



# CORK re-Wall

CORK re-WALL

CEAAD | AMORIM ISOLAMENTOS 2014/15

# **CORK re-WALL**

## **Computational Methods of Automatic Generation and Digital Fabrication of Cork Partition Walls for Building Renovation**

Developments in computational design methods and their integration with digital fabrication processes are ushering a customized fabrication paradigm. This paradigm is particularly suited to renovation of old buildings built with traditional construction techniques, a diversified corpus in which interventions are surgical and unique, and where partition walls play the central role. Insulation Cork Board, OSB and plywood, natural and renewable materials, can have an important role in a material system that responds to this context. Cork re-Wall is a parametrically modeled construction system and a file-to-factory digital process with the aim to generate high quality custom solutions that respond to diverse renovation design challenges.

Cork Re-Wall parametric wall is composed of a wood frame structure cut out of OSB panels and customizable composite panels of ICB and plywood. The parametric model was developed with two purposes in mind: to simulate the system behavior and optimize it, as well as to provide an interface for design customization and digital fabrication by an end user be it a client or an architect.

The construction of new buildings in Portugal has dramatically shrunk in the last few years, while the renovation of old buildings within cities historic centers gained traction, after decades of neglect.



- modern wood frame partition wall is not competitive with LSF partitions
- traditional techniques have become too expensive (labor intensive)
- craftsmen are no longer available

## PARTITION WALLS



Tabique de Frontal, PortoVivo

Tabique de Frontal, CMP

Casa em Arruda dos Vinhos, PlanoB

Sistema de tabique Pladur

## DIGITAL TOOLS



Instant House no MoMa, Larry Sass

Shelter, Emergent Design and Tech.

Honeycomb Morphologies, Kudless, A GF+PG, Paul Coates

## ICB



Lambordé

GypCork

ETICS

Tabique autoportante

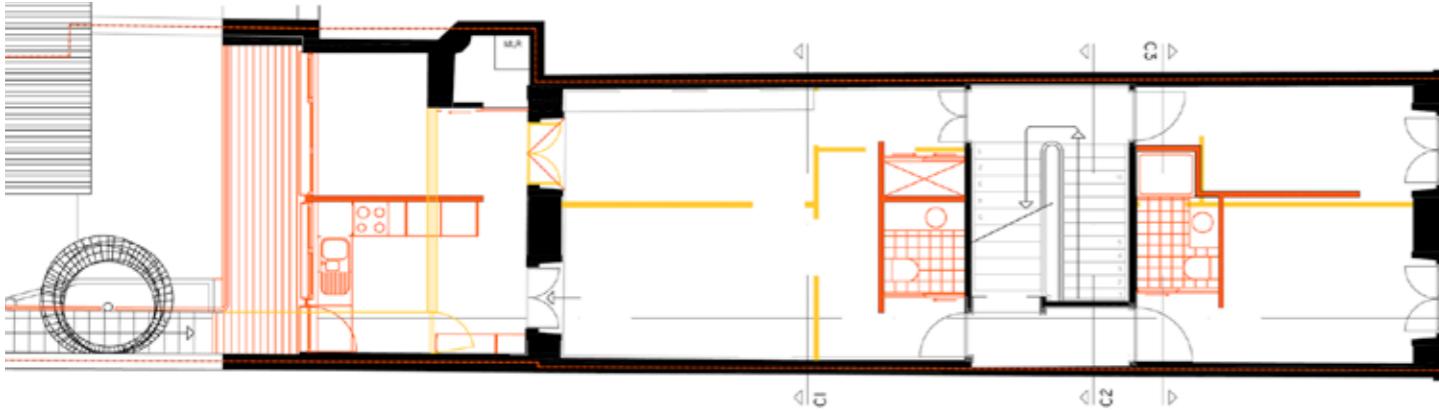
## DIGITAL TOOLS + ICB



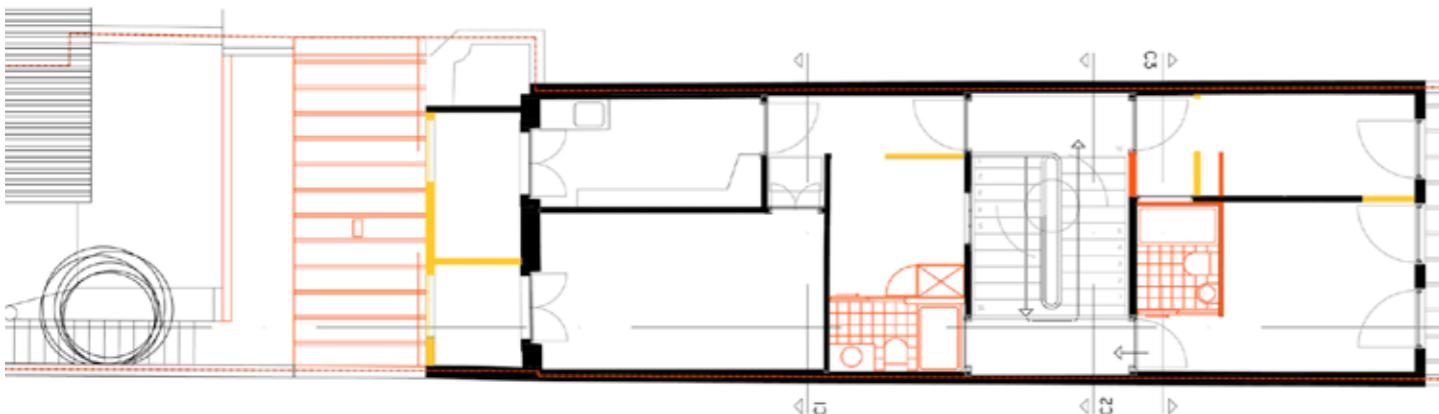
Cork Vault Pavillion, CEAAD

CorkEWS, Maria J. Oliveira CEAAD

Tetra-Shed, Weproductise MD Fachada Cork Vault Aarhus, PAV



PLANTA 1º PISO



From the analysis of renovation case studies and traditional partition wall systems, but also taking into account LST partition wall advantages, a group of requirements was derived:

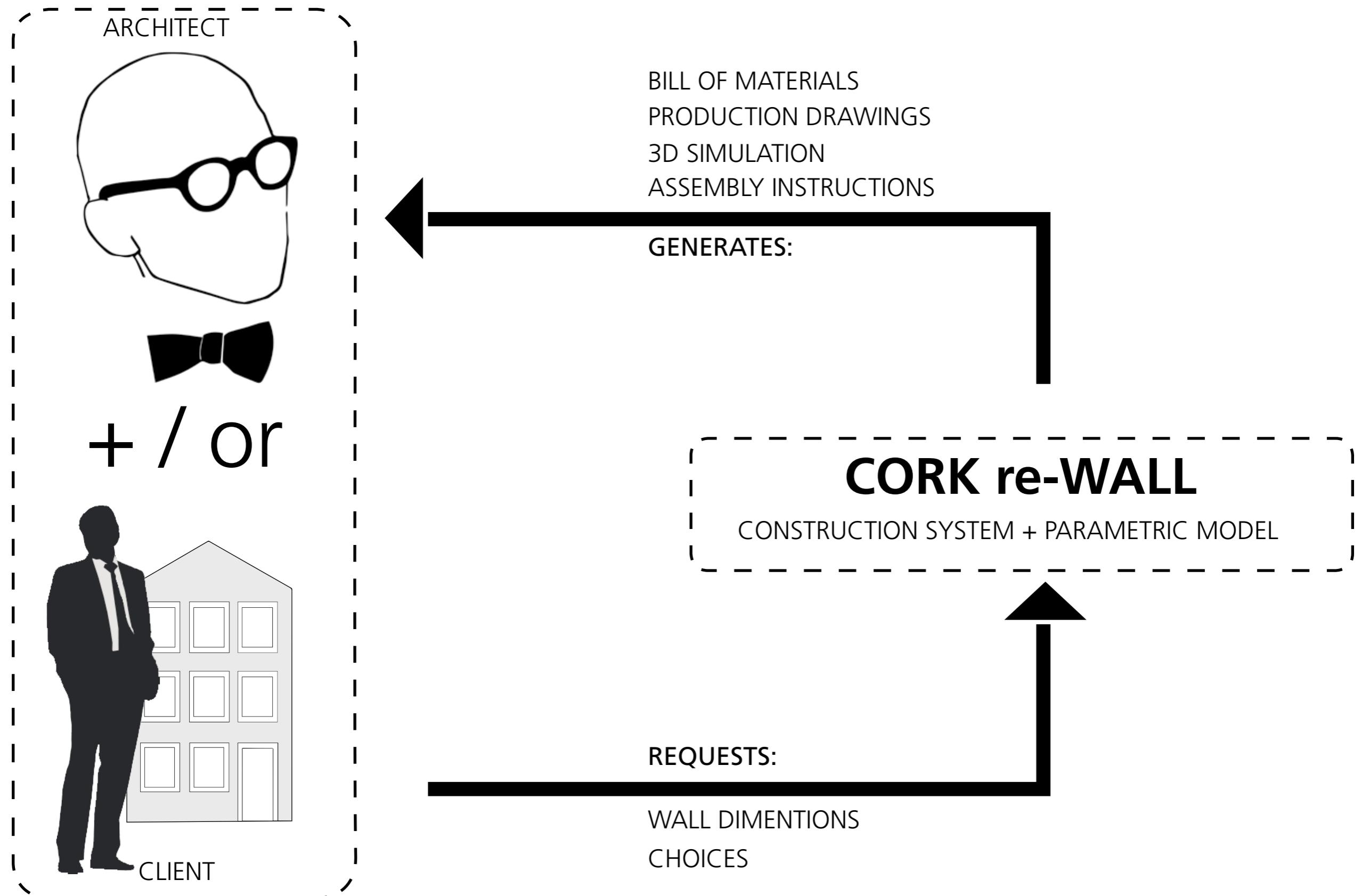
- Wall thickness that is adjustable
- Adequate airborne sound insulation
- Dampening impact sound transmission
- Quick and easy assembly
- Lightness
- Dry construction
- In-wall cavities for infrastructure
- Reusable and renewable materials
- Low cost
- Flexibility in finishing

## Material properties and Cradle to Gate Embedded Carbon / Energy (EC / EE) values

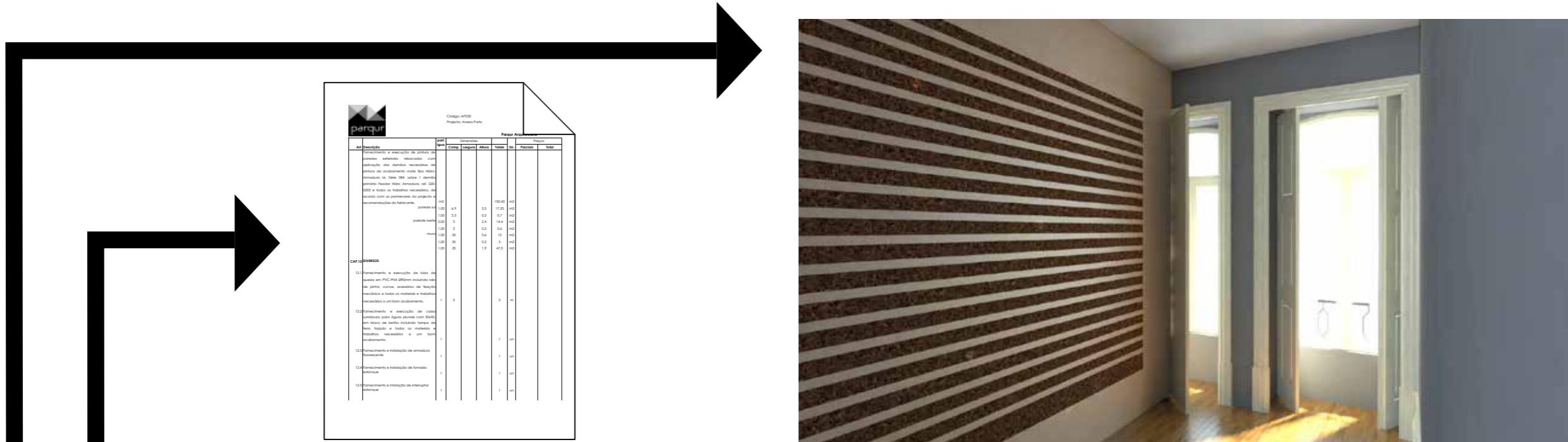
Materials	Density (Kg/m3)	EEu (MJ/Kg)	ECu (KgCO2e/Kg)	Thickness (m)	EEs (MJ/m2)	ECs (KgCO2/m2)	EE (MJ/m)	EC (KgCO2/m)
Plasterboard	800	6,8	0,39	0,015	81,00	4,680		
M90 Galvanized Steel profile	7800	27,1	2,03	0,0006			22,131	1,658
M70 Galvanized Steel profile	7800	27,1	2,03	0,0006			19,785	1,482
M46 Galvanized Steel profile	7800	27,1	2,03	0,0006			16,741	1,254
Mineral wool	70	16,6	1,28	0,060	69,72	5,376		
ICB	140	4,0	0,19	0,060	33,60	1,596		
OSB	640	15,0	0,99	0,015	144,00	9,504	17,280	1,140
Plywood	640	15,0	1,10	0,012	115,20	8,448		

NOTE 1: The EE and EC reference values were obtained from the Inventory of Carbon and Energy (ICE) edited by Hammond and Jones (2006) in the University of Bath. These values are Cradle to Gate average for the UK/EU, that with the exception of ICB are equally valid for Portugal. These values do not take into consideration the lamination of galvanized coil into profiles or the energy and carbon used in the transformation of OSB, ICB and plywood.

