Design model through the lens of circularity and blue economy

P. Mendonça, A. Rocha and H. Daruari

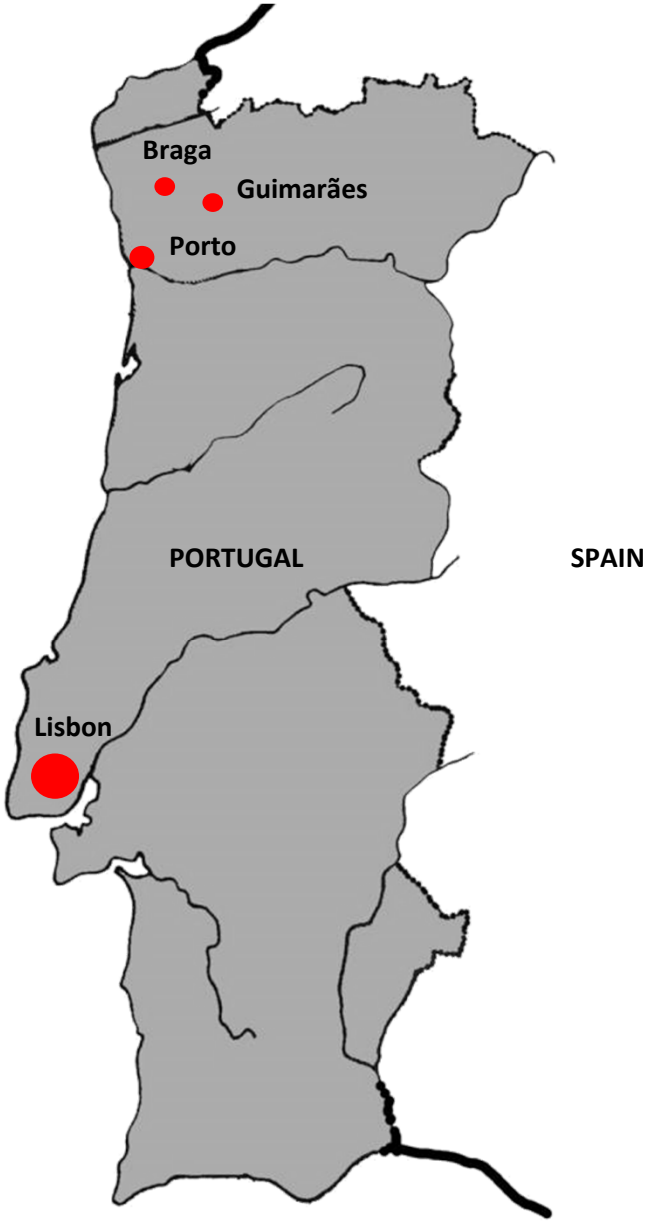
School of Architecture, Art and Design - University of Minho, Lab2PT

University of Minho

University of Minho

Founded in 1973, the University of Minho is located in the north of Portugal, with a campus in the city of Braga and another in the city of Guimarães.

Braga is the third largest Portuguese city, born from the ancient Roman town of Bracara Augusta. Guimarães is known as the "cradle of the nation“ and its historical center is classified as World Cultural Heritage by UNESCO



University of Minho

Braga

Guimarães

University of Minho's School of Architecture, Art and Design

Landscapes, Heritage and Territory Laboratory

60 Researchers with PhD

Scientific areas:
Architecture and Urbanism (Main Scientific Area)
Archaeology
History
Design

Research groups:
Lanscapes and societies (Land-S)
Design and Technology (De-Tech)
Space and Representation (Space-R)

R&D unit integrating a wide research team from different scientific areas (Archaeology, Architecture and Urbanism, Design, Geography, Geology, History and Visual Arts) converging to the common interest for the study of the territory, its landscapes and heritage. The transversal scientific character of Lab2PT is ensured by its organic articulation with two schools of the University of Minho: the School of Architecture (EAUM) and the Institute of Social Sciences (ICS) through its History Department.

University of Minho's School of Architecture, Art and Design

Based in Guimarães, Azurem and Couros Campi

Staff:

30+25 academic staff

5+2 non teaching staff

Students:

575 undergraduate and IM

65 (Arch MSc) **+**

40 (Prod Des BA) **+**

30 (Visual Arts BA) **st/y**

30 PhD students

University of Minho's Graduation in Architecture

	City and Territory	*Construction and Technology*	*Architectural Culture*
1st SEM 20 HOURS 30ECTS	***LANDSCAPE***	***SUSTAINABILITY***	***HISTORY & UCRONY***
	STUDIO 1 / 8H / 10 ECTS	**STUDIO 1** / 8H / 10 ECTS	**STUDIO 1** / 8H / 10 ECTS
	SEMINAR / 3H / 5 ECTS	**SEMINAR** / 3H / 5 ECTS	**SEMINAR** / 3H / 5 ECTS
	COMPULSORY / 3H / 5 ECTS	**COMPULSORY** / 3H / 5 ECTS	**COMPULSORY** / 3H / 5 ECTS
	OPTIONAL / 3H / 5 ECTS	**OPTIONAL** / 3H / 5 ECTS	**OPTIONAL** / 3H / 5 ECTS
	OPTIONAL / 3H / 5 ECTS	**OPTIONAL** / 3H / 5 ECTS	**OPTIONAL** / 3H / 5 ECTS
2nd SEM 20 HOURS 30ECTS	***TERRITORY***	***INNOV. & TECHNOLOGY***	***MANIFESTOS AND UTOPIAS***
	STUDIO 2 / 8H / 10 ECTS	**STUDIO 2** / 8H / 10 ECTS	**STUDIO 2** / 8H / 10 ECTS
	SEMINAR / 3H / 5 ECTS	**SEMINAR** / 3H / 5 ECTS	**SEMINAR** / 3H / 5 ECTS
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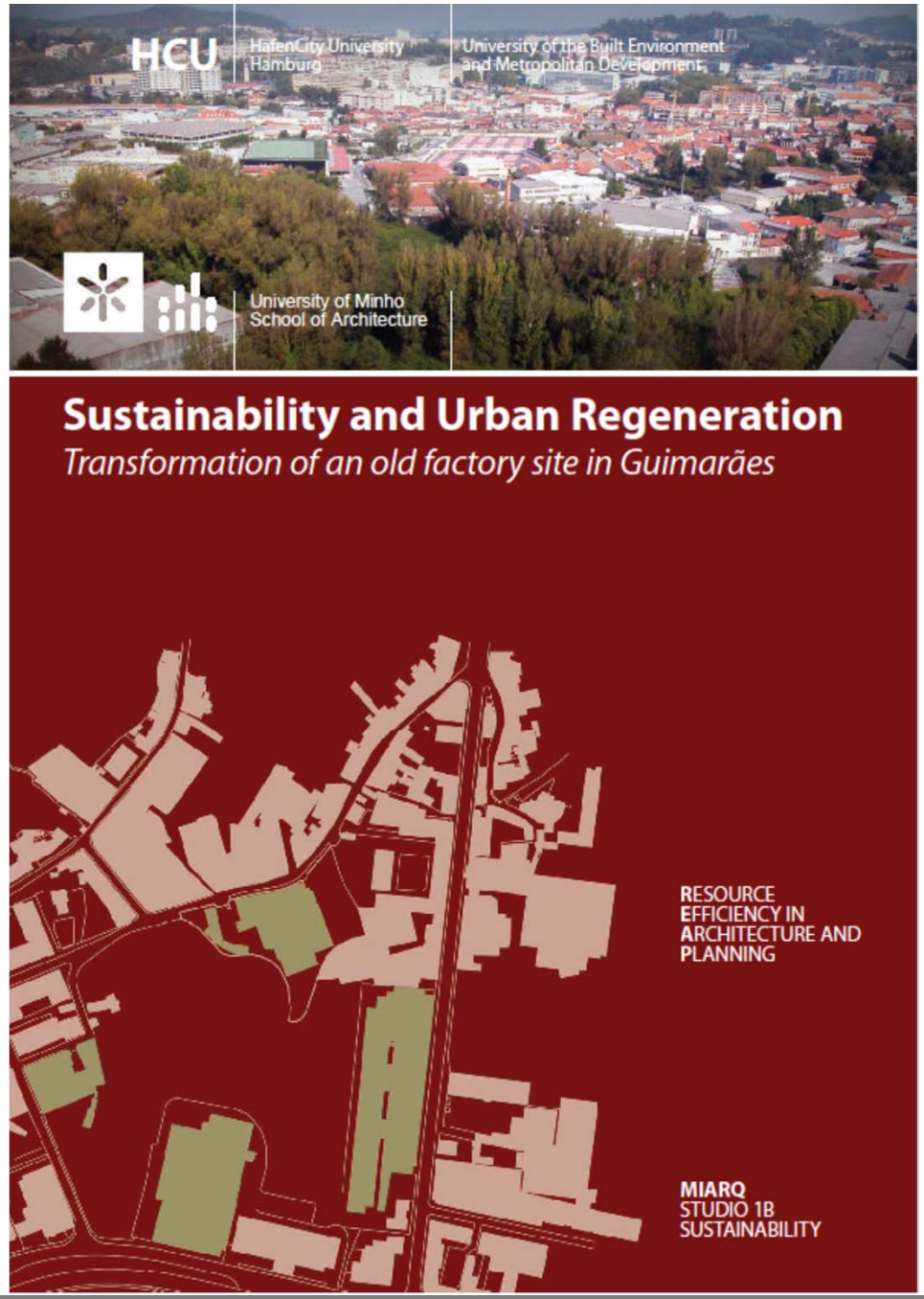
	OPTIONAL / 3H / 5 ECTS	**OPTIONAL** / 3H / 5 ECTS	**OPTIONAL** / 3H / 5 ECTS
	OPTIONAL / 3H / 5 ECTS	**OPTIONAL** / 3H / 5 ECTS	**OPTIONAL** / 3H / 5 ECTS
3rd SEM 20 HOURS 30ECTS	***PUBLIC SPACE***	***PATHOLOGY & REHABILITATION***	***EMERGING PROGRAMS***
	STUDIO 3 / 8H / 10 ECTS	**STUDIO 3** / 8H / 10 ECTS	**STUDIO 3** / 8H / 10 ECTS
	SEMINAR / 3H / 5 ECTS	**SEMINAR** / 3H / 5 ECTS	**SEMINAR** / 3H / 5 ECTS
	COMPULSORY / 3H / 5 ECTS	**COMPULSORY** / 3H / 5 ECTS	**COMPULSORY** / 3H / 5 ECTS
	RESEARCH PROJECT / 3H / 5 ECTS	**RESEARCH PROJECT** / 3H / 5 ECTS	**RESEARCH PROJECT** / 3H / 5 ECTS
	OPTIONAL / 3H / 5 ECTS	**OPTIONAL** / 3H / 5 ECTS	**OPTIONAL** / 3H / 5 ECTS
4th SEM 30ECTS	***RESEARCH LABORATORY***	***RESEARCH LABORATORY***	***RESEARCH LABORATORY***
	DISSERTATION OR A PROJECT WORK 30 ECTS	***DISSERTATION OR A PROJECT WORK*** 30 ECTS	***DISSERTATION OR A PROJECT WORK*** 30 ECTS

University of Minho's Graduation in Architecture

Sustainability Module

Compulsory courses :

	Construction and Technology
Studio 1	Sustainability
Seminar 1	Sustainability
Compulsory 1	Indoor Environmental Quality

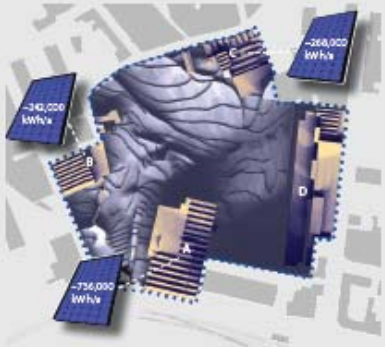

HCU
HafenCity University Hamburg
University of the Built Environment and Metropolitan Development
University of Minho
School of Architecture
Sustainability and Urban Regeneration
Transformation of an old factory site in Guimarães
RESOURCE EFFICIENCY IN ARCHITECTURE AND PLANNING
MIARQ
STUDIO 1B
SUSTAINABILITY

Introduction

A.1: WEST FACADE OF BUILDING A

A.2: AVENUE DOM AFONSO HENRIQUES

Energy



SOLAR POTENTIAL: SHADOW RANGE ON DEC 21 AND ESTIMATED SOLAR GAIN

Climate

Location: 41°27' N, 8°18' W
Climate zone: Csb (temperate, mesothermal climate)

- **Air temperature:** 14°C annual average temperature. Warmest and coldest month average between 20°C and 8°C.
- **Humidity:** Summer dry, the driest month has precipitation less than 60 mm.
- **Wind velocity and direction:** 4m/s average wind velocity from all directions more or less consistently throughout the year.
- **Radiation:** 1570kWh/m² annual global radiation on horizontal surface, 1197kWh/m² vertically 90°, 1813kWh/m² at 35° (best angle).
- **Climate responsive architecture:** most important design rules are allowing for passive solar direct gains, high thermal storage mass, sun shading of windows (Climate Consultant 5.2).

Solar Potential

The shading analysis illustrates, that even on the darkest day of the year (Dec 21), most of the roof surfaces are entirely exposed to sunlight or only little shaded. Most of the areas are tilted at an optimum angle of 30°-35° facing south (5470m²), others range between 10°-20° (2645m²). The flat roof surfaces (5128m², mostly building D) are less suitable due to partial shading and less radiation on horizontal surfaces. For building A,B and C alone, a total harvesting potential of around 1,200,000kWh per year can be expected (with monocristalline PV-modules, efficiency of 12%).

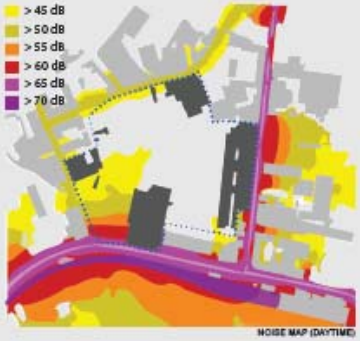
Energy Supply

Energy is needed for different functions of the site. While buildings need to be heated in winter months, a lot of cooling energy is required in summer. Following the aim to reduce heating and cooling demand of buildings by specific measures towards zero energy buildings, thermal energy becomes a smaller share of the energy balance. Accordingly, electricity, that is often connected to cooling devices, and for ventilation and lighting as well, starts to dominate. Looking beyond buildings, the field of traffic, where electricity could play a more important role in the future, is of importance.

The Electricity Production in Portugal is mainly based on coal, gas (since 1997 natural gas was introduced) and oil (together 66%) and hydropower comprises a wide extent, as it covers 16% (IEA 2008). Other renewable sources are waste, biomass and wind which makes up 13% (boom in wind generation since 2004). From this situation, it can be concluded that the decentralized electricity production has potentials. According to IEA 2008, heat in Portugal is mainly generated by gas and oil. Here the possibility of co-generation becomes aware. However Portugal is highly dependent on electricity imports (19%).

Portugal's National Energy Strategy 2020 (NES 2020) is a continuation of the NEEAP which sets the final energy consumption reduction target of 20 percent by 2020. Renewable energy sources should account for 31% of final energy consumption and 60% of power production.

Noise



NOISE MAP (DAYTIME)

The Site

The Project Site is a hub of activity - from the bustling central train station, to the cultural center and numerous residences surrounding the periphery. This activity results in various levels of noise emissions, all of which impact the site in various ways. Noise can heavily affect the environment and health of those around it, causing annoyance and in some cases, irreversible health damage.

SWOT

In terms of noise protection, the project site already hosts a few attributes working it its favor. A major contribution to noise reduction is provided by existing buildings onsite, namely Building A and Building D. The former blocks noise emission from the main arterial road, while the latter, Building D, lines the eastern border shielding the site from light traffic noise. Additional strengths include the site's dense greenery coupled with the location of residential buildings in the northern area, resulting in 30-35 dB, roughly as quiet as the average library. It should come as no surprise, the site's major weakness stems from two major noise sources: automobile transport on the surrounding roads, and rail transport from the adjacent railway. The weakest point of the site is the southwestern corner, where wide gaps between buildings allow noise to penetrate the site. Noise levels there, range from 60-70 dB. As revealed in the following sections of the brochure, opportunities to integrate noise protection in responsible urban planning are manifold. Closing the gaps between the buildings and the incorporation of additional noise barriers at the north and western border, constructed as natural berms or with reused material, can reduce noise while conforming to the site's environmental caliber and tone. On the receiver end, modifying floor layouts can significantly mitigate noise, in turn avoiding the threat of irreversible health effects.

Regulations

In 2006, the European Directive 2002/49/CE issued a decree-law n.o 146/2006, introducing new acoustical parameters for urban occupancy, including three reference periods of the day: (day (7 h – 20 h), evening (20 h – 23 h) and night (23 h – 7 h), strategic noise mapping, action plans and lastly, obligatory public information and participation (Rocha & Carvalho, 2007).

Portuguese noise legislation approved the new requirements in the 3rd Portuguese Noise Code January 2007 (RGR – Decree-Law n.o 9/2007) to better harmonize acoustical parameters. This means the project sites' day-time levels, along the main arterial road, can at times exceed the limits, as set out in the legislation (detailed in the chart below).

NOISE LEVELS

Form of Occupancy	Full day period (24 h)	Nighttime period (23 h – 7 h)
Mixed Zone	L_{den} = 65 dB(A)	L_n = 55 dB(A)
Sensitive Zone	L_{den} = 55 dB(A)	L_n = 45 dB(A)
Sensitive Zone close to an existent major transportation infra-structure	L_{den} = 65 dB(A)	L_n = 55 dB(A)
Sensitive Zone close to a major transportation infra-structure during design stage (not valid for airports)	L_{den} = 68 dB(A)	L_n = 58 dB(A)
Sensitive Zone close to a major airport infra-structure during design stage	L_{den} = 65 dB(A)	L_n = 55 dB(A)
Non classified zones	L_{den} = 63 dB(A)	L_n = 53 dB(A)

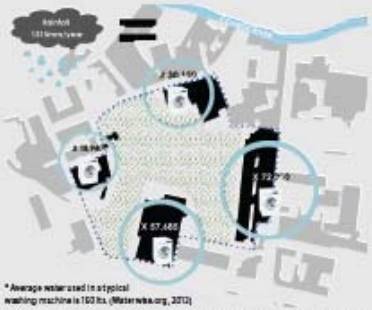
Introduction

A.3: WATER COLLECTION IN STA. ÁGUEDA, IDANHA-A-NOVA

A.4: LOCAL BUILDING MATERIALS: GRANITE | CERAMIC | CORK | BASALT/LIMESTONE/MARBLE

Water

STORM AND WASTEWATER MANAGEMENT



STORMWATER HARVEST POTENTIAL

Current Situation

Annual average precipitation in the city of Guimarães is 1315mm/year (NASA, 2002). The study site has 39,000m2 of open/permeable space and 33,000m2 of non-permeable surface area. Runoff stormwater from the site flows primarily into the northern underground Couros River, tributary of the Ave River Basin, which covers a total area of 468 km2 (Oliveira, Lima, & Vieira, 2005).

Water Supply and disposal in Portugal is managed by the Águas de Portugal Group in partnership with local companies and municipalities. Águas do Noroeste S.A. is responsible of the supply and disposal of water in Guimarães. This group operates 12 WTP, 570km of water mains. In terms of wastewater it operates 105 WWTP and 721km of sewers (Águas de Portugal, 2012). Guimarães has a water demand of 120 l/capita/day, which is largely emanated from surface and underground sources.

SWOT

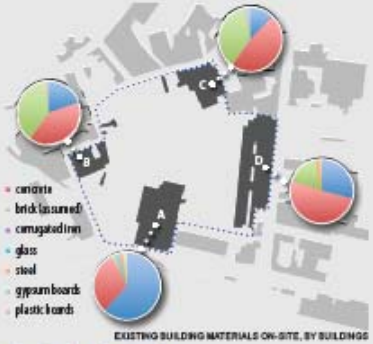
The fact that the site has over 50% permeability (totally unsealed area) is a STRENGHT. The assumed combined sewage and rainwater system is seen as a WEAKNESS. The large amount of roof area can be regarded as an important OPPORTUNITY to harvest and reuse rainwater. Climate change, the city's plan towards densification, the old (centralized) infrastructure and the cost associated with the renovation of the latter are all considered THREATS.

Legal Instruments

The EU Water Frame Directive (WFD) came into force in October 2000 with the aim to improve the aquatic environment of all member states. The WFD promotes decentralized waste and rainwater management with instruments such as the taxation system, which gives incentives to use water resources more efficiently.

In terms of sustainable water management, Portugal launched the National Program for Efficient Water Use (PNEA) in 2005. However, the country still needs to fulfil the EU regulations (EU, 2007): many wastewater treatment plants operate insufficiently and potable water quality also does not always fulfil European standards. Furthermore, there are some legal constraints about the reuse of wastewater and rainwater (ISBE Portugal, 2009).

Materials



EXISTING BUILDING MATERIALS ON-SITE, BY BUILDINGS

#03: CONSTRUCTION WASTE ON-SITE

Situation in Portugal

Building materials should be suitable and adaptable to the local conditions of the building/site. Portugal has many natural ressources such as cork, iron ore, copper, zinc, silver, gold, marble, clay, gypsum etc. 40% of the world's raw resources are consumed by buildings. At the same time, buildings are one of the main producers of waste, harmful air and CO2 emissions (Zari). Therefore the choice of building materials to be used, as well as their disposal/recycling, is very important.

On-site situation

When analysing the project site, its main advantages regarding materials are the high concentration of reusable materials and the diversity of locally produced building materials. Although only a small part of the four buildings is still in use, a considerable part of the buildings' structure is in good shape.

On the other hand, the waste management system in Guimarães is still under construction and most waste goes to landfill rather than to composting, recycling or incineration plants. Waste separation is practically nonexistant, and the capacity of the bins in the city is limited. On the site itself there is a high risk, due to the former use for textile and leather production, that the buildings and surrounding soil are contaminated. Furthermore, the buildings have no improvements such as insulation and are still in the same situation since the 1900's.

On the other hand, these conditions offer several possibilities of upcycling the buildings and their materials, and reuse of the majority of the structures, materials and existing vegetation. Additionally, the site provides the opportunity to have a pioneer role in exhibiting waste separation and other sustainable ideas.

The reuse of the buildings and a change in their uses may entail removal of some of the old structures/materials. Future use of new materials should be balanced and carefully weighed in respect to required functionality, cost and historical value.

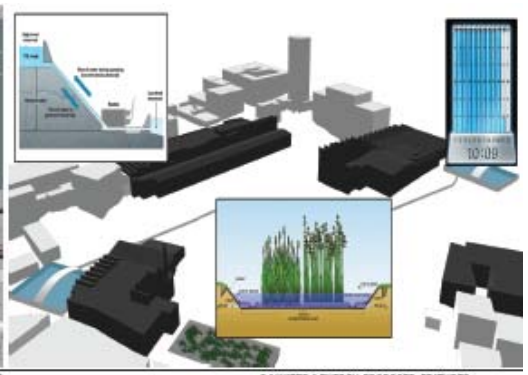
Legal instruments

Several instruments and regulations describe a first step in the direction of waste separation, reuse and recycling. For example, Portugal has developed a National Plan for industrial waste prevention and more focused for municipal waste prevention as well. Additionally, the EU Directive 2010/31/EU ensures the extension of renewable energies.

