Universidad de Valladolid

Escuela de Ingenierías Industriales

Grado en Ingeniería en Diseño Industrial y Desarrollo del Producto

Pop-Up Store

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Valladolid, Julio, 2015

Trabajo fin de Grado realizado en Programa de Intercambio

Título: Pop-Up Store
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Fecha: 02-06-2015
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Resumen

El presente proyecto muestra el proceso de diseño y conceptualización de una tienda “Pop-Up” que será la re-localización temporal para distintos comercios. Los negocios presentes en la calle Meir (Amberes) tendrán que renovar sus edificios para que la ciudad de Amberes sea zona de cero emisiones de CO_2 en 2050. Por esta razón el proyecto explora las posibilidades de ofrecer un espacio que sea flexible y móvil, y que pueda adaptarse a distintos tipos de comercios dependiendo de sus necesidades e identidades. Otro aspecto importante de la tienda Pop-Up será reflejar la ideología de la eficiencia energética y la sostenibilidad como objetivo de diseño.

En el proyecto se puede encontrar el proceso de investigación e ideación que guiaron la definición de la geometría del edificio, el sistema completo de construcción y selección de materiales, así como el diseño completo de el mobiliario e interiorismo.

Utilizando herramientas de gestión y cartas Gantt se llevó a cabo una gestión del proyecto. Se realizan durante todo el periodo reuniones semanales con los supervisores, validación de ideas, se realizaron también modelos a escala y test de usuario.

La solución final consigue alcanzar los requerimientos establecidos siendo modular y flexible, teniendo en cuento la sostenibilidad y el aprovechamiento de la energía natural así como el diseño para de-construcción.

Palabras clave: Pop-Up Store, sostenibilidad, eficiencia energética, construcción modular, diseño para de-construcción.

Abstract

The present report shows the process of design and conceptualisation of a Pop-up store that will be a temporary relocation for shops. Businesses in the Meir Street will have to renovate their buildings so the city of Antwerp becomes CO_2 neutral emission zone in 2050. Therefore, the project explores the possibilities of offering a space that can be flexible and movable, and which can be adapted to different kinds of shops according to their needs and identities. Another important aspect of the Pop-up store is it will be sustainable and energy efficient to reflect the ideology that wants to be achieved.

What can be found in this paper is the research and ideation process that guided to the shape definition of the building, the whole construction method and selection of materials, as well as the design of the entire furniture and interior.

A project management has been carried out using Gantt charts and managing tools, weekly meetings have taken place throughout the project and the ideas have been tested through user validations and scale models.

The final solution has achieved the requirements established, being modular and flexible, taking into account sustainability and how to seize natural energy, as well as using design for deconstruction.

Palabras clave: Pop-Up Store, sustainability, energy efficiency, modular construction, design for deconstruction.

Pop-Up Store *Final Report*

University of Antwerp - EPS Program

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Antwerp | June | 2015

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Section 1 **Abstract**

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Section 2 **Introduction**

The present paper is part of the European Project Semester carried out in the University of Antwerp in which students from different countries and fields of study work together in a multidisciplinary project.

In this case, the project consists on the creation and design of a sustainable pop-up store in which local shop owners in Antwerp will be able to locate for different purposes. The main goal is to offer a space to shops that need to renovate their buildings so they can continue their sells and do not lose clients. This need to renovate the building is caused by the decision of the city of Antwerp to become CO_2 neutral emission in 2050; therefore, all businesses will have to apply energy efficient system to their buildings and will need this extra space.

Other purposes for the pop-up store will be studied throughout the project as there is a wide range of possibilities. Nevertheless, the principal focus will be the one mentioned above, which leads to another requirement: the store will have to be energy efficient as well as an example for the citizens and salesman of a sustainable business. That means that sustainability will be an important component of the project to take into account, from the overall design, through materials selection, technical definition until promotion and future implementation.

To get a clear idea of what is going to be done in the project, there is the need to state that the pop-up store will not be located in an existing building, but will be in an outdoor environment, that means the group has to design a specific building for it, which represents one of the biggest parts of the project.

Another significant point to keep in mind is that the project has been given without any stakeholders to collaborate with or someone who could give the guidelines to follow. Consequently, there will be no budget for the project which means that it cannot be implemented in the reality nor any real scale prototype can be built. That only lets the possibility to create a conceptual pop-up store as much detailed as possible in the way that if there is an interested stakeholder in the future they can build it and make it real. Apart from this, the requirements of the project were not clear at the beginning so they had to be rearranged according to the team decisions together with the supervisors, who will be our guides to follow.

Section 3 **Project Management**

The management of this project started from the requirements that will guide it and limit it, which were not enough defined from the beginning. Because of this reason, the first step was to define the requirements being sure they were specific, measurable, assignable, realistic and time-bound (SMART).

After several discussions with the supervisors the final requirements were defined. Even so, since the project does not have stakeholder, some of the requirements are sensitive to be changed during the project.

Requirements

General goals of the project:

- The main purpose of the pop-up store is to provide a space to continue the business for those shops making renovations to become energy efficient. This place will at the same time be an example of sustainable and energy efficient store.
- Other interested parties in the pop-up store may be suggested later but they will not influence the project nor the design of the store.

Movable

1. *The complete building of the Pop-Up store and the furniture have to be settled within 3 working days. Also the deconstruction has to be done within 3 working days. (Five workers with basic qualification 8 hours a day).*

2. *The basic unit building with the furniture have to be transported with one standard truck (around 35m3).*

3. *The building has to be composed by different small and easy to carry elements to make the transportation and construction easier (limit weight 25kg/person).*

Flexible

4. *The building will be modular and it will be adaptable to at least three different sizes: the standard size (module unit), and two more sizes combining other basic units.*

5. *The furniture will be designed to have more than one function so it can be transformed depending on the needs.*

6. *The store will provide at least three different tools* to personalise the interior and to help the brand to adapt its own identity in the shop.*

**Tools for marketing (ex: free space for logo, colour...).*

7. The Pop-Up store will have at least two possibilities to transform its exterior (opened or closed structure) depending on the needs of the client.

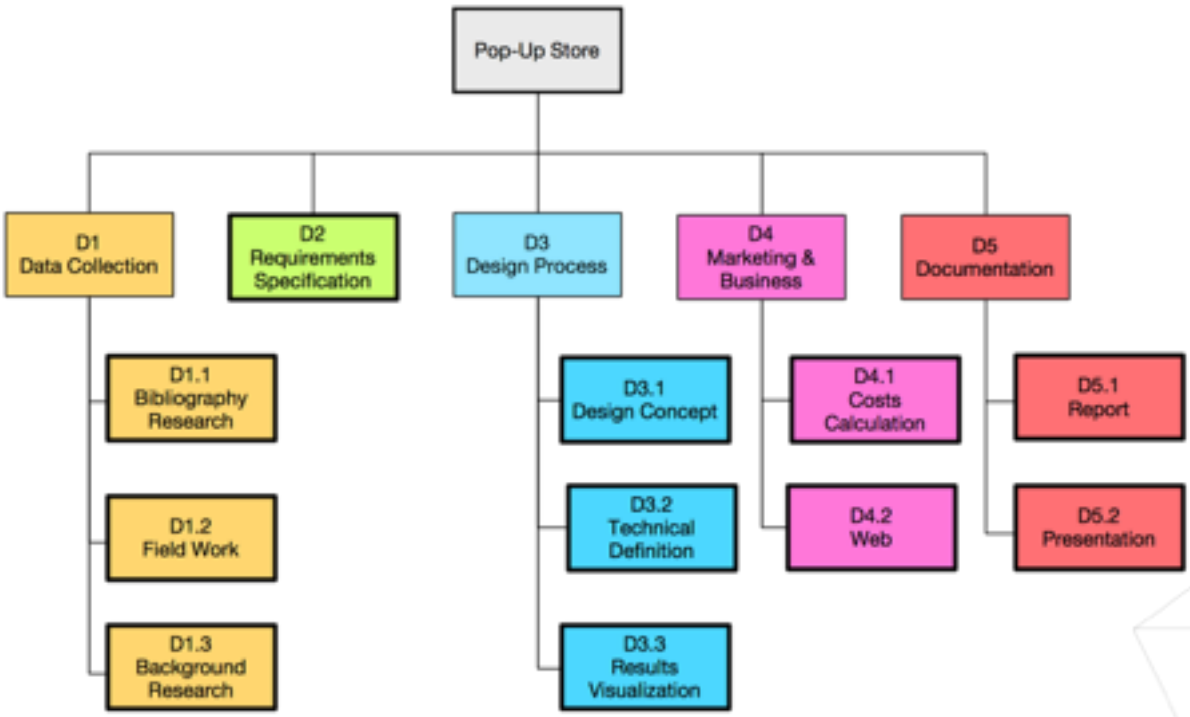
Sustainable

8. To assure that 80% of the elements composing the pop-up store are reusable everything will be deconstructable (design for disassembly).

9. As the pop-up store is temporary and at some point its use will be finished, as maximum parts as possible will be thought to have another future use to ensure a sustainable life-cycle. The others, not possible ones, will be recycled.

10. Find the balance between the eco-label of the materials and their durability.

Based on this requirements, the work breakdown structure was established.



Work Breakdown Structure (WBS)

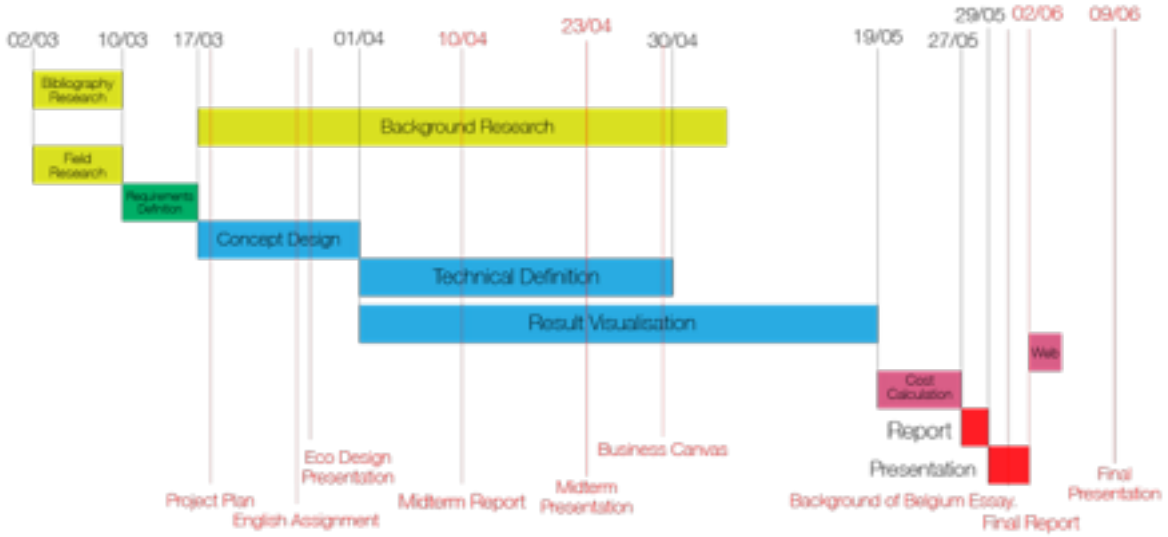
The different colours represent different fields of the project. The same colours are used in the Gantt chart to understand how the different deliverables are distributed along the calendar.

Following, the initial Gantt chart is compared with the modified one representing the followed process of the project. Also, in this last Gantt chart are represented all the assignments the

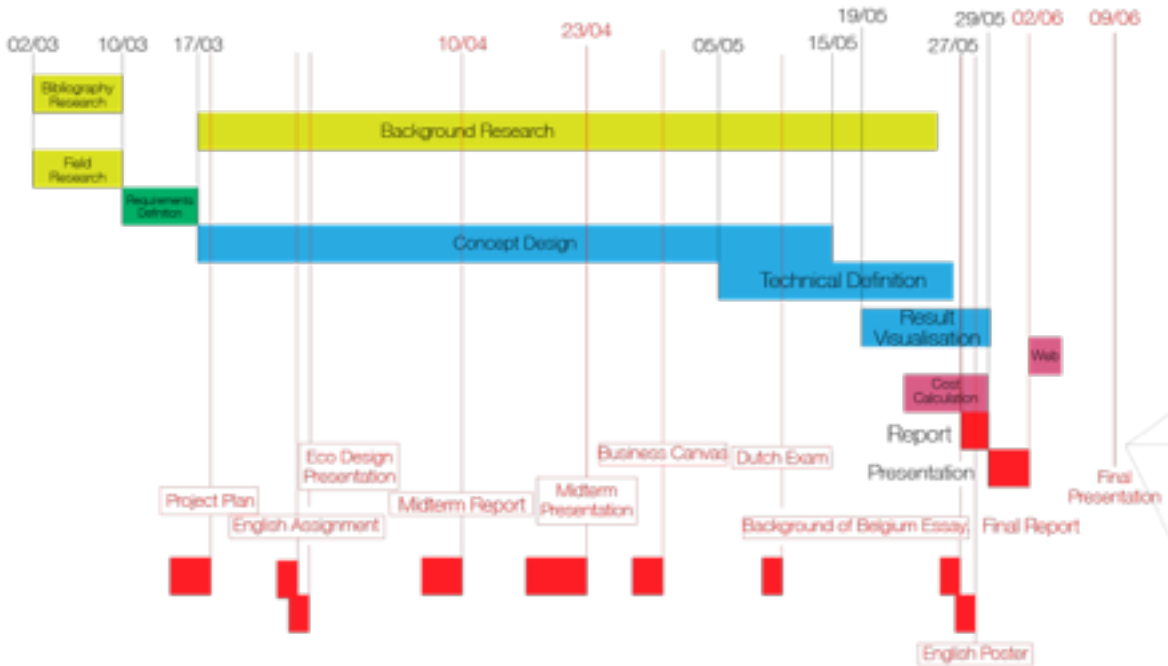
team had to deliver and the periods during which the tasks were combined at the same time with classes and project time*.

*Explanation of the academic calendar available in the Midterm Report[1].

First version of the process after the midterm report



Gantt chart. First version.



Gantt chart. Final version.

As showed in the last version, the "after the midterm presentation process" changed significantly. The main reason of this modification comes from the feedback after the

[1] https://dl.dropboxusercontent.com/u/24827617/Midterm_Report_Pop-Up_Store.pdf

presentation. The group had an important meeting with the supervisors in which they discussed the lack of justifications. The point was that the different decisions taken during the concept design were not justified enough. This meeting changed the programme to follow and the concept design period was extended until the concept definition was more defined. That is why the technical definition and the concept design were made at the same time and having impact on each other.

As a conclusion, because the Gantt chart had to be changed after the midterm presentation feedback, it forced the team to keep focusing on the concept design in order to define the building. This took more workload of the concept design part, which made the technical definition shorter.

For more detailed information there is a Project Plan[2] available.

[2] https://dl.dropboxusercontent.com/u/24827617/Pop-Up_Store_Project_Plan_FINAL.pdf

Section 4 State of the art, What does already exist?

During the research process it was important to investigate and get knowledge of what already exists or what has been done in the pop-up store field. Internet was the main tool of this research, based on the different websites from pop-up companies and other events. Fieldwork investigation could also be considered a tool for research.

The pop-up store phenomenon has been getting more popular through the years and revealed many ways to integrate a temporal environment. Three main ideas seemed to reappear more often, they all have a different context but they have the same important characteristic of a pop-up store, which is being temporal. To have a better idea of what the project could look like, it is important to study each option, so mistakes from the past can be avoided and the good ideas are kept to improve.

First, it is quite common to find pop-up stores made out of containers. As already seen, containers are a good alternative for student houses or other living areas. That way, containers can be reused and it also gives an opportunity to re-valorise it while saving money from new materials. They are made of resistant materials have dimensions respecting the requirements to be transported easily.

Container Pop-Up stores.

As part of this project, the originality and the wish to be sustainable both in the energy and materials, excluded these containers. As said before, this method has been popular lately and the innovative mind for creating spaces disappeared. To think out of the box there is a need of renovation of the concept.

Second, Pop-up shop companies rent an existing building for limited time to keep the temporal aspect of the pop-up store. They just integrate their design, products or devices in the predefined places. It is somehow easier because they do not have to take into account the

electricity or water services as independent and so can easily accommodate their own identity with their proper furniture.

Pop-Up stores in existing buildings.

The disadvantages of this way are quite obvious. The modularity of the place is limited and so is the location of it. To make it more interesting and to catch the attention of the customers, it is advised to put it somewhere susceptible to be seen by people, for example in the middle of a street or a square.

At last, some stores are choosing the option of a structure which they incorporate in the inside of a furnished building, for example a shopping centre or a big hall during an event. In this case they can use more creative structures without having to take into consideration the insulation of the building or a construction concerning the influence of the weather. Usually the space is more

Indoor Pop-Up stores.

limited what can lead to height restrictions if there is a wish of making two floors or space. restrictions if the store wishes a bigger area to sell and promote.

Of course there are few pop-up stores that have a similar goal as the project assigned for the EPS but most of them do not promote the sustainability and energy efficiency of the building. It is also not adaptable for different kinds of business and they do not apply the design for disassembly principle in their construction structure. Delocalise their business to promote it is the main goal of their pop-up store but has not another meaning to sensitise the customers or the stores.

Existing similar Pop-Up concepts.

After this research the good ideas were kept as an inspiration but disadvantages were written down to create the requirements of the project. Our project might be more similar to the last option; nevertheless the purpose of it will be deeper than just to promote the brand.

Section 5 **Research**

Construction System

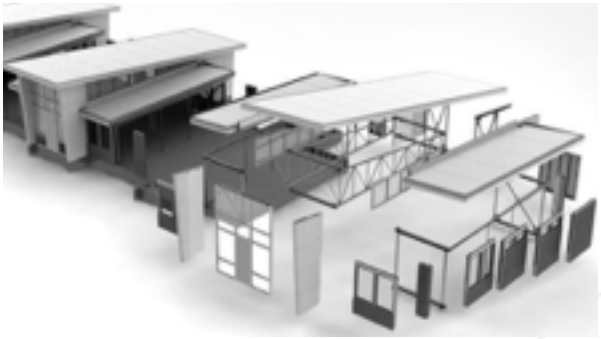
The construction part is one of the most challenging of the project and therefore an accurate research has to be done to acquire the knowledge that will allow a good design and construction method. Many things have to be taken into consideration, such as how long the building will be used for, the sustainable materials, the energy efficiency system application, resistances, etc. A good building will be created according to the customer needs, and it will implement a design to adapt the identity of each type of shop.

There is a wide variety of construction methods for buildings. In this project, the product will be transferred which means it is going to be disassembled and assembled several times during the life of the building. This requirement is based on segmented construction which is the simplest option. Components can be easily connected to each other and this will have to respect a requirement in which the elements cannot weigh too much to allow a maximum of three people carrying them. In addition, the segmented building is suitable for a few labourers to be built, without using a crane or truck for transportation.

Following there is a summary of the construction systems researched that are considered interesting for the project:

Prefabricated elements

Prefabricated building elements are factory-finished parts. This element is usually the size of one wall, and by connecting the elements to each other, the outer facade of the building will be formed.



Modular building/constructions

The modules are built in a factory to be pre-fabricated, stand alone objects. The modules give the opportunity to build different kinds of shapes, while the basic module stays the same. The prefabricated modules are connected easily and rapidly to each other at the construction site. One good example is the container.

Container

While the container is not designed for the use of a building, it is perfect to be used as one. Because of the perfect modular way to stack the container, it can be used in a lot of ways.

Geodome

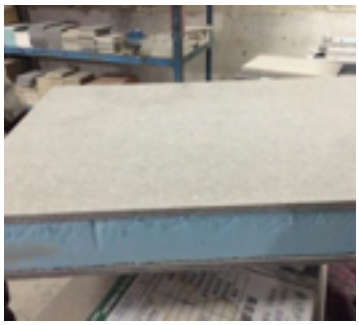
A geodome is a spherical shell structure that consists of triangles. Geodomes are efficient in several ways: mainly, the triangle is a very stable shape which means a given force will not deform the triangle, and so it is highly resistant to such forces as snow coverings, earthquakes, wind. Geodomes can be constructed quickly without heavy equipment which is an important criteria for this project.

Scaffolding

Scaffolding is a temporal structure used to facilitate the construction for workers to build or renovate the facade of a building. It is easy and quick to build up and even easier to break down. It is also easy to expand or increase the size as long as the beams and connections allow it.

Panel construction research

The panels used for the construction can be attached to the building in different ways. Following there i s a list with the different options to attach the panels and they are compared to select the for the Pop-up store.

Type	Method	Advantages	Disadvantages
Wood panel with wood frame 	OSB panels in both sides Wood frame 2/4 's Insulation: Wood fibre Frame and panels connected to each other with nails.	Durable, strong, sustainable.	Quite heavy, use a lot of wood, need a lot of screws .
Wood sandwich panel 	OSB panels in both sides Insulation: Foam Panels The panels are connected to the insulation with nails	Lighter than with a frame	Easy to damage (if insulation goes wet for example), usually the insulation material is foam (not sustainable)
Wood panel with metal frame 	OSB panels in both sides Metal frame Insulation: Wood fibre Frame and panels are connected to each other with screws	Durable, strong	Heavy, expensive, more work to assemble

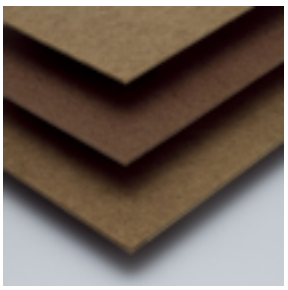
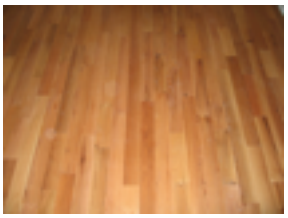
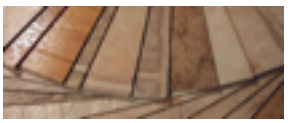
Materials

Examples of material choices

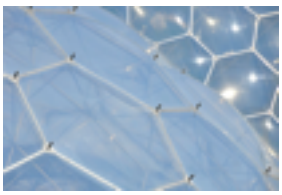
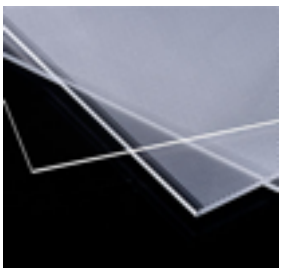
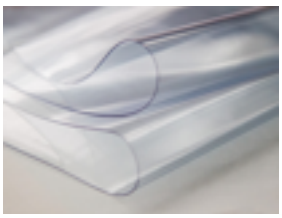
Since one of the main requirements of the Pop-up store is to be sustainable, the materials need to be chosen accordingly. To have a first idea of possibilities that can be applied for the various parts of the building, a simple comparison according to the advantages and disadvantages of materials has been done. The different parts to take into consideration are the walls, the floor, the roof and the windows. Both wall and floor are put together because they can be the same material.

Wall / Floor

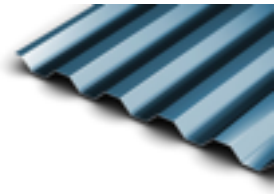
Material	Advantages	Disadvantages
European redwood 	Quite cheap, durable, readily available, easy to work with, well finished	Knotty
Plywood 	Resistance for warping, cracking and twisting, ideal for construction, not too expensive	Porous and susceptible to water damage if exposed over time, heavy when wet, use of glue
OSB 	Cheaper than plywood, high decay resistance, thick, no soft spots (knot hole)	Not water resistant, use of glue
Wood-plastic composite 	Ability to be molded so many option for shape, can be bent and fixed to form strong arching curve, sustainable material because made of recycled plastics and waste products of the wood industry.	Have a lower strength and stiffness than wood, time and temperature-dependent behavior, wood-plastic composite difficult to recycle again after use
Veneering 	Cheap material, constructed of layers of wood	Lower quality compared to hardwood counterpart, extremely thin and susceptible to water
Cardboard 	Lightweight, cost effective, made from renewable resources, environmentally friendly, recyclable	Not water resistant, can be easily puncture (depending on thickness)

Honeycomb 	Lightweight, fairly cheap, recyclable, strong, variety of different thicknesses, recyclable	Not water resistant
Hardboard 	Three different types: standard, medium and oil-tempered, oil-tempered integrating with oil makes it more stiff, harder and more resistant to moisture and scratch	Can not be used outside, easily bendable
MDF 	Flat, no knots, stiff, is easily machined, can be painted, cheap	Formaldehyde dust dangerous, use glue, structurally not resistant enough, not easy to combine with other materials
Hardwood floor 	Very easy to maintain and clean, tough, strong, durable	Expense, slippery, needs extra special care
Vinyl floor 	Durable, comfortable under the foot, quite cheap	Damage easily by sharp objects, colours can fade with exposure from sunlight

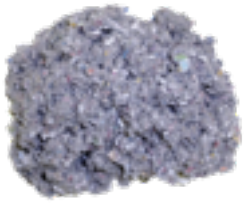
Windows

Material	Advantages	Disadvantages
ETFE 	Super lightweight, light transmission, durable, insulation properties, eco-friendly, fire resistant	Is prone to punctures by sharp edges, transmits more sound than glass
Perspex 	UV-resistant, reusable, eco friendly, cheaper than glass, many colours, light	Break easily, do not glow and glossiness
PMMA 	UV resistance, excellent clarity, do not scratch, hard, low water absorption	Poor fatigue resistance. Notch sensitive.
PVC 	Durable, light, fire resistant, low permeability, excellent insulating properties	Poor weather-ability, fairly heavy, relatively low impact strength, is easily scratched, not sustainable

Roof

Material	Advantages	Disadvantages
Bitumen roof 	Strong, waterproof, durable, recommended for low-sloping roofs or flat roofs	End-of-life environmental impact
Metal roof 	Longevity, durable, energy efficiency, safety, Environmentally friendly	Noisiness, expansion and contraction, inconsistency of Colour match, performant
EPDM 	Made from recycled materials, long-last life, lightweight, waterproof, reflects heat, variety of textures and colours	Must be installed by experts, it can be damaged easily when something fall, not always straight

Insulation

Material	Adventages	Disadvantages
Wool 	Production process that respects the environment, reliable and cost-effective product, use of locally-sourced renewable natural resources.	Protective gear must be worn when installing (inhaled silver), silver irritates the alveoli and can cause cancer
Sheep wool 	Sustainable, environmental friendly, long lasting, light, cost effective, safe, manages moisture, non flammable, air quality, no glass fibres, easy to install	Expensive, not locally available in many areas
Straw bale 	Durable and sustainable, use only natural resources, highly insulating (hot, cold and noise)	Fairly expensive, quite heavy when it is used in big amount at once, susceptibility to rot
Cellulose 	Sustainable, lightweight and ecological, fire- and insect-resistant, sound insulation, long-term cost savings	Absorbs moisture easily, dust of cellulose is dangerous
Wool fibre 	High capacity to retain moisture, flexible, water vapour open structure, easy to handle, non allergic, good compression strength, light, ecological, environmentally friendly and fully recyclable	fairly expensive
Natural rubber 	Really good water resistant, elastic and resilient, strong, abrasion resistance	Severe allergic response and weakness for chemicals, difficult to process

Modularity and flexibility

Modularity is an important feature of the pop-up store, as its name indicates this needs to be pop-up (temporal) and needs to change periodically, for example from a clothing shop to a café, or from an office material to an accessories store. Because of this, it requires a big **flexibility** in its components to transform and have different functions, and one way to achieve that is working with modular furniture and building structure.

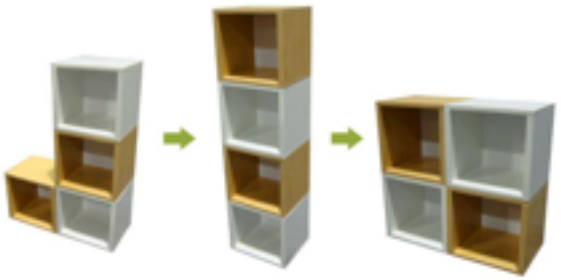
To help understand the concept and do not make confusions with the meaning of modular, it is useful to define the word:

Modular:[3]

1. of, relating to, or based on a module or a modulus
2. constructed with standardised units or dimensions for flexibility and variety in use

This term has been applied first of all in the building, which is going to consist on a basic module that can be repeated and combined to offer a bigger space depending on the kind of shop that is establishing. What's more, the construction system of the building can also have some modularity, for instance, if panels are used for the walls: one same piece combined repeatedly can form the whole structure.

On the other hand, for the furniture and interior design this feature will also be used, because it offers the chance to combine different pieces and give a wider range of possibilities to the shop owners to adapt it to their needs.



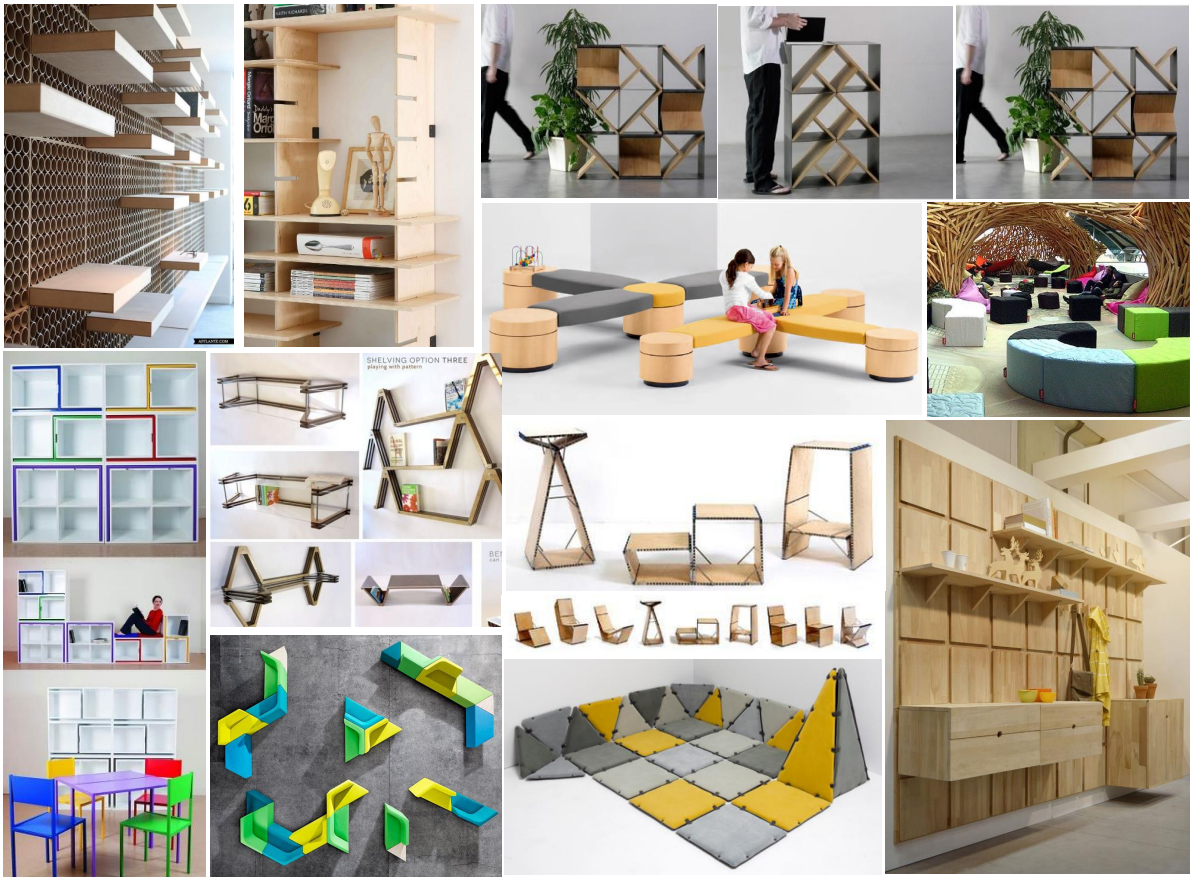
Modular Storage.

Still, there is another essential characteristic the furniture will have, and this is the **multi-functionality**. Each piece will attempt to have at least two different functions, making it easier to adapt to different types of shops. A table can be converted into some shelves, a stool can also be used as stairs, or a wall/panel can hold either hangers, boxes or mirrors depending on the use.

Transformable furniture.

3 http://www.oxforddictionaries.com

To be able to get inspiration from already existing designs, a mood-board has been created showing different solutions for modularity and multi-functionality in furniture.



Modular furniture examples.

Sustainability and energy efficiency

Two subjects this group did research on are sustainability and energy efficiency. Both subjects have a lot of influence on each other. “Being energy efficient means doing the same amount of work while using less energy”[4] and that is why it is combined somehow with sustainability. To have a better understanding of sustainability, two definitions are given.

Sustainability; noun[5]

1. *The ability to be sustained, supported, upheld, or confirmed.*
2. *Environmental Science. The quality of not being harmful to the environment or depleting natural resources, and thereby supporting long-term ecological balance: The committee is developing sustainability standards for products that use energy.*

The second explanation is the one that EPS project refers to, even though this word has a lot of other meanings. It is about using as less transportation as possible, choosing materials that can be recycled, being socially sustainable, etc. This is why it is useful to have a deeper explanation before it is used.

Sustainability in this report is applied in the following ways:

- The building should avoid losing energy as much as possible and use natural resources,
- Materials used for construction should be recycled or recyclable,
- Transport impact should be reduced,
- Apply sustainability in a social way. This will be implemented involving people with the project and raising awareness on sustainability.

A wondered question is why is it sustainability important for the project?

The city of Antwerp wants to become CO_2 neutral in 2050, therefore, shops will have to renovate their buildings and becomes energy efficient. In this moment the pop-up shop will be a perfect way to show the customers that the shop is concerned about the future, but it is also a way to attract new environment friendly customers.

Before the group started designing the building and its furniture, more information and knowledge about insulation, construction and usage of natural resources was needed to know, what it is and how it can be implemented in the design in a smart and efficient way.

After defining all aspects relating to sustainability only few of them were kept for the project, the ones that were thought could be profitable in a temporal and deconstructable store. Some were taken into account while designing and some were set aside for later on in the project. The insulation and construction are things that were chosen and researched after defining the concept while the ventilation is something that was taken into account while designing because it is important to adjust the shape in a way to stimulate the natural airflow of the building. All

[4] http://alaskarenewableenergy.org

[5] http://dictionary.reference.com/browse/sustainability

those researches lead to different kind of solutions which were compared first and then selected. The three main subjects are deeply discussed separately later on the report.