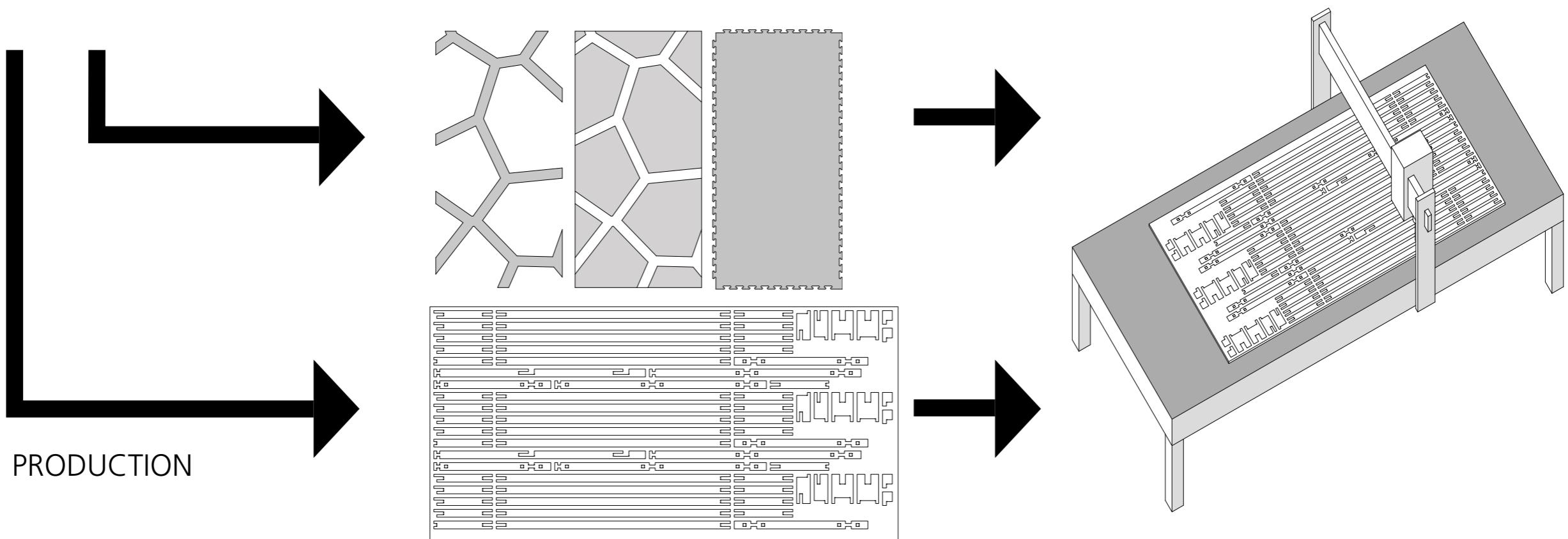
NOTE 2: The EE and EC per meter of M90, M70 and M46 profile was calculated with the assumption of 0,6mm thickness and 200mm, 156mm e 132mm lenghts respectively. OSB profile section is 60x30mm.