Introduction

5.1:AVENIDA DOM ALFONSO HENRIQUE

5.2:WATER & ENERGY DIAGRAM



5.3:WATER & ENERGY: PROPOSED FEATURES

Group 5

Water-Energy-Link: A showcase project

Project area as signal Gateway to Guimaraes

The project approach aims to regenerate a derelict area as the southern city gateway to Guimaraes by developing the site with appropriate mixed uses and encouraging permeability through the site. The area contains many structures of historical significance, such as industrial buildings and the green park in the center . These were all to be enhanced and brought back into use.

The proposal creates new routes and enhances existing floor patterns at an urban design level, while providing significant architectural and landscape features which will attract new life into the area.

MORPHOLOGY DIAGRAM

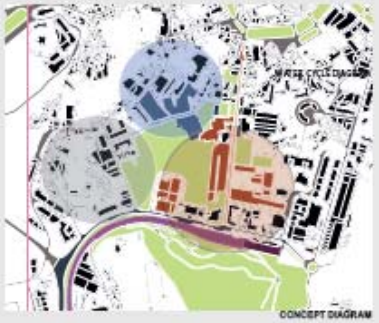
In developing the project concept, initially the most appropriate uses were considered to give a clear character of the spaces within and around the site. The morphology diagram identifies three major uses in the area such as cultural, residential and services and office and landscape use. These uses are to be enhanced by the street design. In this context, three major types of streets were identified: The Green Belt enhancing the cultural and leisure use in the area, The Blue Belt consolidating the office and landscape use, and the Red Belt backing up the commercial and services use in the residential area.

By developing new mixed-uses in the existing industrial areas and connecting them with the new urban design features on the street, the project area is to become a vibrant arterial link within Guimaraes, directing visitors intuitively from the station to the inner city. In the same time, the area will be developed considering the lowest possible impact on the urban environment while helping to reinstate a sense of community and connection to nature by creating a closed, compact system which condenses the place where you live, work and play.

Healthy, supportive,diverse and sustaining relationship between natural and man-made space

Concerning the environmental aspects, the project inspires delight and expresses human design symbiotic with nature. The Guimaraes southern city gate seeks to be a life support system in harmony with energy and water flows, human experinces and other living things.

This is to be achieved by street and green area design features which harvest the energy of the sun, sequester greenhouse gases, harvest and distill water, transform waste water to energy, and provide habitat.



CONCEPT DIAGRAM

Water Concept

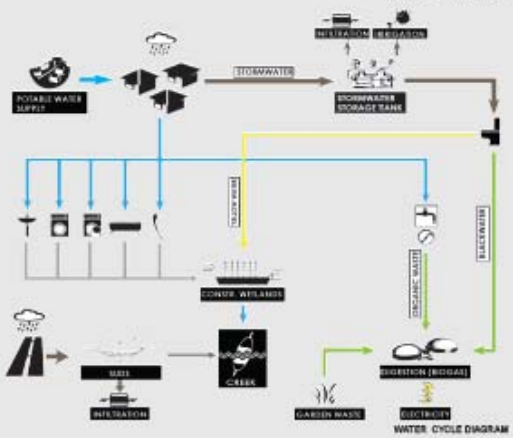
Regarding stormwater, the slope of the site suggests to reduce and retend runoff. The resulting water concept involves rooftop rainwater harvesting on-site, and sustainable urban drainage features in the redesigned streetscape to retend and infiltrate street runoff.

The harvested stormwater is used for toilet flushing. Yellowwater and greywater from the buildings is channeled to constructed wetlands situated in the northern, lower part of the site and eventually discharged into the creek. Blackwater and organic waste from kitchen sink grinders is directed to a small biogas plant. Since most areas on-site are unsealed, some stormwater infiltrates the soil. Excess stormwater from street runoff is also eventually discharged into the creek.

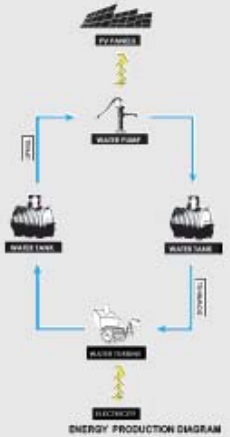
Energy Concept

The underlying principle of the energy concept is to showcase the integration of water and energy aspects. It consists of two parts: a small-scale biogas digestion plant run by blackwater and organic waste, and a pump-storage hydroelectric plant which stores electricity from PV panels on the on-site buildings.

The potential PV production vastly exceeds - on an annual basis - the on-site consumption. Along with the topography of the site, this enables the installation of a pumped-storage hydroelectric plant, serving as a showcase facility for the balancing of fluctuating renewable energy production. With two 3.000.000 L storage tanks in the southern and the northern area (height difference of 30m) and a pump-generator, 212 kWh can be produced over a period of 5h, while 231 kWh are initially required.

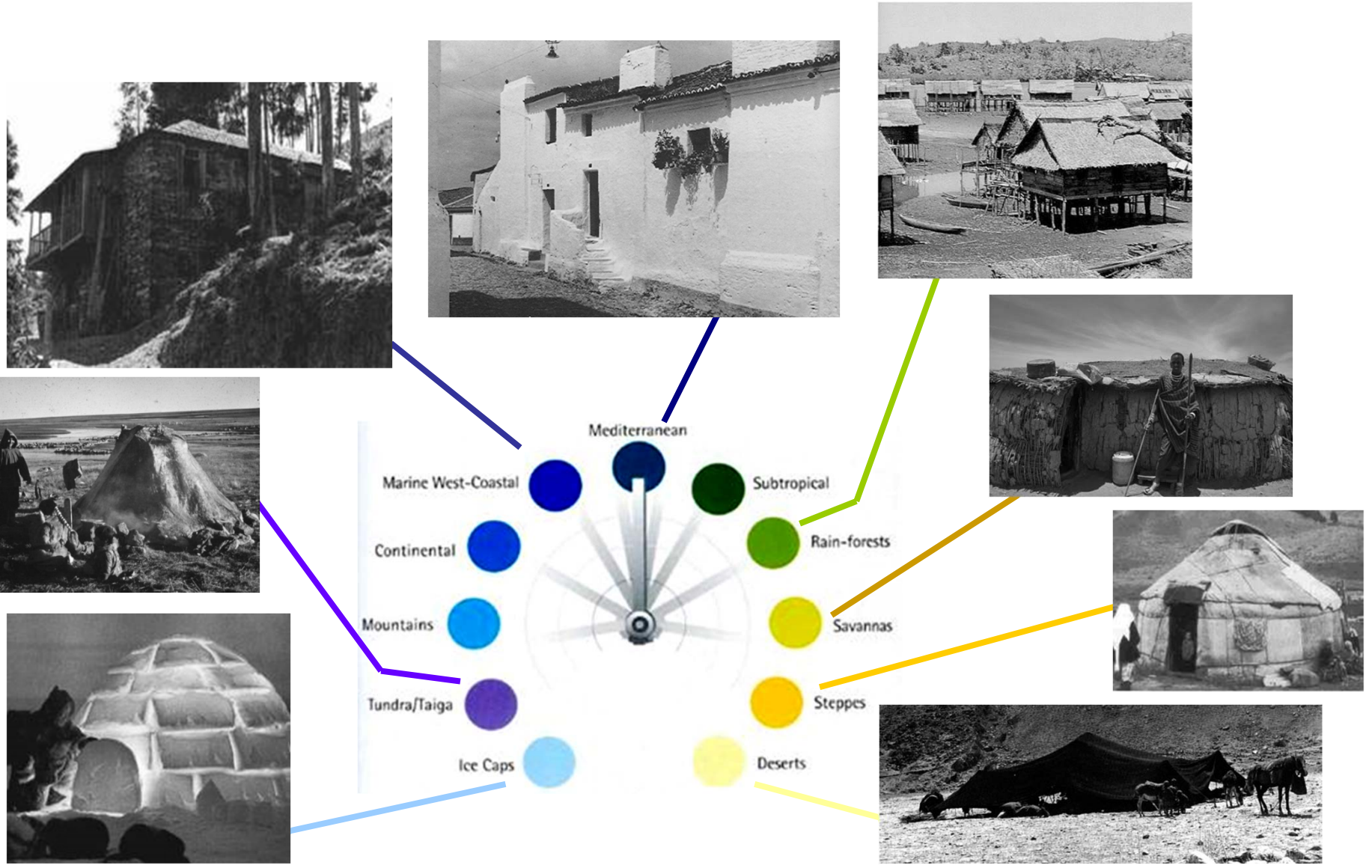


WATER CYCLE DIAGRAM



ENERGY PRODUCTION DIAGRAM

Introduction



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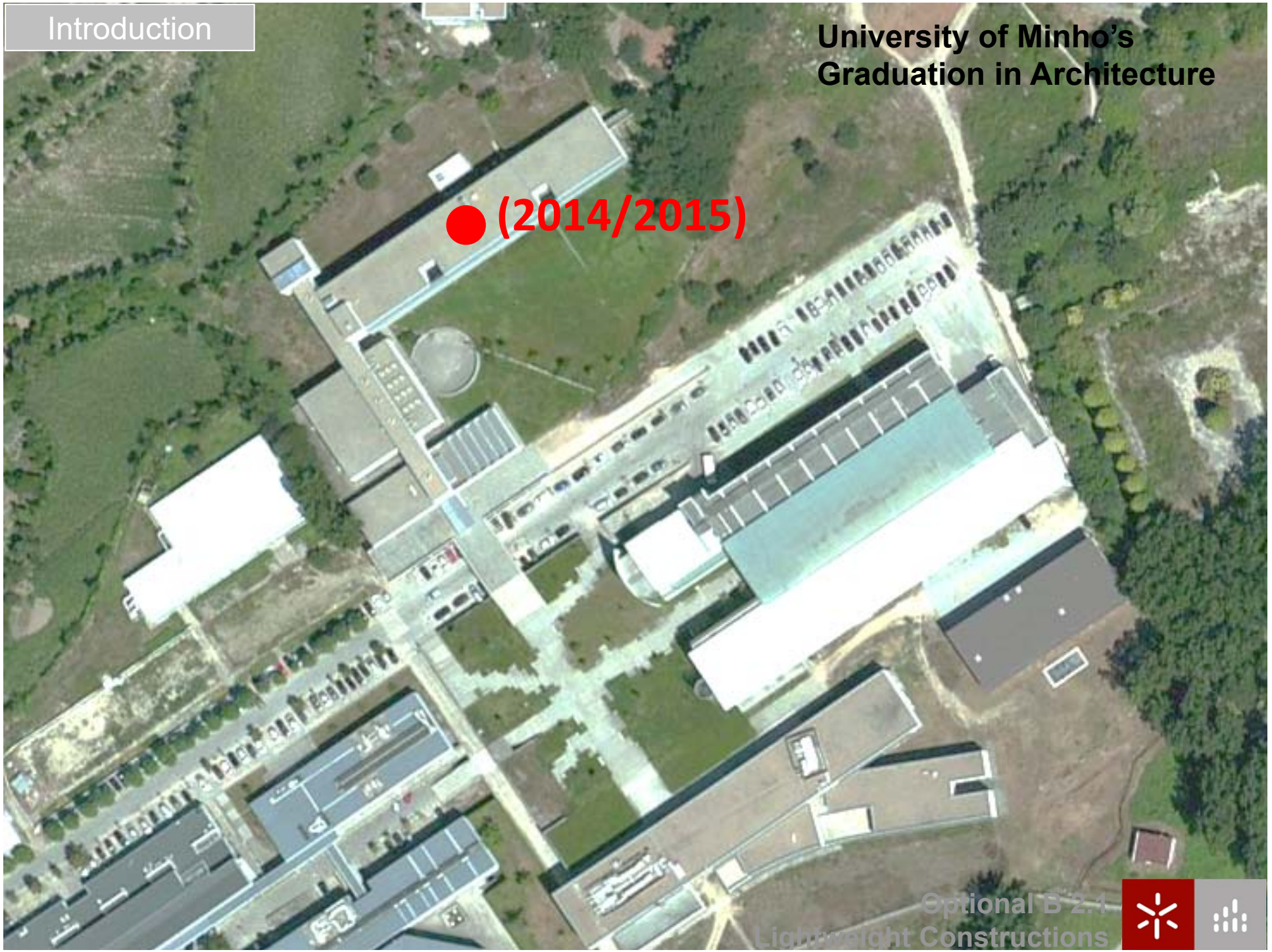

Introduction

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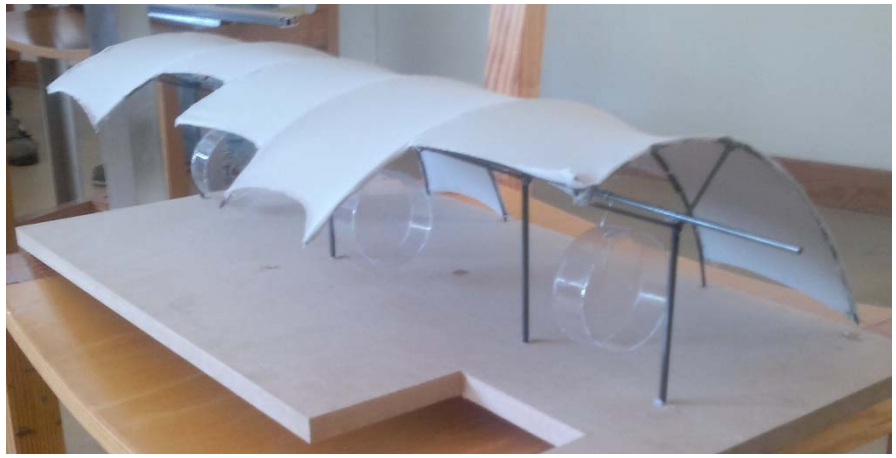

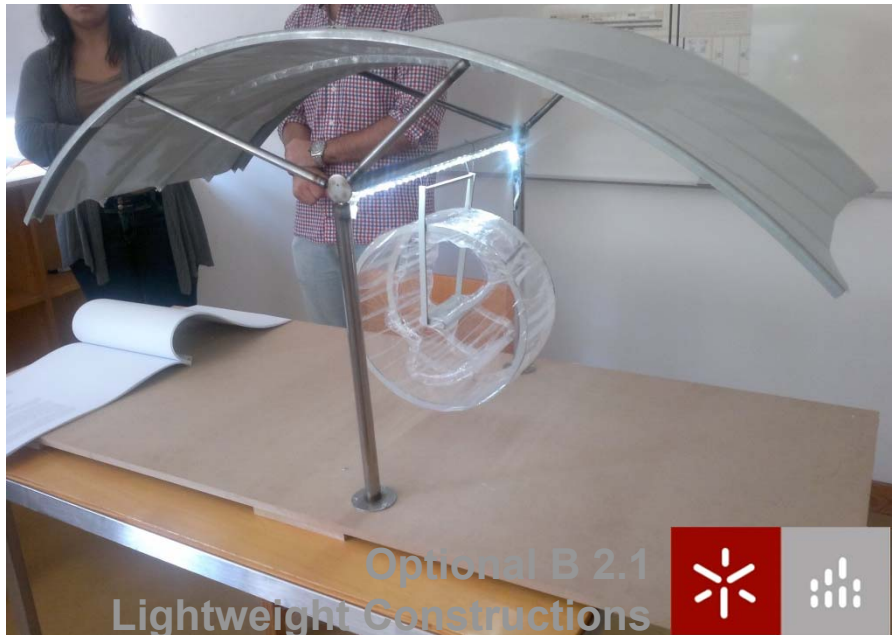

Optional B 2.1
Lightweight Constructions

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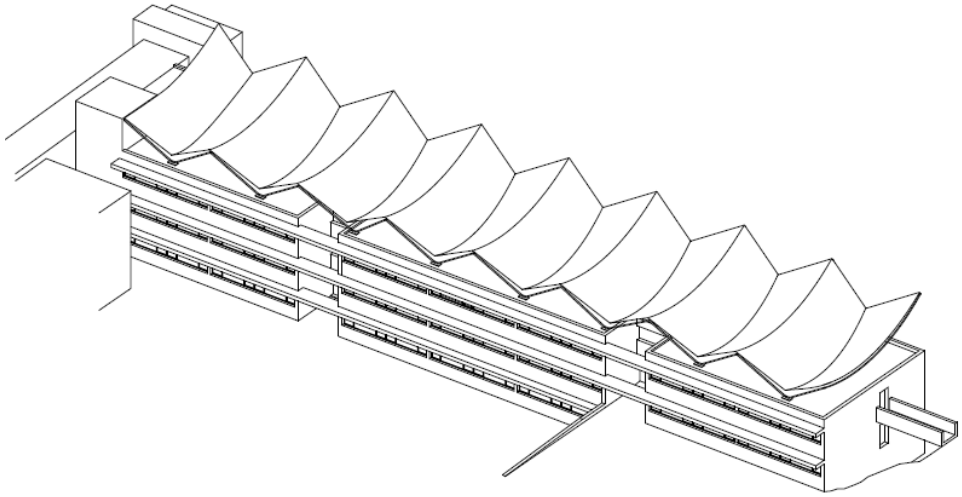

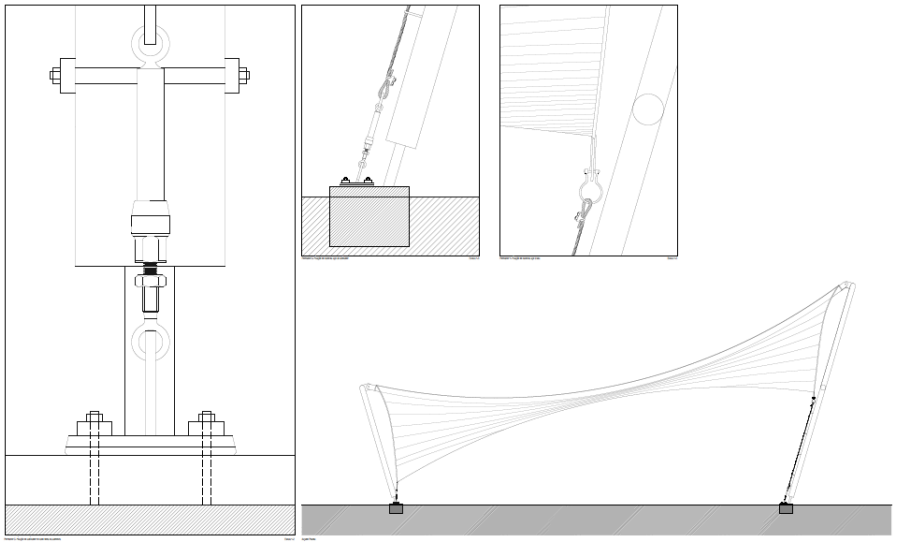

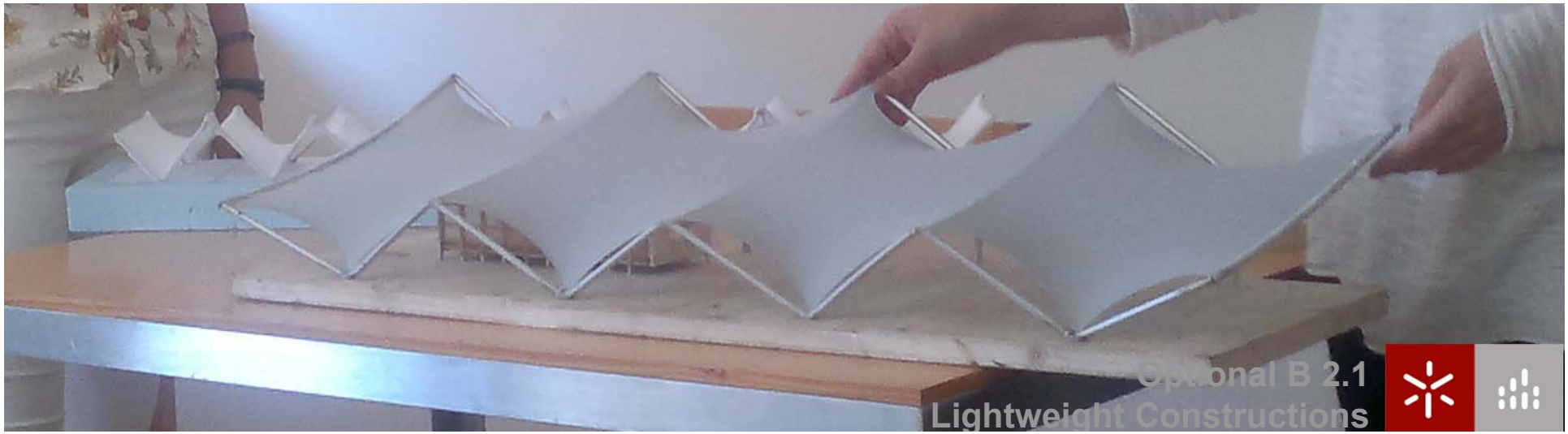

Optional B 2.1
Lightweight Constructions

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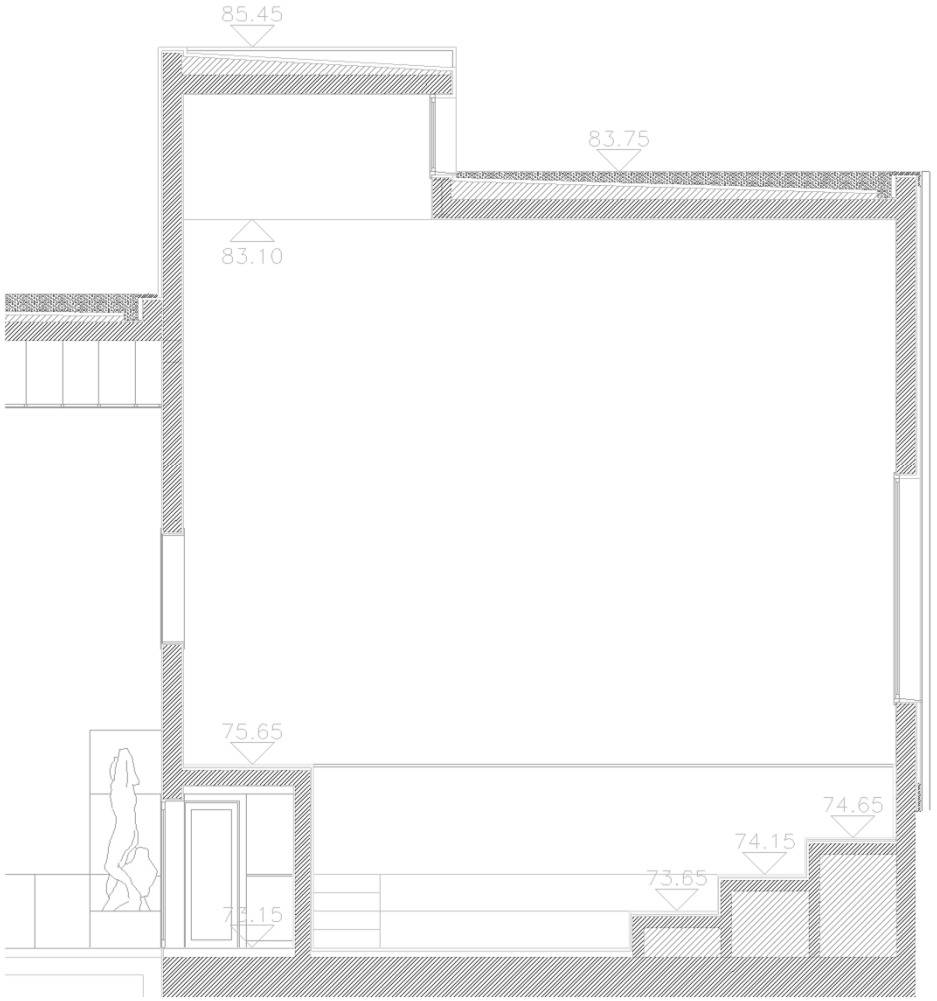