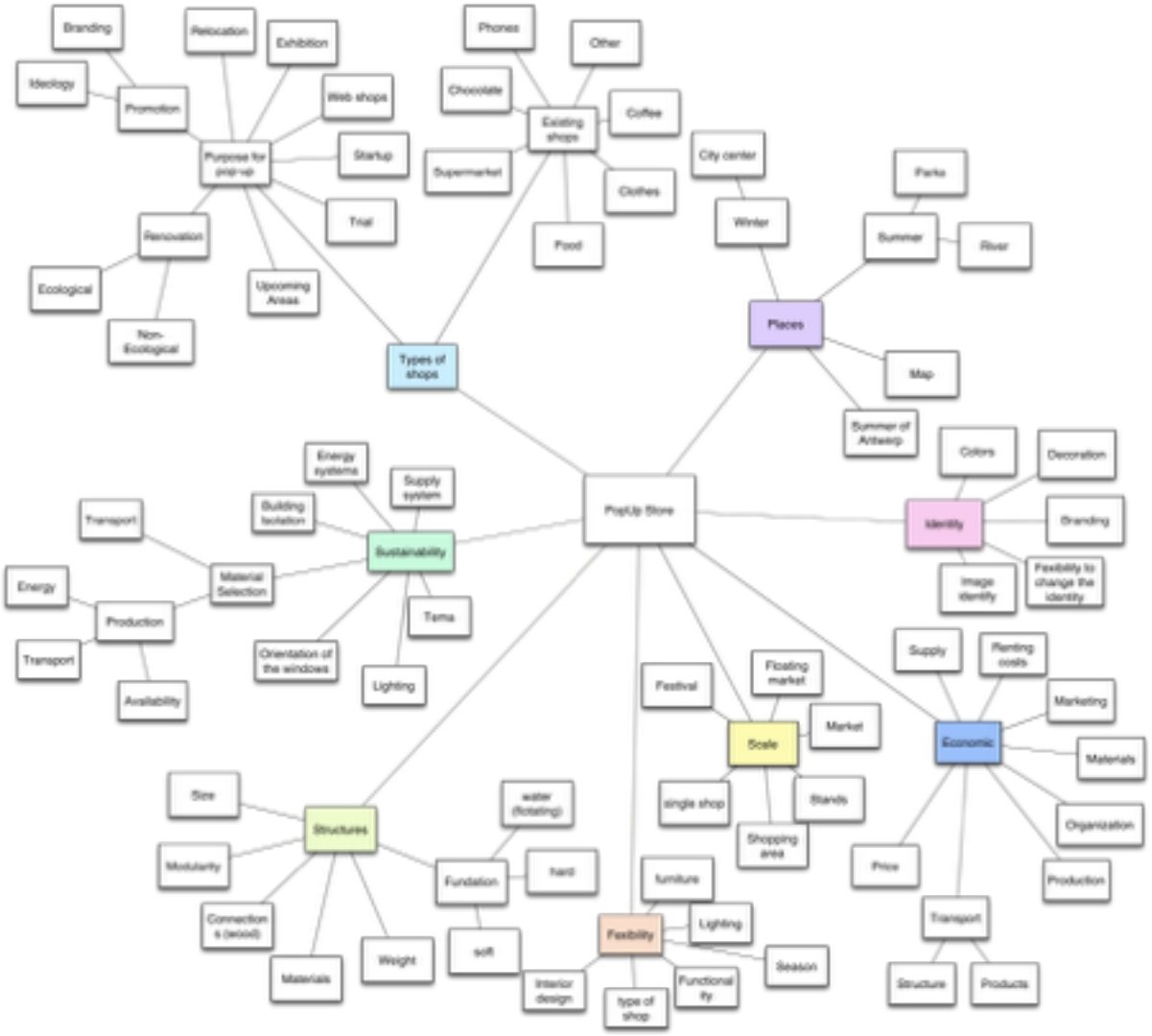
Solar energy

Solar energy became quite known these last years, in fact the average in Belgium for a year of energy production with solar panels is 1050 kWh/m^2. Solar panels systems are fairly expensive and a really big investment plus the payback time is long (around 20-30 years). The proposal of putting solar panel on the roof of the building was given, but to decide if it was a smart and justified idea, a small study to compare the diverse kinds of systems was made.

Type	Information
Photovoltaic (PV) 	Produces directly usable electricity, stored or converted for long-distance transmission
Solar Heating and Cooling (SHC) 	Generates thermal heat energy for water, pool heating and space heating, can be also used for cooling
Concentrating Solar Power (CSP) 	Systems using reflective materials such as mirrors and lenses, concentrated sunlight generates thermal energy, used to generate electricity

Section 6 **Ideation**

Mindmap



Mindmap

As it can be seen above, the main concept of a Pop-Up store has been divided into major subjects, which are: types of shops, places, identity, economic, flexibility, structures and sustainability. These chosen subjects are topics of the project that are thought important to take into consideration, and which comprehend the whole aspects of the pop-up store. These have been divided into more specific ideas that describe the topics; this way, it is easy to have with a quick brainstorm a perspective of the concepts related to the project to later select the ones that are going to be applied or reject some.

Pie chart of shops

Pie chart: shops in the Meir.

This pie chart is representing the types of shop diversity and it has been made to see what kind of stores are located in the main shopping area of Antwerp, the Meir Street. The pie itself is divided into shop types like Cafeteria, Clothes, Phones, Supermarket, Food, Chocolate and others, each of them with the given examples of brands (showed on the photos). This exercise helped the group to understand the people's needs and which kind of shops are more recurrent to be adapted in the pop-up store. Clearly, the type with more shops and different brands is the clothing business, thus this will be the principal client for the pop-up, following by the cafeterias and accessories store, which can contain office material, jewellery or even food.

Different purposes of a Pop-Up store

Different purposes.

The main purpose for this project is **renovation**, however, other purposes were also thought as the project has a wide range of possibilities to be implemented which could give more sense to the pop-up store.

The first one is **relocation**, it allows existing businesses to change their regular selling location to another one that could attract new clients. **Startups** and **trial** are similar because they have the same reason. It is a great opportunity for example for young people because they can try their skills at business, check if the product they made is worth selling and see if people are interested in their brands, all without having to spend a lot of money.

Some brands do not have an existing shop because they are focused on online sales. The main disadvantage of **web shop** is people cannot touch or check the product they want to buy before it arrives, that is why the Pop-up store could be a great opportunity for them to start real sales. A last one is **brand and ideology promotion**, which are meant to give a chance to some brands or even schools to promote themselves, to advertise a new brand or even promote the spirit of eco-friendliness and sustainability of a business.

Brainstorming

An inspirational research has been done using Pinterest, Keeeb, ArchDaily and other websites that made the process quicker. In the following pages there is a selection of some ideas that were useful for the building sketching process.

Building inspiration 1.

Building inspiration 2.

Section 7 **Field Work**

The project is based in the city of Antwerp, a quite known touristic city with many activities and events going on during the year. The area of Antwerp is diversified and can go from a quiet park to a crowded city centre, passing by cultural areas, main historical buildings, events squares, markets or shopping streets. Because of this multitude of environments, the pop-up store could have various possible locations all around the city to get the chance to be seen by many people. To choose the best place or places to locate the pop-up store a research on the field has been made in the beginning of the semester. During brainstorming few interesting places were pointed out and visited to get a better vision of the space and surroundings. In those short visits, pictures were taken and information notes made about positive and negative points of the location which were written down and then compared with the others to find a balance between possibilities.

Those few possibilities were selected according to important characteristics:

- *It needs to be a crowded place.*
- *It has to be a place big enough to allow a fluent circulation of people around the pop-up store.*
- *It needs to be a flat surface to have a stable construction.*
- *The open area needs to be light enough to illuminate the interior of the pop-up shop.*
- *It has to be implemented in an economic environment, a place where people might need or want something (e.g. an ice-cream in a park).*
- *It cannot be in an isolated place.*

The pre-selected places were:

Possible locations.

Central Station.

In front of the Central Station

•*Pros:*

Popular place, flat and wide space with light.

•*Cons:*

Already used for many events (Christmas market, Big wheel), a lot of traffic around, just a pass-by place.

The Meir street.

The Meir

• *Pros:*

Popular place, flat surface, ideal economic environment, protection from buildings around.

• *Const:*

Very crowded (not easy place to construct), small space, space needed for “traffic”.

Park Spoor Noord.

Park Spoor Noord

•*Pros:*

Wide space, frequently visited in summer, green spaces, events around it, open area with a lot of sun.

•*Cons:*

Only popular during summer time, far from the centre, not an economic context, not flat everywhere.

MAS museum.

The MAS

• *Pros:*

Popular place, architectural context, flat and wide space with light, quiet place.

• *Cons:*

Very windy, not an economic context, far from the centre.

Groenplaats.

Groenplaats

•*Pros:*

Popular and historical place, centre of the city, flat and wide place.

•*Cons:*

Used for many events (market), crowded.

Steenplein.

Steenplein (close to the Schelde)

• *Pros:*

Popular place, known place for events, flat, more natural environment, close to the city centre

• *Cons:*

Very small place, windy, not an economic context.

After considering all those places, at least two locations were kept to choose different kind of environments depending on their business. The Meir seemed the best place for a store because of its economic context.

On the other hand, a different idea was really appreciated. The idea consists of choosing an area where the context is different and the environment is more quiet and calm than the city centre. Park Spoor Noord has a reputation of fun during the summer where a lot of events happen. By inserting a pop-up store with a food or drink business in the park, the chance to attract people is high; they could grab a drink or take a seat in a nice pop-up store and enjoy the open area and the animation around it. Another option is to combine few pop-up stores to create a small “pop-up store renter” where various businesses can join.

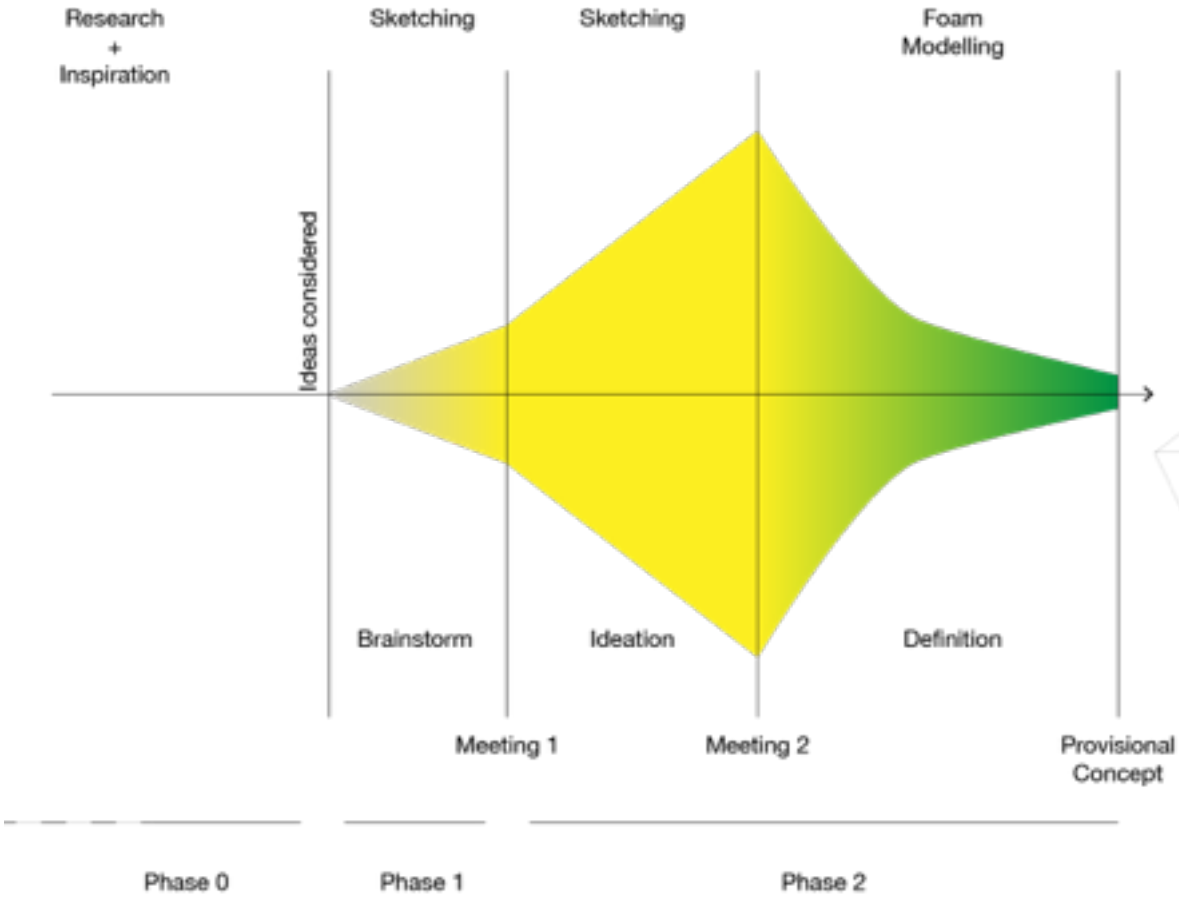
Section 8 **Building Concept**

Sketching / Brainstorming

For the concept design phase, the team decided to begin with the shape of the building. The starting point of the brainstorm was to mention some of the basic design criteria around the construction of the building so there were some ideas on which to start thinking around. This are:

- *The shape should help improving the energy efficiency of the shop.*
- *The building needs to be modular and adaptable to at least three different sizes.*
- *The basic unit should have enough surface to the smaller business proposed (small café, accessories shop…).*
- *The building has to be attractive to the customers.*

In a first brainstorm some concepts were developed around the idea of combining basic geometries to generate more complex ones. After some sketching sessions and a very useful meeting with the supervisor, the team decided to change the ideation methodology.



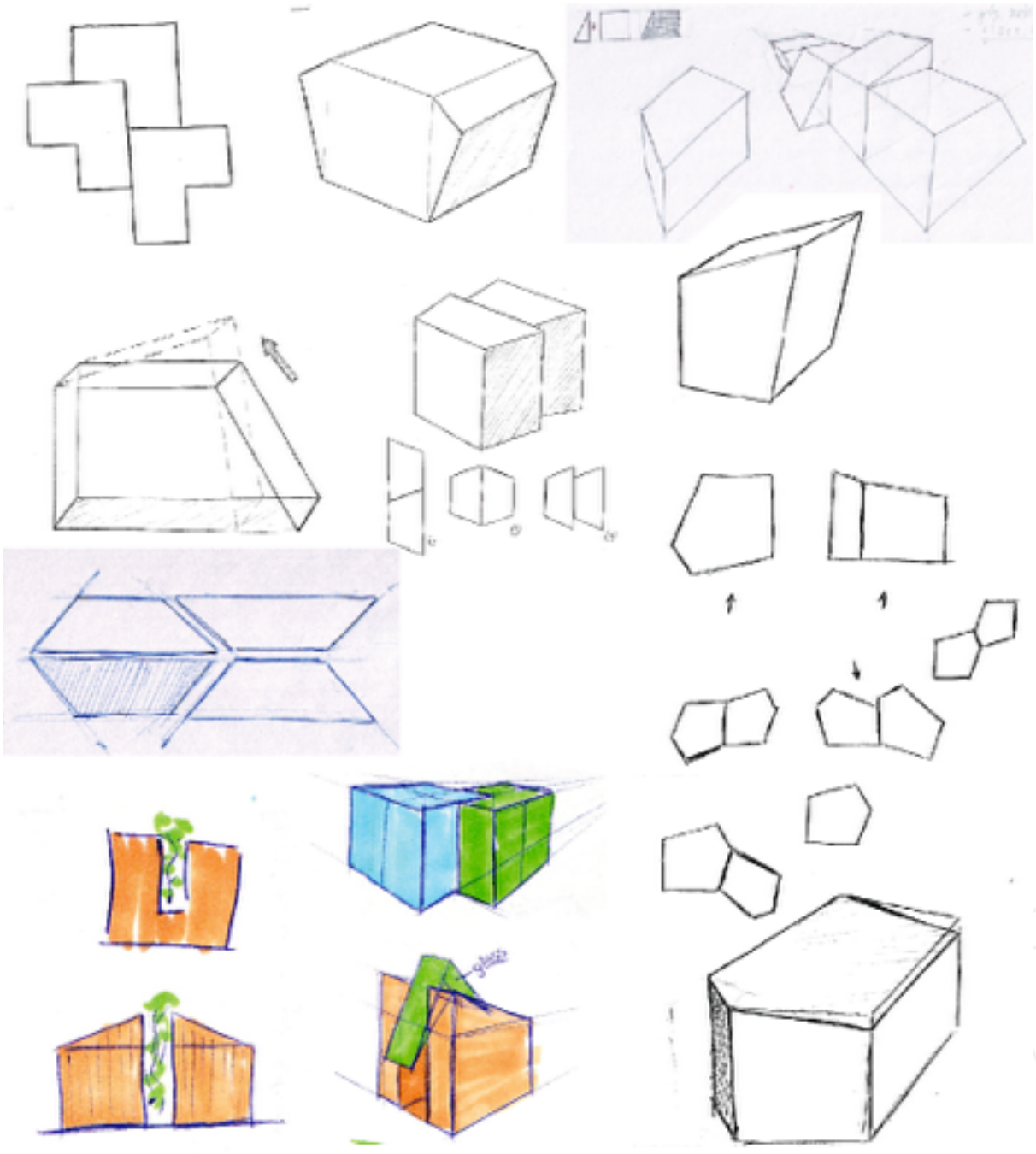
The second brainstorm round started playing with the shapes from the study of the different functionalities and behaviours inside and outside the building. As a result of this methodology's and a second meeting with the supervisors the sketching was combined with a session of foam modelling in which it was easier to verify if the modularity was working properly.

Finally, the provisional shape for the building was defined to be able to move onto the furniture design and also do more research on the construction system and materials.

Following, some of the sketches and foam models from the different phases are presented.

Phase 1

During the first phase the modularity was studied in two different ways. On one hand the basic module is the building and its combination with more modules generates bigger buildings. On the other hand the basic module combined several times generates the basic building.

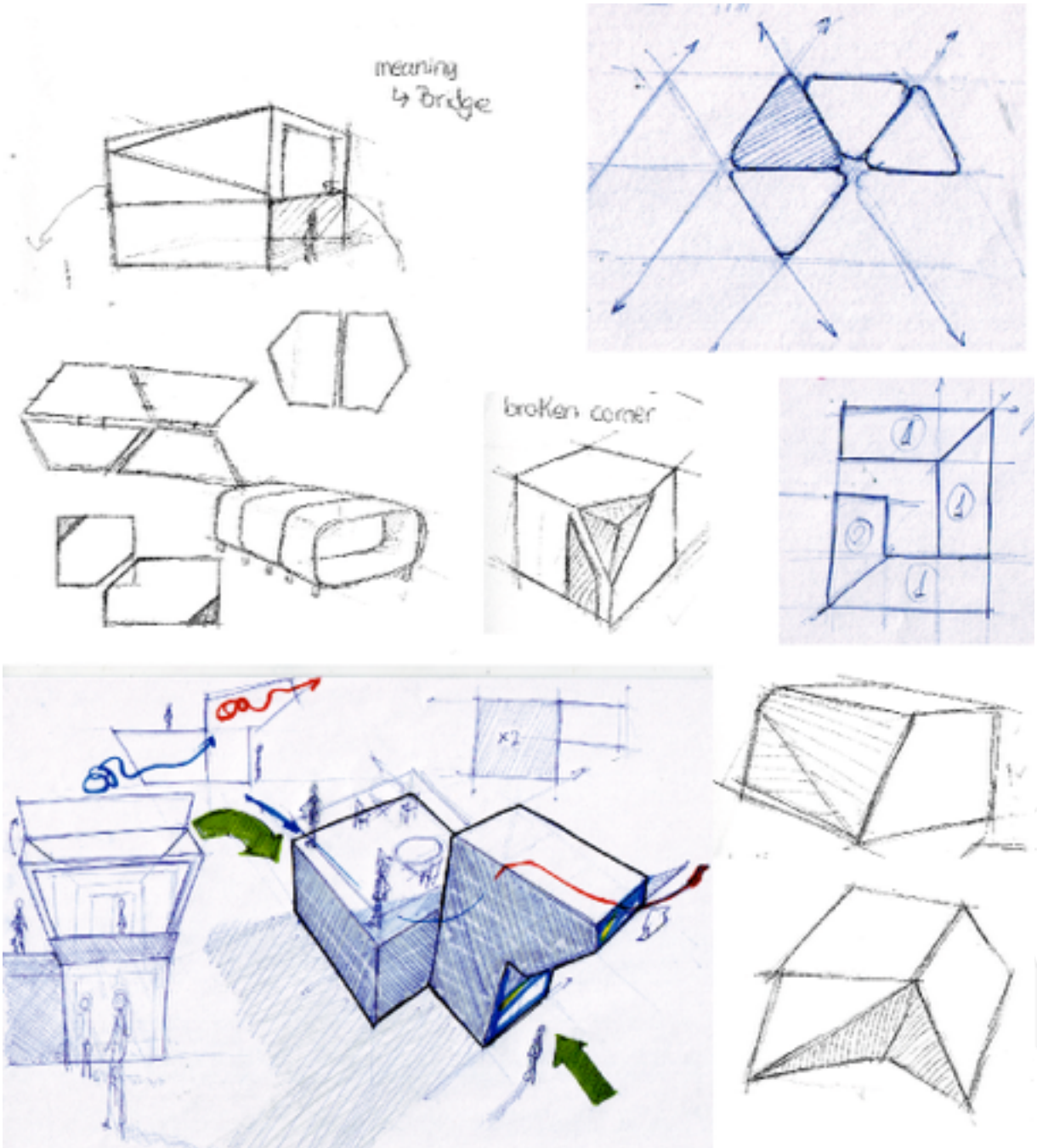


Sketches phase 1

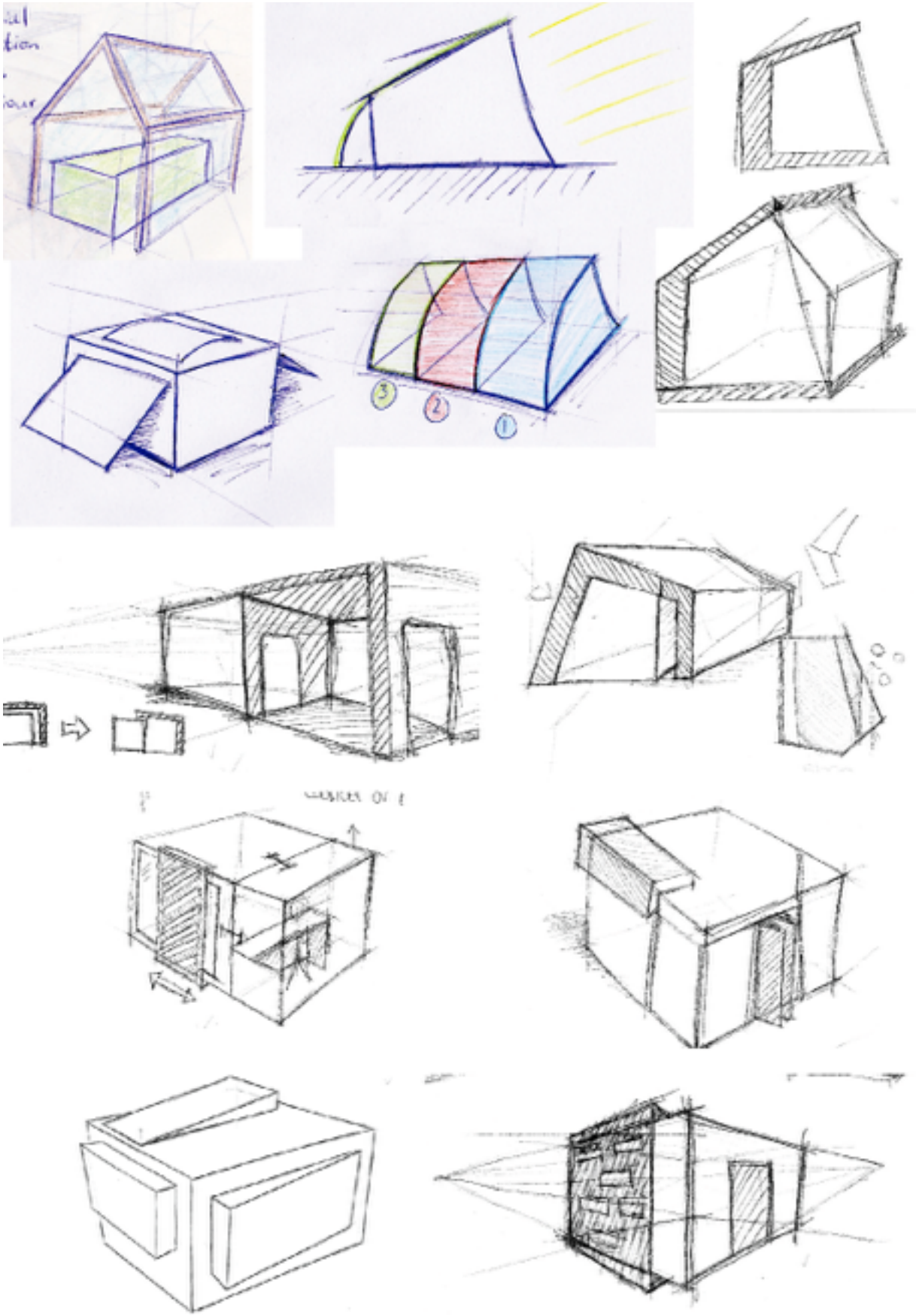
Phase 2

After some advice from the supervisors, the modularity is only studied in the way of the building as the basic unit. That means only by combining several buildings is possible to create bigger ones.

The combination of the basic unit is obtained by linear addition in some cases and by more complex methods in other. Also in this second phase the shape of the building is derived from concepts like the air flow inside the building, the shadows in the different seasons or the usability of the roof space.



Sketches phase 2



Sketches phase 2

Foam modelling:

Modelling process.

Idea selection

To make a good selection of the final shape, a comparison of the best ones that have been designed in the first weeks/months have been done, this overview gives the justification for the selection.

Idea 1

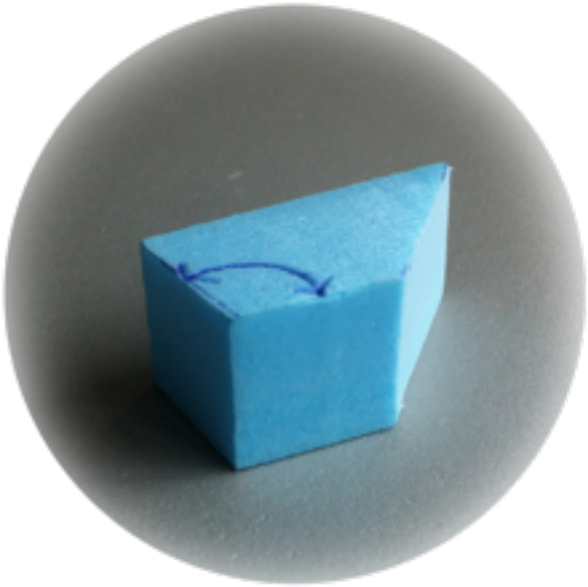
Pros

- Good proportion of internal surface
- Interesting passageway
- Easy internal distribution

Cons

- Boring shape
- Loss of space
- Passageway makes modularity difficult

Idea 2



Pros

- Good modularity combinations
- Attractive shape
- Good airflow with inclined roof
- Good display of products
- Sunlight use considered

Cons

- Inclined wall
- Difficult to construct

Idea 3

Pros

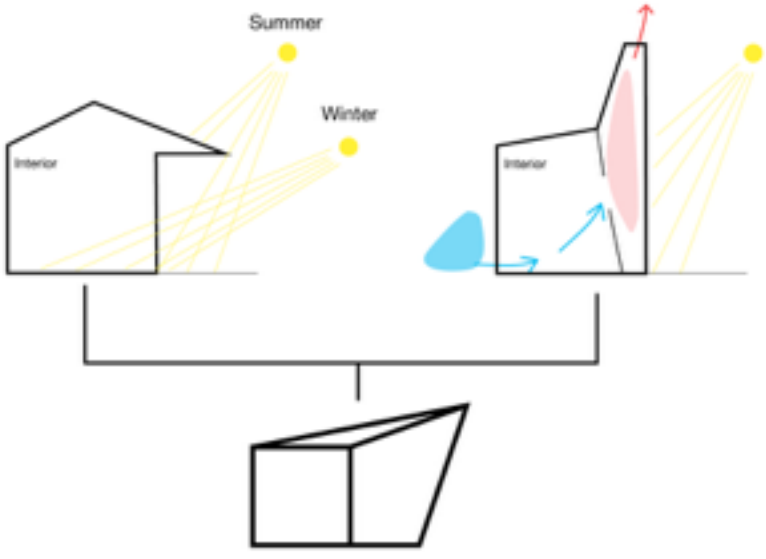
- Good modularity
- Cool shape
- Interesting ways of combining

Cons

- Too sharp corner
- Loss of space

The selection of the final shape was based on several concepts. Mostly, it was tried to keep the interesting aspects of each concept and see how possible it was to combine them. The main idea was focused on the second option, and further on, redeveloped to make it fit with the requirements.The main justifications for the final shape selection are:

1. Light and heat



Shadow control & Air flow control.

Two different concepts were combined in the chosen shape and will be taken into consideration when defining the details as well: the first one is using the seasonal inclination of the sun to create a good environment inside the shop, cooling shadows in summer and direct sun in winter. Whereas the second one is to use windows and openings to have a good airflow: warm air goes out in summer but is kept inside during winter.

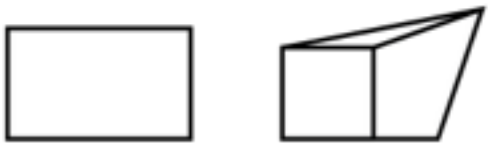
2. Modularity

As explained before in the project the modularity is a key point to make the building flexible and adaptable to different sizes and kinds of shops. It was decided to create a modular shape that did not look linear but which could be combined in different ways an offer original shapes. In the next illustration it can be seen that there is a specific surface used to combine the modules, the green lines, and the different possibilities that it offers.

Modularity concept.

3. Attractive

In the brainstorming process it was perceived that square and geometrical shapes were too used already in this kind of construction, this is why it was thought to go further and create a form that could generate curiosity in the people going around and invite them to go in. A different shape combined with a good identity design will make it attractive.



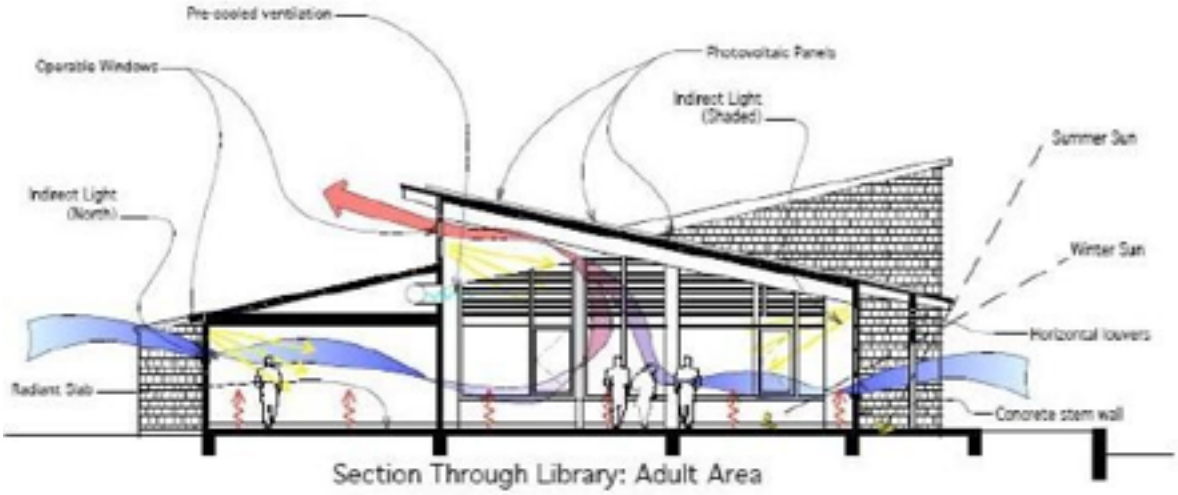
Cozy/attractive corners

One of the positive sides of having in some of the combinations (2 or 3 basic units) a building with some corners is that it can make them really attractive and cozy. Every corner can be given its own style or atmosphere. One corner could be for working, like flex working, one could be for reading and another could be for talking and drinking your coffee. In the dimensions section, the different possibilities of how to use the space are shown.

Final shape justification

Ventilation:

One important aspect of the building is the ventilation and the air flow. Both are influenced by the shape of the building and the disposition of the elements, but above all, by the ventilation system. That is why all possibilities need to be considered to find the most efficient one and to find its position in the building



Section Through Library: Adult Area

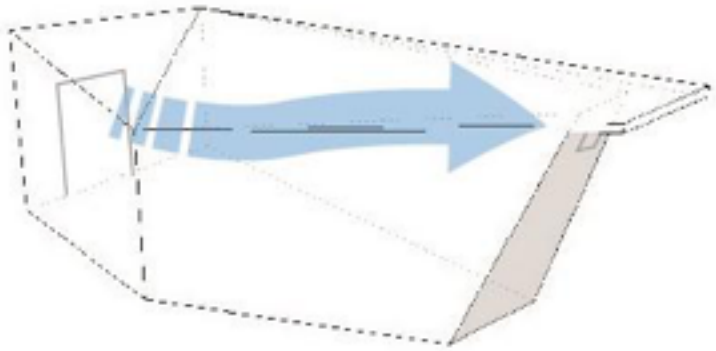
The shape of the building has a big role in the ventilation, because of its inclination it encourages the warm air to go up. To make use of that advantage it is better to put the opening up to have significant ventilation by creating a thermal chimney effect. That way, the hot air escapes from the ceiling level where it accumulates. However, the placement of the ventilation system can be set in different places. Basic principles and guidelines to provide fresh air need to be taken into account to know where to place those systems, the most important are:

- Place operable windows in all rooms to give occupants opportunity for fresh air.
- Provide cross-ventilation by placing window openings or ventilation systems on opposite walls in line with the prevailing winds.
- Use casement windows to direct and control ventilation.
- Use operable skylights or roof windows to enhance ventilation.
- Use landscape.

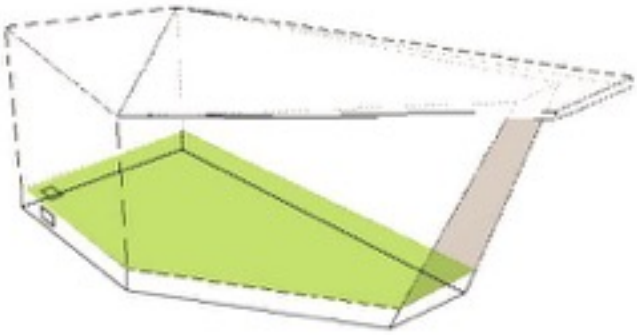
As shown in the image above, the best way to provide efficient ventilation is by cross-ventilation, the one on the right. This means the two systems should be placed opposite sides and since the warm air is supposed to go up, the building's shape defines already where it should be placed.

