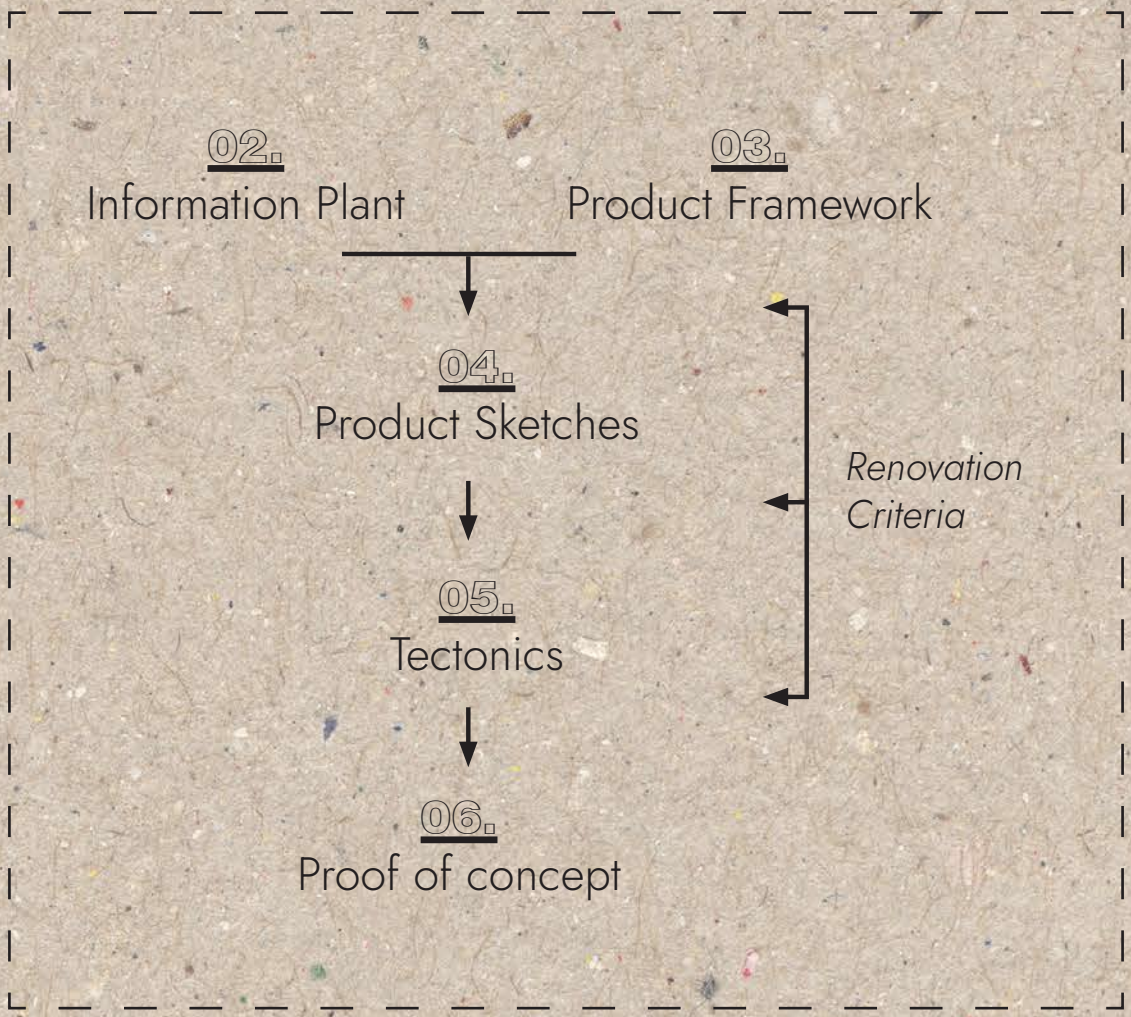
Look
Book
3

CLAY LANDSCAPE

This look-book aims to provide inspiration and showcase the enormous potentials of renovation by utilizing materials that can be harvested from a specific landscape. It is essential to approach this with utmost respect for the environment, by ensuring responsible harvesting practices and minimizing any negative impact. Through this exploration, we can promote the sustainable use of hyper-local bio-based materials, discover their beauty as well as functionality, and contribute to a more environmentally conscious approach in the building industry!

CONTENT


02.
Information Plant
03.
Product Framework
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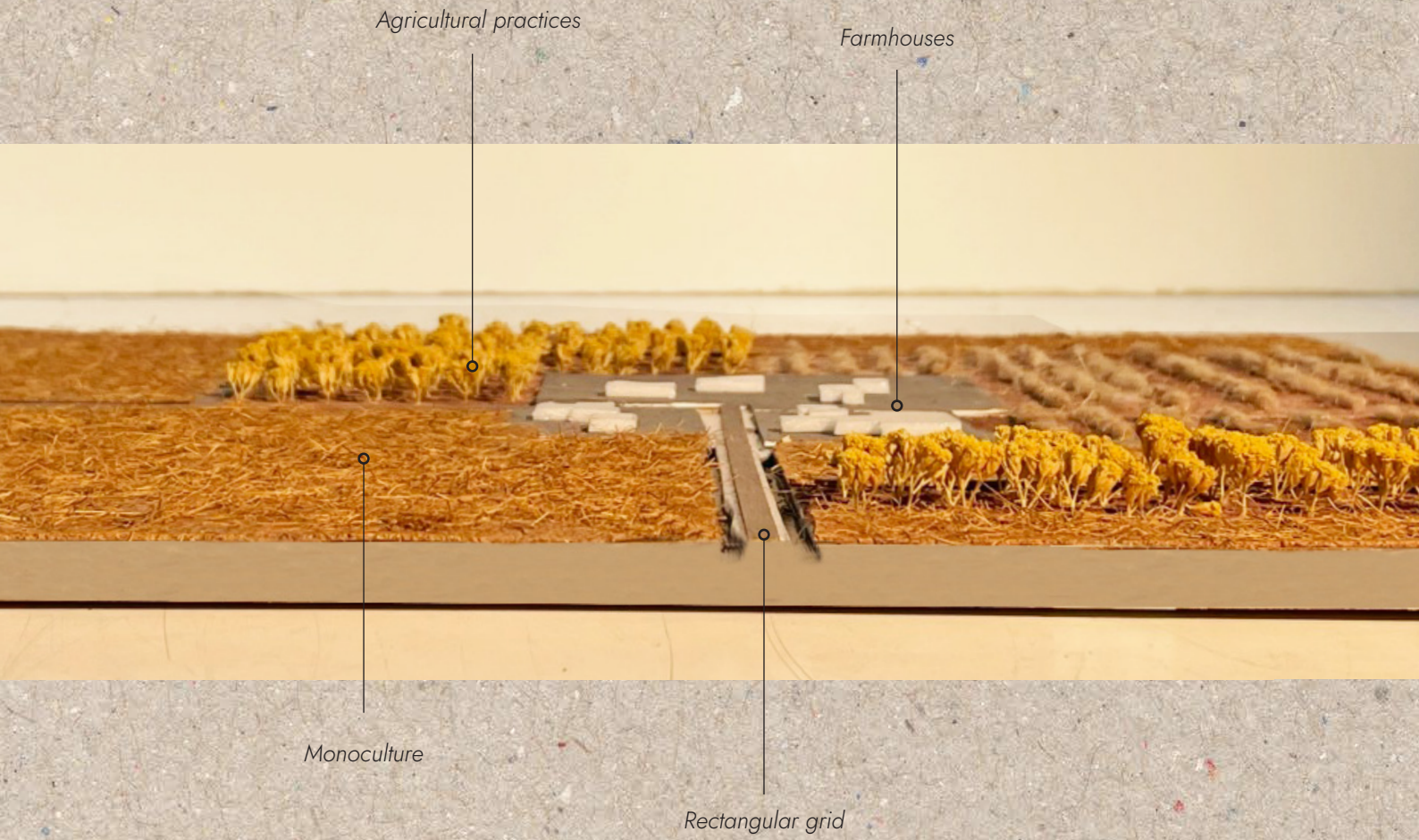
Product Sketches
05.
Tectonics
06.
Proof of concept
Renovation
Criteria