## EVALUATION / SIMULATION



## CORK re-WALL

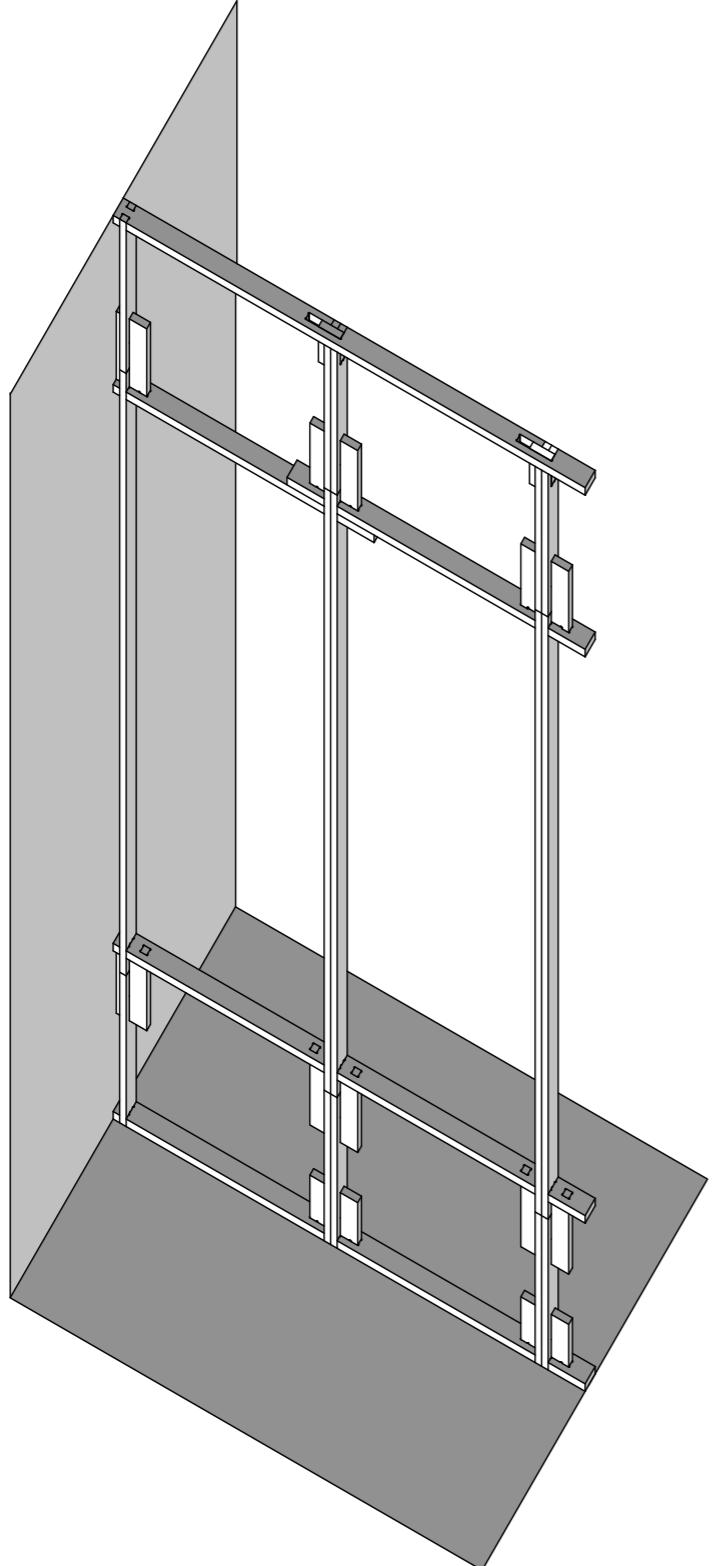


PRODUCTION

CORK re-WALL

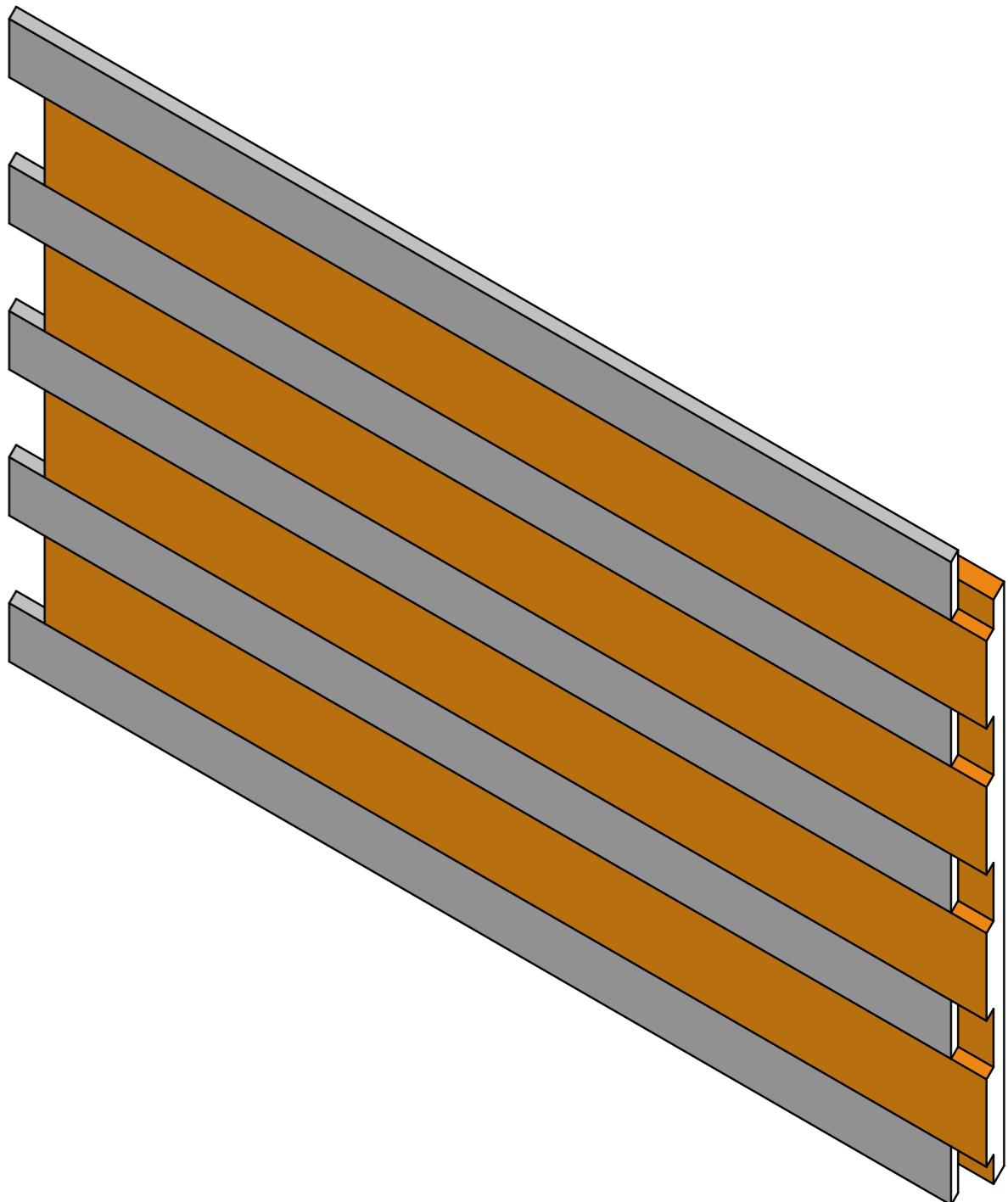
CONCEPT

CEAAD | AMORIM ISOLAMENTOS 2014/15

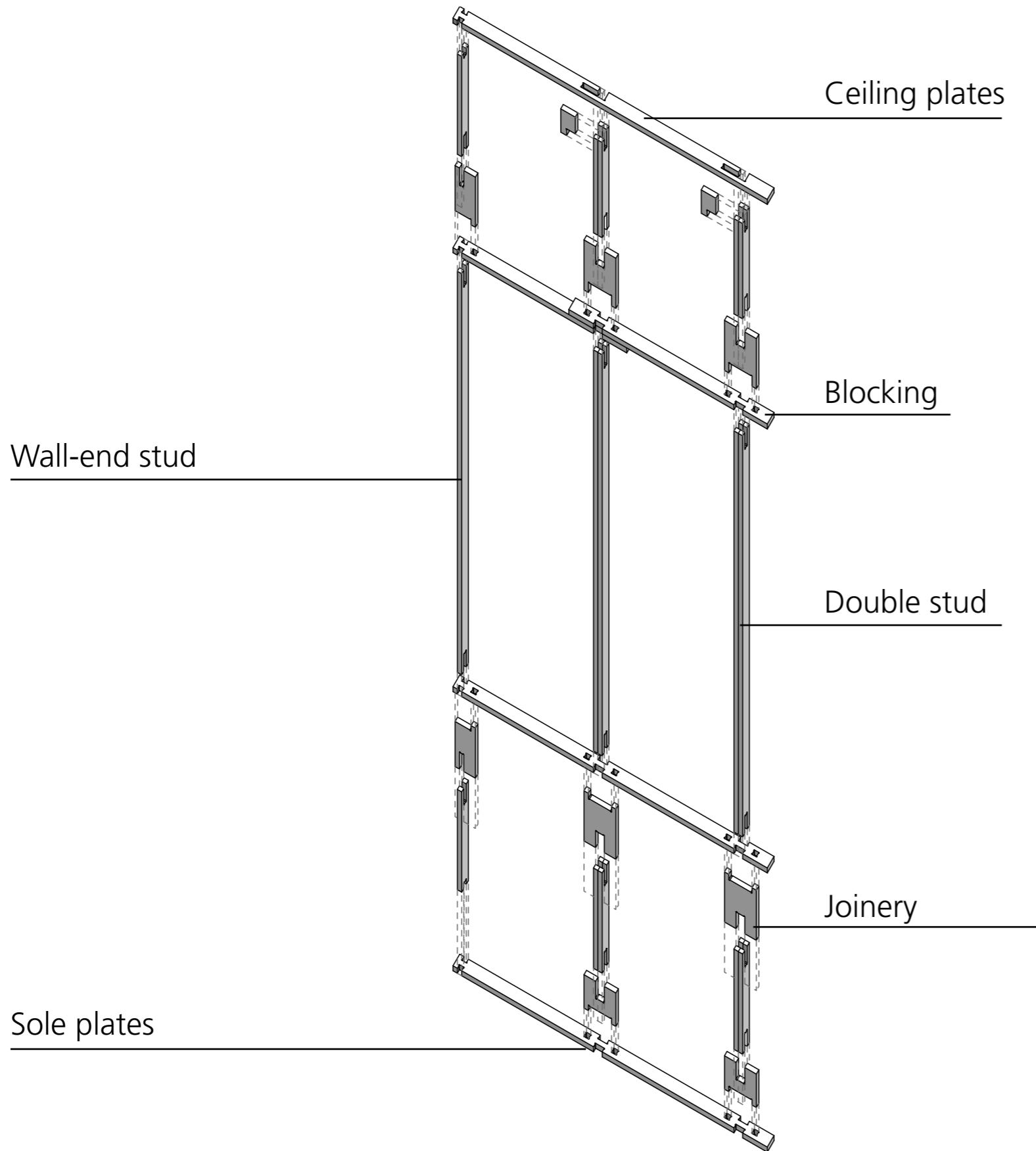


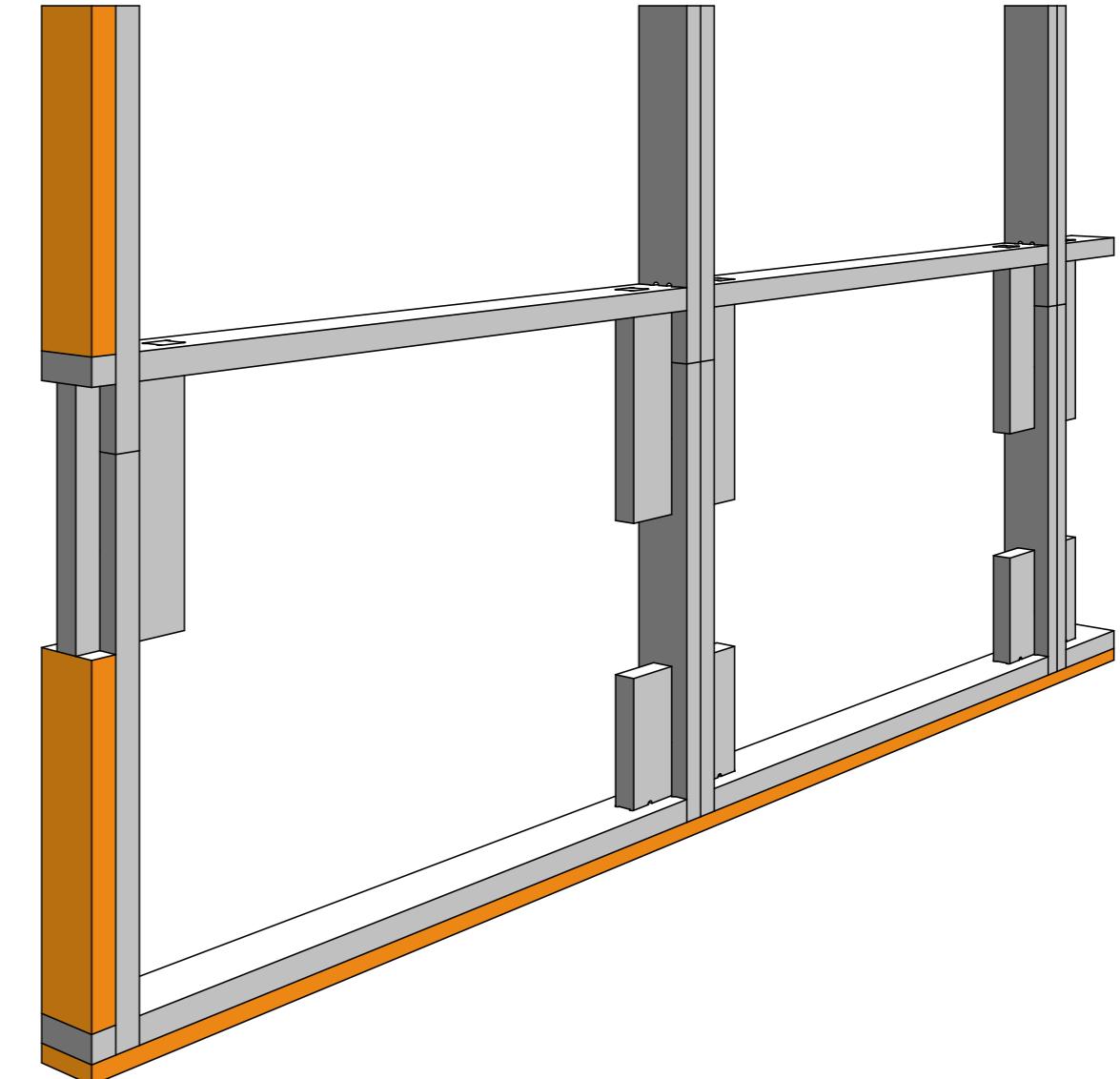
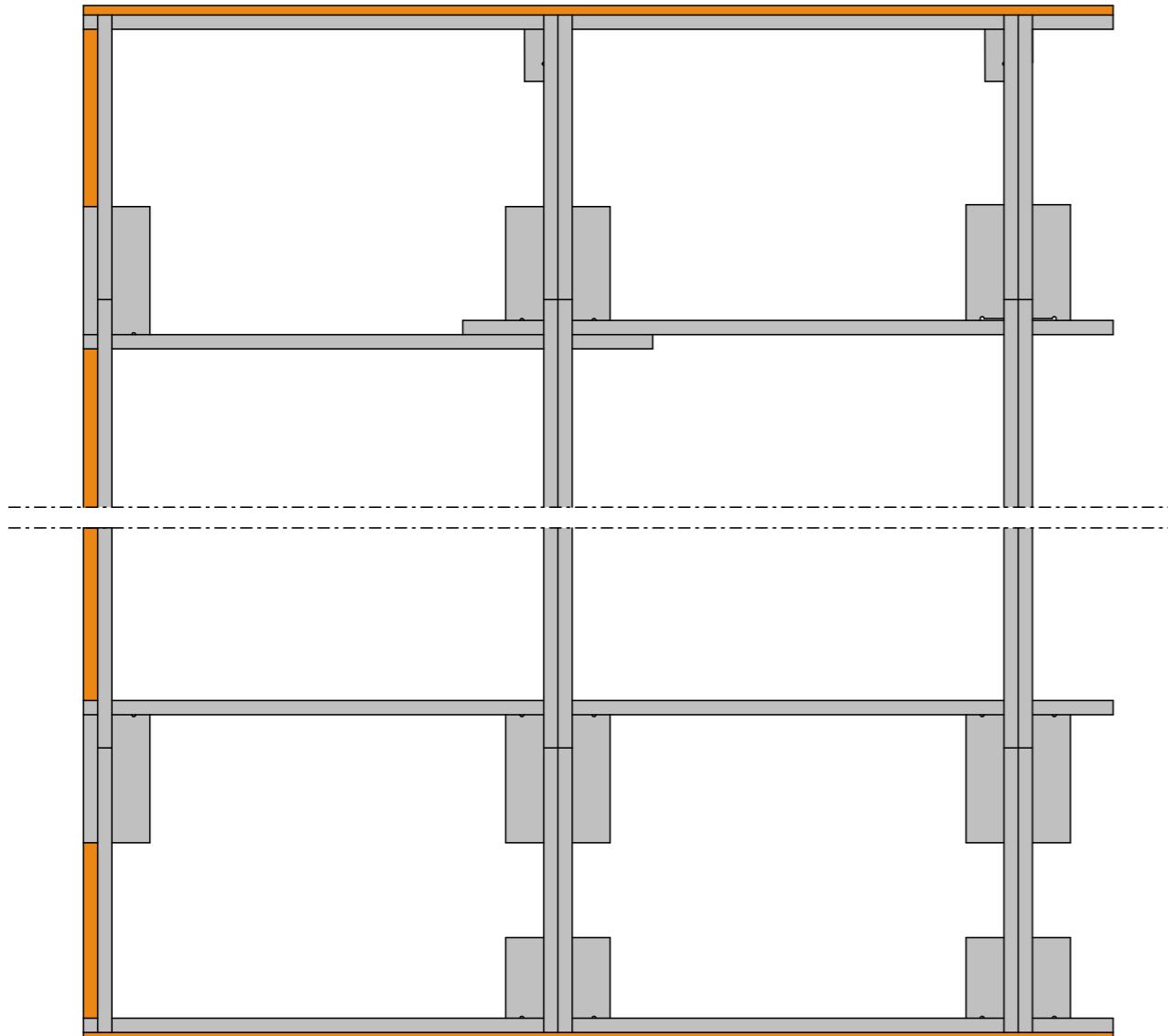
WOOD FRAME STRUCTURE

