gable walls**.

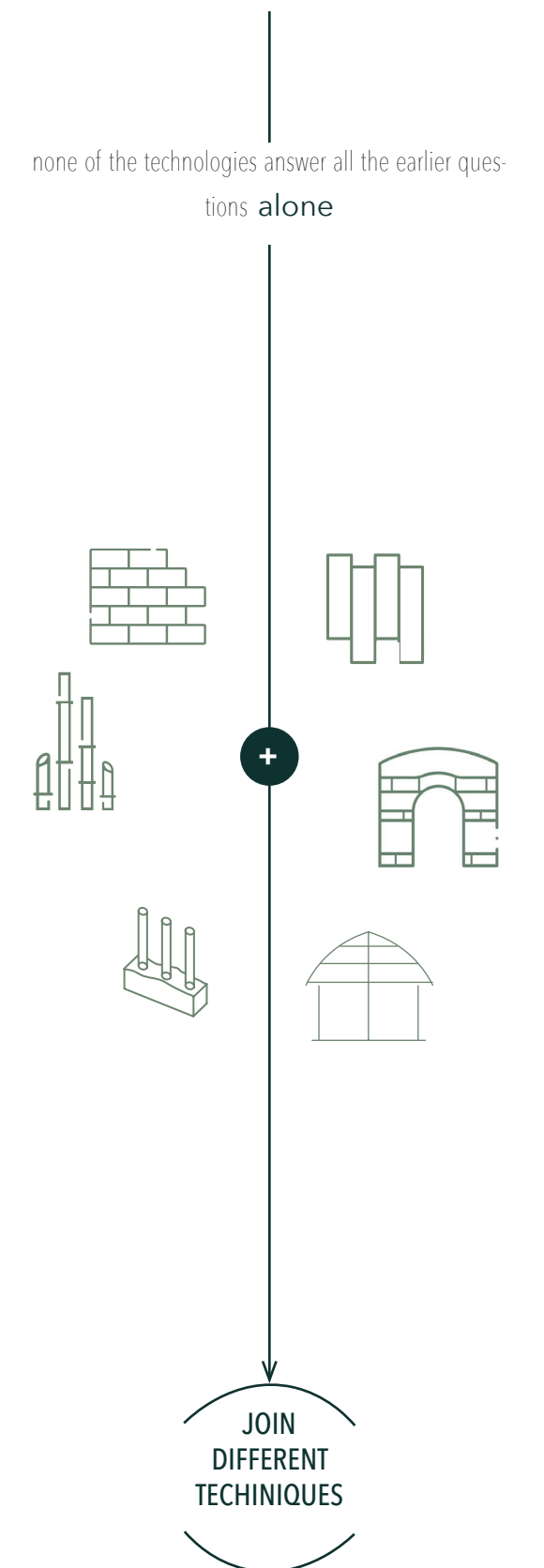
Precision: A cable made of six steel wires coiled together is stretched between the two gable walls and defines the central axis of the vault. A cord fixed to a sliding ring on the **cable acts as a guide** to ensure that the bricklayer maintains a constant radius for the vault.

Waterproof: The roof is waterproofed, using **plastic sheeting** (locally manufactured), over a smooth coat of mud mortar. The sheeting is then covered with a rendering around 5 cm deep of enriched mud mortar (using traditional additives), which both protects the plastic from damage by the sun, and provides additional protection against heavy rains.

EVALUATION

RESULTS

<p>TECHNIQUES</p>  <p>Mud Bricks (adobe)</p>	<p>ADVANTAGES</p> <ul style="list-style-type: none"> - Good Insulation earth has the properties of temperature regulation and sound barrier - Flexibility in Construction and Design The tiles can be produced with simple equipment, tools and skill. For the design the can be easily cut for fitting. 	<p>DIS-ADVANTAGES</p> <ul style="list-style-type: none"> - Durability The life service of a brick is limited - Not water resistant Mud bricks are non-resistant towards moisture and hence it could cause bacteria growth which is unhygienic. - Requires regular maintenance
 <p>Yomata House Building Technique</p>	<ul style="list-style-type: none"> - Combined materials uses both timber and mud properties for the walling part - Precision It is made with timber grid so it is easy to grant precision - Vernacular Technique easy to build and teach 	<ul style="list-style-type: none"> - Not Adherent Grip between earth and wood can be week, hence framed doors and windows are difficult to be done. - Not attractive Since it is a vernacular technique the people tend to think that it is not modern enough.
 <p>Vault-Nubian (VN) technique</p>	<ul style="list-style-type: none"> - Local abundant material The raw materials can be extracted, made, and transported locally - Teaching The NV technique is already being used as an educational tool by the program: A Roof, A Skill, A Market. - Adaptability It is possible to combine the technique with more modern materials. Also possible to reduce the maintenance load inherent to all earth-built mixing it with others elements. - Low cost 	<ul style="list-style-type: none"> - Weather restriction The constructions have the need to be suspended as it starts raining. Less time of production - Mechanical weakness It is susceptible to mechanical damages like rodents and burglars - Not fire proof - Not termite proof - Structure For the vault dimension, strutral calculations needs to be done



IV.I ARCHITECTURAL REFERENCE [31]

WOMEN'S OPPORTUNITY CENTER

Function: Community Center (educational center for women) Architects: Sharon Davis Design Site: Kayonza, Rwanda Year: 2013 Size: 20.000 m²

- Clay brick: crafted by the women of the center, made of clay from the site -Roofs are designed from the study of the most efficient shading form that could be created -Self-sustained program

LYCÉE SCHORGE SECONDARY SCHOOL

Function: School Architects: Kéré Architecture Site: Koudougou / Burkina Faso Year: 2016 Size: 1660 m²

- Walls: locally-harvested laterite stone -Furnitures are made from local hardwoods and leftover elements -Shading element in the facade is made of eucalyptus -Wind towers, overhang roofs and undulating ceiling for natural ventilation



FIGURE 34: Women's Opportunity



FIGURE 35: Lycée Schorge Secondary School Center

IV. PROPOSAL

GANDOS PRIMARY SCHOOL

Function: School
 Architects: Kéré Architecture
 Site: Gando / Burkina Faso
 Year: 2001
 Size: 520 m²

- **Traditional building** techniques modified and modernized
- Clay/cement hybrid
- **Robust** construction with bricks
- Pulled away roof with a perforated clay ceiling for ventilation
- **Community participation**

TI KAY LÁ

Function: Orphanage
 Architects: Bonaventura Visconti di Modrone
 Site: Ans-à-Pitres, Haiti
 Year: 2015
 Size: 400 m²

- **Freestanding roof** spans for natural ventilation and flexible spaces
- **Childrens participation** through workshop to strength the feeling of ownership
- Most materials and components were customized on-site by **local craftsman**

DAKAR INTERNATIONAL FAIR

Function: Pavilion
 Architects: Jean Francois Lamoureux and Jean-Louis Marin
 Site: Dakar, Senegal
 Year: 1975
 Size: 27.000m²

- Combination of partially open and fully enclosed **structures**
- Inspired by the building system of nomadic tents
- **Timber structure**
- Rough texture of the façades inspired by African traditions

POST-WAR COLLECTIVE LIBRARY

Function: Community library
 Architects: RAW (Robust Architecture Workshop's)
 Site: Ambepussa / Sri Lanka
 Year: 2014
 Size: 1.400 m²

- **Rammed-earth walls**
- Recycled materials
- Design through the landscape
- Support of the army: taught young soldiers building techniques
- **Developed techniques and skills** through its construction process.



FIGURE 36: Gandos Primary School



FIGURE 37: Ti kay lá



FIGURE 38: Dakar International Fair



FIGURE 39: Post-War Collective Library

IV.II DESIGN'S INSPIRATION

TANOH SAKASSON

is a small village located less than ten kilometers from Bouaké. Less than 600 people compose it, and it is possible to find one of the most important tradition-based pottery in the country.

A **collective of potters**, founded more than 30 years ago by the woman Chief potter Koua Aya. Each woman's, or man's, work is distinctly their own. There are traditional forms followed, but within this collective, innovation and unique designs are always found. **All the vases are hand-made and then burnt for the finishing.**

The work is developed by most **WOMEN** and is based on the **ANCESTRAL TECHNIQUES** thought from one generation to another. [32]



FIGURE 40: Pottery



FIGURE 41: Pottery production

ENTITY

KNOWLEDGE

COMMUNITY

LABOUR

ADINKRA

is a set of **SYMBOLS** that represents ideas expressed in proverbs.

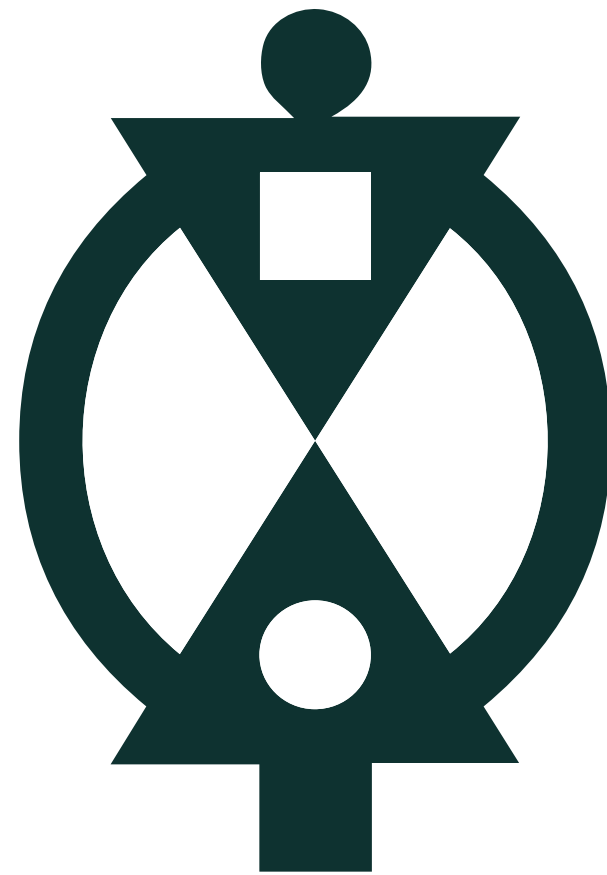
It was developed, in the early 1800s, by the Akan people that is a historically significant ethnic group of West Africa. Moreover, they are the dominant people of the Ivory Coast.

Many Adinkra symbols use radial or reflective symmetry and express messages related to life, death, wisdom, and human behavior. The Akans use the symbols as an aspect of **COMMUNICATIVE COMPETENCE**. It is used to reduce conflict between family members and even a speech community as a whole. [33]

These symbols were often painted or stamped as patterns onto fabrics (Adinkra cloth), pottery, and more. The philosophical and moral lessons inherent in the adinkra symbols are the incentive for its **APPROPRIATION** among contemporary artists, designers, craftsmen. [34]



FIGURE 42: Adinkra cloth



“BOA ME NA ME MMOA WO”,

is the symbol of **COOPERATION** and interdependence. Its literal translation is:

“help me and let me help you.” [35]

Hazeltine once said that “**appropriate technology**” benefits a society more than high technology because it fosters self-reliance and responsibility, as well as **COOPERATION** and frugality. [21]

The symbol was chosen as the **GENERATING GEOMETRY** for the project.



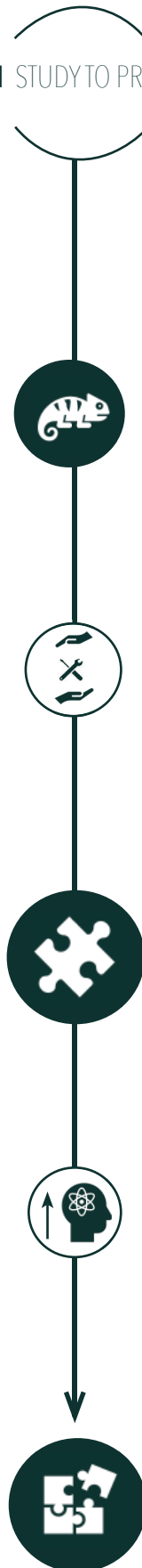
By the studies of **appropriate technologies** an extensive research was made for the **DECISION MAKING** of which technology should be introduced.

I was created then then, he **CATALOG OF TECHNOLOGIES TO BE INTRODUCED** [annex 2] describes the most basic existing technologies applied in project. It emphasizes the **feasibility** of the Workshop.

To the workshop itself is predicted some tools in order to guarantee the **safety** of all the workers as helmets, protective goggles, appropriate protective gloves, security shoes and reusable dust masks.

The technological choices and mainly the design choices will **INCREASE THE COMPLEXITY** as the phases go on, according to the construction steps of the building.

IV.III STUDY TO PRACTICE



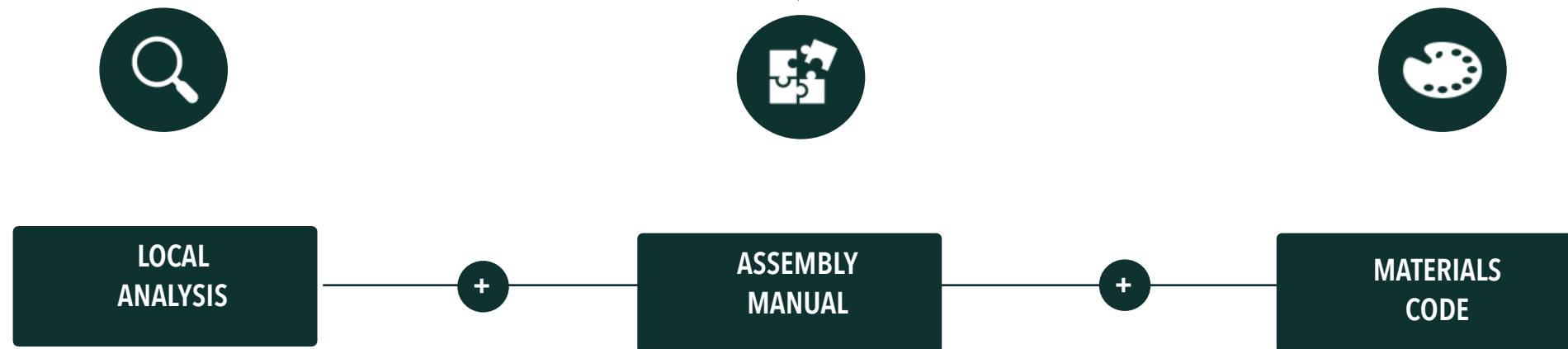
- By analysing :
- **bocco's list of ideal characteristics**
 - **techniques catalogues**
 - **local availability**

The specific choices of the materials were made based on that analysis. The project presents mostly **BIO-BASED MATERIAL**, with the exception of Metal tiles following the principal of **- ordering only what is needed**

WORKSHOP INSTRUCTIONS

The objective of the project's representation is to be **didactic**. For that reason, the technologies to be applied where **numbered** according to its appearance in the project. I is also expected to achieve a clear guidance through the project by combining the three codes below:

EARTH FLOOR
EARTH STRUCTURAL BRICK
EARTH BRICK
WICKER
CHIPBOARD
BURNED WOOD
METAL TILES



V. PROJECT

BRIEFING

SPECIFICATION

1.
ACTIVITES AREA
(20.000m²)

Activities	Amount	Area
-Vente (sale)	260	52m ²
-Meusiers (carpentry) with machines	45	60m ²
with out machines	75	25m ²
- Découpe (cutting)	20	52m ²

Site:
CNRA,
outside city center

Size:
100.000m² (total)

Initial budget:
1 milion euros
for infrastructure and
local services

Function:
Bulky activities market

Users:
craftsmen / sellers
(approximately 400)
Manager of the market
employees

Products of the market:
- Timber (Most of part)
- Motos
-Tyre

2.
SANITARY +
WORSHIP PLACES
(min: 150m²)

Sanitary
- 4 sanitary blocks
- two of which will have shower blocks

Worship place
- Latrine blocks
-Distributed on the site

3.
SERVICE BLOCK
(200m²)

Located closest to the entrance to the site
-1 Site manager's room (with M / F latrines)
-1 Meeting room for artisans / sellers
-1 Room for first aid (private nurse)

DISHES SPACES
(50m²)

- Spaces for the sale of dishes cooked by
restaurats



ANALYSIS MAP

- STUDIED AREA
- POSSIBILITY OF EXTENTION

LAND USE

- institutional
- residential / commerce
- agriculture
- funtions defined by author analysis
- EXISTING BIUILDINGS
- ROADS
- MAIN ROAD A3

↓  NEAREST BUS STATIONS (1,4km)



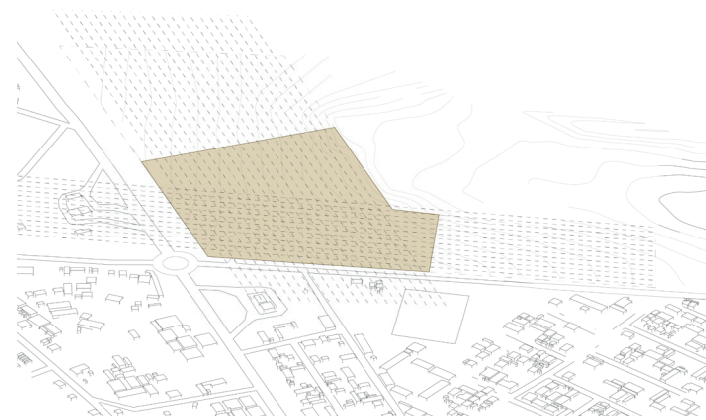
PROJECT CONCEPTION



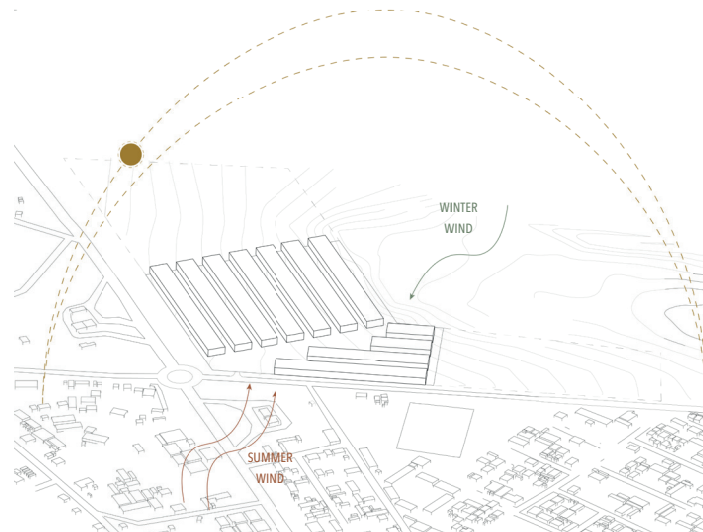
REMOVAL EXISTING INFORMAL BIULDINGS [17]



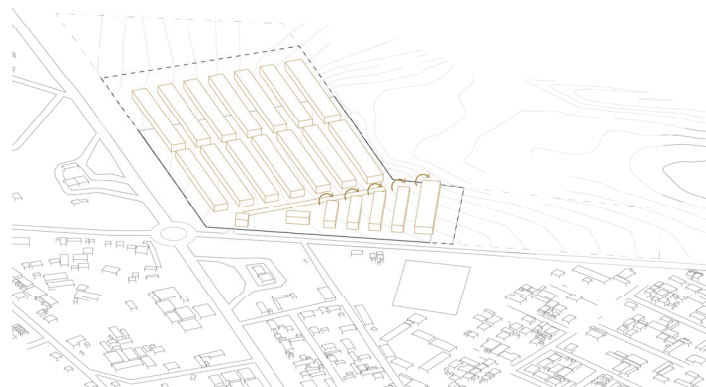
ROUTE A3 REGENERATE AND INSERTION OF A RING ROAD



SITE GRID



CLIMATE ANALYSIS [20]



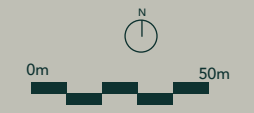
ROTATE FOR LESS SUN EXPOSURE



ACTIVITIES DISTRIBUTION

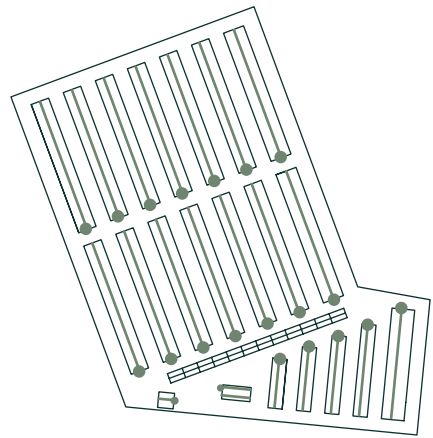


CNRA -BOIS MARKET

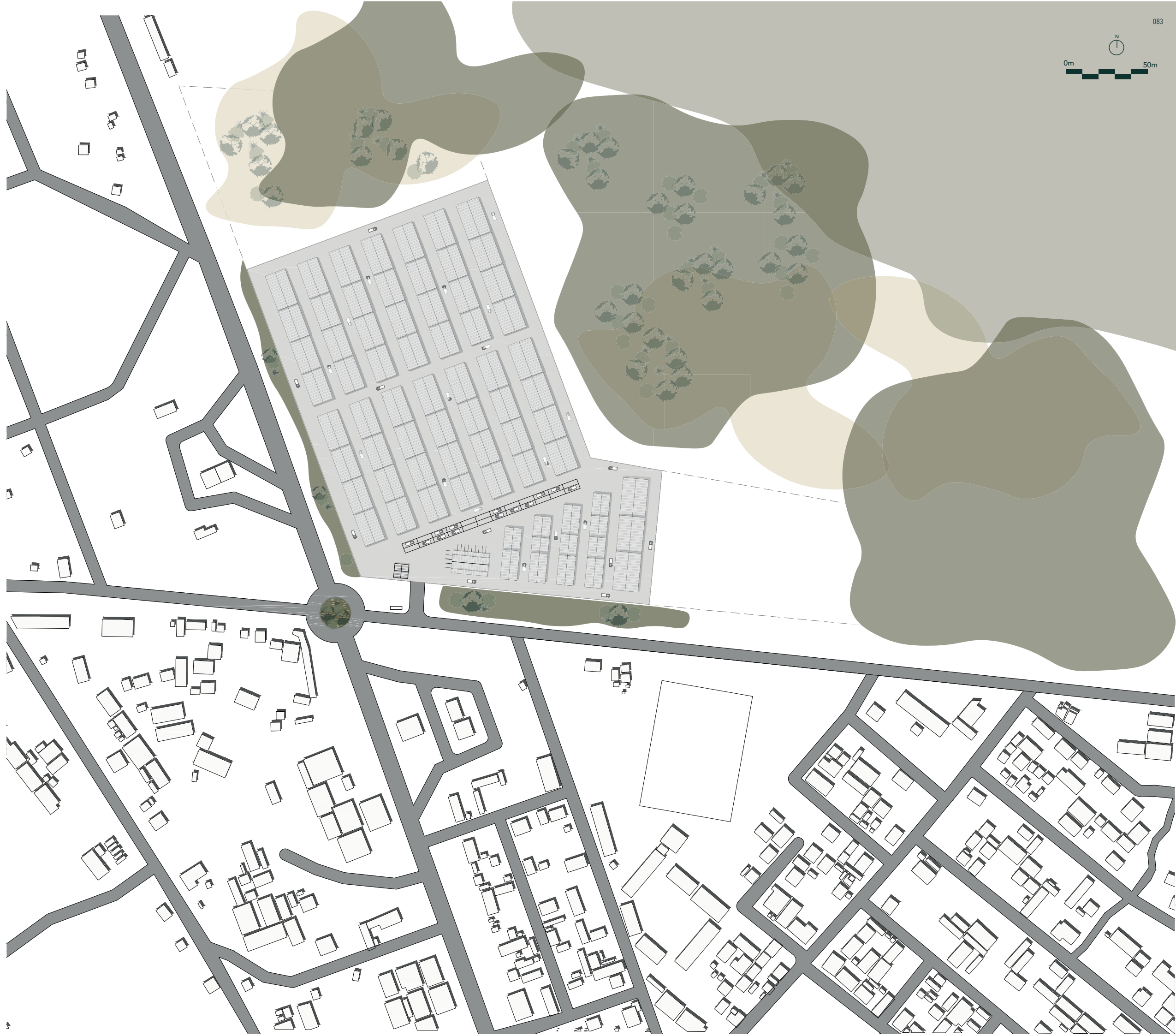


MASTERPLAN

Rain water harvesting system






— WATER PATH
● DOWN/STOCKAGE POINT

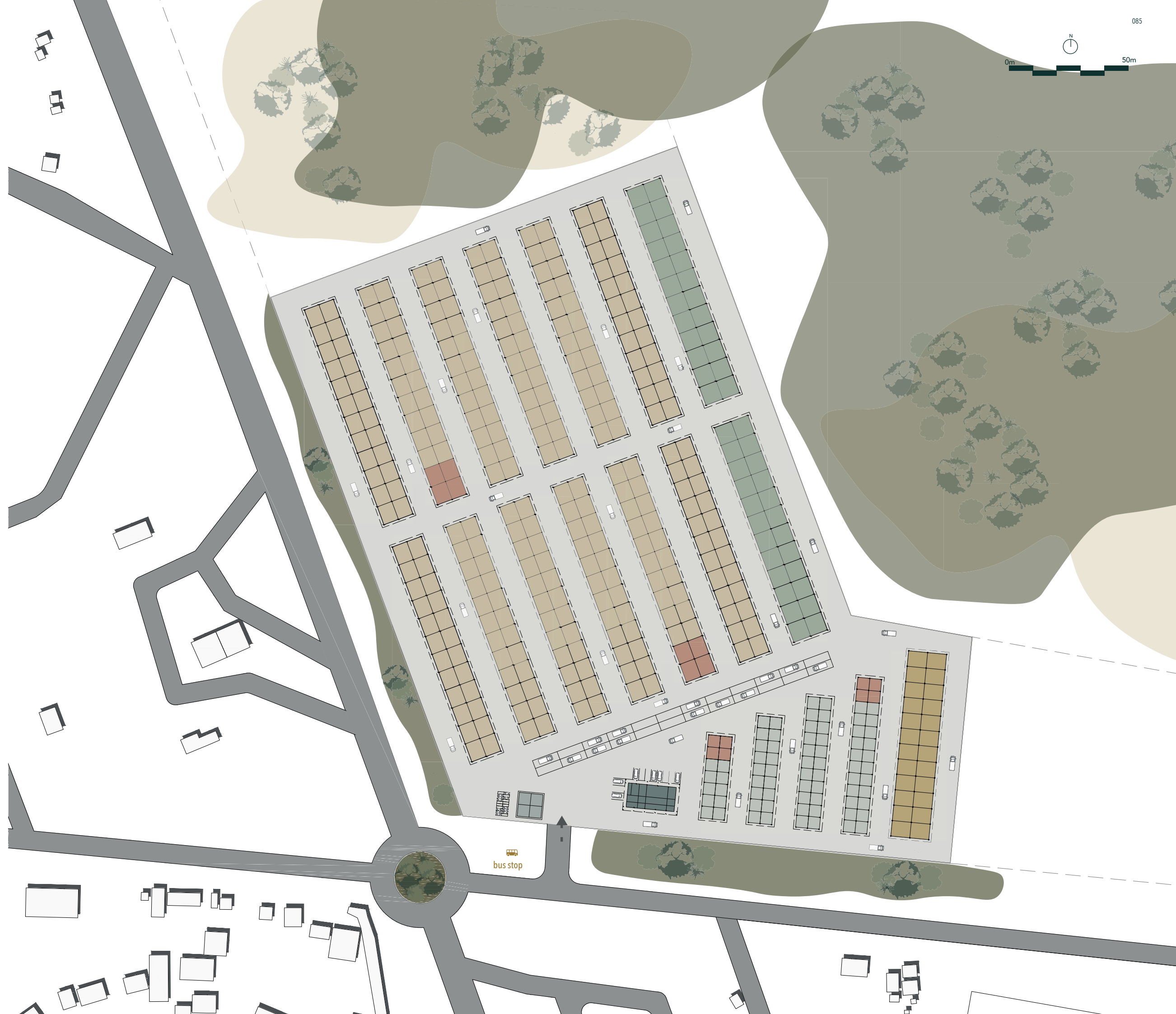




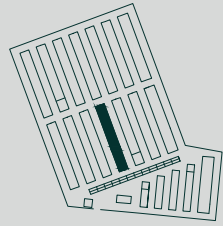
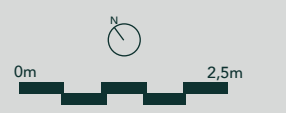
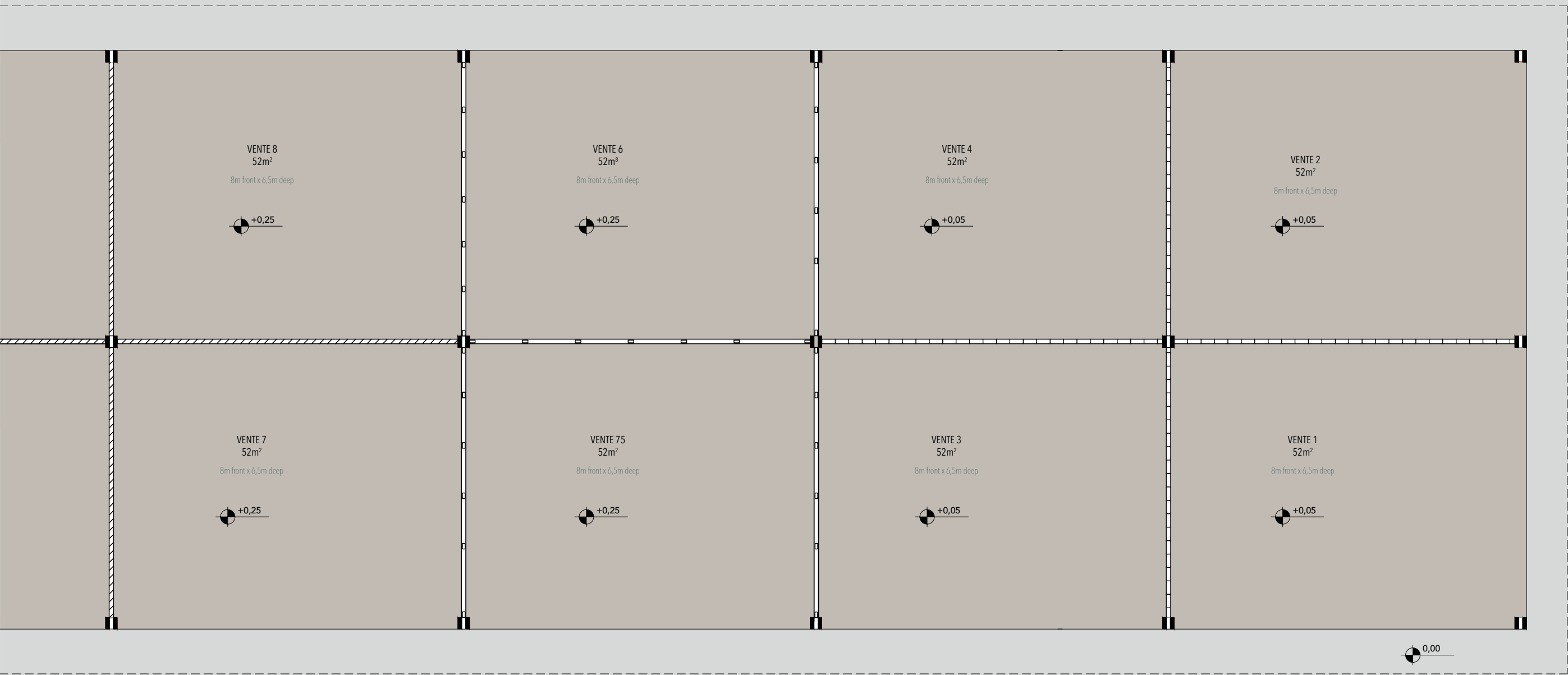
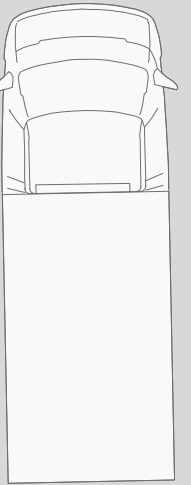
DISTRIBUTION PLAN



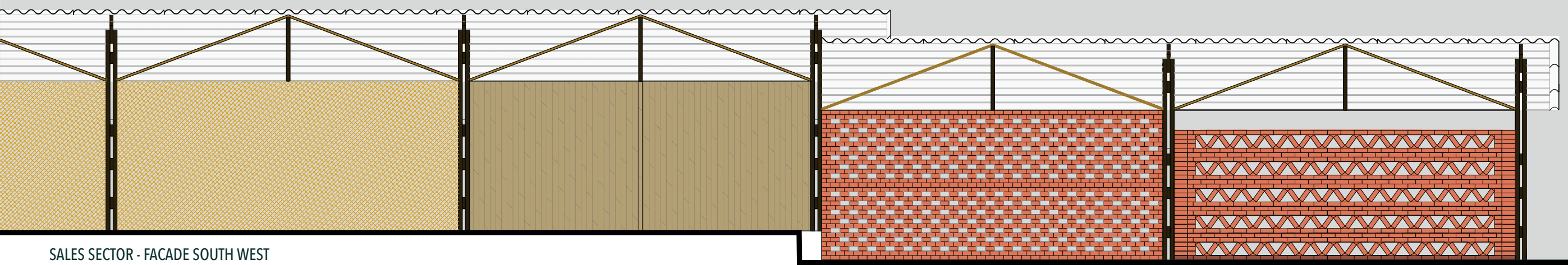
- 260 Vente (sales sector)
(8m front x 6,5m deep each)
- 45 Meuisiers with machines
(8m front x 7,5m deep each)
- 75 Meuisiers with out machines
(5m front x 5m deep each)
- 20 Découpe (cutting)
(6,5m front x 8m deep each)
- 1 Service block
(20m front x 10m deep)
- 4 Sanitary and Worship block
- 1 Dishes space
(10m front x 5m deep)
1 Entry control cabinet
(10m front x 5m deep)
- ➔ vehicles access
-  parking 24 trucks
-  parking 13 cars
-  parking 10 two wheels vehicles