Incoming air

For this project, the door and the windows openings will not be the system that provides the ventilation because the windows will not be able to be opened, as they are only display windows and lightning sources. It is also obvious that if the door is used as the ventilation system, the room will not be ventilated in case nobody or a small amount of people come in. Nevertheless, even if a big number of people came in, the door only would provide ventilation of the upper height which means the ventilation will be limited as represented on the following sketch. As seen, the lower area of the building would not receive fresh air.



Since the building will be on a small elevation to be adaptable to all kind of floors that are not totally flat, the ventilation system for the incoming fresh air will be placed on the floor of the building. That way, the air will be always fresh as it will come from the shadow under the building. It is also convenient because it will not be seen on the walls of the shop and will be more discreet. Of course, it will need to be placed on a corner so people do not step on it and a grid will prevent damage and dirt. The decision to put it on the left corner has been taken because it means the air will cross the room diagonally and the ventilation will reach more areas of the shop.



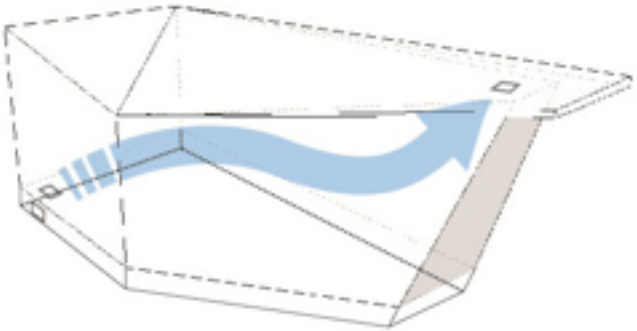
Outcoming air

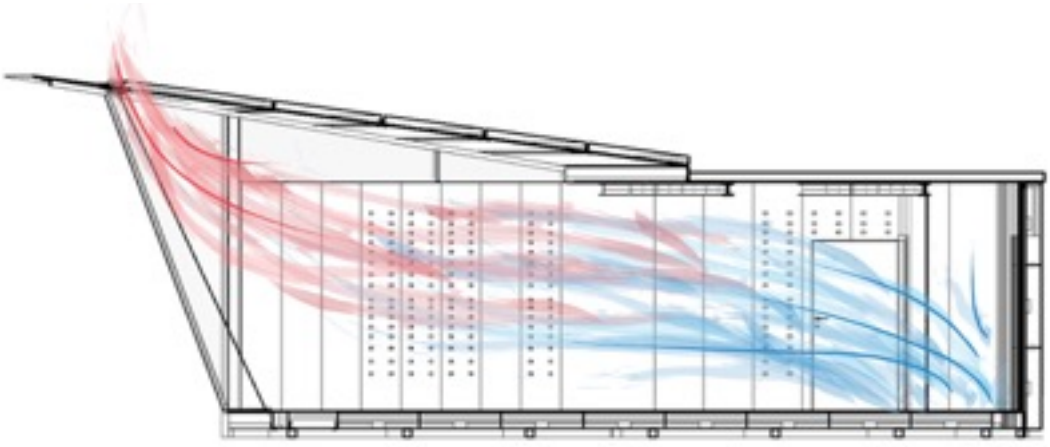
The shape of the building was somehow made this way to facilitate the ventilation (passive energy efficient system), and to use it properly the outcoming air area needs to be placed on the top of the building. The best place would be the inclined wall, however, it was decided that this wall would be transparent. What is more, the roof is slightly longer than the building and it will stop the air if the opening was in that wall. Thus, there are three other options left, the two other walls or the roof, and to decide which one is the best solution, the aesthetic aspect was taken into account. For a matter of discretion, the roof disposition seems the most appropriate. There

will be no need to hide it and it will be less seen than if it was on the walls, above all it will be not seen from outside since flat systems exist. Those systems are made for roofs which are thought to avoid the water coming in case of rain.

Possible places to set the ventilation for out coming air:

The final solution is shown below and represents the airflow going all the way through the building, from down the floor to up the roof by an air supply and an air extractor on the top.





Systems

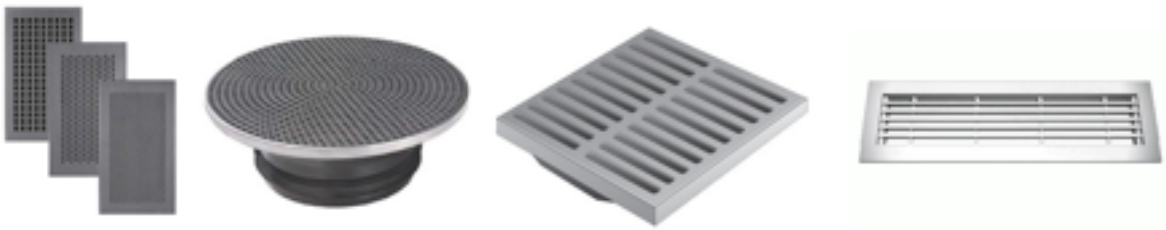
The buildings always need a ventilation system, and because most of them have various rooms, they use big ventilation systems that work sometimes with electricity. For the pop-up store, the decision to have a natural air flow was made to be more sustainable and because it is only a room there is no need to have an electrical appliance. The pressure of the air inside the building will create a flow and take the warm air out, the systems are simple but the ones from inside and outside are different. To make the good selection of which one to use it is interesting to compare them, mostly the aesthetics will influence the choice and also the size of it. The size of the system must be at least 140cm² for this kind of shop to ensure a good ventilation and both bottom and top one should be more or less the same size. Below, there is a small list of the existing possibilities for the inside and outside systems.

Options for the incoming air (inside/outside of the bottom)

- Outside:

These systems will be positioned in a place where they will be not seen by anyone so its design does not matter that much. To follow the identity shape of the building though, the first one has been selected.

- Inside:



The first one is the most convenient one because the shape must coincide the system from out and because it is better to fit with the shape of the building and its identity. The holes are small which avoid small things to fall inside but there are enough to let a big amount of air to come in.

During summer the ventilation is needed to prevent overheating but it is not recommended during winter because it would bring in cold air. To control the ventilation there exist few commands that allow to program the working time or to turn it off manually.

There are four different command systems:

- Manual setting
- Humidity detection
- People detection
- Timer

The selection of the timer has been made because you can set specific timing of use and you can also choose the summer/winter setting. During summer, for example, the shop owners can set the timer for their work time and opening hours and choose to set it turned off for the night to avoid getting the cold air in.

Options for the out coming air (inside/outside of the top)

- Inside

The fourth one has been chosen for its flat shape and simple design which will not disturb the interior design.

The air extractor is not exactly the same as the incoming air one because it needs protection against the different kind of weather as the rain, for example. For that kind of air extractor many designs exist, there are various options as follow but the choice of a flat and as discreet as possible one would be more convenient.

- Outside

The chosen one is the third one, it is the most discreet and flattest one which allows a good integration in the building.

What happens when we combine few modules?

A characteristic of the project is the modularity and the possibility to combine other building modules to make the shop bigger. Of course that aspect usually influences the ventilation but

because the ventilation openings and extractor are positioned in an strategic way, the air that comes in always find its way out by going up. No matter the position of the other units, the air always comes in in the middle of the big module and goes out by the upper extremities of the different modules.

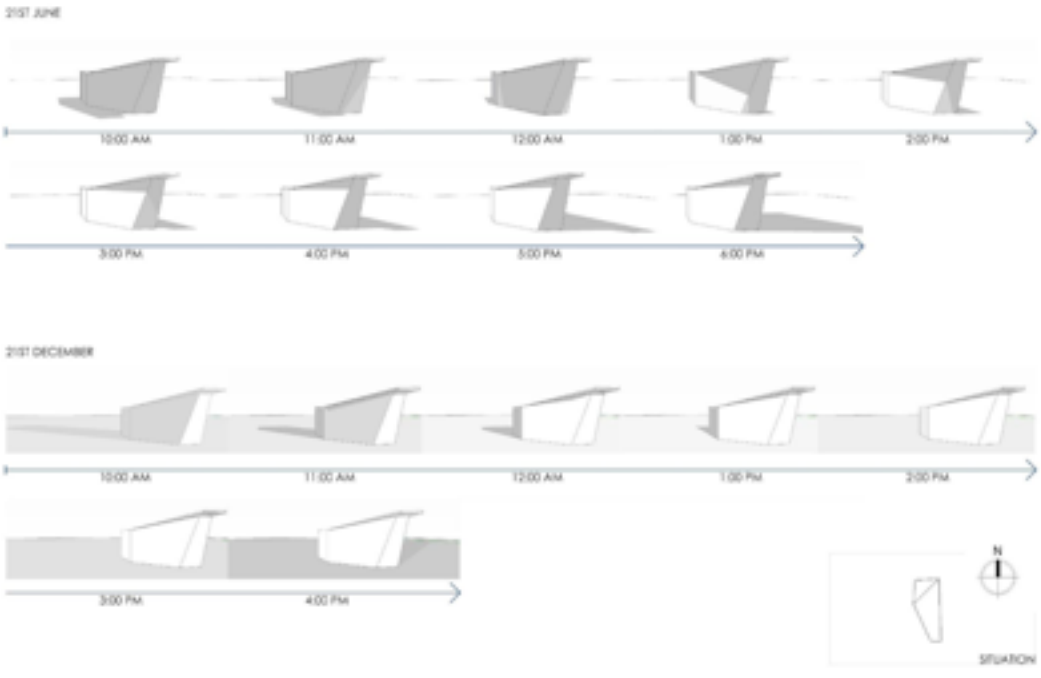
Lightning

To be able to know what was the best position for the windows, thinking about energy efficiency, a shadows analysis was carried out, which helped realising how to seize sunlight and avoid using a lot of artificial light, but at the same time respecting the shops' requirements.

The way of how the shadows behaves was checked for the pop-up store analysing how the shape of the building influences on the light. This was made in summer solstice, which is on 21st June, and winter solstice, on 21st December, which are the extreme days for both seasons, focusing on the critic day hours. In summer, the sunlight is really strong, so it is important to avoid direct light because the textiles of the clothes can get damaged. Stores do not normally have a lot of windows, only the display ones, and this fact needs to be taken into account. In winter, sunlight is welcomed as it is not so strong and makes the store brighter, which creates a better atmosphere and attracts more people to come in, a positive thing for the business.

By designing a roof extension it was possible to avoid strong summer sunlight to go inside directly. After analysing shadows' movements, it was decided that the windows would be placed in the parts where the facade is in shadow during summer period, that way, the building will be bright but not direct light will go in. Unlike summer, this area will be enlightened during winter time which will heat the interior of the building and make energy costs lower. The reason of this change is due to the lower sun angle in winter time.

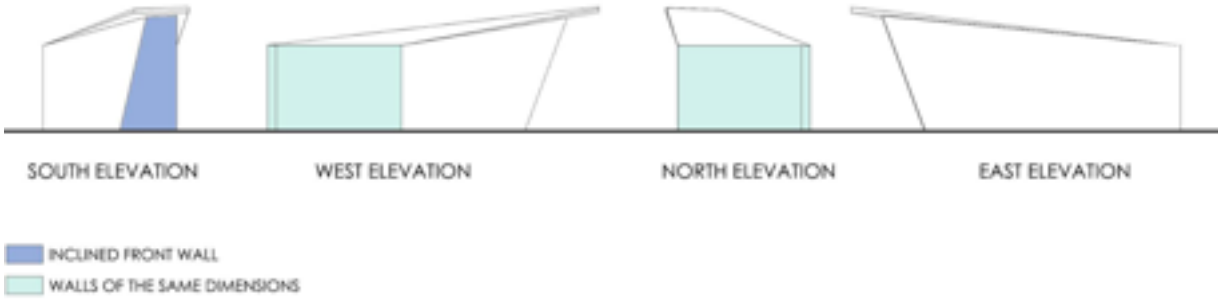
In the next image the shadows' movement during the whole day can be appreciated:



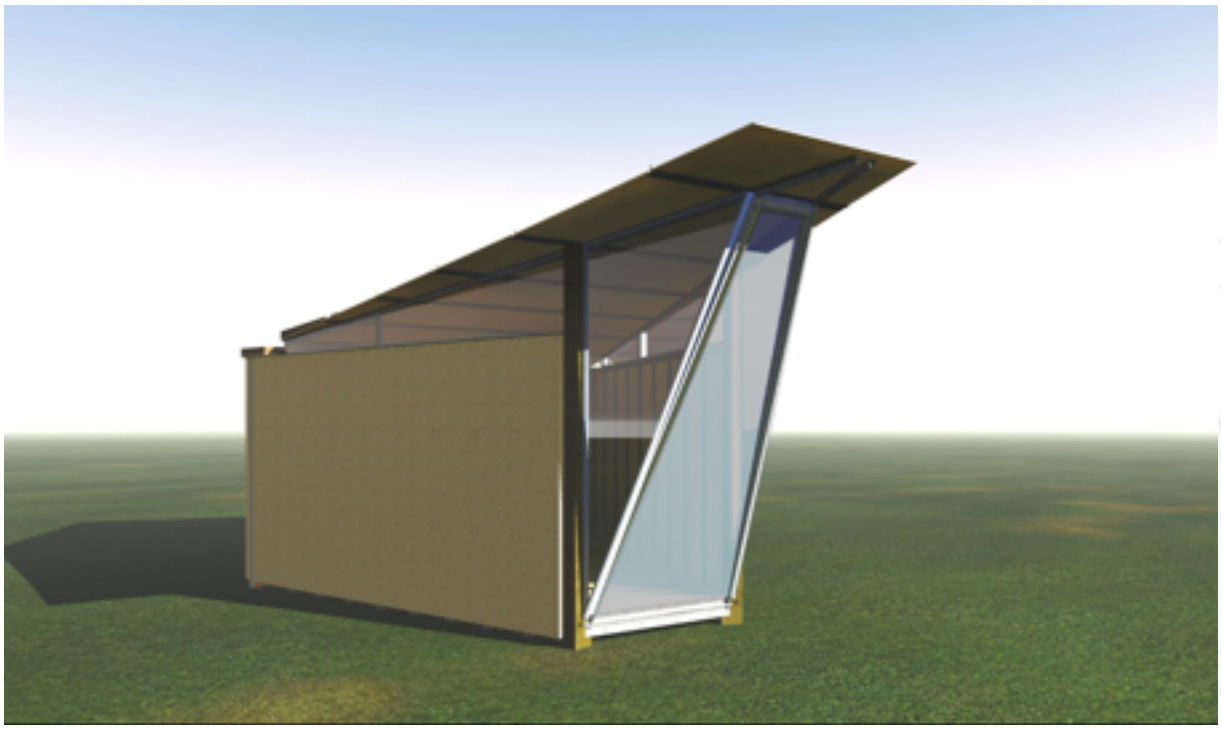
It is obvious that the inclined wall facing south is an important part of the building, it is a very catchy side and that is why it was decided to make it totally transparent, using plastic since glass cannot be used because of its weight.This is expected to let a lot of light go in and will also offer a nice view from the inside.

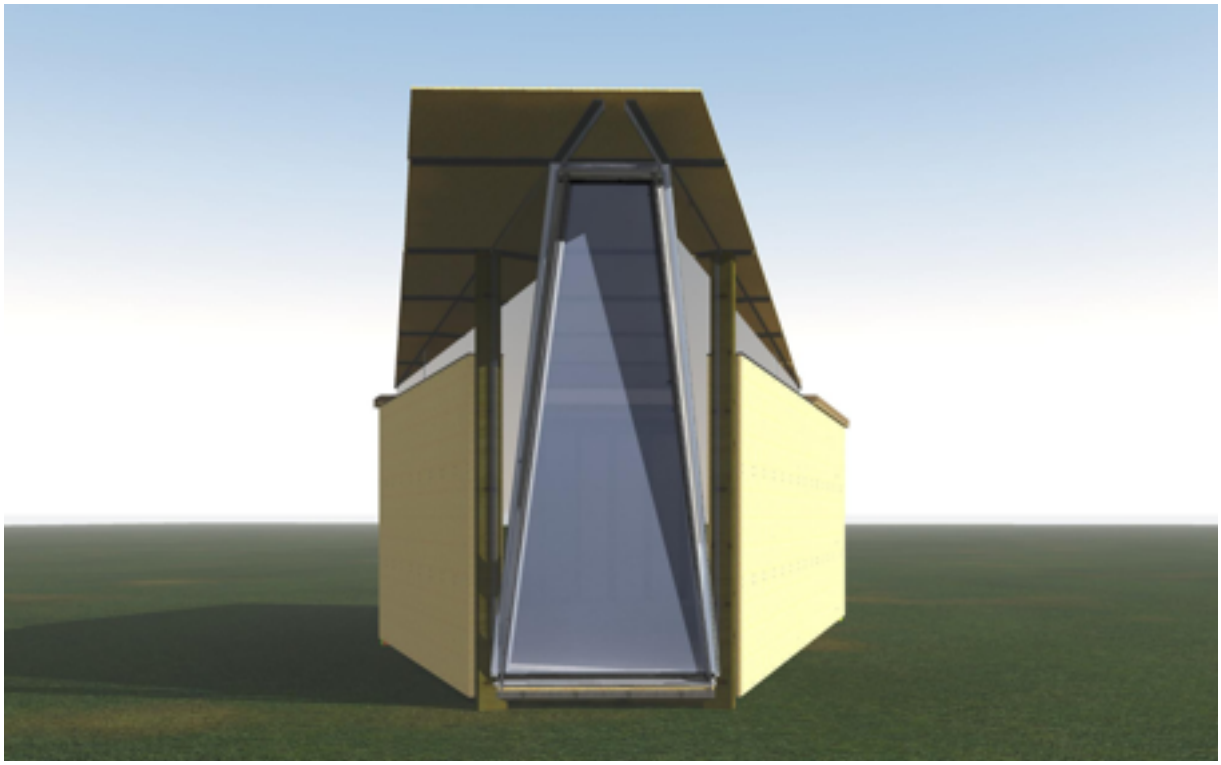
Apart from this, more windows had to be set, as more light is needed. Seeing which area of the facade is in shadow during summer, it was decided to make the upper part of the east and west elevation transparent following the roof's inclination. Therefore, no direct sun is going into the building because the roof is shadowing the windows.

Considering that two facades need to be removable to connect more than one building together, one facing north and another located on the west side (as seen in the image below), these cannot be used as windows. Finally then, the fixed windows will be the ones already mentioned, and there will be the possibility of adding more of the same dimensions as the building panels, which can be easily installed. That way each business can decide what is best for them, as probably coffee shops will like to have more light than clothes shop.



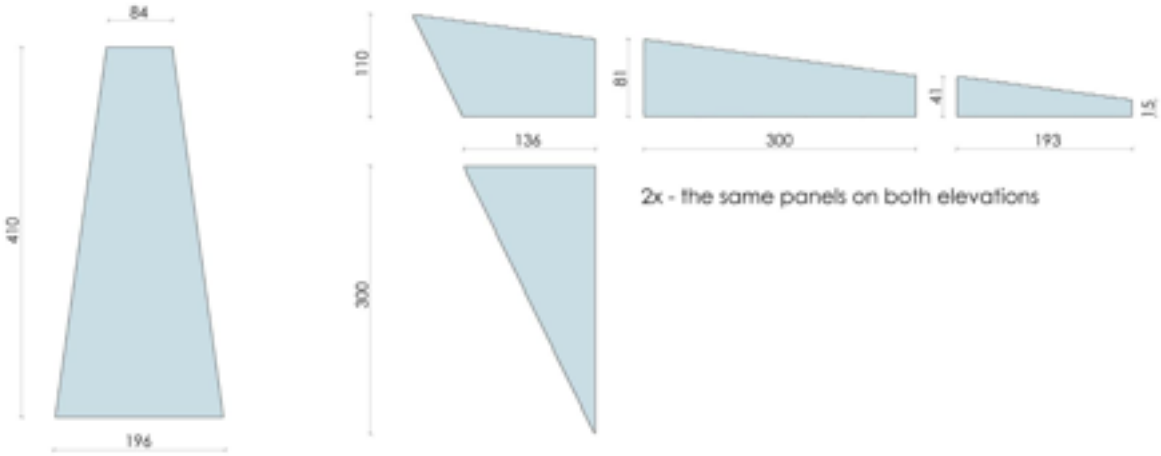
Following, there is a visualisation of the final position of the windows, together with the final building shape.





From this view, all the interior of the shop can be seen, which is a positive thing as people can easily know what is the shop about or what they sell and decide whether to go in or not. It is also an attraction point, so this window can be grabbed to apply identity.

Panel division

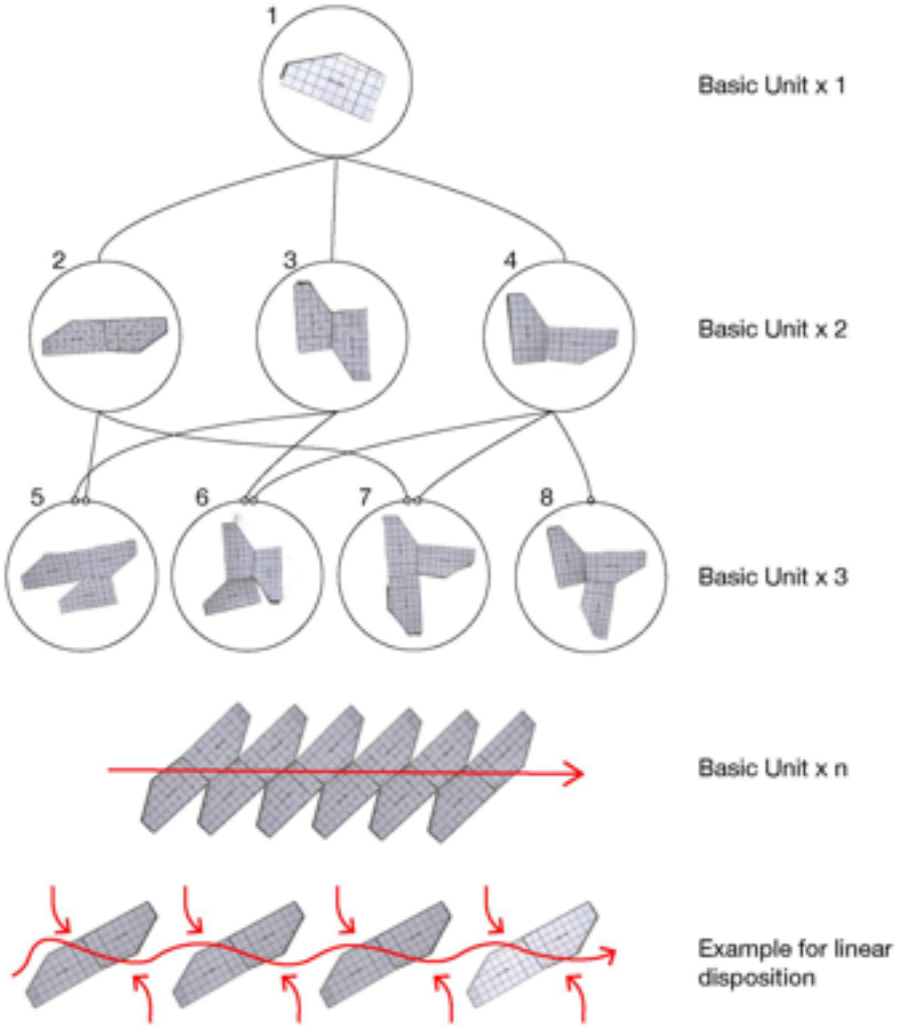


To make the windows easier to carry, the whole transparent area has been divided into eleven pieces of different dimensions which are stack-able. Four pieces on west elevation, another four on east elevation and one bigger piece to fit the inclined wall.

The technical definition of the windows, how they are fixed to the building and their material are explained later on in the report.

Modularity

The different available combinations were structured to give a clear vision of all the possible options the client can choose, and to prove the good modularity of the shape.



Once the different possibilities were clarified, some small angles were detected, especially in the combinations number 5 and 6 (picture above), but this was thought to be possibly used for external toilet access.

After realising how many different combination of modules were possible, and knowing that these combinations respect the requirements by allowing three different sizes, it was decided not to give the possibility of mirroring the structure.

The options are:

Basic unit: two different doors. 2 OPTIONS

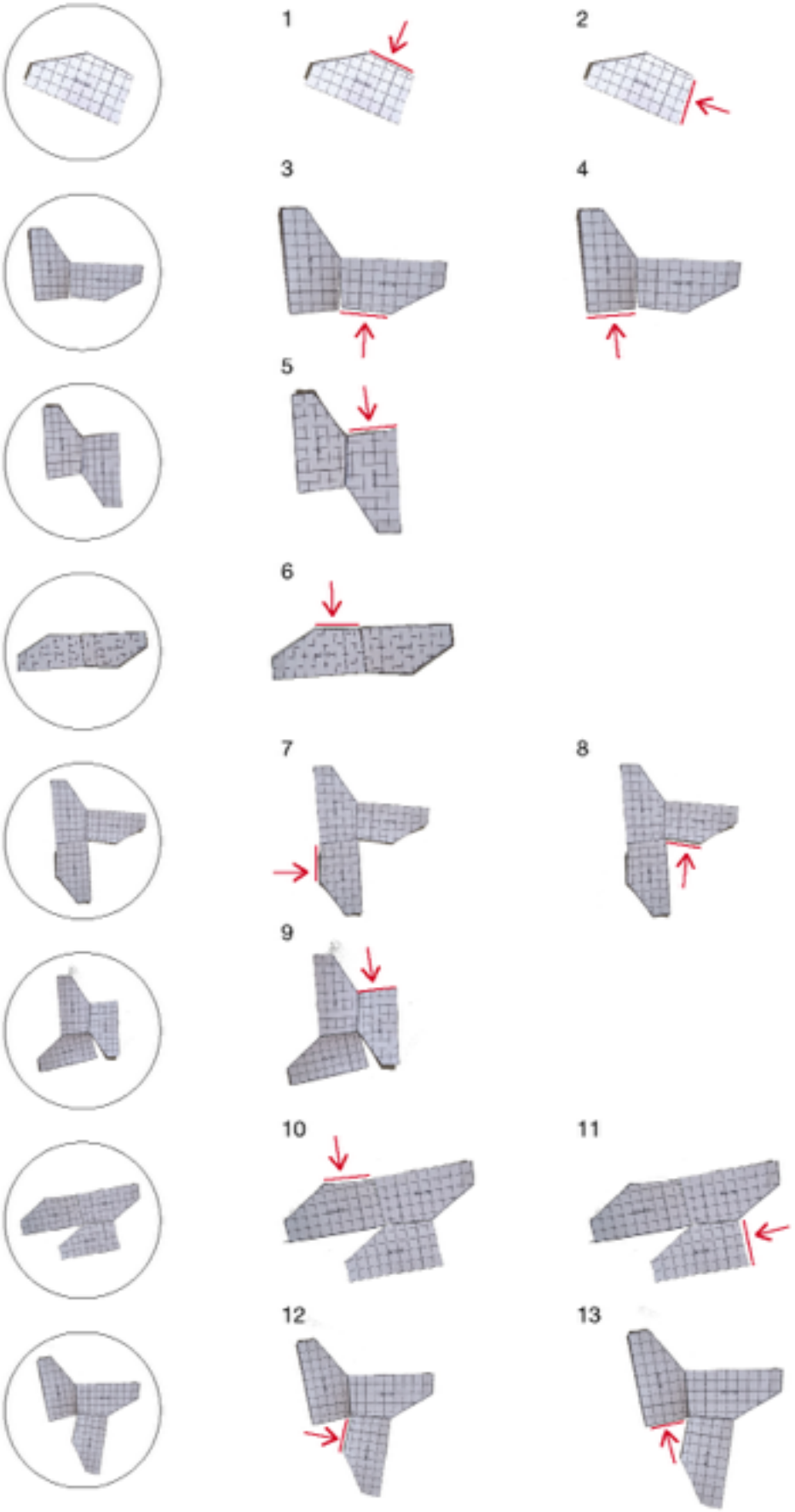
Two units: three combinations, two different doors in one. 4 OPTIONS

Three units: four different combinations, two different doors in three of them. 7 OPTIONS

n units: one combination. n OPTIONS (not in the requirements)

The total options that fit in the requirements are 2 + 4 + 7 =**13 different typologies**.

ALL POSSIBLE COMBINATIONS FROM 1 TO 3 UNITS

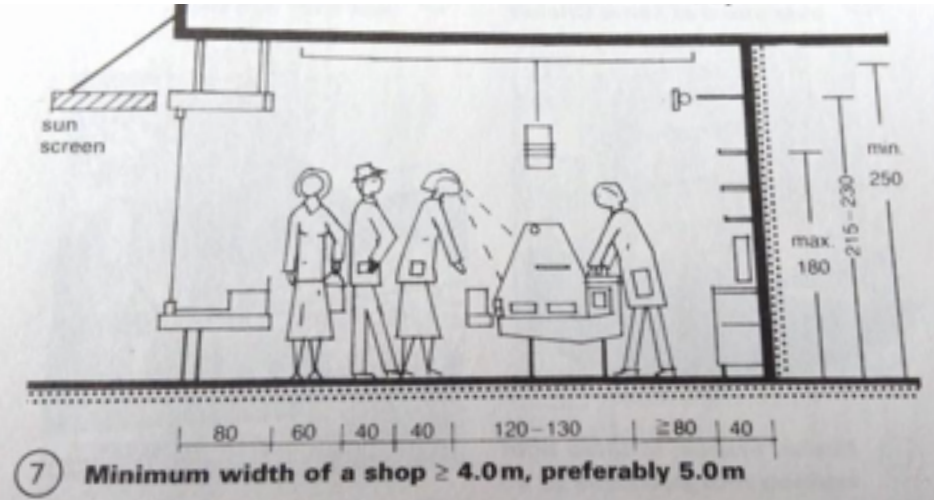


Dimensions Definition

Many things have been taken into consideration when choosing the dimensions for the pop-up store. The most important one is the limited space of transportation, which is, according to the requirements, of 35 m3.

To decide the dimensions of the pop-up store two different studies were carried out:

1. Research and consultation in Neufert Architect's Data[6]. With the help of this book the minimum dimensions for important aspects in the shop were extracted:



- Minimum width of the shop: ≥ 4.0 m, preferably 5.0 m
- Minimum height of the shop: 250 cm
- Functional space behind counter: ≥ 80 cm
- Minimum space needed for a person's path: 60 cm

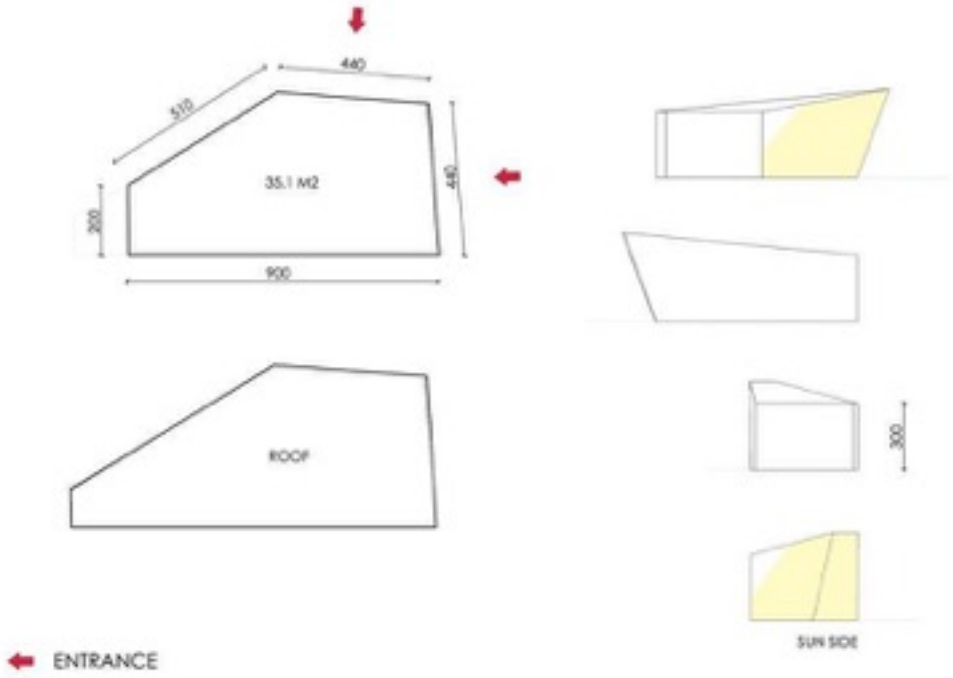
2. Dimensions testing. To get a real idea of how big the space is and how the furniture can be distributed, a representation has been done in a big room. The shape of one module of the building was represented on the floor with tape and then the interior area was studied.

- How do people walk around it?
- How much furniture fits inside while leaving enough walking space?
- What is the maximum number of people that can come in without being too crowded?

The results of this test will be shown later in the section "Validation" where it will be confirmed that the dimensions of the building are correct.

[6] Neufert, E. and Neufert, P. (2002) Neufert Architects' Data, Wiley-Blackwell. Page consulted: 368 (Retail outlets chapter).

Finally, after considering the possibilities, the dimensions chosen for the pop-up store are the following:



These dimensions are only a first approach to get a reasonable and useful space according to the validation test. Later on, during the construction method and details definition these dimensions will probably be adjusted.

With the one module size set, also the dimensions with more modules combined can be known:

1 module: 35 m2

2 modules: 70 m2

3 modules: 105 m2

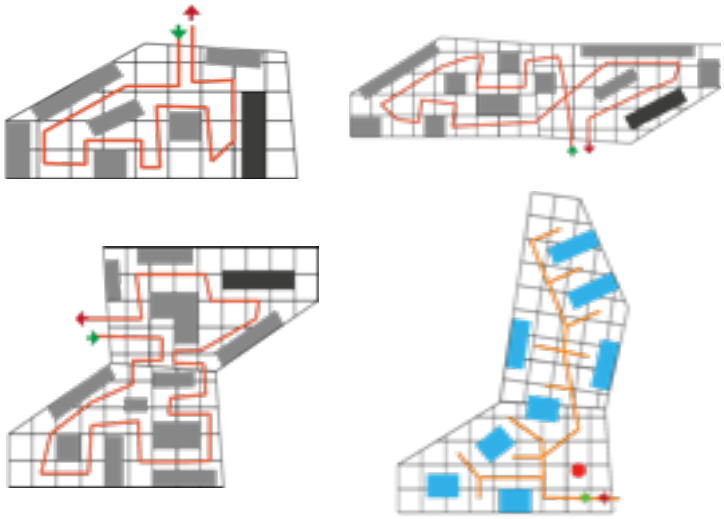
After this study, it is believed that with these dimensions it is possible to adapt different kinds of businesses if the interior distribution is carried out properly. What is more, the pop-up store is temporal, that means that all their products are not going to be re-located into the store, but only the most needed ones. Thus less space will be needed than in the regular shops in the Meir.