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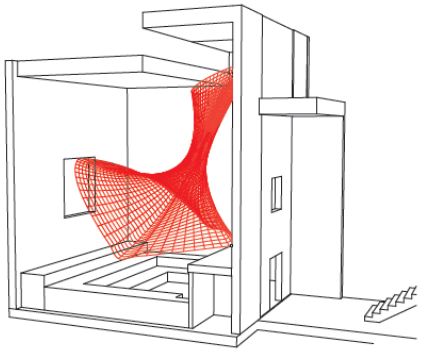
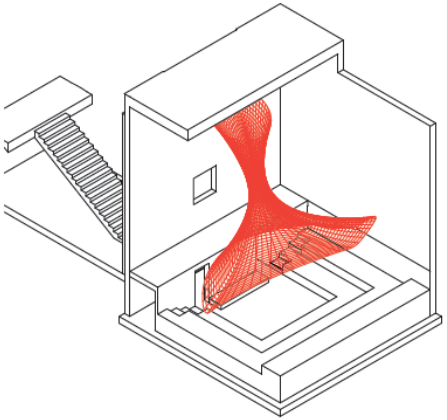
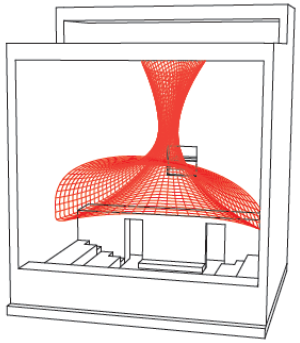
Graduation in Architecture

Introduction

University of Minho's
Graduation in Architecture

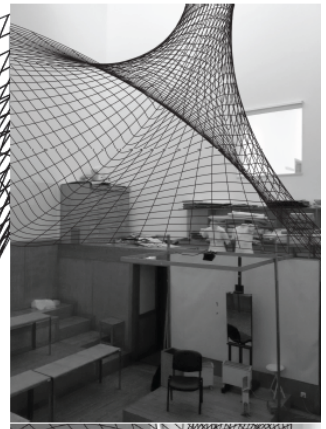


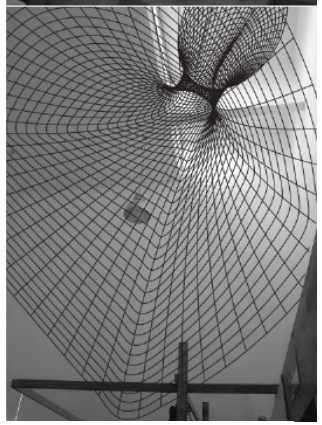


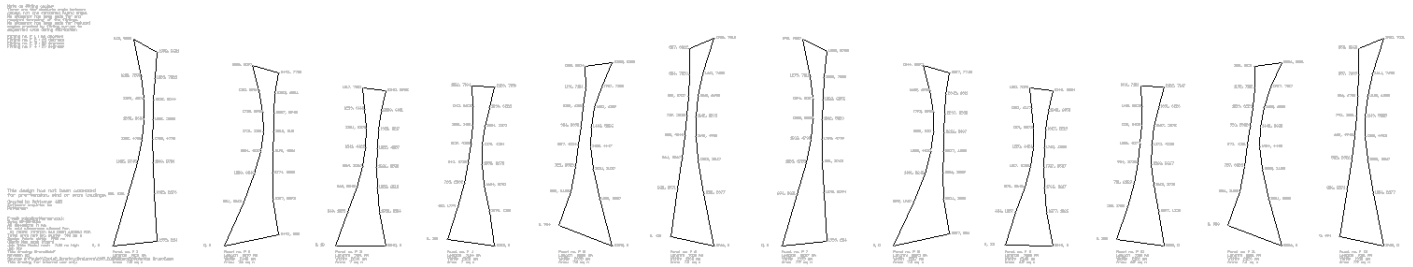


COBERTURA DE PALCO

Bruno Silva
Opcional - construções leves **2015/2016**

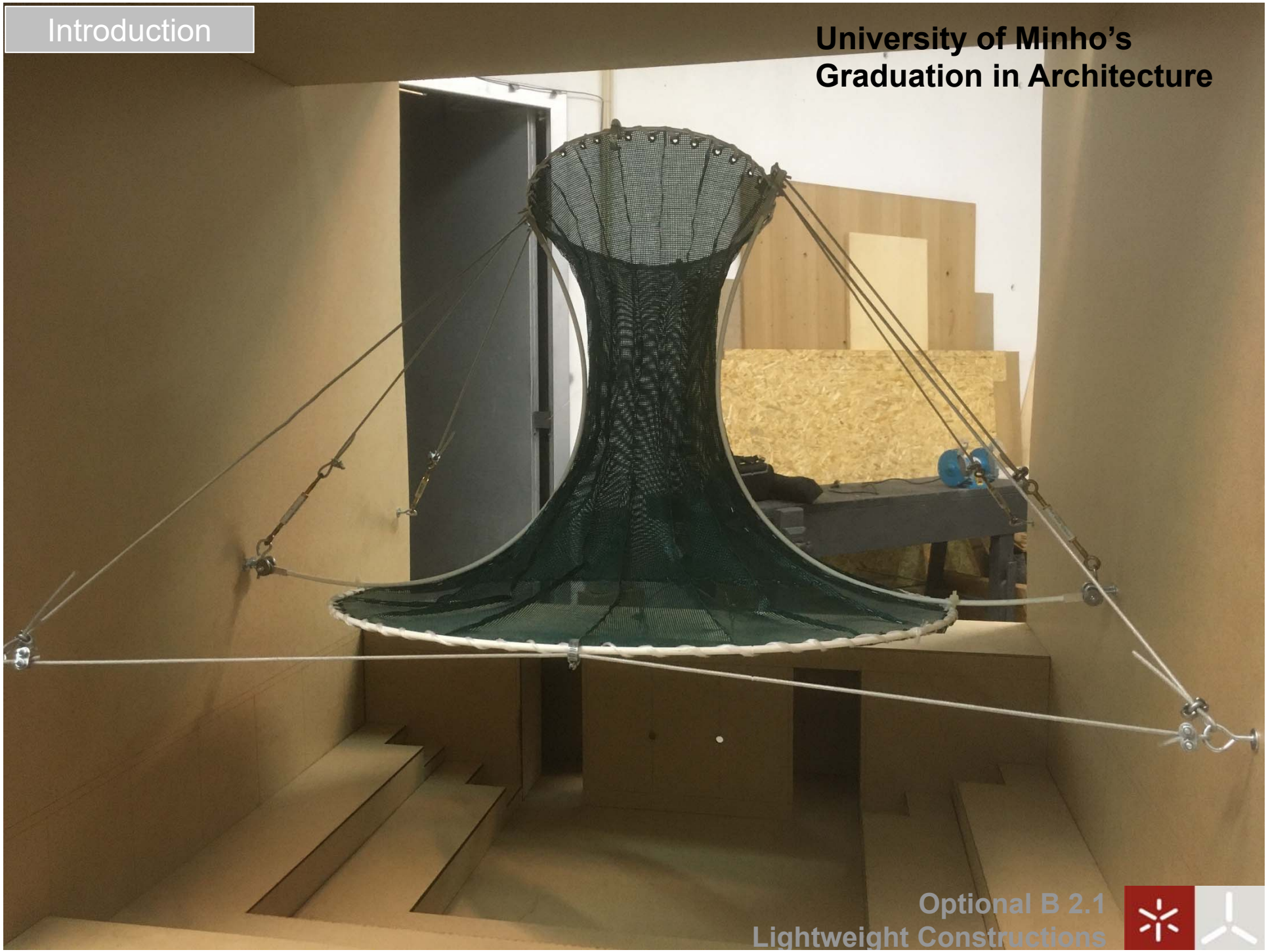






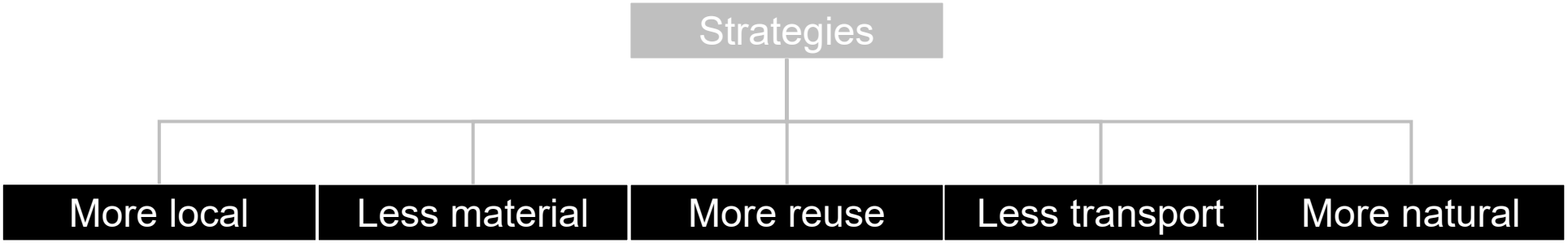
Optional B 2.1
Lightweight Constructions

University of Minho's
Graduation in Architecture



University of Minho's Graduation in Architecture





Strategies
More local
Less material
More reuse
Less transport
More natural

Contemporary Systems

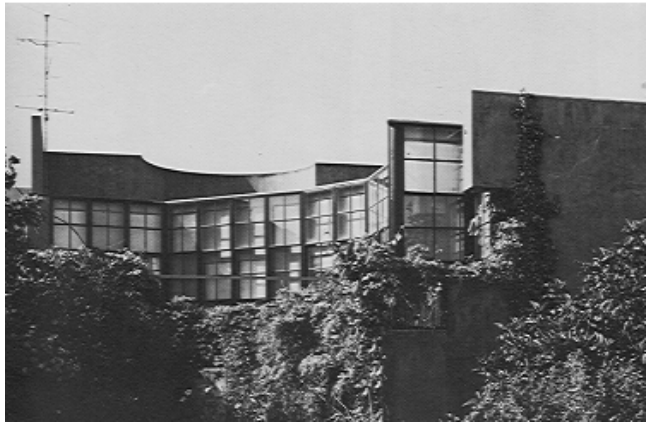
The contemporary construction presents several problems of eco-efficiency:

- Reduced possibilities for reuse or even recycling materials (permanently adhered components);
- Non-local materials (centrally produced);
- Industrialized materials (high embodied carbon).

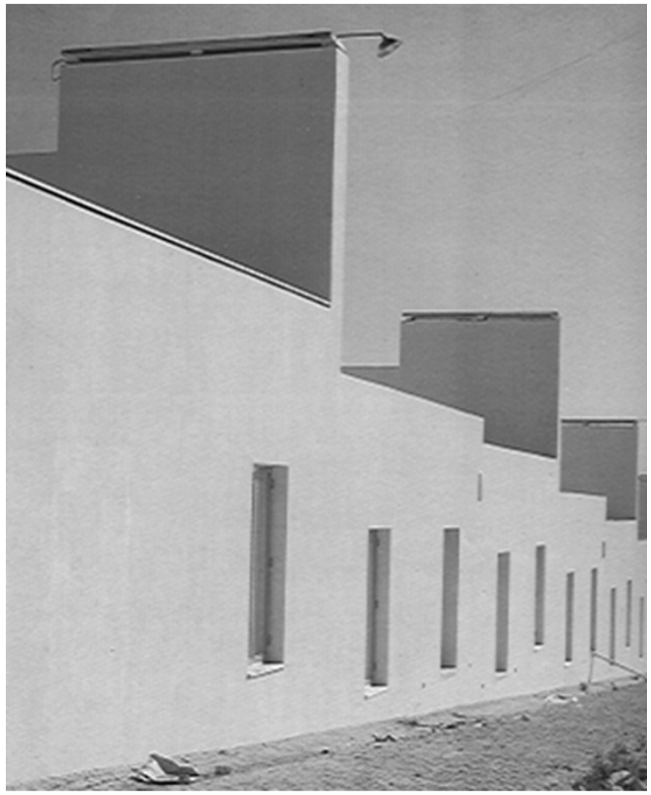
Traditional Systems

Traditional construction on the other hand is generally much more eco-efficient:

- Increased possibilities for reuse and recycling materials (due to the use of dry" joints);
- Local materials (heavyweight from site);
- Natural materials (low embodied carbon).



Casa Beires (Póvoa de Varzim) – Siza Vieira



Bairro da Malagueira (Évora) – Siza Vieira

Hi-Lo-Tech

SIMPLE STRATEGIES FOR A MORE SUSTAINABLE CONSTRUCTION

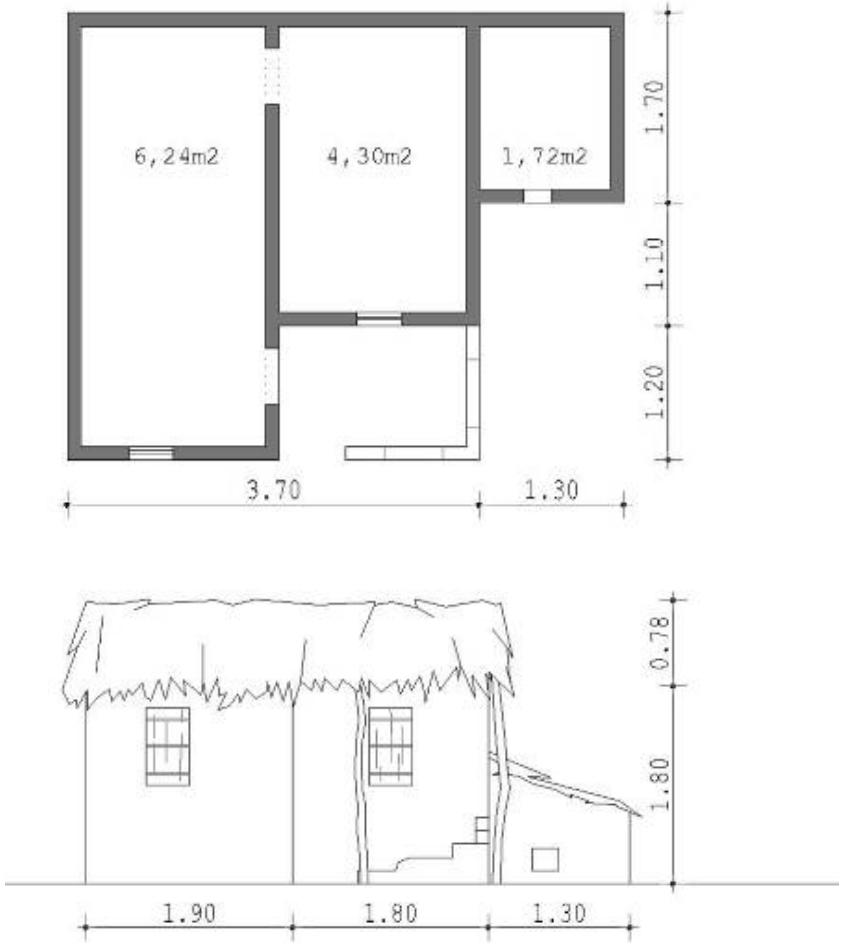
Luis Ramos** Paulo Mendonça* and Said Jalali**

University of Minho, Portugal

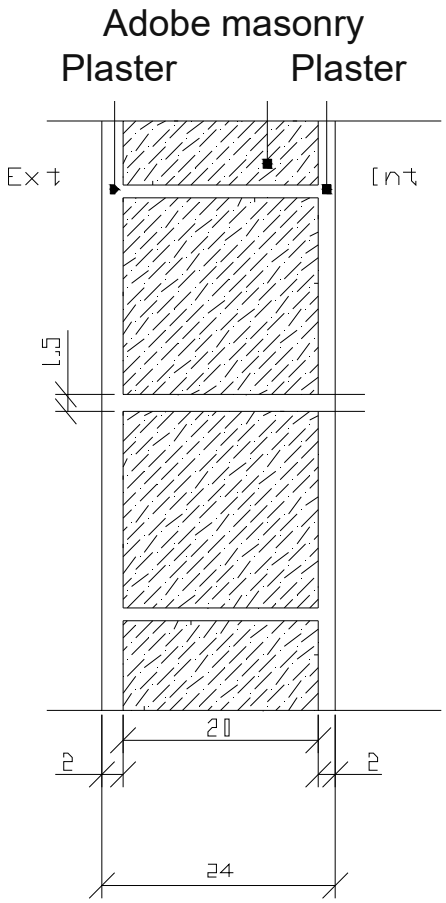
* School of Architecture
** Civil Engineering Department

Hi-Lo-Tech

Rural house in Ntcheu



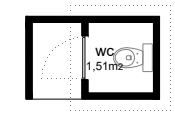
Hi-Lo-Tech

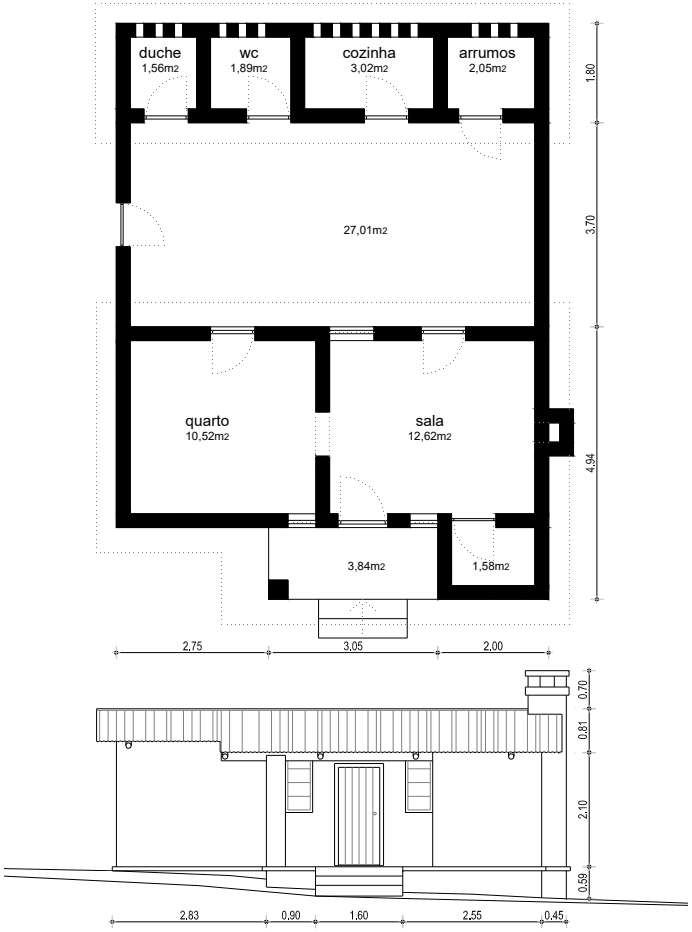


Single wall in adobe blocks
(rural dwelling)

Hi-Lo-Tech

Urban house in Ntcheu



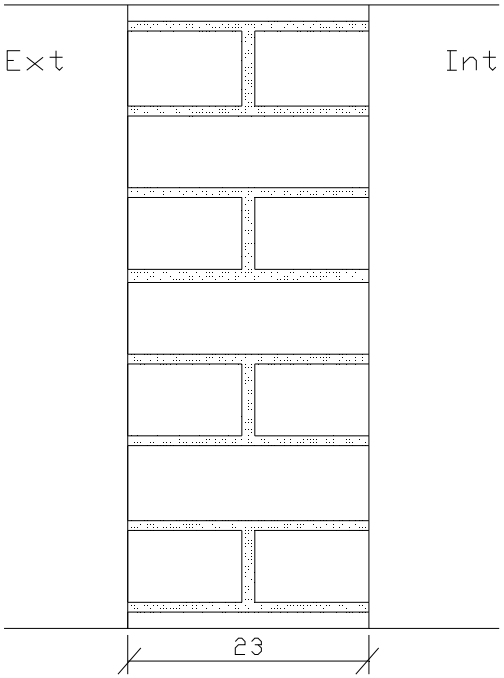


General Description	Urban area
Household	4 persons, 2 adults and 2 children
Process of Construction/ Materials	Walls in Fired brick, roof in steel plates with timber structure
Pathologies	Brick pavement with severe erosion
Conservation state	Reasonable
Tipology	T1 – Living room, bedroom, kitchen, arrumos, shower and toilet
Total area	83,0m^2
Usefull area	66,9m^2
Others	Rented house 35-40 years

Hi-Lo-Tech

Conventional constructive solutions found

Brick masonry



Single wall in burnt brick
(urban dwelling)

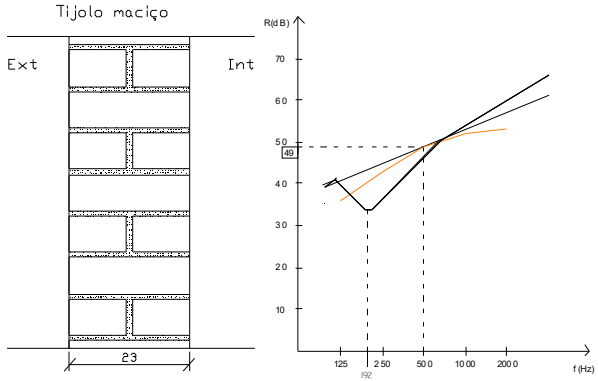
Hi-Lo-Tech

Challenge:

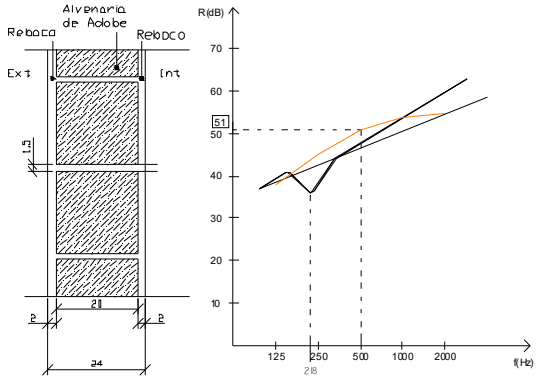
- Increase the flexibility of the typology, by using the average areas of a T1 in an evolutionary T1 - T2 dwelling;
- Optimize the ratio UA/GA (usable area / gross area);
- Replace burnt bricks by compressed earth blocks;
- Opimize roof solution (insulation).