1
ACTIVITIES AREA

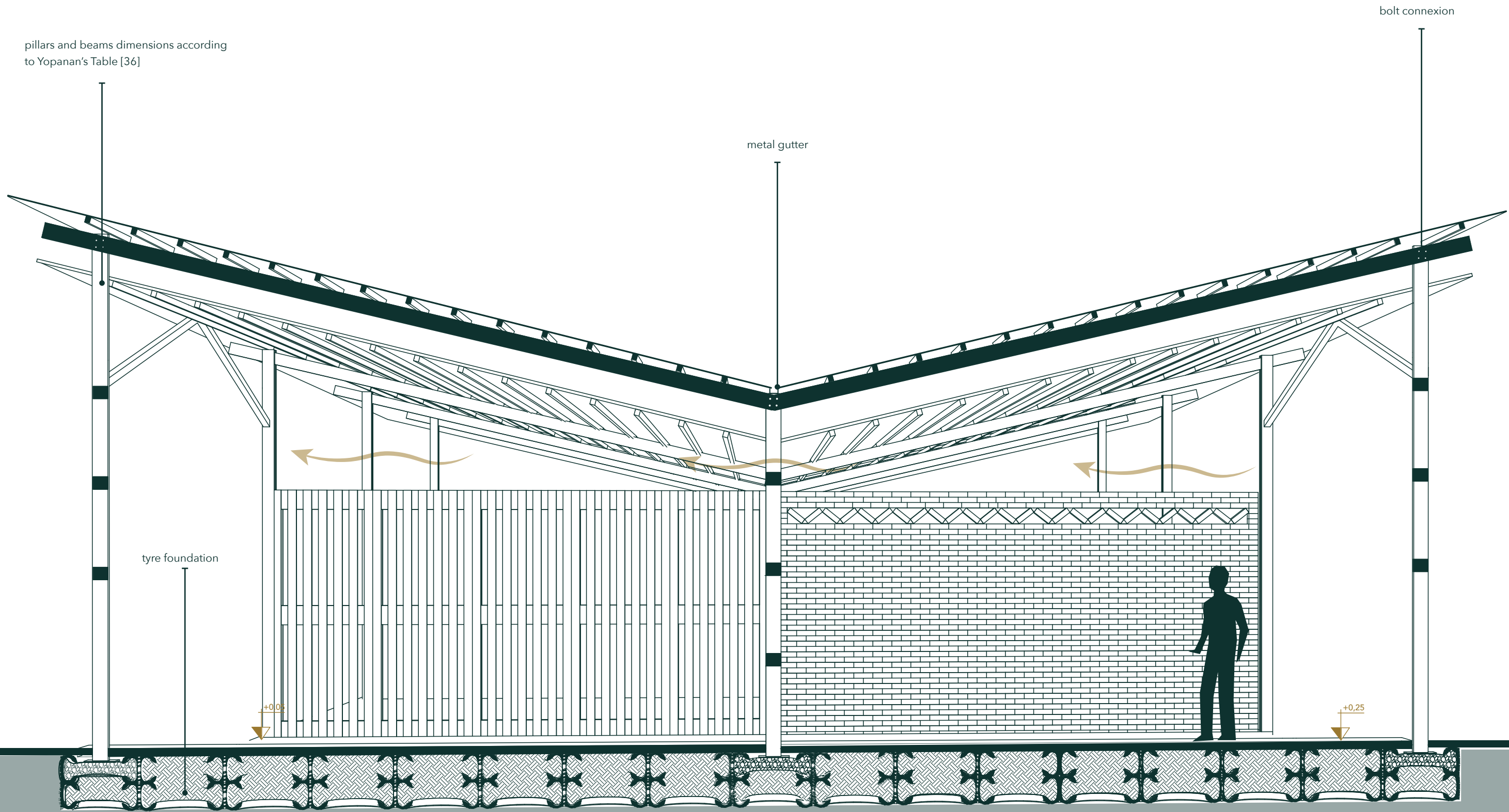


SALES SECTOR - GROUND FLOOR



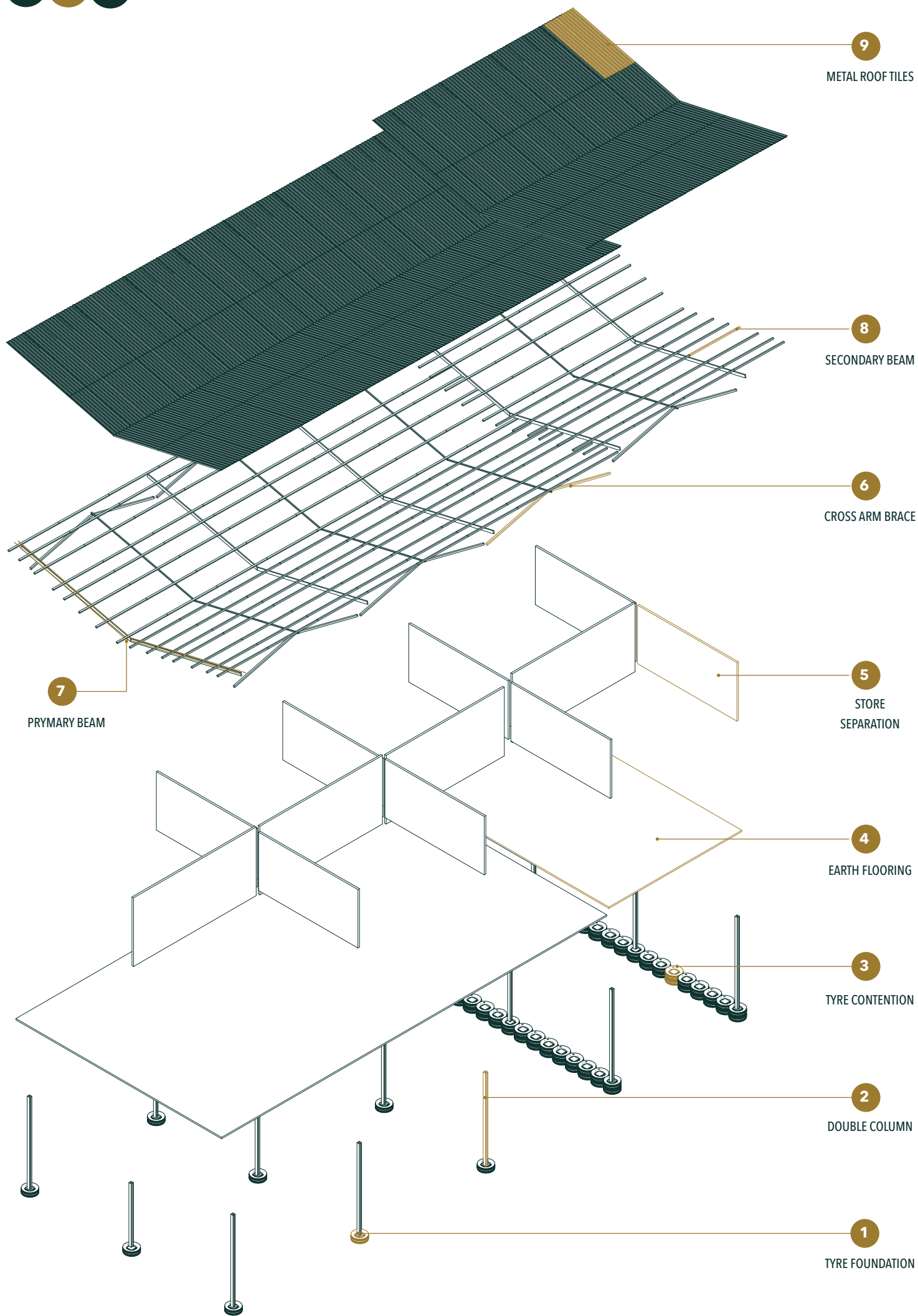
SALES SECTOR - FACADE SOUTH WEST

pillars and beams dimensions according to Yopanan's Table [36]

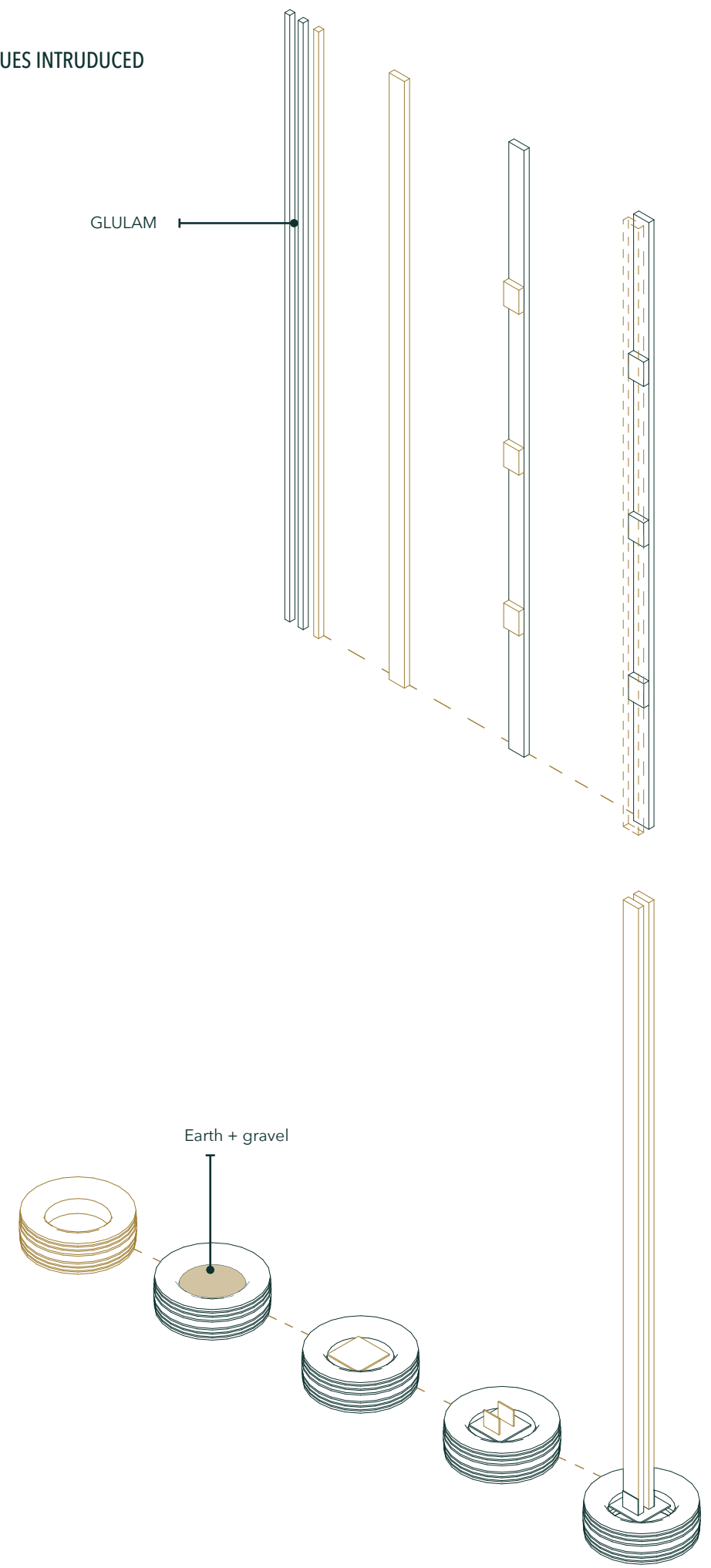


SALES SECTOR - SECTION AA

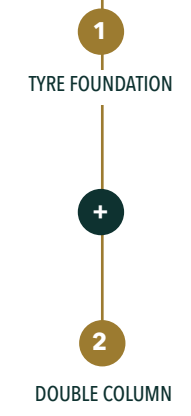




TECHINQUES INTRUDUCED

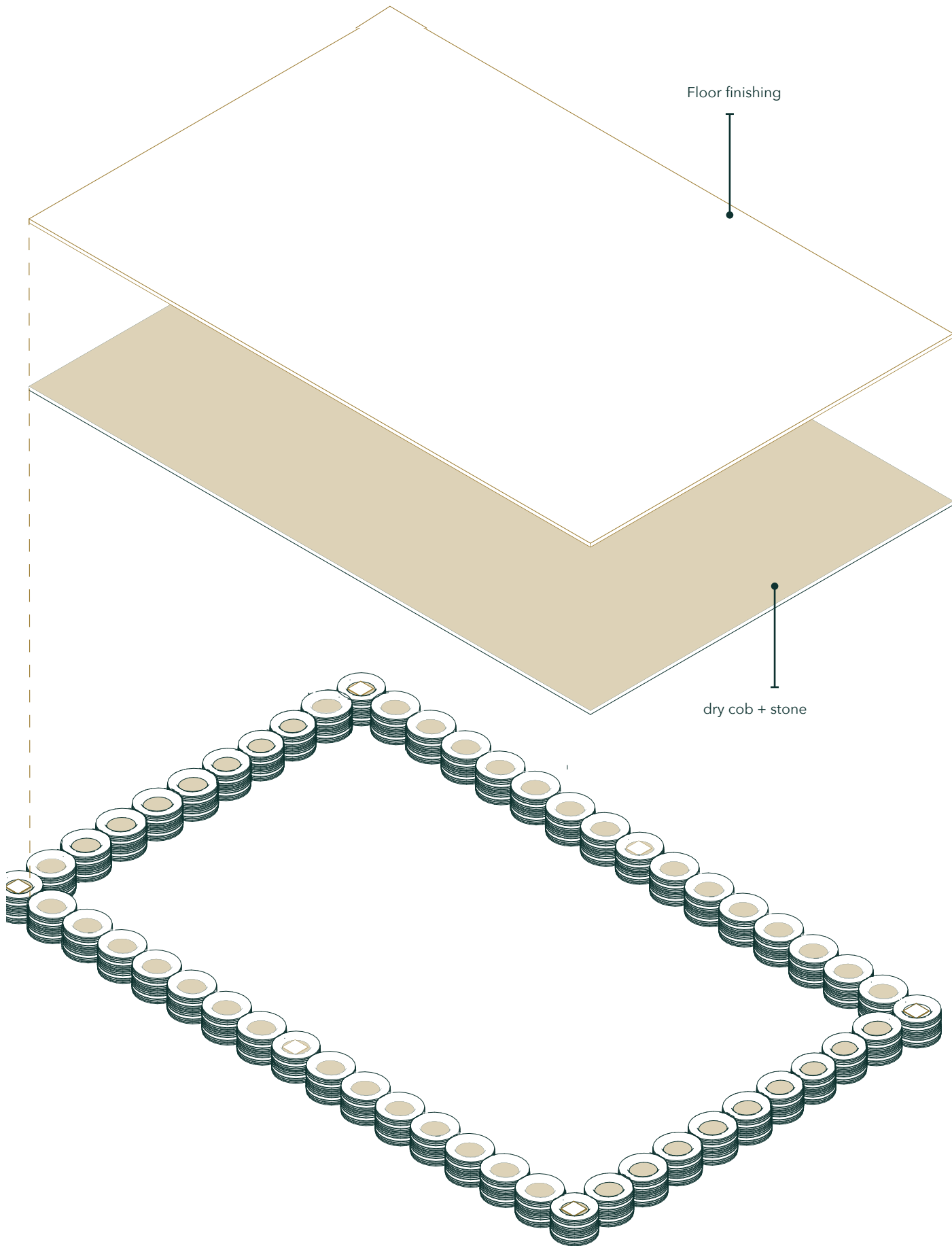


ASSEMBLY





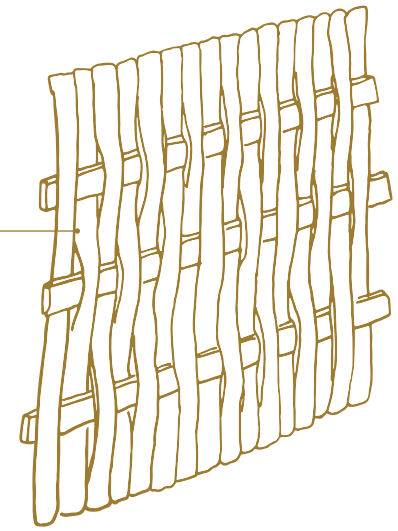
ASSEMBLY



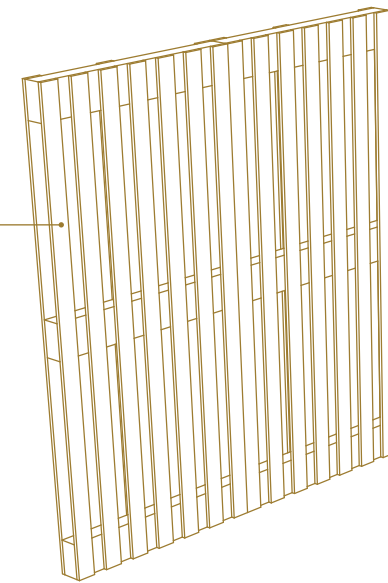
SUGGESTION



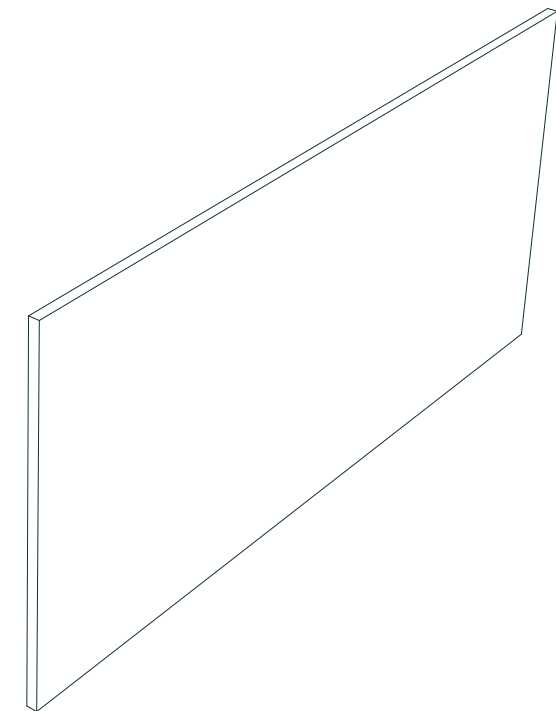
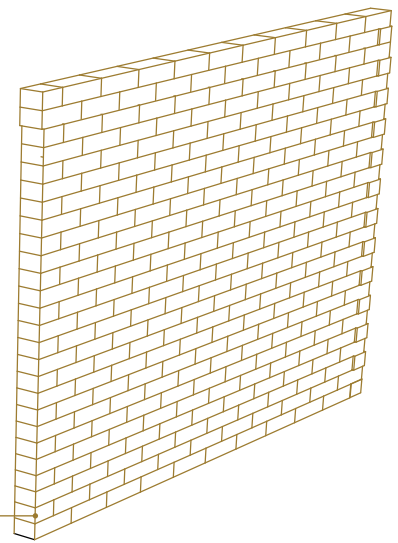
wicker type 1
(created by local artisans)

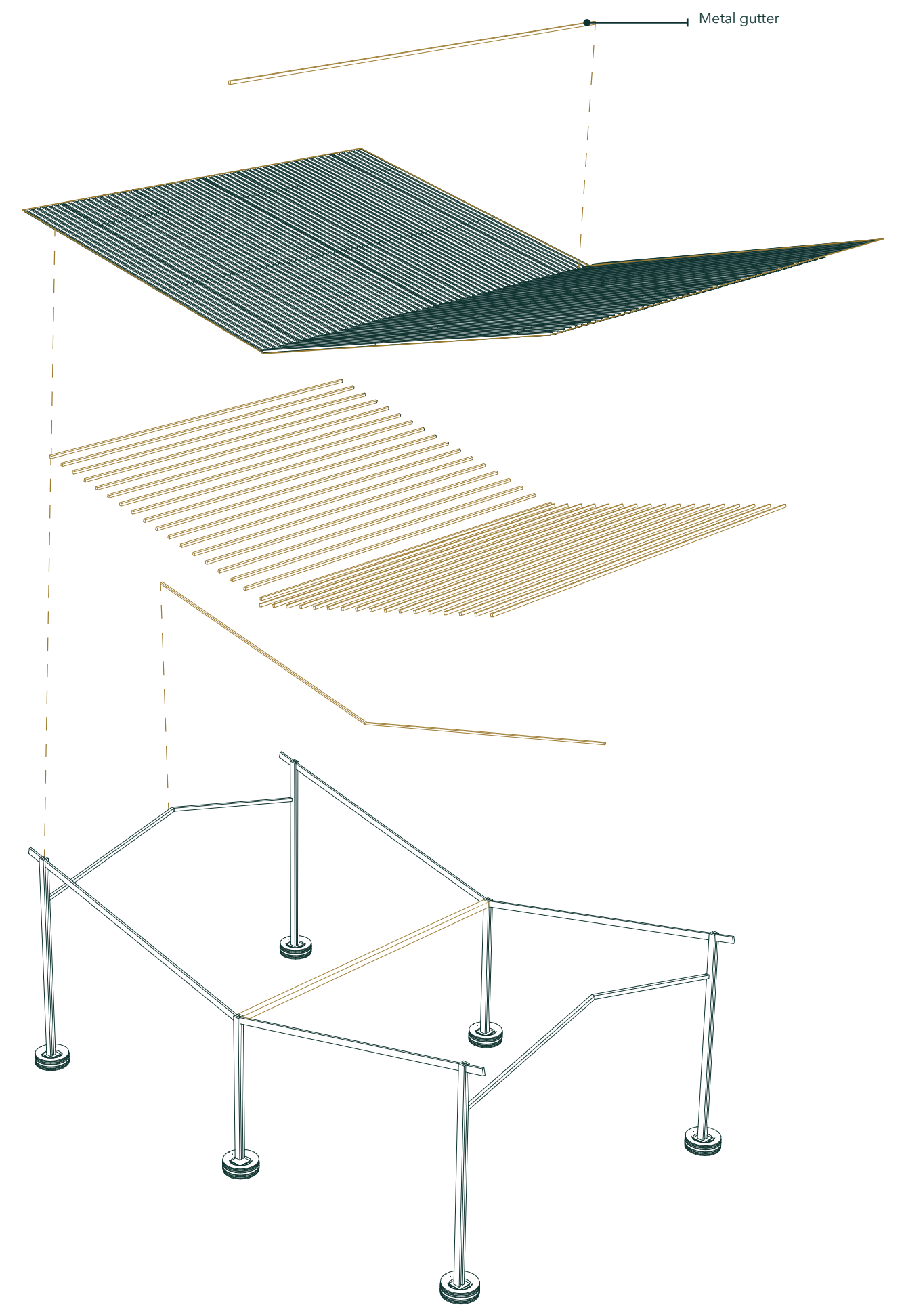
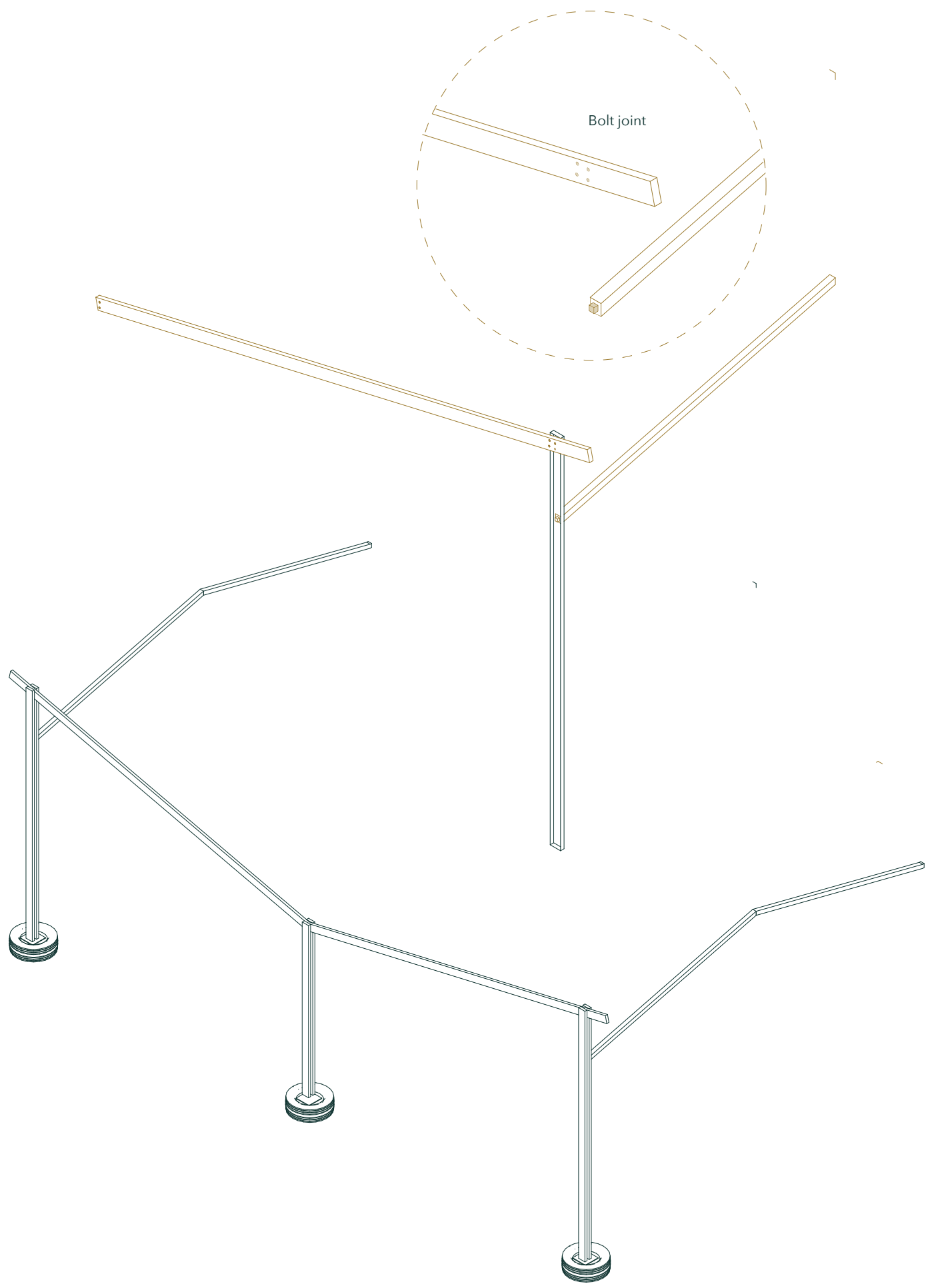
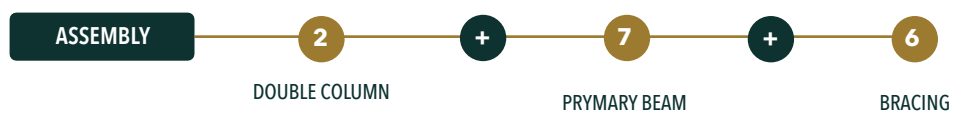


pallets

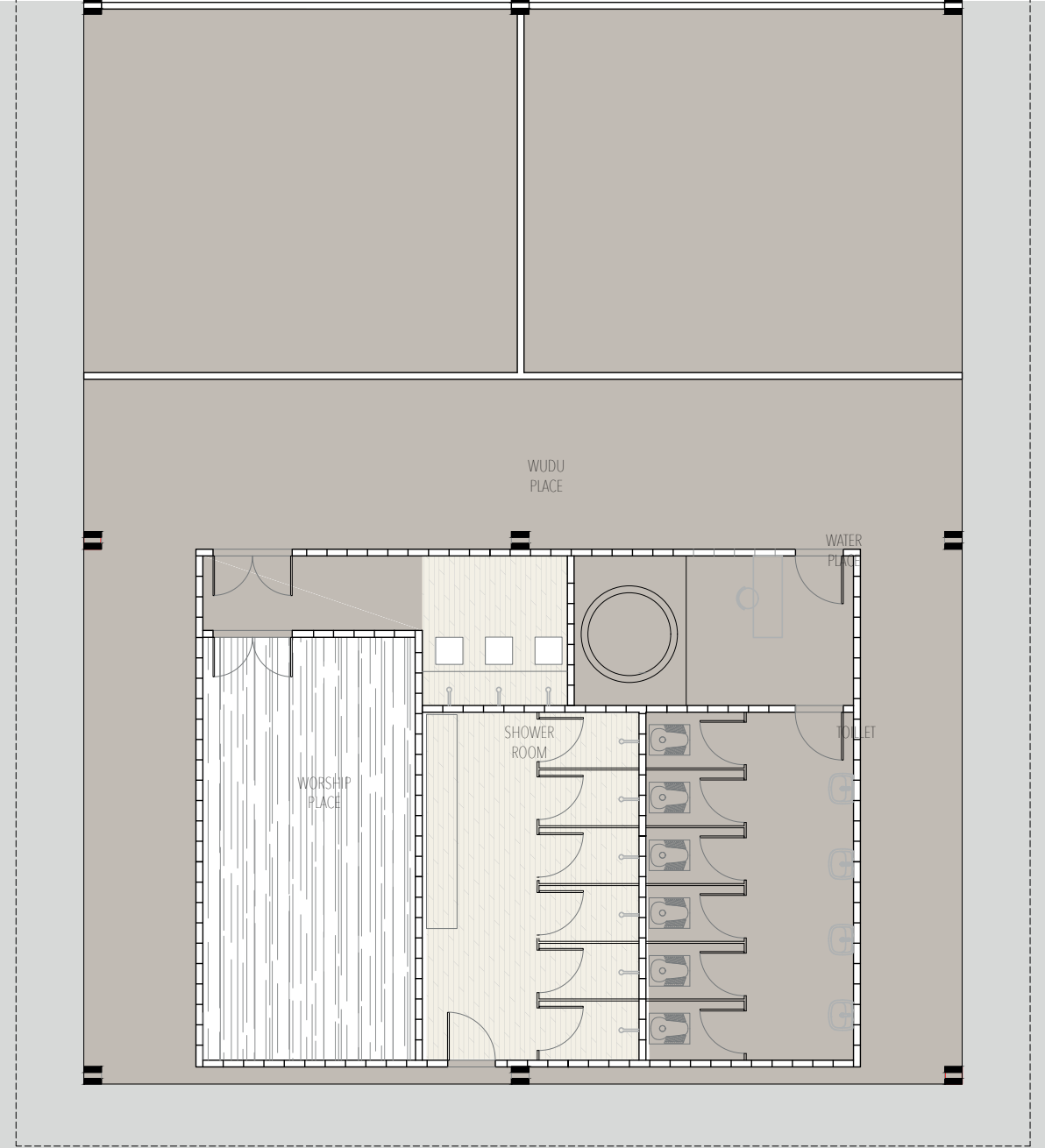
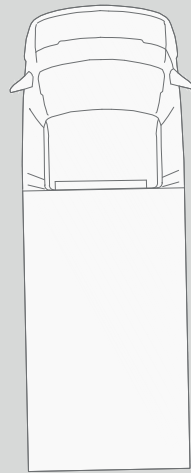
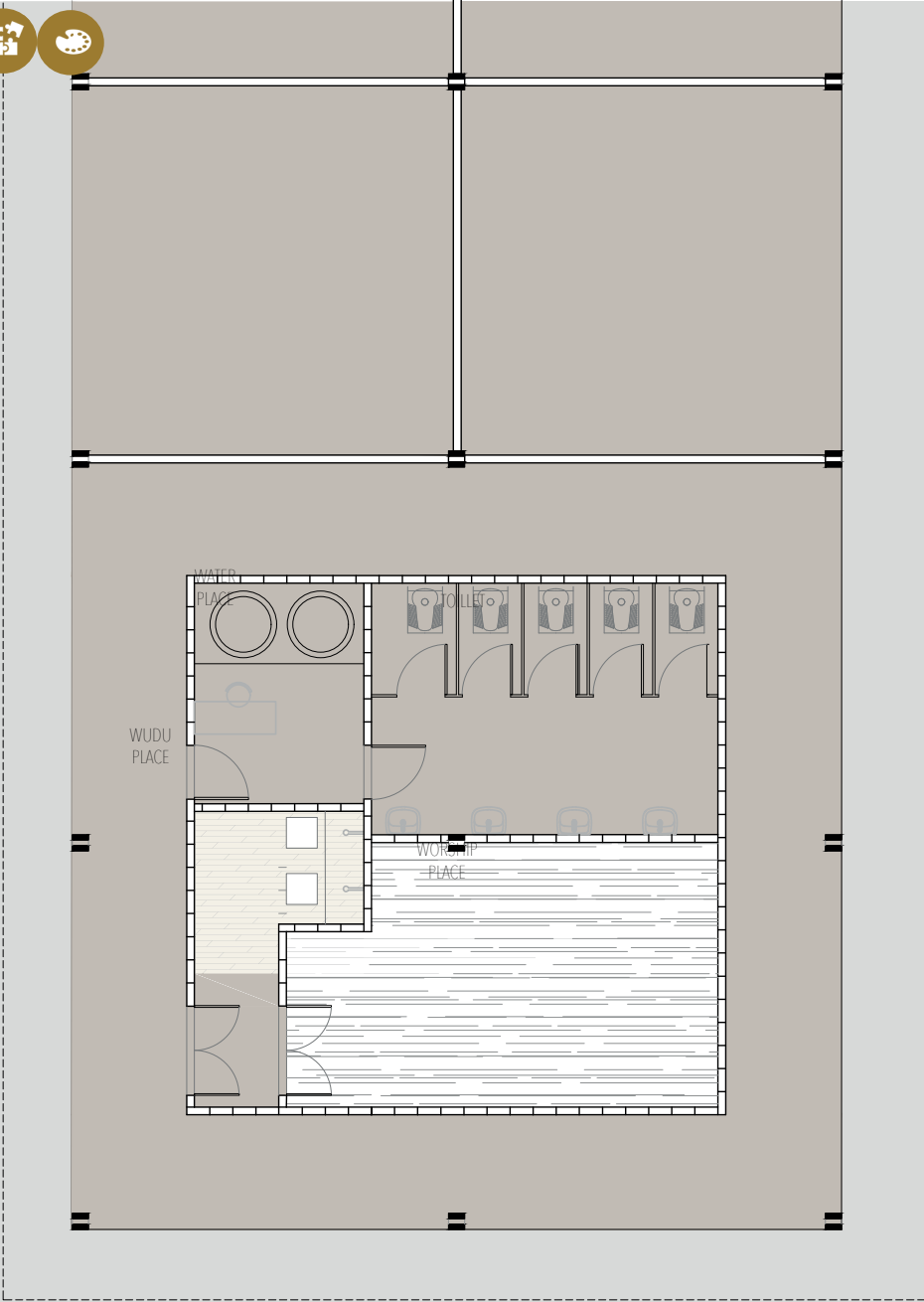