By studying people's flow in the area of the store it is shown that there is enough exposition surface and also enough walking area, even in the smallest configuration of the shop (one module).

Next are some examples of the flow studies:

- The orange line represents the possible people flow around the shop.

- The counter is the black rectangle and the rest grey figures are furniture distributions (they are all examples, it does not mean they are the ones chosen for the project).
- The blue rectangles represents the tables' distribution for a coffee shop, and the red dot the counter position.
- Each square represents 1 m^2, to get an idea of the surface available.



So as shown, there is plenty of space for the clothes or accessories exposition and furniture distribution, as well as for tables for a coffee shop. On the other side, there is also a good free surface to wander around the shop even with many people in it, always considering the N*eufert's* minimum dimensions mentioned before.

Building validation

Once the shape of the building and dimensions were set, it was possible to carry out a test creating a representation of the building with its real size. As said before, the representation was done in an university room were some tape was used to define the shape on the floor, ropes and fabric were used to represent the walls and get the sensation of being inside the building. As there was no budget for the project, this could not have been done very accurately so it did not look very real. However, the test was considered successful.

Some students were invited to have lunch inside the Pop-up store and also walk around it to see what they experience, some first renders of the real building were also shown to them to give a better idea of how it is supposed to look like. Meanwhile, an interview was made to each person to get feedback about their thoughts and see which improvements could be applied. This helped verifying the building has good dimensions and an attractive shape, and in addition, it gave advices about other aspects. Below there are some pictures of the test and the results of the interview:

Interview questions:

1. What is your first impression when you go in the Pop-up store?
2. Do you think there is enough space to move around?
3. The store will have some information (posters, screens…) about the project, considering sustainability and energy efficient matters and showing how the building was constructed. If you come to shop or to have a coffee would you be interested in reading/ watching it?
4. If you see this building in the middle of the Meir or somewhere else, would you feel curiosity to go in?
5. Do you think the counter is well positioned?
6. Would you change anything or do you have any advice?

The interview was made to eleven people[7] and the result was very positive. The general answer for the first impression when entering the building was that it shows a wide and bright space, with an original modern shape that catches attention. This was the meaning of the big inclined wall and one challenge was to make the space look big even with its tight dimensions, therefore, it is considered that this is a successfully achieved point.

Next question, if there is enough space to move around, was mainly yes which is already good, but it also depends on how the interior distribution is made and the quantity of furniture that needs to fit. Moreover, when explained that more modules can be attached to each other, most of the people thought there is enough useful space and it does not feel crowded (as said previously,the number of people that were inside at the same time during the test was eighteen, although more could be possible).

[7] For this activity BEX coins were used, as other EPS groups were invited to do the validation and answer the interview.

Third question about giving information of the whole project in the Pop-up store was very useful. Some good advices were given which will be considered in the identity section.

To know if this building would get people's attention when positioned in the middle of the street there was a very positive response, everyone feels that it is very attractive and they would feel curious to go inside. There was only one answer that also gave a good advice which was to put some encouragement to go inside and information from outside that could let you know what it is. This will be included in the identity and graphic design part.

As a validation of the counter position it was deliberated a good location, although some variations could be made, and as this is not fixed it is absolutely possible. And finally for the last question, there were only few comments made on the height of the building and ventilation method, which can not be understood without previous information.

To sum up, the test was very useful to get feedback on the building and confirm the project was being carried out in the right direction, as well as it helped to get advices and new ideas to implement.

Use of the building

With the combinations of the modules, another purpose was thought. This is to use the two or three different modules combined as separated spaces and create different environments in them. For example, it is very useful to separate women and men's clothes in a shop or have a working area and a more relaxed one in a café. Below, there is a list of the possibilities this can offer and some representations with the plant view of the building.

- Clothes shop:

Women/Men collection

New collection/Sales

Adults/Children clothing

Clothing/Footwear/Underwear

- Accessories shop:

Bags and handbags/Jewellery

- Café:

Relaxing area (sofas…)/Working area (high tables, more light…)

Take-away food (close to the door)/Restaurant

Flow Validation

Flow of the customers

It was needed to study the flow of the customers entering in the building. The requirements are different for each kind of business; some need the people to enter, buy and leave as soon as possible (to leave space for more customers) and others need the customers to stay inside

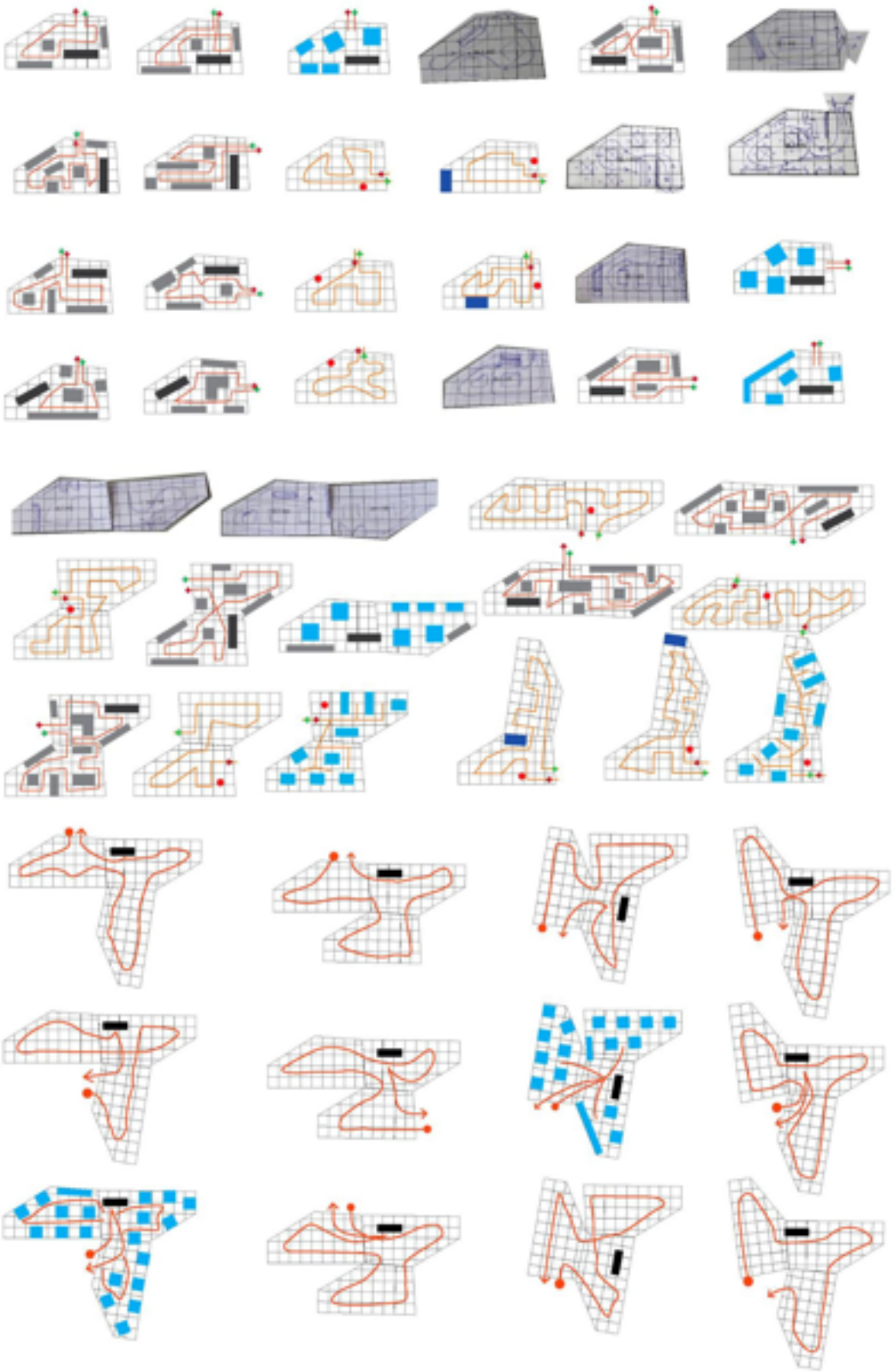
more time to convince them to buy. Sometimes the same business have both needs depending on the amount of people they already have.

For this reason, it was found different ways to make the customers walk-in easily on fast tracks or in the other case, to make the track slower.

The study took into account three different sizes needed to fit the requirements and an extra option of having one or two doors was considered.

The study was carried out without measuring the precise dimensions of the flow, the study has been done by imagining interactions of customers in a space with different disposition of the inside elements.

Following, a vast study of the flow can be found with basic modules and its different combinations. It shows the wide range of possibilities there are in the way of distributing the interior disposition.



Conclusions

By checking most of the possible flows, connecting the different units using only the two faces that were defined before; the conclusion is that the flow can be adapted to all needs depending on the disposition of the internal elements and the place of the door chosen to be open.

During the analysis of the internal flow, some concepts were discussed and after a new analysis, decisions were taken. Here below, are the decisions taken which derived from the flow analysis.

Only one door opening

To define if the building should have one or two doors, the group analysed the advantages and disadvantages of each option, from that information the group was able to choose the one that fits better the needs and requirements.

Pros and Cons for using one door:

- Less energy loss: Every opening in a wall is an area where the building loses energy. To prevent the building from losing energy, the aim is to use the least openings as possible.
- More control for the shop owner: With one door, the shop owner has more control over who comes in and out of the shop. Therefor he/she has more chance to prevent robberies and increase the security of the shop.
- Easier to construct: Building a plain wall is easier to build than adding a door to a wall.
- Less material use: Adding a door is adding extra material.
- More economic: Because adding an extra door will cost more material, it will also cost more money. When using only one door, this money can be saved.
- More eco-friendly: Using less material, losing less energy, saving building time, are all ways of being eco-friendly. Saving things that are not needed, is a good way of being eco-friendly.

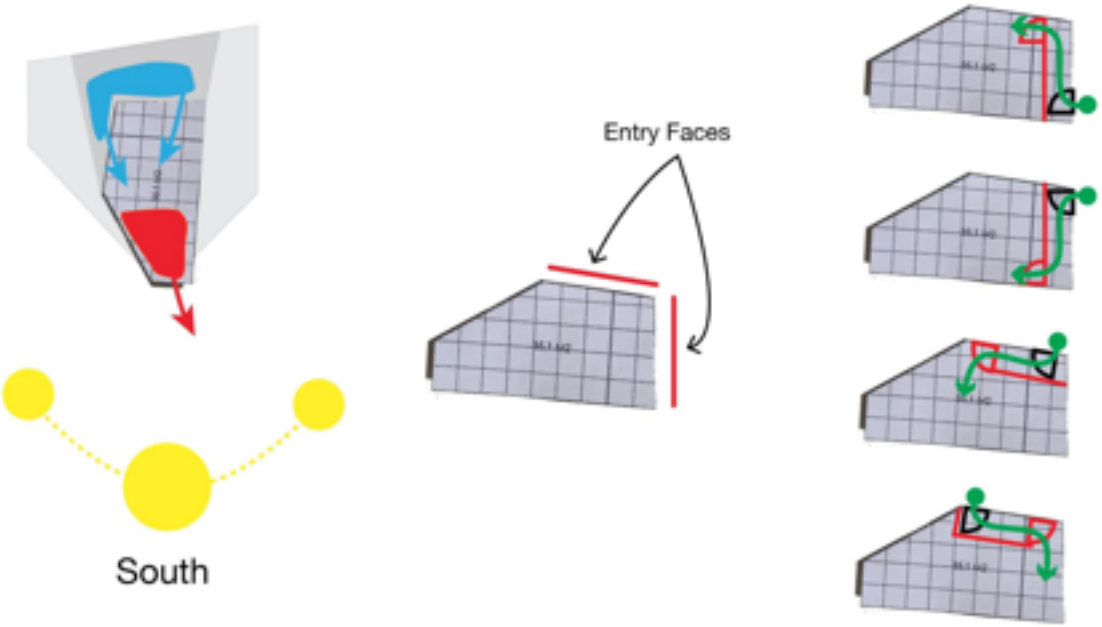
Pros and Cons for using two doors:

- More flexibility: There are more ways to design the building, the flow of the customers or the interior of the shop.
- Avoid crowded entrance: If there are a lot of people who want to enter or leave the shop, two doors would prevent a collision of people.
- Not intuitive flow: The two doors can create a flow that is not intuitive and distract customers, which can lead to problems in which customers do not reach certain areas.
- High loss of energy: Two doors will imply more energy loss in the building than one door.
- Less space for exposition: An extra door will take space from one of the walls, which will take exposition's space instead.

Doors in the connection faces

For the position of the door, it was necessary to think about which facade is the best. For this reason, it was considered to place the door in one of the two connection facades because it would help the passive energy system in a significantly way in summer. The building was designed to place the inclined and highest wall facing the south, which exposes it in the sun irradiation; and the other faces (the ones for the door position), to be in shadow. That way the ventilation can work by using the door as opening point in the shadow face, letting new air come inside and hot air leave the building through the ventilation system that will be located in the upper part.

The building can use the door as a ventilation element for the incoming air or not depending on the season. For the efficiency of the warming system, another disposition was developed for winter time. The concept of an intermediate space placed inside, right after the door would help to reduce warm air loss. This intermediate space will be created by a transparent wall and depending on the position of the door, it will be shifted to cover the same function.



As an example of the fresh air incoming application, the project for the EREN building in León (Spain) uses the shadow facade of the building to pull the fresh air in and push the warm air out through an aperture in the roof.

Real Scale Model

During the test with the real scale model it was proved that the flow of people in one of the proposed disposition as a coffee shop, was natural, not crowded, even with 18 people inside of it. The space was comfortable and big enough to have lunch or a drink. The group had the opportunity to give some explanations to the participants of the test and make an individual interview with each of them.

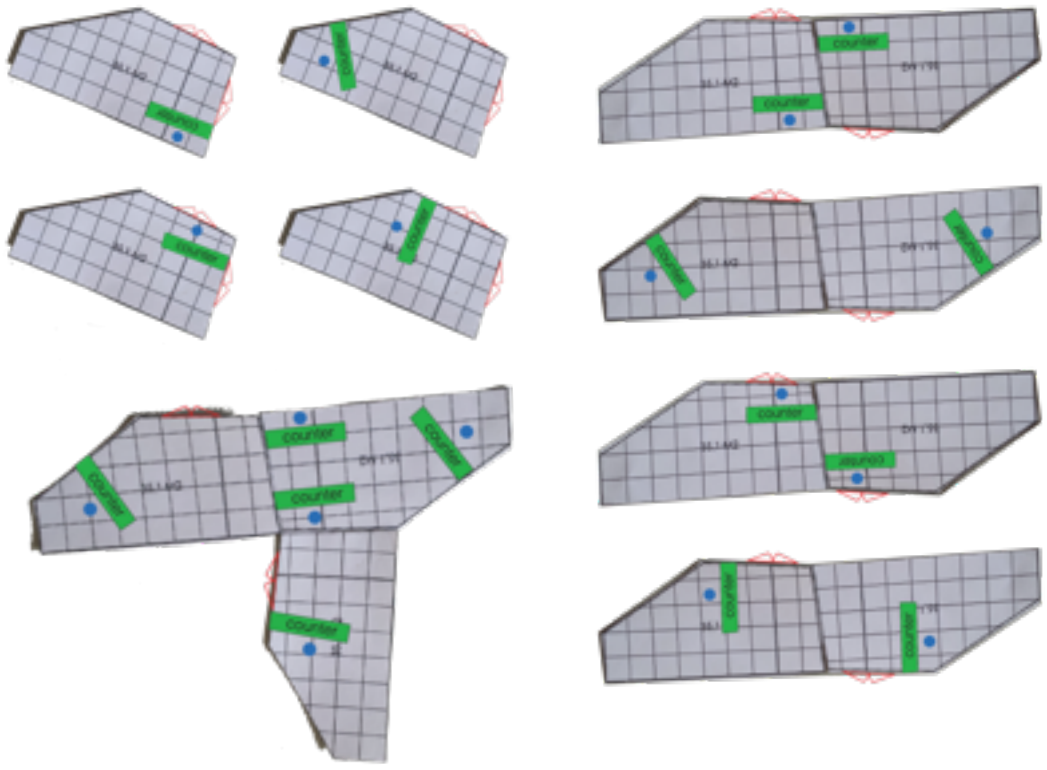
Counter position

Testing the different positions

To find out what the best spot is to place the counter, the group shuffled the counter around the building. It is important because if there is a fixed spot for it, the installation will be the same for every shop. Different positions were tested in each module combination and the bad ones were excluded one by one to find the best one at the end. The following criteria was taken into account while testing the different positions:

- The view of the vendor
- The way the flow of the people goes
- The connection where the counter could be

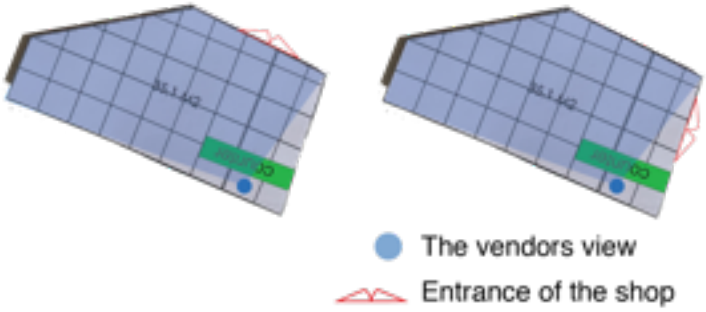
Here below there are the options of distinct possibilities for the counter's position in the three different kind of combination.



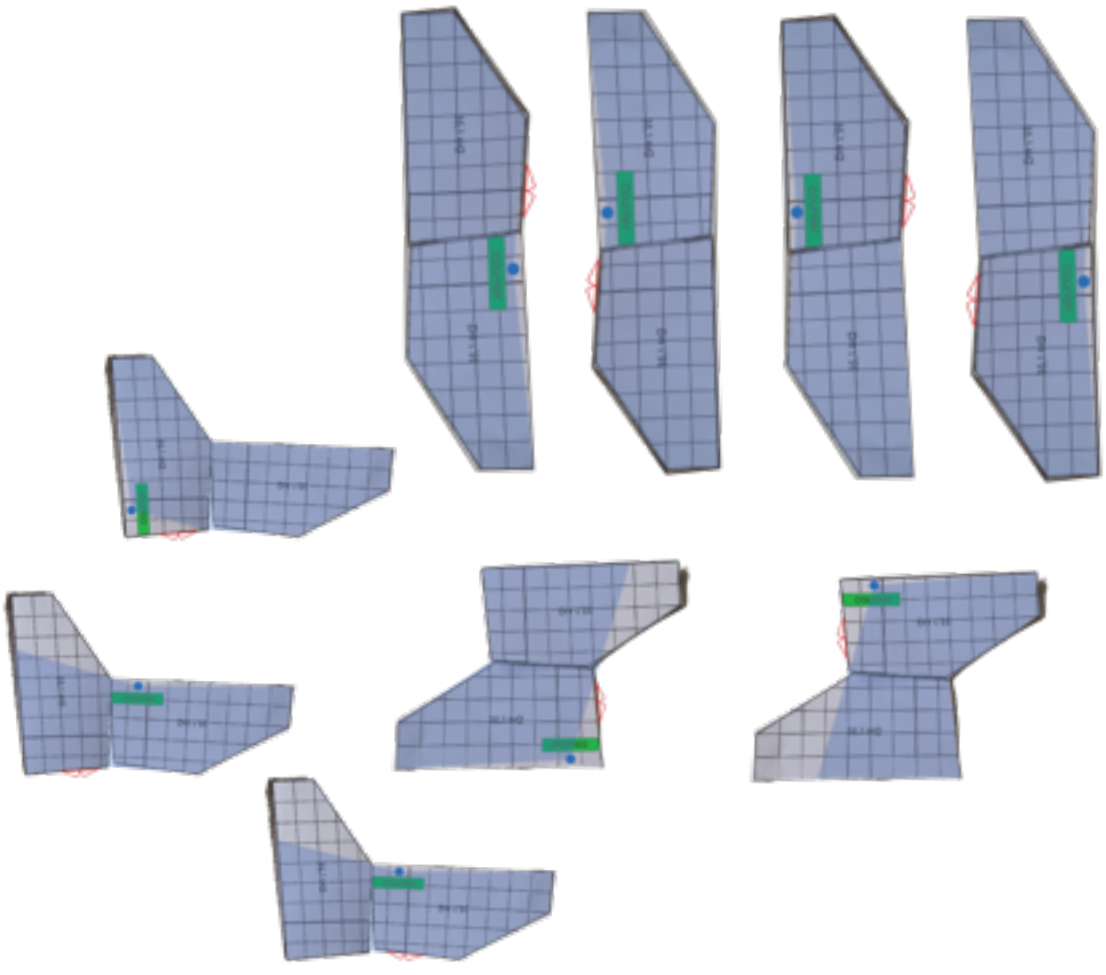
After this study case, one option was kept. To justify the choice of this option, illustrations with all the combinations were made and prove clearly what the vendors of the shops can see from the counter. For each option, the two diverse door position are shown to see all the variations.

Chosen position:

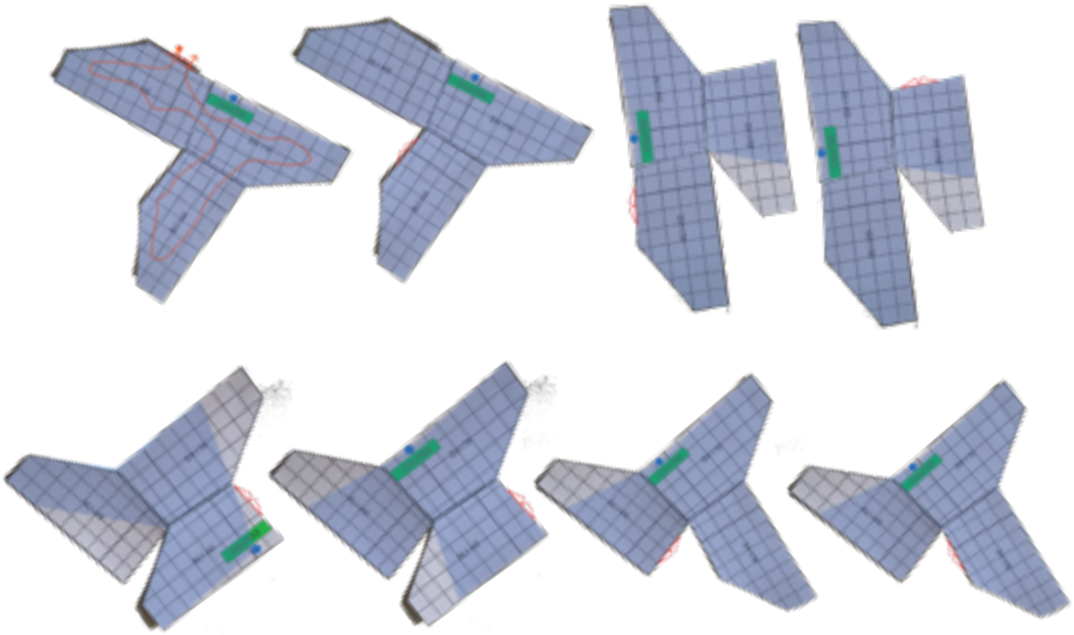
- 1 block:



- 2 blocks:



3 blocks:



Of course, the position of the counter is not mandatory. The business can choose where to put it in the building depending on the interior design they want to apply. This study has been made to give them the best option in case they do not have specific requirements.

Construction method

To define the construction the requirements have to be followed. This means that the project group has to find a construction method that makes it possible to build a modular and lightweight pop-up shop with only few builders.

The first step is to design a logical pattern which contains the least amount of different elements, so these elements can easily be prefabricated in the workshop and afterwards placed at the construction site. At the same time, it is important to design a construction that can support the elements and have the possibility to be modular but it has to be defined technically. Materials have to be chosen and the defined parts need to fit together without any problems.

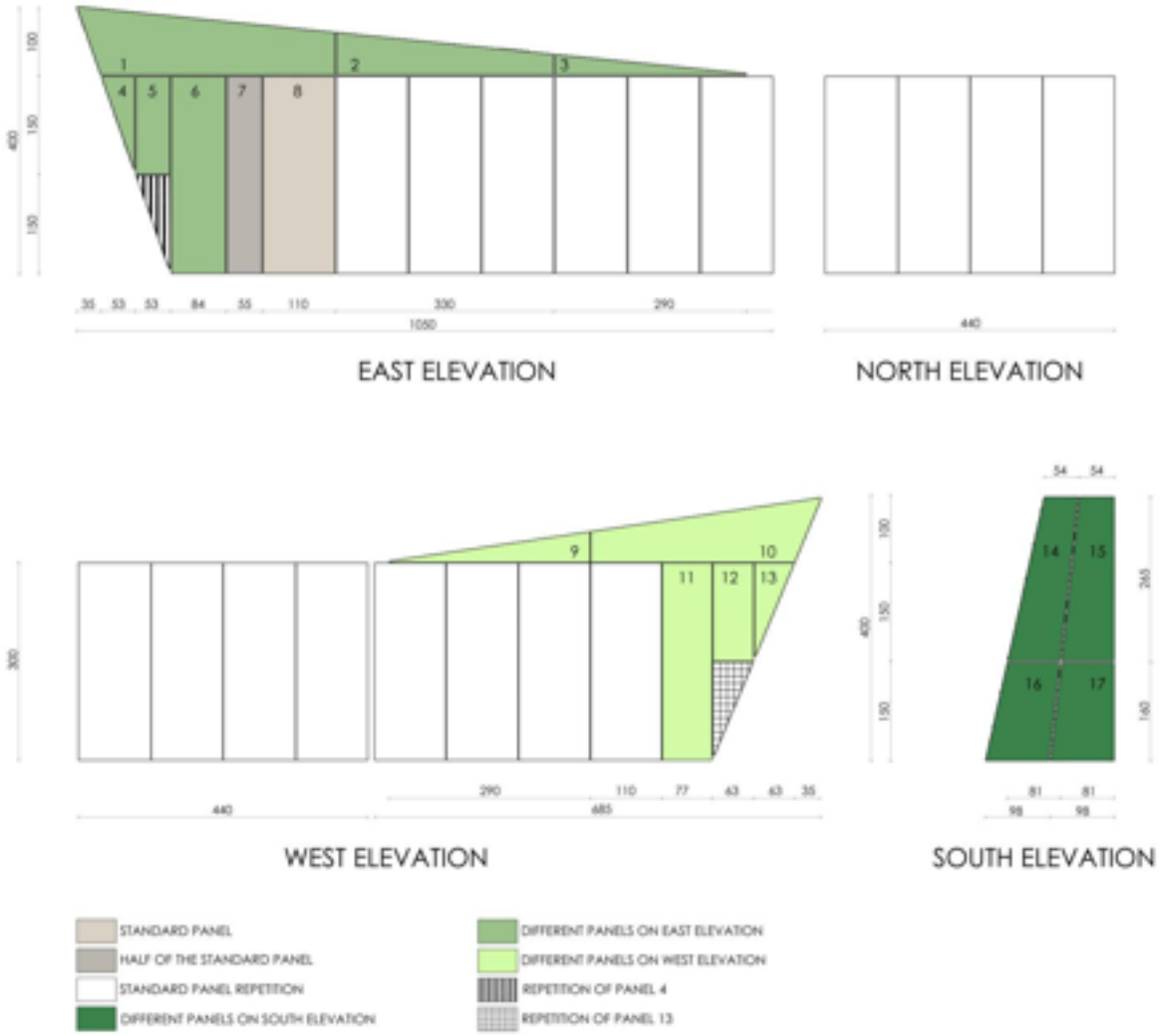
Geometrical definition of the panels

The definition process was done in two phases, the solution of the first attempt was the base for the second phase, in which the general geometry was slightly modified to solve the panels easily.

Phase 1

In the beginning, many different alternatives were checked to know how the panels should be constructed to make it as simple as possible. It has been decided to have standard panels of 1,1x3m which would fully cover the walls of the same area. The ideal was to use the standard

panel as many times as possible to cover the most of the building, but unfortunately it was not possible. Therefore other panels with different dimensions had to be created.



Firstly, to cover the upper area on the east elevation, a division of the triangular form into three parts (1,2,3) was necessary to make the transportation easier. The pieces are not the same, but it was decided that it is better to have three different small pieces than a big one.

A similar method was used for the upper area on the west elevation. The only difference is the division in two pieces (9,10) instead of three because of its smaller size. To cover the area remained on the east and west elevation, six more panels had to be designed.

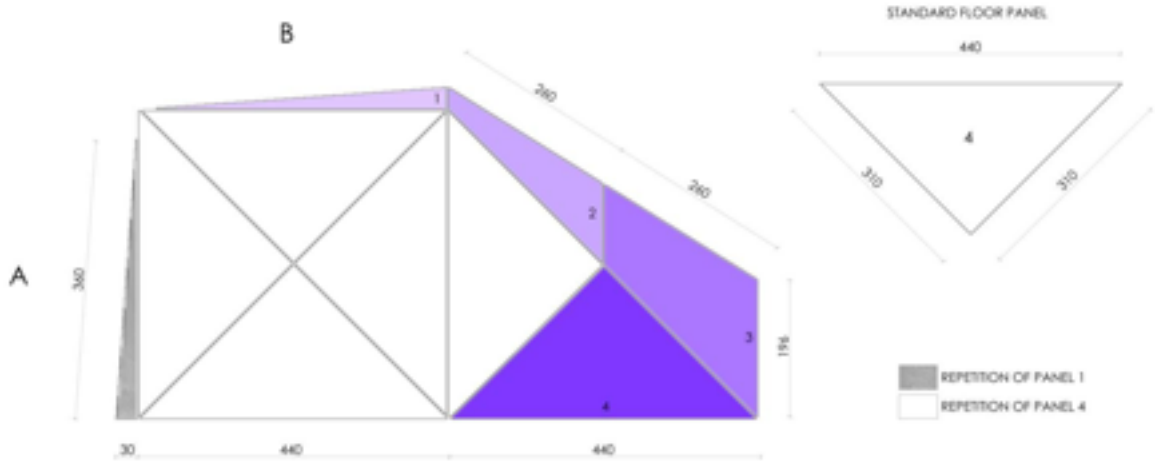
On the east side, it has been decided to use two times small triangular shapes of the same dimension (4), one small rectangle (5) connected to the triangles and a bigger rectangle (6) connected to the half of the standard panel (7). The rest of the wall is covered with six standard panels (8).

On west elevation, two triangular shapes (13) were used, but those are different than the triangles on the east elevation (4) because the angles vary. Moreover, there is a small rectangle

(12) connected to the triangles and the bigger rectangle panel (11) which is distinct from the one on the east side. The panel is connected to the standard panel.

Due to the impossibility of dividing the front elevation's panel into four pieces of same dimensions, it has been decided to divide the panel into four panels (14,15,16,17) of similar dimensions which will help to transport them in pieces.

Floor

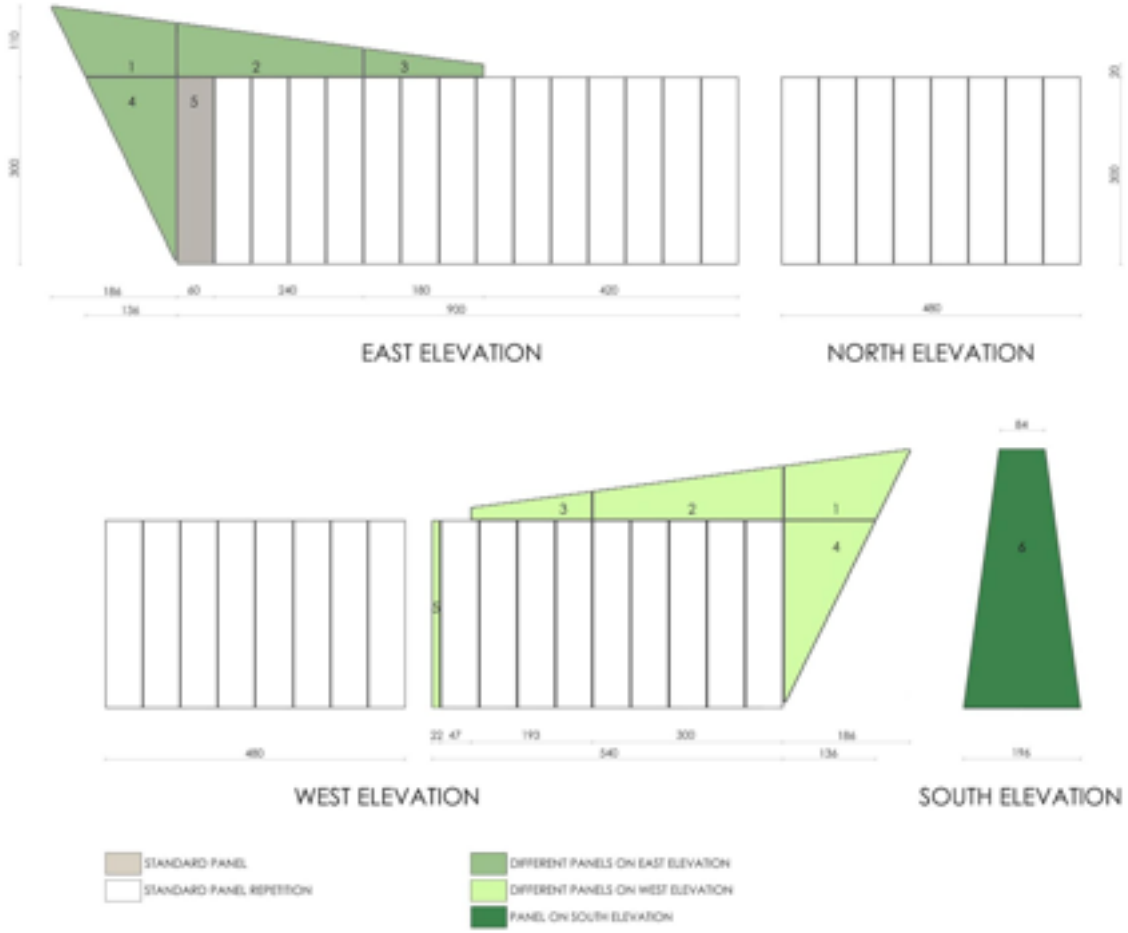


After trying many times to find the appropriate panel division solution for the floor of the pop-up store, it was believed that the floor should be divided as showed above. To cover as much area as possible by using the same panels, one standard panel (4) for the floor has been defined and it is possible to apply four times. But due to the fact that the floor is not symmetrical, more panels had to be defined. As a solution to cover the rest of the remained floor area, three more pieces were designed.