Hi-Lo-Tech

Designation	Composition	Acoustic insulation- Dn,w [dB(A)]	U value [w/m2.°C]	Embodied Energy [kwh/m2]	Weight [kg/m2]	Thermal mass Msi [kg/m2]
Reference: simple wall of burnt brick	Massive brick + Cement Plaster (25cm)	49	2,14	815	457	**150**
Proposal: simple wall in Adobe or CEB	Alvenaria de Adobe + Lime Plaster(24cm)	51	**0,72**	**30**	**300**	**150**



Reference: burnt brick wall



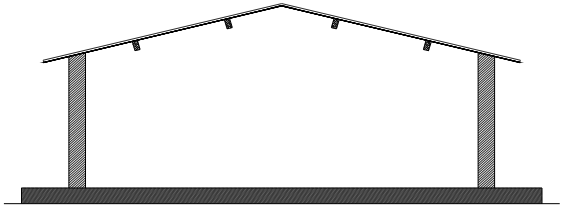
Proposal: Adobe or CEB wall

Hi-Lo-Tech

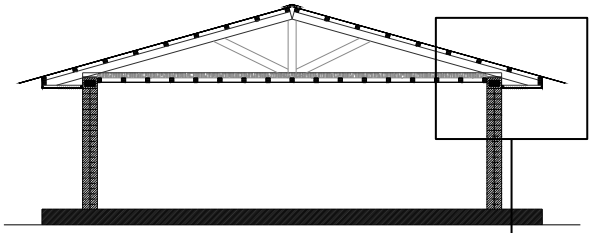

HABITAÇÃO T1
PROPOSTA a)
AREA BRUTA = 48,4m2
HABITAÇÃO T1
PROPOSTA b)
AREA BRUTA = 48,4m2
HABITAÇÃO T1
PROPOSTA c)
AREA BRUTA = 48,4m2
N
WC
2,2m2
COZINHA
4,4m2
QUARTO
9,0m2
A. DIST.
2,5m2
ARRUMOS
1,6m2
ESCRITÓRIO
6,2m2
SALA
10,2m2
VARANDA
3,7m2
QUARTO
15,4m2
QUARTO 1
9,0m2
QUARTO 2
5,9m2
CONSTRUÇÃO PESADA
CONSTRUÇÃO LEVE
0
3

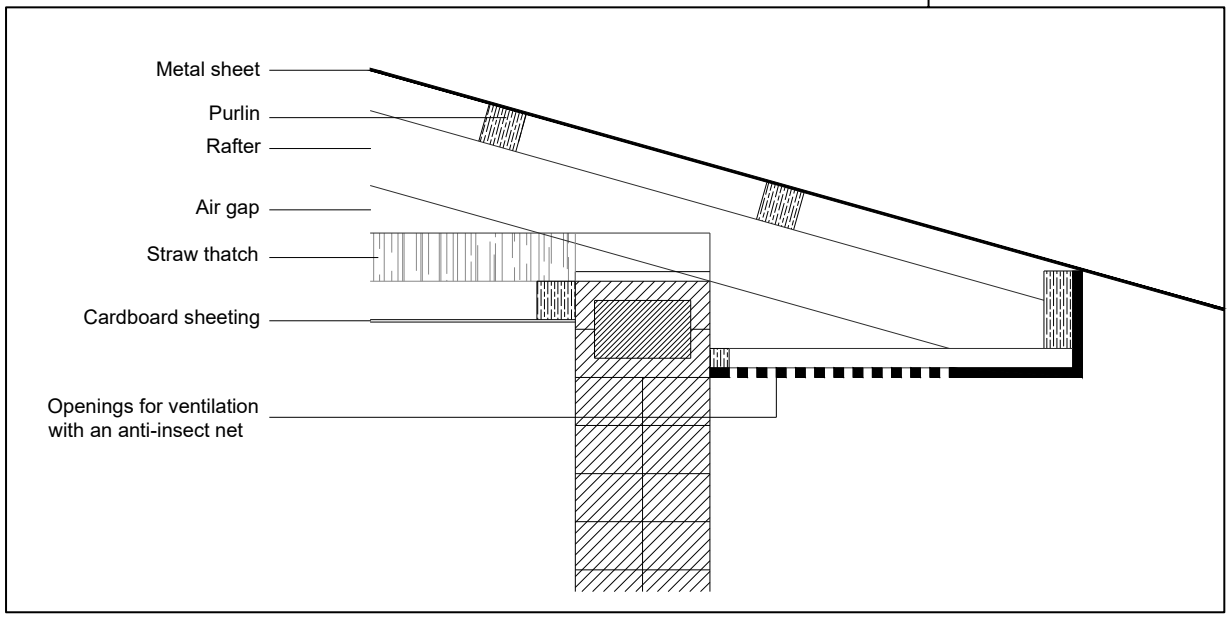
Hi-Lo-Tech

Existent roof:



Proposed roof:



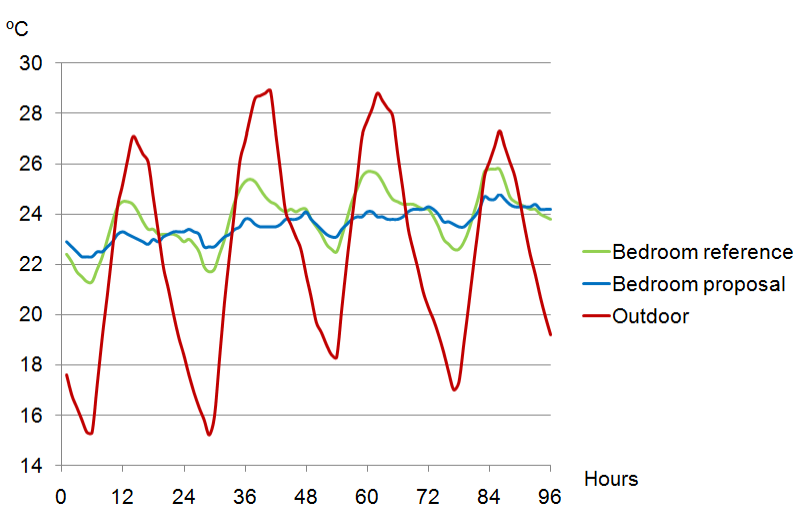


Detail of Existent metal sheet roof

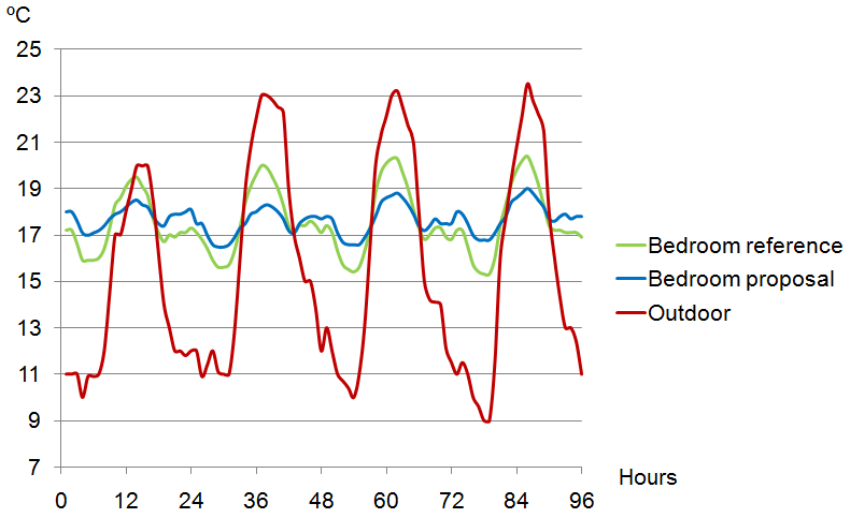
Hi-Lo-Tech

Thermal simulation – proposed roof

Cooling season (21-24 November)



Heating season (21-24 June)



- As it is shown, the proposed system for the roof improves significantly the thermal behaviour in the cooling season (summer) and in the heating season (winter).

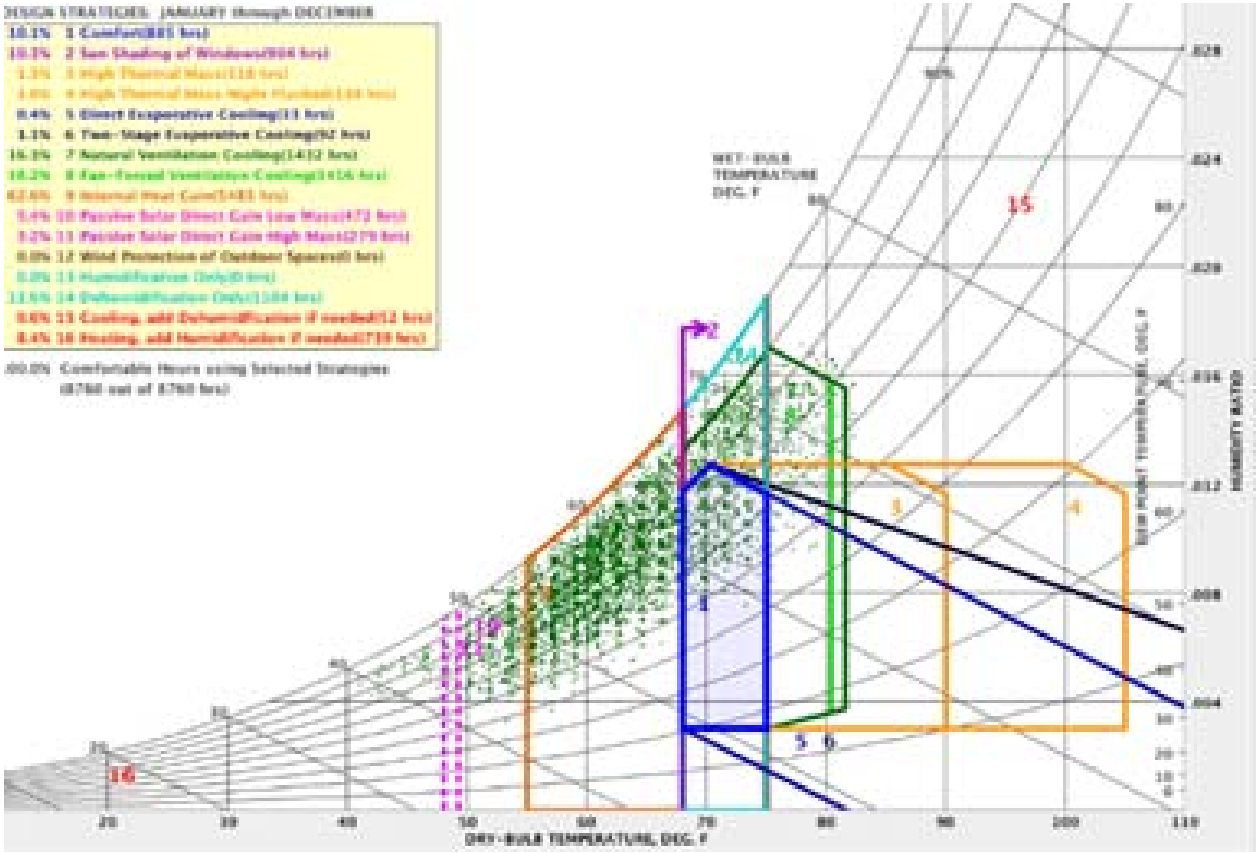
- This is due by the fact that the proposed system has a ventilation system improved, and thus the ventilation is more controlled and acts more efficiently. On the reference solution we used to have some openings usually above the windows without an integrated control of the air changes. The insulation on the ceiling and a consequent ventilated roof works well with this hot humid climate, characteristic of the Central Africa.

Hi-Lo-Tech

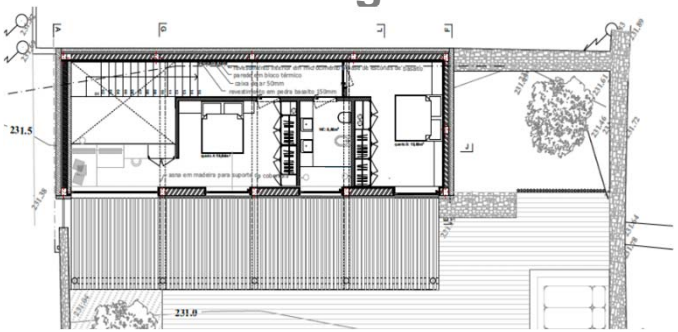
Eco cabin Model for tourism integrating circular economy principles”

Antonieta Rocha
Integrated MSc Thesis
Architecture, University of Minho, 2023

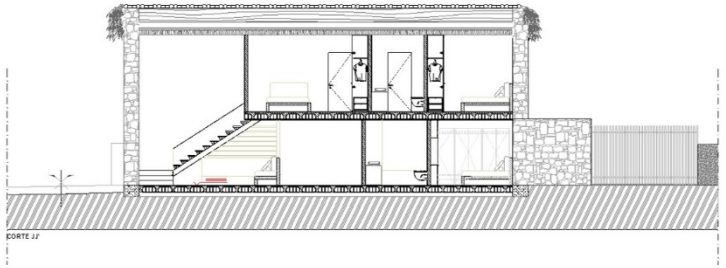
Angra do Heroísmo

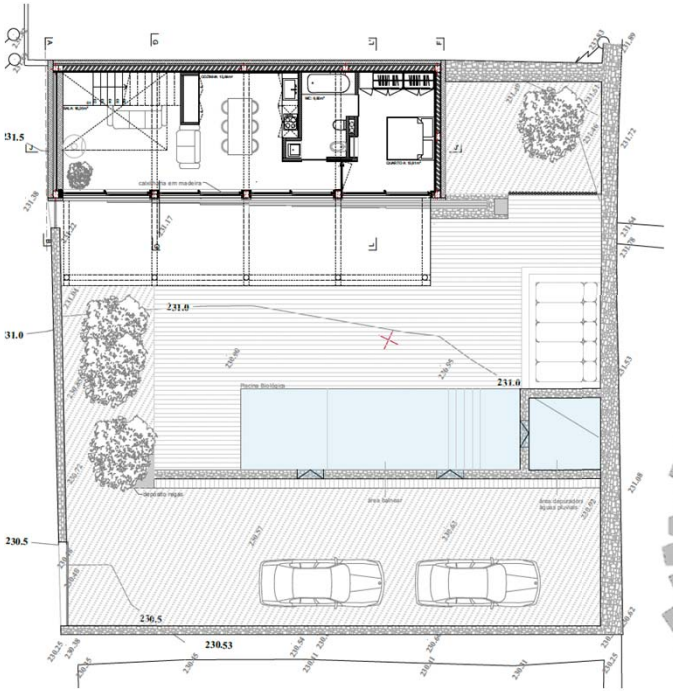


Design with climate: Sun and Wind – Angra do Heroismo

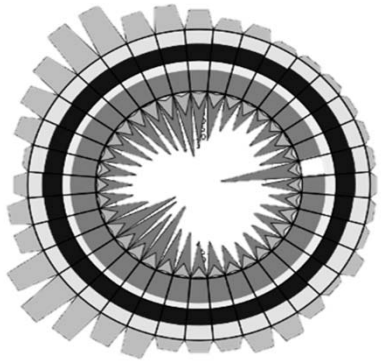


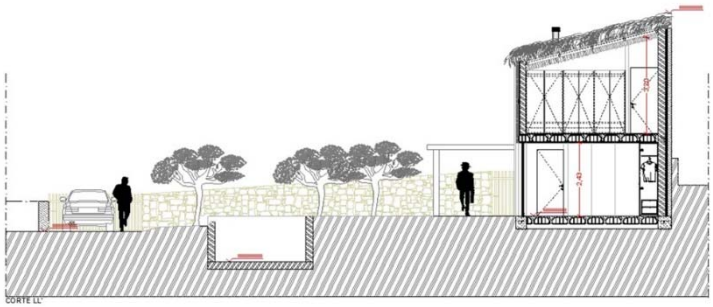
Iluvw Iarru Sdlq





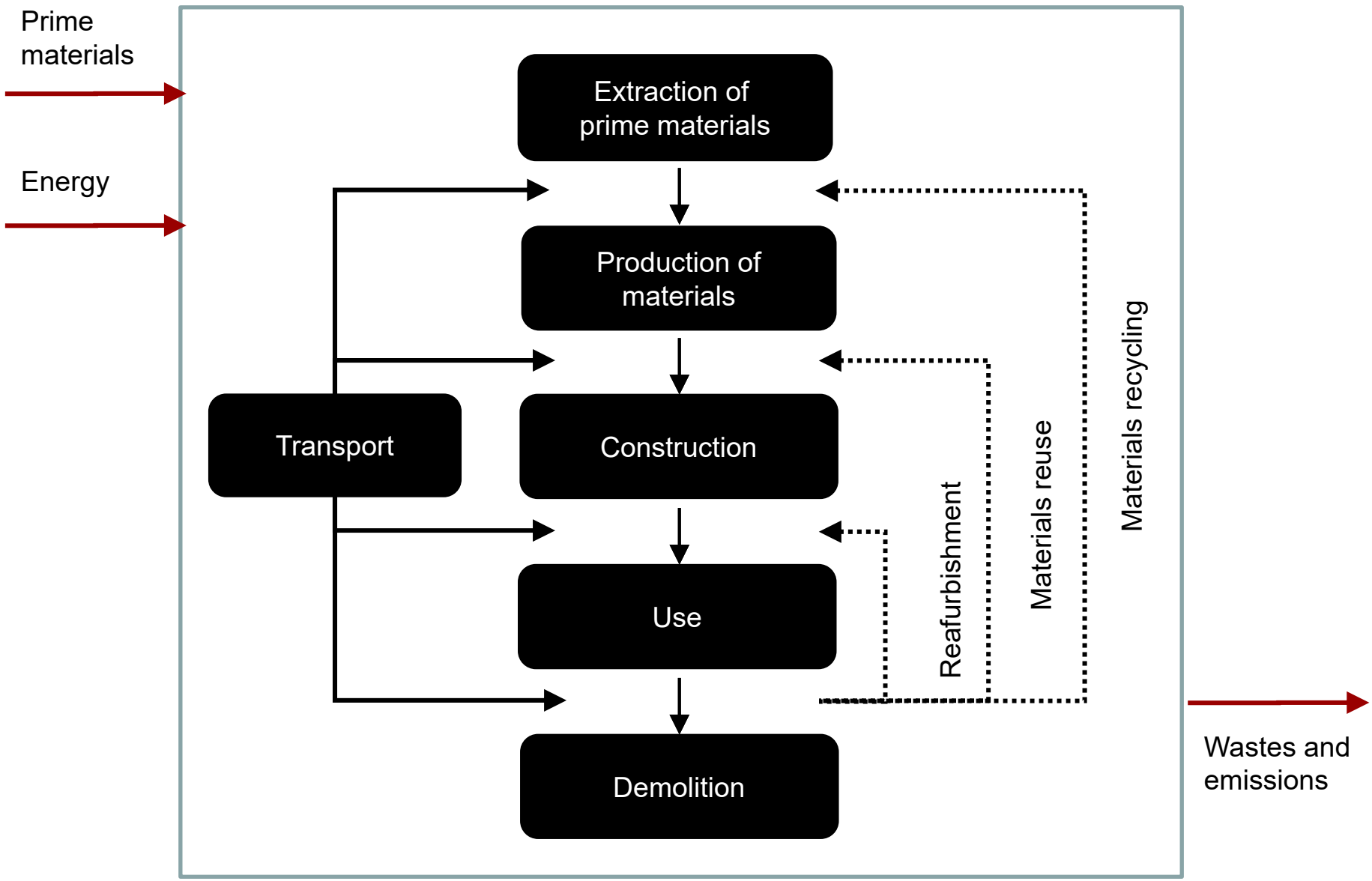
Jurxqg Iarru Sdlq





Vhfwlrqv

Construction phase - LCA



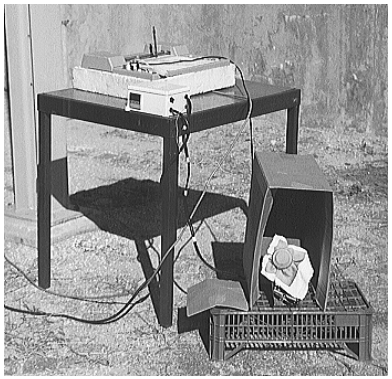
Smart Textiles in Architecture

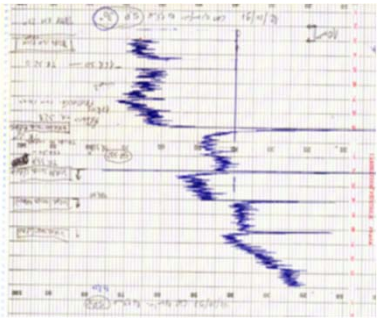
Paulo Mendonça
MSc Thesis
Textile Engineering, University of Minho, 1997

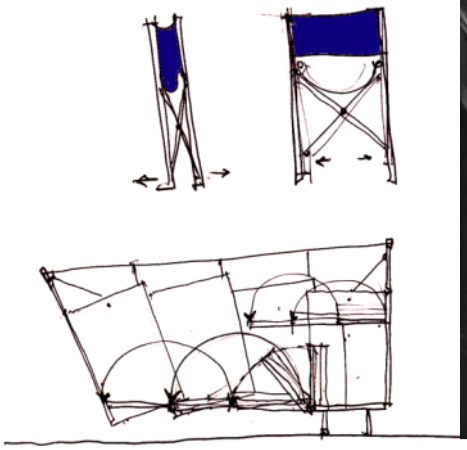
Within this research two different uses of smart textile membranes in architecture were developed, one is a reactive membrane using thermochromic pigments and the other one is a portable library.

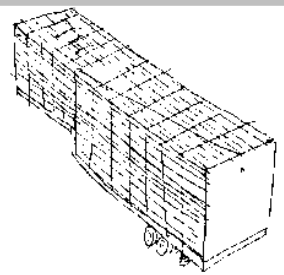
Reactive membrane

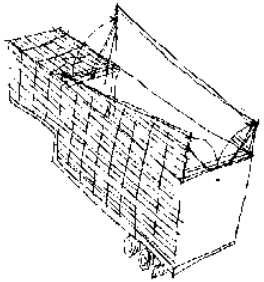
The main disadvantage ascribed to textile roof structures is their problematic thermal behavior, due to their small thermal inertia, not as suitable as heavyweight buildings to assure comfort on livable compartments in climates such as the one in Portugal (where the thermal amplitude makes the interior ambient temperature sway between values either higher or lower than the ideal comfort temperatures. The active solar solution here developed - a membrane dyed with a thermochromic pigment - has the advantage of changing its absorption properties, becoming black when the temperature in its surface stays under the interior comfort temperature.