mud brick



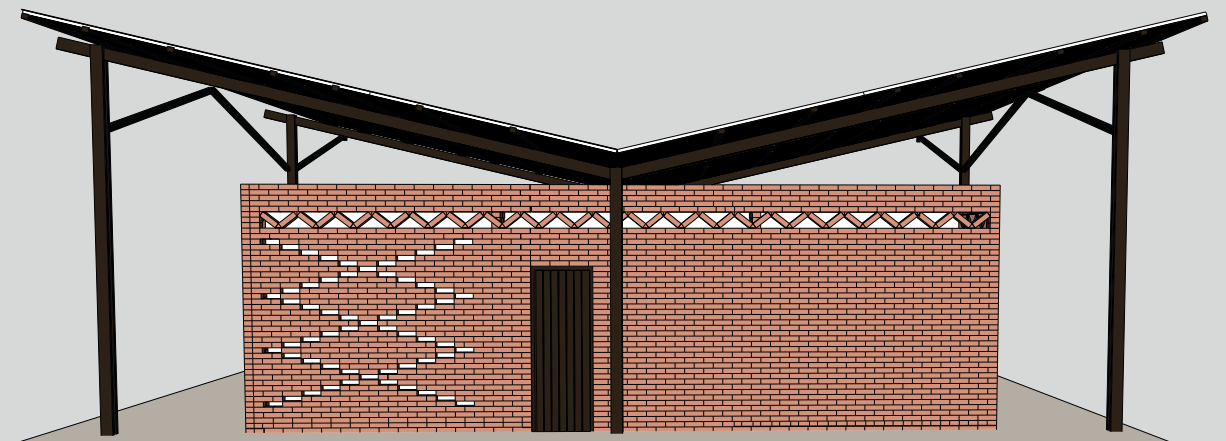
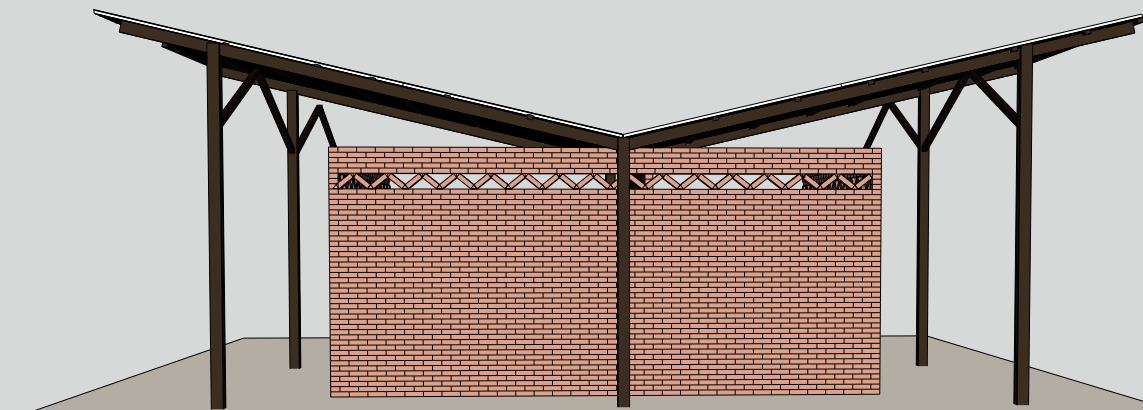
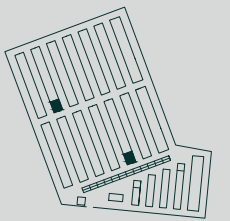
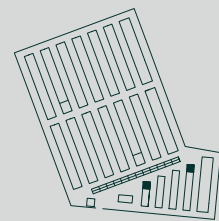


2
SANITARY + WORSHIP PLACES



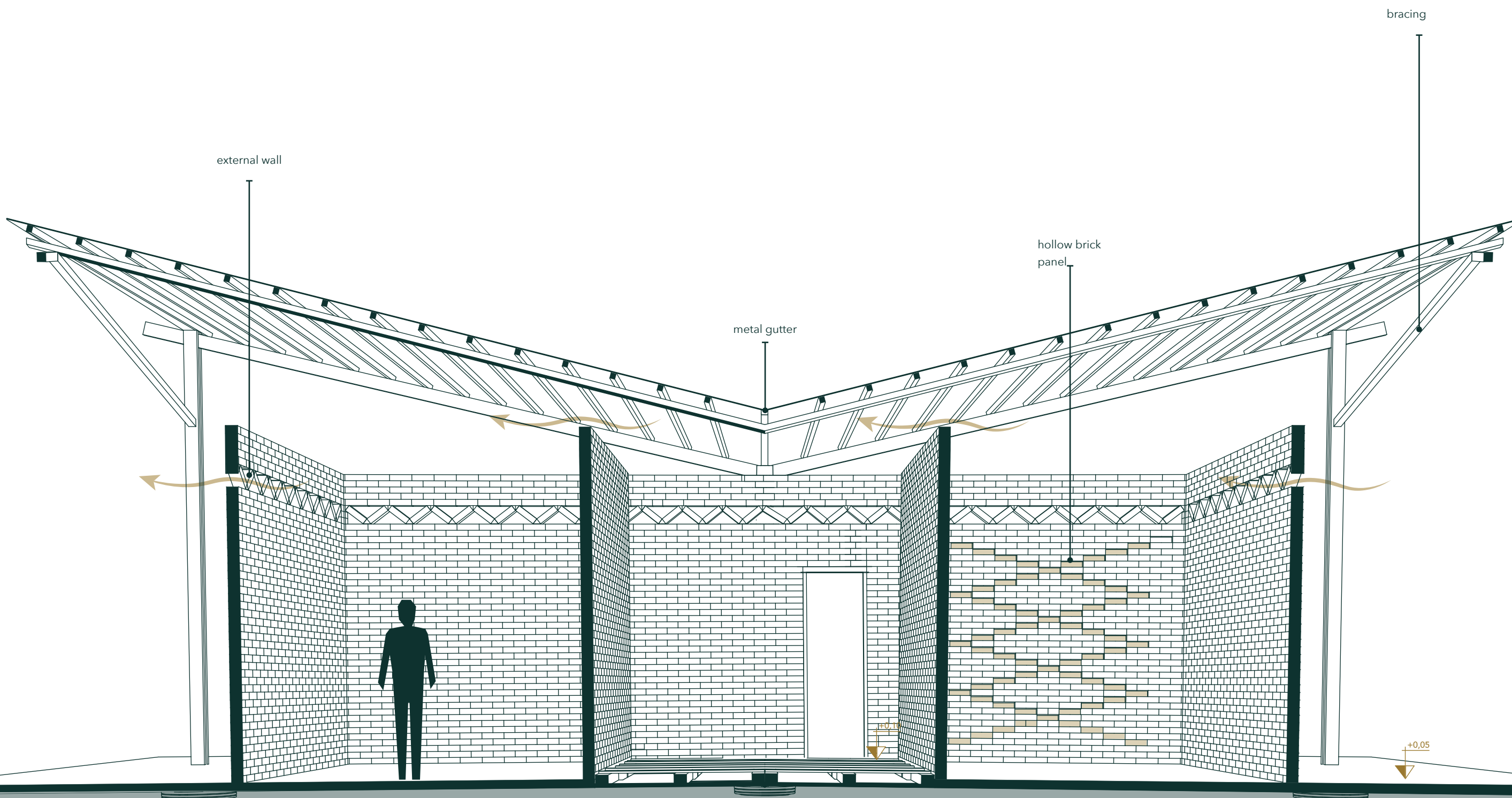
BLOCK WITH OUT SHOWER - GROUND FLOOR
49m²

BLOCK WITH SHOWER - GROUND FLOOR
75m²

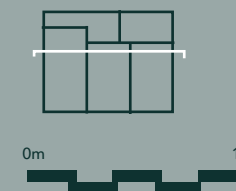


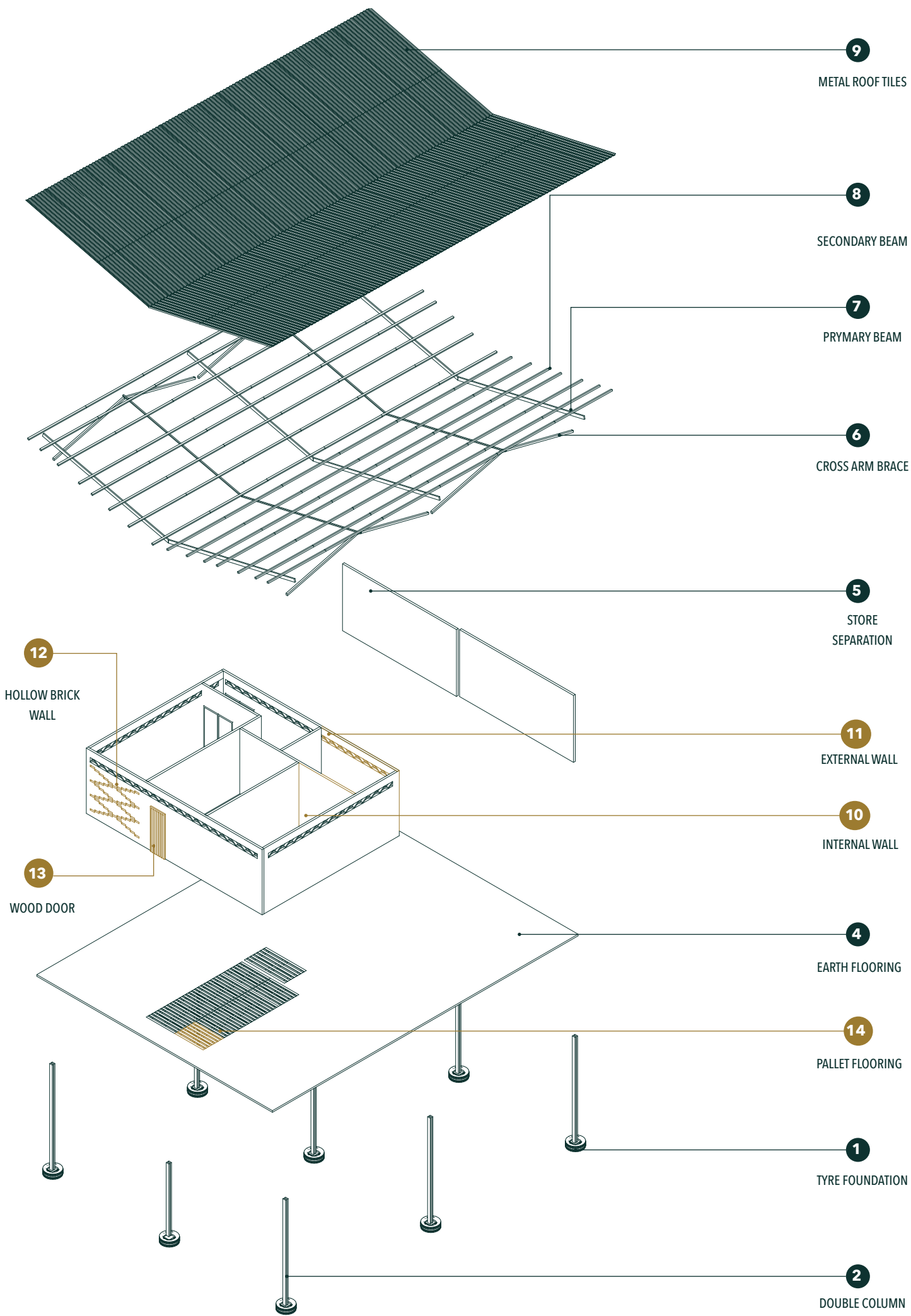
BLOCK WITH OUT SHOWER - FACADE SOUTHWEST

BLOCK WITH SHOWER - FACADE SOUTH EST

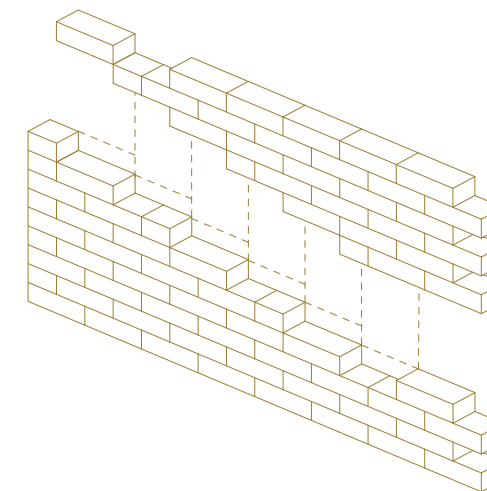
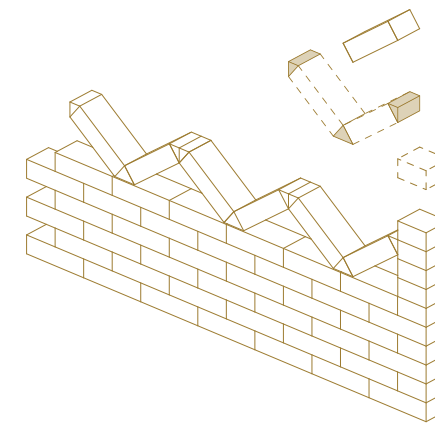
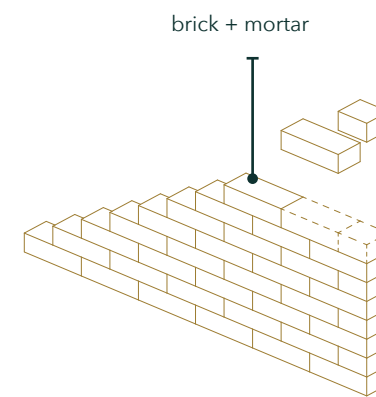
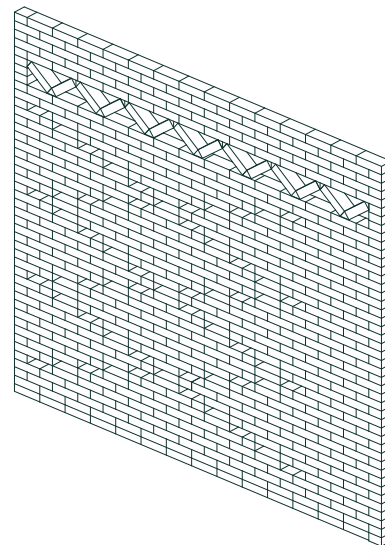
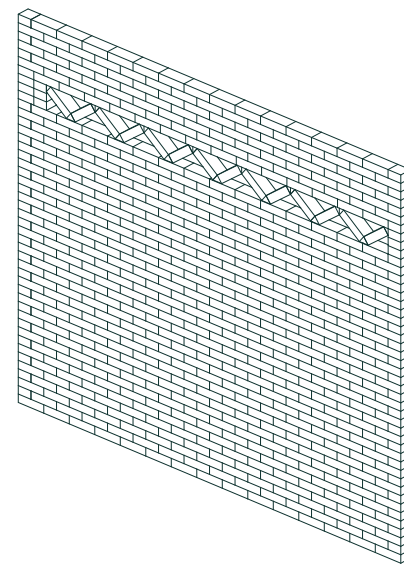
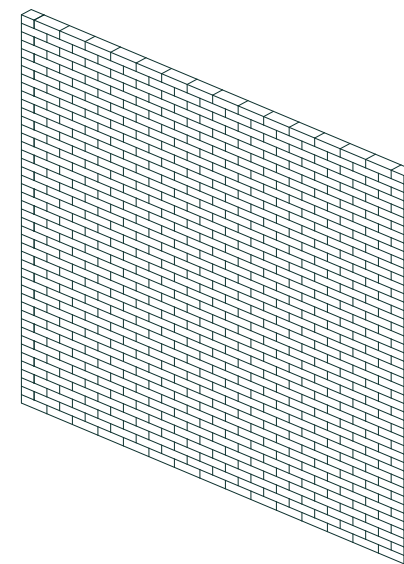