Fortunately, there was the possibility to use two same panels (1) to cover the area on the sides of the square made with the floor standard panels (4). To do so, to pieces were created to make the connection angles of the walls bigger than 90 degrees (A & B). Finally, on the remained area, two panels more had to be designed to cover the empty space (2,3) and they were divided by two to make it easier to transport.

Phase 2

At first, after trying to find a good pattern to build the pop-up shop in an easy way, the group rearranged the tasks to accelerate the process and found a better pattern which will support the modularity of the building and its construction method. The building is divided into three parts: the walls/windows, the floor and the roof.

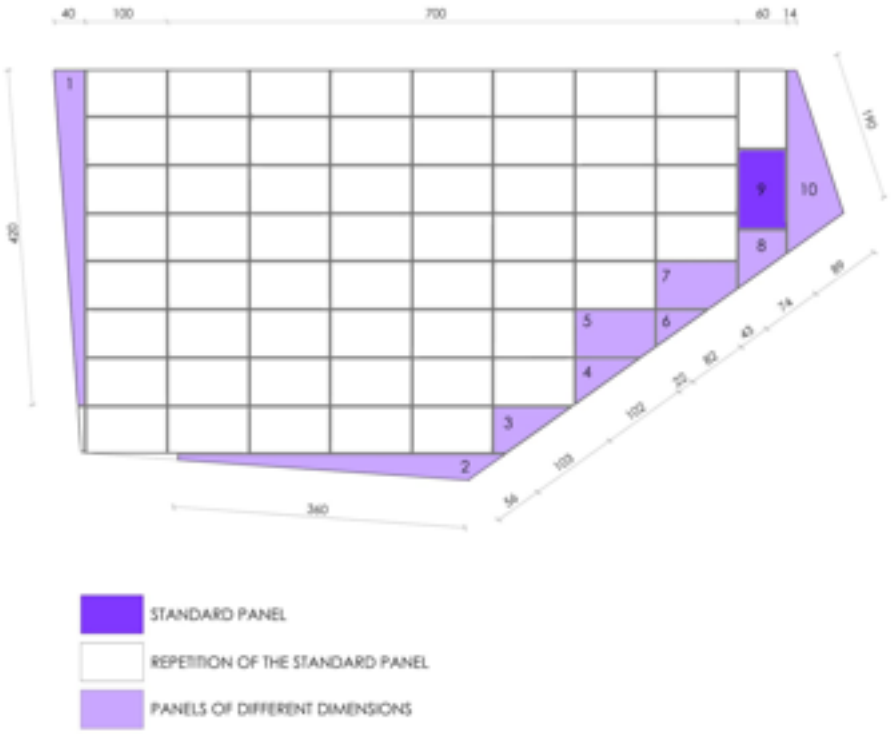


The walls consist of forty standard panels(5), nine window panels from which eight are symmetrical panels (1, 2, 3 and 4) and one big window panel (6) for the exposition face. With the forty standard panels most of the walls can be covered and the remaining faces will be covered with window panels.

While defining the details of the construction, it was found that the most limiting requirement is the weight of the elements. That is why each standard panel was divided into three to weight more or less 20kg. To build the building with the least number of elements, the walls and the floor are constructed mostly with the same standard element.

Floor

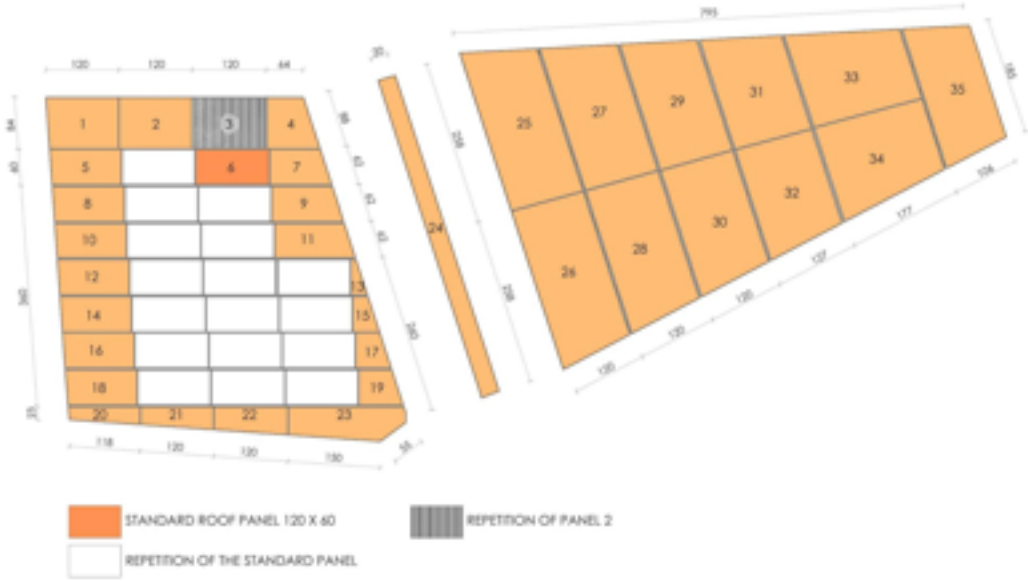
The floor consists of fifty eight standard panels and nine customised panels. The direction of the panels has been determined by the one that permits the most standard panels to fit in.



Roof

The geometrical definition of the roof was mostly done while defining the details of the construction.

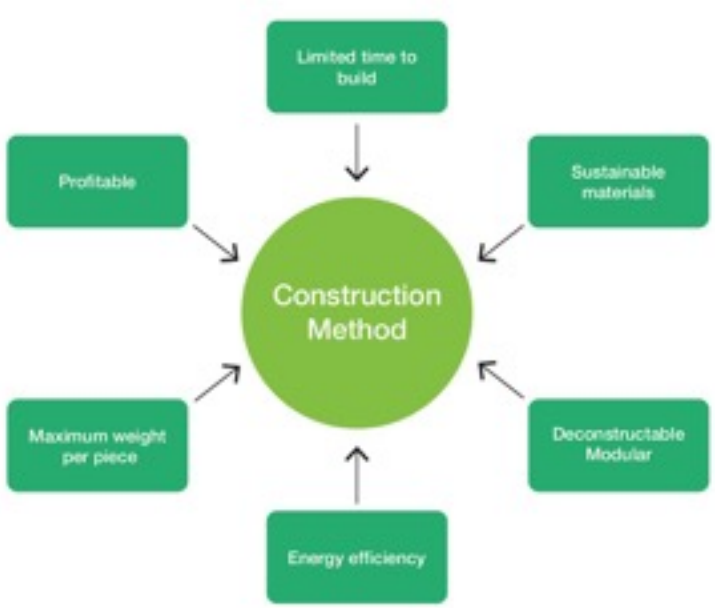
Since the roof does not support as much weight as the floor, it is not covered the same way than the floor and the walls. In this case there are twenty identical panels and few different ones that are bigger than the floor/walls ones.



This geometrical definition is the base to define construction in the next steps.

Construction definition

The main materials and method of construction had to be determined, to do so, several important points were taken into account: the requirements about the maximum weight for each piece, the limited time to build, the way of building (with only builders) and the sustainability when choosing materials and systems. At this stage of the project, all the limitations meet and have to be considered to develop the next steps.



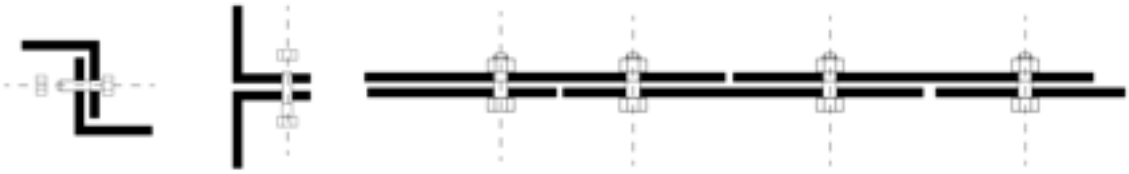
One of the first aspects to define was the way the structure had to be done. In this phase of the project, different options were studied, such as wood structures or conventional resistant block walls. The wood structure was deeply considered but was finally discarded because of the following reasons:

- Problems for deconstruction: since the building has to be deconstructible, the conventional fixation method for wood is not suitable. The screws are not a good option when the same pieces of wood have to be separated and reused many times.
- Weight: for structural pieces as big beams, the wood needs to be one big piece to resist the stresses and it might weigh more than the limit fixed for the builders to carry.
- Modularity: the wooden profiles (normally rectangular) does not offer many possibilities to combine.

The conventional blocks were discarded because of the weight, the slow construction and the impossibility to deconstruct.

After discarding the other options, steel L profiles were chosen as the main structure system. The 70x70x7mm steel profiles weight 7,38kg/m, which makes the 3m long profile weight around 22kg.

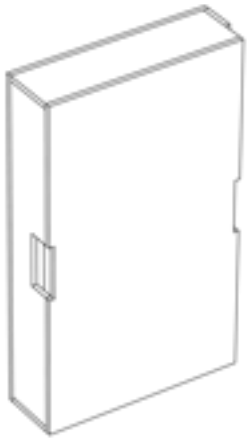
This profile offers the possibility to overlap or screw themselves together and it makes the system flexible enough to solve many requirements of the building.

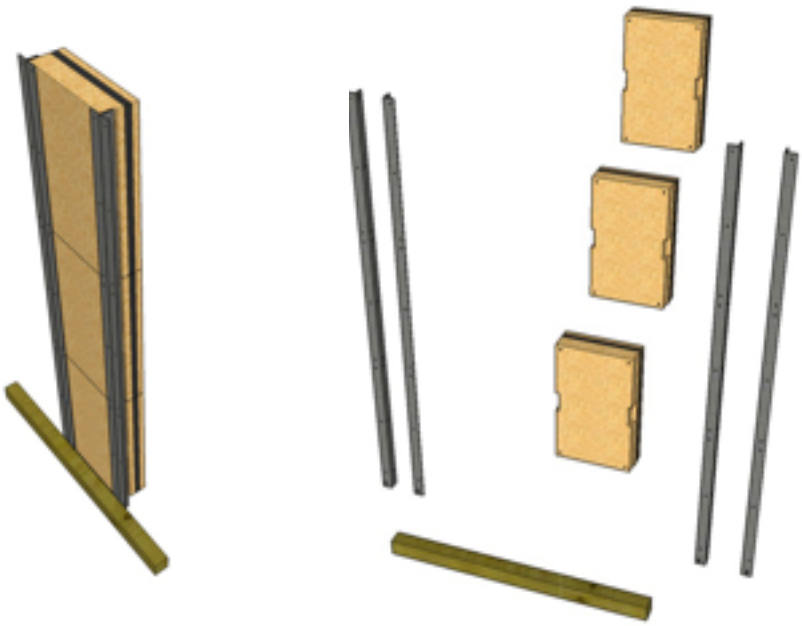


After deciding to use steel profiles for the general structure, the insulation was defined by choosing recycled materials and using pre-made OSB boxes.

*Detailed explanation on page 79.

In short, the construction of the pop-up shop was defined as a grid of steel L profiles combined with a pattern of insulated OSB boxes (IOB), which will create the walls themselves and will also justify the stability of the building.



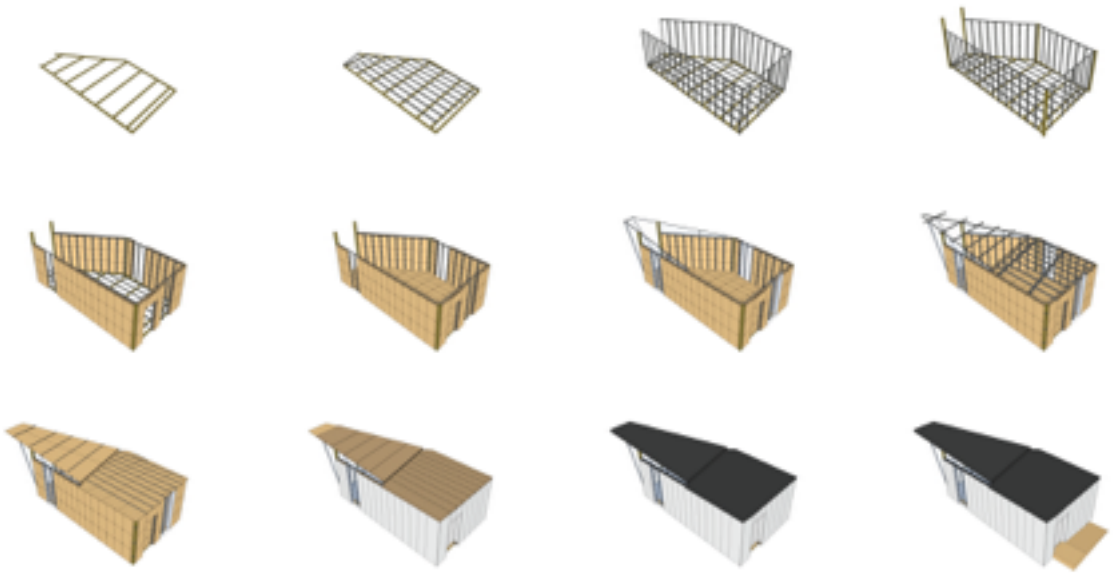


The reason why this option was chosen is because of its ability to fit all the requirements. The steel L profiles will be put together at the construction site. This enables the builders to build

with the same elements for every shape. It is even possible to change a panel for a window or build a door wherever it is needed. The weight also plays a part in this decision, every L profile weighs about 22kg which makes it possible for the builders to carry the profiles.

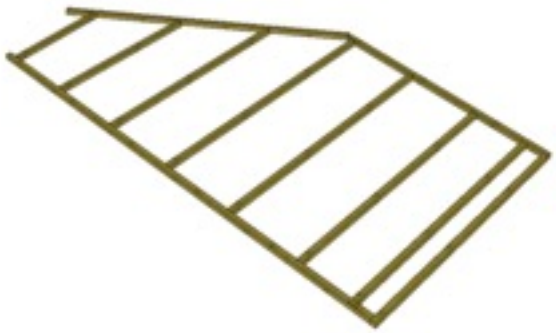
In the following chapters, the construction method is explained step by step to make it easier to understand, and each pre-made piece or system used is detailed.

Construction step by step



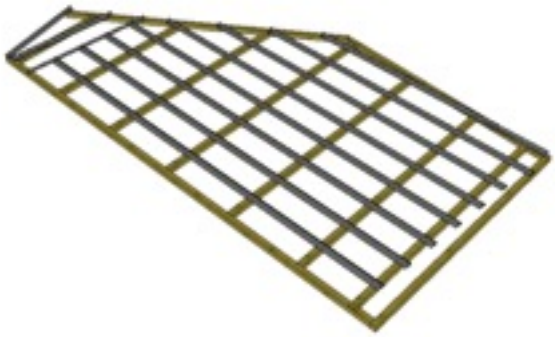
1. Building the fundament layer

To give the building a good fundament layer, it will be consisted of a layer of wooden beams. The beams are connected all together to compose a strong base to connect the steel structure. This prevents the panels from water damage, it enables the builders to level the building and ensures a spot to get fresh/cold air for the ventilation system.



2. Building the metal floor layer

The second step is to place the metal profiles on the wooden structure base. The floor profiles just lean on the wood beams without fixation. The reason of this decision will be explained later in the step 6.



3. Building the metal wall construction

The profiles of the walls are attached together and then screwed to the wooden base structure through pre-made holes. Once they are positioned, another L profile is screwed on the top to make them a uniform structure. The pillars are showed in the next illustration, but the construction of both parts will be simultaneous.

4. Placing the pillars.

As previously said, the pillars are added in the same stage and are used to reinforce the structure of the building.

5. Adding the wall panels

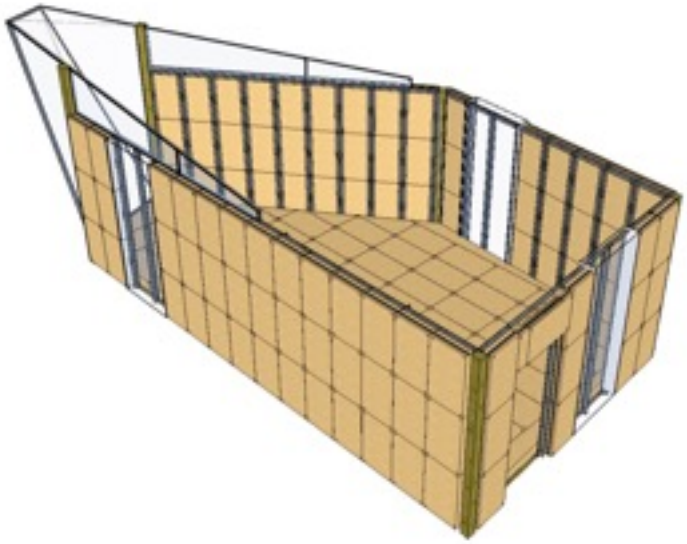
Then, the wall panels are added and screwed to the vertical profiles in four locations. This attachment provides stability for the walls.

6. Adding the floor panels

At this stage, the standard panels are placed on the L profiles of the floor. Since the panels fit exactly with the shape the walls generate, the panels force the horizontal steel profiles to lean in the correct position. This way is not necessary to screw them and the structure is built by gravity.

7. Building the window panels

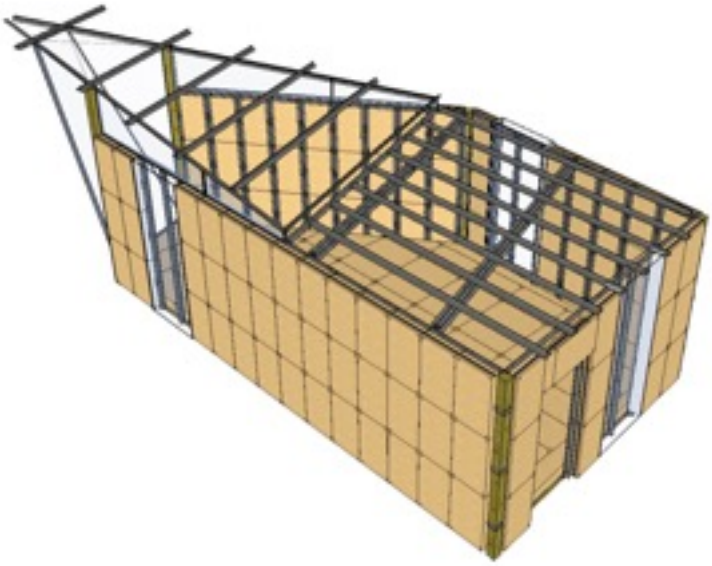
The structure of the windows is the next step. In this case the secondary structure of the windows (see chapter Windows definition. Page XX) is built. As long as the structure is built, the ETFE foil can be placed whenever it is desired but normally it is placed by a specialist in the final stage of the building. In the representation is also included the installation of the ETFE foils.



8. Building the metal roof layer

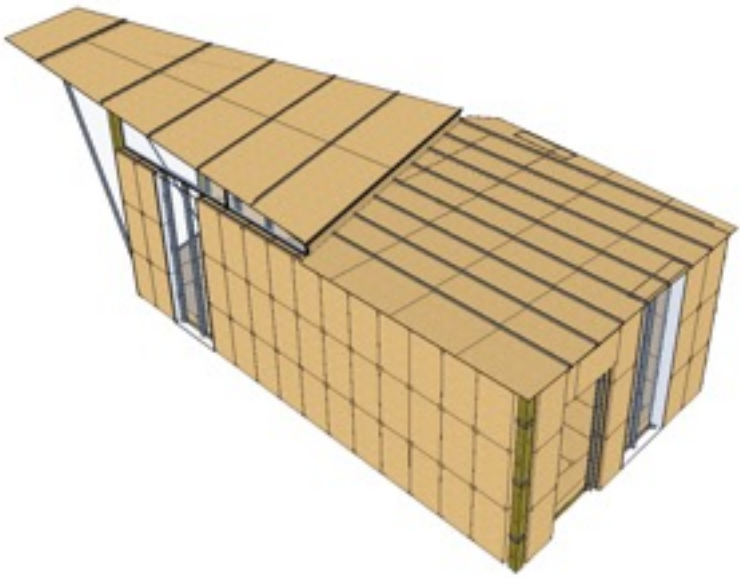
The roof materials are again supported by a layer of L profiles which are supported by two big beams. The beams are made by four L profiles lines combined with a plate of OSB. Since the dimension that the beams have to cover is longer than three meters, it is necessary to combine several profiles overlapping them to generate these beams. This case is a good example of how the L profile helps to generate multiple solutions with the same standard piece.

The L profiles on the top are screwed to the beams and to the walls' horizontal profiles. In this way the profiles stay in the correct position to hold the roof OSB panels.



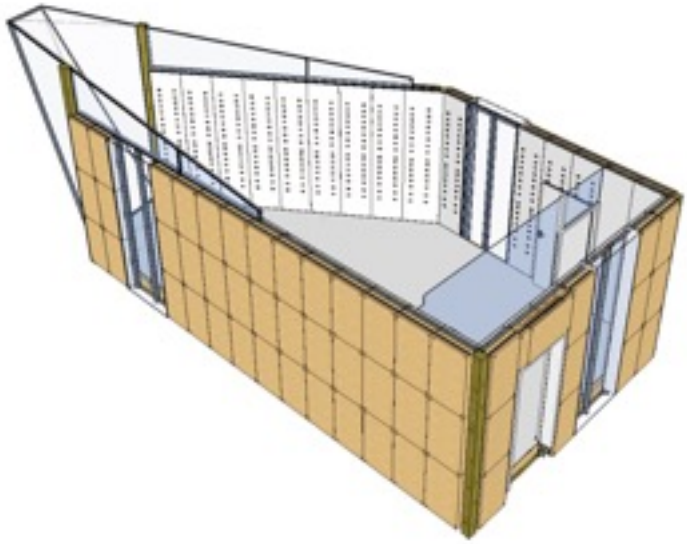
9. Adding the roof panels

The roof is built differently because the weight it has to support is lighter than the floor and that is why the IOB are not used. The insulation and OSB plates are used separately. This makes the system lighter to carry and it saves more than the half of the OSB used in the IOB. The OSB plates are added on the L profiles and screwed up to them using t-nuts.



10. Placing last layer of floor, internal panels and doors.

Once the OSB plates are placed and the roof is covered, the work can follow different lines. The things that can be done in this stage is the placement of; the internal panels, the doors or the last floor layer.



*This picture does not include the roof to be able to show the internal changes.

11. Placing insulation on the roof

The insulation of the roof is placed between the L profiles to stay in place, meanwhile the external panels are screwed to the building. The holes in the IOB have a t-nut inside to allow the external panels to be screwed in it.

12. Pacing the EPDM layer

After placing the roof insulation, the EPDM layer is unrolled on the entire roof. Then, the perimeter of the EPDM foil is attached to the lower side of the OSB roof plates and tied to the complete structure using high resistance tires.

13. Placing the ramp

Since the complete building leans on a wooden beams structure, and the floor of the interior is made of IOB, it generates a difference of level that is solved by a OSB pre-made ramp.

Construction details

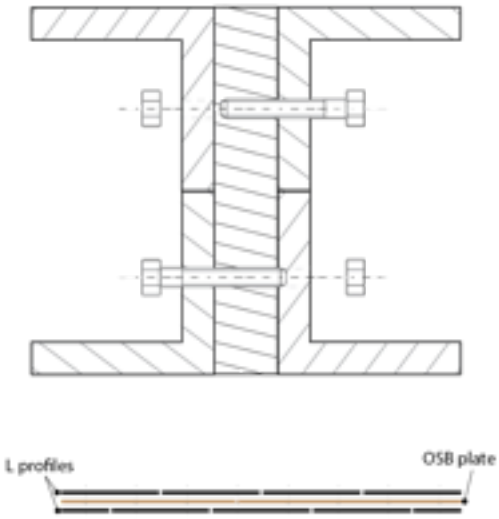
Wooden base structure

The base layer of the building consists of a wooden structure which is fixed together with a system showed in the picture below, to be able to use the same pieces several times without damaging the wood beams. The wooden beams enables the building to be leveled and it helps the panels to avoid getting damaged by water.

The wooden structure is the base for the layer of horizontal steel L-profile, which holds the insulated OSB boxes for the floor.

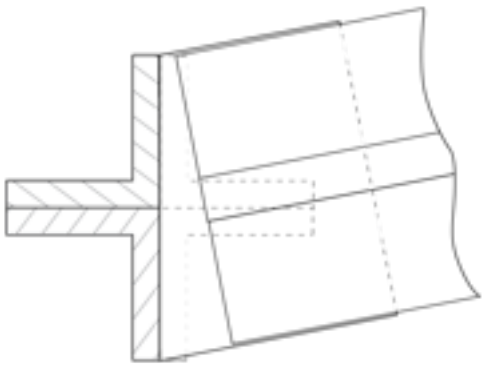
Roof Definition

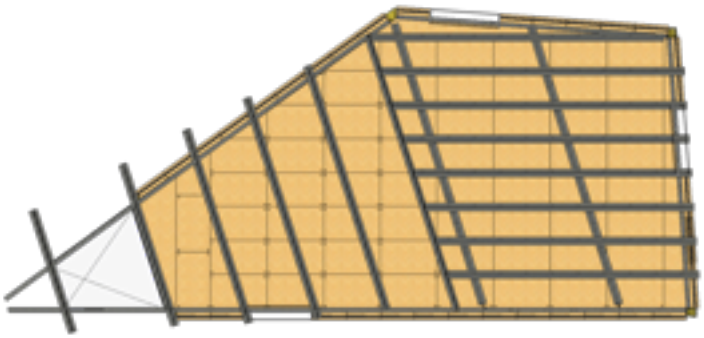
The main requirement to keep in mind in this case, is the insulation. To spare material, the roof is built with OSB plates and insulation wood fibres separately. Then, on top of the insulation layer is an EPDM layer to make it waterproof. All the mentioned materials are supported again by a steel structure built from L profiles.



Two big beams are constructed overlapping the L profiles and screwing them together through an OSB plate. This big beam can be attached to the walls or to the pillars by using always a fixed part. These pieces are reusable every time the building is deconstructed and constructed again.

Then, on this two big beams, several L profiles are screwed with 60 cm of separation between each.

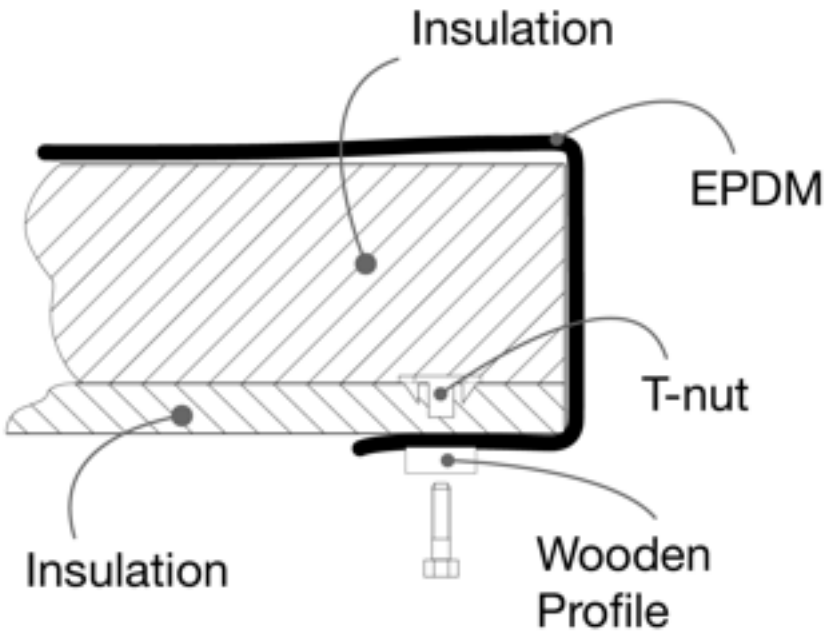




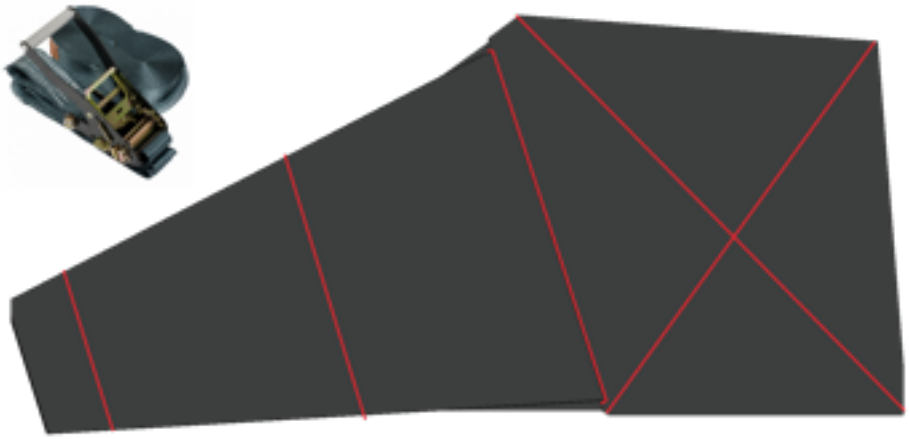
For the inclined surface of the roof, there are two profiles that follow the line of the windows and are screwed to their structure. This profiles continue after the frontal window's structure to hold the last OSB plate, the one for the roof extension. More parallel profiles fixed together in pairs are screwed to the mentioned inclined profiles. In the windows area, there is steel cables cross to increase the stability of the windows structure.

To make the construction sustainable and faster, there are two important points. On one hand, the commercial dimensions of the OSB plates are followed. On the other hand, to make the construction process easier, panels of the same dimensions are used, and when this is not possible, there are big panels that cover the surface with less pieces and make the process faster.

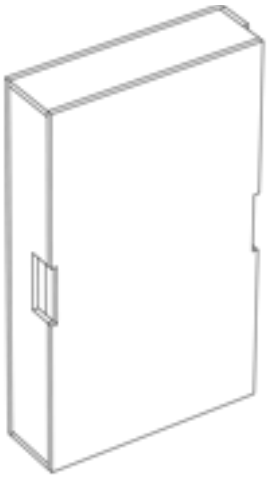
Once the L profiles, the OSB plates and the insulation are placed, all the surface of the roof is covered with an EPDM layer. To do that in a way that can be deconstructed, instead of using adhesives, the EPDM is attached using two different systems. First, in all the perimeter of the roof, the foil is attached to the OSB plate on the bottom.



Second, some high resistance slack-lines are used to tie up the EPDM to the hole structure.



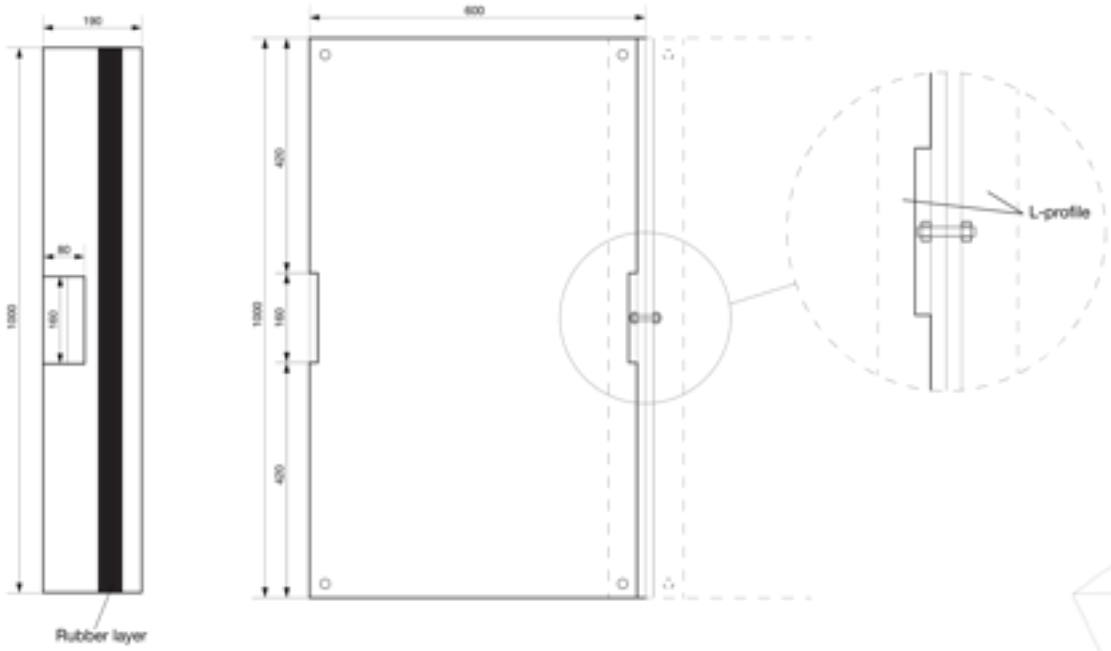
Insulation OSB Box definition



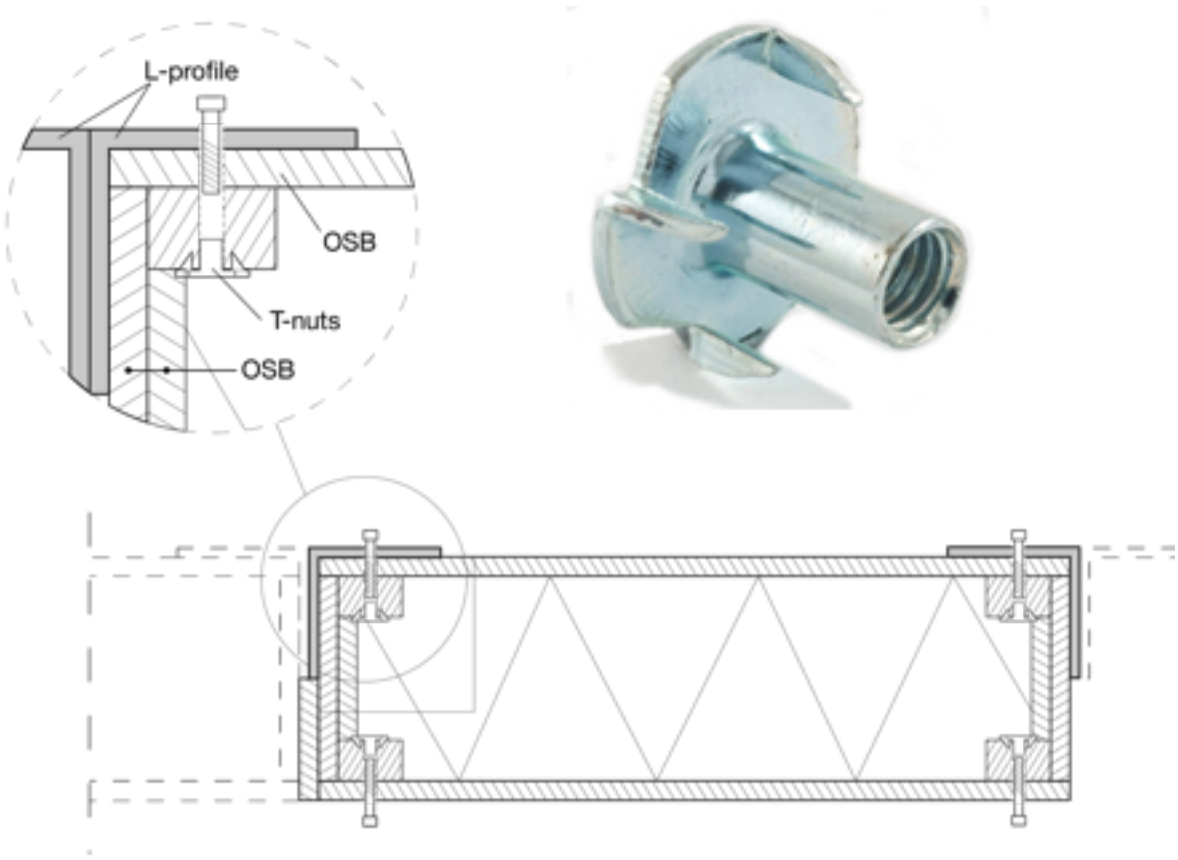
The insulation OSB box (IOB) is the main element of the building. This makes it possible to build the complete structure in a fast way. The IOB is made of a 16 cm layer of wood fibres wool, which is the main insulator, and all of it is covered by a box of OSB of 15 mm thick. There is a construction inside to make sure the IOB is strong enough to be connected to the steel profiles.