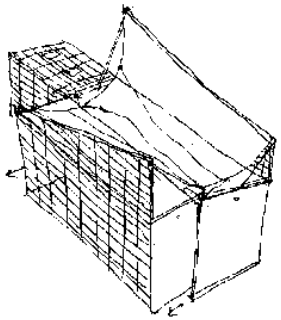


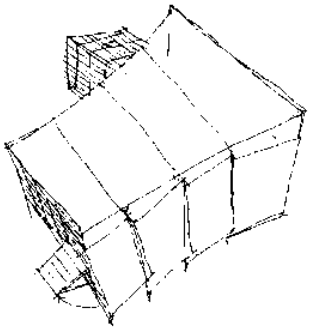




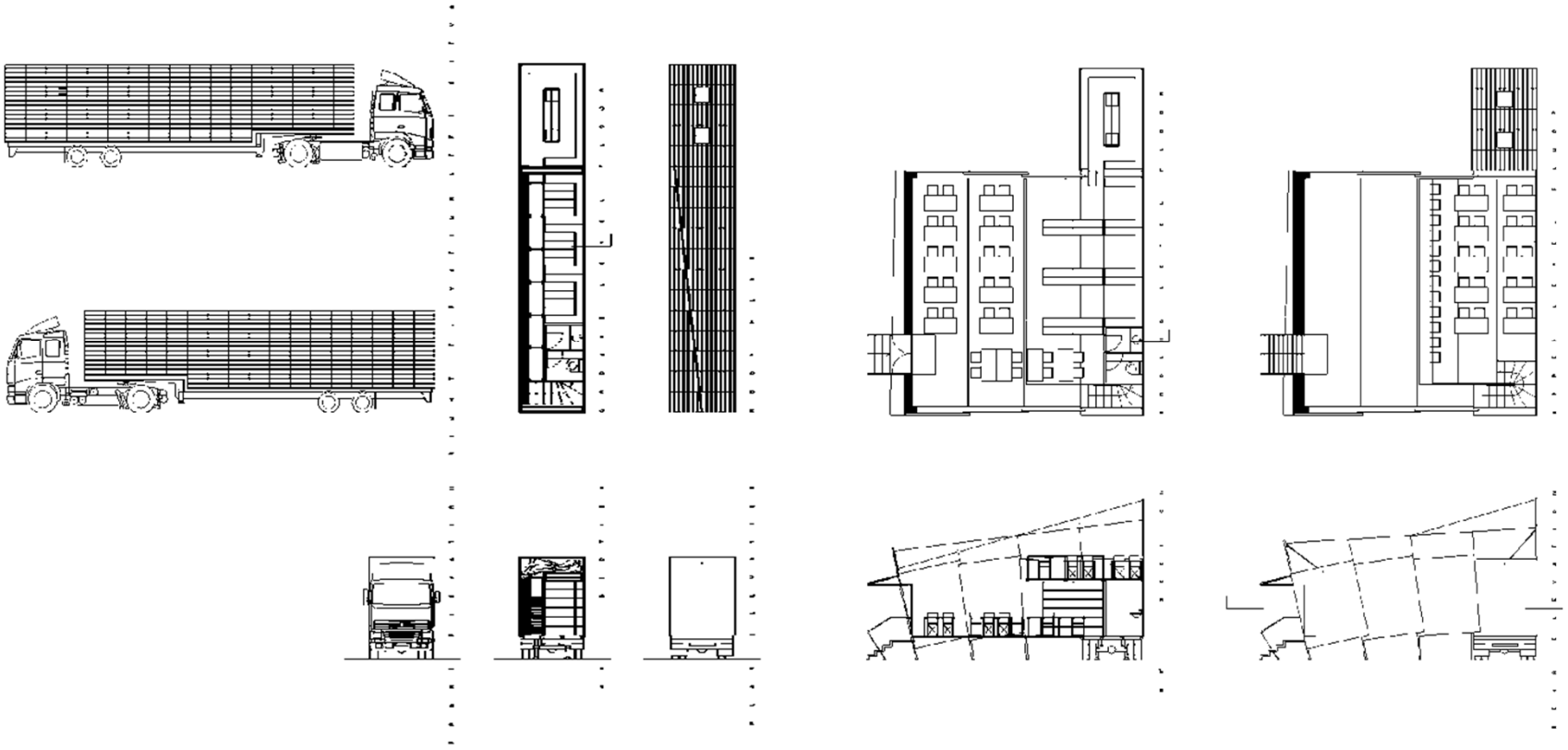


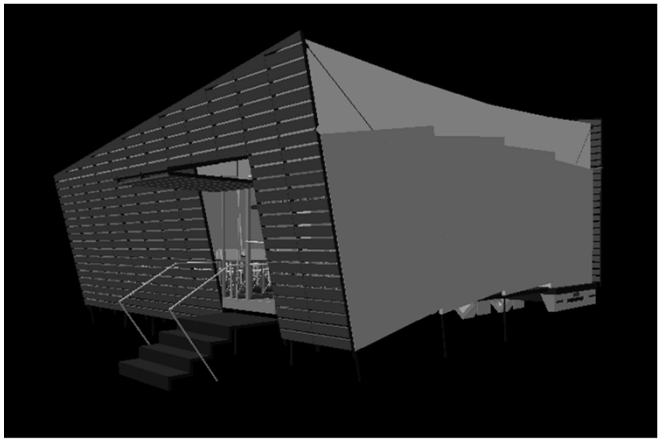


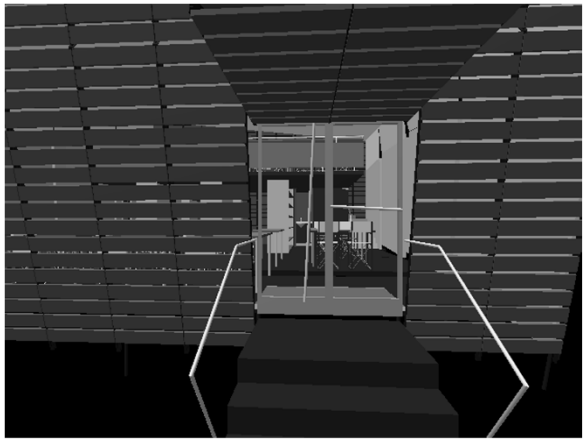




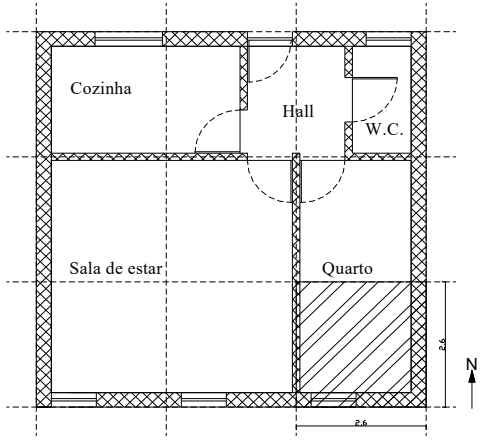
The second proposal developed was a portable building, made with a textile membrane roof structure, which can be used as a library, based on a semi-trailer pulled by a truck. In itinerancy, it has the dimension of a normalized container which, when unfolded, presents a covered pavement area and habitable volume approximately five times greater than the container where it is based. It has been conceived specially for temperate and hot climates, with daytime temperatures close or slightly higher than the ideal comfortable interior temperature, exploring natural ventilation and lighting.



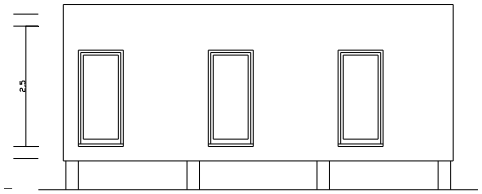


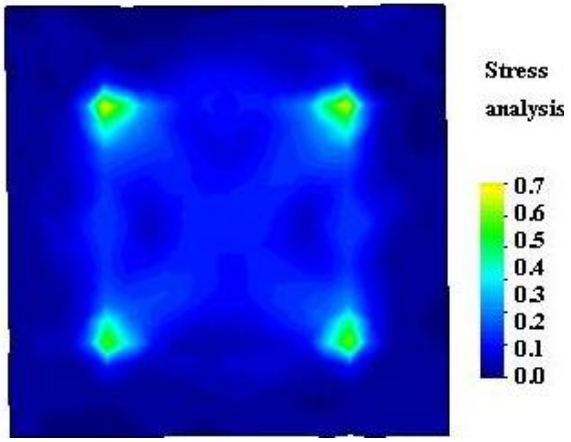


Membrane test cell
(Mendonça, 2010)



b) Módulo construído do prototipo de membrana



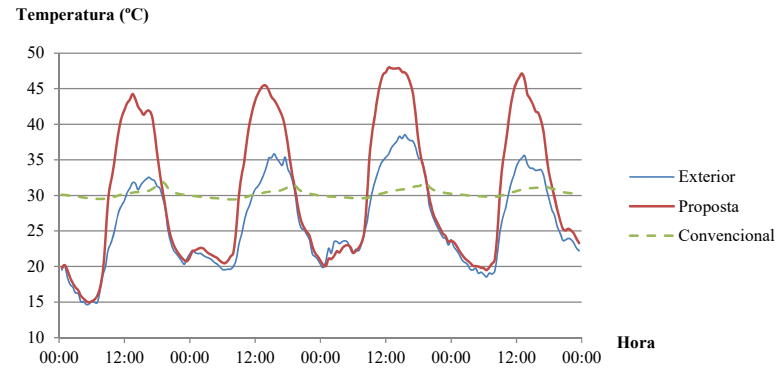


Opaque membrane façade on module prototype - computer stress analysis for form finding optimization (MENDONÇA, 2010)

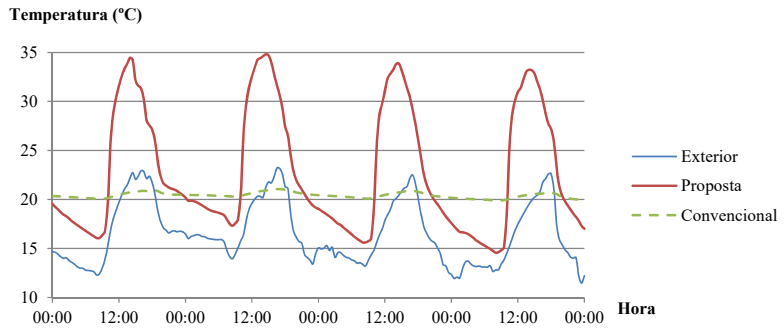
Internal view during the assembling process

Membrane test cell - Structural analysis

Membrane test cell - Functional analysis



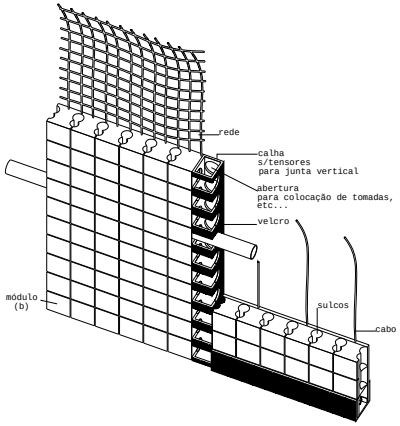
Temperatura ambiente de 5 a 8 de Agosto de 2010, apenas estrutura com revestimento em Poliéster/PVC



Temperatura ambiente de 14 a 17 de Outubro de 2010, com 110 garrafões cheios de água no pavimento

Title: **Adjustable partition membrane - PTDC/AUR-AQI/102321/2008**

Coordination: Paulo Mendonça (EAUM / C-Tac), Duration: 2010/2013

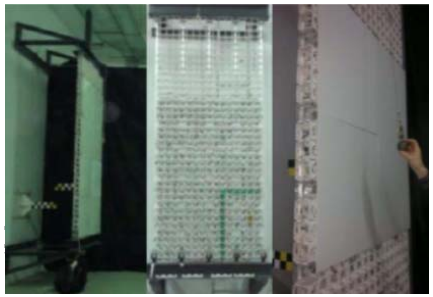


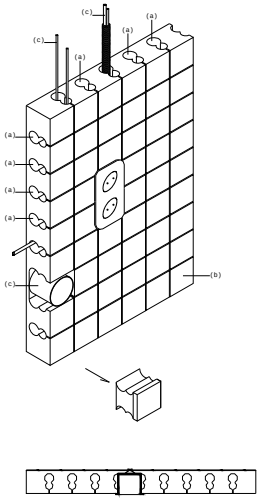
Four areas of Minho University with complementary knowledge were associated: Architecture, Civil Engineering, Textile and Polymer Engineering.

Objectives: development of a lightweight partition wall solution that use the pavement and ceiling slabs as anchoring elements; development of a new material/system, using innovative reinforcement fibers, with some porosity to guarantee acoustic absorption, thermal insulation, hygroscopic and thermal inertia.

Results:

- 1 Book;
- 8 papers on international journals;
- 2 papers on national journals;
- 13 presentations on international conferences;
- 2 presentations on national conferences;
- 4 reports;
- 1 national and 1 european patent.






Detalhe 3
Etapa 1
Etapa 2
Etapa 3
Variante 1
Etapa 4
Etapa 5
Detalhe 2
Detalhe 1

Architectural Membranes on the Functional Refurbishment of Buildings

PhD Thesis, Mónica Macieira
Supervisors: Paulo Mendonça and João Guedes

About 60 analised projects of building refurbishment with membrane technologies

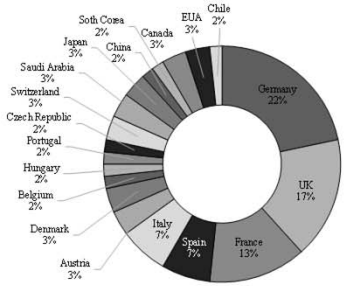


Figure 1. Countries where analysed case studies are located..

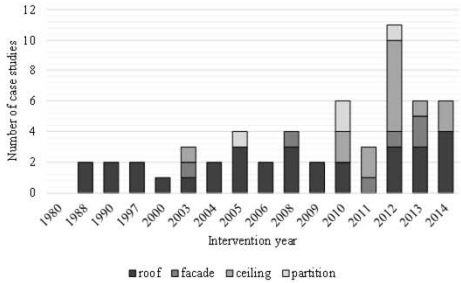


Figure 2. Distribution of the case studies by its refurbishment/ intervention year with membrane building technologies.

From the sample analysis were also identified five basic design options: (1) building inside a building: a membrane structure spans the entire building; (2) creation of facades, skylights and roofs; (3) roofed-over atrium: a courtyard retrofitted with a roof; (4) membrane envelope acting as a second skin; (5) suspended ceilings and stretched partitions.

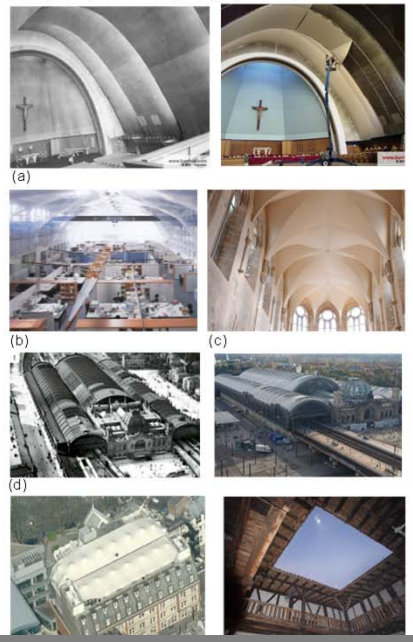
Identified principles on functional refurbishment projects with membrane solutions:

(1) Replacement

(2) Integration

(3) Juxtaposition

Examples of some analysed projects/ case studies:

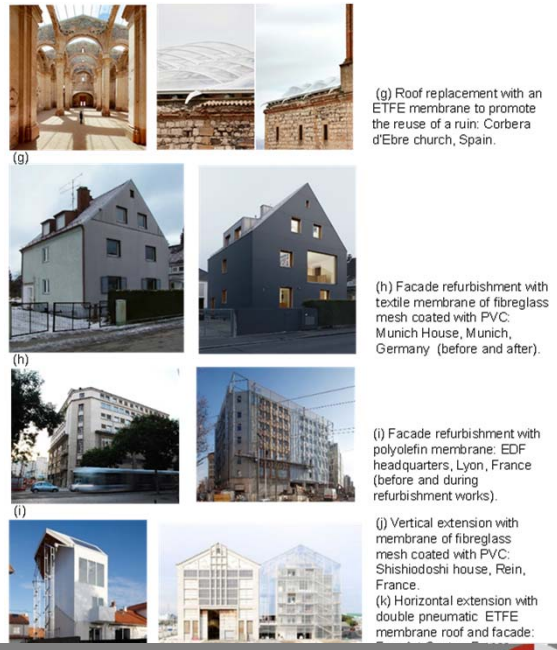


(a) St-Ignatus-Loyola church, Canada - interior views, before and after refurbishment intervention to minimize the effects of abestos..

(b) Building inside a building approach: Eco Membrane, conversion of an warehouse into Siemen's design office, Germany.
(c) Reconstitution of vaulted ceiling to achieve higher acoustic performance; with microperfurated membrane: kostel Povýšení sv. Kříže, Chec Republic.

(d) Roof replacement with a membrane of fibreglass textile coated with PTFE: Dresden's train station, Germany (before and after).

(e) Imagination Headquarters - exterior view; - linking two existing buildings;
(f) Roofing over atrium with double pneumatic ETFE membrane skylight at an heritage building: Igartza palace, Spain



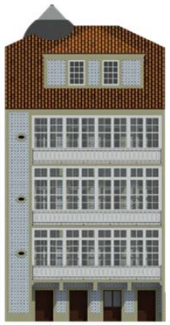
(g) Roof replacement with an ETFE membrane to promote the reuse of a ruin: Corbera d'Ebre church, Spain.

(h) Facade refurbishment with textile membrane of fibreglass mesh coated with PVC: Munich House, Munich, Germany (before and after).

(i) Facade refurbishment with polyolefin membrane: EDF headquarters, Lyon, France (before and during refurbishment works).

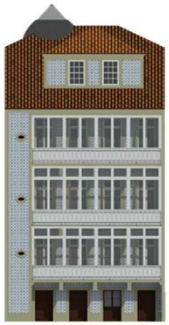
(j) Vertical extension with membrane of fibreglass mesh coated with PVC: Shishiodoshi house, Rein, France.
(k) Horizontal extension with double pneumatic ETFE membrane roof and facade:

PhD Thesis, Mónica Macieira (2021)



ET
(Estufa Tradicional)

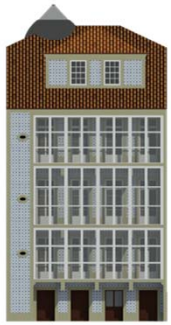
Solução com janelas de guilhotina (vidro simples e caixilhos em madeira pintada); com paramento opaco em tabique (1m de altura) revestido a chapa metalica ondulada e pintada.



EConv

(Estufa Convencional)

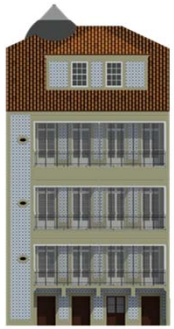
Solução com janelas de correr (vidro simples e caixilhos em aluminio lacado s/ corte termico); com paramento opaco em alvenaria de tijolo de 0.11m (1m de altura) com reboco e pintura em ambas as faces.



ECont A

(Estufa Conteporanea)

Solução em fachada cortina com janelas de guilhotina e fixas, com prumos e caixilhos em aluminio lacado e com corte termico, vidro duplo.



ECont B

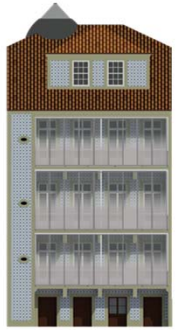
(Estufa Contemporanea)

Solução com cortina de vidro temperado, sem perfis verticais e sistema de calhas horizontais em alumínio; sistema de carris e recdha de painéis de vidro em harmónio.

EM

(Estufa com Membrana)

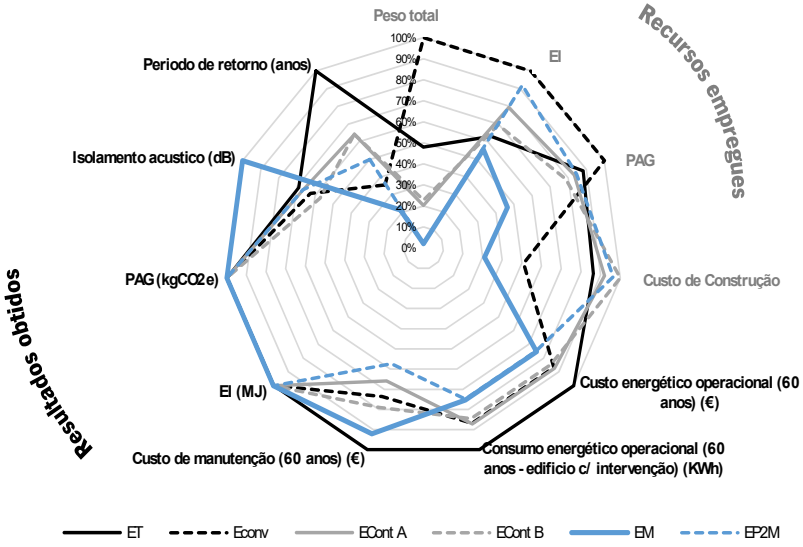
Solução em rolo de membrana PVC cristal, com estrutura de suporte em perfis de aluminio lacado (calhas verticais, caixa de estore e perfil de contrapeso e fecho) com fecho zip e caixa de estore para garantia de estanquidade e com mecanismo de recolha manual.



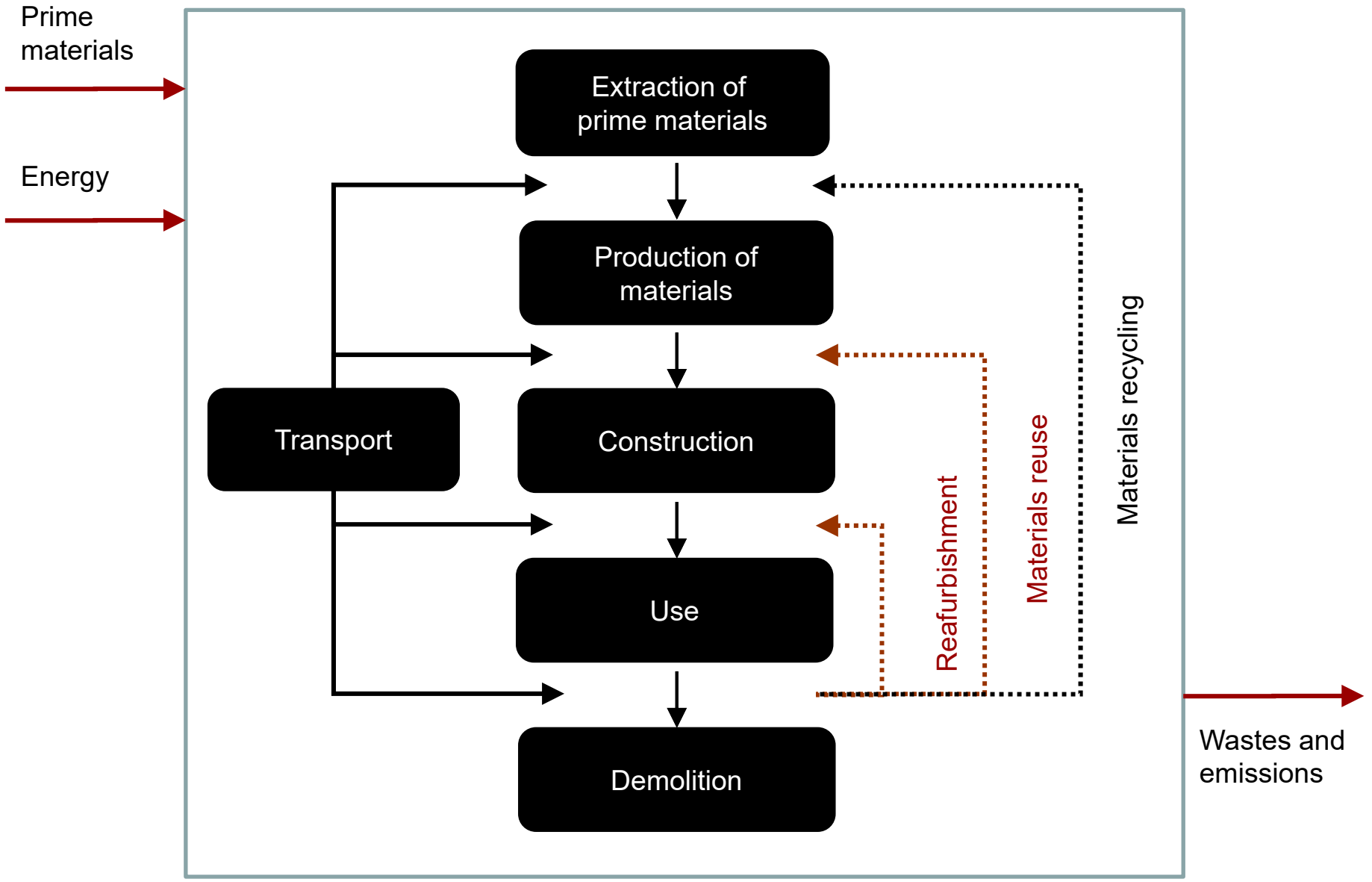
EP2M

(Estufa com Paineis encapulados Membrana dupla)

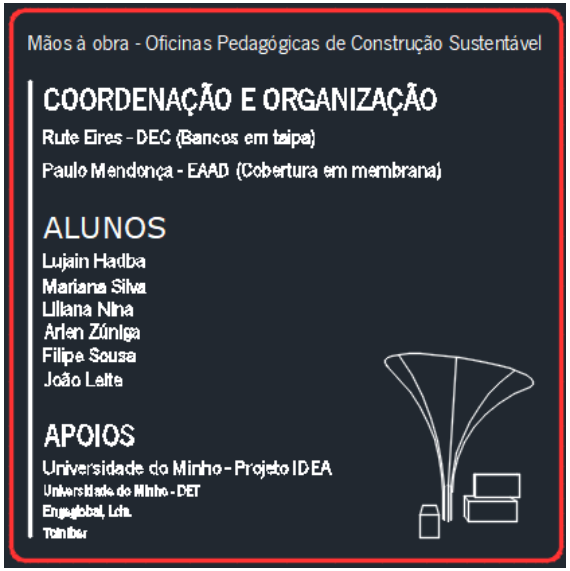
Solução com paineis compostos por estrutura em aluminio encapsulada em dupla membrana de ETFE 100%transparente na parte superior e 70%na parte inferior; abertura em harmonio dos paineis.