TOILET BLOCK WITH SHOWER
SECTION AA





TECHNIQUES INTRODUCED



10 INTERNAL WALL

11 EXTERNAL WALL

12 HOLLOW BRICK WALL



ASSEMBLY

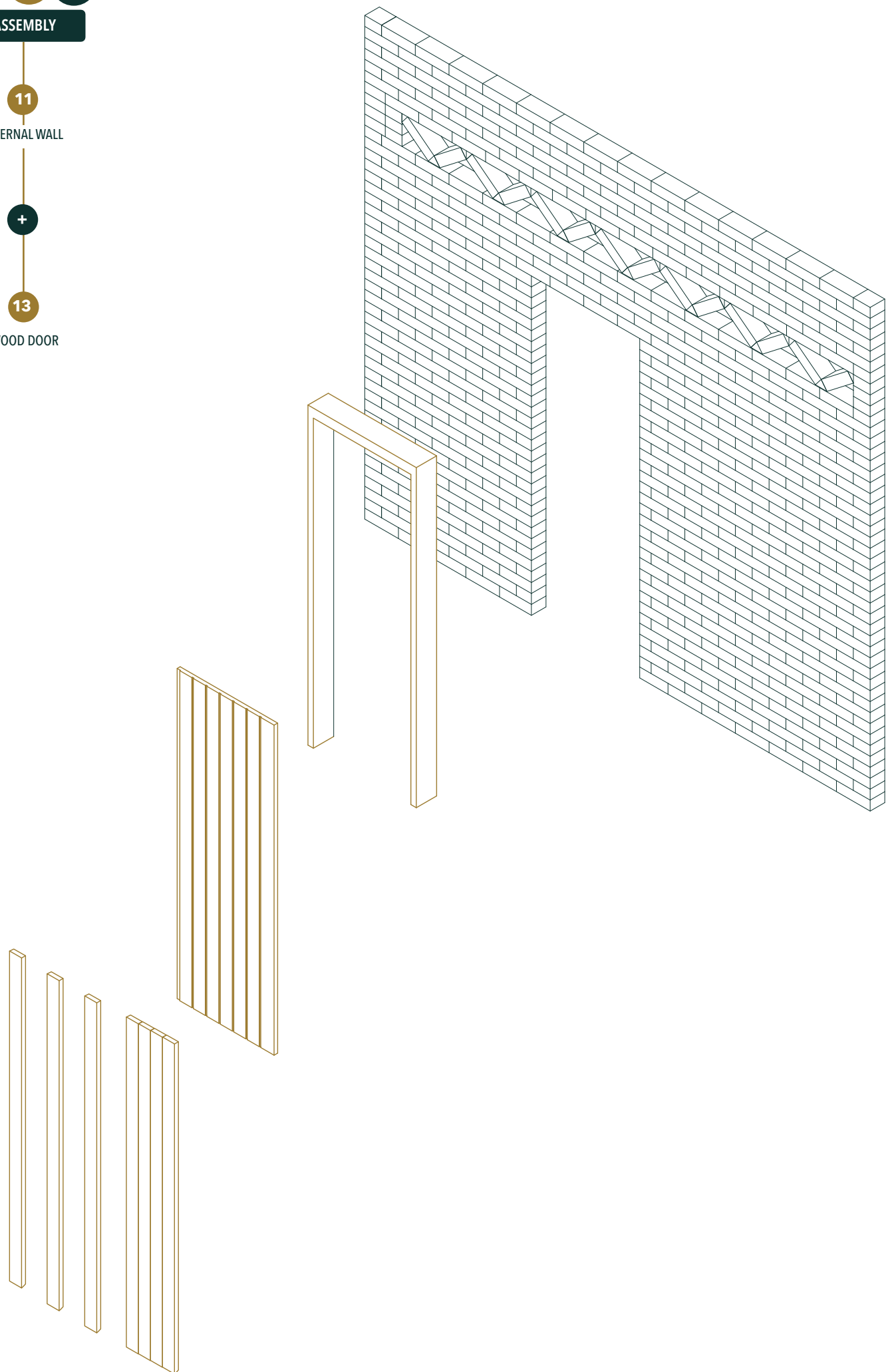
11

EXTERNAL WALL

+

13

WOOD DOOR



ASSEMBLY

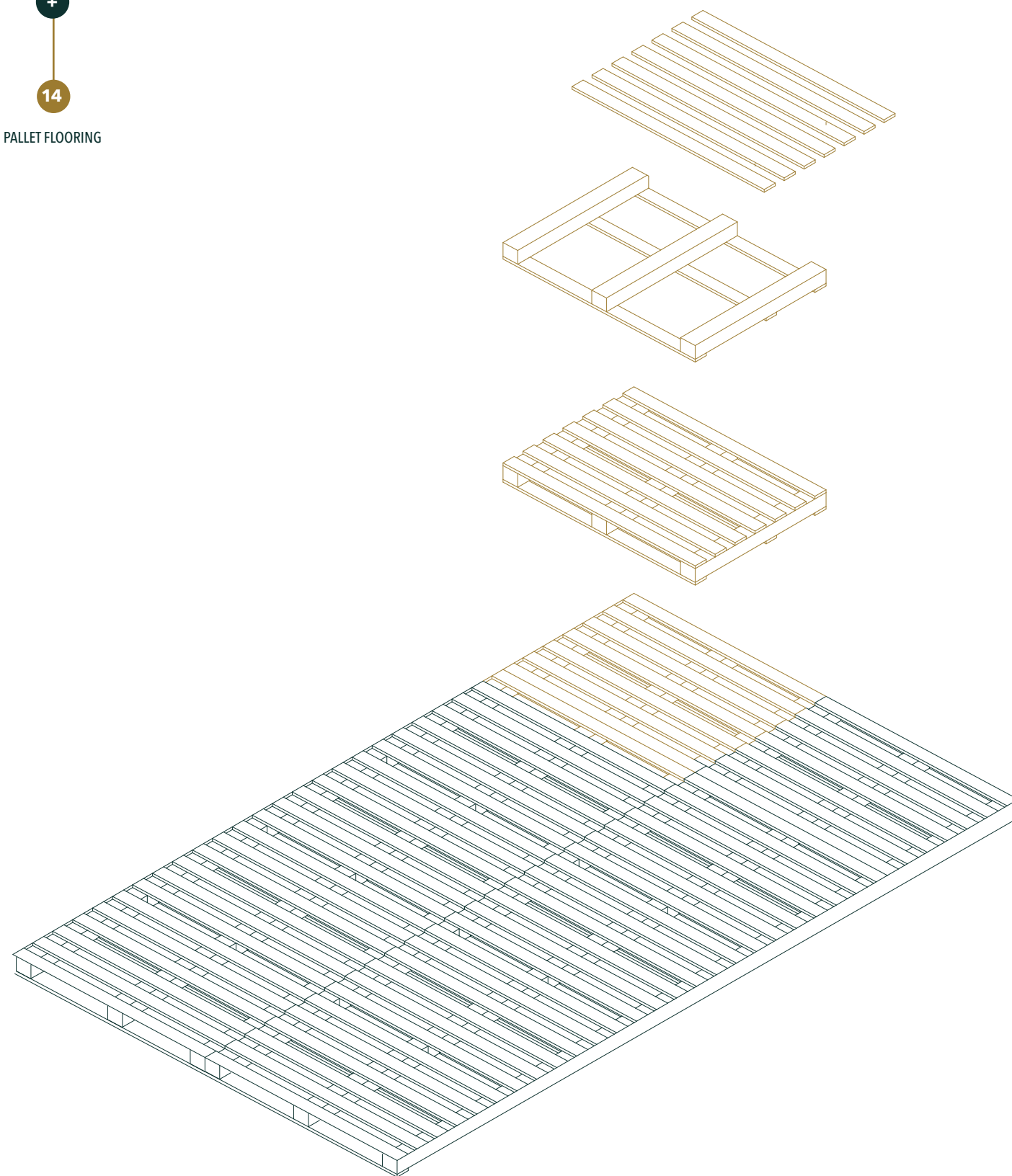
4

EARTH FLOORING

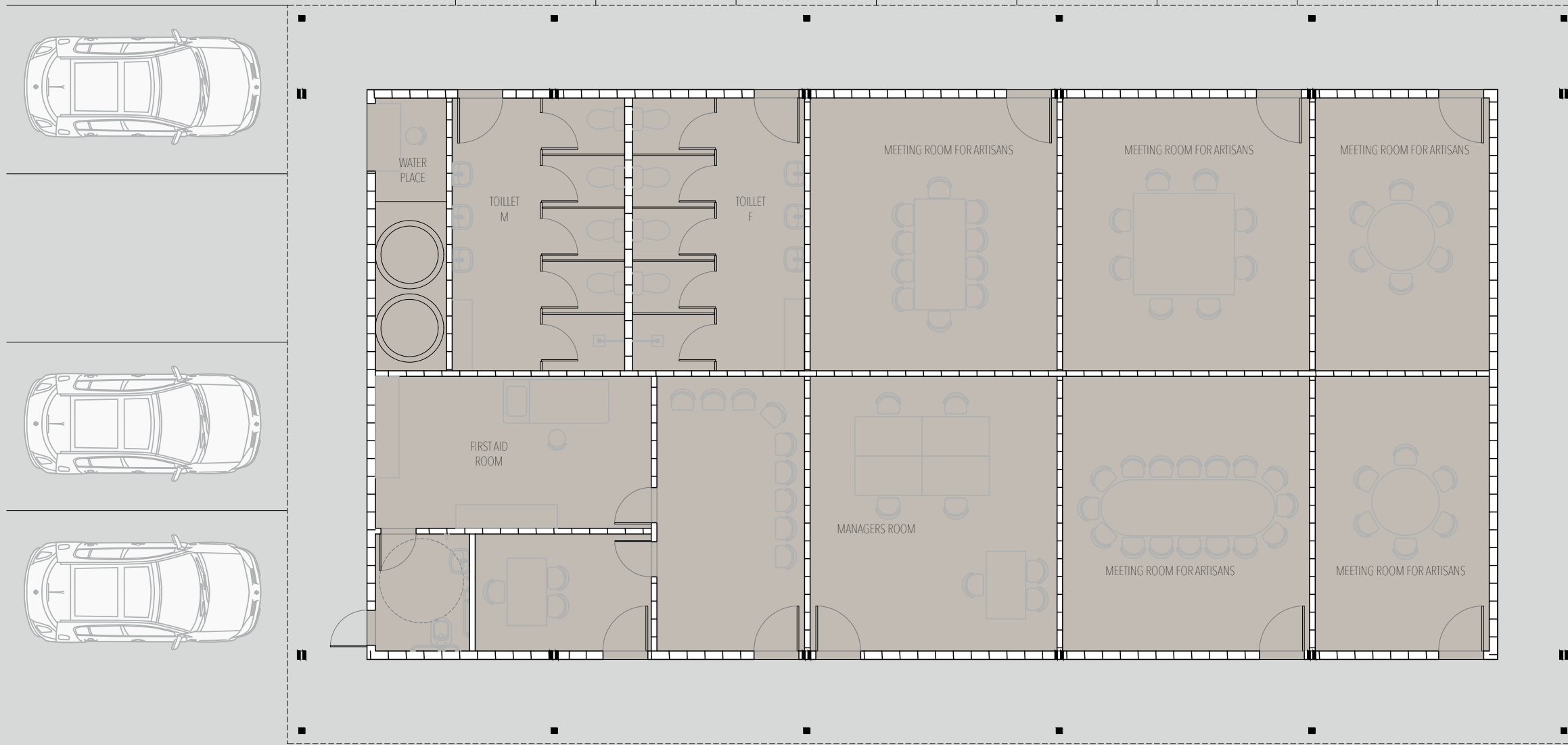
+

14

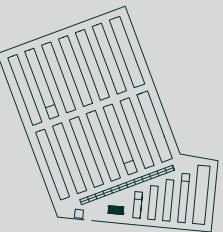
PALLET FLOORING



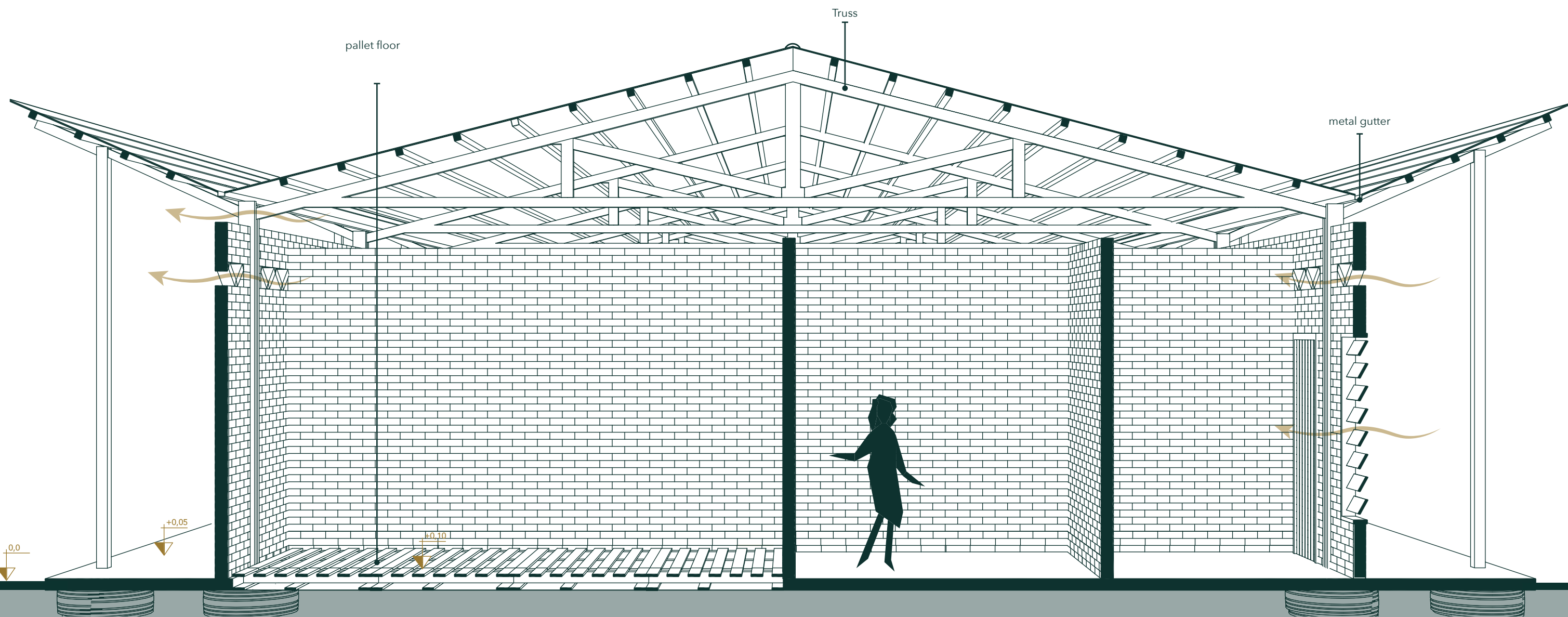
3
SERVICE BLOCK



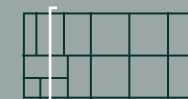
Ground floor
200m²

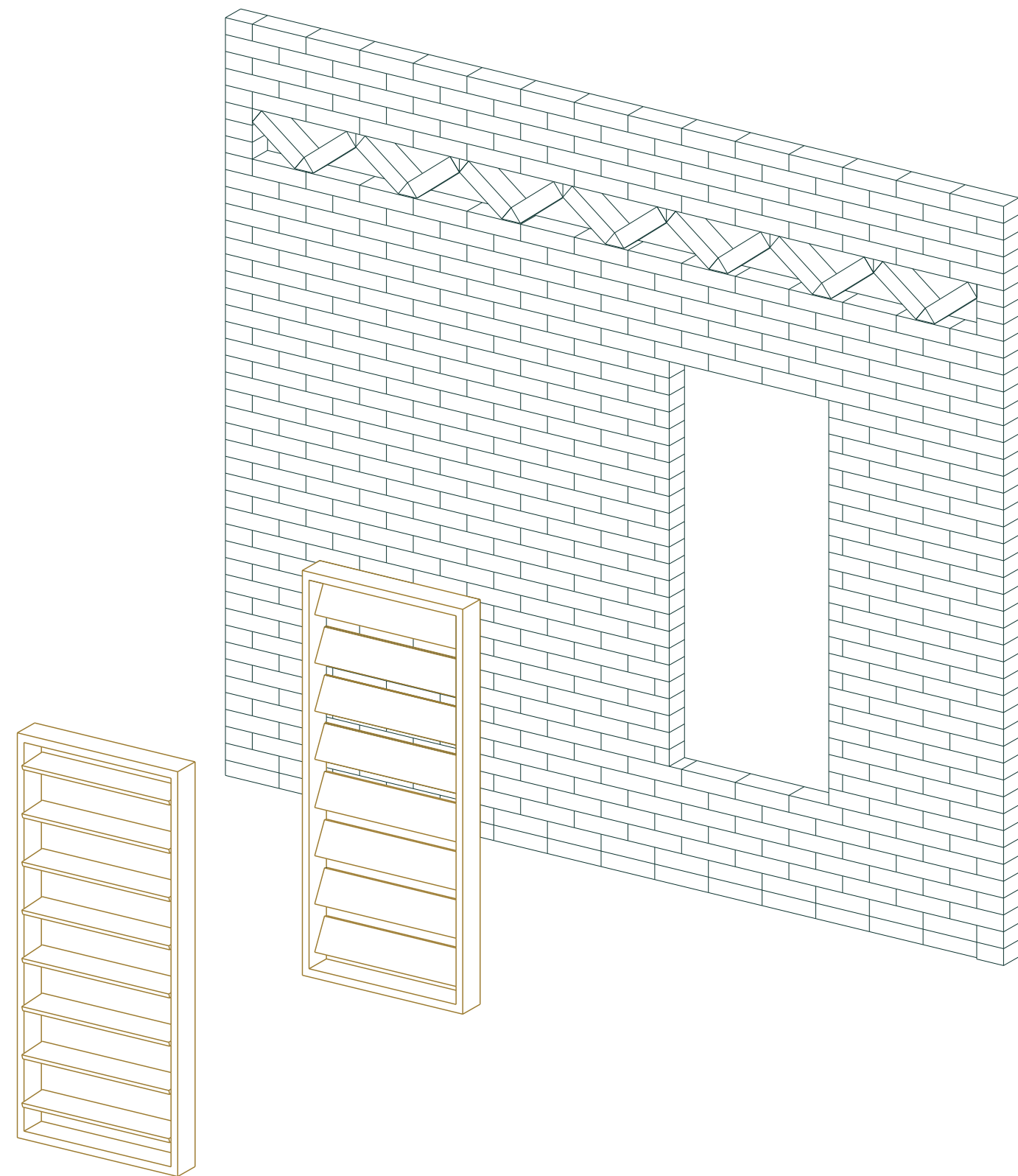
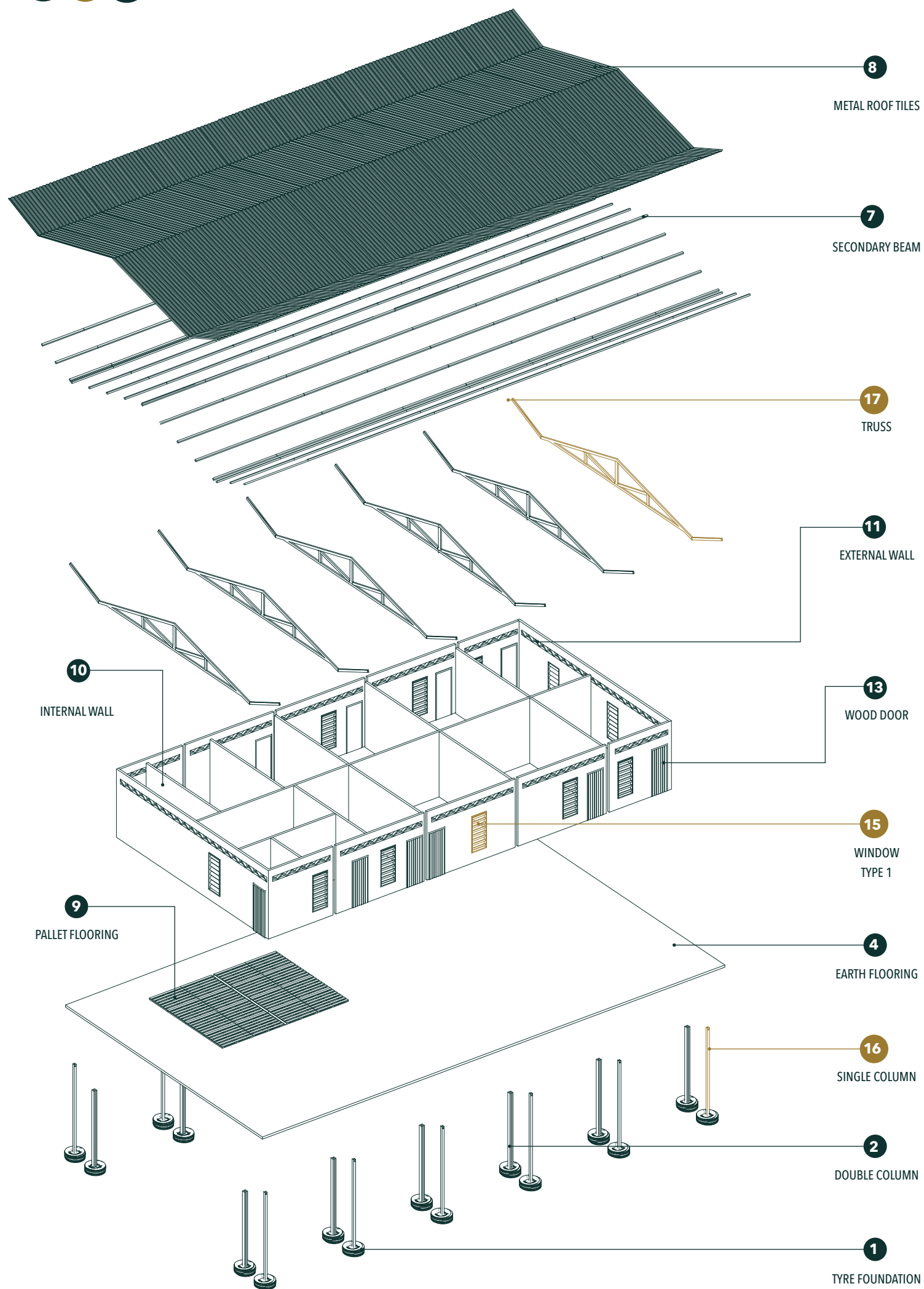


South Facade



SECTION -TOILET WITH SHOWER







ASSEMBLY

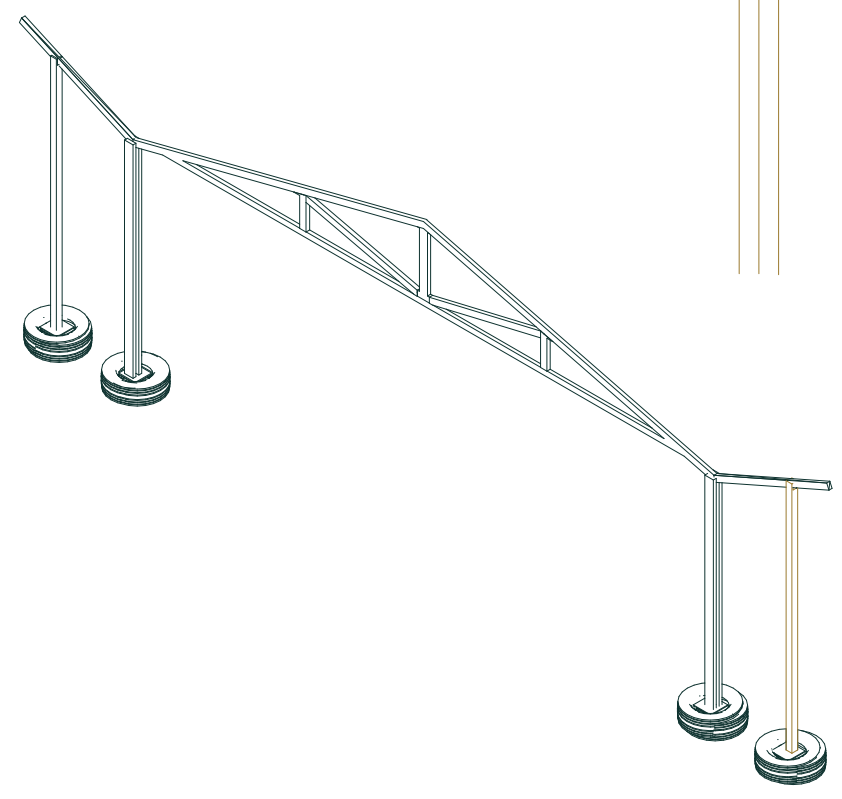
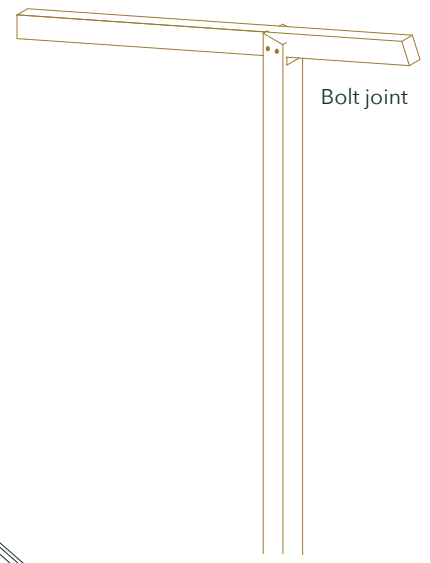
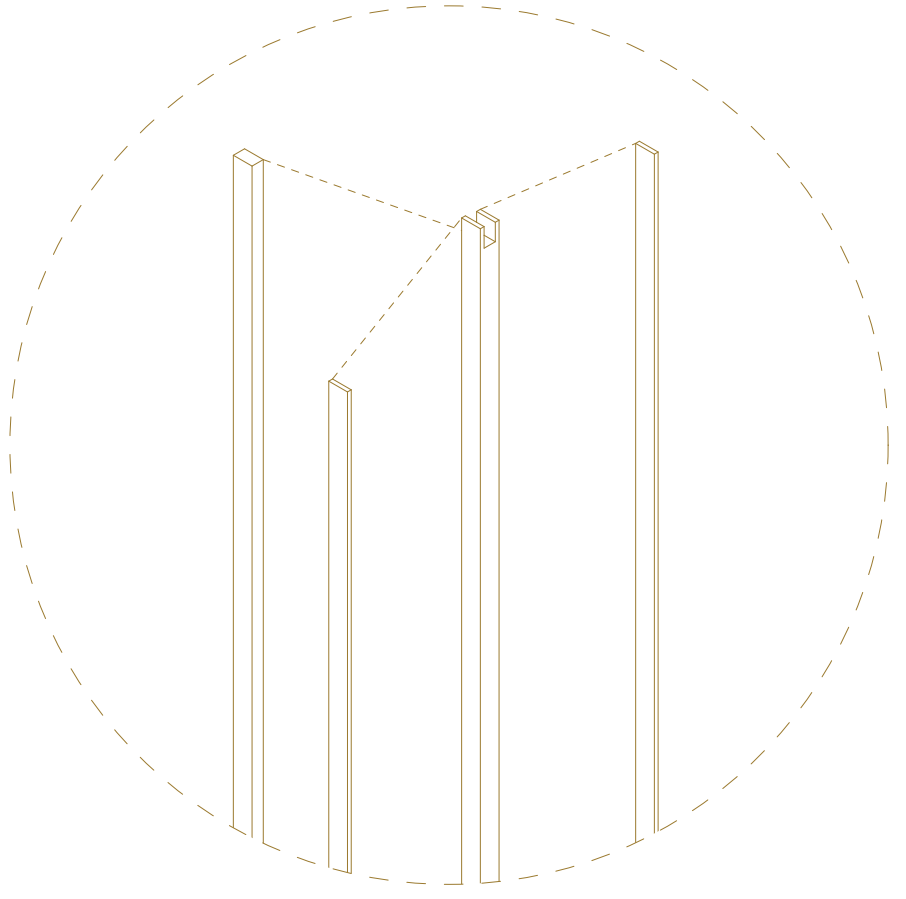
16

SINGLE COLUMN

+

17

TRUSS



ASSEMBLY

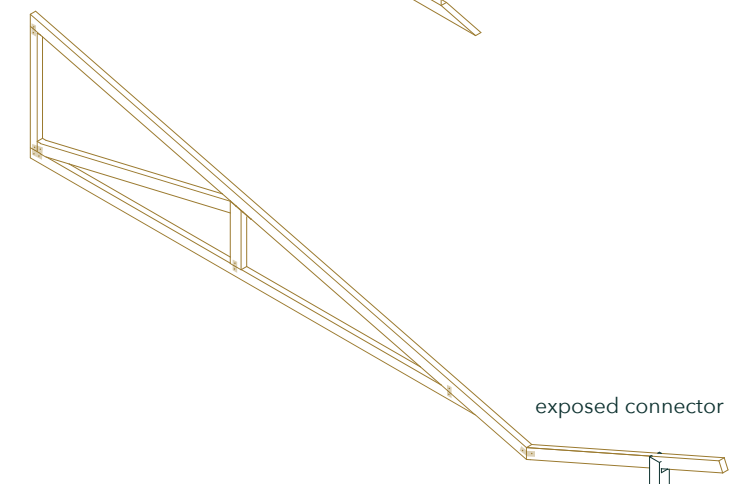
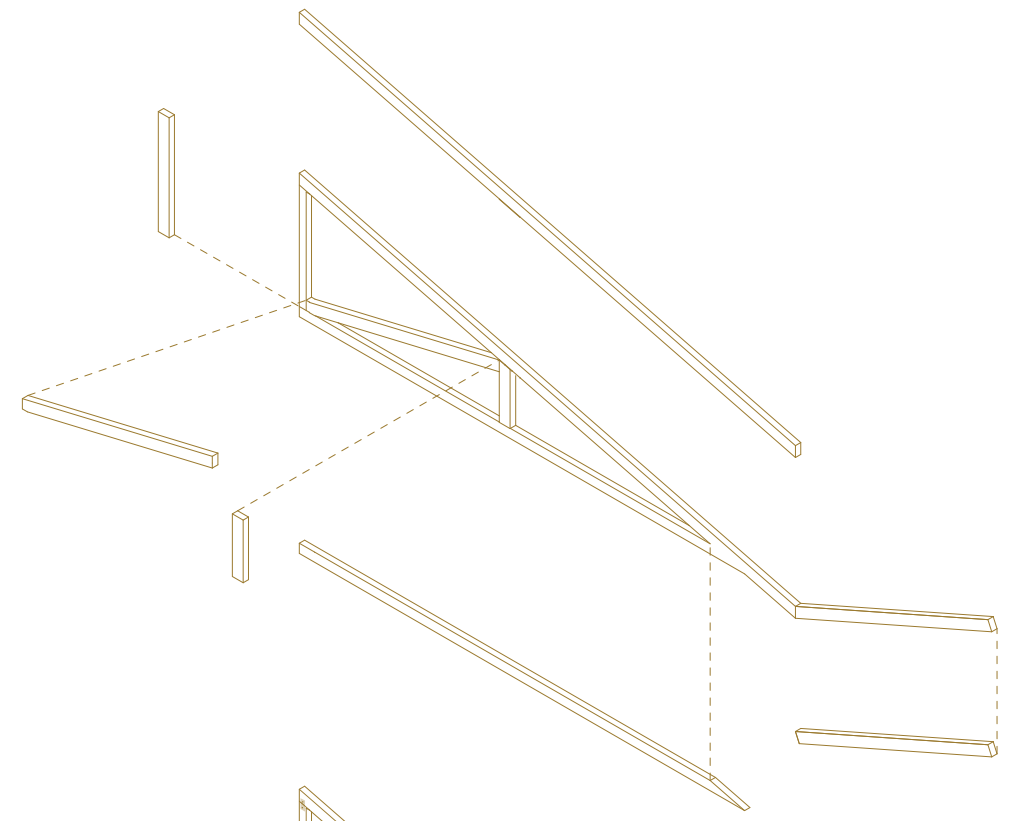
2

DOUBLE COLUMN

+

17

TRUSS





VIEW: Vente Corridor, Activities area

PHASE
1



PHASE
2



DIFFICULTY

KNOWLEDGE

SPECIALIZATION

WORK FORCE

URGENCE

SYMPPLICITY



BRIEFING


 Terrain areas (5.100m²)

4. DAYCARE AND NURSERY SCHOOL 1.115m²

Activities	Area
- Block with 3 classrooms (70m ² each)	210m ²
- Room for babys (toddlers) (play and awake)	100m ²
- Office for management	20m ² x2
- Equipped restroom for toddlers	50m ²
- Technical rooms	10m ² x2
- Sanitary Blocks	25m ² x2
- Covered Gallery	100m ²
- Outdoor courtyard	500m ²
- Secure play area	70m ²

PARKING AREA 230m²

Activities	Area
- Parking for 30 cars	150m ²
- 2 wheel Parking	80m ²

5. WOMEN'S HOUSE AND ASSOCIATIONS
5.1 WOMEN HOUSE BLOCK 515m²

Activities	Area
- Reception	50m ²
- Technical room	10m ² x2
- Material storage	10m ² x2
- Office	20m ² x5
- Training room (100 places)	150m ²
- Training sessions (50 places)	75m ²
- Sanitary facilities	25m ² x2
- Activities room	50m ²

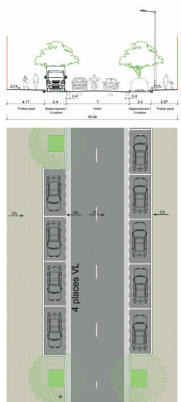
5.2 SOCIAL CENTER BLOCK 510m²

Activities	Area
- Reception	50m ²
- Technical Rooms	10m ² x2
- Sanitary Block	25m ² x2
- Multipurpose room (75 places)	100m ²
- Blocks for the associations hotlines	30m ² x 9
Secreterial room	10m ²
President's office	10m ²
Second Office	10m ²



ANALYSIS MAP

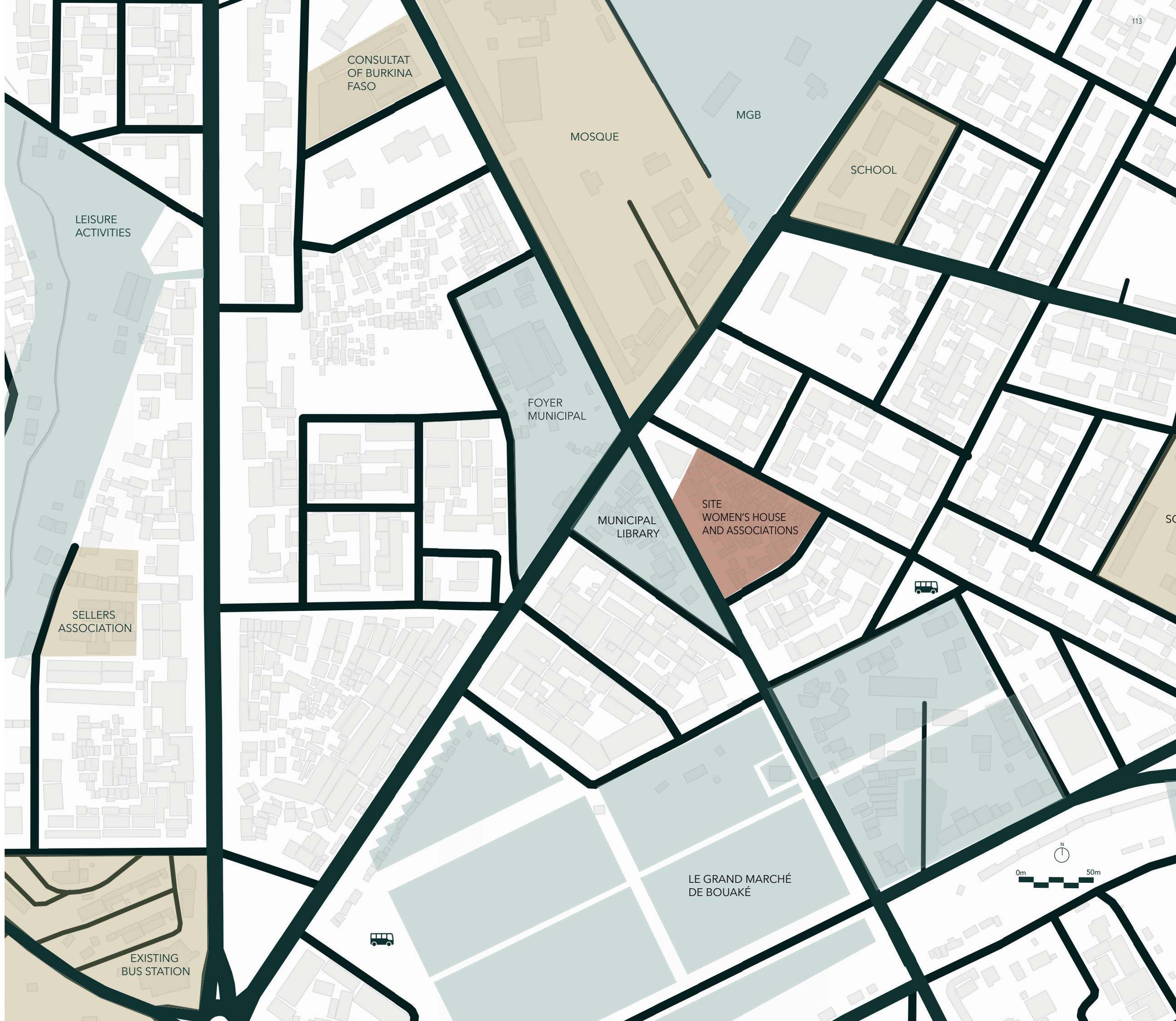
- STUDIED AREA
- CURRENT LAND USE PLAN given by the municipality [16]
- institutional
- residential / commerce
- LAND USE ADICITONS planned by project of bouake city centre commercial zone
- EXISTING BUILDINGS
- ROADS INTERVEINED BY THE INFRASTRUCTURE PLAN [16]



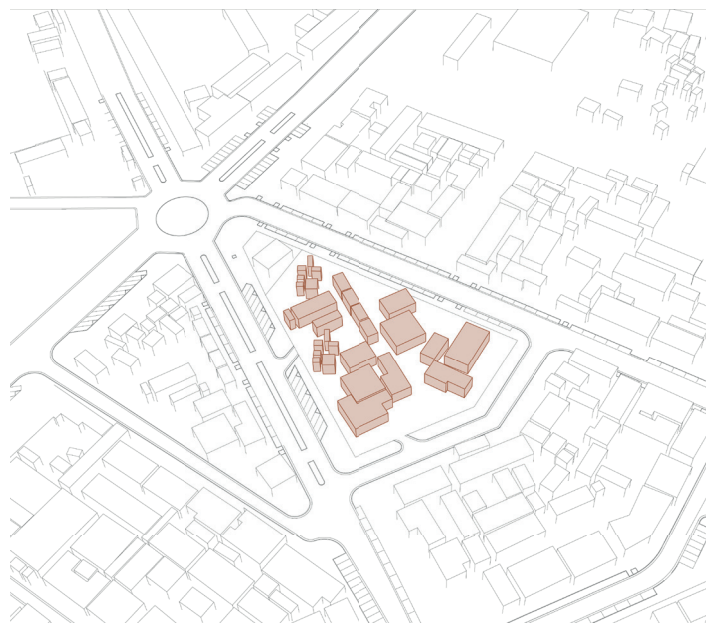
The plan proposes to rebuild the streets the market and surroundings:

- Pedestrian path
- Arborization
- Parking along the streets

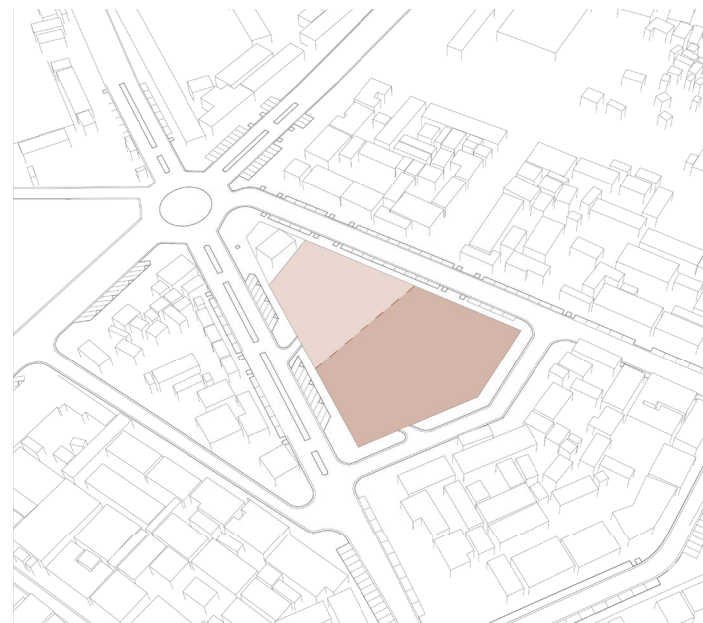
PLANNED BUS STATIONS



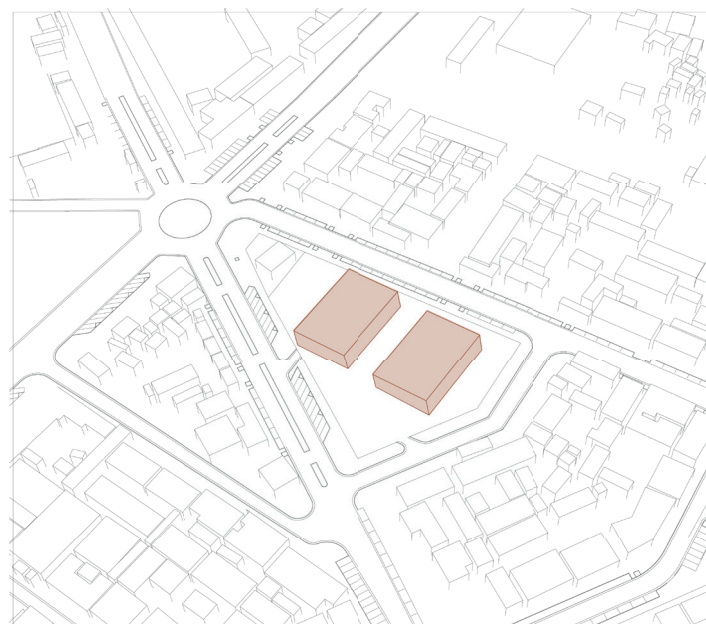
PROJECT CONCEPTION



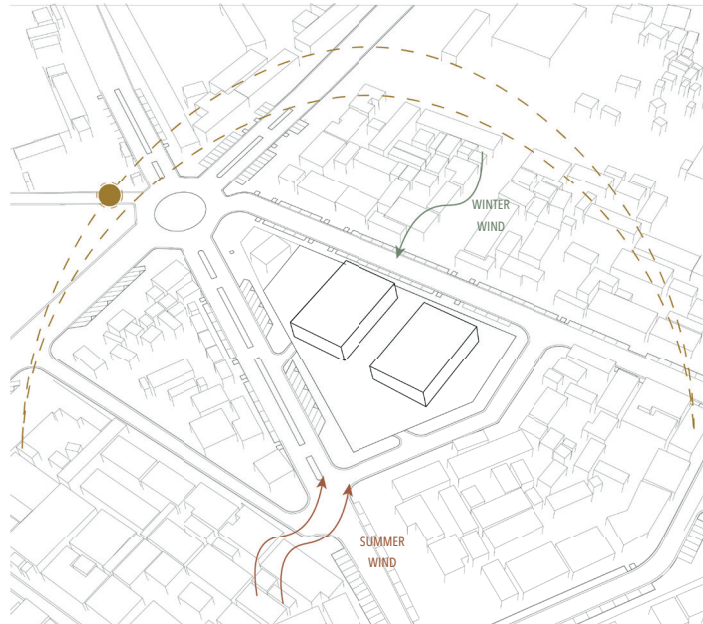
REMOVAL EXISTING BUILDINGS [17]



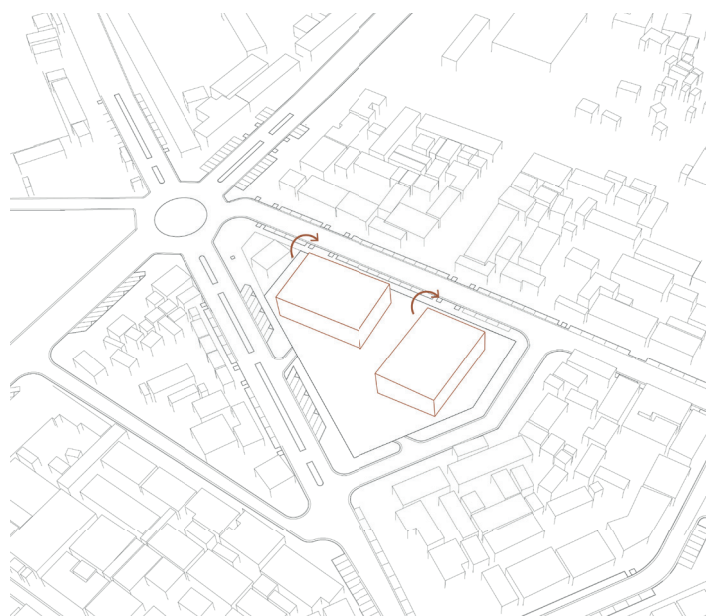
DIVIDE THE SITE IN TWO AREAS



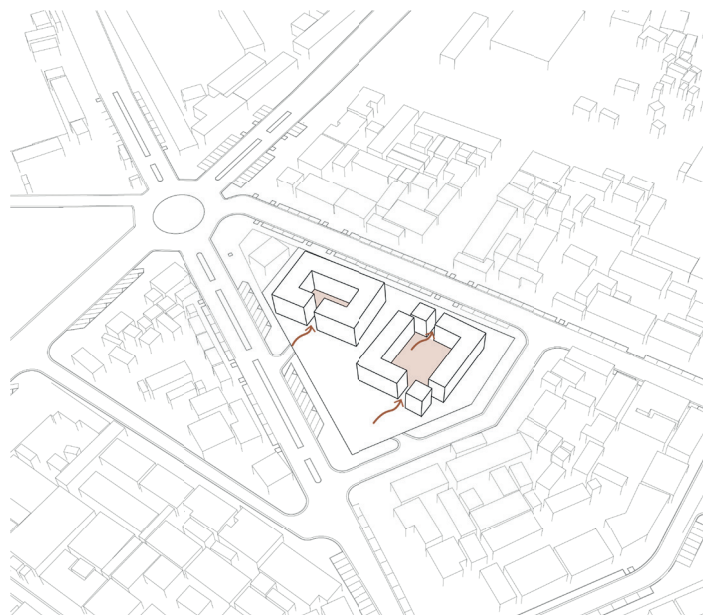
BLOCKS INSERTION



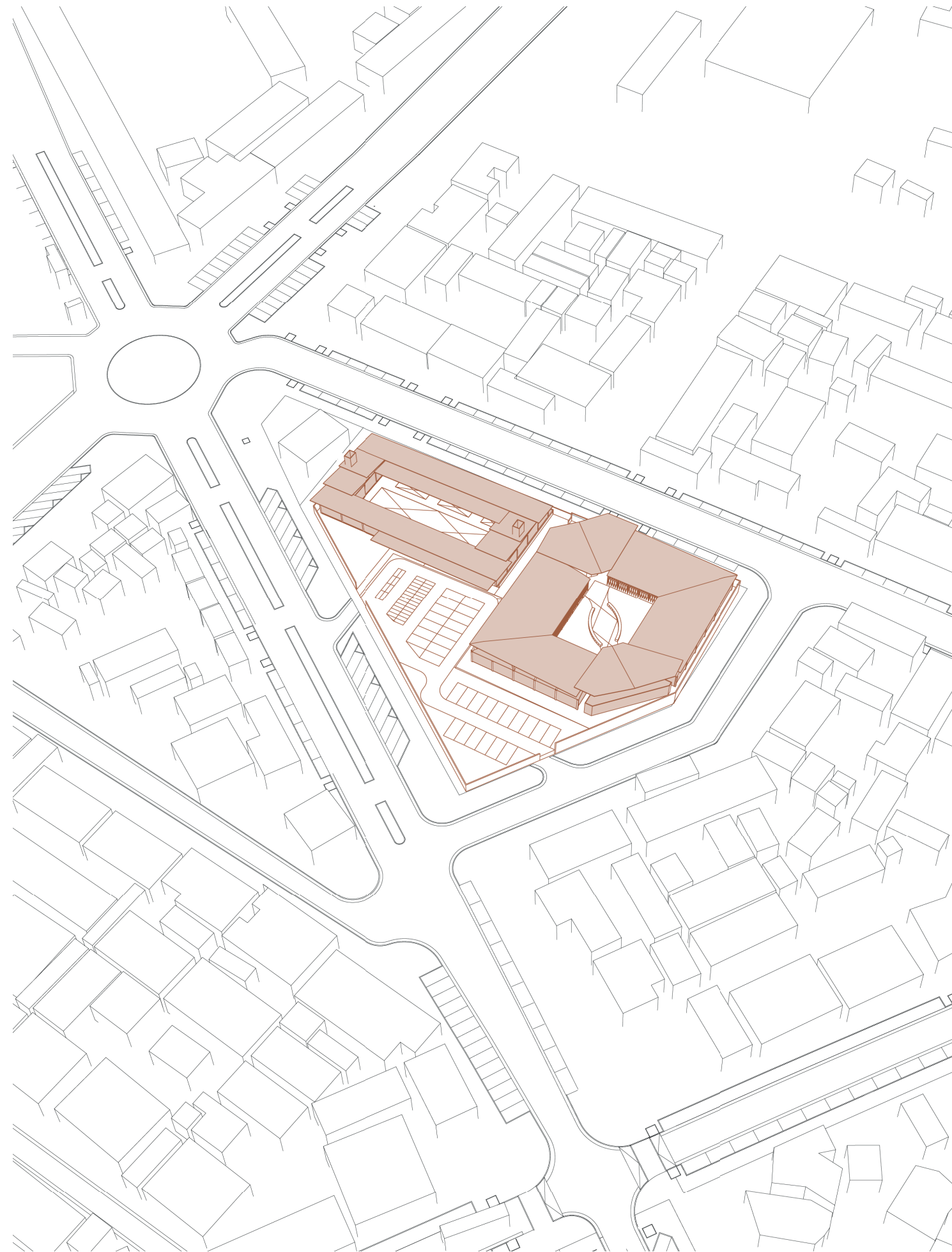
CLIMATE ANALYSIS [20]