However, there is the problem of the walls air tightness, because these are made of a combination of multiple IOB's, they create a lot of gaps in the walls. To make sure the building is airtight there is a rubber layer on three sides of the IOB (top, bottom and left side). When the boxes are combined the rubber layer will close the gap, so the air cannot go through.

The cuts-out on both IOB sides are made so they will fit the steel construction. The steel L-profiles are fixed together with bolts and nuts at 3 spots. At these spots there is a cut-out in the IOB to make space for this connection of the steel profiles. This is visible in the drawings below:



Following a horizontal section of the IOB can be seen how it is built and how it is connected to the steel profiles. A way to connect the boxes to the steel profiles without damaging the wood has been thought. If the building is going to be assembled and disassembled every time, it is not possible to screw the wood every time without damaging it. Therefore, a system to fix this problem has been applied. The solution is called the "t-nut", which is this metal unit that is visible in the drawing below. First,there will be a hole in the box; on the rear side of the hole a t-nut will be placed with a blow to fix it to the wood. This t-nut will enable to fix the IOB to the steel profiles or to install the panels to the IOB's.



Window definition

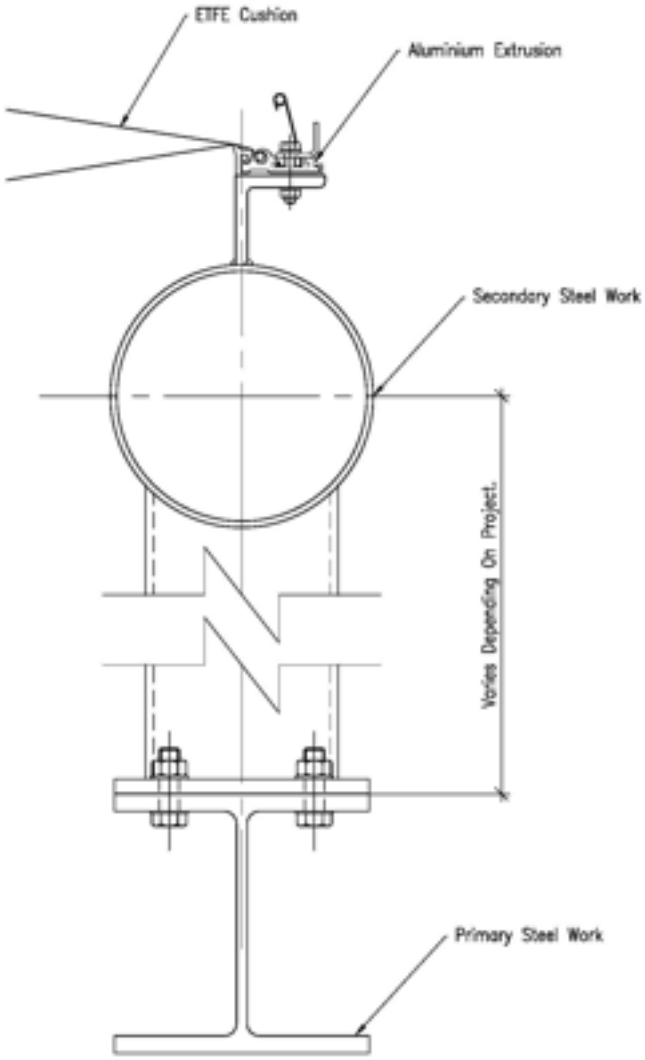
For the windows, the glass option was discarded first because of the high weight and its fragility, which needs a special transportation. After doing some research, the best solution was the ETFE foil windows. This system uses two layers of plastic which cover a volume of air that is pumped into the window. The structure of the windows is made of steel pipes that are normally welded in each customised angle. This steel structure is normally called secondary structure. For this project, to be able to deconstruct it, the pipes are fixed together by screwed joints. These joints are customised because the angles are not standard, but they make it possible to deconstruct the structure and to be transported easily.

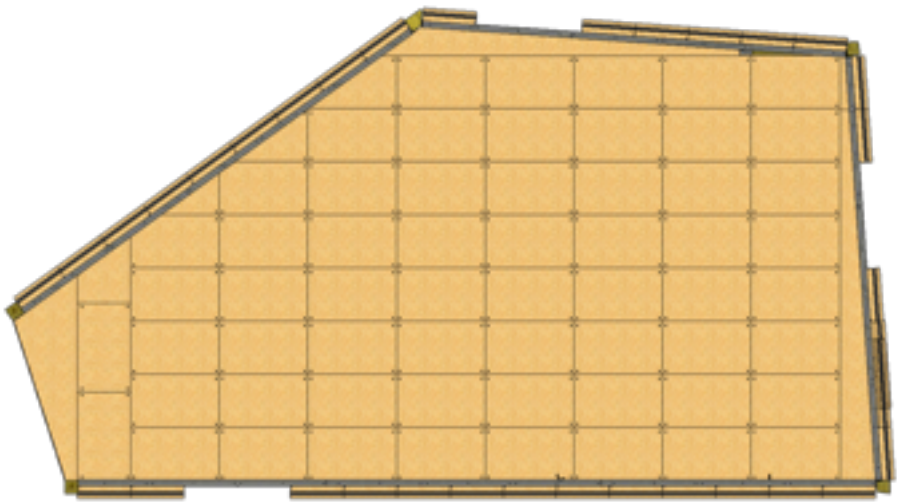
The primary system that holds the ETFE foil is made by an L profile that is previously welded to the steel pipes. Then, to hold the foil, there is an aluminium profile that is screwed on the L profile mentioned. The secondary structure in the store is used to help the general structure to resist properly.

This system is not only useful for the construction and transport issues, but it also offers many possibilities when applying identity. All this options will be explained in the identity chapter.

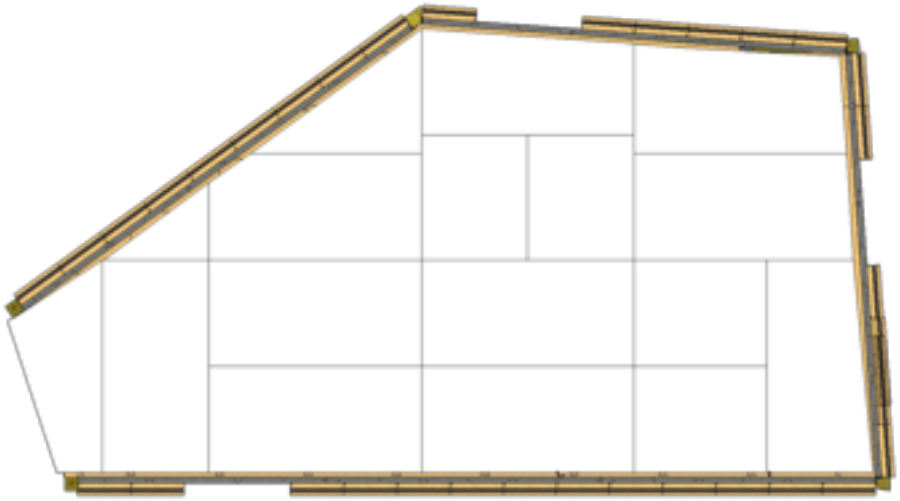
Floor definition

The floor was built using standard panels. As mentioned before, the direction of the panels has been determined by the one that allows most standard panels to fit in. In the space left, some customised panels were designed to cover all the surface. When building the floor, the profiles have to be placed first, then the IOB on them, being sure the profiles are pressing the first line of IOB on the longer wall. The same system is used for the following lines of panels until the customised ones are placed. In that moment, all the panels together hold the profiles in the correct position and make it easier to disassemble.

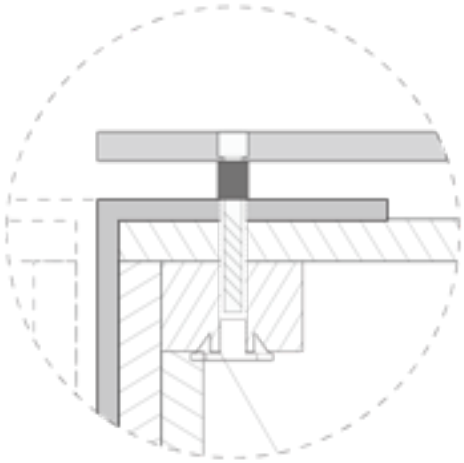




After placing all the IOB and customised panels, a last layer of OSB is added. This layer is the last layer and protects the IOB panels from usage wear. This layer is made from standard OSB plates and screwed to the IOB panels using the internal t-nut. The pattern was decided to be from standard panels, so in case any of them is damaged, it could be replaced easily.



Internal/External panel



The internal wall panels are fixed through the steel L-profiles into the IOB's. To install the internal panels some connection holes need to be left open while building the walls. There are twelve connection points of 600mm each. At least four of them should be used for fixing the panel to the wall structure.

To create some space behind the panels, so the furniture attachment system works (explained deeply in the furniture section), there will be some blocks in between the panels and the wall structure.

The external panels installation is the same as the internal panels. The only difference is that the external one will be fixed directly to the IOB, without the steel L-profile in between, and there will be also a separation piece to create some air layer between the external panel and the wall structure. The width of the external panels can be bigger than 600mm, it will depend on its manufacturer. What is more, these panels are offered in different colours which can help as an identity tool.

A recycled plastic called Ecosheet was chosen as material for the external panels, which is made of a grinding from industrial mix of plastics. Checking the Ecolyzer there was found the grinding mix from industrial plastics has a low value(57 mPt/unit).

The main reason to chose a plastic panel was that using only one material it is possible to cover the external surface, make it waterproof and it is still easy to recycle. The other existing alternatives use glue to make it waterproof or to fix the waterproof layer, which is not an ecological solution.

Door definition

For the door selection a research was carried out to be able to choose a standard door of a manufacturer that takes sustainability into account and that is energy efficient, but at the same time checking that the price is not too high. Also, Belgian manufacturers were chosen to avoid long transportation. In fact, in Antwerp, there are some companies that could provide a door for the Pop-up store, but because of the limited time and because it is very difficult to contact the companies to get exact features and prices, it was finally decided that a simple representation would be used for the final visualisation.

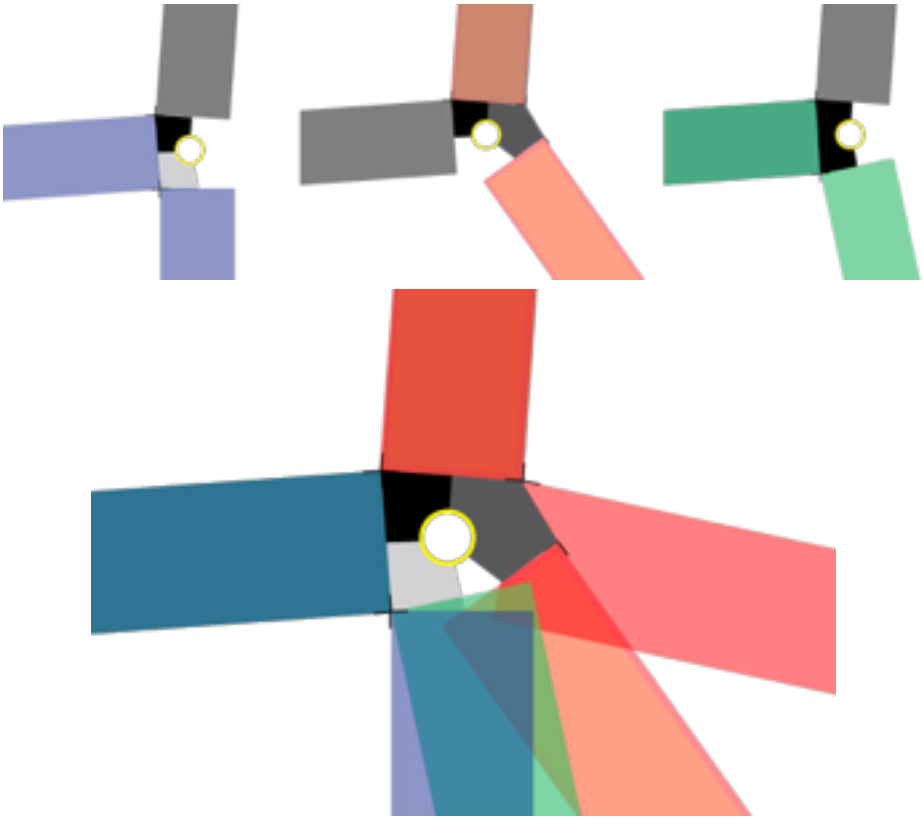
For its installation, this needs to be arranged depending on the chosen manufacturer, as different solutions are possible and it depends on how the door frame is made. However, what it is defined is that the door is going to be attached to the building profiles, using the space of two panels (1.20m) for the exterior one. For the interior one, there is a wooden column that will allow its fixation, also with the same dimensions, next to the transparent panel that avoids losing energy when entering the building, as explained previously.

Pillars definition

The pillars solution has to take into account all the different possible combinations of the buildings. The first solution was a unique profile for two of the corners of the building and a second geometry for the third pillar. But then, this sections did not fit correctly for the different building combinations (when more than one module is attached together).

After discarding the first option, the problem was studied to fit all building combinations, and the result was a pillar composed by different parts. The final concept uses an internal metal circular pipe, around which three different profiles can be placed. Using each different profile it allows the structure to hold in a different angle the following wall.

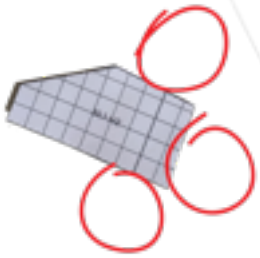
This system allows the pillar to fit in every possible combination of the basic unit. The total amount of pieces is four: the central pipe plus three different wooden profiles that generate the angle needed.



This concept was developed in a final stage and would be a good starting point for the complete technical definition of the pillars.

Extra Storage unit

To facilitate the pop-up shop it has been thought to add a storage unit.The wondered questions are:



- Where to place it and what would it look like?
- Where to enter and what is its function?

It is known that some storage space is needed in the shops to refill the goods and put all the stock, or in case of a café, to deposit drinks and food or to cook it. Another important reason is to attach the store to the power and water source, the storage room could be a perfect option

to facilitate it. That is what drove the group to think about it and how an extra space could be attached. Below is the result of this study.

Something else to bear in mind to get an opening licence for a shop is the sanitary service. A toilet for the clients is not mandatory in a shop, though a minimum one of 1m2 is required for the staff working there. Therefore, as it is important to seize all the space in the pop-up store and the dimensions are limited, it has been decided to have portable toilets outside the building if needed. If so, it is going to be carried out just by contracting a company that can supply toilets. Otherwise, if there is already a toilet area close to the place where the pop-up store is located, there is no need to install one. On the other hand, if an extra storage module is combined with the pop-up store, there is the possibility to put a bathroom inside.

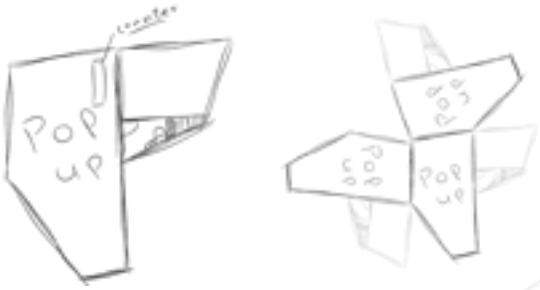
Knowing all these options, the design process for a storage unit able to fit this project began.

The requirements for the pop-up shop were the following:

- Facilitate power and water supply
- Create storage space that is easily accessible
- Facilitate a bathroom/toilet
- Supply the counter with power and water
- Possible to connect easily to the building
- Build it from the same panels as the building

Final concept and placement

The storage unit will be installed on the side of the building which is not a connecting face (as shown in the picture). The reasons for this position are because from most of the combinations of the pop up shop, it is the only free side and there is no interference in that side of the building. Moreover, the counter is easily reachable since the storage unit is behind it.



Explanation of the design

The shape of the unit is made to fit the pop up store. It does not have to be the final shape, but it is a proposition which fits the requirements.It is built in the same way as the pop up store with the same construction, as are the panels.

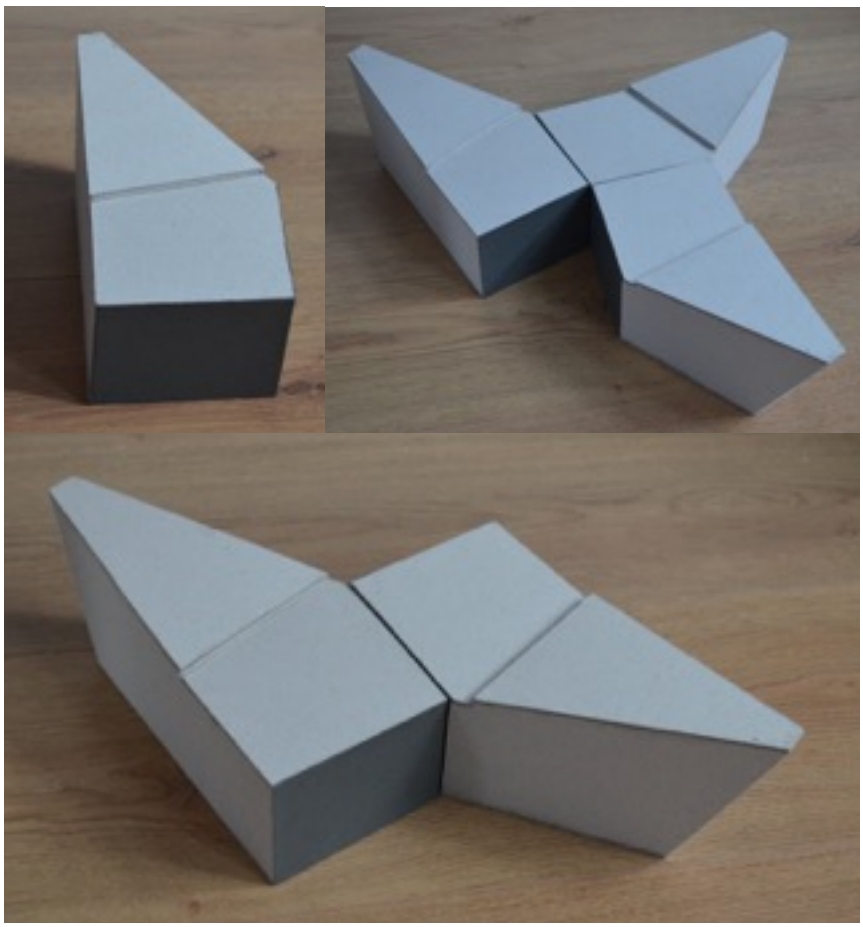
The storage space is of course the biggest space devoted in the unit, the bathroom is only a small space with a toilet and a washbasin, then there is the red part, which is a fixed part where the installation for the water and power supply will be situated. From there, the storage unit can be connected to the governmental water and power supply which will provide water and energy for the bathroom/toilet and the counter.

Final statement

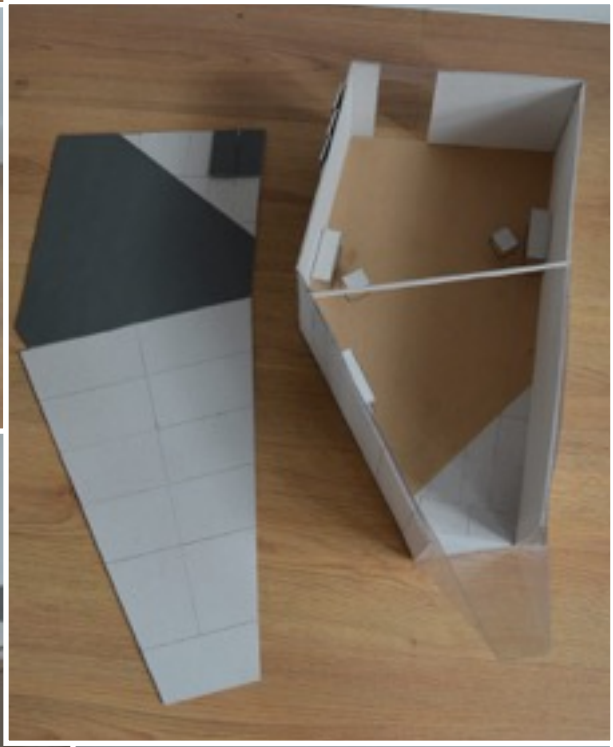
The storage unit is not a fully defined design yet, it is still a conceptual which needs some defined requirements to be applied. The purpose is to make the pop-up shop more functional but the storage unit is considered as an extra option that needs more work. That is why it is still a concept, the focus lies on the pop up shop itself.

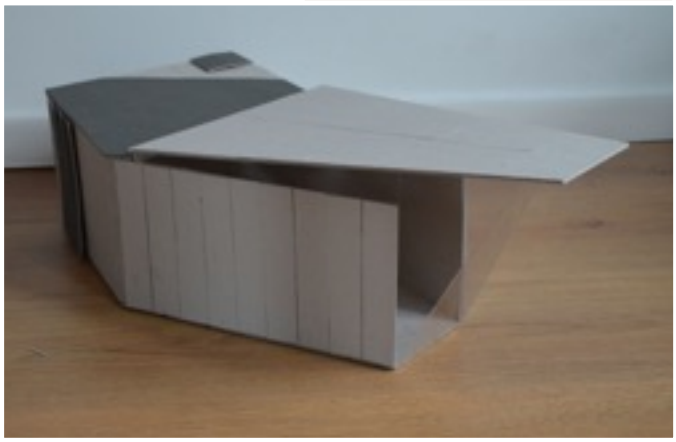
Prototype

Three small cardboard models were made in scale of 1:50. The models' purpose is to show the modularity of the building, the way in which they can be connected. To make it easier, the connecting walls were marked with grey paper, so whenever someone who does not know how it works can intuitively guess the parts that connect together. The models only show the general outside shape of the building, but no details are applied.



Apart from this, one big cardboard model was made in 1:20 scale. This is a detailed model which shows how the building is constructed and how it works. The division of the panels and the possible door position were considered, as well as the windows, which were represented with transparent material. The model includes five pieces of furniture in the same scale so the interior distribution can be changed and it is easy to realise how the space is used.





Section 9 **Furniture concept**

Ideation process: brainstorming and sketching

The interior design of the pop-up store, meaning the furniture design but also the distribution of it, decoration and lightning, is an important part of the project, as this is the one that will allow the different kinds of shops to adapt their products and identity to the pop-up store.

A useful thing that has been done to be able to start with the furniture brainstorming is a visualisation of the different furniture needed in each kind of shop. To know what has to be designed, it is needed to have a first look at the chosen businesses to be implemented in the project and the needs of each of them, thinking both in the workers that will sell the products and the customers that will go shopping. Below there is a table listing the items needed.

Clothes / Shoes shop	Café Bar	Accessories shop
Hangers	Hangers?	Hangers
Shelves	Shelves	Shelves
Tables	Tables	Tables
Seats	Seats	Seats?
Counter (cash)	Counter (bar)	Counter (cash)
Drawers (storage)	Drawers (storage)	Drawers (storage)
Mirror	High Table	Mirror
Changing room	Stools	Stairs?
Stairs	Decoration	

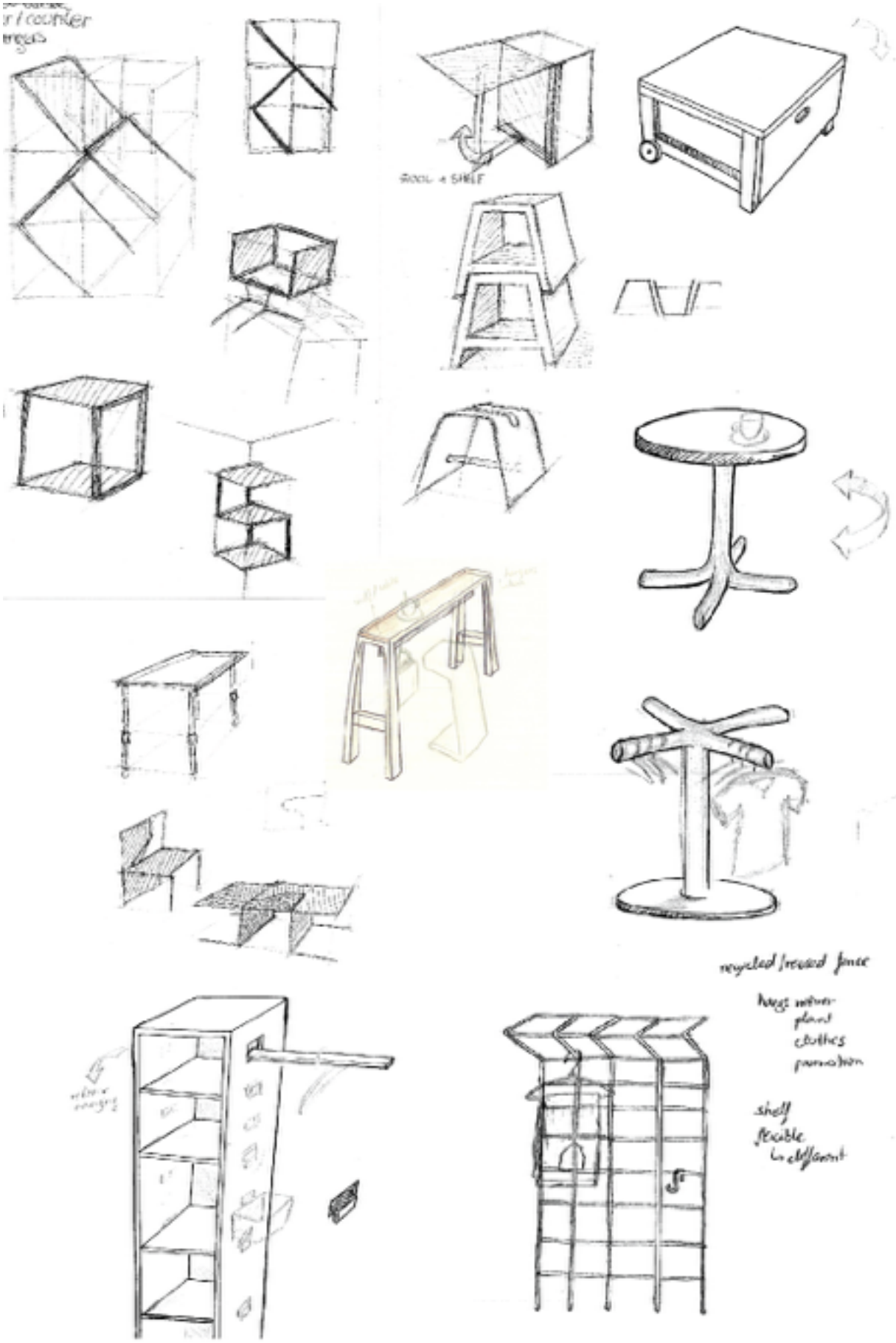
The three types of shops are; a clothes or shoes shop, a café bar and an accessories shop, which can include complements and jewellery, office material, electronic products, etc.

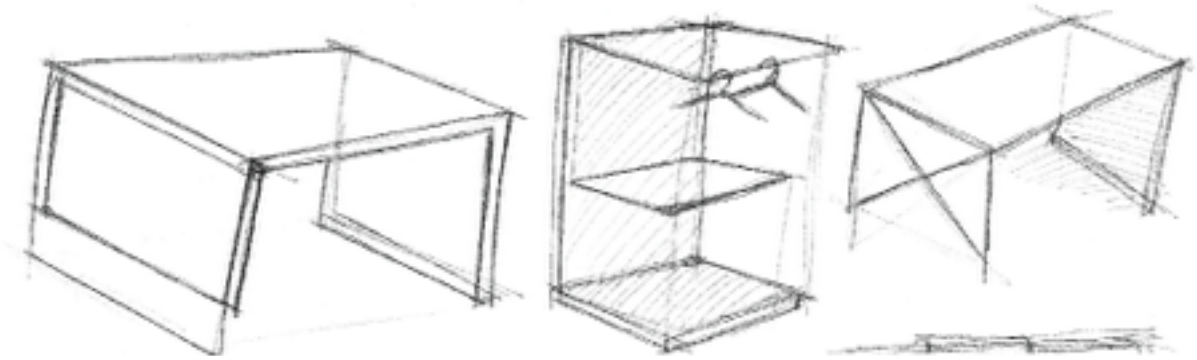
There is a number of items listed that are the same in the three columns (green area), indicating that these ones may be more easy to use in different environments even if they only have one functionality; and what is more, they can be combined to meet the needs of each shop better.

The red colour points out the objects that are needed in a bigger quantity in each kind of shop or only one unit is needed but it cannot be replaced by another one (such as a shelf could be replaced by a table). The asterisk in changing rooms means that only the clothing shop will need this item but that it is important to think about it because it is totally necessary.

Others in black are not that required but they would be good if combined with others and by having double functionalities.

From here, and also with the inspirational research that has been showed in the modularity moodboard, some brainstorming sketches were done. This are the following:





This was the beginning of the process (already showed in the midterm report). Many more sketches needed to be done and the ideas had to be analysed and combined to reach more innovative and original concepts. To be able to get a better idea of the shops' needs, more field work should be carried out, that is why some visits to different kinds of shops in the Meir were done. There, it was possible to deeply analyse the furniture they need and also how they use it. Below, there is a compilation of some photos taken during this fieldwork, where there are also pictures of Pop-up stores:

In this first steps, it was thought that the best way to make the furniture work and be modular would be to combine different functions and create pieces that could solve various needs. As it is shown in the previous sketches, there were different kinds of furniture with a minimum two functions each. However, it was realised that this design was not connected to the building in any way; furniture and building were different concepts, which did not show the Pop-up store as a whole unit, a fact that could be improved. From this reflection, what was thought was to integrate the furniture in the building and make all of it as one same concept that works together. So again, a new brainstorming and inspirational process was carried out.

The best idea to integrate the furniture in the building was following its main feature, the key word in the whole project is Pop-up, which is what defines the building as well. Therefore, this same thinking could be applied to the furniture: pop-up furniture.

This concept creates a kind of surprise and curiosity, the way the furniture is assembled and created just pops-up and then disappears again, depending on the needs. To achieve this, another mood board was created to see the possibilities and how the furniture could be integrated in the concept.

Henceforth, different ideas/concepts for pop-up furniture were considered, as follows:

- **Panel with holes** → this solution uses the wall itself to create the furniture. The panels can have holes that are useful to hang things and that also let indirect light come in when covering a window.

  The panels can be movable, sliding to the sides, which allows flexibility in its use.

  Advantages: Modular, multi-functional, useful for all businesses, integrated design

  Disadvantages: heavy depending on dimensions needed

- **Foldable furniture** → foldable shelves, hangers, tables, etc. They come out from the wall and are only used when needed.

  Advantages: integrated design, easy to transport

  Disadvantages: missed materials when not used, difficult to make it work (mechanism, resistance), not intuitive, does not solve all needed functions

- **Modular attachable furniture** → these are pieces of furniture that are attached to the wall and can be used in different ways, even separately.
  Advantages: useful in two ways (wall and

alone), integrated design, easy to use, multifunctional, modular
Disadvantages: not perfectly convenient for transportation (can be improved)
For this concept there are many possibilities of designs.

- Foldable structure → multifunctional structure that can be easily folded and transported. Useful as hangers, shelves, separating areas and also changing rooms.
  Advantages: modularity, easy to transport, multifunctional
  Disadvantages: lacks integrity with other concepts, not very useful in coffee shops

- Pop-up box → compacted piece of furniture than can be opened and transformed in many different functions. Wheels for easy mobility.
  Advantages: easy to transport, multifunctional
  Disadvantages: only defined functions, not modular enough

Idea selection and definition

From this five concepts a new ideation process has been carried out. It had to be decided which concept best meets the needs and is more useful, and if only one concept can be applied or whether two or more can be combined.

Analysing the advantages and disadvantages of each one, it was decided that the ones with more suitable benefits considering the businesses' requirements are the panel with holes and the modular attachable furniture. This was of good convenience as they can be perfectly integrated together: the same panel will serve as the supporting surface for the attachable furniture.