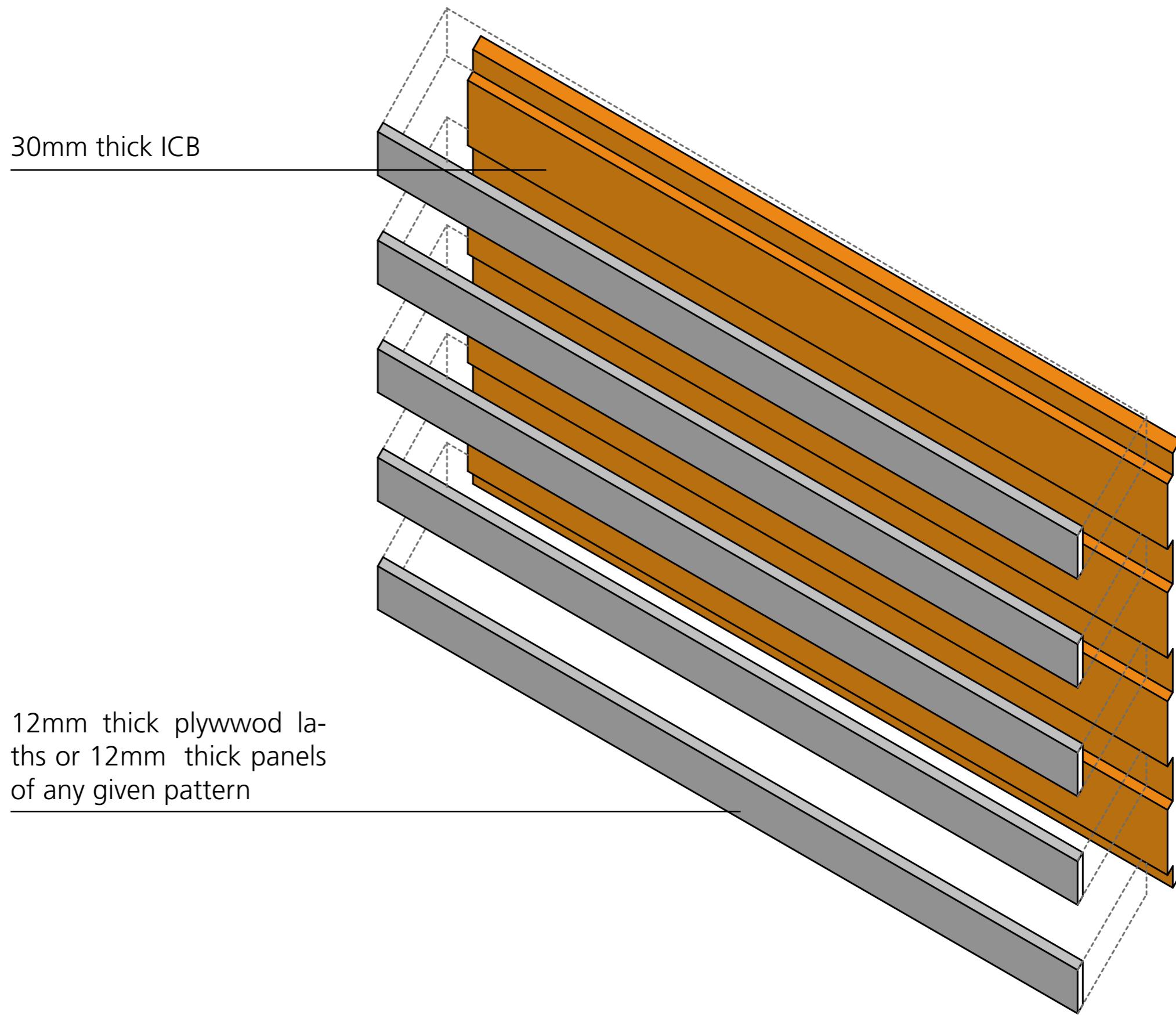
+

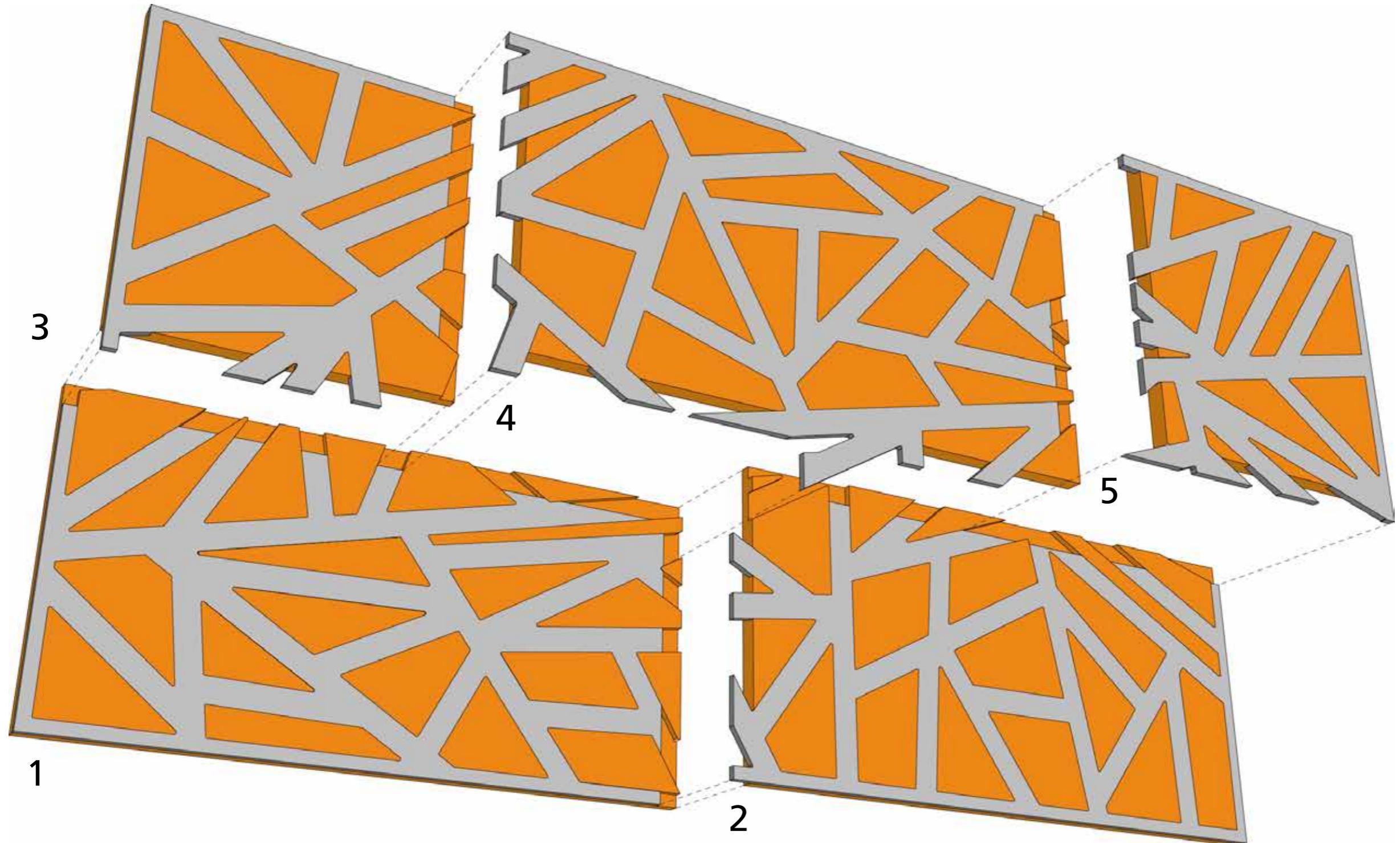


WOOD / CORK COMPOSITE PANEL









## CORK re-Wall

Project name

Length (m)

Width (m)

## CORK re-Wall

### FRONT SIDE

Do you wish to see just cork?

YES

NO

### BACK SIDE

Do you wish to see just cork?

YES

NO

If your answer is yes, the wall finish will be just cork and a solution will be generated.

If your answer is no, the wall will be finished with a combination of cork and plywood. Next you will be able to decide if you want a baseboard or a ceiling board and choose one pattern for the wall.

## CORK re-Wall

### FRONT SIDE

Choose one of these patterns

LINES

ICE-RAY

VORONOI

### BACK SIDE

Choose one of these patterns

LINES

ICE-RAY

VORONOI

## CORK re-Wall

### FRONT SIDE

Set the width of the laths (m)

Height (m) of the baseboard?

Height (m) of the ceiling board?

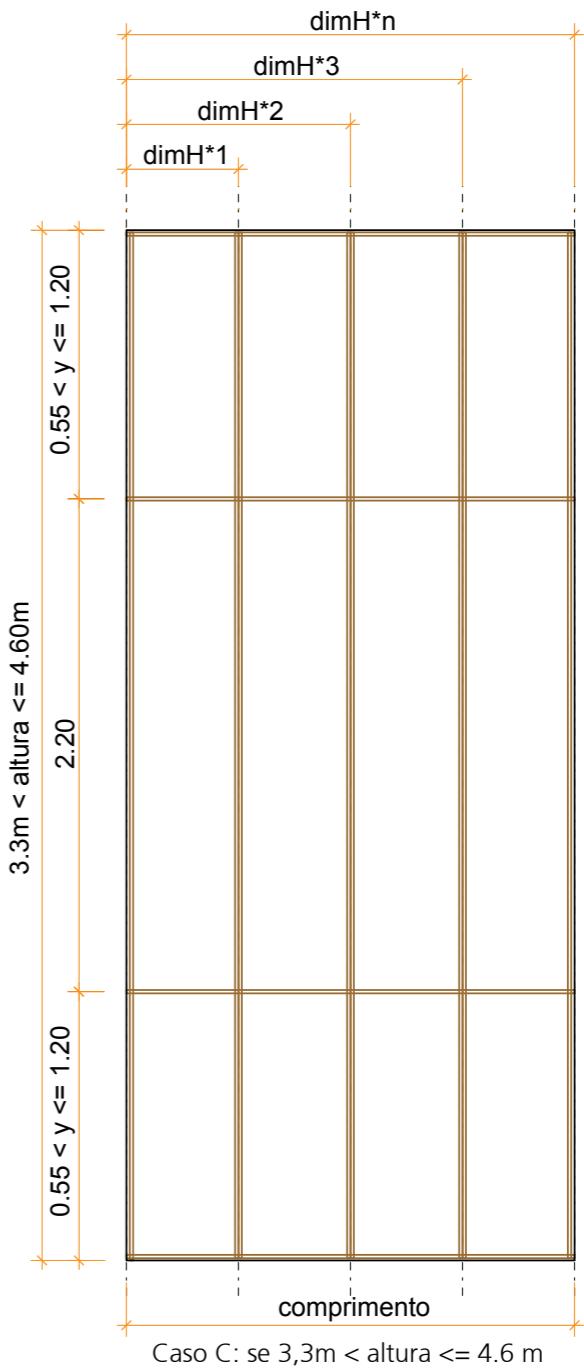
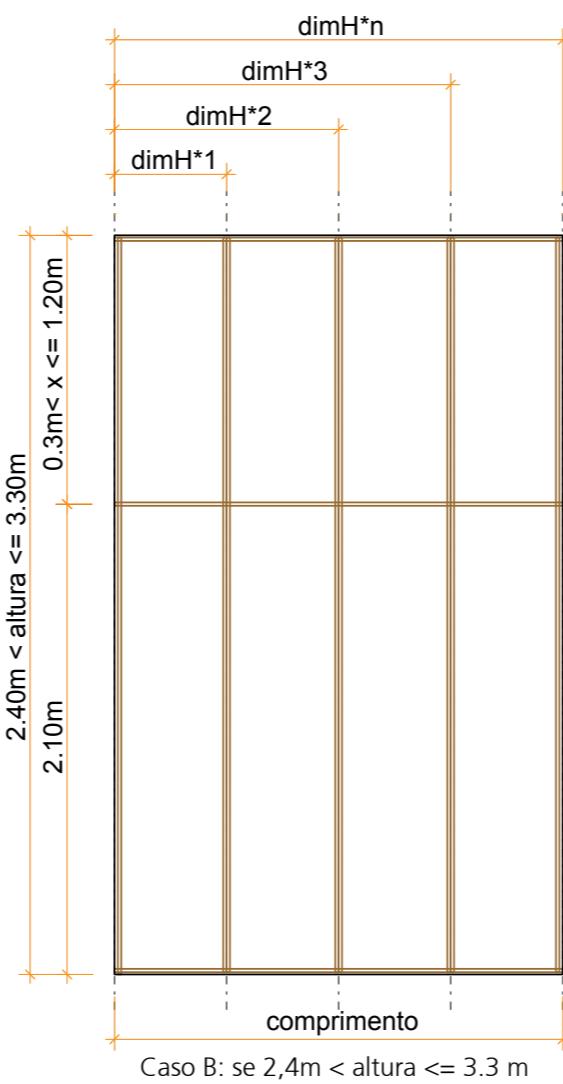
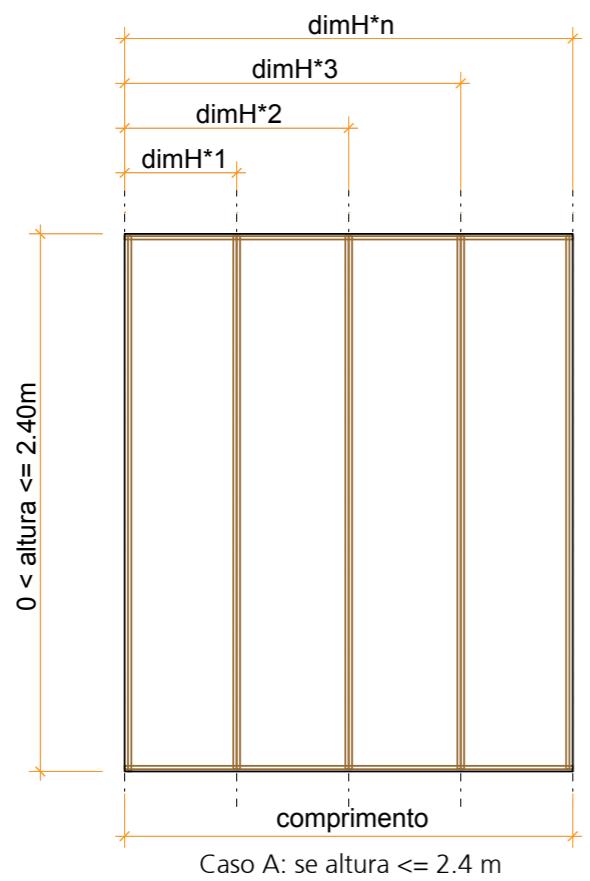
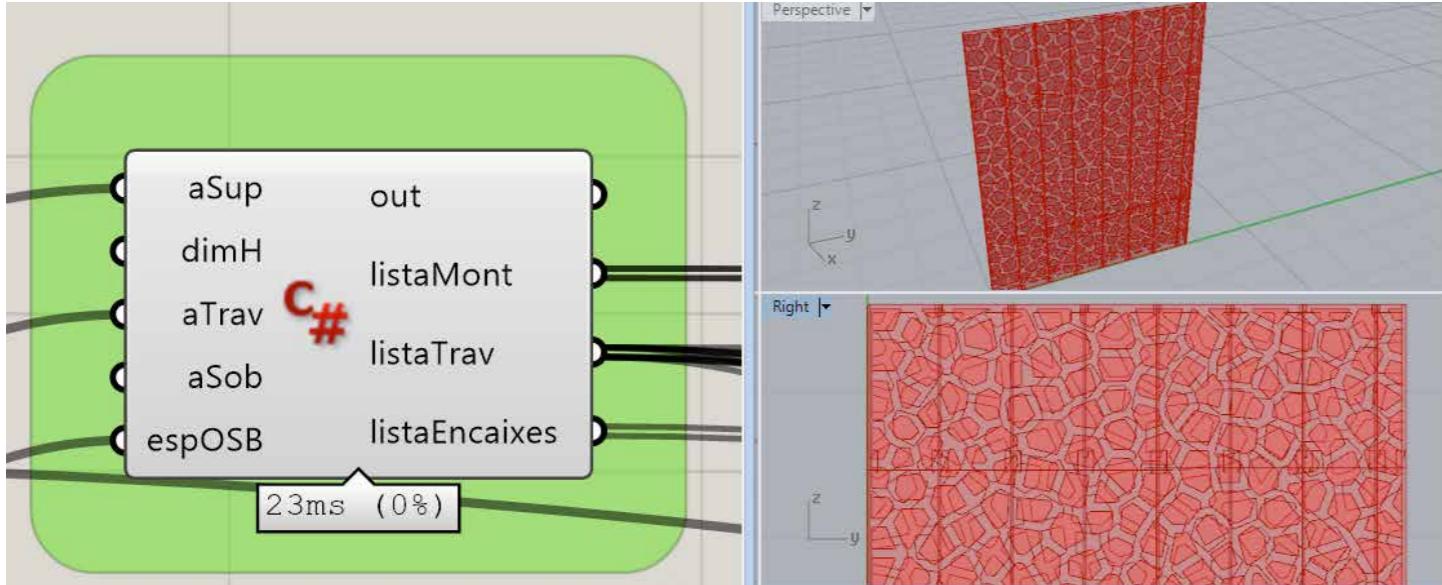
### BACK SIDE