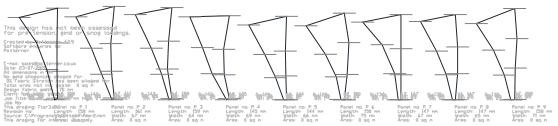


Construction phase - LCA

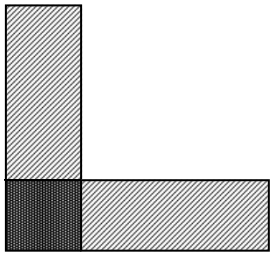


IDEA – Pedagogical Workshop for Sustainable Construction

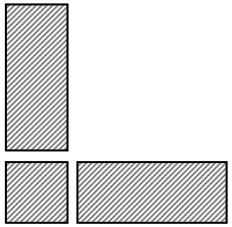




Design for Deconstruction



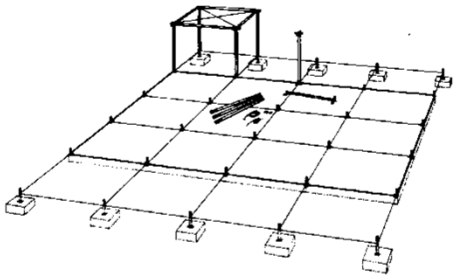
Better quality structure and permanent connection - contemporary construction

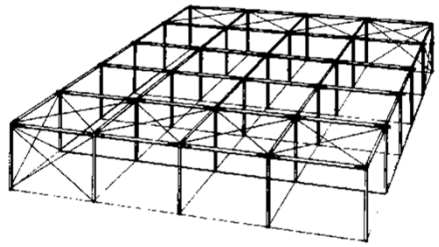


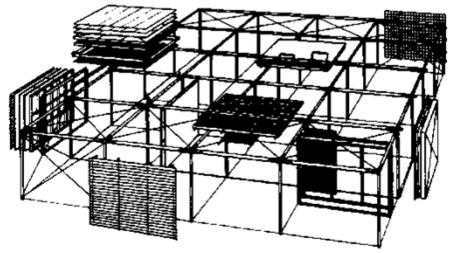
Similar or different quality but easy separation - building 100 years ago

Certain factors may allow building components to be more easily recovered, including:

- Use dry joint systems;
- Possibility of separating the components in each system - modularity;
- Use standardized and homogeneous materials;
- Lightweight building systems.







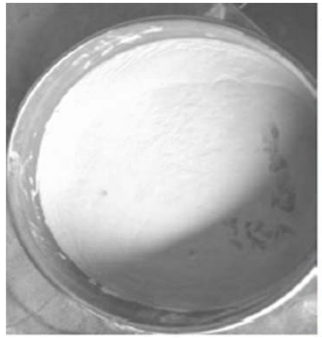
"Yacht House" (Horden 1995)

COMPETE PROGRAMA OPERACIONAL FACTORES DE COMPETITIVIDADE
QREN QUADRO DE REFERÊNCIA ESTRATÉGICO NACIONAL PORTUGAL 2007-2013
UNIÃO EUROPEIA Fundo Europeu de Desenvolvimento Regional
adi agência de inovação
GOVERNO DA REPÚBLICA PORTUGUESA

Projecto SipdECO – Uma solução inovadora para paredes divisórias

sofalca AGLOMERADOS E REGRANULADOS DE CORTIÇA EXPANDIDA
Biosafe Grupo Auto Sueco
pegop

Graça Vasconcelos ; Pedro Alves
Paulo Mendonça; Aires Camões
Paulo B. Lourenço






Objectivos

- **O principal objectivo consiste na proposta de uma solução para paredes divisórias com base em blocos moldados de material compósito à base de gesso que resulta da combinação de subprodutos industriais, nomeadamente gesso FGD, regranulado de cortiça e fibras texteis**

- **Estudo do material compósito**
- **Concepção do bloco de alvenaria**
- **Definição da tecnologia de construção**
- **Validação mecânica da solução**

isise Institute for Sustainability and Innovation in Structural Engineering
Universidade do Minho

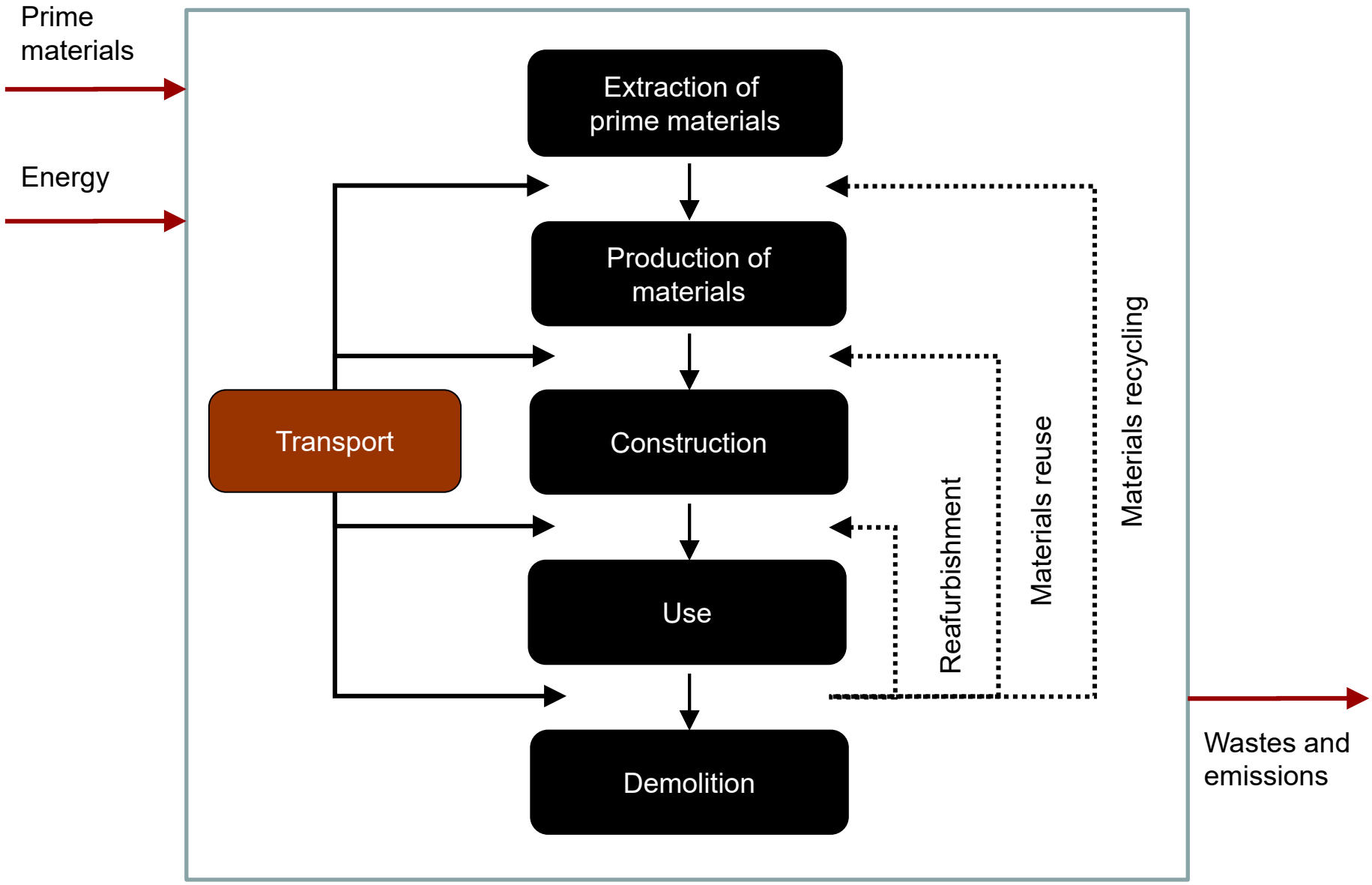
Arts and Crafts – Angra do Heroísmo






Nieta Atelier

Construction phase - LCA



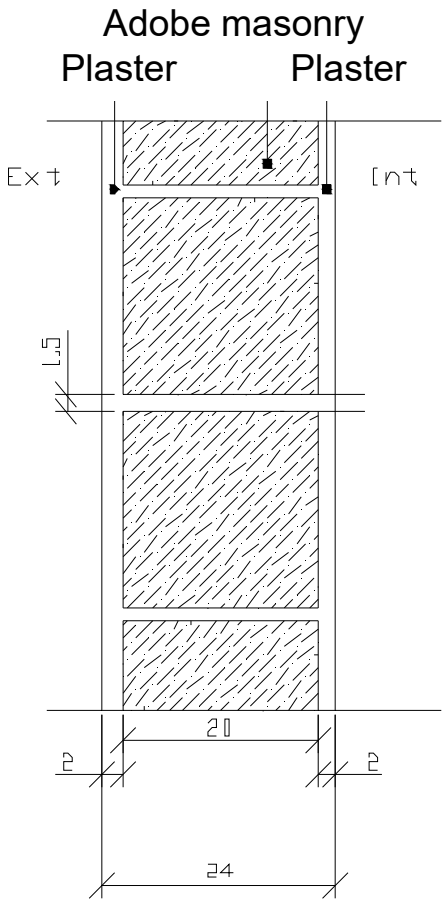
0,1kW/h

100kW/h


Kodak
FILM • CAMERAS
Airtel

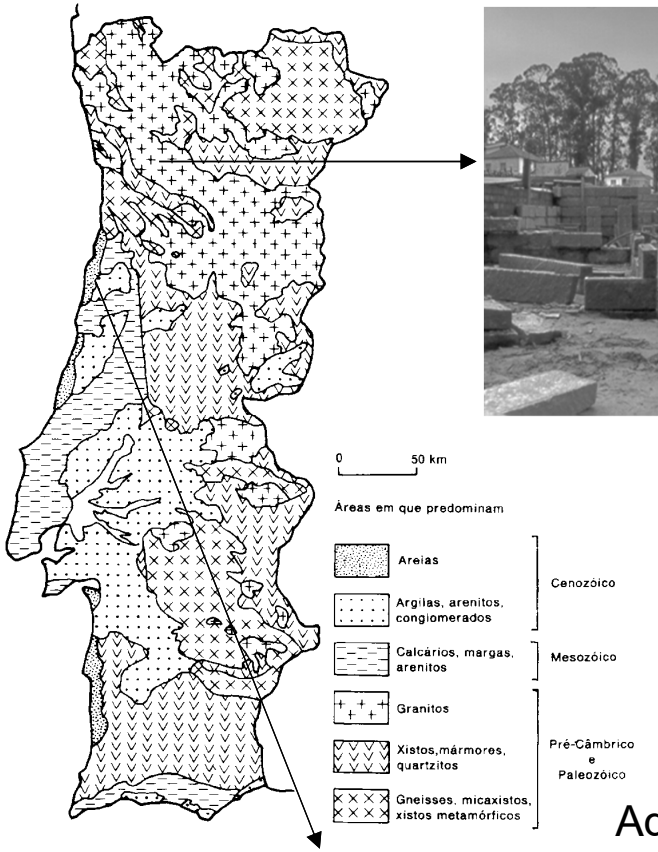
1,5kW/h

150kW/h

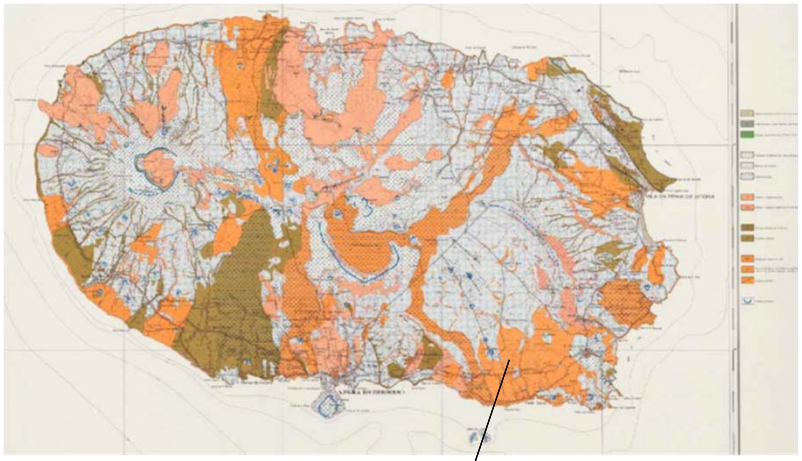


Single wall in adobe blocks

Adobe (workshop in UMinho)



Granite



Basalt - Azores

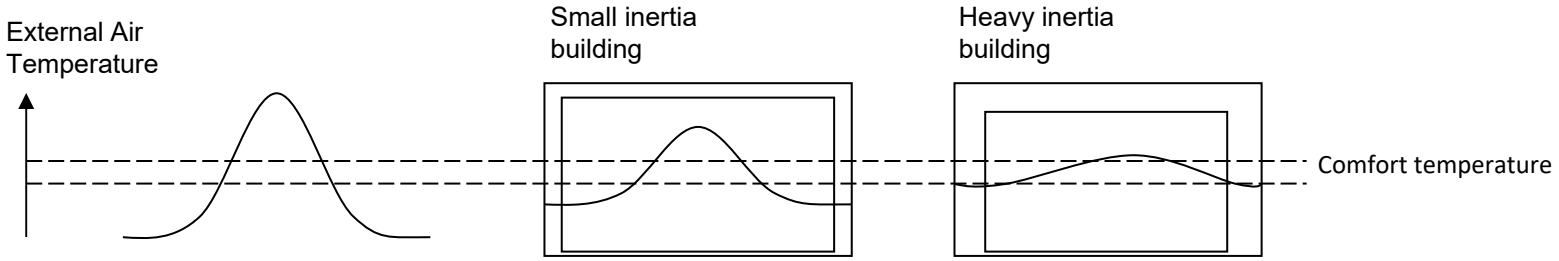
Adobe - Aveiro

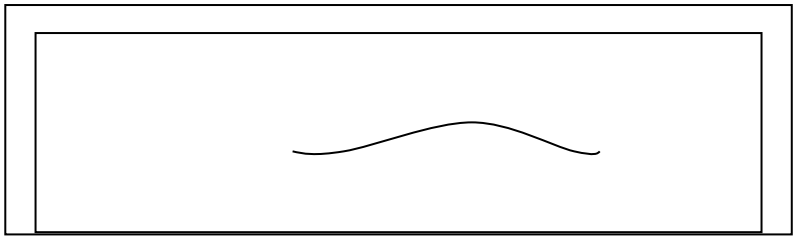
Living under a second skin

Strategies for reducing the environmental impact of passive solar constructions in temperate climates

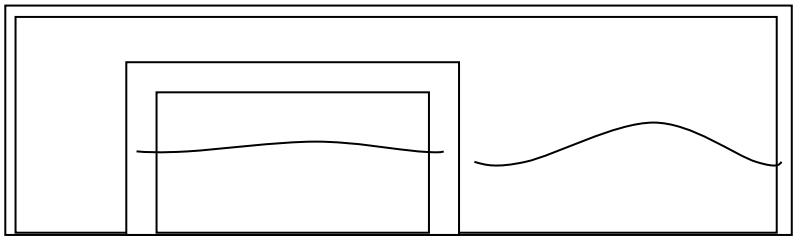
Paulo Mendonça
PhD Thesis in Civil Engineering
University of Minho, 2005

Effect of weight (thermal storage mass) on thermal inertia



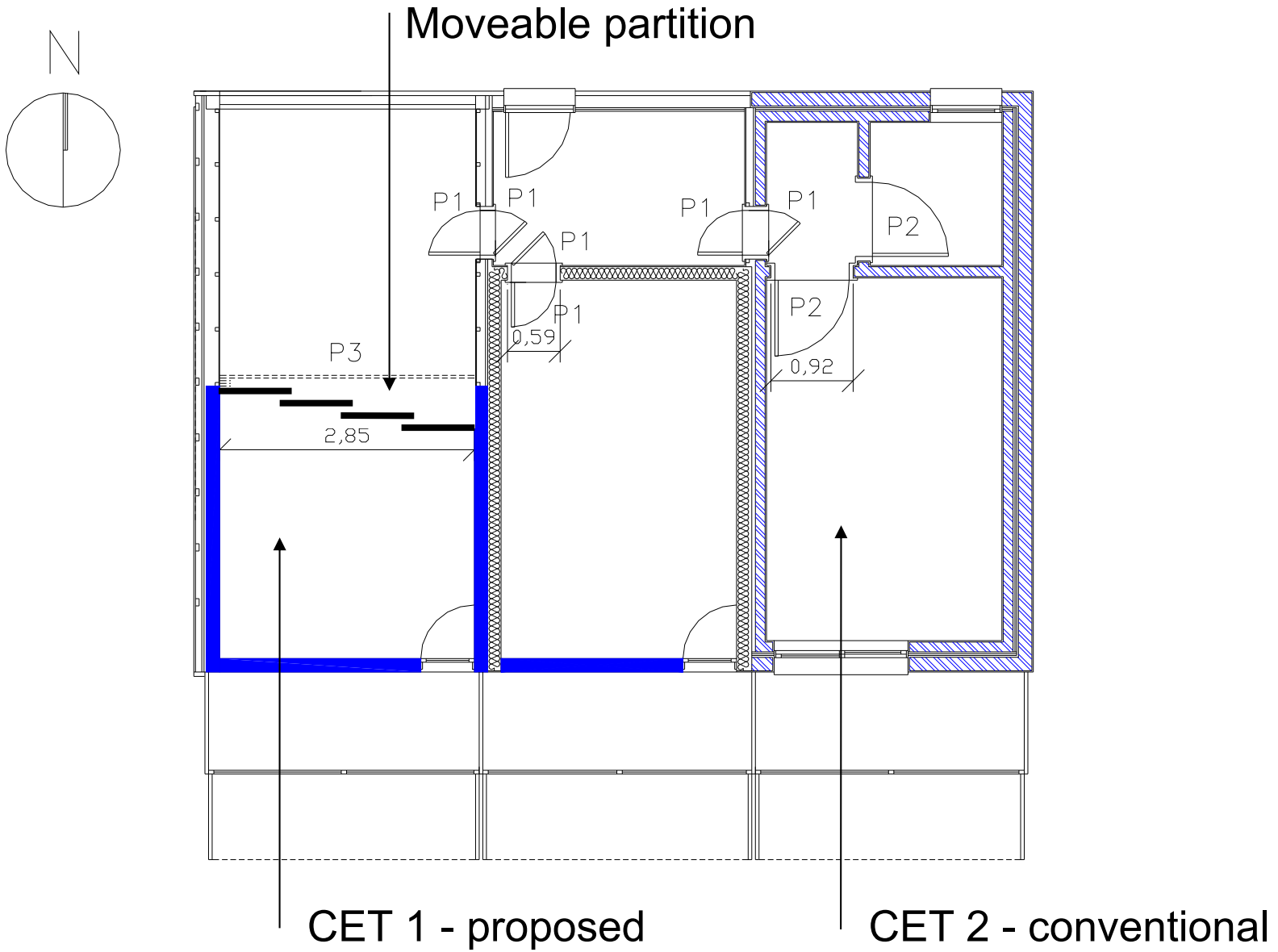


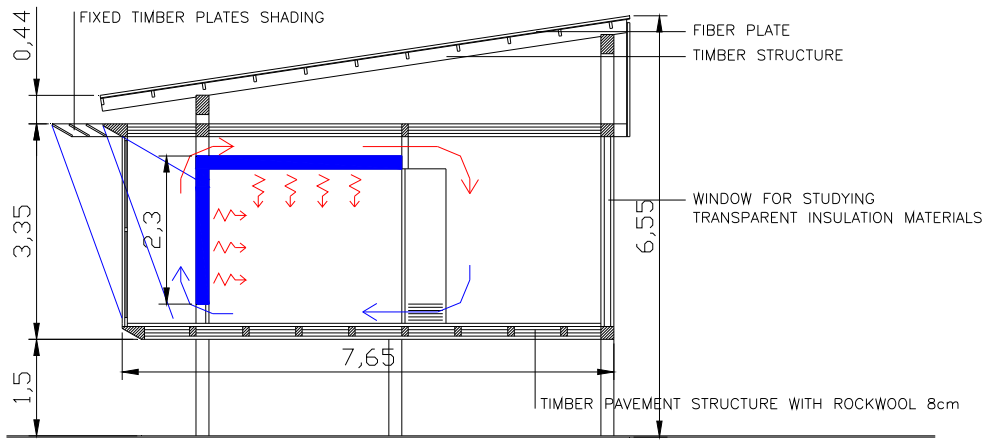
Conventional building
Medium Inertia



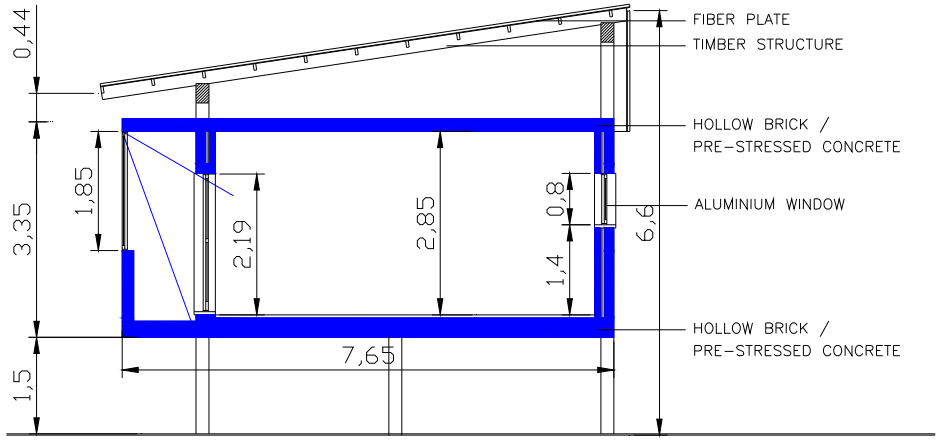
Proposed concept(Mixed-Inertia building)

the “SECOND SKIN”

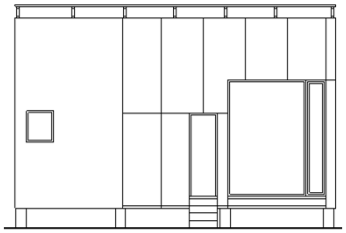

N
Moveable partition
P1
P1
P1
P1
P1
P1
P2
P2
P3
0,59
0,92
2,85
CET 1 - proposed
CET 2 - conventional



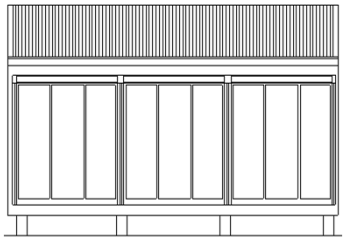
LONGITUDINAL SECTION OF TEST CELL 1



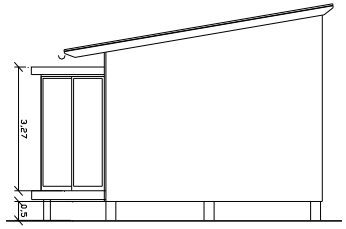
LONGITUDINAL SECTION OF TEST CELL 2



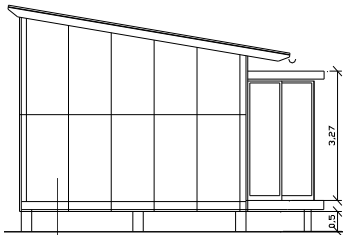
N



S



E



O









Implementation of energy optimization on solar passive solutions

Optimizing orientation and façade design

Indirect gains on South façade – less theoretical gains but higher effective gains;
North natural lighting capture;
Blind façades to East and West.