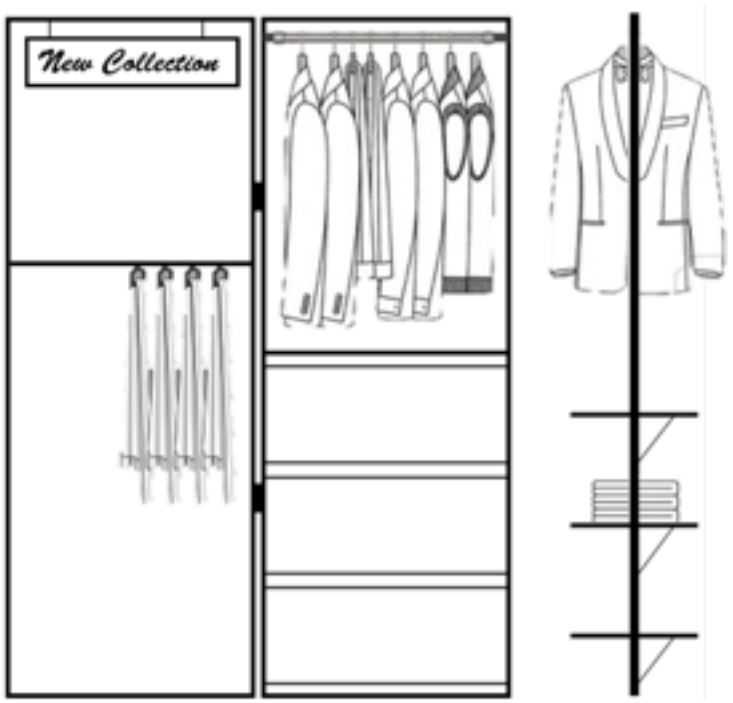
For the foldable furniture option there was an important drawback, as this will be attached to the wall in a fixed way, it may not always be useful because the needs of the business change constantly, and thus the material will be missed while some functions may not be fulfilled. It also did not allow much modularity and flexibility, which is why this was discarded.

Another option was a foldable structure that can allow the use of hangers and shelves, the strongest point of it was the easy transportation. This, however, would only be really useful for a clothes or accessories shop, but not for a café, since there is the need of tables and chairs and the structure does not cover those functions. Also, it could only be used in a central place, but not on the walls, which makes it difficult to combine with other concepts and be flexible.

An example of this last one was produced to see its possibilities, but it was left aside. Nevertheless, it was kept in mind for later to see if it was needed or useful to combine with more concepts.

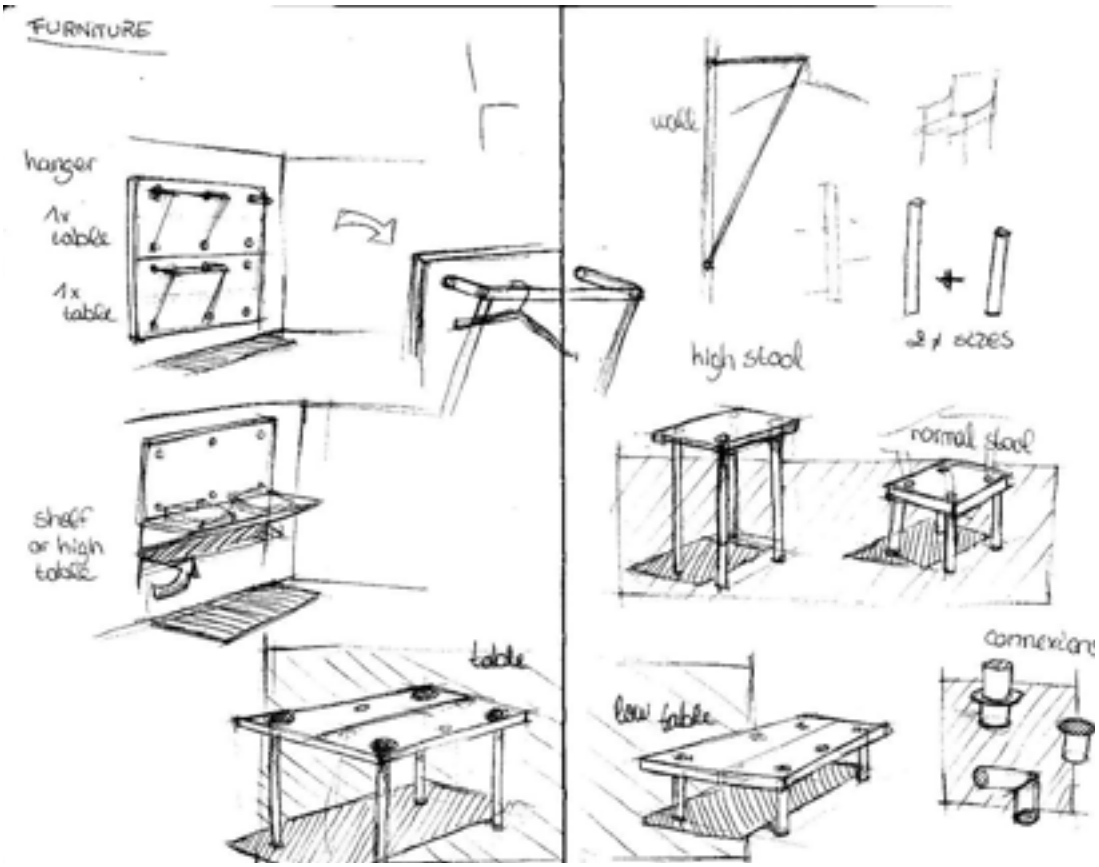
A last concept was the pop-up box, another good idea to make transportation easy and create the pop-up effect. However, this option needs to have certain defined functions and those are

not the same for each kind of business; for example, one box could solve the functions for tables and chairs but maybe not for hangers. Unless different kinds of boxes with different functions were designed, this concept would not work properly, but even then there will probably be some furniture that is not totally used.



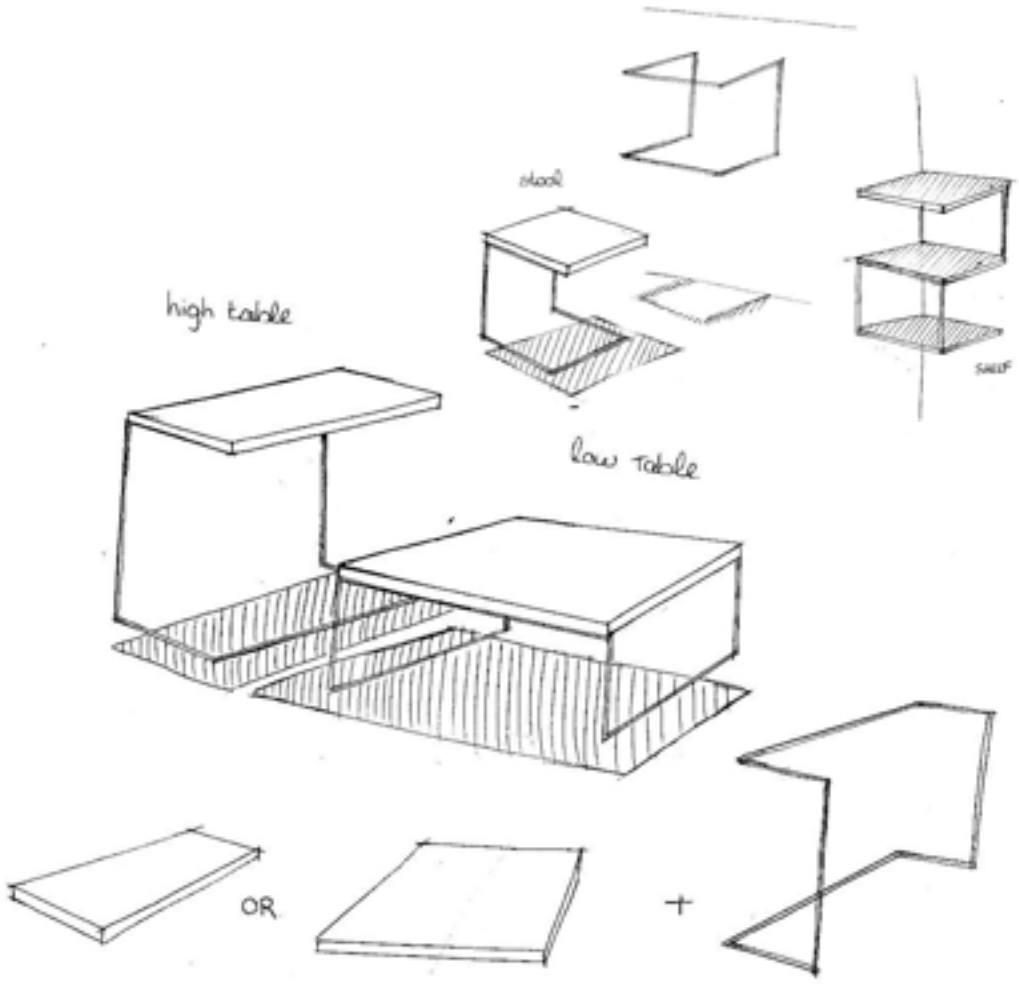
From this reflections it could be decided, as mentioned before, that the concepts of a panel with holes combined with the modular attachable furniture would be the best options. Therefore, the design process started. Following, there are two options that were thought to be able to combine the furniture with the walls and also to make them totally modular. One defined goal was to be able to have as many functions as possible but with the least pieces to manufacture.

Option 1:



This idea consists of bars of different sizes that thanks to some connexions can be attached to a wooden board and form a piece of furniture. Depending on the connexion chosen, size of the bars and wood, it is possible to create different kinds of furniture. The same bars make the connection to the wall to create hangers or shelves, and the connexions allow to stack one piece on top of another.

Option 2:



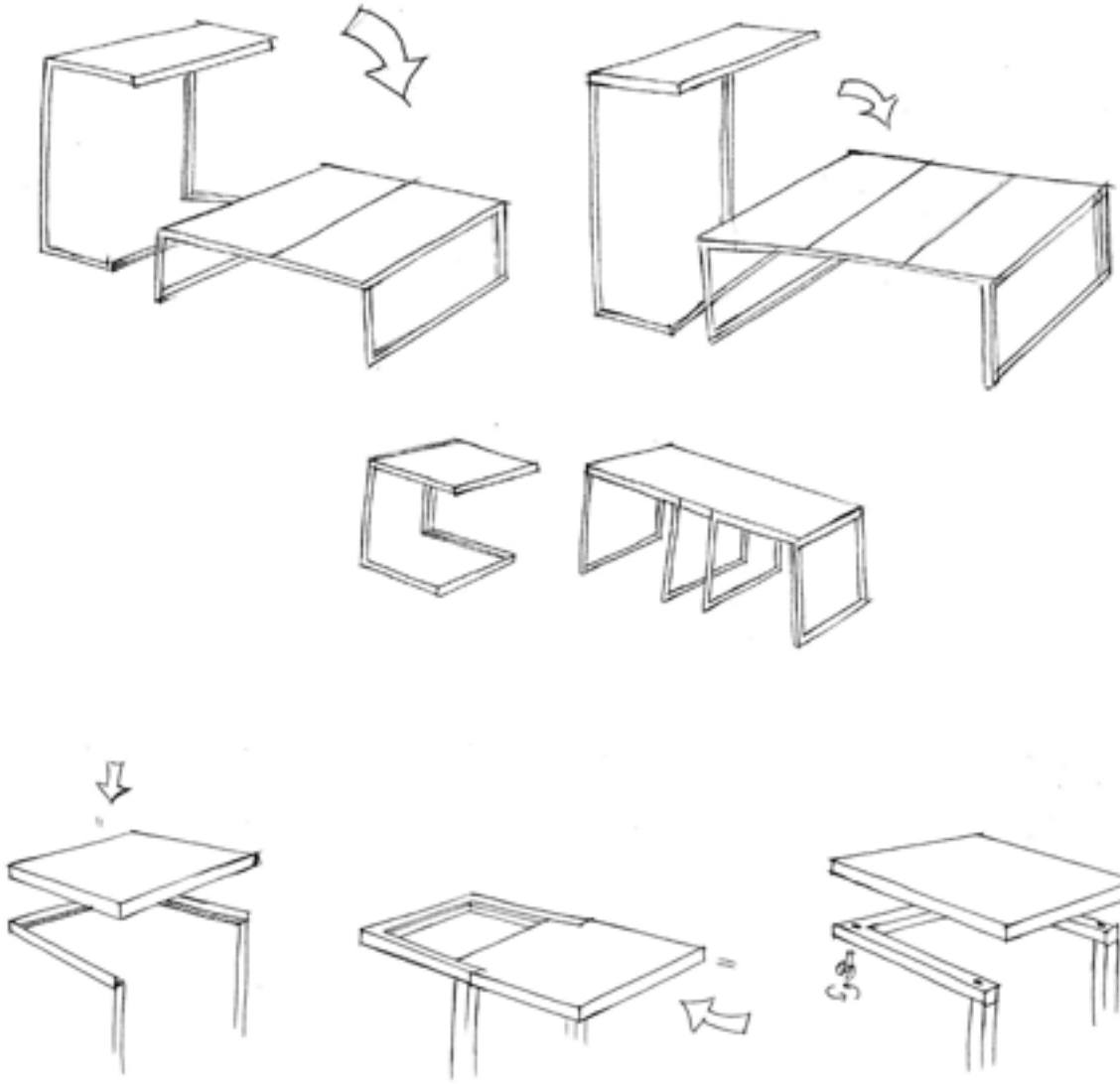
This second option consists of two parts, a metal structure and a wooden board. Depending on how the structure is positioned there is the possibility to obtain different kinds of furniture. The structure allows also to hang it on the wall with the help of some hooks, and therefore, get shelves or hangers. What is more, one piece can be stacked on top of another using the hooks on the wall.

Studying the benefits of these two options and their aesthetics to integrate it in the building, the final decision was to take the second option and continue working on it. Below, the main reasons are shown:

- Straight lines, follows the concept of the building shape.

- No need of an extra connection between the two pieces.
- Easy assembly.
- Less pieces needed (changing the orientation of the frame).
- More attractive.

Apart from this, the furniture concept is also inspired on how the building will be constructed: a metal frame that gives the whole shape and wooden panels attached. That way, the concepts are totally integrated, and an initial idea is to use the same wood for the walls and for the furniture, therefore, it will all look like a whole unit. From the first idea, more drawings were done to check for details and see the exact assembly method. This was a difficult part as there were different possibilities:



Technical design

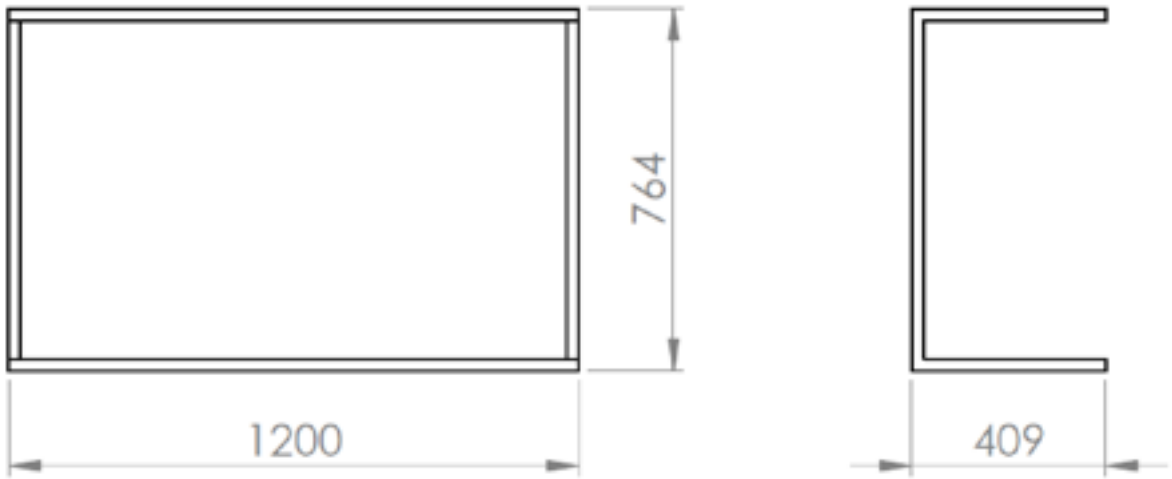
After considering different possibilities and trying to find the best way to get more functions with less pieces, the final parts were defined, and with this also the utilities they will cover. The dimensions of the furniture were verified with the neufert's book for Architects, assuring they were within the standards for good ergonomics, as well as taking into account that the wooden boards had to fit in both positions of the furniture.

A summary of the standard dimensions for furniture:

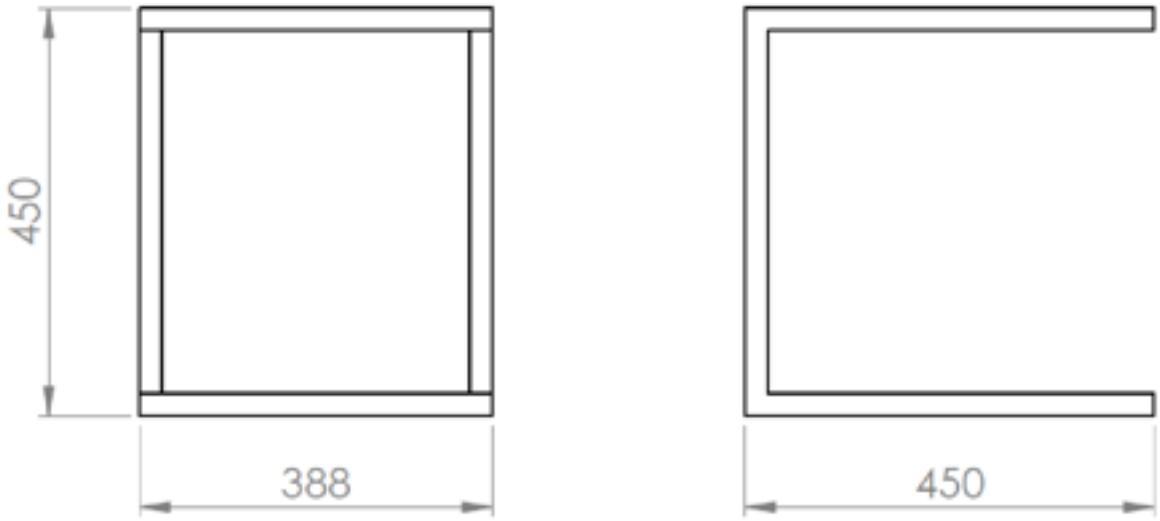
	Minimum (cm)	Maximum(cm)
Table height	65	77
Standing table height	90	135
Low table	38	43
Table width	60	-
Seat height from floor	40,5	45,5
Chair width	38	50
Chair depth	38	45
Shelf height	8	215
Shelf spacing for clothes	35	45

The final pieces chosen with its general dimensions are the following:

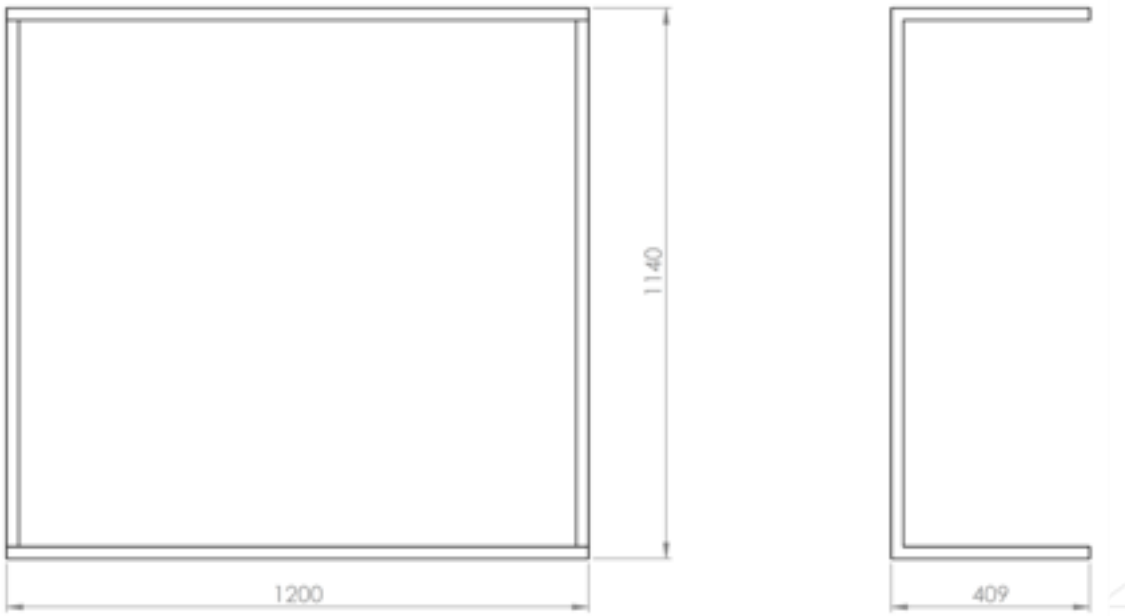
1. Normal frame (table)



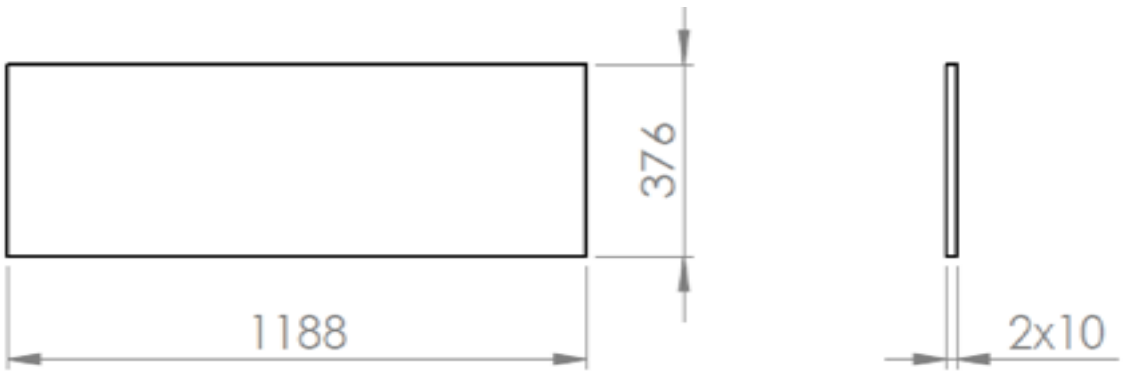
2. Small frame (chair)



3. High frame (shelf)



4. Board



5. Small board

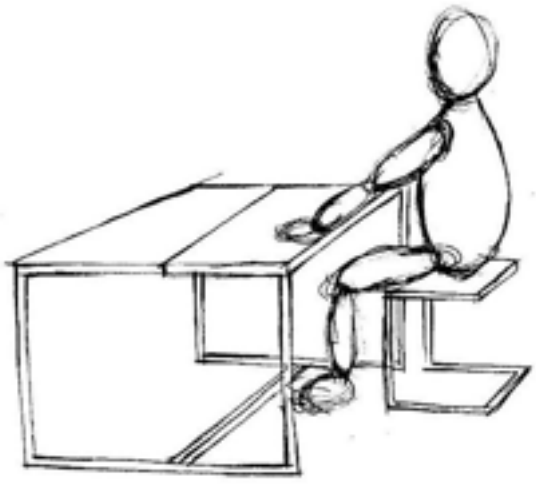
There is a reason why three different frames were chosen instead of two, while only two boards are needed. First of all, it has to be remembered that the pop-up store will be able to hold three different types of shops. For the coffee shop, it is important to offer the possibility to have normal standard tables and chairs, which require two frames of different dimensions. Both can also be used as hangers and shelves for clothes if hanged on the wall.

On the other hand, for the clothes shop, it is important to provide useful hangers and shelves. This means that in case they are not fixed on the wall at a certain height but placed on the floor around the shop, they need to be high enough to avoid the clothes to touch the floor.

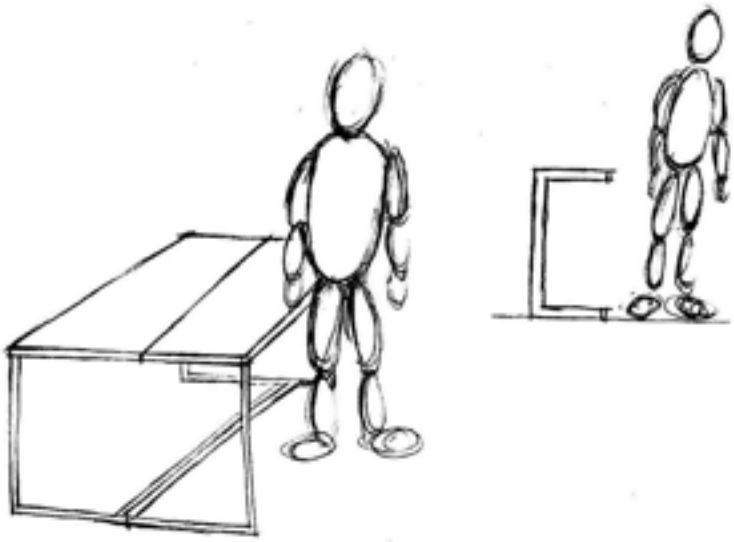
Apart from this, the width of the two big frames is related to the height of the low table, so when it is turned around, it can have this other function. That is why this has the lowest height allowed for low tables, so the shelf is not too wide.

The pictures below show how the different frames' dimensions work and the ergonomics of each one:

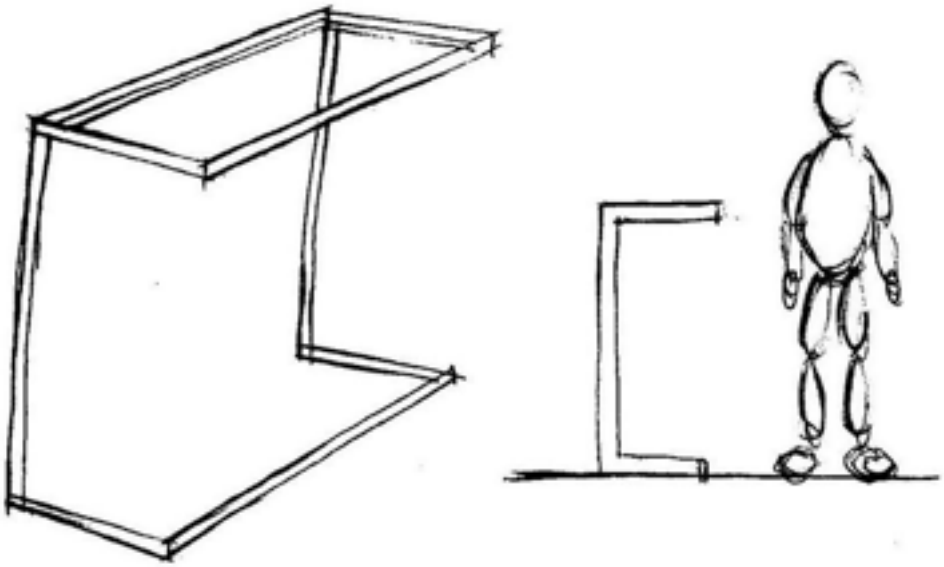
1. Normal table + chair: dimensions taken for a good user's position.



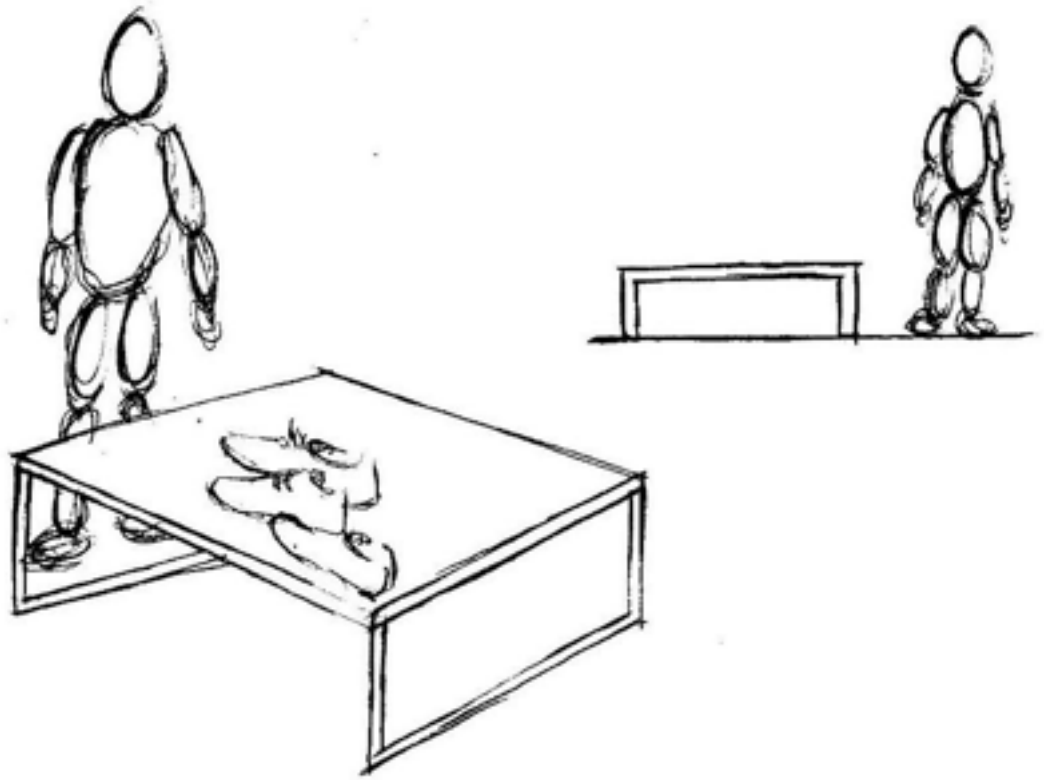
2. Normal frame (table): the height is too small to allow hanging clothes and if so, the user has to bend to take them.



3. High frame: proper user position to look for clothes (not bending) and appropriate height to hang clothes and avoid them touching the floor.



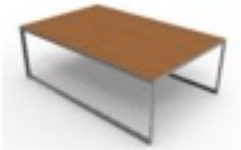
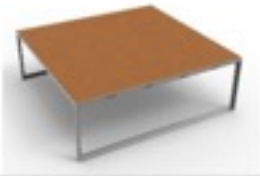
4. Low table: useful for products exposition and also to position small shelves on it.



For the accessories shop, it was considered that all furniture could be useful, since it does not need that much hangers, and shelves are used all the time. So, with the three different sizes of the selected frames, it was necessary to see how many panels were needed. It was noticed that, if the height of the normal table was twice the width of the panel, this could be used for both normal and low table. That is why the same method was applied for the high frame, which corresponds to three times the width and gives the possibility to have a bigger low table.

Following, there is a description with pictures of all the possible functions the furniture can solve, each one with the needed pieces.

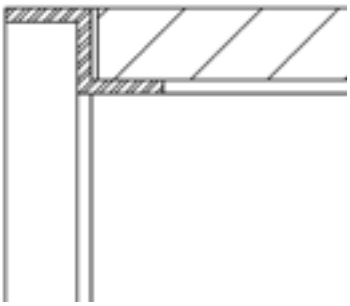
	Functions	Nº pieces	Needs hook?	Visualization
1	Normal table	+	No	
2	Shelf + hanger	+	Yes	
3	Double shelf	+	Yes	
4	Standing table	+	No	
5	High shelf	+	No	
6	Hangers	or	Yes	
7	Chair/stool	+	No	
8	Bench	+	No	
9	Small shelf + hanger	+	Yes	
10	Small double shelf	+	Yes	

11	Low table	+	No	
12	Low big table	+	No	

Assembly and transport

The assembly of the furniture is very easy and quick, and requires no connections or tools. This was carefully thought to make it more sustainable and avoid having lots of different materials and pieces. Also, it is a good thing for the transport as everything can be disassembled and stored in the best way.

Because of this, the whole frames' design was done in standard L profiles, making it possible to just place the boards on them without screws or any other fixation system. All sides are closed so the board cannot move or fall. To be able to turn the structure around and have a low table, the same profile was needed, that is why one of the borders has an Z shape, to allow putting the board on both sides. Following there is a visualisation to understand how it works:



After researching materials and determining which one would be the best considering sustainability and resistance at the same time, the choice was to make the boards with hardboard. However, to be able to use hardboard, as the thickest one is of 10mm, and 20mm are needed for the furniture, the decision was to put one on top of another. This allows to change the boards or to turn them around in case they are damaged. Moreover, if any interior wall panel breaks, this can still be reused for the furniture.

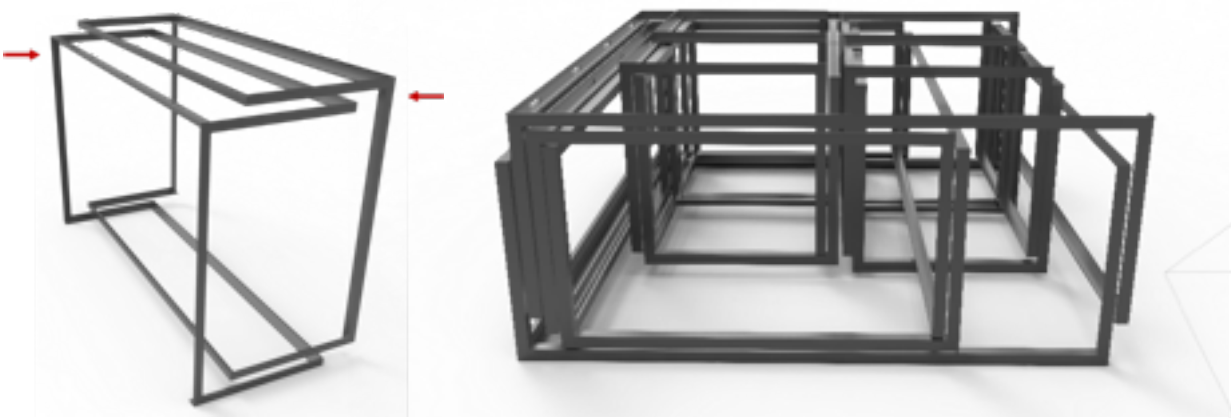
Even though this was the chosen selection, the furniture would work perfectly with any other material, as it is just a simple rectangular board. This gives the possibility of changing it any time, for example if some better and more sustainable material is produced in the future.

As for the frames, these are made of the same steel used for the standard L profiles in the industries, which give a lot of resistance and do not need to be specifically produced for this, but can be found easily in markets in different dimensions.

Storage

One of the requirements of the project is to be able to transport all one module for a shop in a standard truck, to avoid more pollution. Hence, it had to be thought which is the best way to store the furniture and how to put it in a compact way to transport it.

First of all, the idea of using a small angle to stack one into another was considered, but after finishing all the design, it was realised that this was not possible, as the angle should be very pronounced to achieve it. Therefore, another way had to be found, and after trying several options facing the frames in different directions, the following method was selected:



This consists on placing one frame against the other in opposite directions, and with this, one smaller frame can be put into the others, as seen in the right image where there is a combination of two big frames, two normal ones and eight stools. Apart from this one, more combinations can be done depending on the pieces of furniture that each shop needs to fill the building. In the holes left between the frames, panels can be fitted and also other parts for the building.

This way it is believed that it is compact enough to achieve the initial requirements.