ROTATION ACCORDING TO THE CLIMATE ANALYSIS



COURTYARD AND OPENING

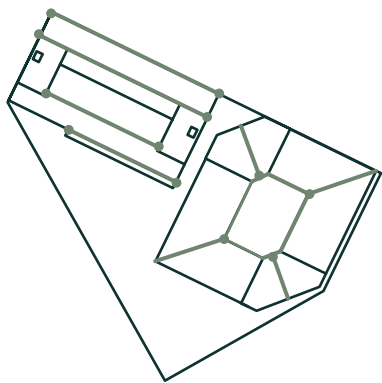


WOMEN'S HOUSE AND ASSOCIATIONS



MASTERPLAN

Rain water harvesting system



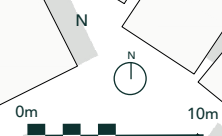
— WATER PATH
● DOWN/STOCKAGE POINT



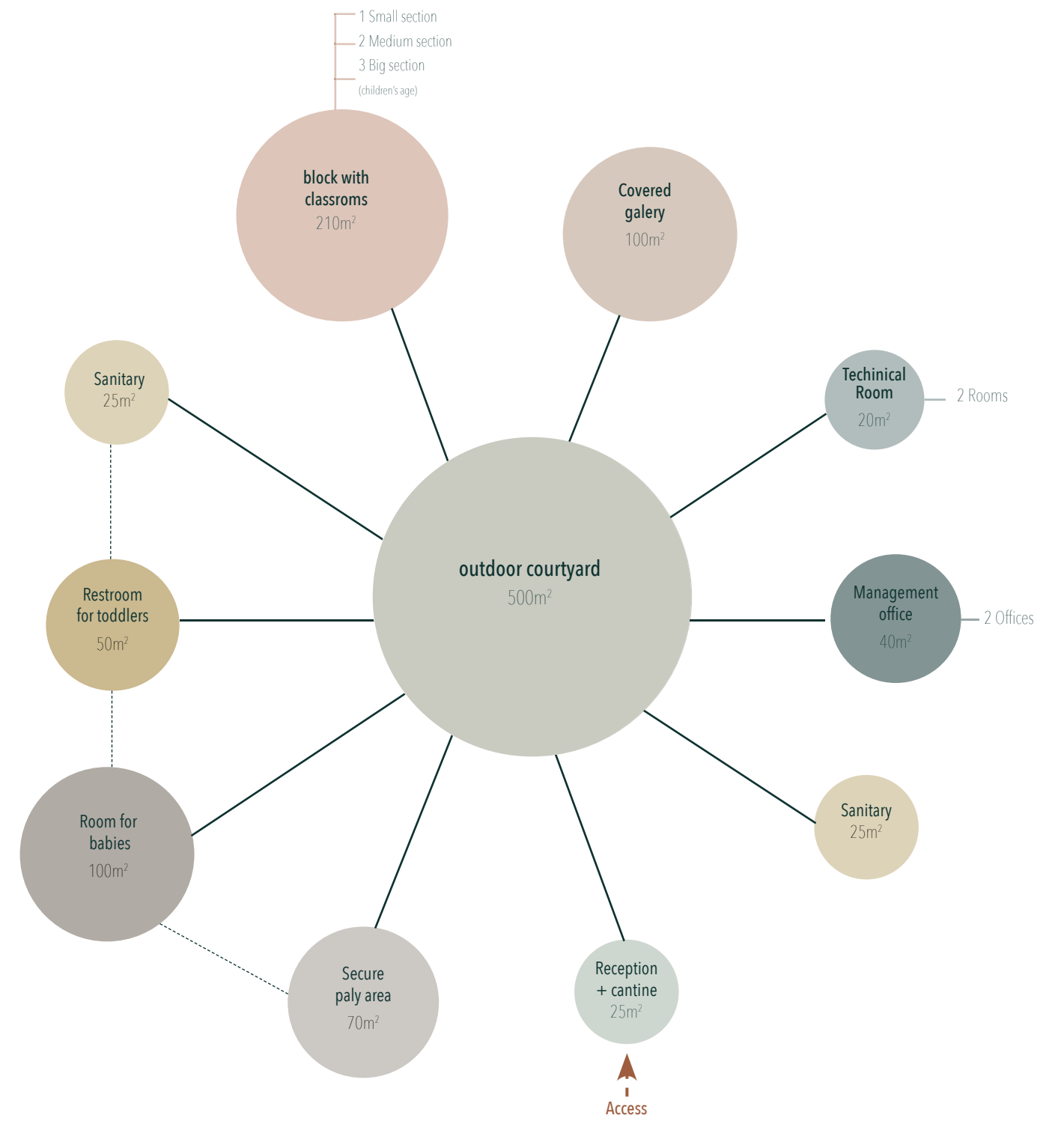


LANDSCAPE PLAN

- EARTH FLOORING WITH FINISHING
- EARTH FLOORING
- GRAVEL
- GRASS
- SAND
- CHILD GAMES DRAWINGS
- PEDESTRIAN ACCESS
- VEHICLES ACCESS
- PARKING 35 TWO WHEELS VEHICLES
250m²
- PARKING 31 CARS
715m²



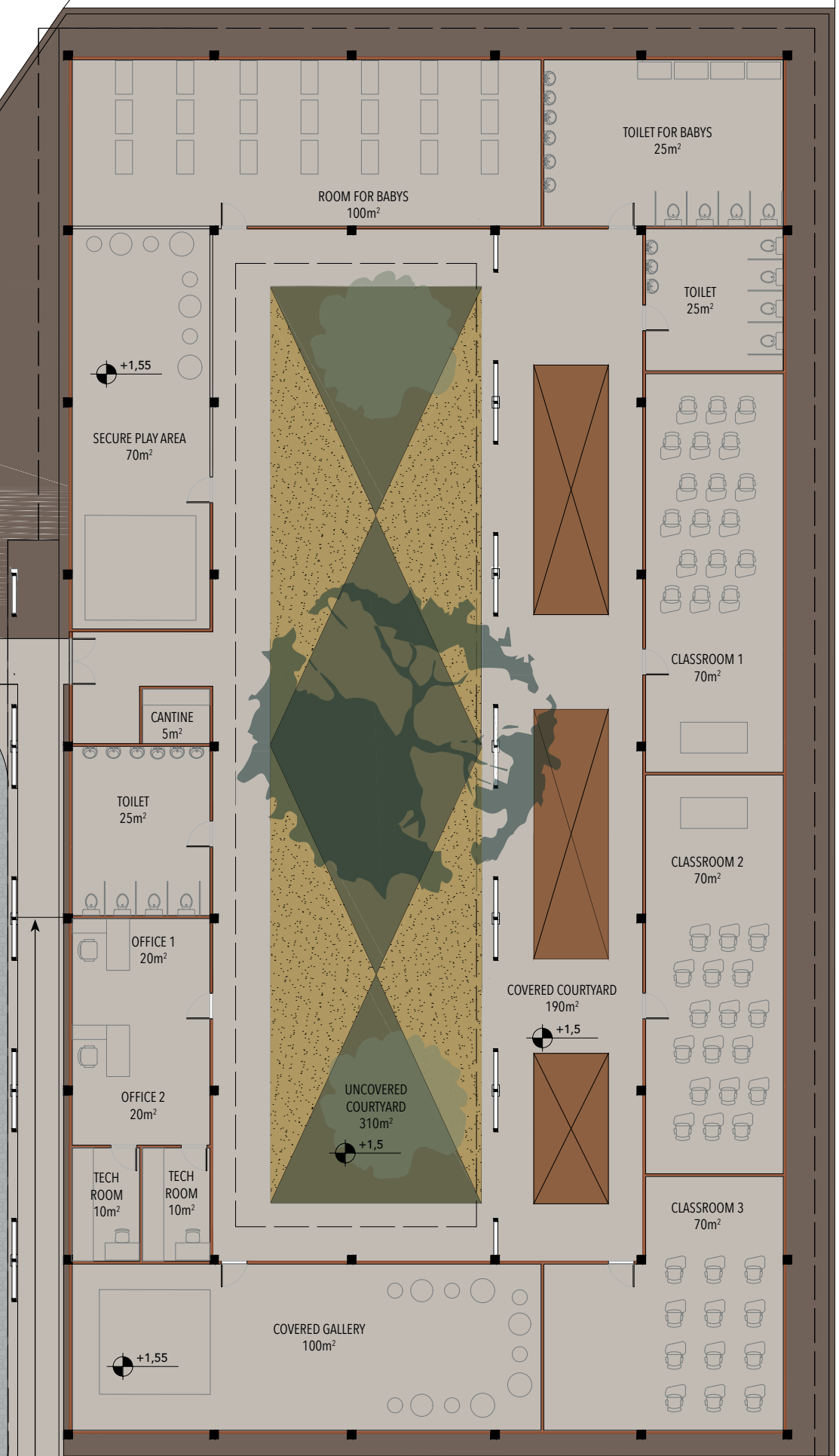
DISTRIBUTION STUDIES

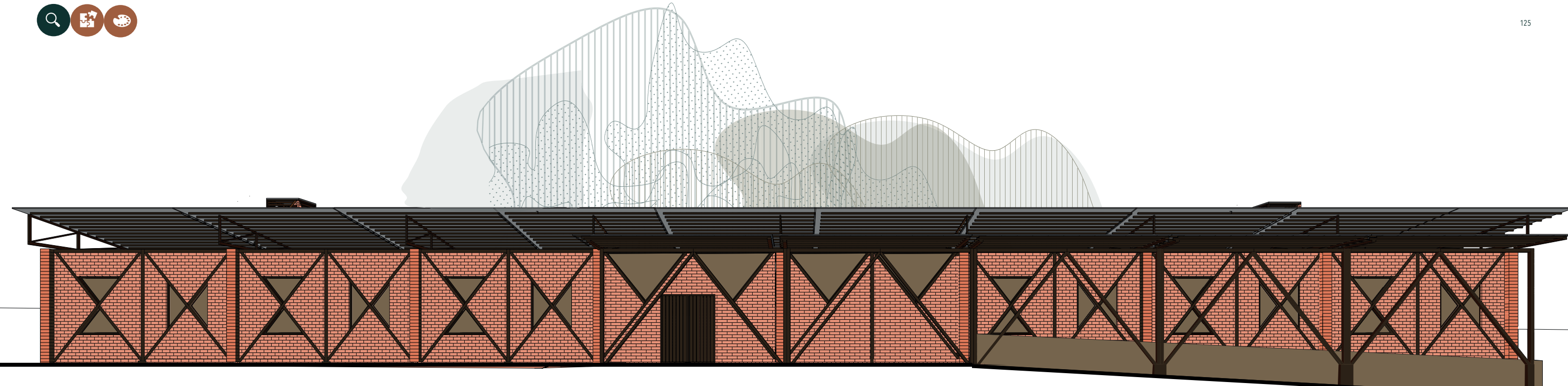
1 Block
1140m²

4
DAYCARE AND NURSERY SCHOOL

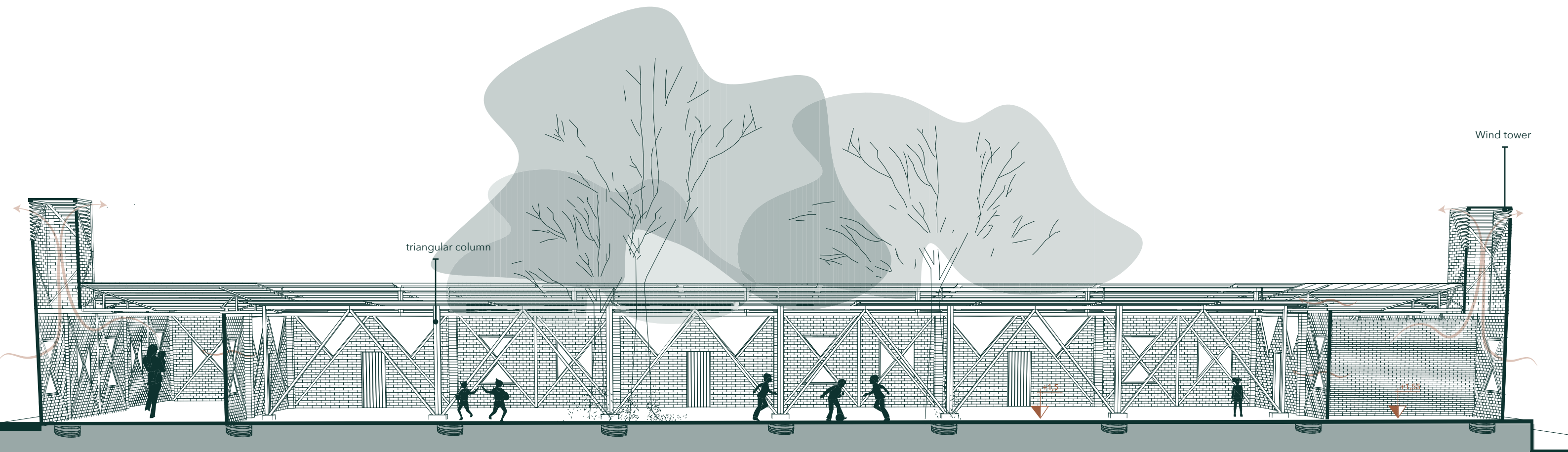


Ground floor
550m²



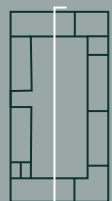


FACADE SOUTH WEST



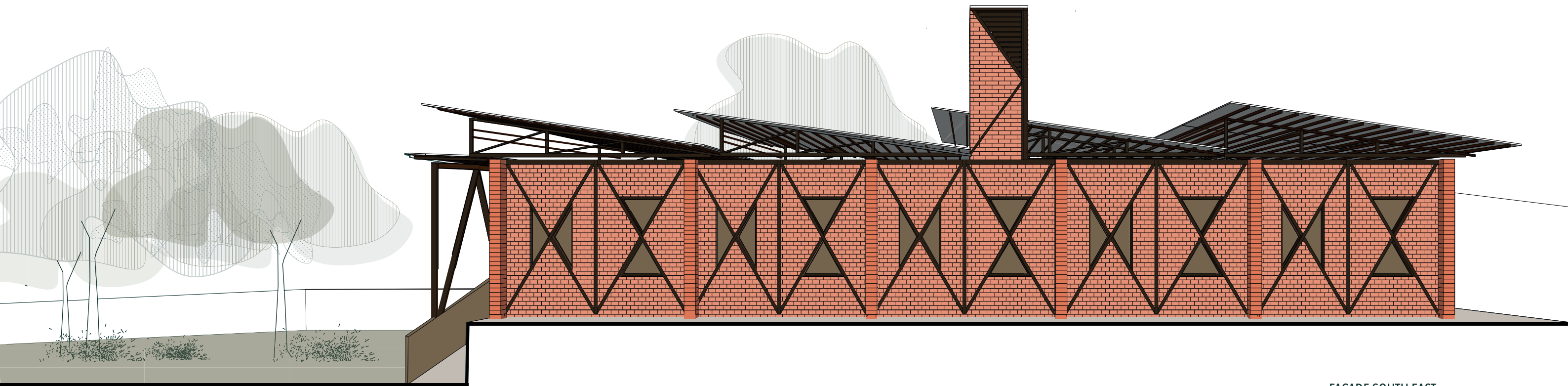
triangular column

Wind tower

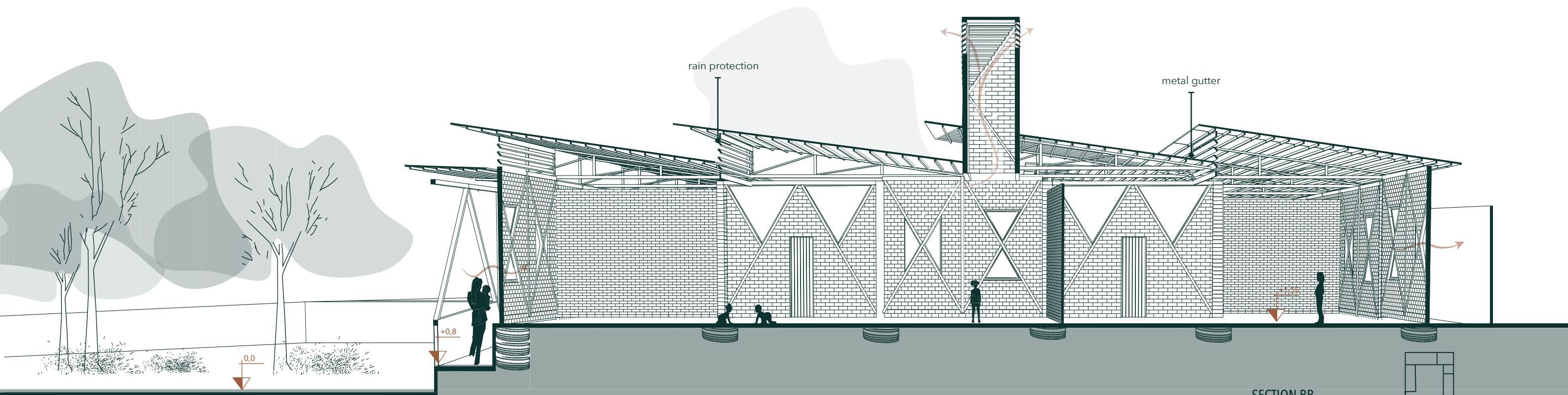


SECTION AA

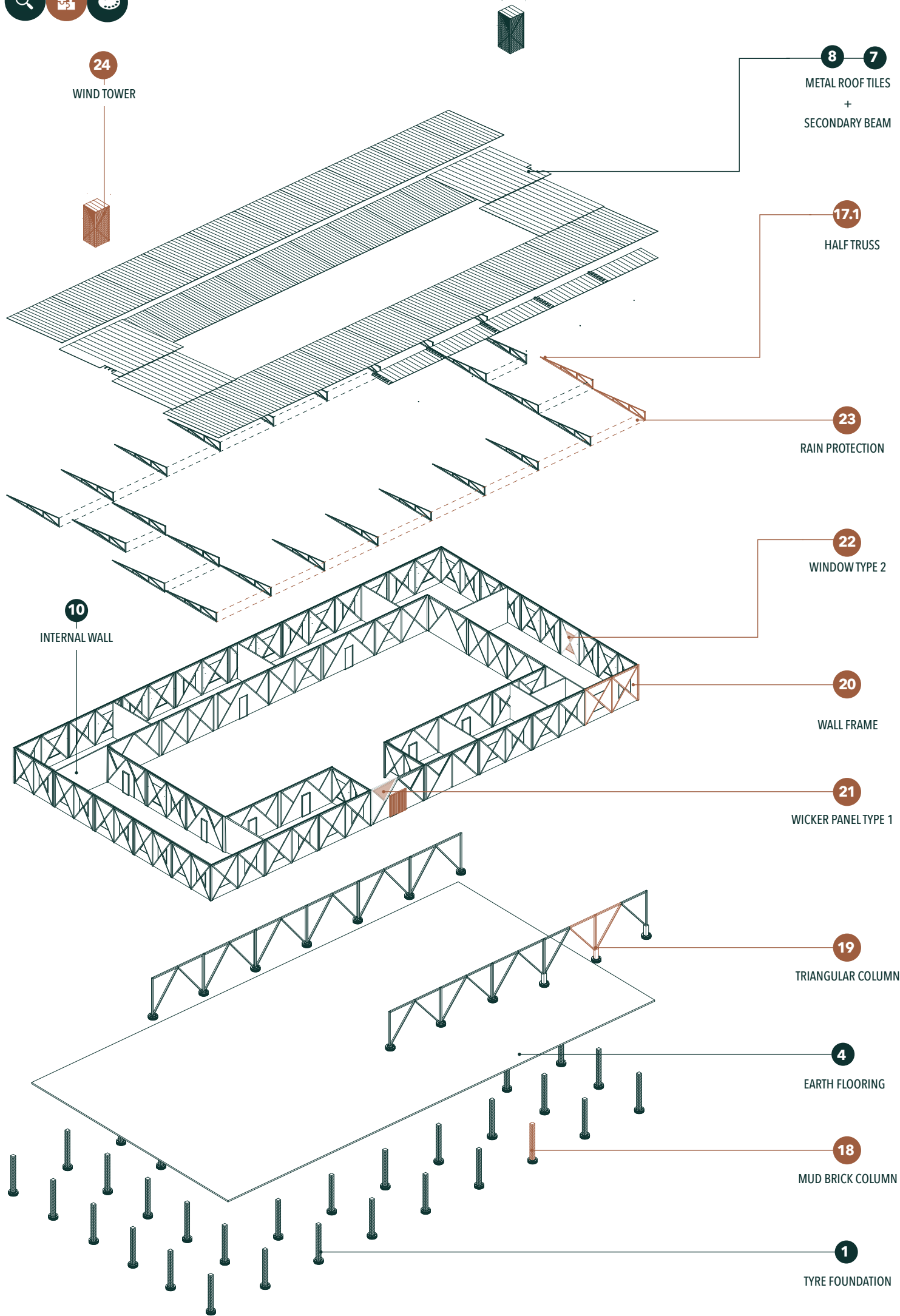
0m 5m



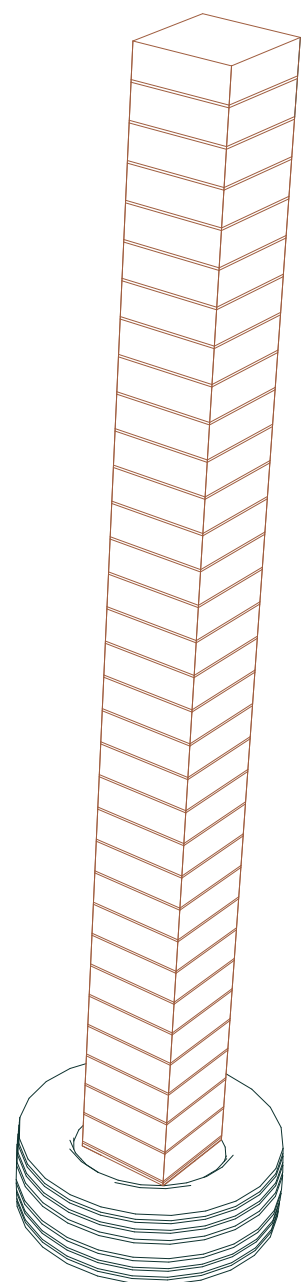
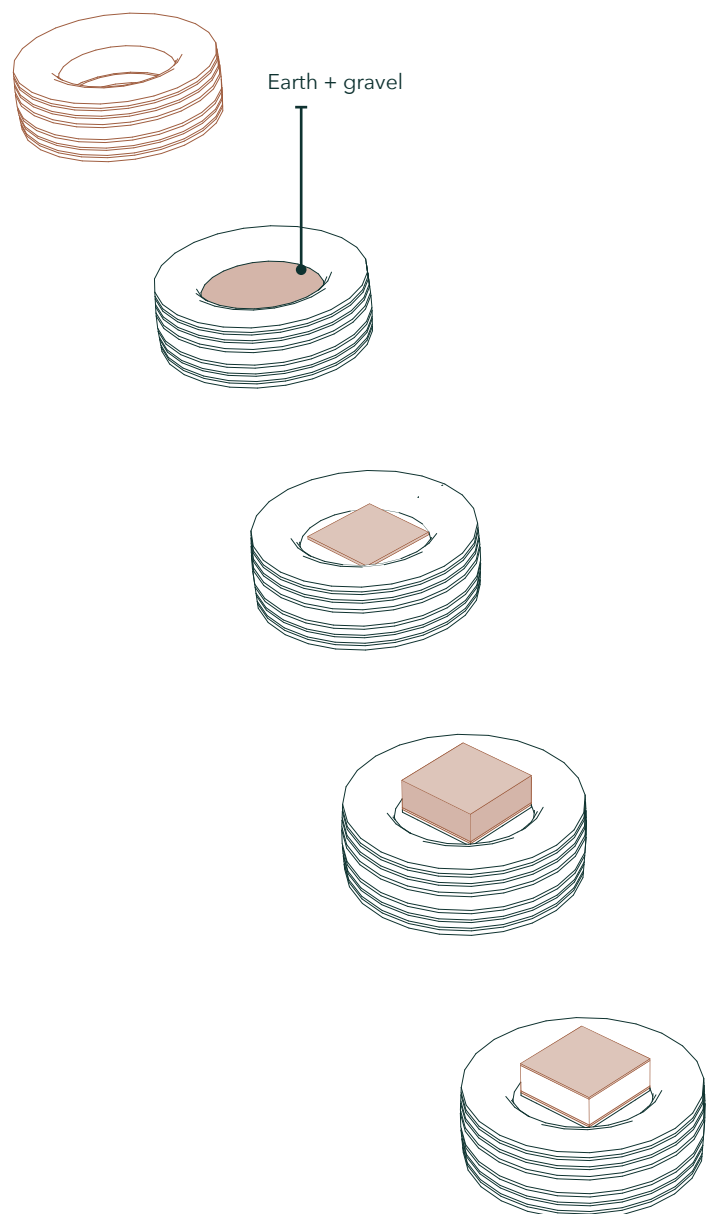
FACADE SOUTH EAST



SECTION BB



ASSEMBLY





ASSEMBLY

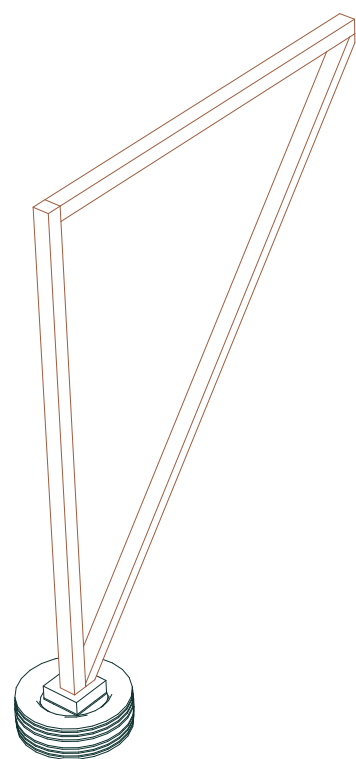
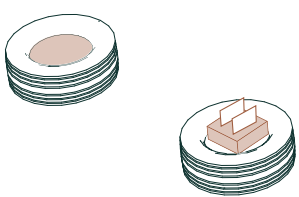
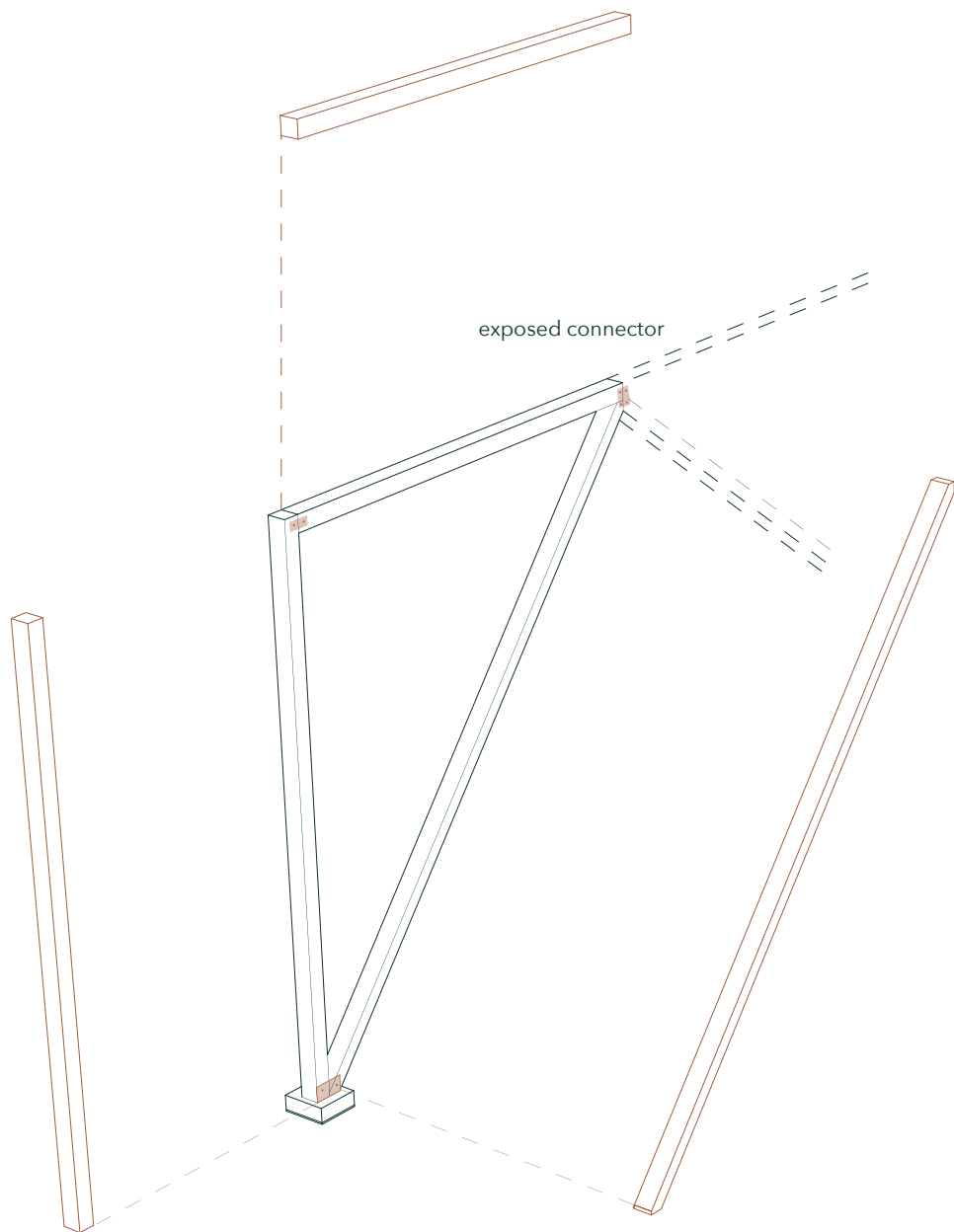
1