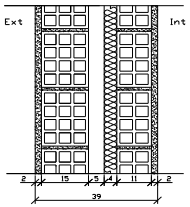
Implementation of a zoning strategy

Sleeping and resting areas South oriented with thermal storage;
Working areas North oriented;
Movable partition separating resting and working areas.

FICHA TÉCNICA DA PAREDE

NOME: **PD1.2/15+11**

DESENHO:



TIPO: Parede Dupla

CONSTITUIÇÃO:		
	Reboco	2 cm
	Tijolo furado	15 cm
	Caixa de ar	5 cm
	XPS	4 cm
	Tijolo furado	11 cm
	Reboco	2 cm

ESPESSURA: 39 cm

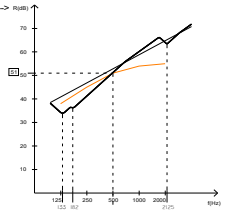
PESO ESPECÍFICO: 313 kg/m²

COEFICIENTE U: 0,49 W/m².ºC

ISOLAMENTO SONORO: 51 dB(A)

ENERGIA INCORPORADA: 910 kWh/m²

CUSTO ECONÓMICO DA PAREDE: 63,35 €/m²

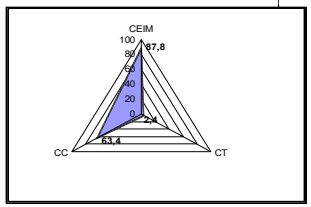


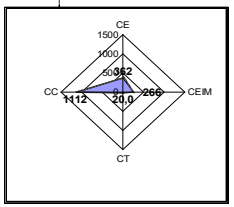
ESTUDO ECONÓMICO:

1º ESTUDO

A partir da aplicação do RCCTE a um compartimento de habitação tipo (Célula de Teste de Referência) e aplicando esta parede obtiveram-se os seguintes resultados, por m² de área útil de Pavimento.

	PAREDE (isolada)	PAREDE (compartimento da habitação tipo)	COMPARTIMENTO DA HABITAÇÃO TIPO (parede + restantes elementos construtivos)	PESO RELATIVO DA PAREDE NO CUSTO DO COMPARTIMENTO DA HABITAÇÃO TIPO
CUSTO ENERGÉTICO (NI)	€/m2		362 €/m²	-
CUSTO ENERGÉTICO INCORPORADO NOS MATERIAIS	191,9	87,8 €/m²	266 €/m²	33%
CUSTO DE TRANSPORTE	5,3	2,4 €/m²	20,0 €/m²	12%
CUSTO DE CONSTRUÇÃO	138,4	63,4 €/m²	1112 €/m²	6%
CUSTO TOTAL	335,6	153,6 €/m²	1760 €/m²	11%





LEGENDA: ■ Em Estudo ☐ Referência

CE - CUSTO ENERGÉTICO (Necessidades de Aquecimento) [€/m2]
CEIM - CUSTO ENERGÉTICO INCORPORADO NOS MATERIAIS [€/m2]
CT - CUSTO DE TRANSPORTE [€/m2]
CC - CUSTO DE CONSTRUÇÃO [€/m2]

NECESSIDADES DE AQUECIMENTO (NI)	73,22 kWh/m².ano
ÁREA ÚTIL DE PAVIMENTO	14,98 m²

2º ESTUDO

Para este estudo considerou-se que a Área util interior iria manter-se constante, com a variação da espessura da parede. Assim o aumento da área exterior resulta num aumento da área de terreno a adquirir*, assim como da área de laje de cobertura e da laje

*Custo Médio de Terreno considerado	500 €/m²

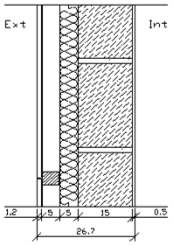
	Solução de referência	Parede em estudo	
Área	20,32	20,32	m²
Custo do Terreno*	10160	10160	€
Custo da Laje de Pavimento	1277	1277	€
Custo da Laje de Cobertura	1149	1149	€
Custo Total	12585	12585	€
Custo Total/m² de Area útil de pavimento	840,37	840,37	€/m²
Diferença para solução de referência	-	0,00	€/m²
% de Variação do Custo	-	0%	

Custo final Célula de Teste com PD1.2_15	-	2438,88 €/m²

FICHA TÉCNICA DA PAREDE

NOME: **PMD2.1/15**

DESENHO:



TIPO: Parede Mista Tripla

CONSTITUIÇÃO:		
	Aglomerado Madeira/cimento	1,2 cm
	Caixa-de-ar	4 cm
	Aglomerado Nego de Cortiça	5 cm
	Alvernaria de Adobe	15 cm
	Cal	0,5 cm

ESPESSURA: 25,7 cm

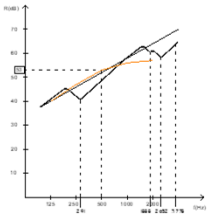
PESO ESPECÍFICO: 257 kg/m²

COEFICIENTE U: 0,44 W/m².ºC

ISOLAMENTO SONORO: 53 dB(A)

ENERGIA INCORPORADA: 171 kWh/m²

CUSTO ECONÓMICO DA PAREDE: 46,55 €/m²

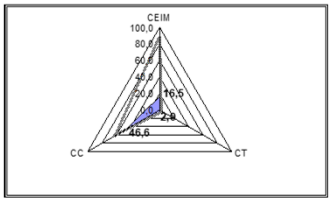


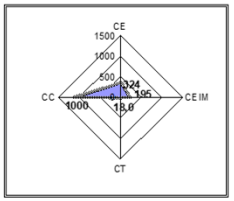
ESTUDO ECONÓMICO:

1º ESTUDO

A partir da aplicação do RCCTE a um compartimento de habitação tipo (Célula de Teste de Referência) e aplicando esta parede obtiveram-se os seguintes resultados, por m² de área útil de Pavimento.

	PAREDE (isolada)	PAREDE (compartimento da habitação tipo)	COMPARTIMENTO DA HABITAÇÃO TIPO (parede + restantes elementos construtivos)	PESO RELATIVO DA PAREDE NO CUSTO DO COMPARTIMENTO DA HABITAÇÃO TIPO
CUSTO ENERGÉTICO (NI)	€/m2		324 €/m²	-
CUSTO ENERGÉTICO INCORPORADO NOS MATERIAIS	32,8	16,5 €/m²	195 €/m²	8%
CUSTO DE TRANSPORTE	4,0	2,0 €/m²	18,0 €/m²	11%
CUSTO DE CONSTRUÇÃO	92,5	46,6 €/m²	1000 €/m²	5%
CUSTO TOTAL	129,2	65,0 €/m²	1537 €/m²	5%





LEGENDA: ■ Em Estudo ☐ Referência

CE - CUSTO ENERGÉTICO (Necessidades de Aquecimento) [€/m2]
CEIM - CUSTO ENERGÉTICO INCORPORADO NOS MATERIAIS [€/m2]
CT - CUSTO DE TRANSPORTE [€/m2]
CC - CUSTO DE CONSTRUÇÃO [€/m2]

NECESSIDADES DE AQUECIMENTO (NI)	66 kWh/m².ano
ÁREA UTIL DE PAVIMENTO	16,47 m²

2º ESTUDO

Para este estudo considerou-se que a Área util interior iria manter-se constante, com a variação da espessura da parede. Assim o aumento da área exterior resulta num aumento da área de terreno a adquirir*, assim como da área de laje de cobertura e da laje de pavimento.

*Custo Médio de Terreno considerado	500 €/m2

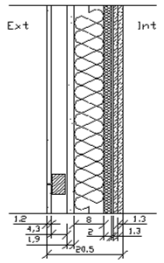
	Solução de referência	Parede em estudo	
Area	20,32	19,99	m²
Custo do Terreno*	10160	9995	€
Custo da Laje de Pavimento	1277	1265	€
Custo da Laje de Cobertura	1149	1138	€
Custo Total	12585	12398	€
Custo Total/m2 de Area útil de pavimento	764,18	752,75	€/m²
Diferença para solução de referência	-	-11,39	€/m²
% de Variação do Custo	-	-1,5%	

Custo final Célula de Teste com PMD2.1/15	-	2144,12 €/m²

FICHA TÉCNICA DA PAREDE

NOME: **PT(L)3.1**

DESENHO:



TIPO: Parede Mista Tripla

CONSTITUIÇÃO:		
	Aglomerado Madeira/cimento	1,2 cm
	Caixa-de-ar	5 cm
	Aglomerado Madeira/cimento	1,9 cm
	Aglomerado Nego de Cortiça	5 cm
	Fibra de Côco	2 cm
	Gesso Cartonado	2,6 cm

ESPESSURA: 20,5 cm

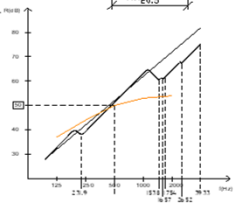
PESO ESPECÍFICO: 79 kg/m²

COEFICIENTE U: 0,40 W/m².ºC

ISOLAMENTO SONORO: 50 dB(A)

ENERGIA INCORPORADA: 442 kWh/m²

CUSTO ECONÓMICO DA PAREDE: 85,9 €/m²

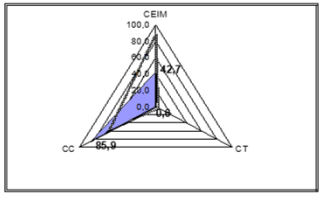


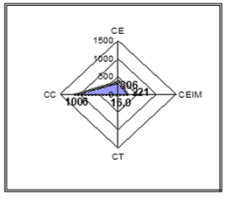
ESTUDO ECONÓMICO:

1º ESTUDO

A partir da aplicação do RCCTE a um compartimento de habitação tipo (Célula de Teste de Referência) e aplicando esta parede obtiveram-se os seguintes resultados, por m² de área útil de Pavimento.

	PAREDE (isolada)	PAREDE (compartimento da habitação tipo)	COMPARTIMENTO DA HABITAÇÃO TIPO (parede + restantes elementos construtivos)	PESO RELATIVO DA PAREDE NO CUSTO DO COMPARTIMENTO DA HABITAÇÃO TIPO
CUSTO ENERGÉTICO (NI)	€/m2		306 €/m²	-
CUSTO ENERGÉTICO INCORPORADO NOS MATERIAIS	81,7	42,7 €/m²	221 €/m²	19%
CUSTO DE TRANSPORTE	1,2	0,6 €/m²	16,0 €/m²	4%
CUSTO DE CONSTRUÇÃO	164,6	85,9 €/m²	1006 €/m²	9%
CUSTO TOTAL	247,5	129,2 €/m²	1549 €/m²	10%





LEGENDA: ■ Em Estudo ☐ Referência

CE - CUSTO ENERGÉTICO (Necessidades de Aquecimento) [€/m2]
CEIM - CUSTO ENERGÉTICO INCORPORADO NOS MATERIAIS [€/m2]
CT - CUSTO DE TRANSPORTE [€/m2]
CC - CUSTO DE CONSTRUÇÃO [€/m2]

NECESSIDADES DE AQUECIMENTO (NI)	62 kWh/m².ano
ÁREA UTIL DE PAVIMENTO	17,07 m²

2º ESTUDO

Para este estudo considerou-se que a Área util interior iria manter-se constante, com a variação da espessura da parede. Assim o aumento da área exterior resulta num aumento da área de terreno a adquirir*, assim como da área de laje de cobertura e da laje

*Custo Médio de Terreno considerado	500 €/m2

	Solução de referência	Parede em estudo	
Área	20,32	19,88	m²
Custo do Terreno*	10160	9940	€
Custo da Laje de Pavimento	1277	1261	€
Custo da Laje de Cobertura	1149	1134	€
Custo Total	12585	12335	€
Custo Total/m2 de Area útil de pavimento	737,19	722,55	€/m²
Diferença para solução de referência	-	-14,64	€/m²
% de Variação do Custo	-	-2,0%	

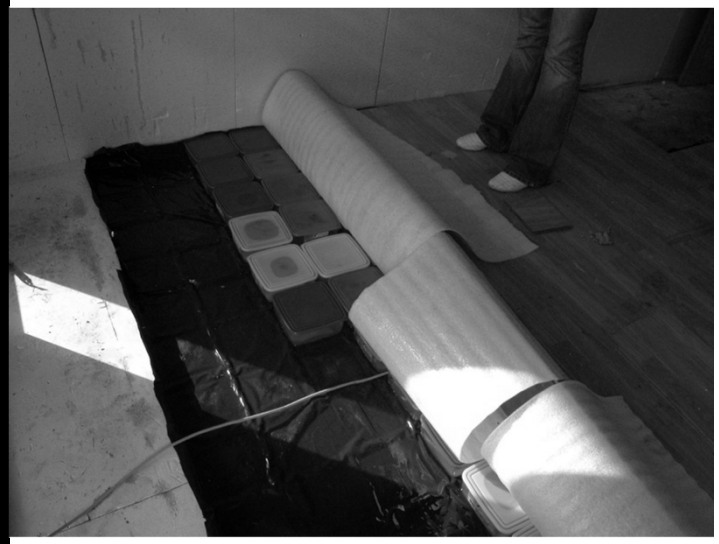
Custo final Célula de Teste com PT(L)3.1	-	2131,54 €/m²

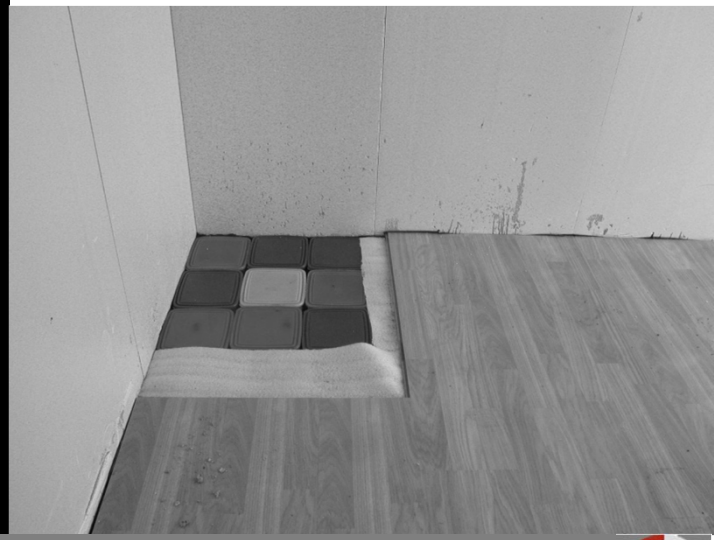
Non conventional thermal mass – PCM's

Thermal storage with PCMs (Cocunut oil)*

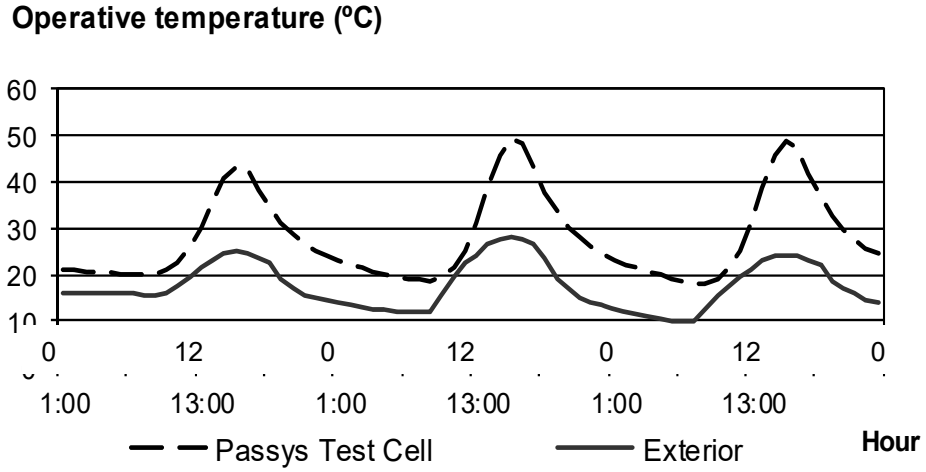
In a "Passys" type Test Cell, an experiment was carried, intended to determine the effect of a natural PCM (coconut oil) as a thermal regulator in a compartment without any thermal mass. In these Figures can be seen images with the installation of 100 kg of coconut oil on the Pavement, inserted in plastic containers, corresponding to 9.2 kg per m^2 of floor area. The total tested was of 300 kg corresponding to 27.6 kg per m^2 of floor area.

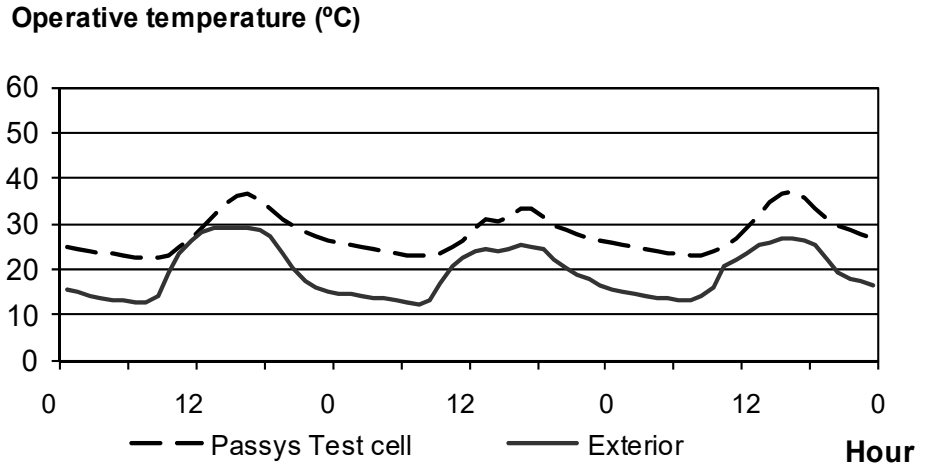
*(Mendonça, 2005)





Non conventional thermal mass – PCM's

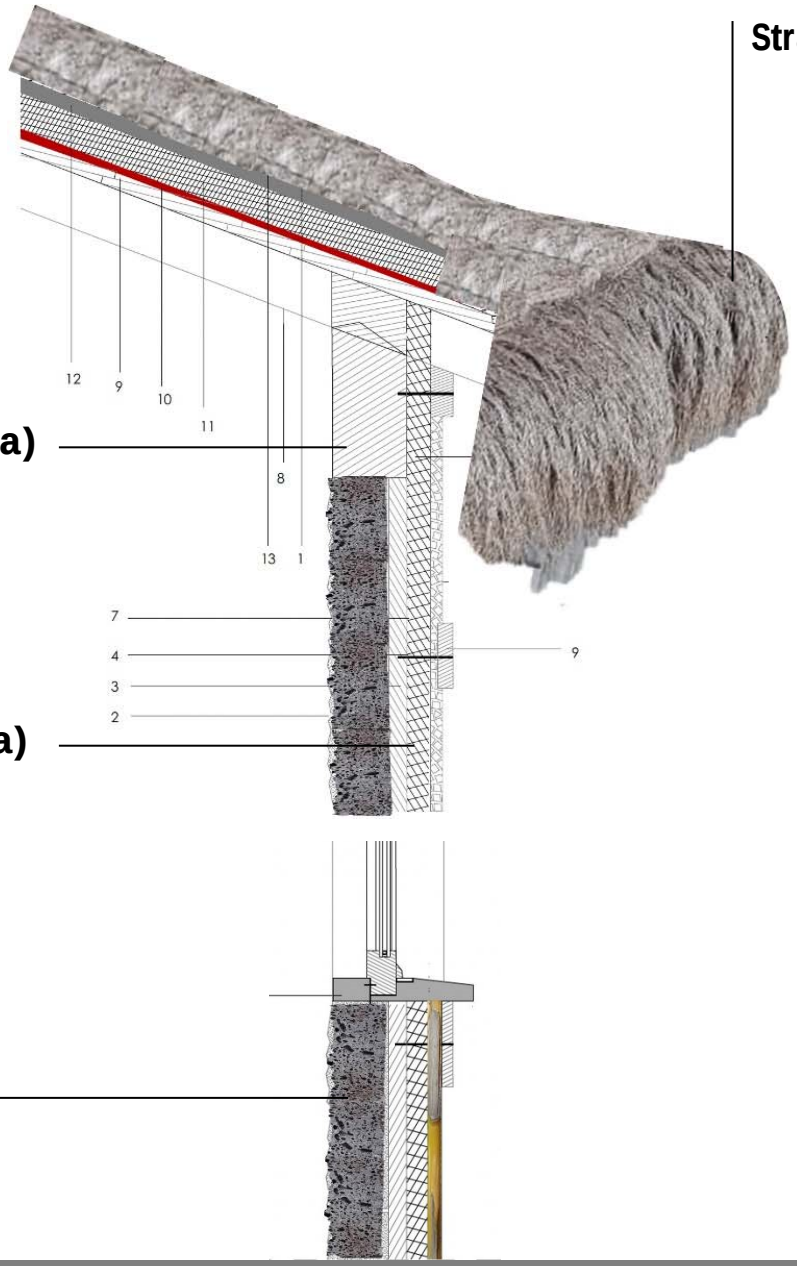




It could be concluded that the introduction of coconut oil into a construction without thermal mass caused a reduction of the maximum internal temperature peaks.

The interior daily thermal amplitude was always decreasing with the introduction of more PCM, up to the total 300kg tested. The difference was significant between the peaks in Passys Test Cell without coconut oil (+20°C than Outside temperature) and with maximum PCM (100+200kg) (+8°C than Outside temperature). The minimum internal temperatures have remained almost always about 10°C above the outside temperature.

It was also found that the Relative Humidity remained below problematic values for comfort and QAI (<60%).