Each landscape has its own characteristics. These are explained in the model representing the agracultural landscape in Dronten, located next to the case-study neighborhood 'De Fazant'. Information about the landscape and vegetation was gathered based on own studies on the regional landscapes and from sources like Stichting Bouwtuin and Boom Landscapes, and applied to the case-study landscape.



01. Character Landscape

Walking through the landscape
(own model)

C1
LOAM

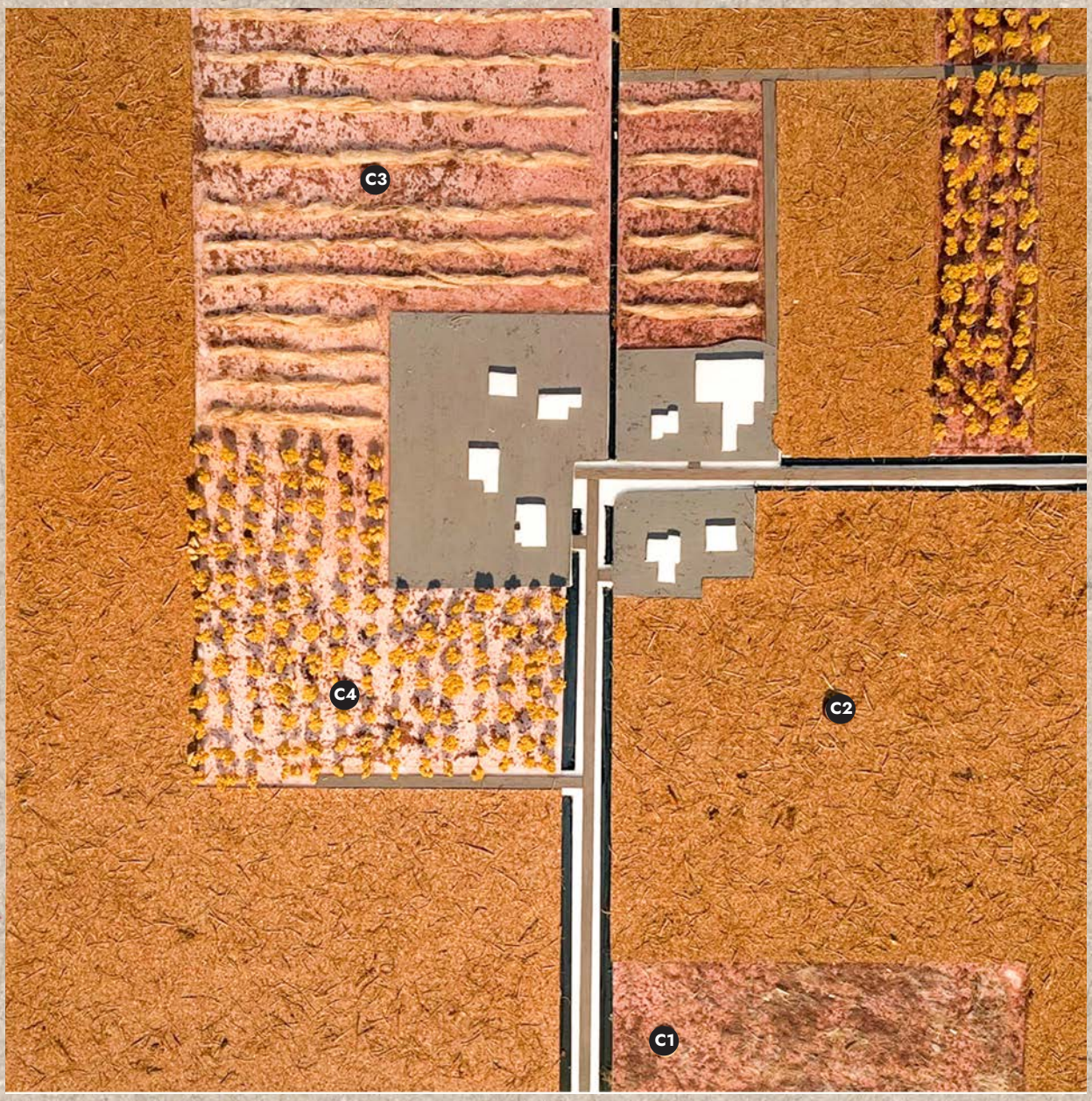
C2
STRAW

C3
FLAX
Linum usitatissimum

C4
FIBERHEMP
Cannabis sativa

02. Materials information

While studying the landscape, various bio-based materials were discovered that hold great potential. The following are the most promising materials for use in construction purposes.



C1
LOAM

Used for:
Cladding

LLoam is a type of soil composed of a balanced mixture of sand, silt, and clay. Loam has been used in the Netherlands for centuries due to its thermal properties and natural abundance. The quality of the raw earth depends on several factors: the type of soil, the mixture of gas, liquid, and solid components, the quality and production method, and protection against various elements such as humidity and maintenance. Building with raw earth requires only 1% of the energy compared to fired brick or reinforced concrete, has overall low CO2 emissions, and is completely recyclable (van Stigt, Esposti, & Kufrin, 2021). Therefore, it is included in this booklet.

Yield:
-

Growing time:
-

Insulation properties:
Lambda = 0.47-2.56 W/m K (1)

Thickness:
2115mm (if only loam was used)*

1: (Nikiforova, Bosschaerts, Savytskyi, & Belarbi, 2013)

C2
STRAW

Used for:
Insulation

Straw is an agricultural byproduct and refers to the dry stalks of cereal plants such as wheat, barley, rice, oats or rye after the grains have been harvested. The residue that stays behind are the plants stems and leaves. This byproduct is commonly used as animal bedding but can also be used as a lightweight building material (Britannica, n.d.). It can primarily be used for insulation, also providing thermal regulation and soundproofing properties. It is often used in combination with other materials like clay or lime plaster.

Yield:
56.29–100.03 tonnes/ha (1)

Growing time:
-

Insulation properties:
Lambda = 0.08W/mK (2)

Thickness:
360mm

1: (Huang, Zhou, & Nan, 2019)
2: (Butler, 2020)

C3
FLAX
Linum usitatissimum

Used for:
Insulation

Linum usitatissum, also known as flax, is a flowering plant that is cultivated for both the seeds and the fibers for various applications. The plant can reach a height of up to one meter and has a slender stem with bright blue flowers. The seeds of the plant are commonly used for culinary purposes. The flax fibers on the other hand are used for textiles and ropes and known for their strength and durability. Flax fibers are also used in the building industry as insulation material (Arslanoglu et. al., 2022). For example the product 'Isovlas' which is made from waste fibers from the linen industry.