TYRE FOUNDATION

+

19

TRIANGULAR COLUMN



ASSEMBLY

17.1

HALF TRUSS

+

23

RAIN PROTECTION

+

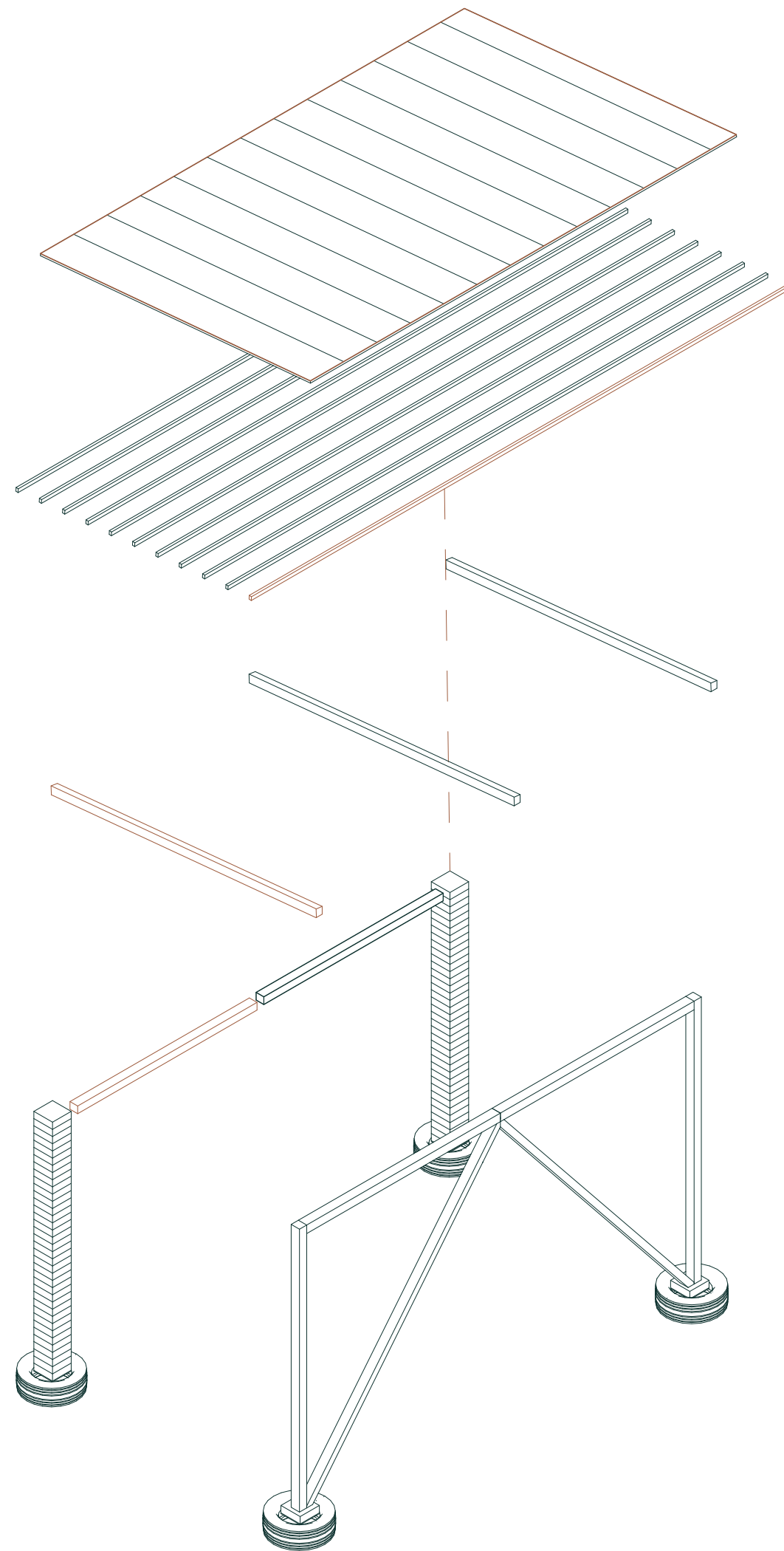
7

SECONDARY BEAM

+

8

METAL ROOF TILES



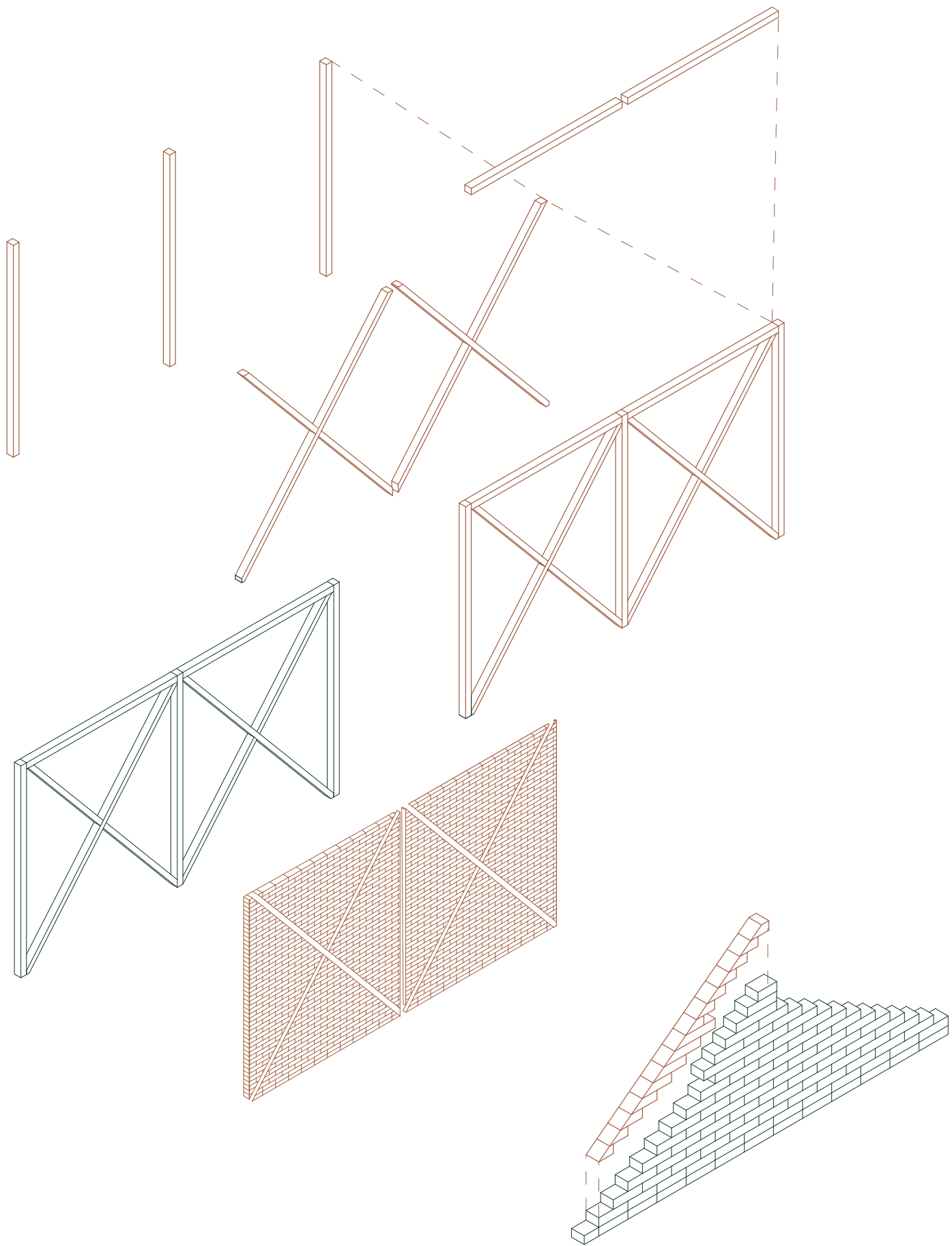
ASSEMBLY

20

+

MUD BRICK WALL ADAPTATION

WALL FRAME



ASSEMBLY

20

+

21

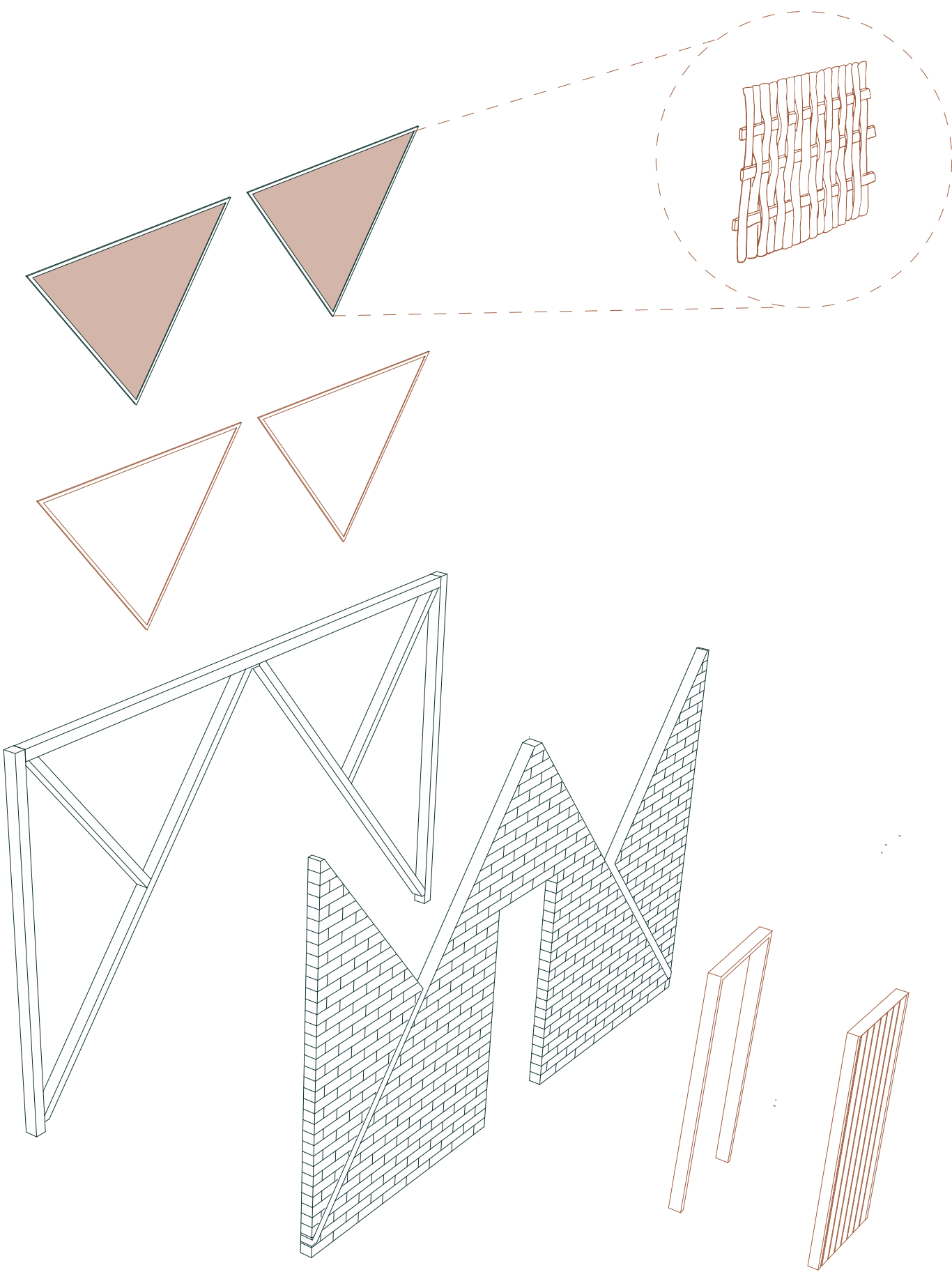
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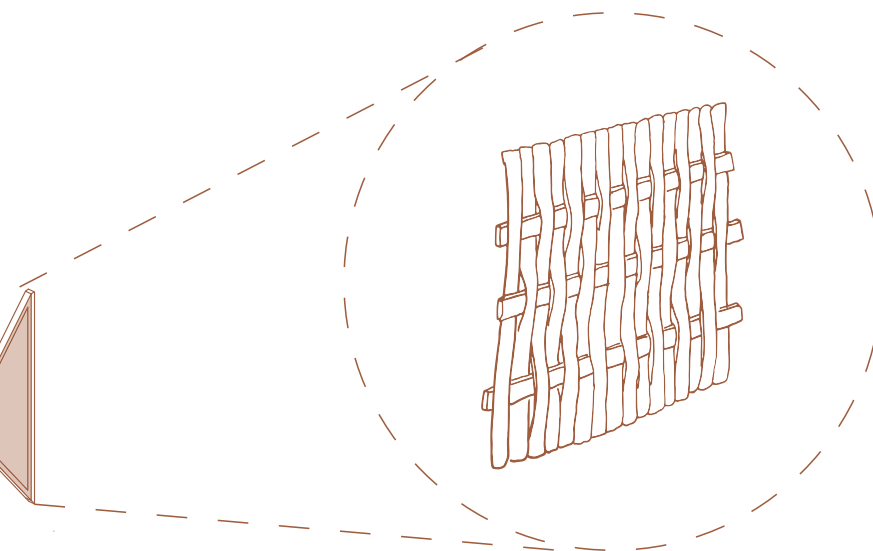
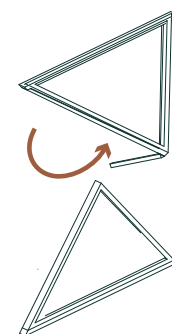
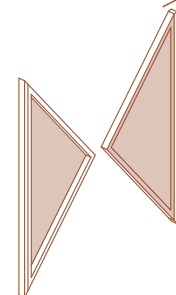
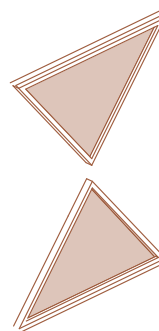
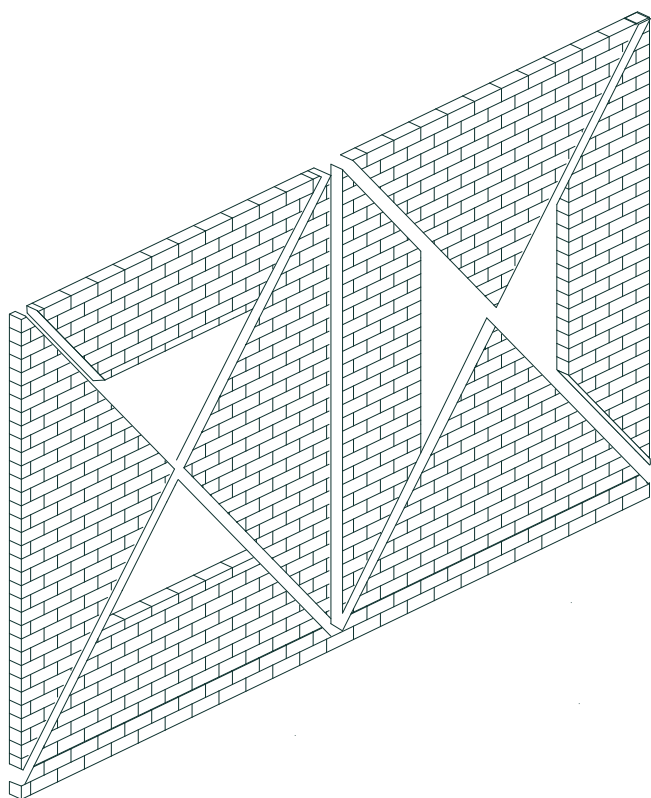
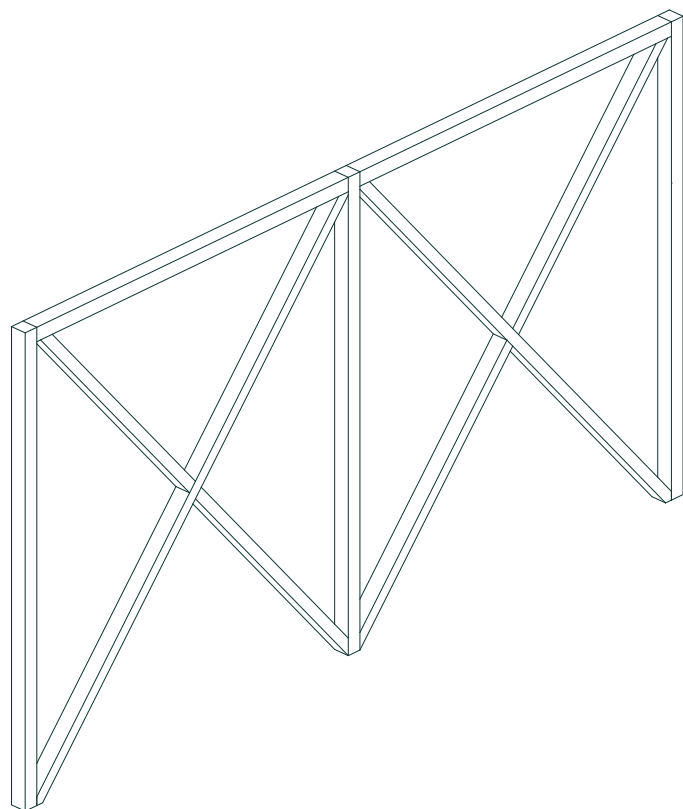
13

WALL FRAME

WICKER PANEL

WALL FRAME







ASSEMBLY

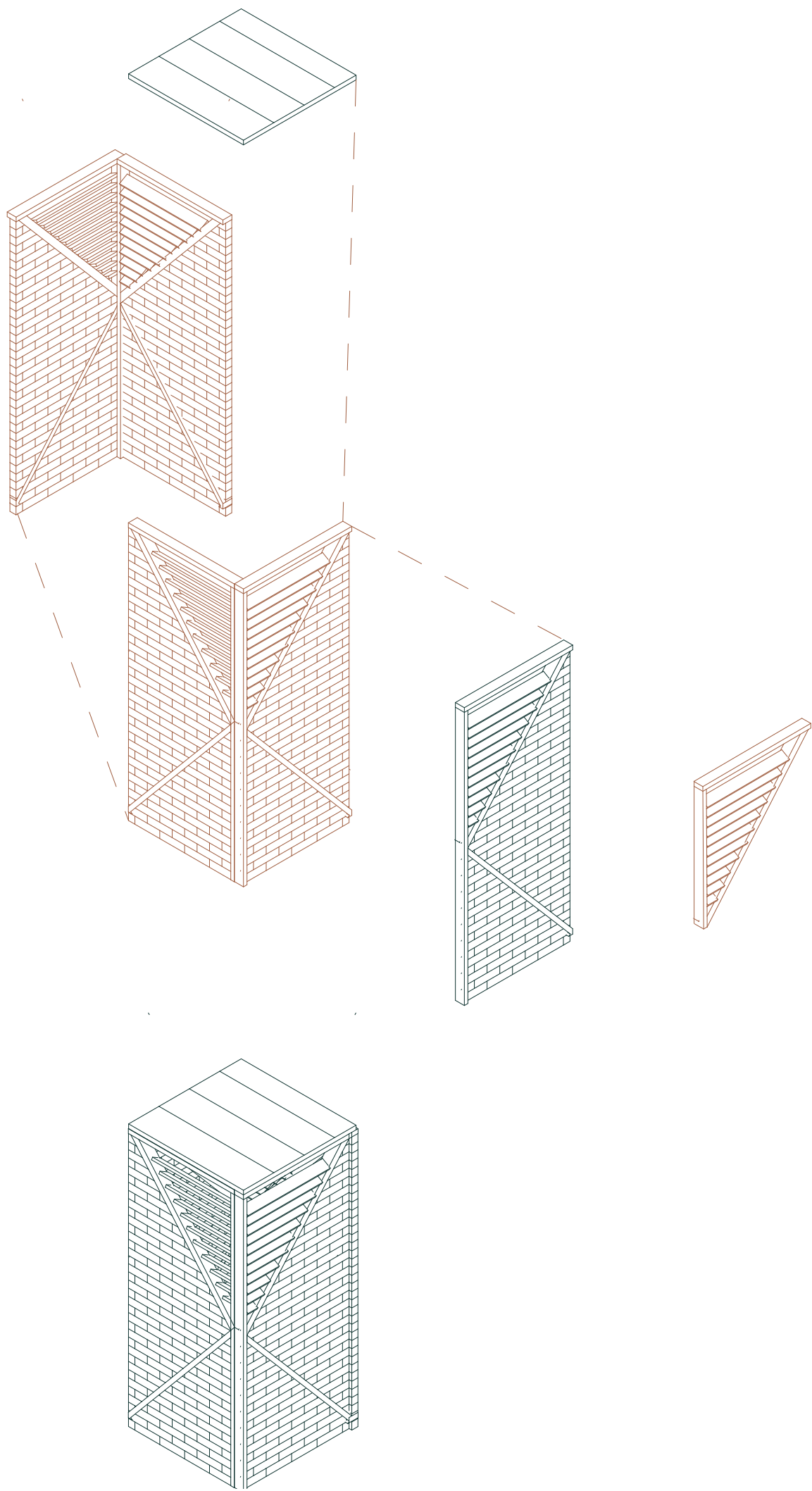
24

WIND TOWER

+

23

RAIN PROTECTION



ASSEMBLY

17.1

HALF TRUSS

+

23

RAIN PROTECTION

+

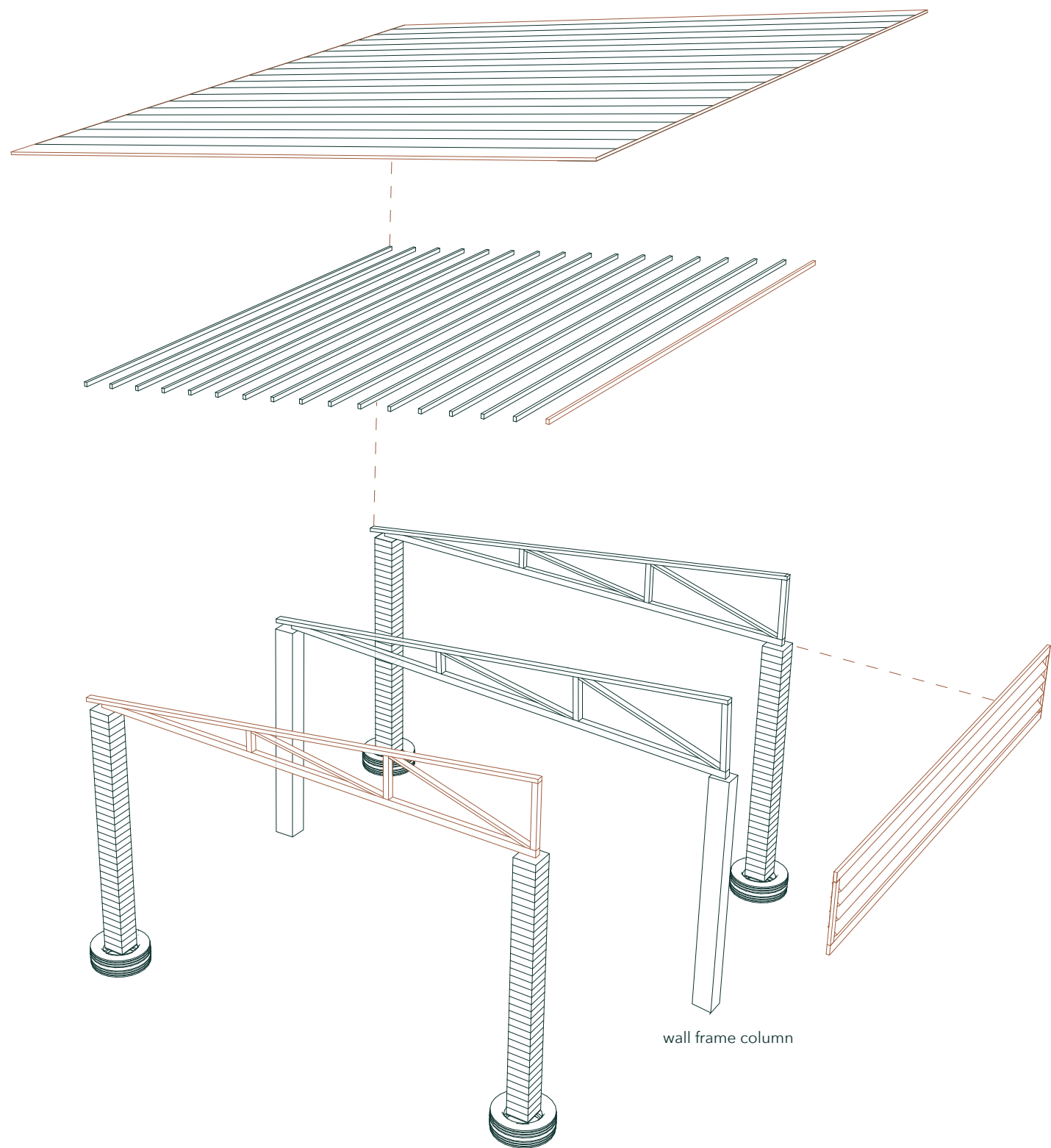
7

WALL FRAME

+

8

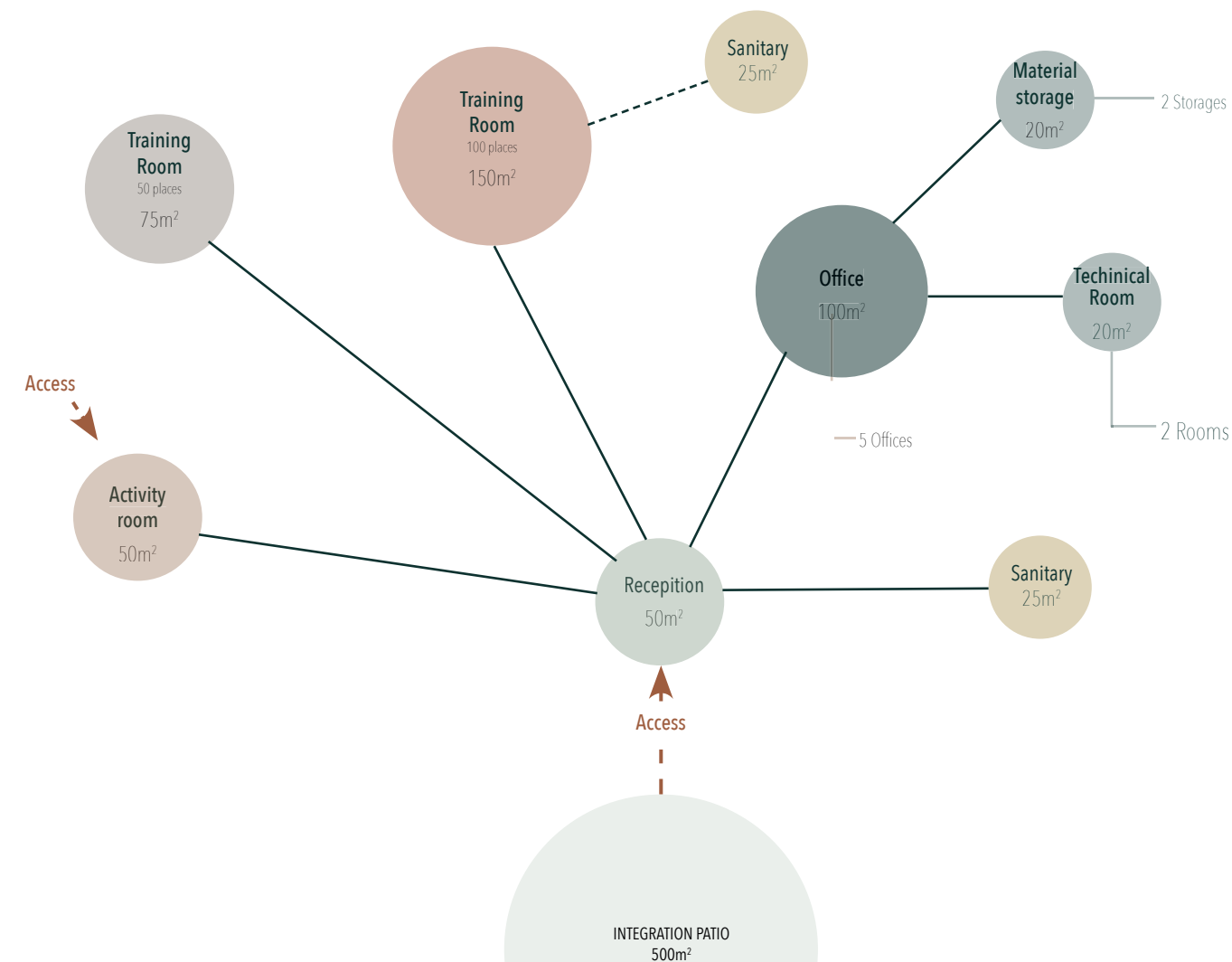
METAL ROOF TILES



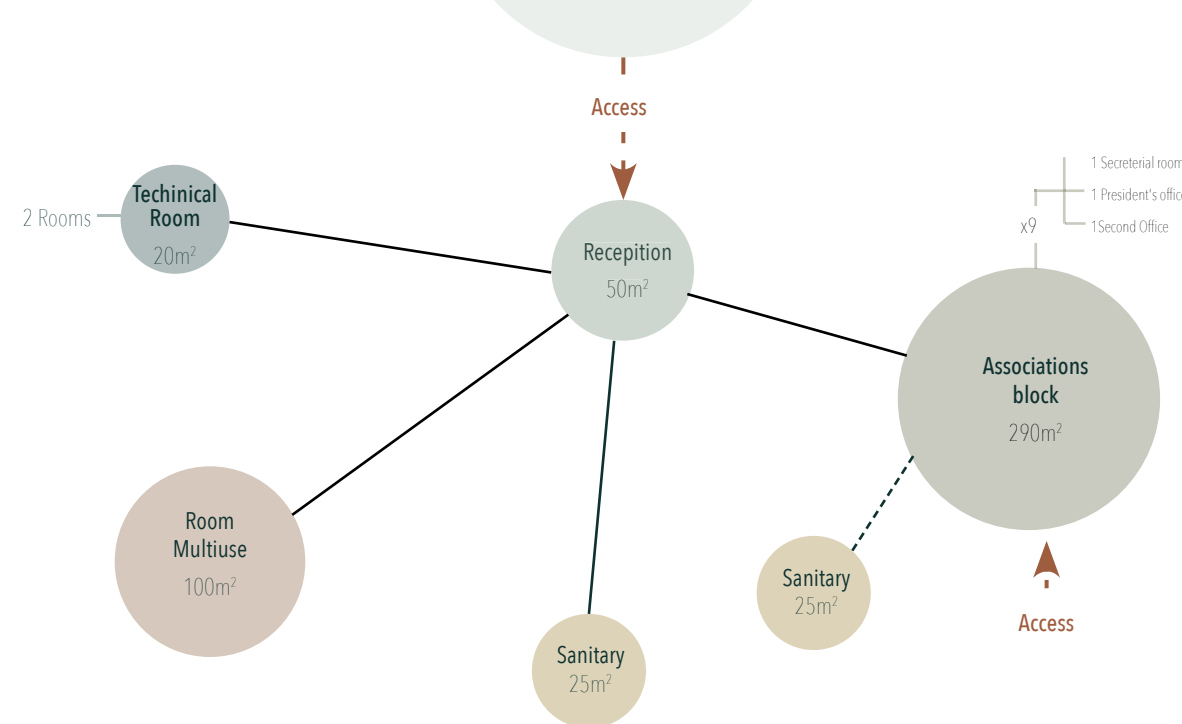
wall frame column

DISTRIBUTION STUDIES

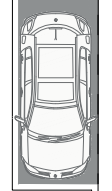
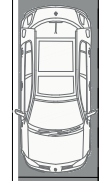
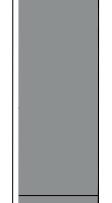
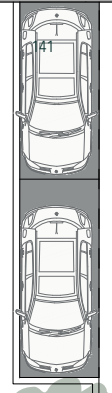
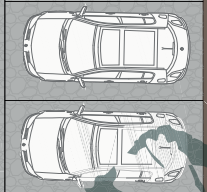
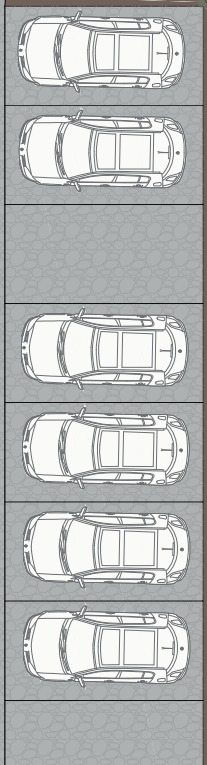
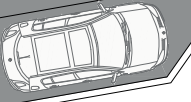
5.1 Women's House block
515m²