LEGENDA:

1 - Aplicação de rede galinheiro granpeada pontualmente para ajudar a fixar a festuca seca
2 - Revestimento em microcimento com escórias vulcânicas de basalto da região, acabamento meio brilho
3 - Madeira de criptómeria
4 - Revestimeto de pedra basalto e cal com alvenaria argamassada
5 - Viga em madeira criptómeria

6 - Forro em cana com 3cm com acabamento em óleo de linhaça
7 - Tabuas de criptoméria autoclavado
8 - Viga em em criptoméria 14x8cm

9 - Forro em casquinha 2cm
10 - Manta/mebrana anti-poeiras feita a partir da polpa celulósica da festuca 0,5cm
11 - Isolamento à base de fibras estraídas da festuca
12 - Sub-telha, placa ondulada constituída por base betuminosa e fibras celulósicas à base de criptómeria
13 - Cobertura Vegetal em Festuca seca dos Açores 15/20/30 cm
14 - Canas da Ilha com espigão para fixação da festuca seca

Conclusions

THE TENDENCY

versus

THE OPORTUNITY

Contemporary construction systems

GREAT MAJORITY OF BUILDINGS ARE IN **REINFORCED CONCRETE** AND HOLLOW BRICK

PROBLEMS

- Reduced possibilities for reuse or recycling;
- Non-local materials (centrally produced);
- Industrialized processes (high embodied carbon).

CONCRETE+BRICK STANDS OUT IN 2 PARAMETERS: **LOW COST, WIDSPREAD TECHNOLOGIES**

Traditional construction systems

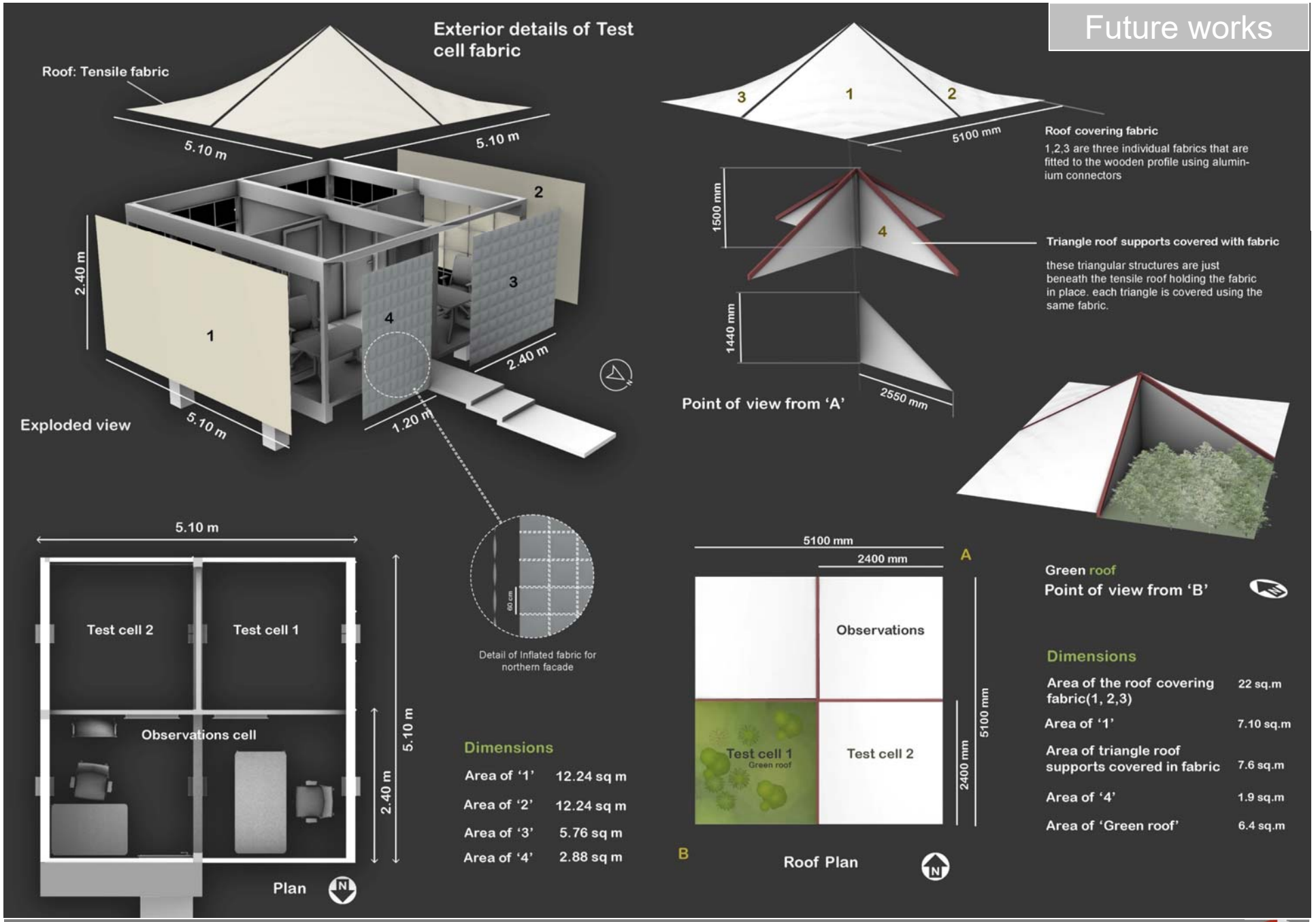
MIXED WEIGHT CONSTRUCTIVE SYSTEM **STONE + WOOD FRAME**

PROBLEMS

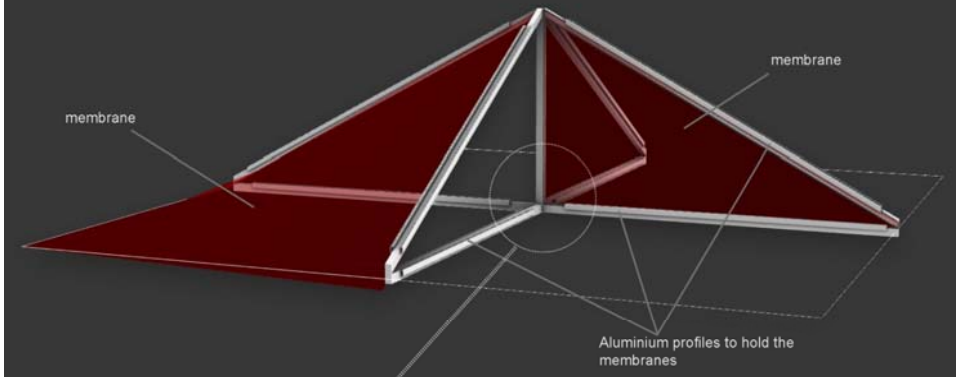
- Higher cost
- Intensive labour;
- Lack of legislation.

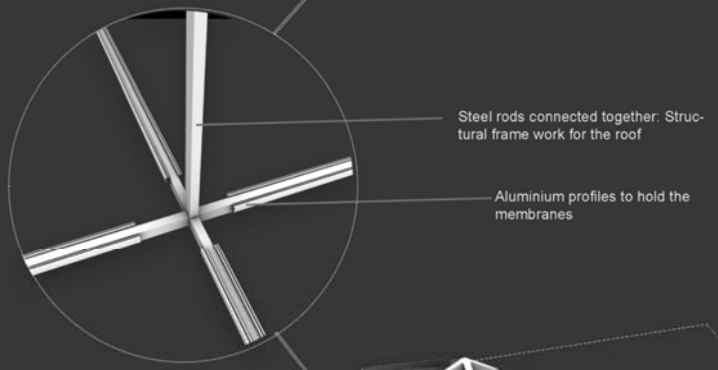
ADOBE/STONE+WOOD STANDS OUT IN 2 PARAMETERS: **LOW EMBODIED CARBON, EASY REUSE**

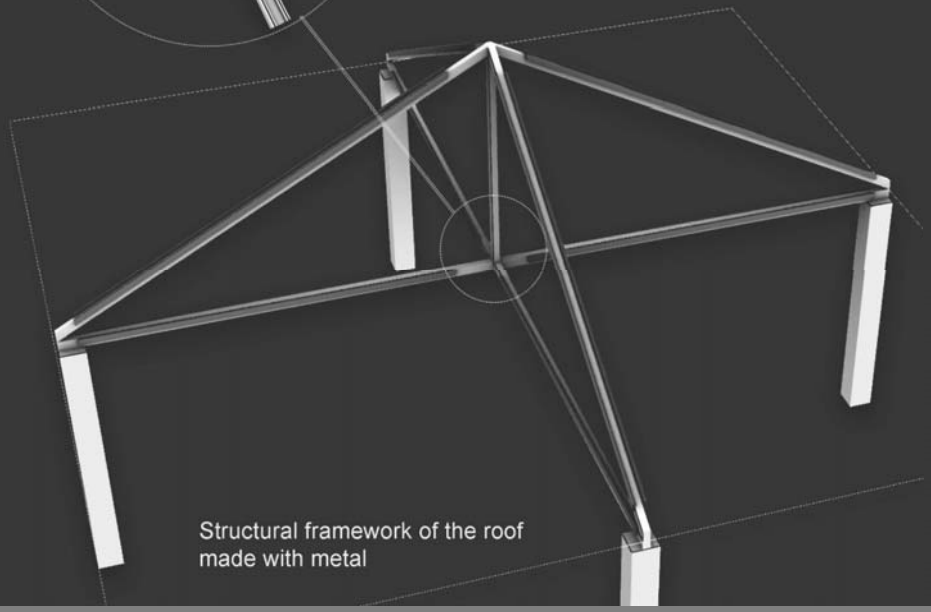
Future works

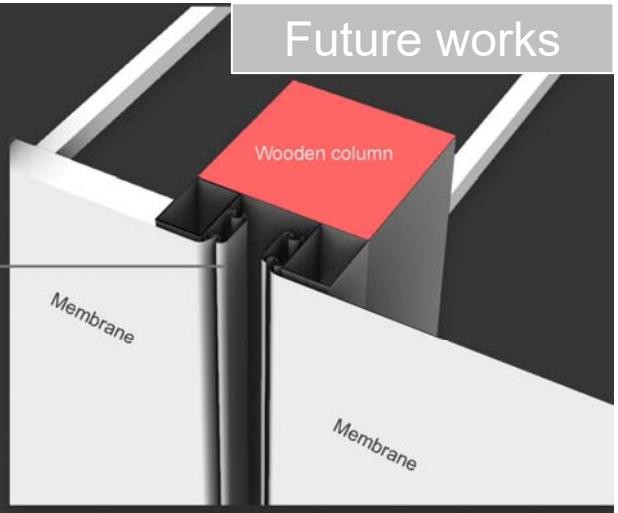


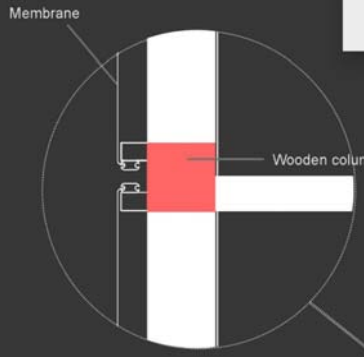
Future works

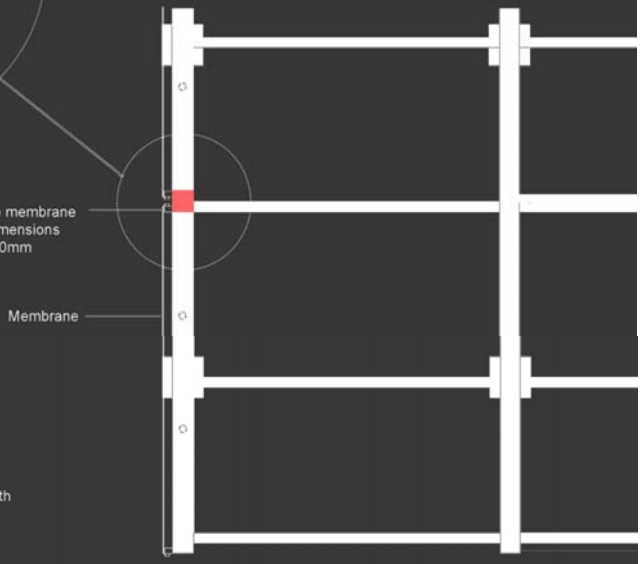












Quantities:

4 Aluminium profile to hold membrane on each side. Total: 8(2.4 mtrs each)

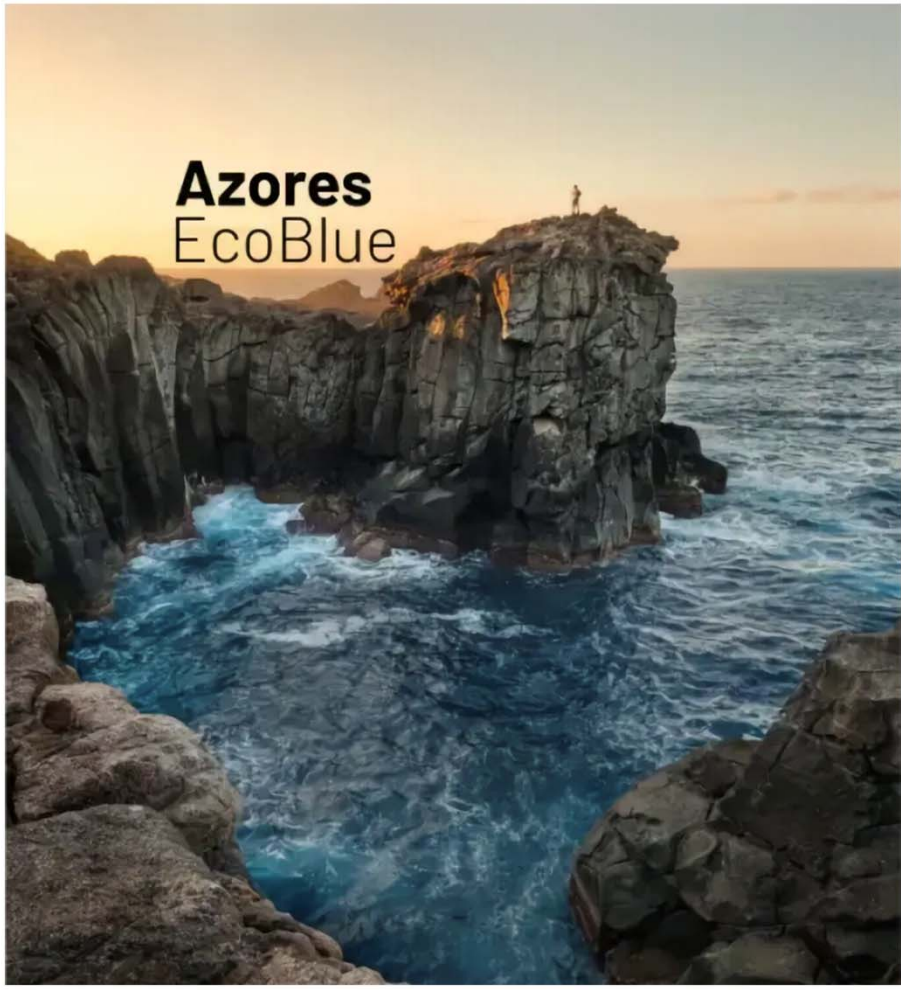
4 rectangular steel rods to hold the membrane profiles. Total: 8(2.4 mtrs length each)

Membrane details for East and West facade

Financed by:

Iceland Liechtenstein Norway grants

know more



Program Operator:

REPÚBLICA PORTUGUESA
ECONOMIA E MAR

Direção-Geral de Política do Mar

Promoter:

CIRCULAR BLUE GROUP

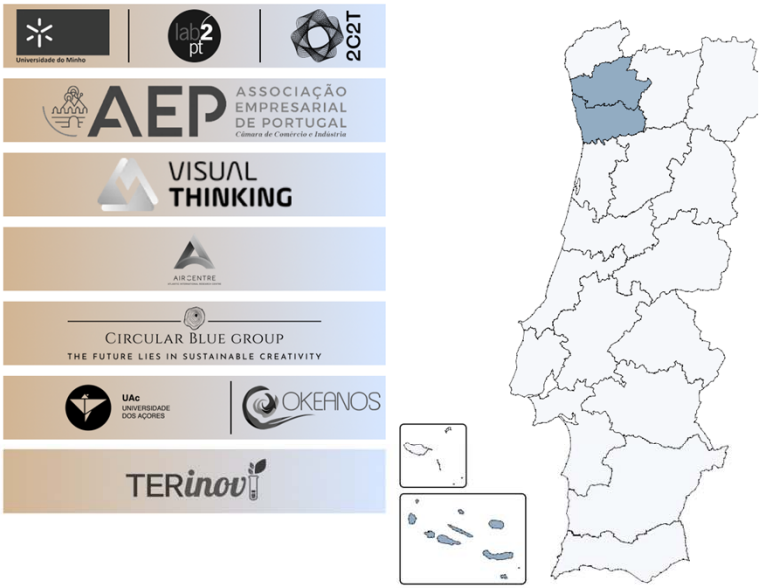
Nieta atelier

Azores
EcoBlue

THE CONSORTIUM

The project consortium presents a model of joint governance with a clear definition of the attributions, contributions and complementarities of each partner. The consortium also intends to include other members at a later stage, through subcontracting, so that they add value and complement their offer, namely companies with competences in the collection, sorting and transport of litter, as well as in the transformation of the yarn and fibre developed from marine litter.

The consortium has technological infrastructures, human resources and the necessary skills to undertake this task, as the group of entities in the consortium will allocate resources and skills with a deep history of scientific and technological development and industrialization projects.

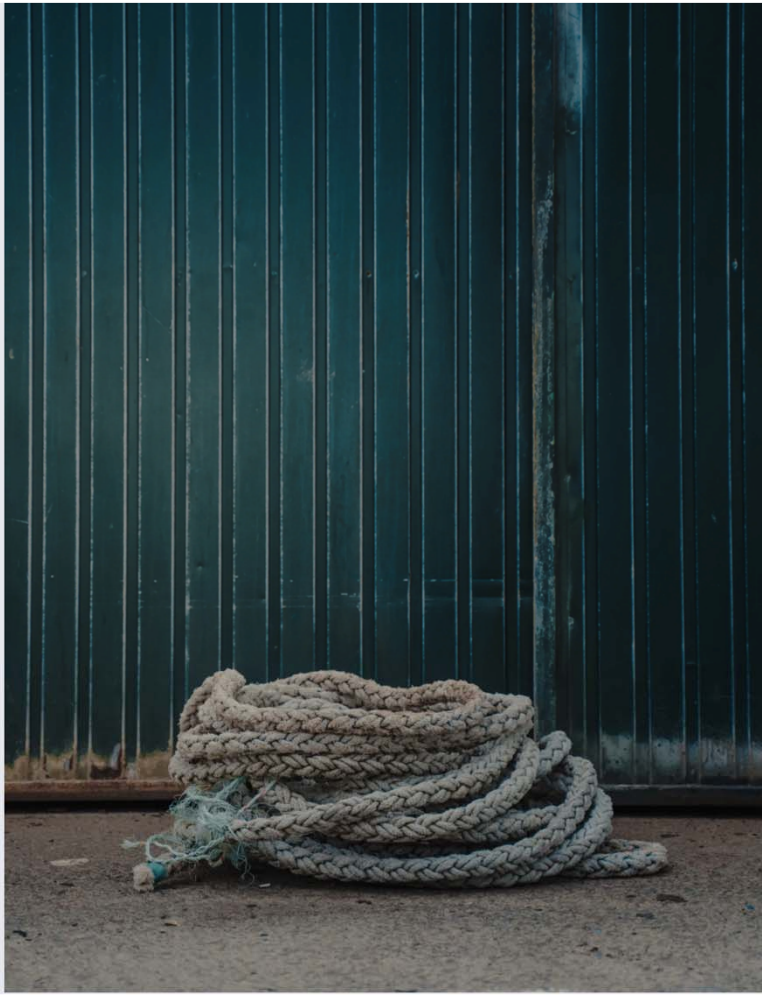


Project financed by Iceland, Liechtenstein and Norway, through the EEA Grants.

Azores
EcoBlue

Marine litter is one of the main enviromental problems with which the oceans are confronted. Continental Portugal and the Autonomous Region of Azores share common challanges, like policy over the sea and the sea in a scenario of waste, given the archipelago of Azores is also not immune to this global problem. There have been studies done to quantify/classify the marine litter in Azores.
Considering the socioeconomical role played by the fishing industry of the Azores, the project is an oportunity to use and develop new and innovative raw materials, transforming marine litter, which is presently little or not at all valued, into a market of excellency, as its "supplier".

To answer these challanges, the project will utilize to their maximum the studies already done and in development by the Universities of Azores and Minho, in their R&D Centres. And, in conjunction with local communities, will collect marine litter and beach residues to develop new threads and fibers for new subproducts. The main activities include the analysis, caracterization, quantification of residues, collection, triage, residue processing, scientific studies about the fibers obtained, development of threads and fibers, and their transformation into fabric and insulating blankets.
Waste will be quantified, analysed, and afterward, presented in a data sharing platform of statistics and scientific studies.



Azores
EcoBlue

As already mentioned, the project intends to transform waste to create threads as raw material for new fabrics and fibers for the development of an insulation blanket. With these and other waste from the sea, a prototype model of an eco-cabin with the new products will be developed. The project will benefit consumers looking for solutions within ecological and recycled eco-design. This eco-cabin pilot prototype can be replicated in other regions that could benefit from its business model, applicable on a global scale. The prototype to be presented constitutes a basis for the development of research work. Simulations and experimental tests of thermal, acoustic and natural lighting tests will be carried out on this prototype.

Scientific studies have already started and are based on the raw materials identified by the R&D centers with the highest percentage of those collected at sea in the Autonomous Region of the Azores. We were able to identify three categories: Silks, cables and algae (weeds). Based on this identification, tests are already being developed in order to create a fiber and thread that will be integrated into the textile, construction and other sectors such as furniture and home accessories. The pilot eco-cabin will be a showroom for the application of construction solutions experimentally validated in the laboratory and in component analysis test cells, as well as a presentation of new craft techniques introduced in construction and home accessories based on marine “trash”.

Azores
EcoBlue

The eco-cabin is based on a constructive system combining heavy local materials as anchorage elements, wood for structure and recycled materials for insulation, panels and shading. The final configuration of the eco-cabin model will be presented in the last semester of the project and it will be unique. With this we intend to develop a base model for sustainable construction, having as analysis/pilot project Terceira Island - Azores and its artisanal culture from marine litter.

In a first phase, analyzing its main environmental problems, such as surpluses from fishing activity, infesting algae and how they can be recreated in a value-added product. Economic studies will be carried out in advance, simulating the structural, thermal, natural lighting and acoustic behavior of the constructive elements and experimental validation of the functional performance in test cells;

Azores
EcoBlue

In view of this analysis and with the scientific knowledge acquired, this base study, in parallel with existing and acquired laboratory equipment for the respective tests, will allow the application of a methodology aimed at the design and construction of eco-cabins that can be flexible enough to be installed in different climatic regions, predominantly coastal. The research and construction model can be based on the analysis and parameterization applied in the Azores EcoBlue pilot eco-cabin. In this way, the parameterization and circular management structure applied in this project can be developed by other creatives, such as architects, engineers and designers.

Azores
EcoBlue

CIRCULAR BLUE GROUP
THE FUTURE LIES IN SUSTAINABLE CREATIVITY

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Thank you!

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