Yield:
1.97–2.05 tonnes/ha (1)

Growing time:
90-120 days (3)

Insulation properties:
Lambda = 0,038 W/mK (2)

Thickness:
171 mm

1: (Arslanoglu et. al., 2022)
2: (Isovlas, 2022)
3: (Heath, 2021)

C4
FIBREHEMP
Cannabis sativa

Used for:
Cladding
Insulation

.Fiberhemp referns to a variety of the Cannabis sativa plant which is specifically cultivated for its fiber content. Unlike the other varieties of cannabis, the fiberhemp plant contains minimal levels of THC which is the psychoactive compound. Instead, it is grown for its long and strong fibers that can be utilized in different industries. Things that can be made from this plant include rope, textiles and bioplastics (Britannica, 2023). In the building industry fiberhemp is used as a insulating material (European Comission, n.d.). For example in hempcrete, which is a mixture of hemp fibers, lime and water being an alternative to concrete. Hempfibers can also be used as insulation panels.

Yield:
4,37 tonnes/ha (1)

Growing time:
60-90 days (3)

Insulation properties:
Lambda = 0,071 W/mK (2)

Thickness:
320 mm

1: (European Comission, n.d.)
2: (IsoHemp, 2023)
3: (Manitoba, n.d.)

** Estimated thickness based on R= 4.5 m2K/W*
*** If left blank, no information available*

The process of converting vegetation into a building material follows a structured approach, which involves three key steps leading to the creation of a final building component.

03. Production framework

PROCESSING | initial process after harvesting

BAILING

CUTTING

PRESSING

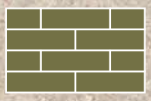
WEAVING

SHREDDING

COMBING

SUPPORT | putting the products on the facade

SUB-STRUCTURE



ON FACADE

BETWEEN

BOX

FRAME

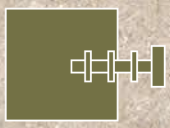
ATTACHING | attachments that are needed in the process

CLAMPING

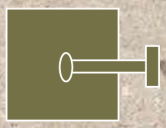
GLUEING

TENSIONING

BINDING



SCREWING

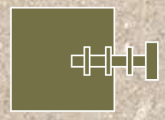
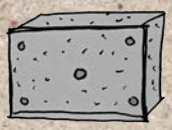


NAILING

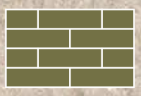
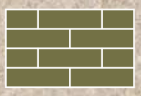
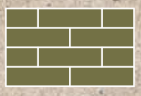
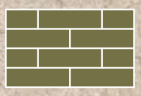
LOCKING

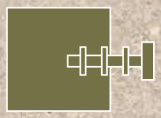
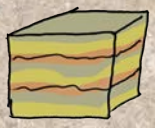
INSULATION

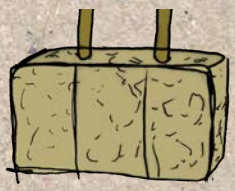
MATERIAL	PROCESSING	SUPPORT
STRAW 	BAILING	ON FACADE
	BAILING	BETWEEN
FIBERHEMP 	SHREDDING → PRESSING	ON FACADE
	SHREDDING → PRESSING	BETWEEN
FLAX 	SHREDDING → PRESSING	BETWEEN

ATTACHING	FRAGMENT	
 SCREWING		*Straw baled*
 CLAMPING		*Straw baled between frame*
 SCREWING		*Fiberhemp blocks*
 CLAMPING		*Fiberhemp between substructure*
 CLAMPING		*Flax between substructure*

CLADDING

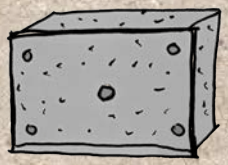
MATERIAL	PROCESSING	SUPPORT
LOAM 	 PRESSING	 ON FACADE
LOAM	 PRESSING	 ON FACADE
LOAM + *fibers*	 PRESSING	 ON FACADE
FIBERHEMP  + *lime*	 PRESSING	 ON FACADE

ATTACHING	FRAGMENT	
 GLUEING		*Loam smeared*
 SCREWING		*Rammed earth*
 GLUEING		*Loam with fibers*
 GLUEING		*Fiberhemp*