5.2 Social Center block
510m²



5
WOMEN'S HOUSE AND ASSOCIATIONS



+0,5

UP 5%

UP 5%

+0,05

0,0

+0,05

ASSOCIATIONS ROOM 1
30m²

ASSOCIATIONS ROOM 2
30m²

ASSOCIATIONS ROOM 3
30m²

ASSOCIATIONS ROOM 4
30m²

ASSOCIATIONS ROOM 5
30m²

ASSOCIATIONS ROOM 6
30m²

ASSOCIATIONS ROOM 7
30m²

ASSOCIATIONS ROOM 8
30m²

ASSOCIATIONS ROOM 9
50m²

TOILET
25m²

TOILET
25m²

MULTI USE ROOM
100m²

TECH ROOM
10m²

TECH ROOM
10m²

RECEPTION
50m²

RECEPTION
50m²

TOILET
25m²

TECH ROOM
10m²

TECH ROOM
10m²

TOILET
25m²

STORAGE ROOM
10m²

STORAGE ROOM
10m²

TRAINING ROOM
150m²

ACTIVITIES ROOM
50m²

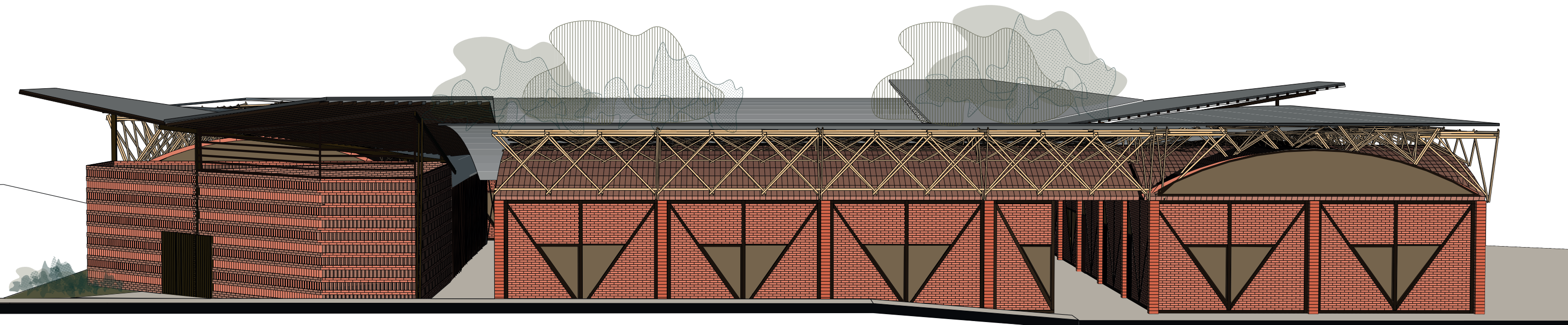
OFFICE
100m²

TRAINING ROOM
75m²

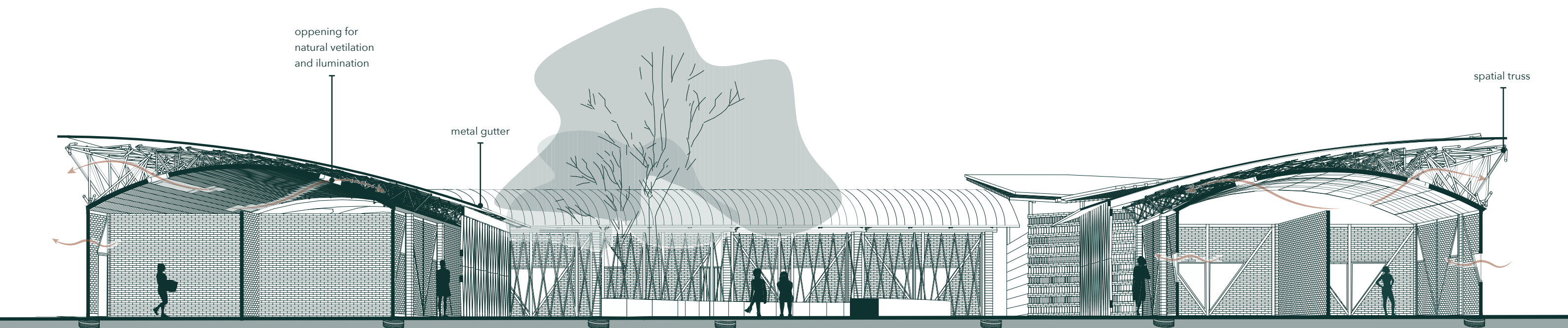
INTEGRATION PATIO
500m²

Ground floor
550m²





FACADE NORTH EAST

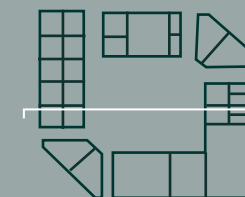


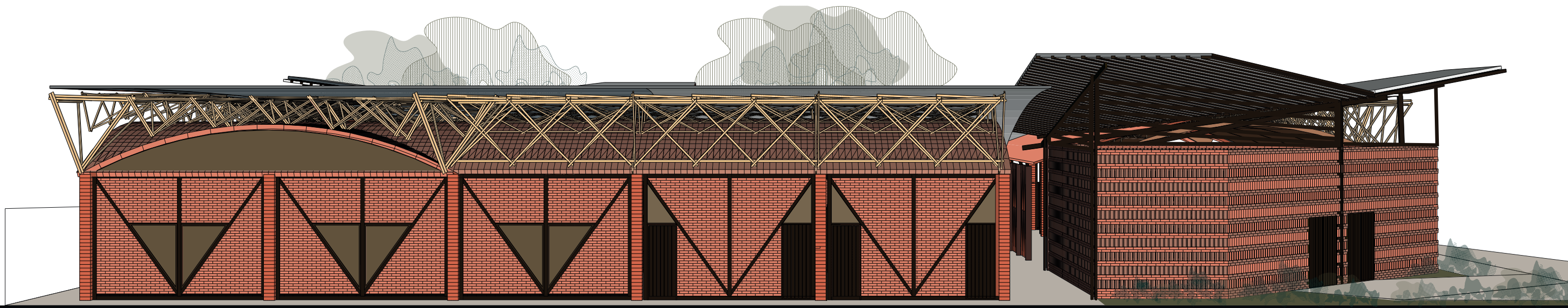
opening for
natural ventilation
and illumination

metal gutter

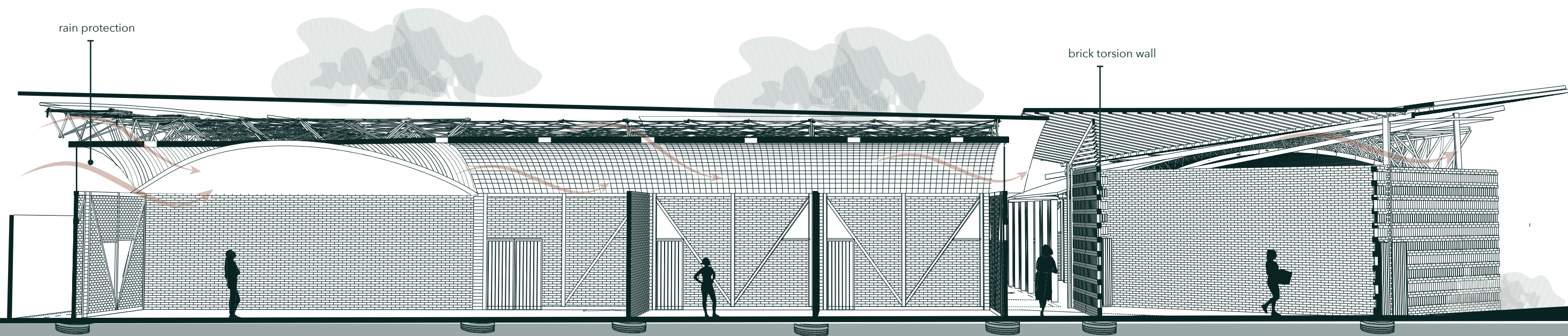
spatial truss

SECTION AA

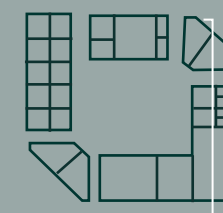


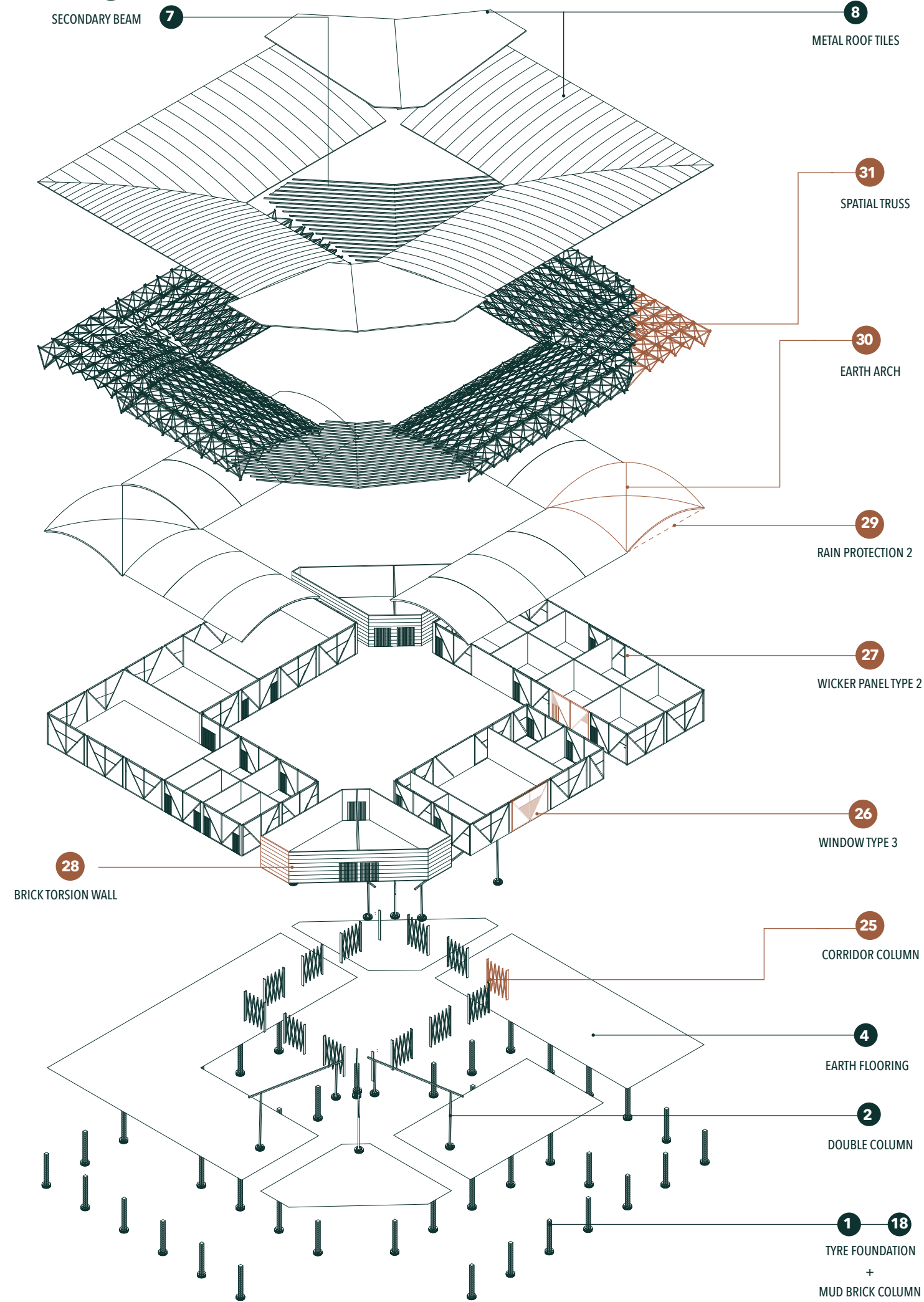


FACADE NORTH WEST

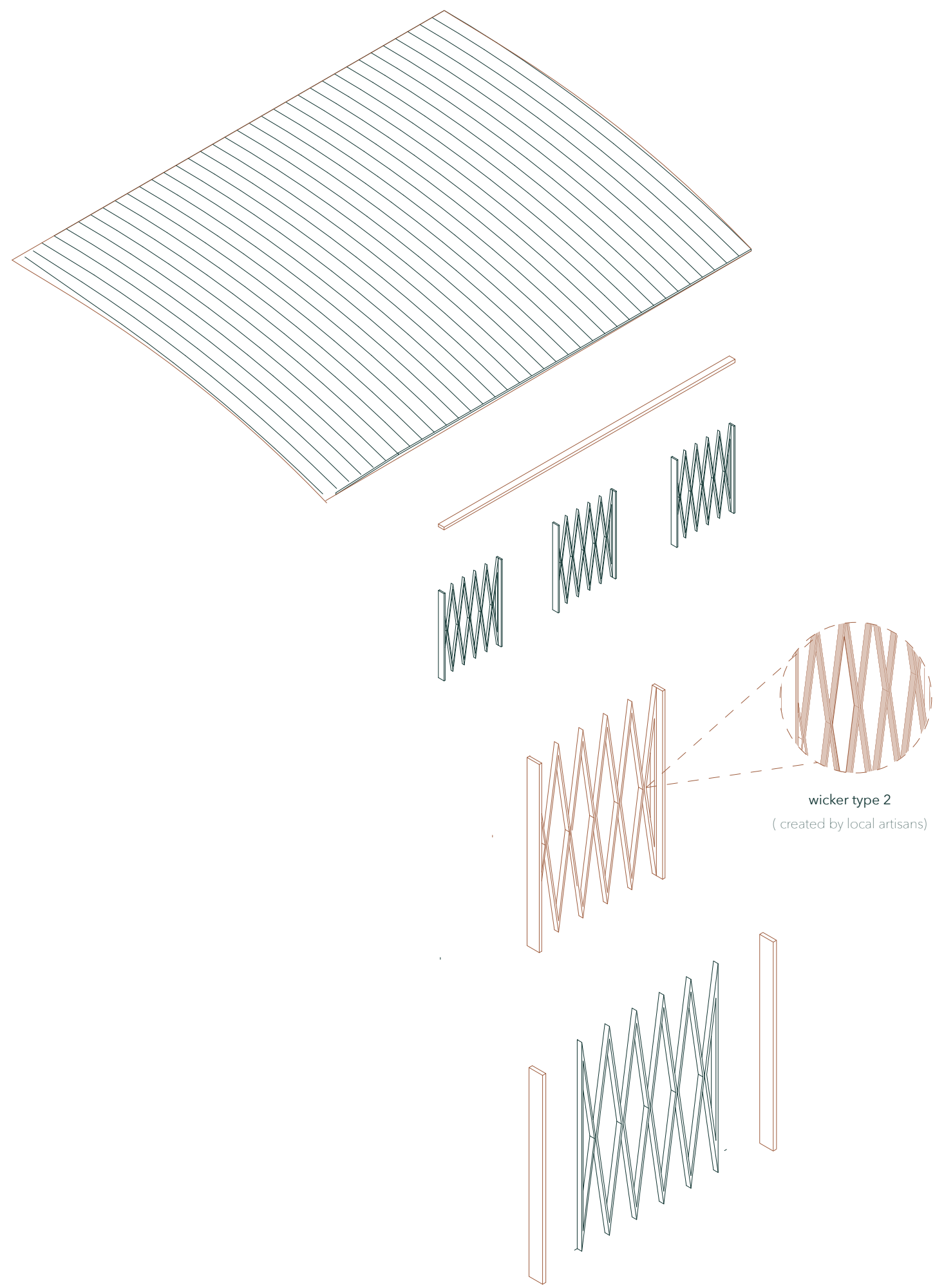


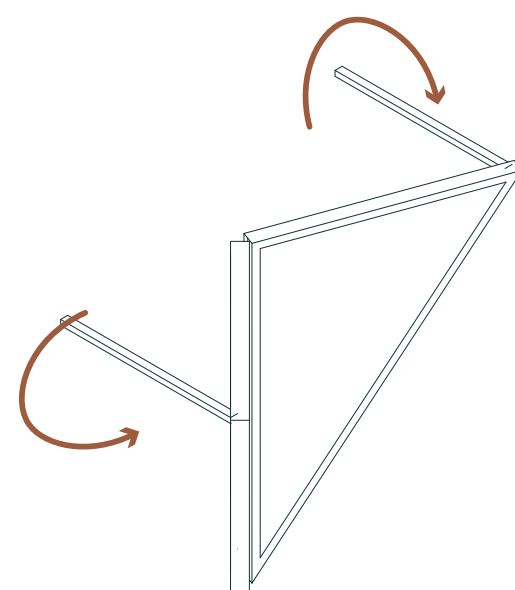
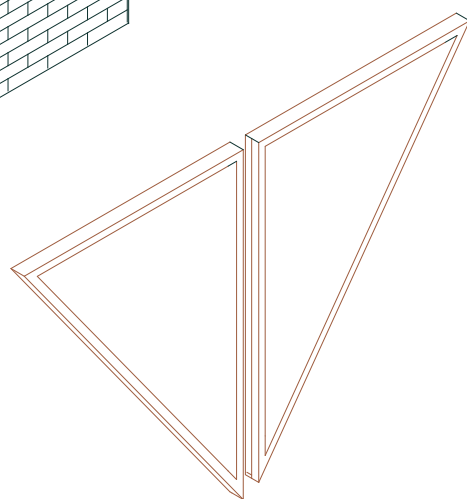
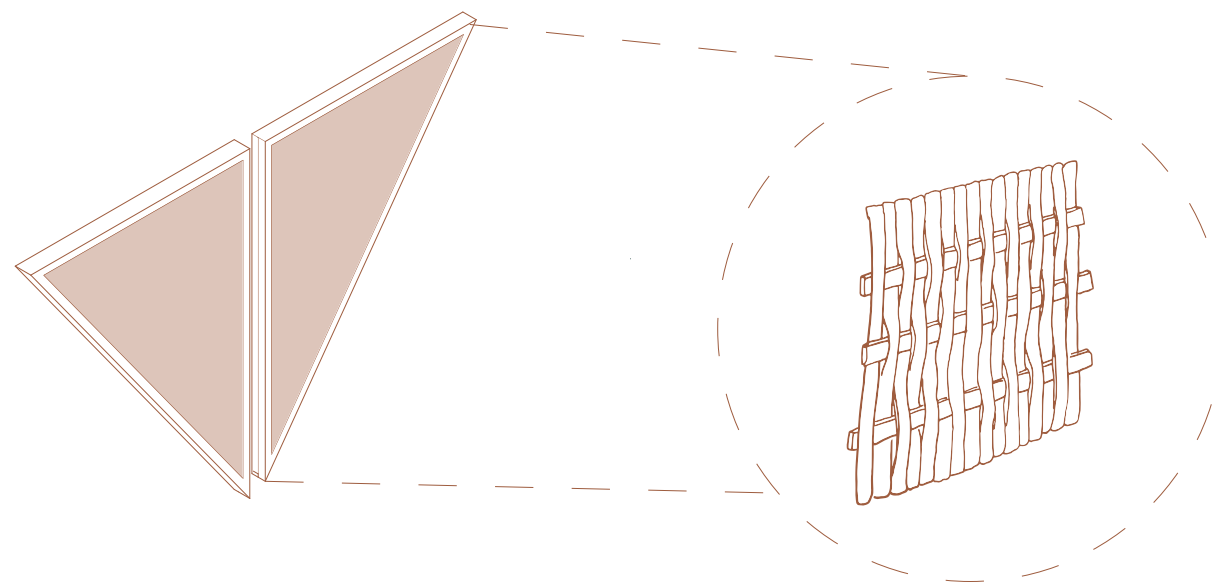
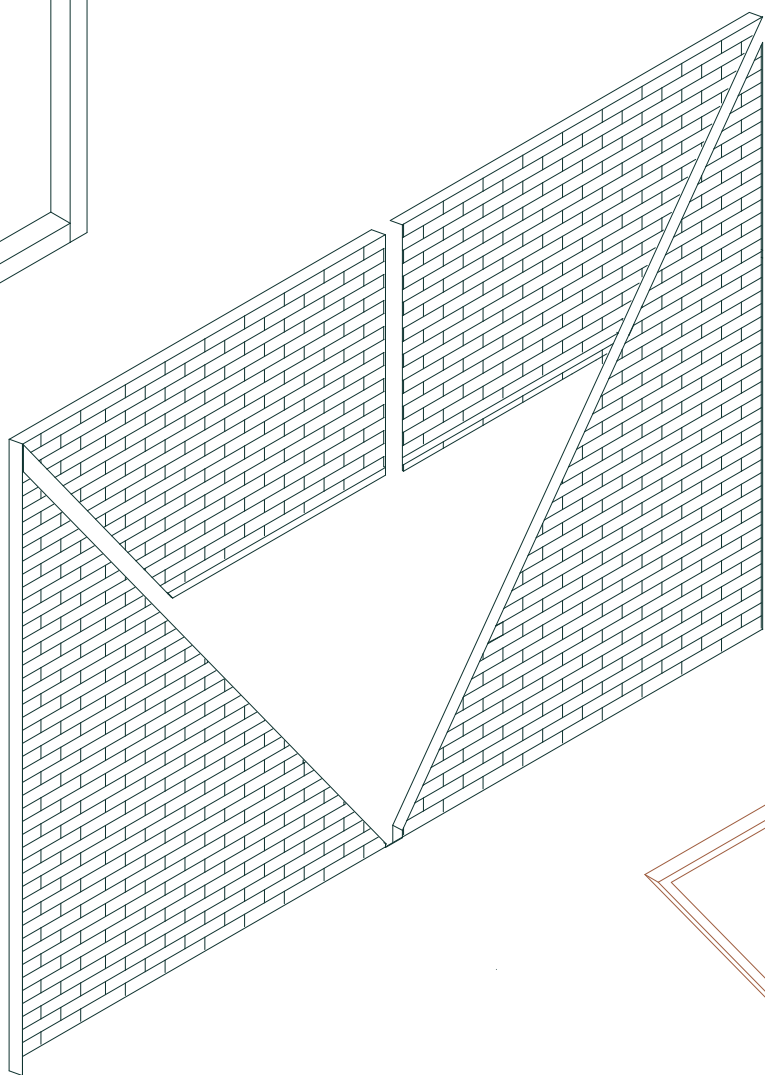
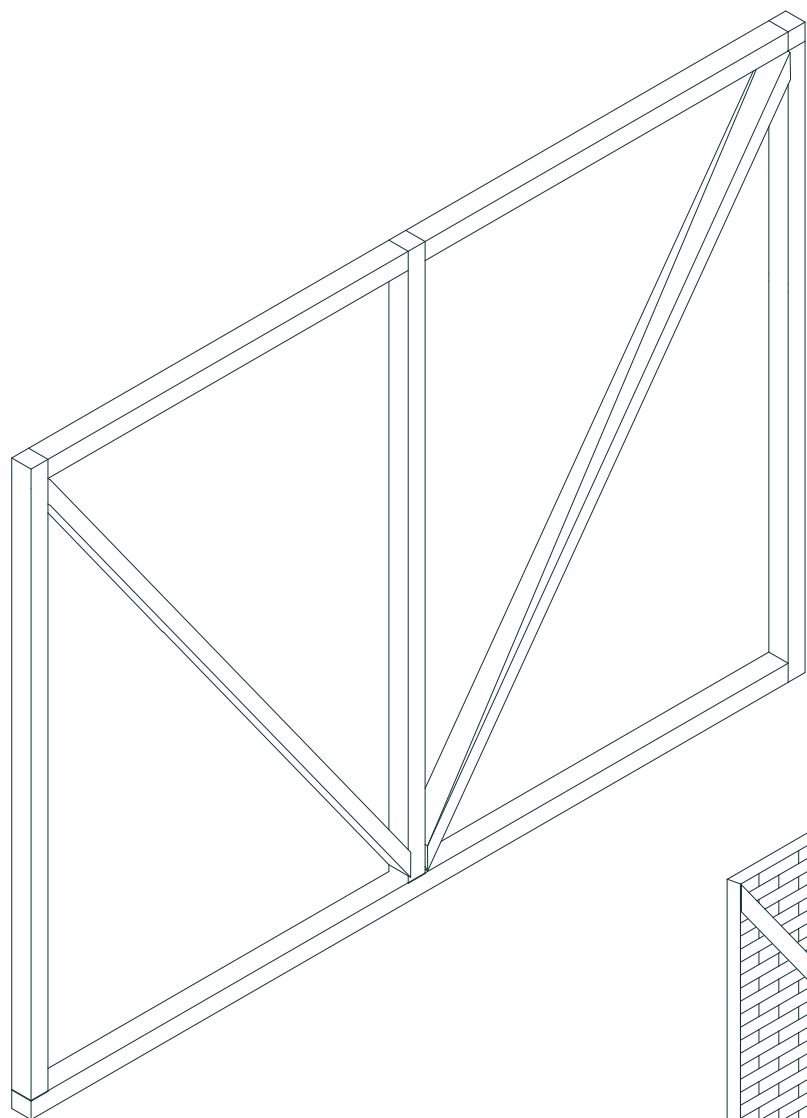
SECTION BB





ASSEMBLY





ASSEMBLY

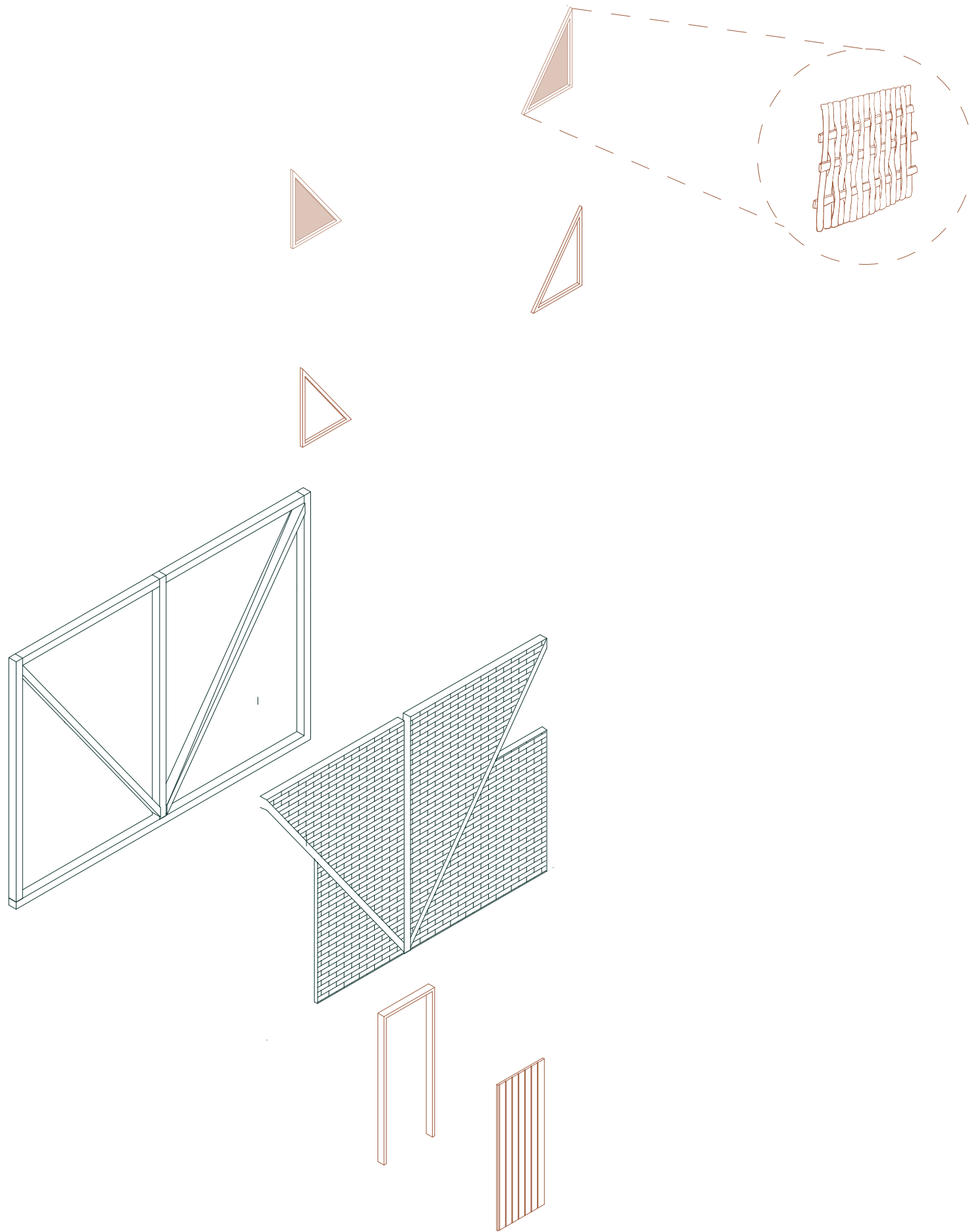
20

WALL FRAME

+

27

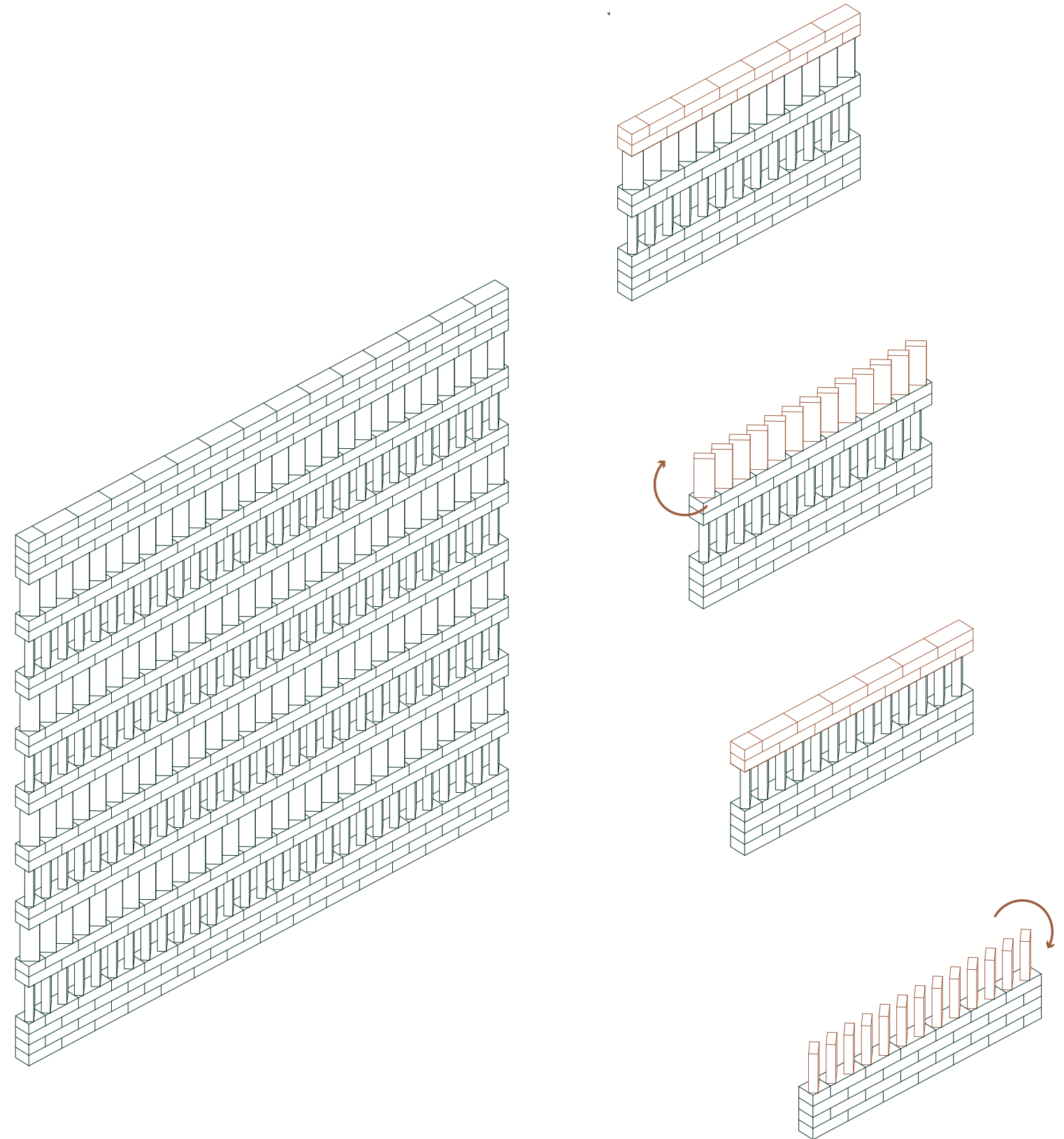
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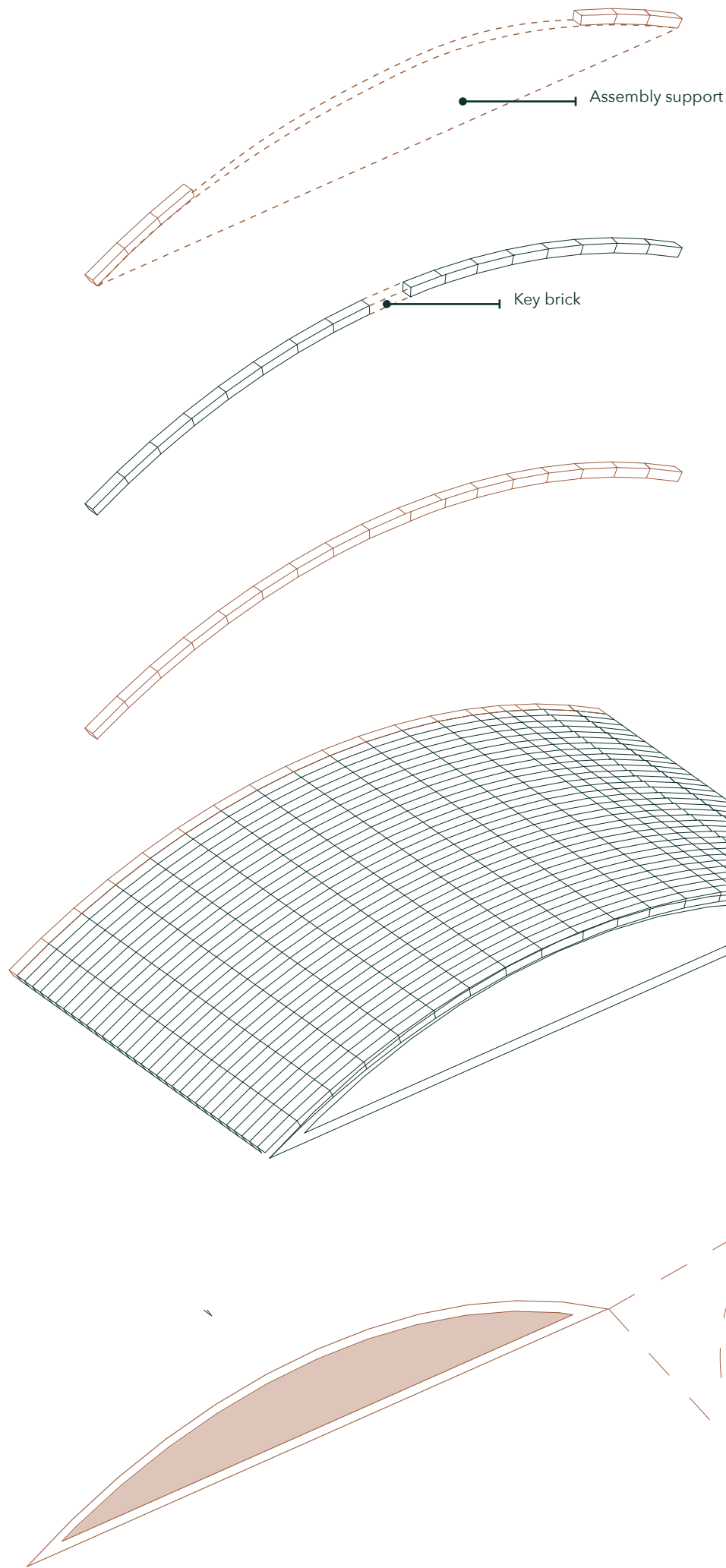