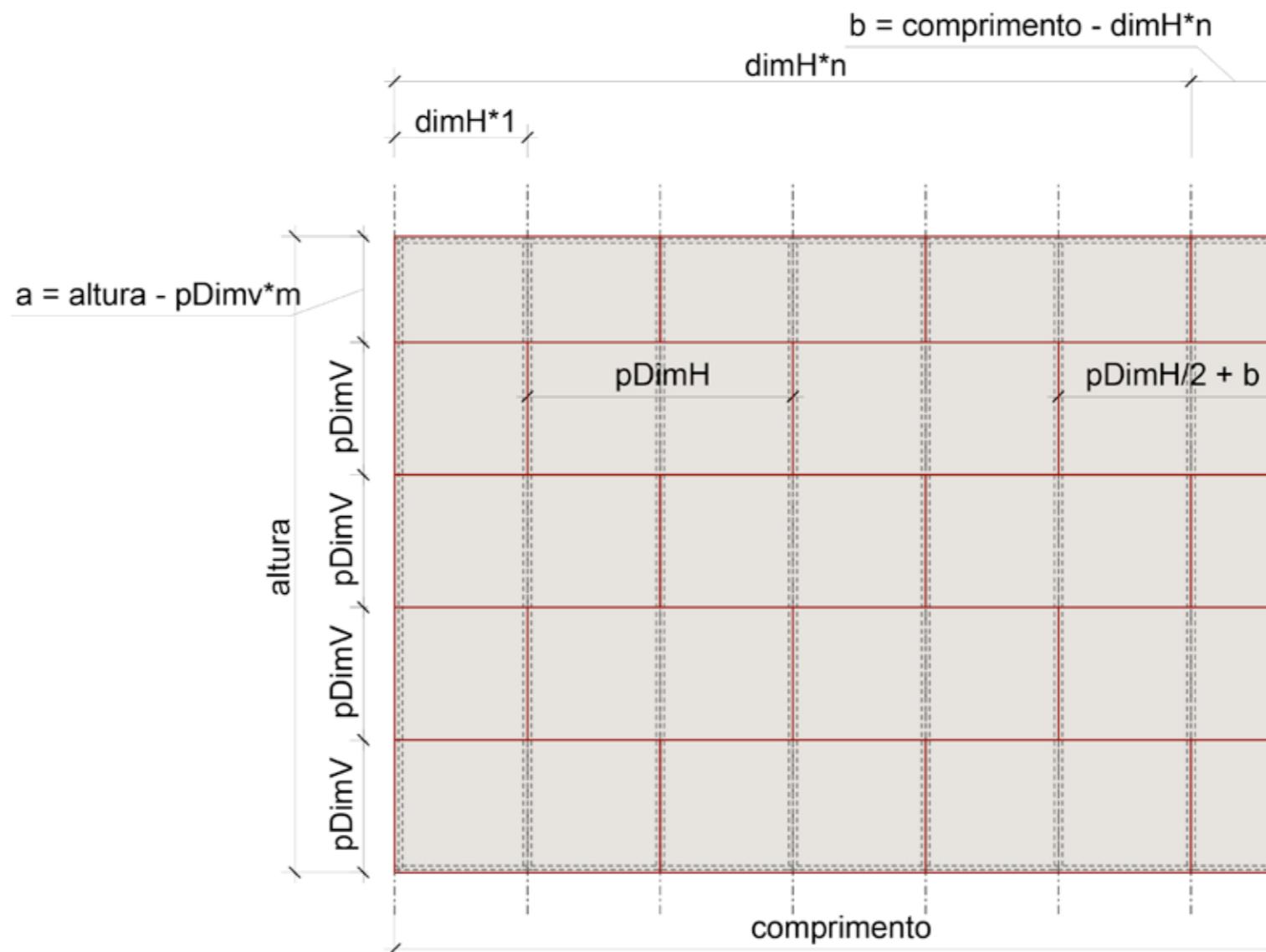
Set the width of the laths (m)

Height (m) of the baseboard?

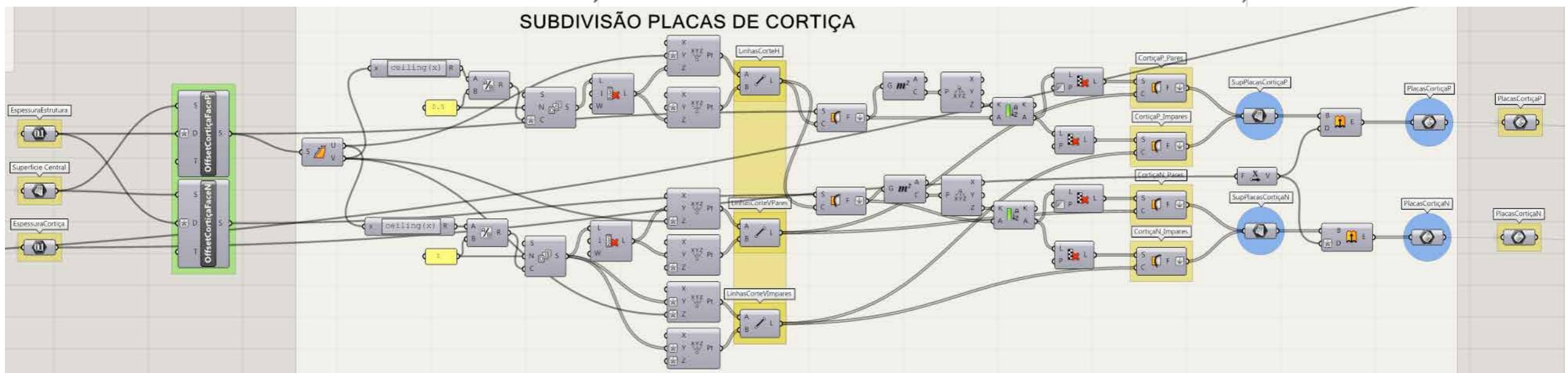
Height (m) of the ceiling board?