Straw baled

Straw baled between frame

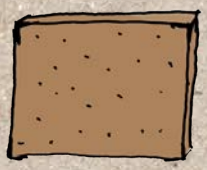


Fiberhemp blocks

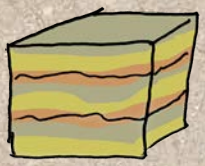
Fiberhemp between substructure

Flax between substructure

Cladding



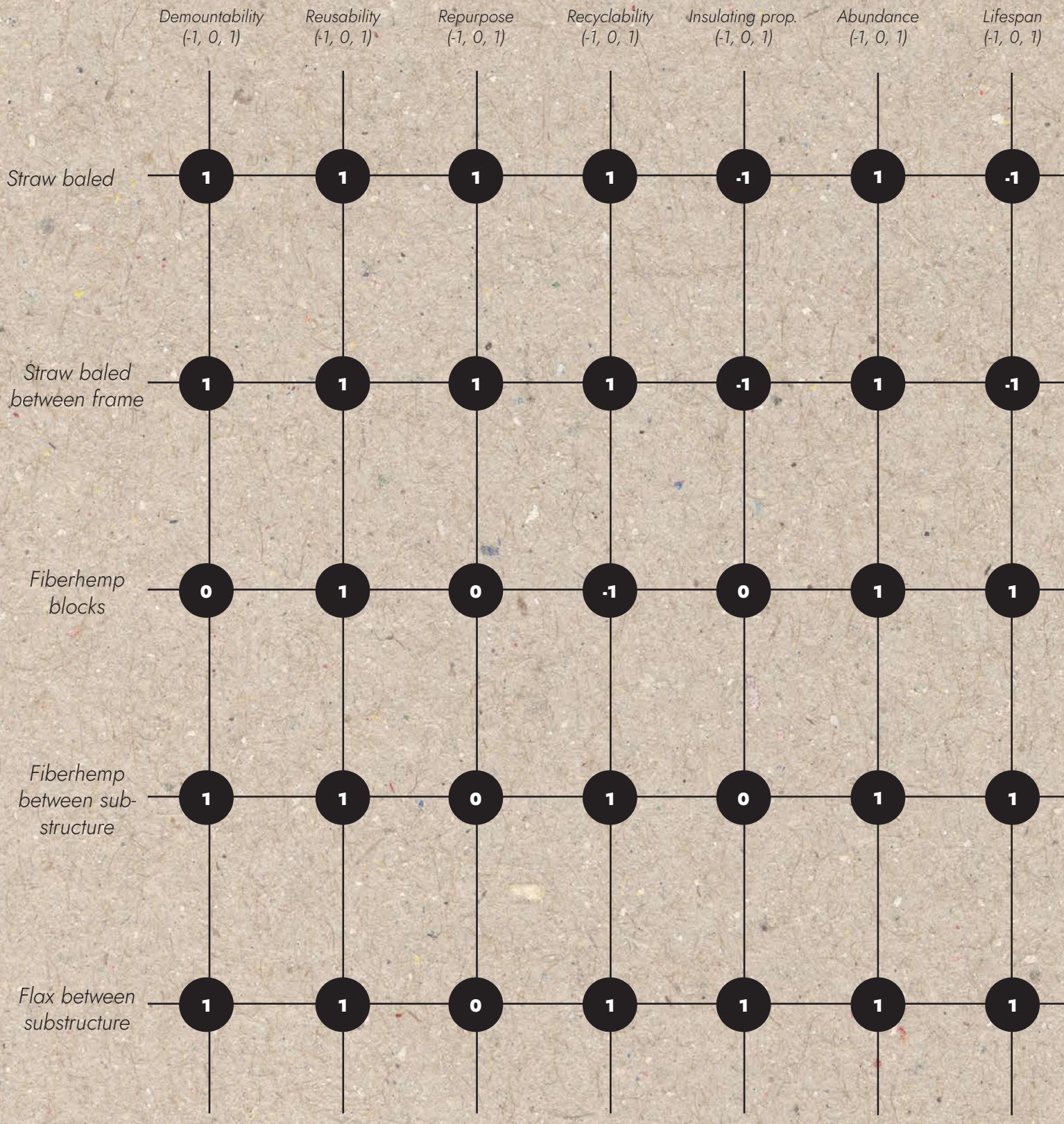
Loam smeared



Rammed earth

Loam with fibers

Fiberhemp



05. Renovation criteria

TOTAL

3

3

2

5

6

The different options can be evaluated based on factors that are important for sustainable renovation. The Pugh chart method can be employed to assign scores ranging from -1, 0, or 1 to each option. This scoring serves as a rough estimation of their performance in relation to the chosen criteria.

Scoring

1. Demountability (take away from the facade)
-1: The element can not be taken away from the facade
0: The element can be taken away from the facade, but requires more work
1: The element can easily be taken away from the facade

2. Reusability
-1: It is hard to re-use the element as insulation after use
0: It is possible to re-use the element as insulation after use, but with less quality
1: It is possible to re-use the element as insulation after use

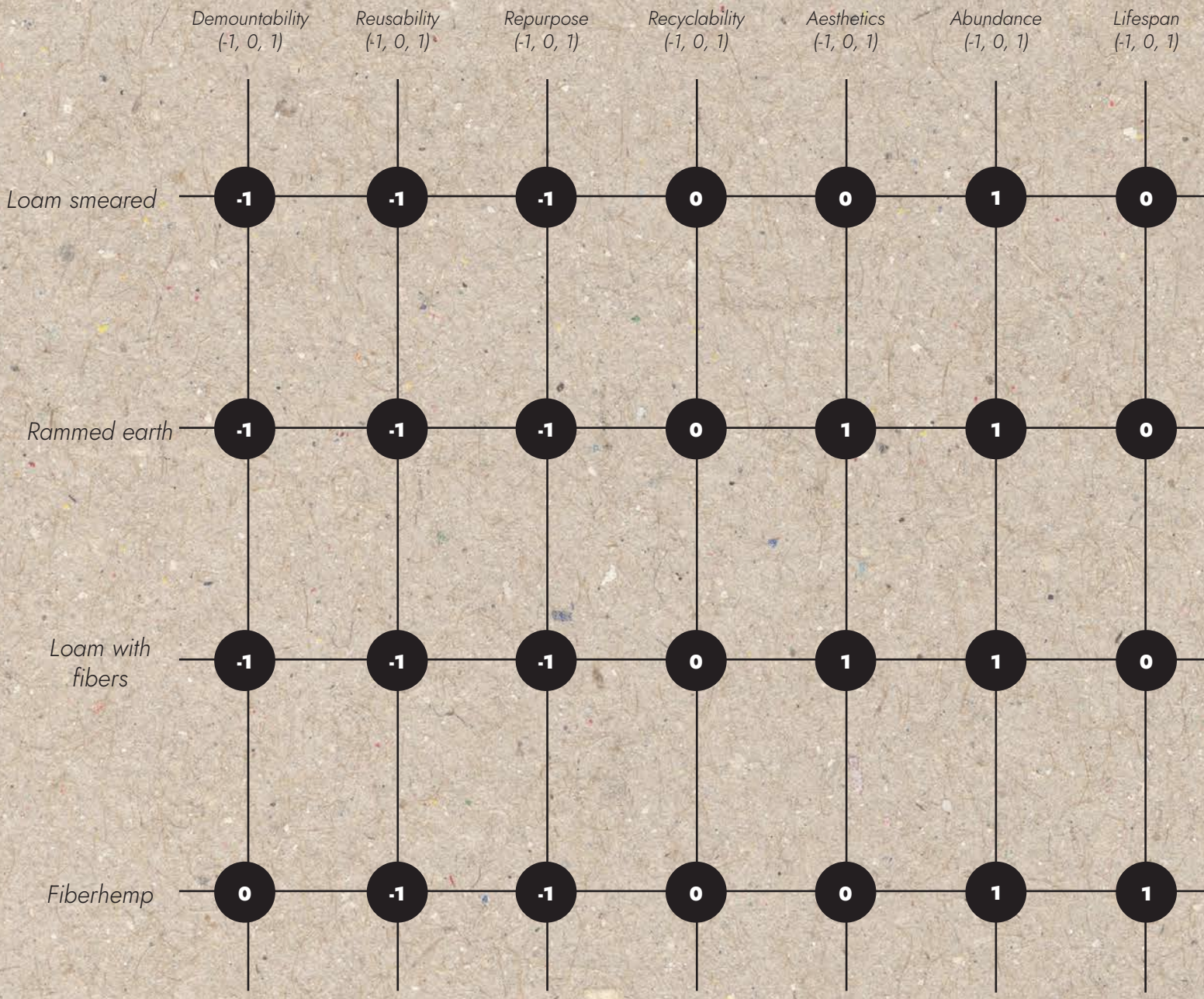
3. Repurpose
-1: It is not possible to find another purpose for the element after use
0: It is hard but possible to find another purpose for the element after use
1: It is possible to find another purpose for the element after use

4. Recyclability (take apart)
-1: It is not possible to take the whole element apart to recycle after use
0: It is partly possible to take the whole element apart to recycle after use
1: It is possile to take the whole element apart to recycle after use

5. Insulating properties
-1: The element preforms worse compared to other insulation materials
0: The element performs average compared to other insulation
1: The element performs better compared to others

6. Abundance
-1: The material is not abundant in the landscape
0: The material is present in the landscape
1: The material is abudant in the landscape

7. Lifespan
-1: The lifespan of the product is short compared to others in the category
0: The lifespan of the product is average compared to others in the category
1: The lifespan of the product is good compared to others in the category



05. Renovation criteria

TOTAL

-2

Scoring

1. Demountability (take away from the facade)
-1: The element can not be taken away from the facade
0: The element can be taken away from the facade, but requires more work
1: The element can easily be taken away from the facade

-1

2. Reusability
-1: It is hard to re-use the element as insulation after use
0: It is possible to re-use the element as insulation after use, but with less quality
1: It is possible to re-use the element as insulation after use

3. Repurpose
-1: It is not possible to find another purpose for the element after us
0: It is hard but possible to find another purpose for the element after us
1: It is possible to find another purpose for the element after us