ASSEMBLY

28

BRICK TORSION





ASSEMBLY

30

EARTH ARCH

+

29

RAIN PROTECTION

ASSEMBLY

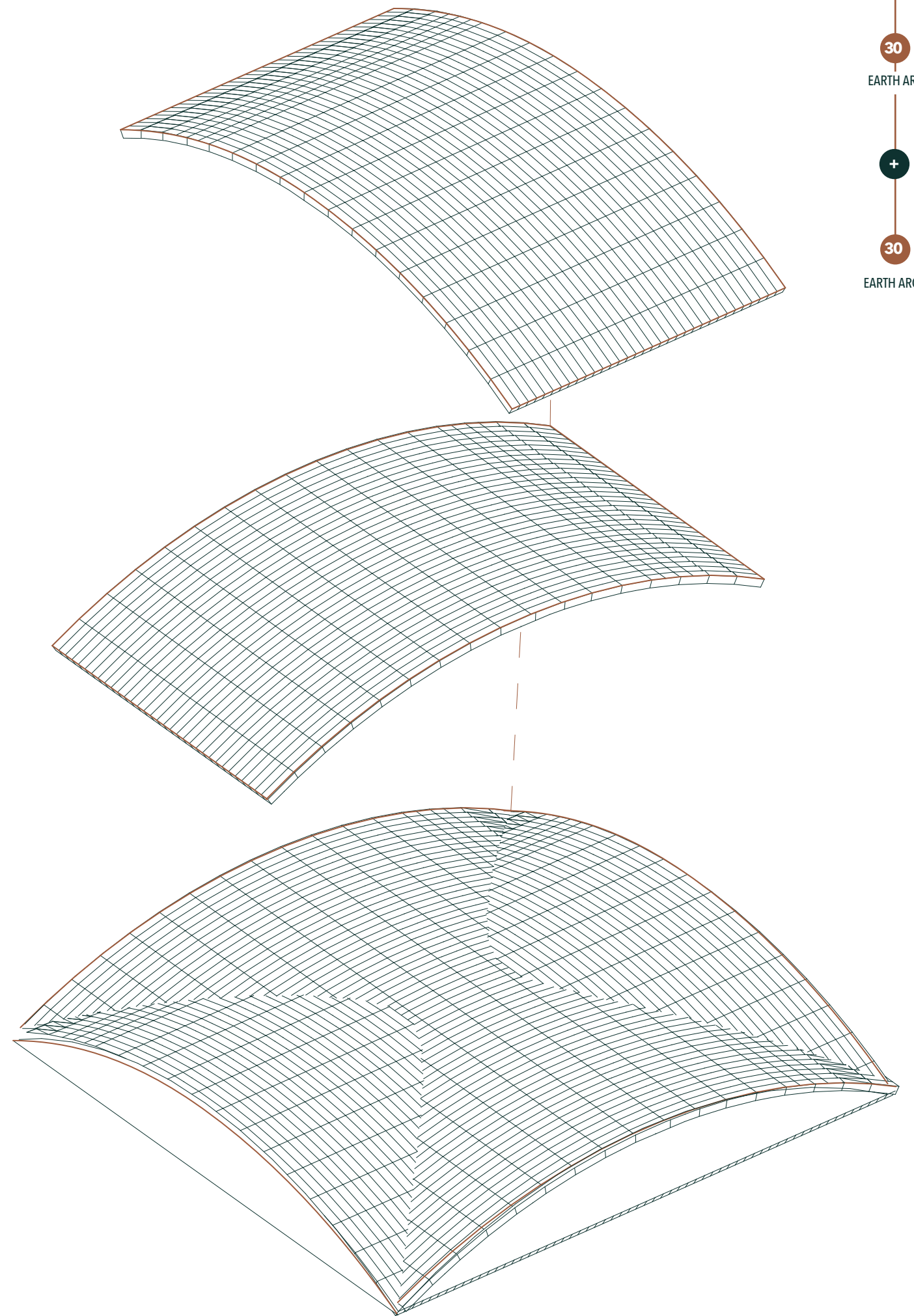
30

EARTH ARCH

+

30

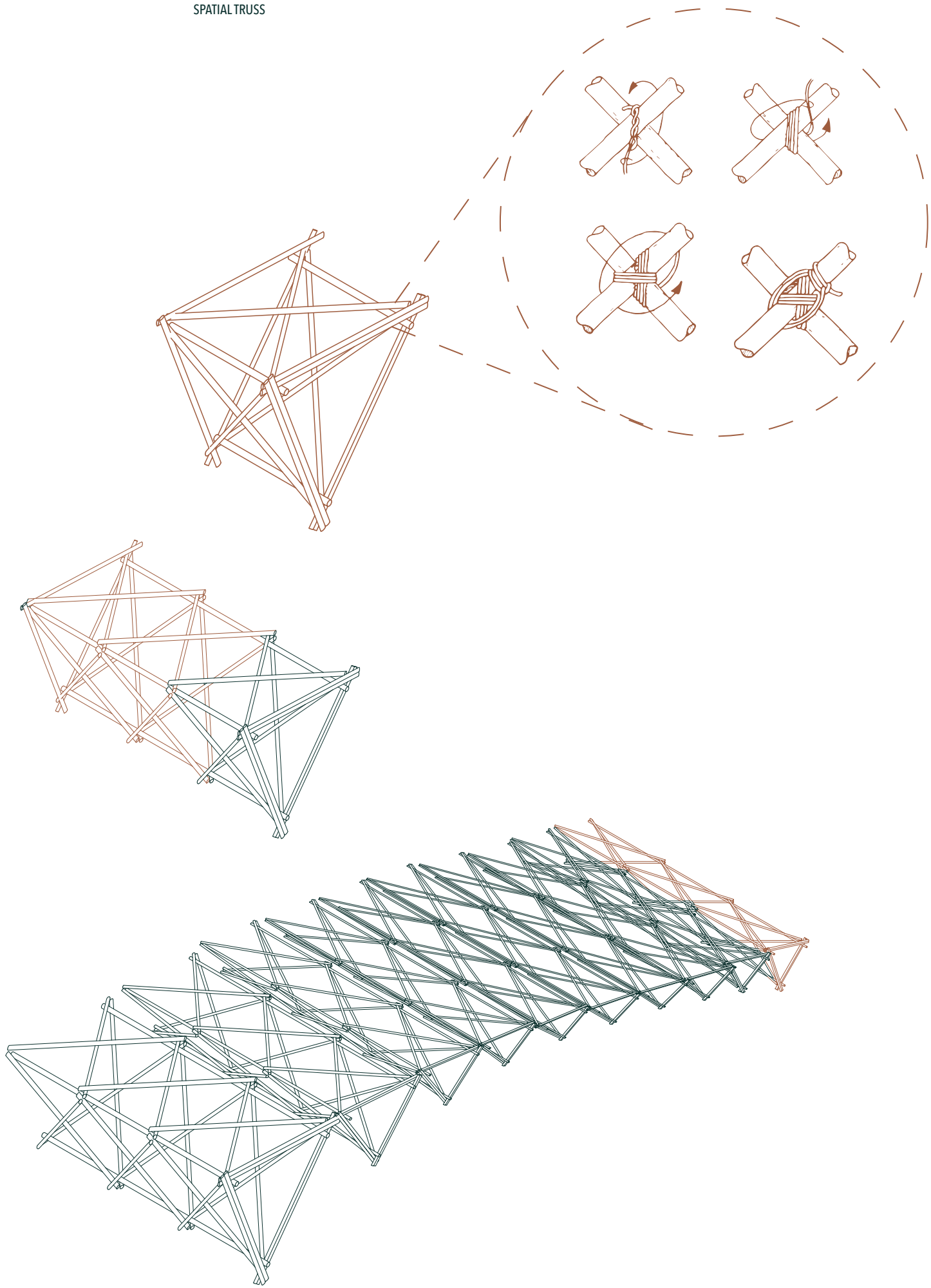
EARTH ARCH



ASSEMBLY

31

SPATIAL TRUSS



ASSEMBLY

30

EARTH ARCH

+

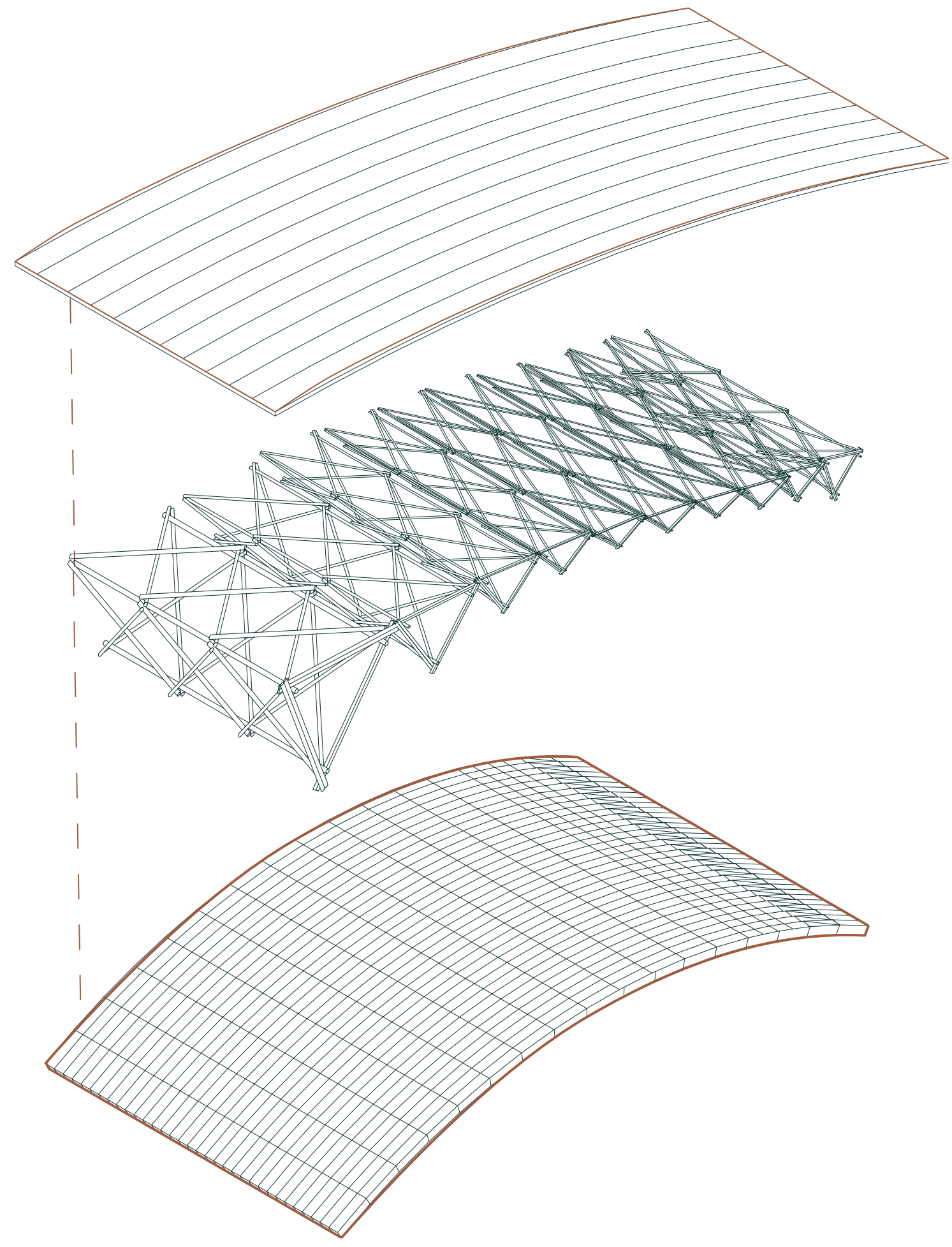
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SPATIAL TRUSS

+

8

METAL ROOF TILES





VIEW: Courtyard, School

The informality of African city centers requires special consideration of the urban environment. The thesis intends to fulfill the distance between the **ARCHITECTURAL** production and the **INFORMAL** industry. The Project of the Bouaké City Center Commercial zone, In Ivory Coast, is entirely dedicated to informal commercial business.

By analyzing the Project's reports, the socio-economic conditions of the area, and referring to **ADAPTATIVE PRINCIPLES**, this Project aims to transform architecture into a social enhancement tool. By enabling the approach of low technology to be used as an educational tool, it aims to result in a project capable of positively impacting the social, economic, and sustainable areas.

The intervention addresses the areas classified with the most urgent needs. The response to each need and local contextualization was based on the social strategy to put together self-construction and education, resulting in the **BOUAKE WORKSHOP PROGRAM**. The sustainable strategy derives from the social one and reflects on the design attempt to achieve natural ventilation with its opening and the materials choices.

The use of bio-based materials is also the economic response to the study of the life cycle of the building. In addition, regarding the stakeholder's analysis, self-construction was identified as the tool to bring **POWER** to the interest group. Considering the local sources of material and the local sources of labor, the choice of the material is the factor that guides the study of possible techniques to be applied in the Project.

The workshop proposal contemplates the **TECHNICAL CHOICES** chosen as appropriate to the progressive development of the building. In each technique applied, the group select to participate will acquire new abilities and increase their knowledge. Divided by phases, the Project brings flexibility and adaptability through time.

The outcome of the Project is summarized in the **SKILLS AND SOCIAL ENHANCEMENT** acquired by the local community. By the end of each building, the participants will acquire construction skills progressively the most specialized ones. With its success, the phases can go through, and the program can be applied and improved to the following vacate sites of the area by the own participants.

VI. FINAL CONSIDERATIONS

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** The figures for the project representation not present in this list were made by the author*

1. It is expected that a dozen sites in the city center will be freed from any occupation thanks to the construction and opening of the three reception sites (central market, MGBextension and CNRA wood zone). What would be the level of priority for intervention of these sites?

It has to be mentioned Pourtours, STM and Blédou have been freed for the need of the construction project. Vendors have been mainly replaced within a new place not indicated on the map, named Face Total, East of the Google area below.

The first priority is to move from where they are today the vendors of: Indigo, Boucherie / Vox, Face Total (the land plot is leased by the municipality) and part of Bromakoté (fresh products sold at retail level). Those priorities are justified by the situation of those places (along the A3, need for urban renewal), the land status (Indigo is a private owned land) and also the types of products (needed to be found within the new central market place).

The Municipality informed us recently they would prefer to favor “Poisson” and “Belleville”, more than Bromakoté ... Discussions are on-going.

Figure 8. Carte des sites occupés à libérer et à reloger en priorité dans le futur marché central totalement ou partiellement



- 1.2 Which would be the main places of intervention? We have discussed about the Poisson, Indigo and the Boucherie Market, Is there more important ones? See point 1.1 above
2. On the official reports it is shown the numbers of traders, the number of places on the market's project. It will have more spaces than the number of trades, for the expected growth. Does all the people from these areas will be relocated to the Official Market? It would need a bigger space eventually? The decision to be replaced within the GMB will be under the control of the vendors themselves. No mandatory. But, the idea is to give them the choice to move to GMB or to move to another market outside the central commercial zone, in order to release

the land plots and to develop other facilities (community facilities for Poisson/Belleville/Bromakoté, or business/commercial ones for Boucherie/Vox).

3. About the relocation of the bulky areas to the CNRA location. Would the traders accept these chances? Would there be any incentive plan to make them to move there? They have accepted to move to CNRA and to waive their current location, to one condition: to move all together. We are working on it. They will pay key money to get their place in CNRA and they will build by themselves their hangar. It is the option they prefer.

3.2 What about the access and transportation to that area, is there a plan to improve these aspects? No need. Very easy: along the A3. Clients are motorised.

4. Would the community, mainly the ones that will be relocated to the CNRA areas, be interested to learn simple construction techniques? Apparently, they have long tradition of self-construction. The hangars are not closed and functional for storage, and easy sale.

5. Does the only activity present in the site (the Poisson, Indigo and the Boucherie) is the market or it has other functions/activities? No other activity.

5.2 The report explains the component 4 as a promotion of different sites and function:

- M'bahiakro station, at the head of Bromakoté Market
- Development of the Marigot Koko and its surroundings;
- Rehabilitation of the Municipal Foyer;
- Women's house and associations, daycare and school kindergarten

(Lot Marché Poisson);

- Media Library (Lot Belleville Station)

Would it be possible to rank these proposals in terms of importance and priority? Those are not funded by the project. The Municipality would like to find additional fundings in priority for Women's house and associations, daycare and school kindergarten (Lot Marché Poisson), Media Library (Lot Belleville Station), Rehabilitation of the Municipal Foyer

5.3 Is there any pre-defined public need? Maybe for example: public buildings, school, hospital, sports activities, parking, central transporting station. The level of service is rather low. But the main function of the area is commerce. Main community facilities planned by the municipality are the one listed just above.

6. Do you think the construction creates a gentrification risk? Would there be people who could be excluded? No regarding the low level of community services in this area.

6.2 The scoping report had proposed to retain three objectives for the Development Project of the Bouaké City Center Commercial Zone: (i) Modernize the city center, (ii) Upgrade the commercial functions which make Bouaké rich, (iii) Develop the Project in partnership with economic operators. Do you think that

with these objectives the client would be interested in the social approach? Not sure to understand the question. Social is a central focus of the project, as the vendors are the beneficiaries of the project.

7. Does the site belong to the government? Yes, to the municipality, after a long administrative process ...

7.2 The municipality will endeavor to create levers allowing the private sector (owners, investors) to contribute to development of the downtown shopping area. With this information, what areas would be destined to the private sector? Would they also be a potential client? Main areas will be along the A3: Boucherie/Vox.

8. How does the construction law work in Côte d'Ivoire? Are there any specifications/ rules that I need follow? Or a place that I can search for it? No Building Code for now. Under preparation. Main specifications are regulated by circulars based on the Planning Code.

8.2 Does the city have a master plan to be followed? Yes. Approved in 2017. We can provide it.

9. About the actors to be considered on the program. Would it be the same as the Markets one: funding donor - Agence Française de Développement; Contracting Authority Delegate- Mairie de Bouaké; The Client-République de Côte d'Ivoire and the public? Not sure to understand the question.

10. About the public profile, it is possible to search the demographic data of the Côte d'Ivoire in general. As the density, population Pyramid, fertilities. And some economical rates, as the unemployment Gross Domestic Product (GDP) growth. Would the city of Bouaké, of the region of the market have any particularities? General macroeconomic data are available through the World Bank, IMF, AFDB or national Institutions. The Master Plan provides some data on Bouaké.

10.2 In the report it is quoted a socio-economics survey that was made on the areas. Is there anything particularly important on the survey? Is there an analysis document about the survey? The results of the survey are presented within the reports. They are mainly quantitative

11. The social hierarchy, the cultural, psychological, behavioral and sociological aspects of the surrounding neighborhood are important for the program definition. How can you describe these aspects? Surveys have focused on merchants. The GMB' area of influence is not only neighborhood but all the region of Gbeke and further. The project will consist in improving but not change the standards of the vendors as of the clients.

12. Do you think that the project would be more feasible and easier to be financed if it is done in phases? The GMB will be delivered by block but entirely at the end of the day (30 months implementation).

13. Would a public, free circulation space, as for example parks and squares, be possible? How are the security issues on the place? The objective is to have a good urban integration of the GMB within the neighborhood (wholesale, parkings, services

etc.). Additional developments will be necessary all around. But parks and squares are not easy or recommended to develop close to a so big market-place.

14. About the urban infrastructure. The basic sanitation, sewage connection and water treatment and electric energy? Clarified and under control within the commercial area, in order to meet the needs including for water. Only real matter: solid waste.

14.2 On the urban infrastructural plans, it is possible to see that the main issues have been take care of. Because of the financial priorities some of the changes have been cut. Will then be done once theirs is more financial budget? Should I consider the site with these chances or not? The second phase of the project could consider development around the GMB and other market-places in the various neighborhood of the city.

15. It is possible to see that there is some station near the market. But how the public transportation works, how bus lines access there? Yes. Described in the SDAU and briefly within the diagnosis. New station planned North of the city, along A3.

16. The Association of African Planning Schools says that the informality of African cities needs to be taken in consideration on the urban environment. How can you describe the informality on the city? Huge subject. The entire project is dedicated to informal commercial business

17. Where can I find more fonts of research of the place? Most of the documents are in French. Not many recent sources. Depends what you are looking for more precisely

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- o BKE_180505_APS
- o AMOES_BKE_FAISA_20180521
- o AMOES_BKE_FAISA_Annexes_20180521_LT
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- o BKE_Rapport_Etablissement

The step-by-step explanation of the following techniques is a summarized way to represent the techniques and the simplistic way to thought in the workshop.

TERRAIN INTERVENTION:

a. TIRE FOUNDATION [30]

The low-tech solution found as reference to the foundation is composed only of scrap tires filled with compressed gravel. Both components are easily accessible in the area, as know the CNRA bois includes the activities of carpentry and wood marketing, repair and sale of motorized two-wheeler spare parts and sale hardware materials. So, the recycle of the tires that has proven especially necessary for the industry can be done on the same place they are thrown away.

The critical concrete lab developed the concept of single stepped footings for columns. The foundation includes a socket which joins it with the wooden column, the connection is important to align the structure.

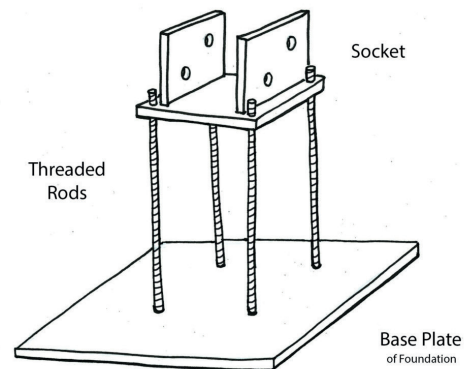
List of tools needed in the progress:

- welding machine,
- crowbar,
- grinder,
- hammer,
- wheelbarrow,
- bench drill,
- shovel,
- cutter.

STEPS

1. Verify for the soil to have the sufficient bearing capacity. If it is not suitable there are possibilities like reinforcing the soil, digging deeper, or adapting the foundation type to a wider tyre.

2. Preparation of the base plate with 4 threaded rods on the center with the measures of the socket.



3. To fill the tyre:
It can be made with only earth or with gravel.

1. First fill the tyre can with a shovel and by hands.



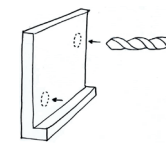
2. When it is not possible to get any more of the mix in, a crowbar and a piece of wood can be used to open the tyre

3. Once held open, a second person can continue to fill up the space with the mix. A piece of wood can be used to shove the mix in as deep as possible and a hammer to compress it.

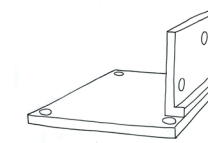


4. Installation of the socket

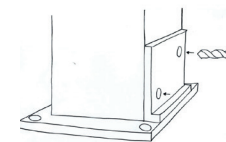
1. Make holes in the brackets



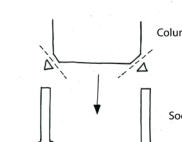
2. weld the first brackets on the base



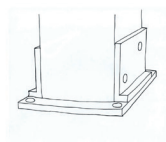
3. mark the position of the holes on the column



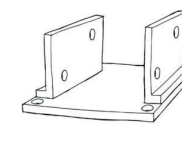
4. cut a little edge of the column to fit



5. find the right position for the second bracket



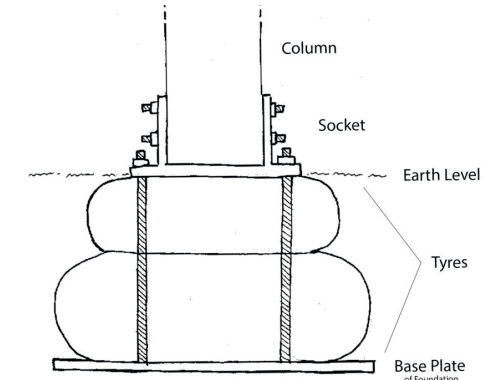
6. Remove the column and weld the second bracket



5. Submerge the foundation in earth and check the levels



6. Install the columns



b. TIRE CONTENTION

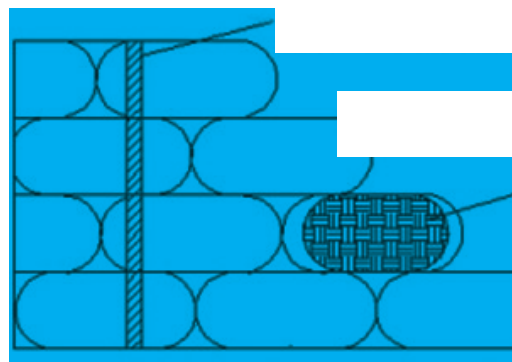
The flexibility of the tire can also offer durable protection in a seismic area. These foundations can indeed reduce the effect of seismic vibrations on the building on top of them and it can be used in every stable soil, even clay soil.

STEPS

1. Dig the soil until having a homogeneous high for the area of the platform.



2. locate the tires in the desired place and insert the earth inside to tires.
Observation: punch the earth as if you were "calibrating it, it is necessary to make it hard with only earth inside.



3. After the tires, it is necessary to fill the part between the tires and the slope. To punch and compact with efficiency it is recommended to use a puncher (it can be made of timber wood)

Observation: Whenever working with soil, it is necessary to work slowly, compacting well and gradually - the rush can leave spaces without compaction, which compromises the earth contention.



4. When the filling height is reached inside and outside the tire, it is time to put the new layer, making a terrace. To locate the next tire it can be decided to leave enough space and use the contention also as a ladder. It will allow easier access from the down part to upper one.



REFERENCE: BERNARDO, E. Reutilização dos pneus em muro de contenção de terra. Universidade Zambeze, Departamrnto de engenharia Civil-Beira, Moçambique Proceedings CLME2017/VCEM 8o Congresso Luso-Moçambicano de Engenharia / V Congresso de Engenharia de Moçambique Maputo, 4-8 Setembro 2017

c. EARTH FLOORING

STEPS

1. Lay out 3cm of high-rock cob mix over the entire floor. Compact using the shovel.
2. Add the second layer. This layer can have a higher earth and sand percentage and does not need to be tamped as firmly. Apply enough pressure to create a layer that will not shift. Allow the floor to dry until damp.



3. Create the finish cob. Mix a fairly dry cob containing no stone, and use small pieces of straw, unless you like the look of straw on the surface. Wet the surface of the previous layer with a watering can.



4. Add the finish layer. Dump buckets of cob on the surface, starting in the far corner. Flatten the mix with your hands, then with a trowel. Press hard to create a smooth surface. The final layer should be between 1/2 inch and 2 inches thick. Use thinner layers in damp climates. Allow the floor to dry.



5. Patch cracks. As the cob floor dries, cracks may appear. Patch the cracks with finish cob and allow them to dry.

6. Use a rag, roller, brush or sponge to apply a coat of boiled linseed oil to the entire floor. Apply the oil until it begins to puddle, then wipe off excess oil. Allow the linseed oil to cure. Repeat the oiling process with another coat of half oil and half solvent.



REFERENCE: BRADLEY, K. Making a DIY Earthen Floor: two methods Retrieved from: <<https://www.milkwood.net/2014/01/28/making-a-diy-earthen-floor-two-methods/>>

STRUCTURE:

d. GLULAM TECHNIQUE [33]

The most appropriate solution found for the structure, mainly in the CNRA area, is the GLULAM. Found as a possibility to the made by the sellers with the timber that they already sell and the machinery that they already have access.

Also known as advantages of this technique it is capable to make timber bars stronger, it is easy it personalizes shapes and easy to crave and make connections.

Tools used

- Hacksaw or two-handed saw
- Clamps
- Planning tool (plane, electric plane, circular saw)
- Milling machine (circular saw with replaceable cutters), preferably, but not necessarily
- Grinder tape, desirable, but not necessarily
- Paint brushes, hairbrushes, synthetic
- Marking tools (tape measure, steel meter ruler)

Necessary materials

- Lumber (boards, timber, slats)
- Glue on wood or universal
- Solvent 646 (acetone) - for degreasing.

STEPS

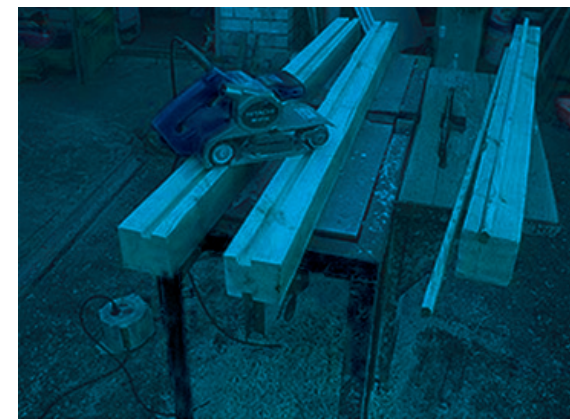
1. Choose a dry and healthy lumber
2. Cut the workpiece of the desired length, with an allowance of 5 cm on each side



3. Select at least three boards for the manufacture of a single timber. Determine in advance the relative position of the lamellae so that the pattern of annual rings would be multidirectional. Use the key connect the lamellae. After glued sides, make 1 groove for each board that on the side and 2 grooves for the one on the middle.



4. Depending on the adhesive used, the order of preparatory actions may vary. In general:
 - Mate the surface treated with grinder.
 - Dust off the surface with a brush.
 - Degrease and let it dry.
 - All manufactured parts (joints) to process fire safety, for two times with intermediate drying.



5. Choose the glue according to the conditions that the wood will be placed. Use clamps to compress and fix the parts to be glued.



6. For drying:
 - Direct exposure of the product to the sun and water should be avoided
 - Connected parts must be tightly pressed on the bonding plane
7. For better performance it is possible to install self-made dowels. Using a tapered wedge at the bottom of the dowel



8. Finally is necessary to plan timber is necessary to withstand the same dimensions for all the bars. Then process it from all sides with fire safety, twice.



e. STRUCTURAL ADOBE BRICKS

The use of adobe brick for structural purposes is a theme that has been massively studied. Their production can be made in the same way as the non-structural adobe bricks, except by the first step: the proportion of the materials in the mixture. The Indian studies about the adobe brick performance show that adding cement on the mixture can increase in the compaction capacity of the product Brick.

However, because of their adverse effects, it may be preferable to use other material to give more strength. The study concludes that the addition of the hay into the mud base, sand and water have had a great effect on the compressive strength of the Product bricks. The optimum hay ratio was 0.48% of the total weight of the sand and mud.

The compressive strength of a structural brick depends on the ratio of each material and its dimensions. According to the references an effective mixture would be:

- 6 parts sand,
- 2 parts clay,
- 1½ parts silt.
- ½ part hay



REFERENCE: CHHABA, S.; SINGH, CHARAN. PERFORMANCE OF MUD BRICK IN BUILDING CONSTRUCTION SYSTEM. 5. 2348-2117. (2017)

f. NON-STRUCTURAL ADOBE BRICKS

As wrote before, structural and non-structural adobe bricks can have the same process of production the only changing part would be the mixture, in case of non-structure brick the hay will be substitute for more clay.

STEPS

1. To mix the materials it is important to measure out and mix and add water slowly: if the mud is too wet it will slump gradually while it dries outside the mold. No large stones or lumps can be left in the mixture but stones up to 1.5 cm are all right.



2. Use hard wood for the mold. Molds for several bricks at a time are easy to make and increase the efficiency of brick production.



3. It can be made on flat, level ground, but using a table is often faster and easier. The mold should be dipped in water. Then it should be fill with mud
4. Clear any excess mud off the mold, but don't make the surface too smooth--the brick will adhere to the mortar better if it has a rough contour.



partially dry the mold should be retrieved



6. The bricks should then, dry in the sun for about 30 days. For the first week or so, the bricks should be protected from rain.



7. For more security it is recommended to make some test bricks and evaluate its performance



REFERENCE: GALLANT, P. Self-help Construction of 1-story Buildings. Peace Corps (U.S.). Information Collection and Exchange. ACTION (Service Corps), Peace Corps 1977.

The project will benefit of the versatility of the pallets and the fact that this technique can reuse timber. Pallets can be used to the separation of the stores of the market, the confection of simple furniture to the buildings.

For the project it will also be used for the flooring of wet areas such as the floor the shower block in the market. Even though this is not the most efficient method, the life of the material will reduce significantly and the require od maintenance will increase.

When impermeabilization of the ground is not possible using pallets can be an option as it can be seen the architectural reference Safe Haven Bath house^[1]

Materials:

- Wood timbres
- Nails

Tools:

- hammer
- saw (hand saw, circular saw, miter saw, etc.)

STEPS

1. Begin by cutting the timber in the same dimensions: approximately 5cm x10cm by the length that you need.



2. Create the slats by cutting the 5cm to 10cm in half



3. Assemble the thick pieces in vertical position and the thinner ones in horizontal to create the frame of the pallet.



4. Leave the space between boards according with the design and nail de slats.



REFERENCE: Make Your Own Pallet.
Retrieved from: <<https://www.instructables.com/Make-your-own-pallet/>>

[1]: Safe Haven Bath house / TYIN Tegnestue
Retrieved from: <<https://www.archdaily.com/291116/safe-haven-bath-house-tyin-teg- nestue>>

Shou sugi ban is a Japanese term that means "charred cedar board." It involves charring planks, then burnishing the burnt wood with wire brushes and sandpaper before sealing it with natural oil. Also known as yakisugi, this ancient Japanese technique produces blackened, charred wood siding that is resistant to the elements. Charred wood can serve as a fire retardant, to increase the water resistance and to protect from termites and other kinds of insects.

STEPS

1. Verify if the wood is appropriate for the process, normally softwood receive the treatment better then hardwoods.



2. To burn the wood, the torch needs to be lit and the gas opened to the full, so the fire appears more in a bluish color, meaning it is more concentrated and strong. A good distance between torch and wood lays between 10-15 cm, held in a relatively straight angle. (The distance depends on the torch, but it should be around the right distance when the top of the touching blue fire separates into orange flames.



3. Use a wire brush or coarse sandpaper to remove the outer char from your wood without sanding it smooth—you want to maintain a textured surface with visible wood grain patterns.
4. Seal the wood to further protect it from the elements.



REFERENCE: WEARSTLER, K. What Is Shou Sugi Ban? Master Class.
Retrieved from: <<https://www.masterclass.com/articles/shou-sugi-ban-guide-how-to-mas- ter-japanese-wood-burning#what-is-shou-sugi-ban>>