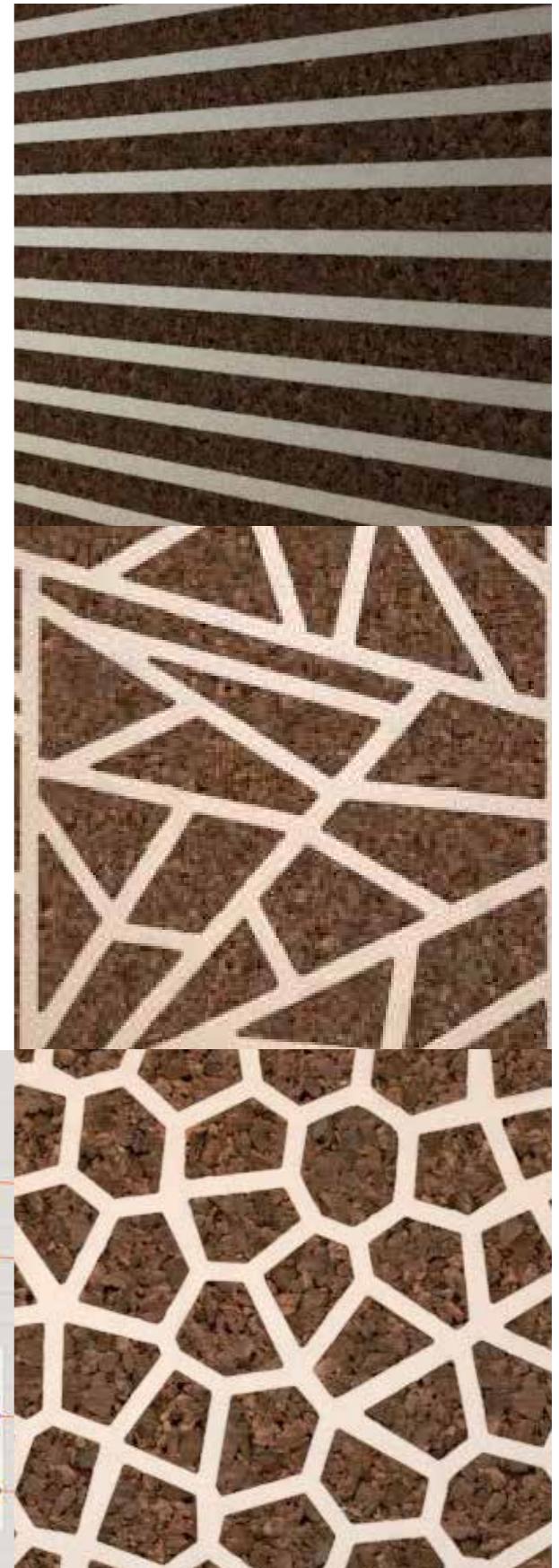
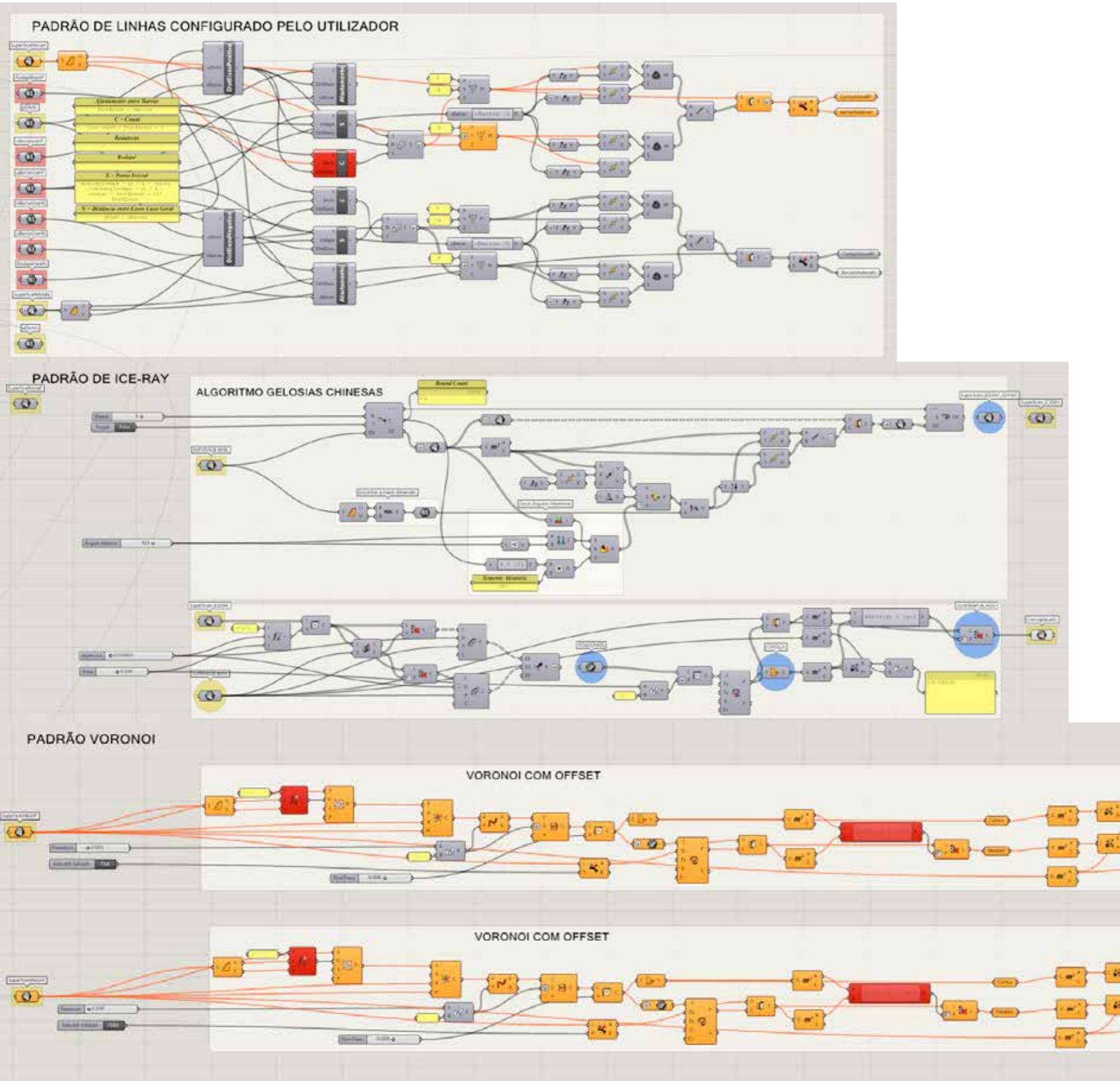
If any of the heights is set to 0 those elements won't be produced. If the sum of both elements height is larger than the wall's height, the wall finish will only be plywood.