-1

4. Recyclability (take apart)
-1: It is not possible to take the whole element apart to recycle after use
0: It is partly possible to take the whole element apart to recycle after use
1: It is possile to take the whole element apart to recycle after use

5. Aesthetics
-1: The element is less aesthetically appealing compared to the other options
0: The element is averagely aesthetically appealing compared to the other options
1: The element is more aesthetically appealing compared to the other options

0

6. Abundance
-1: The material is not abundant in the landscape
0: The material is present in the landscape
1: The material is abudant in the landscape

7. Lifespan
-1: The lifespan of the product is short compared to others in the category
0: The lifespan of the product is average compared to others in the category
1: The lifespan of the product is good compared to others in the category

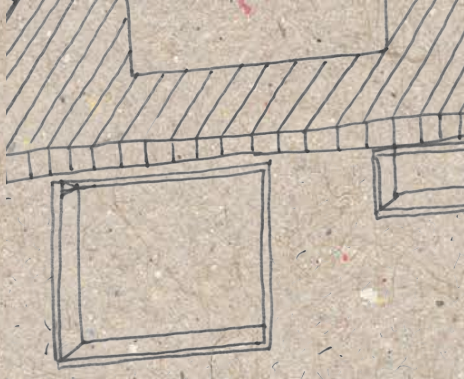
Once various vegetation options have been identified, they can be combined in different variations on the facade. These combinations can be explored through various layouts and arrangements. This section showcases a range of these possibilities and provides conceptual sketches to illustrate what they could look like.

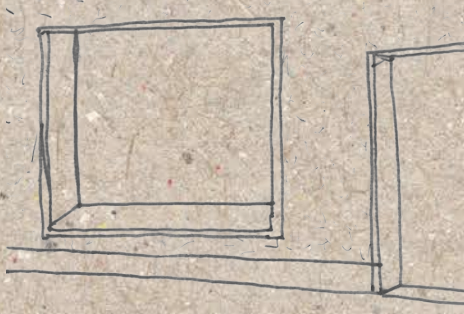
MOZAIC

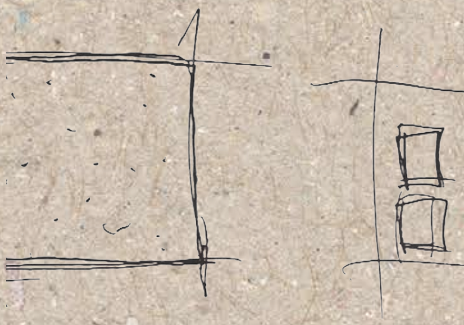
HORIZONTAL

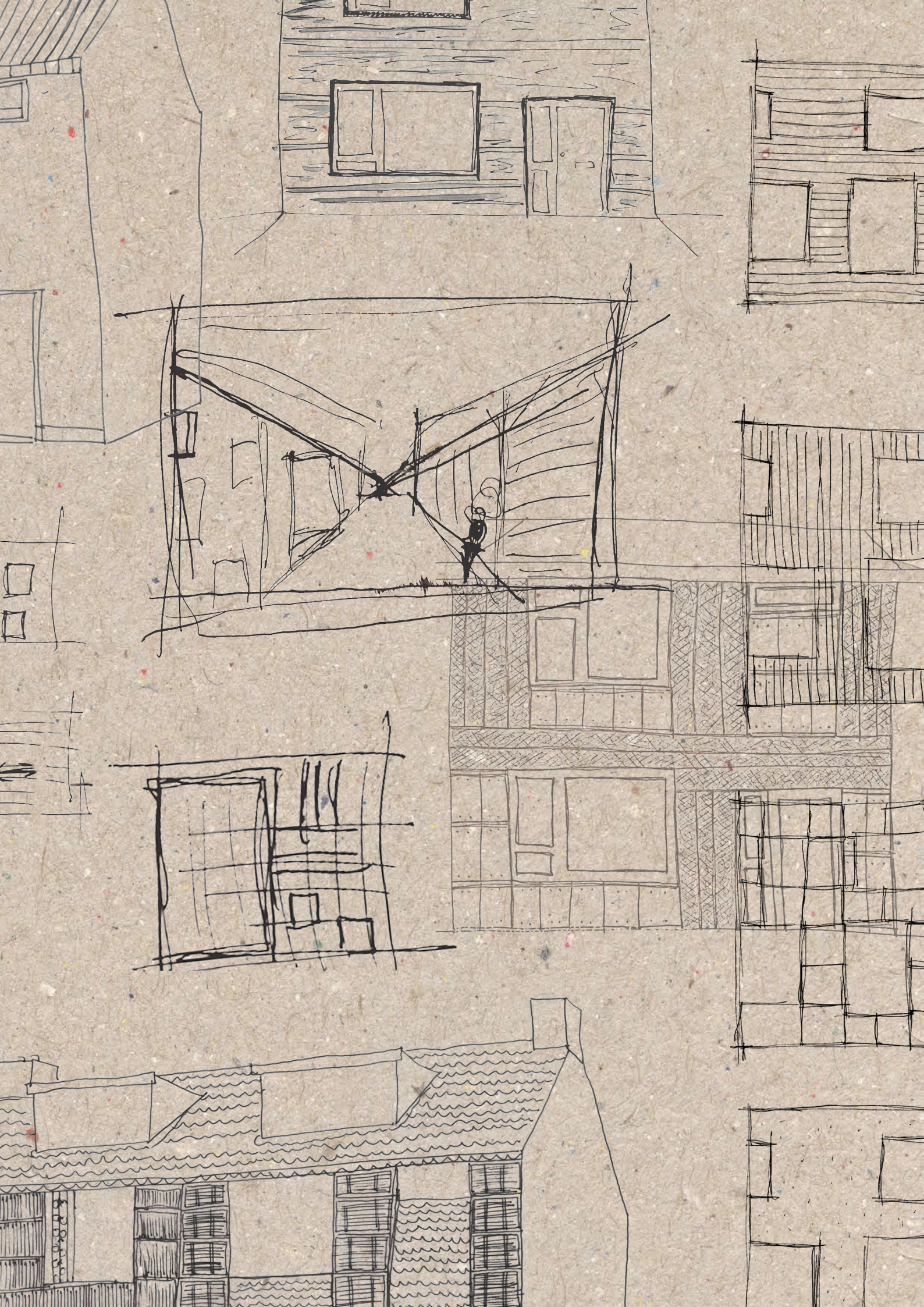
SURFACE

VERTICAL









MOZAIC

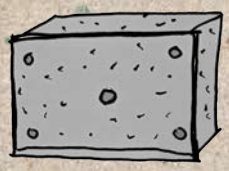
‘Different fiber combinations’

Straw baled

Loam with fibers

HORIZONTAL

‘Totally fiberhemp’

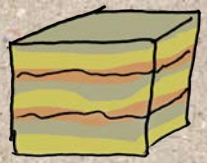


Fiberhemp blocks

Fiberhemp

‘Rammed earth’