### SUBDIVISÃO PLACAS DE CORTIÇA





CORK re-WALL

PATTERN ALGORITHMS

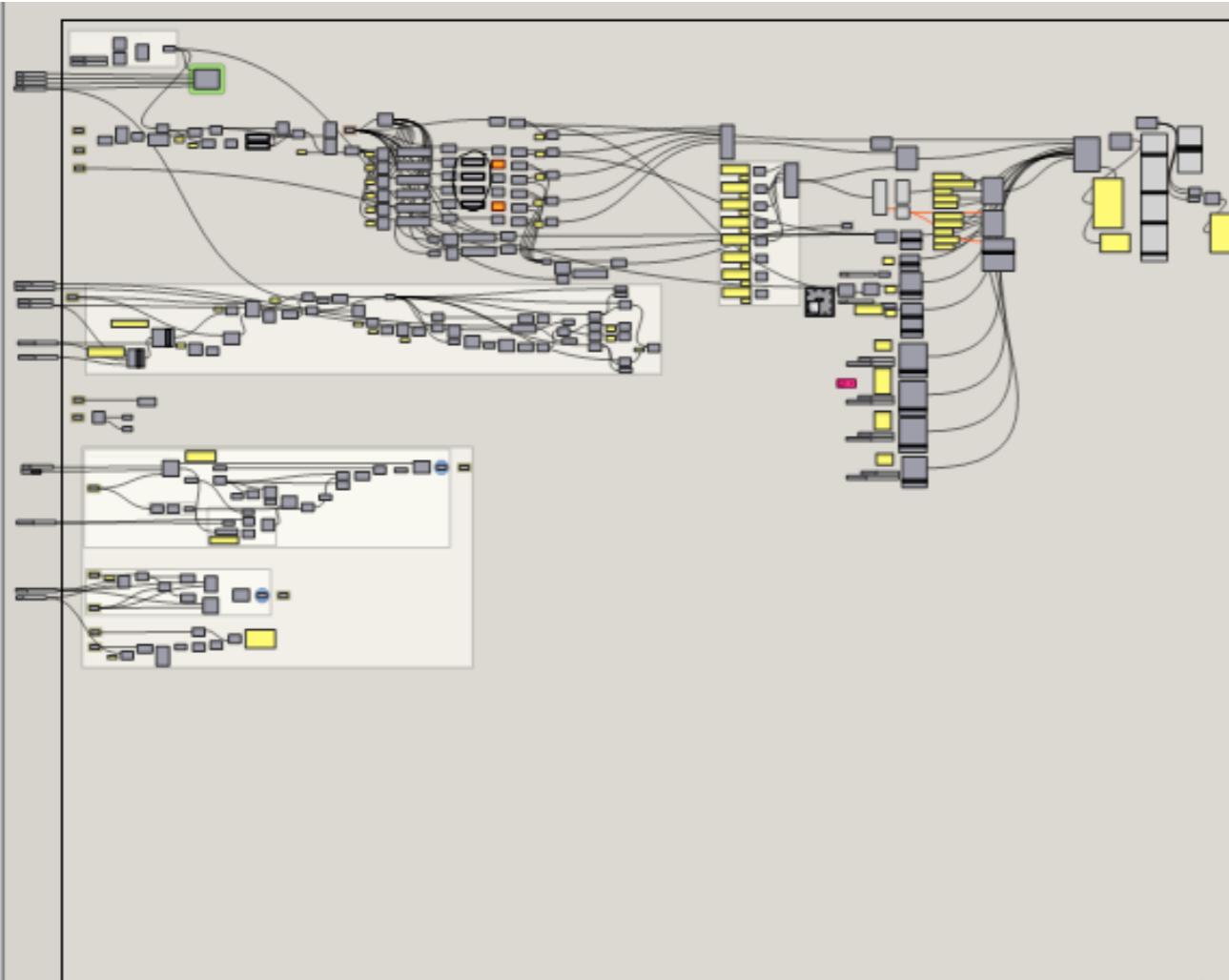
CEAAD | AMORIM ISOLAMENTOS 2014/15



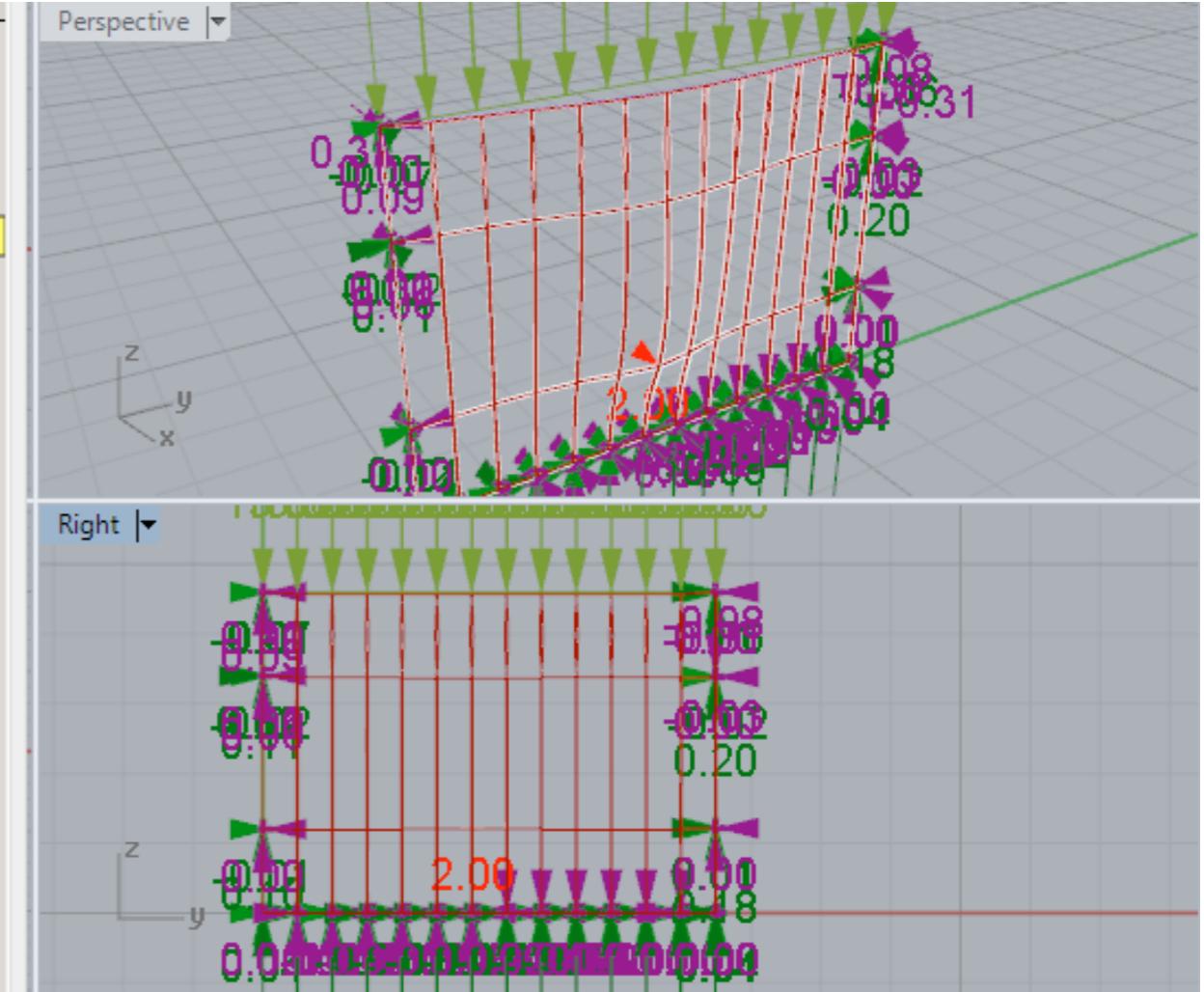
CORK re-WALL

PATTERNS

CEAAD | AMORIM ISOLAMENTOS 2014/15



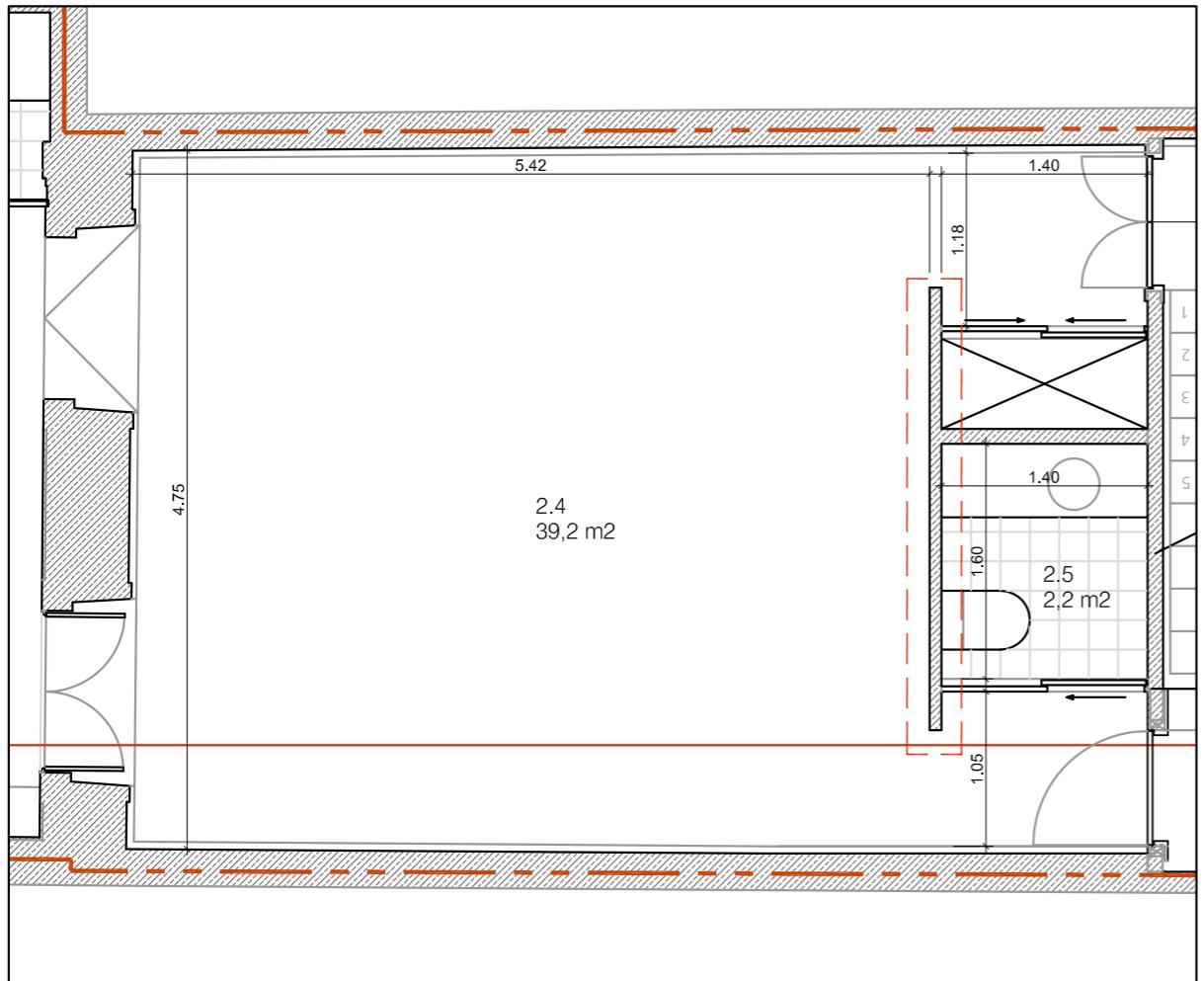
Parametric Model



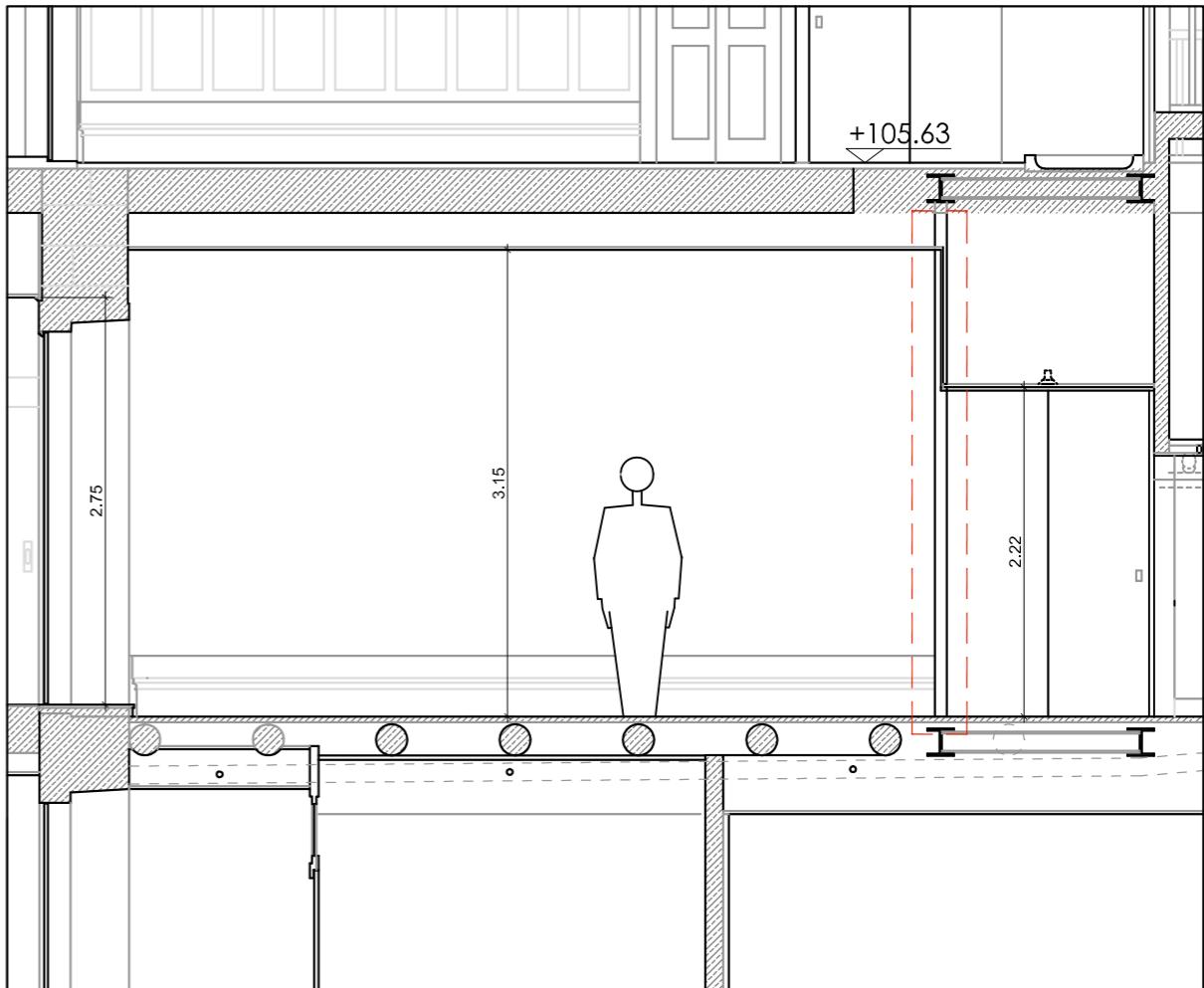
Simulation of Deformation under Loads

Global weighted EE and EC values per sqm of wall

	<b>U</b> [W/m <sup>2</sup> .°C]	<b>m<sub>TSU</sub></b> [J/m <sup>2</sup> .°C]x 10 <sup>3</sup>	<b>EEs</b> [MJ/m <sup>2</sup> ]	<b>ECs</b> [KgCo <sub>2</sub> e/m <sup>2</sup> ]
<b>Cork re-Wall</b>	<b>0,59</b>	<b>13</b>	<b>153</b>	<b>10</b>
LST 96/600 (46)	0,74	18	354	22
LST 100/400 (70)	0,77	12	306	20
LST 120/400 (70)	0,67	19	414	26
LST 120/600 (90)	0,64	12	286	19



PLANTA 1º PISO



CORTE C4

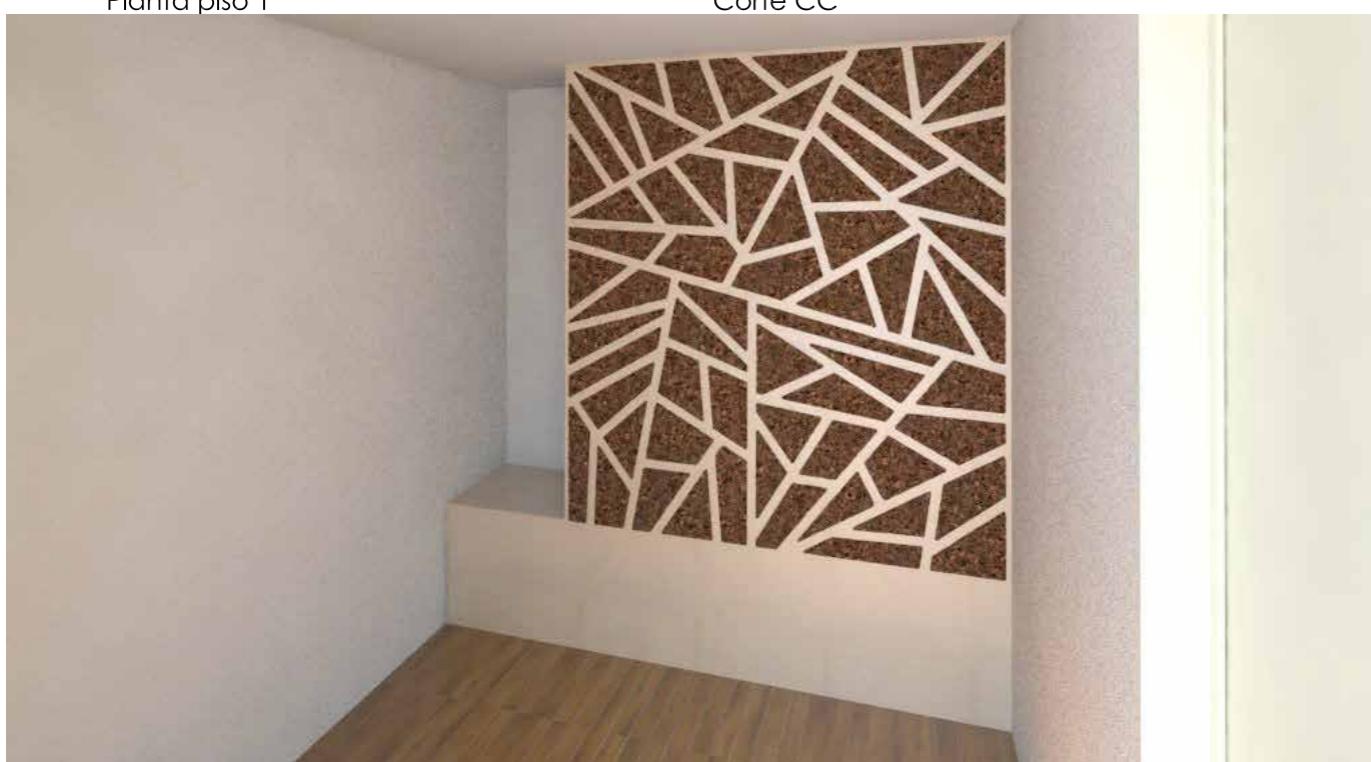
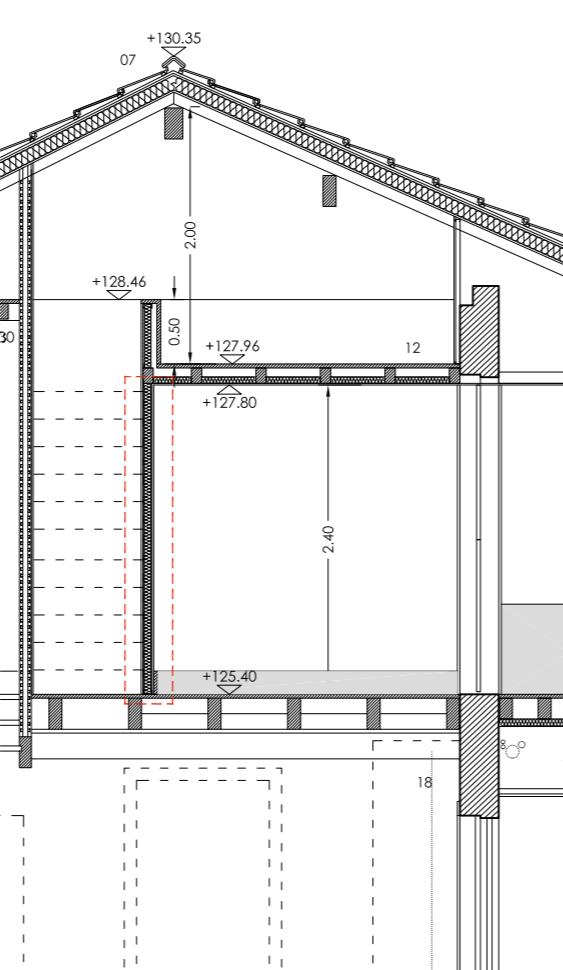
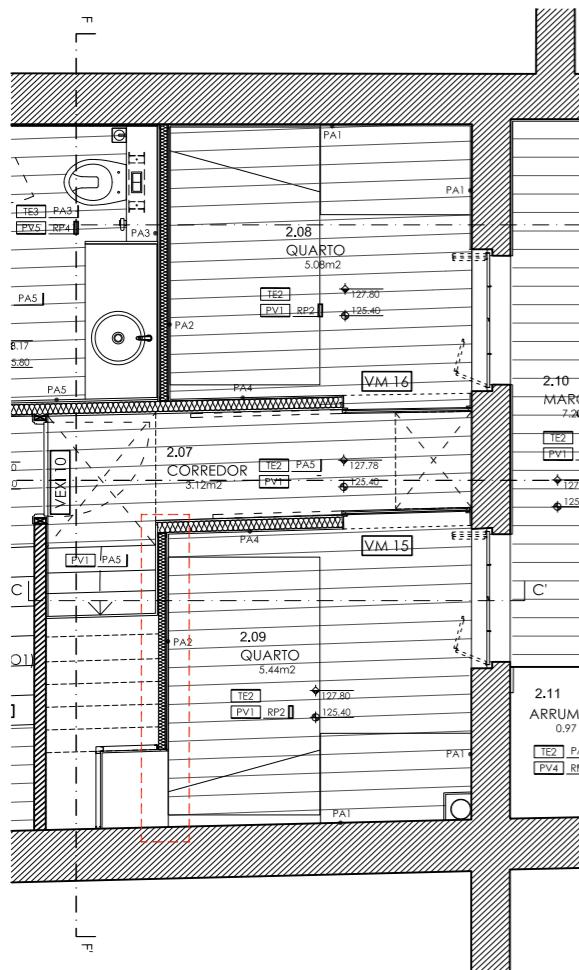


**CORK re-WALL**

**CASA COELHO NETO**



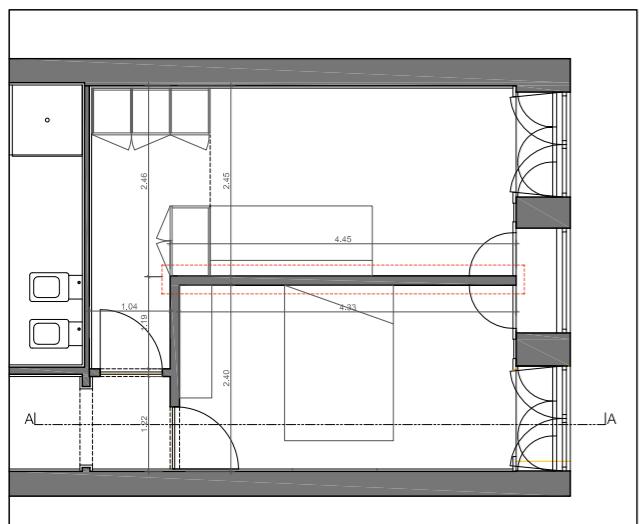
**CEAAD | AMORIM ISOLAMENTOS 2014/15**



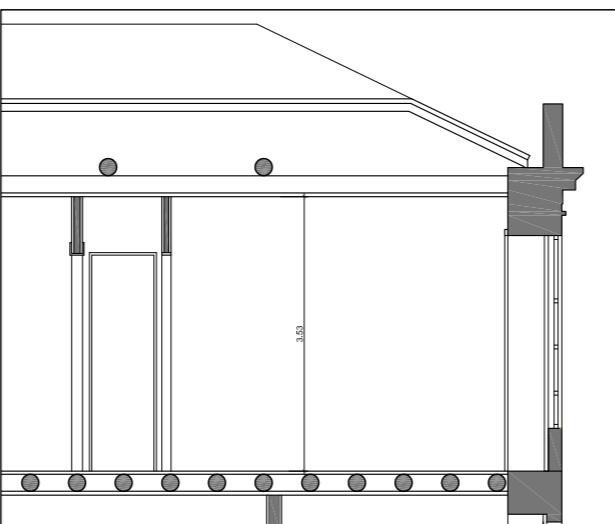
**CORK re-WALL**

**CASA LOBO AMADO**

**CEAAD | AMORIM ISOLAMENTOS 2014/15**



PLANTA 1º PISO

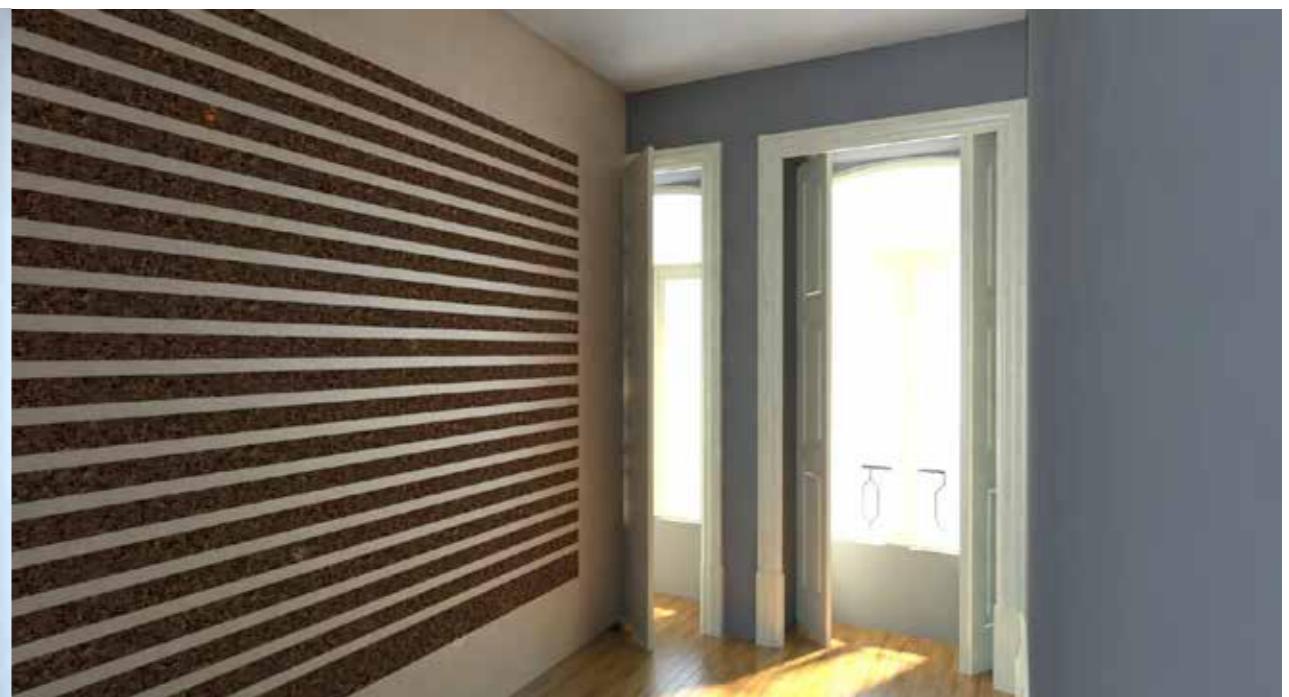


CORTE AA

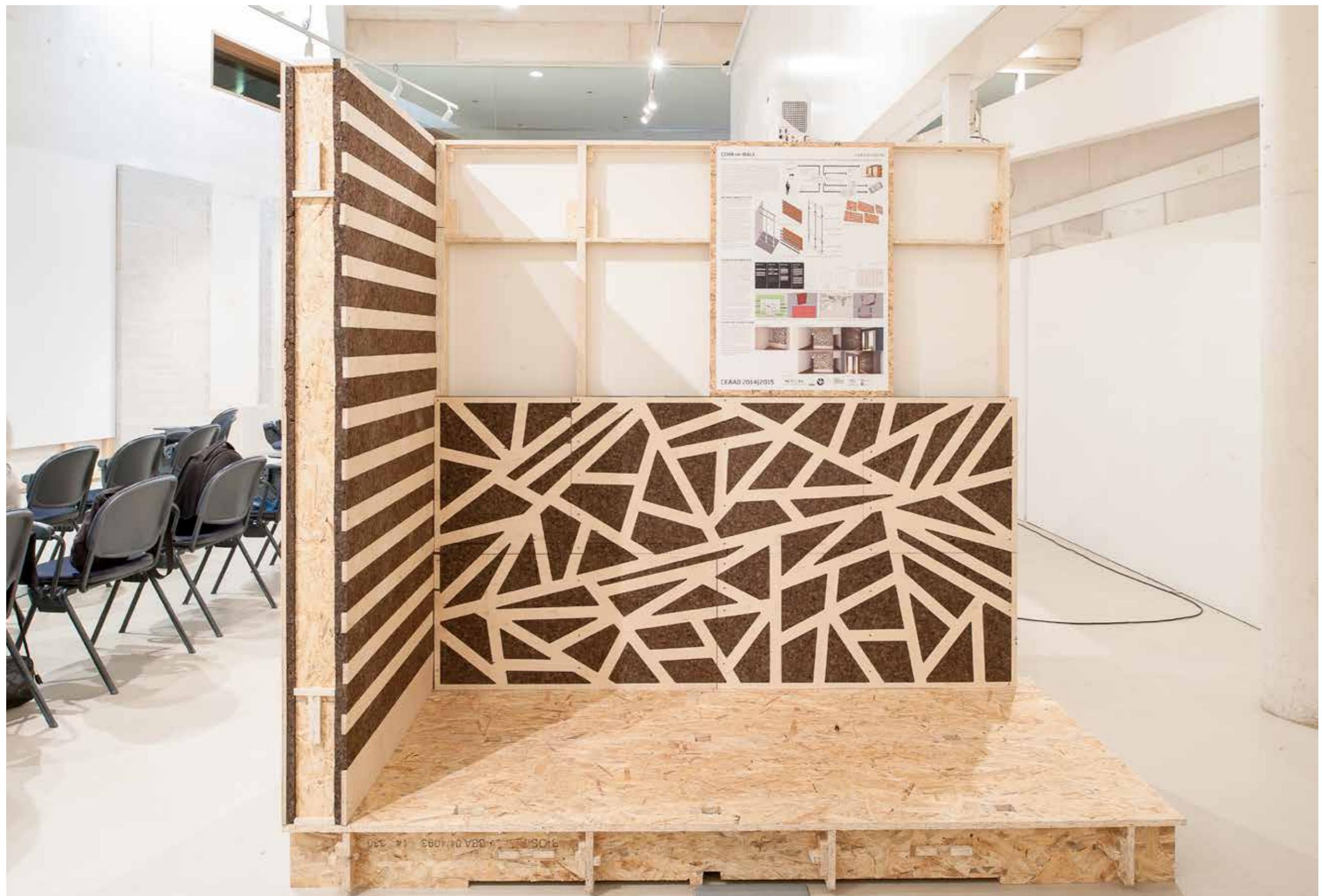


CORK re-WALL

CASA BOAVISTA 202



CEAAD | AMORIM ISOLAMENTOS 2014/15



CORK re-WALL

CEAAD EXHIBITION

CEAAD | AMORIM ISOLAMENTOS 2014/15