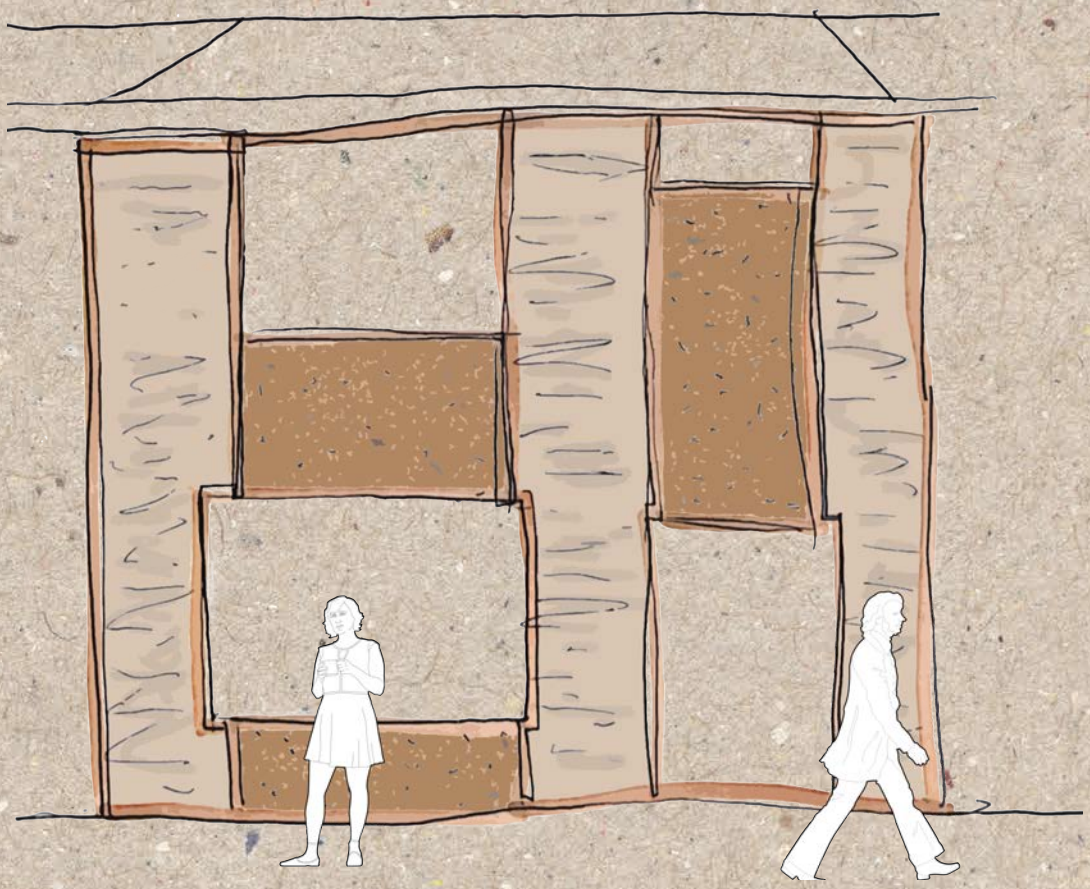
Flax between substructure

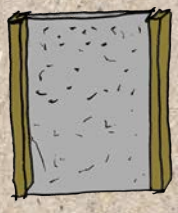


Rammed earth

VERTICAL

‘Combining different techniques’

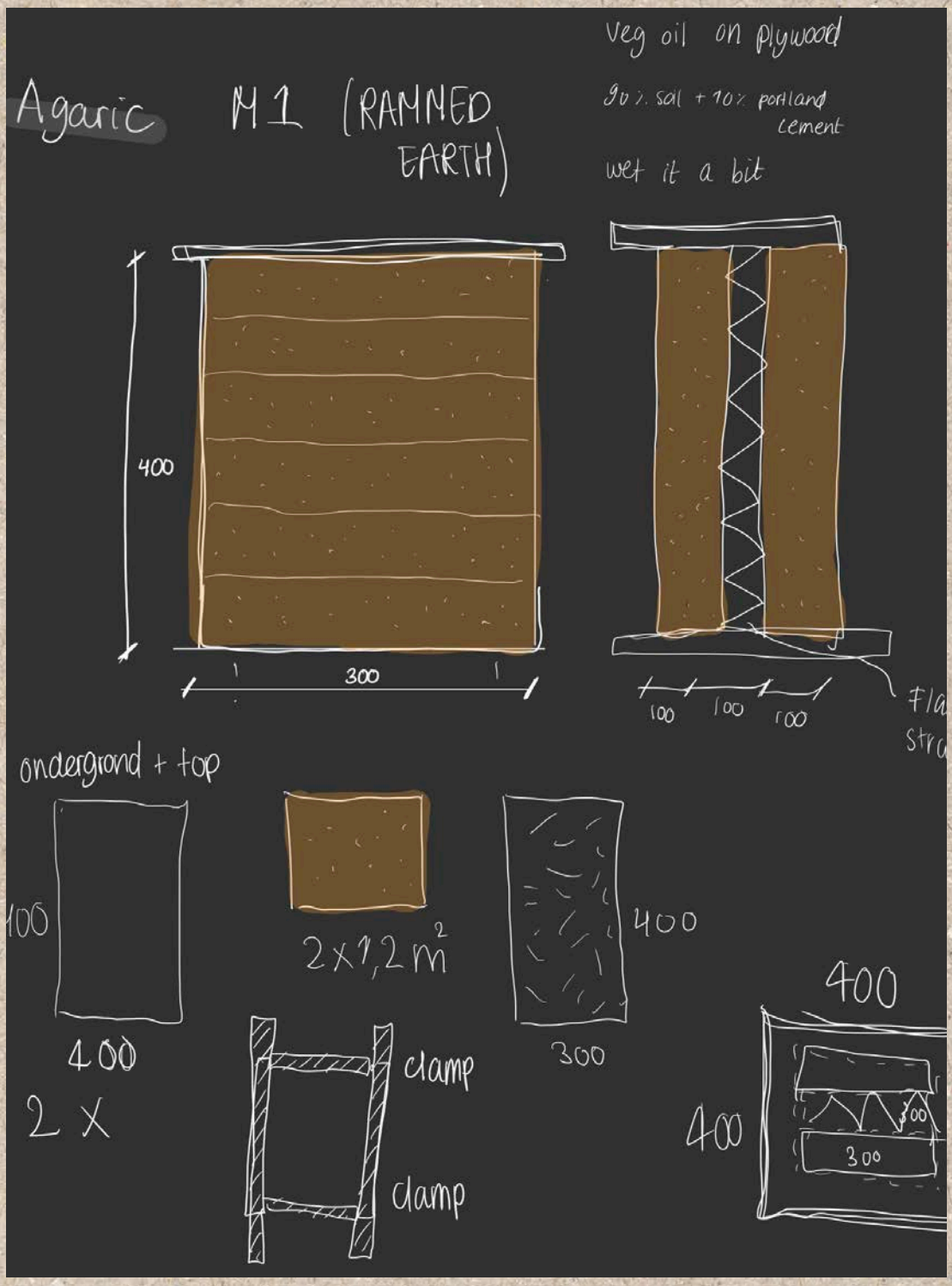


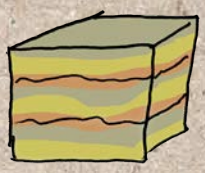


Fiberhemp between substructure

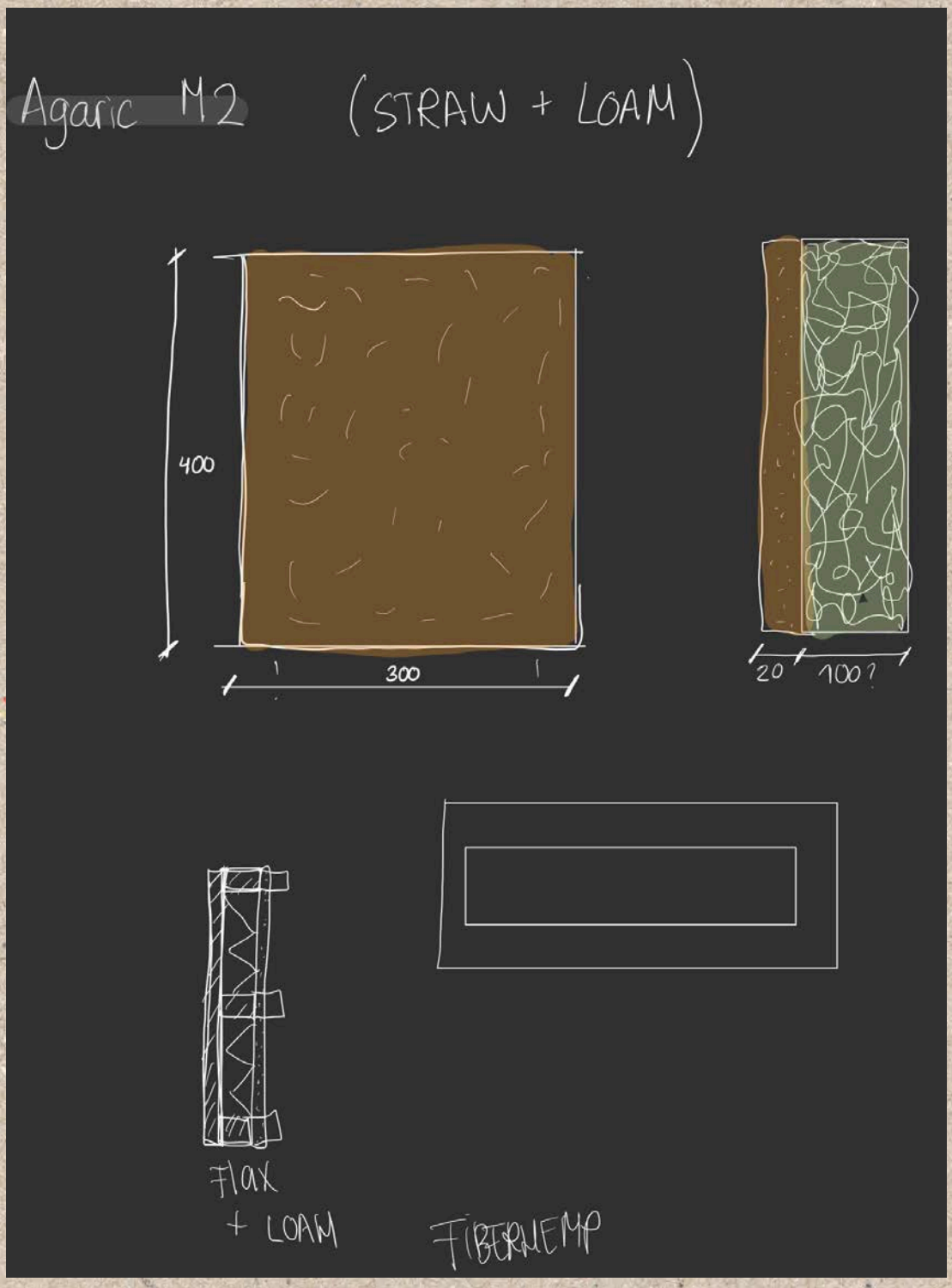
Loam smeared

Fiberhemp

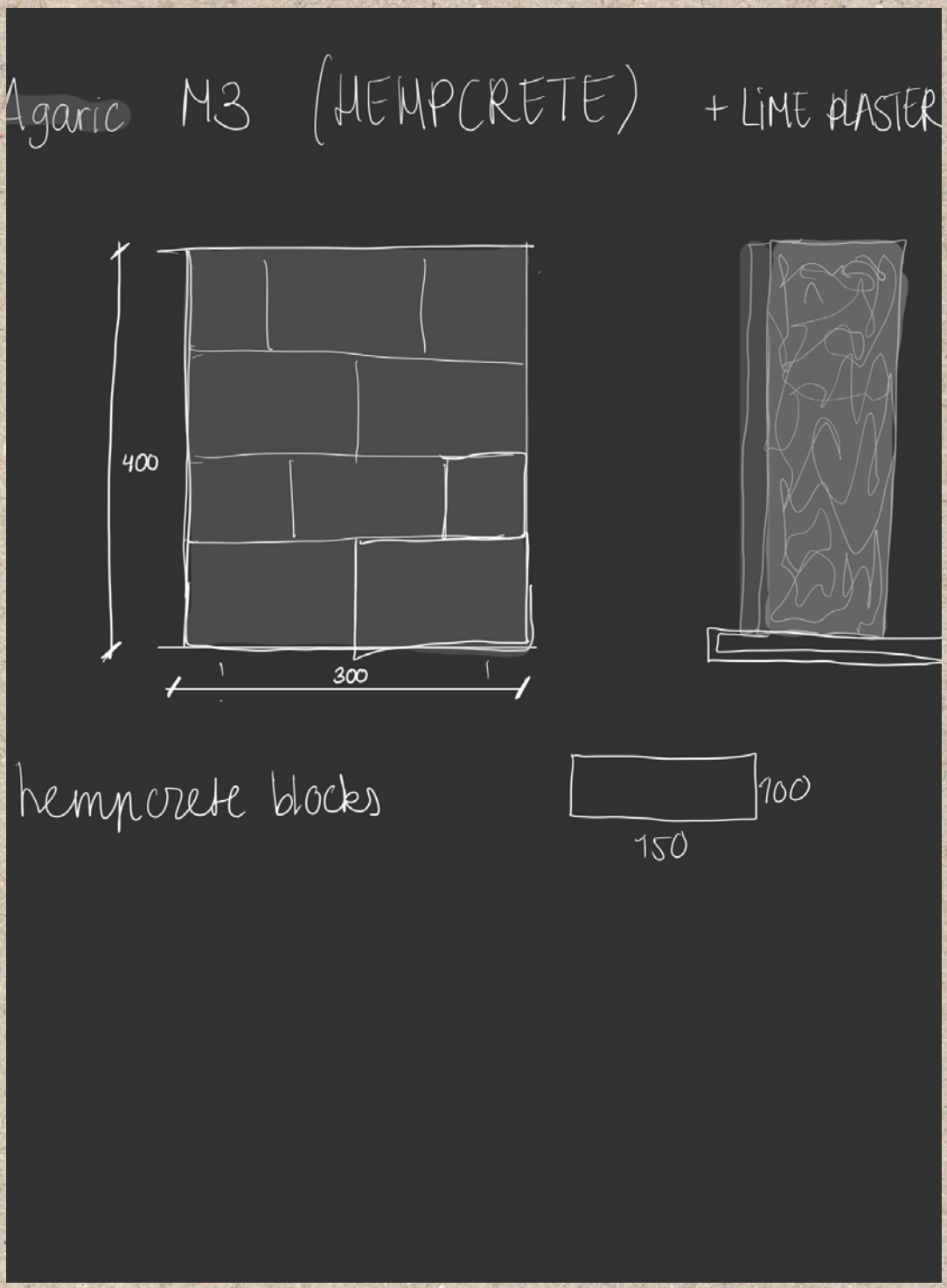




Rammed earth

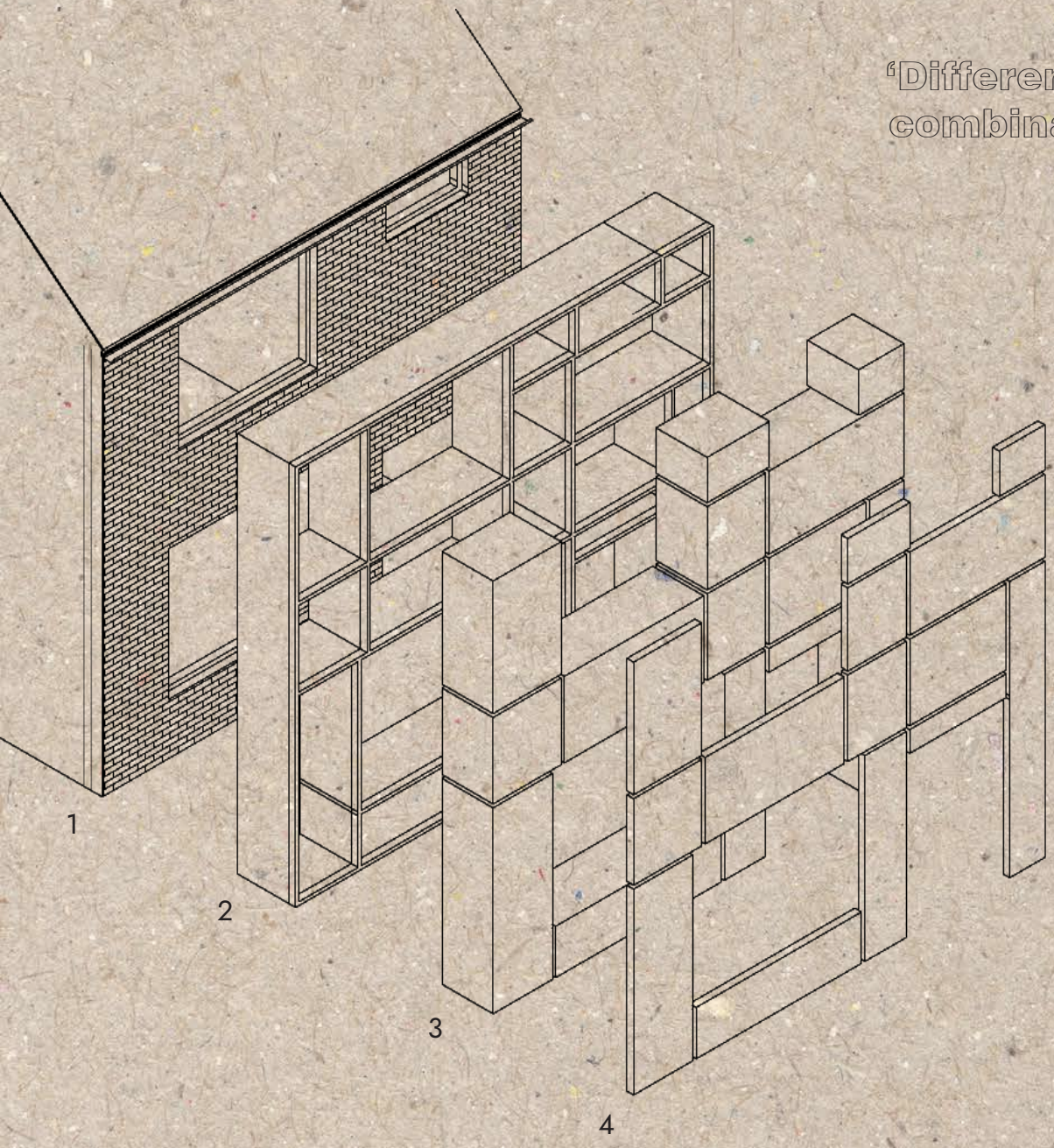


Loam with fibers


Agaric M3 (HEMPCRETE) + LIME PLASTER
400
300
hempcrete blocks
100
150

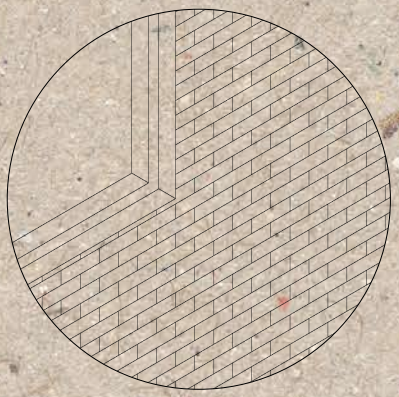
Fiberhemp

‘Different fiber combinations’

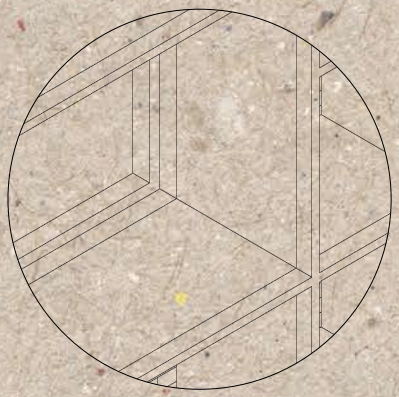


1= Existing brick wall
2= Wooden frame
3 = Baled straw
4 = Loam with different fibers

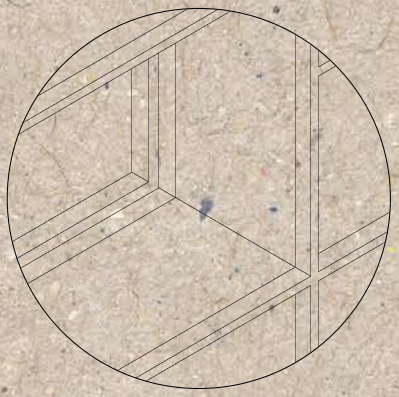
06. Proof of concept



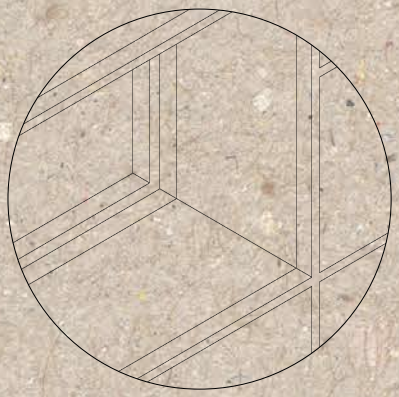
1.0 | Existing brick wall



2.0 | Wooden frame



3.0 | Baled straw



4.0 | Loam with different fibers

07. Impression

References

Arslanoglu, Ş. F., Sert, S., Şahin, H. A., Aytaç, S., & Sabagh, A. E. (2022). *Yield and Yield Criteria of Flax Fiber (Linum usititassimum L.) as Influenced by Different Plant Densities.* Sustainability, 14(8), 4710. doi:https://doi.org/10.3390/su14084710

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Look-book (3/3) as part of the Thesis Research: Bloemkoolwijken - the New Vernacular?

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