Hanging system

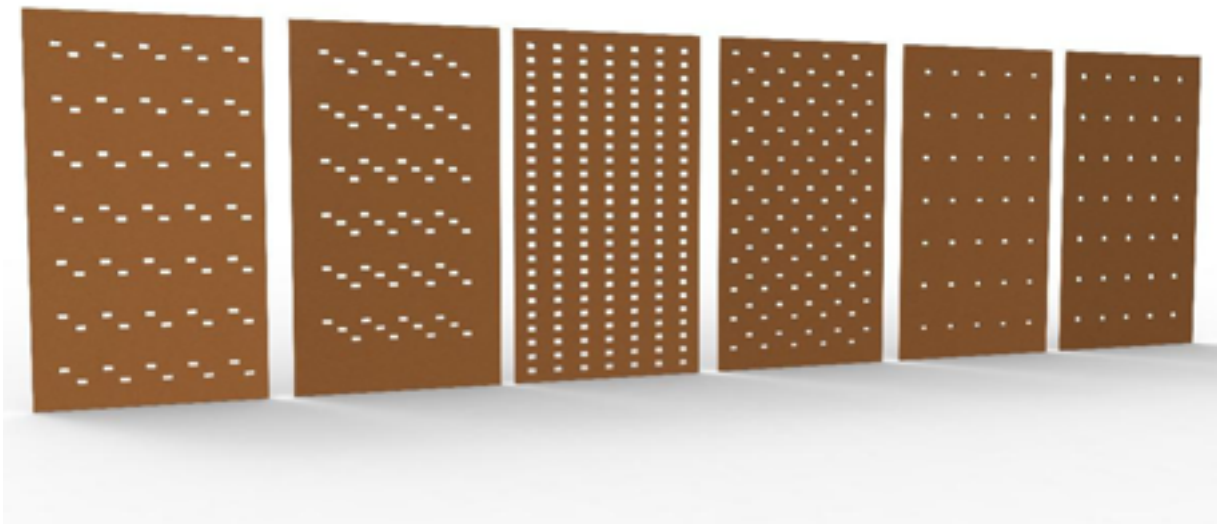
As it has been shown in the functions table, the furniture can be hanged on the wall to offer shelves and hangers, which is why a method had to be found to be able to fix the furniture on the wall, again thinking in the easy disassembly to later reuse the parts. Because of that, no screws wanted to be used or any other fixation that could damage the parts. The panels with holes are a known solution in many shops because it is easy to hang clothes and accessories and it is also easy to create a shelf from it. The many inspiring images proved the utility of these panels and gave a good solution to solve this problem.

These panels were first considered to be extra walls inside the shop that could be moved to the sides according to the needs, but this required more material and it was not a very ecologic thinking. For this reason, it was finally decided that the panels would be at the same time the inside walls of the building, solving this aspect too.

What was needed then was a hook that could be adapted to the furniture design to connect them with the panels, but first the holes type was defined. This was thought for its aesthetics so that the identity of the pop-up shop was respected, but also for a good and strong fixation of the furniture. To make sure which was a good solution different kind of shapes were compared to consider all possibilities.

Shape	Pros	Cons
Circle	Shape without edges, easy to position	Not a stable shape to hang a hook
Triangle	Strong shape, fits with identity of the building	Hard to find the proper position of the hook, sharp edges
Square	Stable shape, fits with identity of the building, easy to position	Sharp edges
Rectangle	Stable and large shape, fits with identity of the building, easy to position, more support surface	Sharp edges

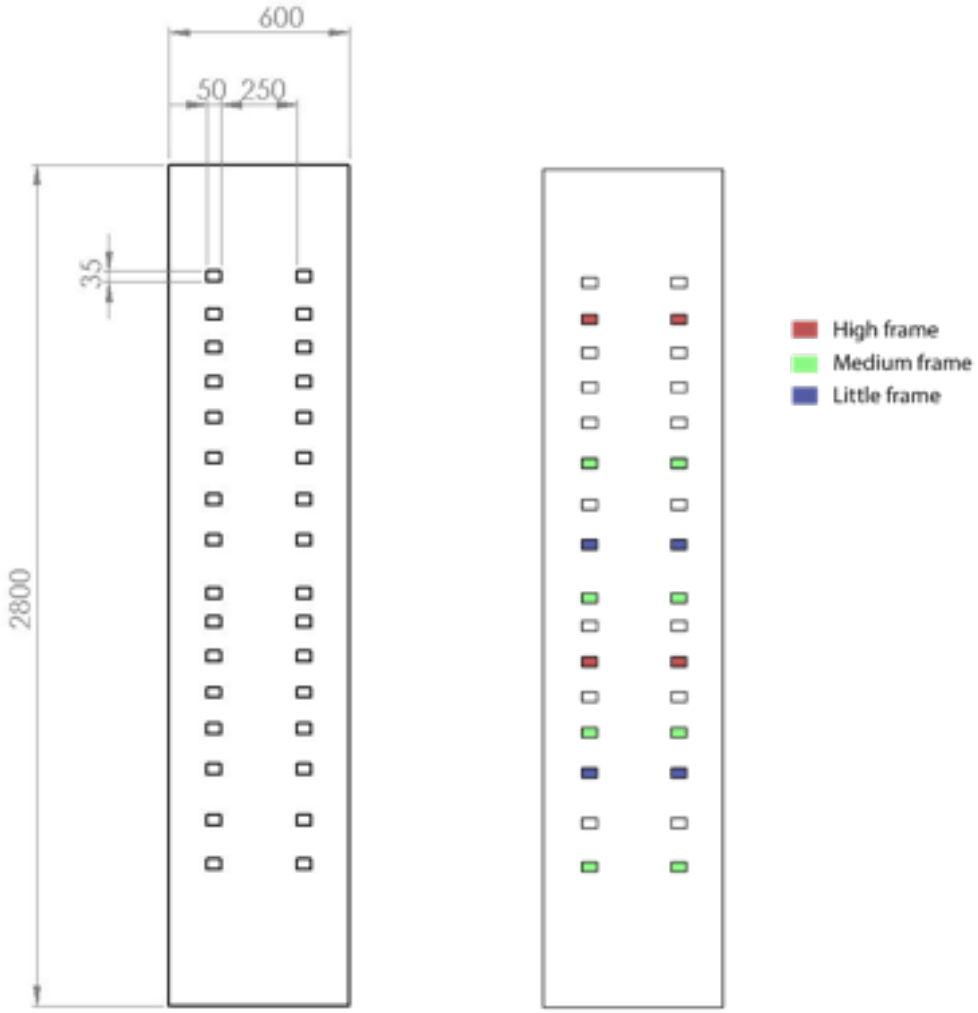
From all this possible shapes, the rectangle was finally chosen because it is the best one considering resistance matters and it follows the store identity, straight lines. Next, different patterns were considered:



However, afterwards, a decision had to be taken which only allowed one option. To be able to stack the furniture one on top of another the holes needed to be in exact positions depending on their dimensions. Each frame has different heights matching their ergonomics, which is why the lines of holes are not equally separated, but are created in order to stack until four little frames, and two of the other types.

The separation between the horizontal holes is also defined thinking of the metal frames, a study to distribute the weight of the frames was necessary and helped to define the good distance between the holes to carry the furniture in a balanced way.

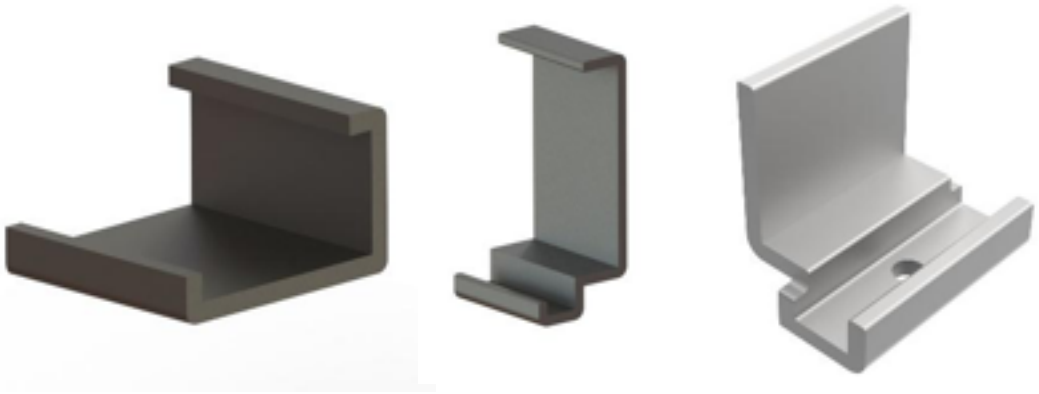
The general dimensions of the panels were chosen according to the construction method, every 60 cm there is an L profile to fix the walls, and the height of the building on its horizontal part is of 2.80 cm. As a result, these are the final dimensions for the interior panels, and next to it the heights to position each kind of frame:



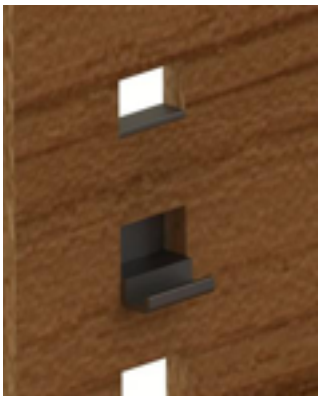
The hook that connects the furniture into the wall has to be strong and easy to use, thus its design needs to be simple. Below, there are a few options that were found, all of them have similar shapes but its usability is improved in different ways.

Because the furniture weight is pushing the hook down, it would be better if it had a support to resist it. Therefore, the idea was to make it rest on the back of the panel to have less compression on the hook. Following there are different shapes that were considered:

During the whole development of the panels and the hooks there has been some modifications to adjust them to the new needs that appeared.



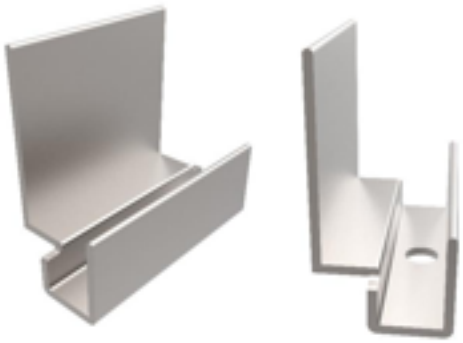
First, it was thought that if the holes were equally separated in the vertical way, the upper hole could be seized to support the hook and distribute the tensions, as seen on the right image. However, after realising that the holes needed to be in different positions this idea had to be rejected, although the vertical part could still be leaning against the back of the panel. The two first hooks showed have a longer and shorter part, this is because it was considered that the distance between the wall and the hook to hold the furniture was too small to hang any other thing. Hence, the hook could be turned around to give the possibility to hang clothes, accessories or decoration items.



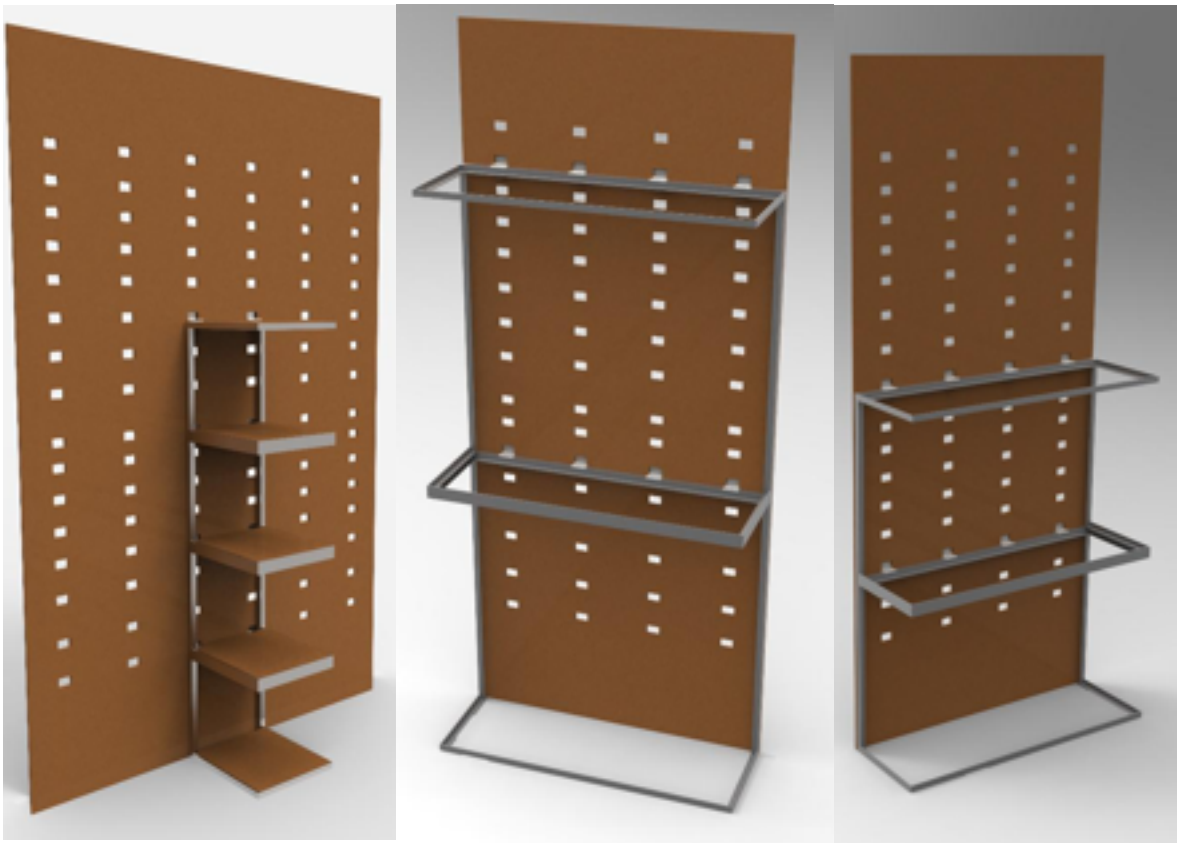
In the last one the dimensions were modified and the two different positions were not useful anymore, as there was no L shape, but it was decided that the width of the hook was enough to hang other things. Also, in the horizontal part a slot was applied, making the front wider than the part that is introduced in the hole, and this way avoiding that the hook could fall backwards when not holding anything.

In the middle of the hook there is a small hole, it was positioned in that place to put hangers to exhibit clothes; otherwise the width of the hook did not allow to hang them.

Another modification that had to be applied far ahead was making the front part higher, this will be better understood in the counter section, later on in the project, but its aim is to be used as a peg to hold the board of the furniture when positioned in a vertical way.



The functionality of these hooks when they are not holding the furniture is very varied: in the case of a coffee shop, they can be used as hangers for people's jackets and handbags but also for decoration objects or information, such as plants, posters and menus. If it is a clothing or accessories shop they can be used to hang hats, scarves, umbrellas, bags, purses, etc. As well as commercial posters, information signs (New collection, Sale, Changing rooms…) or exhibition clothes. On the next images this multiple functions can be appreciated:

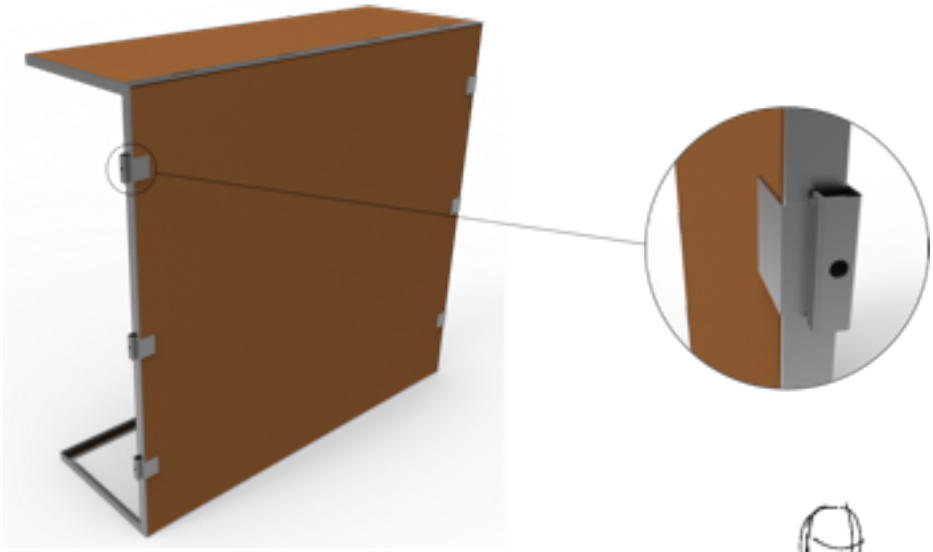


Extra requirements

Counter

As seen in the furniture list of each kind of shop, the counter was an important piece that is recurrent in every business. Thus, this needs had to be kept in mind, and a useful counter for the three shops had to be provided.

Like it has been done during the whole project, all the parts are thought to be used for different functions to avoid having to produce more and use different materials. That is why it was decided that the high shelf frame could be a good option, if it has the possibility of making it closed with panels placed on top and in front. However, the three vertical boards would fall down if they are not hold with something, so a good idea was found to prevent using new mechanisms and seizing some of the parts already applied in the shop. This was using the hooks of the panels to hang the furniture, rearranging them a little bit so they have the same dimensions as the frame (25 mm), thus they could be placed as pegs and hold the boards. Below some images can be seen showing this method and the way the counter looks like:



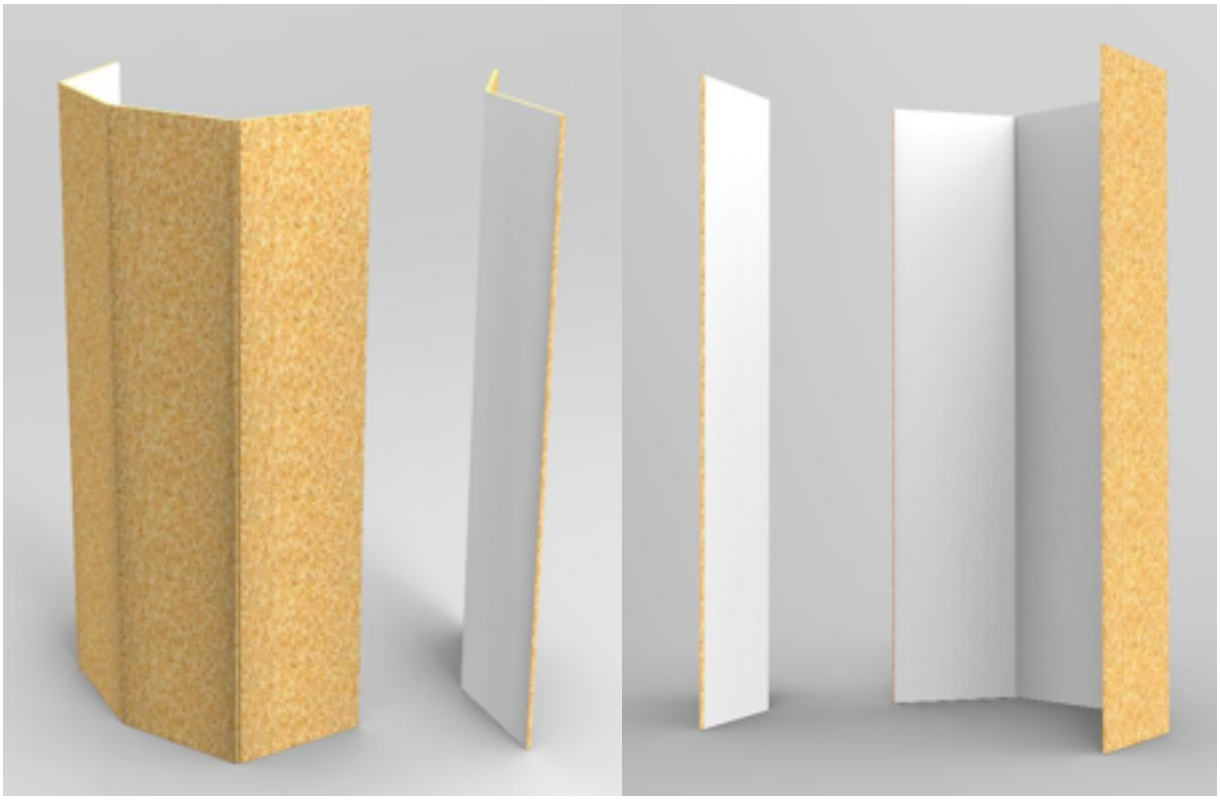
For a coffee shop, it was believed that the businesses can bring their own coffee machine or electrical appliances. Also, the space below the counter can be useful to place all the things needed, such as boxes to keep the hangers, shopping bags, etc. Behind the counter the panels with holes are useful too, as the waiters can use shelves to place the food or drinks. In the final renders (section 13) the usability of the counter together with the walls and the whole shop will be shown.

Changing room

Another piece of furniture that is essential in a clothes shop is the changing room. This was not designed as a part of the furniture, but it was considered afterwards. There are two options that can be applied:

Use the panel holes on the wall to hold a pipe with a curtain. This would be a quick an easy way to get a changing room that would not require much space.

Build a folding screen using the same hardboard or OSB panels and attaching them with a hinge. As it is a pop-up store, the changing rooms can also be temporal and change position according to the needs.



Resistance calculations

To check if the furniture is strong enough to resist the applied tensions and to validate the resistance of the hooks to hang the shelves, some quick calculations were made:

Steel hooks resistance:

$T = F/A < \text{Material's yield strength}$

Steel's yield strength is approximately of 235 N/mm2.

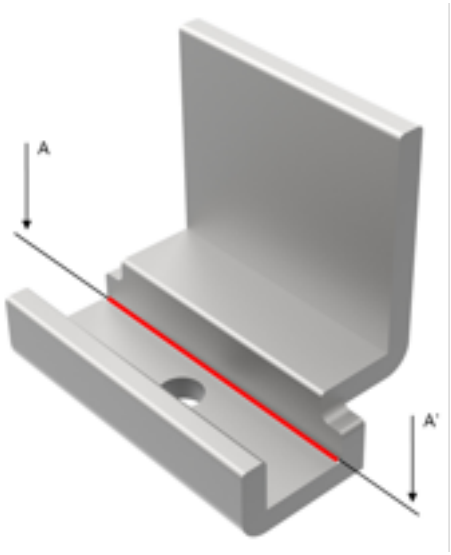
The maximum weight the hook has to support is the weight of the shelf itself plus the weight of the clothes or products that is going to hold. Therefore:

- Furniture maximum weight ≈ 15 kg

- Maximum weight of exposition products = 50 kg

Total kg = 15 + 50 = 65 kg x 1.5 (safety factor) = 97.5kg

The red area on the left picture is going to be the critic section that will support the weight of the shelf. Hooks section AA' = 2 x 60 mm = 120 mm2



T = (97.5kg x 10m/s2) / 120 = 3.25N/mm2

3.25 MPa << 235 MPa

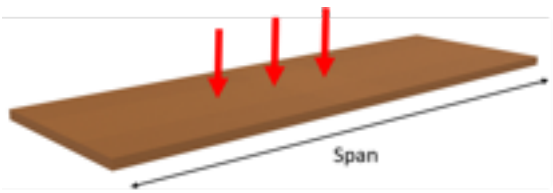
Also, considering that one shelf is hanged by four hooks, this tension would be divided by four, hence, even more, it is confirmed that the products and the shelf itself could be support perfectly.

Board span:

The design of the furniture needs to bear in mind the stiffness of the boards so they can support the products placed on them. To know if the span of the shelves is the correct not to sag, some references[8] were taken with a similar wood, particleboard, of the same thickness as the one designed (20mm), as follows:

For a shelf of 25 cm wide supporting 20 kg (typical approximate loading for a bookshelf), the maximum no-sag span is of 66 cm.

Considering the dimensions of the big board, 118.8 cm of span and 37.6 cm wide, the following calculations can be made:



37.6 cm × 66/25 cm =99.264 cm

118.8 > 99.3

As the result is slightly lower than the actual length of the board, although it was considered it would be enough, a sag calculator[9] was used to see the weight that would be acceptable for this shelf:

[8] Standard dimensions for furniture design, http://www.cawspi.org/

[9] http://www.woodbin.com/calcs/sagulator.htm

So finally, as seen in the image, a weight of 15 kg is the maximum that a shelf of these dimensions and material could support without bending too much, but considering that this is floating (only resting on the edges). In the design, there is a third support all along the board in one of the sides, therefore, the weight that it can support can be much higher.

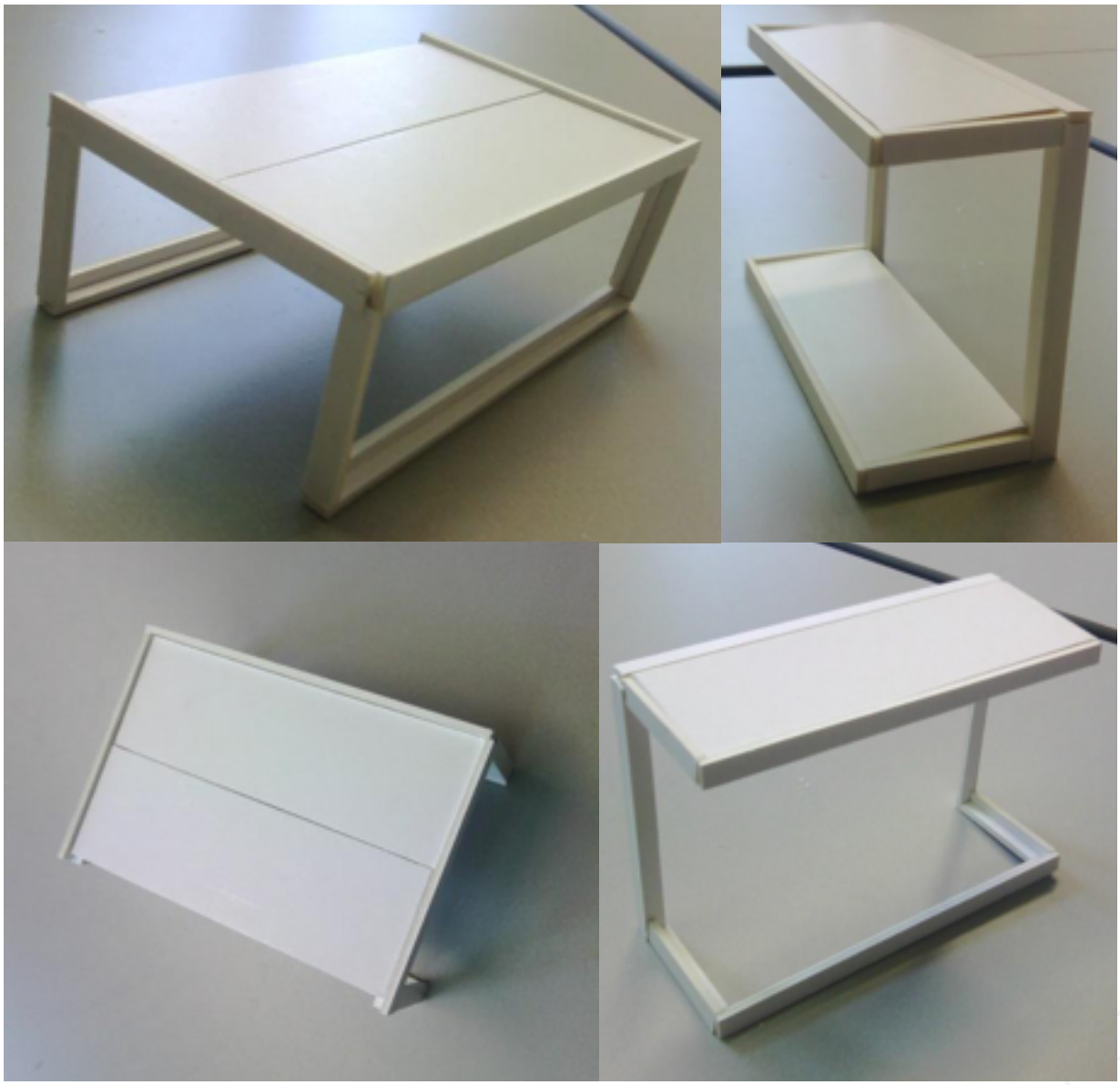
Another thing to take into account are the stools. The board on them is supported by four L profiles on all sides to have better resistance, but again, using the sag calculator with the floating option, 100 kg can be supported well enough.

For the bench, the long board is used, which has more span, but as this is supported by four legs all along, the wood will perfectly support the weight.

Scale model

To see how the furniture works and how the L profiles are positioned to be able to put the boards on both sides, and also on the bottom, a scale model was built with foam board.

Some pictures of it are shown below:



Section 10 **Identity**

As previously said in the requirements, the identity of the businesses must be applied in the Pop-up store. Different tools will be given, permitting them to personalise the interior and exterior, and making it a part of the marketing to promote their brand and ecological foot-print by using the temporal shop and renovating their own building.

Three main categories of identity were made to have a better idea of the possibilities that the shops have and choose the tools that best fit their needs. These are just examples of ways in which the identity can be applied in the building, considering its short usage, and some of them will be shown in the final renders to see how it would look like. Following, there is a list of the three groups with their options:

1. Graphic design

Exterior graphic design consists on how the business is going to promote its brand from the outside. The people passing by must see and be able to guess what kind of shop it is and also which brand. The tools provided to achieve that can be:

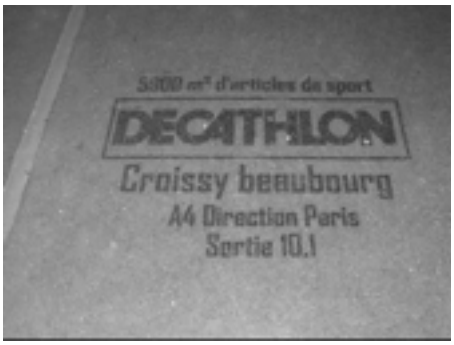
- Stickers for windows or panels that can show the logo of the brand.

Since the windows of the Pop-up store will be made of ETFE some researches about it has shown that it is possible to print on this foil or to put stickers. It can be for text as well as for textures effects.

- Frames to hang or to put promotional posters and information in the

- If there is some leftovers from the building panels, this can be used to fix the brand or logo on the exterior facade.

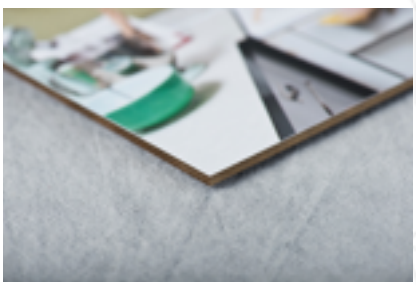
- Reverse graffiti: this consists on creating text pattern on the street floor by cleaning the shape desired. It provides curiosity, information and does not cause any damage.



2. Brand identity

Interior branding applies the same criteria as the exterior one but also influences the interior design and creates a certain environment that makes a brand recognisable. In this case, inside elements will be used as they have the advantage to be customisable.

- The inside panels give the opportunity to put stickers on it when the hardboard is covered by a glossy layer. This can be a way of putting posters, text or different colours.
- The same method applies to the furniture board, businesses can choose if they want to set their personal identity and print on it to give the same look as the building.



- The hooks to hang the furniture can be very useful to hang anything, as already explained in the hooks section: posters, decoration, flowerpots, customers handbags or jackets in a coffee shop, accessories, the menu, information signs, etc.

If the business does not want or cannot afford colour printing on the panels, there is another easier and cheaper solution:

- Led lights can create coloured atmospheres without using too much energy. The idea is to position the Led on the small space between the insulation and the inside panel, making the light come in through the holes.

- Lighting can be also used to project texts on walls or objects from a projector and have cool effects; it is usually seen on expositions and commonly used for alarm clocks with Led to project the time.

- In case there are no holes panels and no way to hang posters, a roll up banner can be requested. This object is small enough to carry and transport easily and only requires printing posters. Roll up banners can be set everywhere and stands by itself independently.

3. Marketing

A final aspect that is going to be applied in the Pop-up store, is the possibility of showing the customers how the business is changing its mentality and becoming energy efficient. People are starting to like eco-friendly thinking and they feel well when they know they are contributing to the environment. This is why it is a good option to get clients involved in the project and attract sustainable aware people. To do that different options were thought:

- Use eco-friendly customisable bags: the brands could print their logos on it and on one of the sides the eco-friendly part of the project could be showed.

- Another good idea, is to put somewhere in the Pop-up store an explanation of the whole project to understand the reasons of the store. Also, maybe some screens showing how the buildings is made and explaining some energy efficient matters with videos.
  During the test for the building validation, some questions about this were asked, whether if they came to the shop they would like to read this information. They mostly answered that this should be in the entrance and very graphical, not too much text, but that it would be interesting. Videos were well appreciated, and an idea was thought to put this sustainable promotion using stickers on the transparent wall between the two doors.

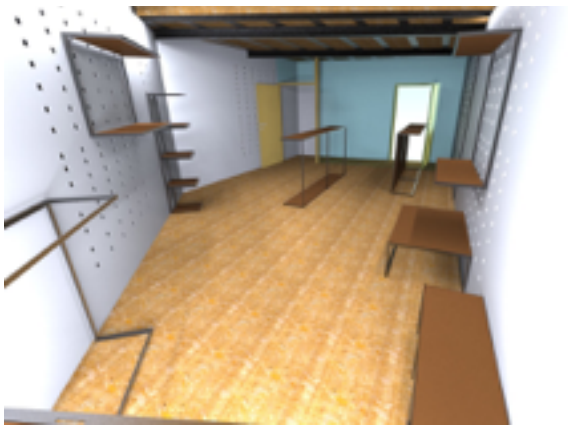
What is more, outside the building there should be some poster explaining the meaning of the Pop-up store and inviting the customers to go in.

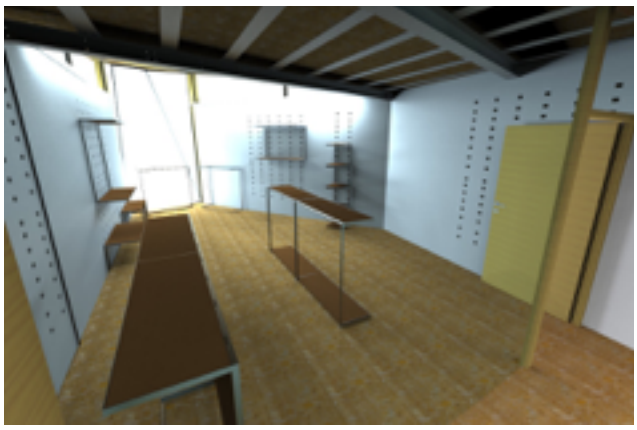
Some of all this tools will be shown in the following section, where it is appreciated how the brands adapt their identities in the Pop-up store.

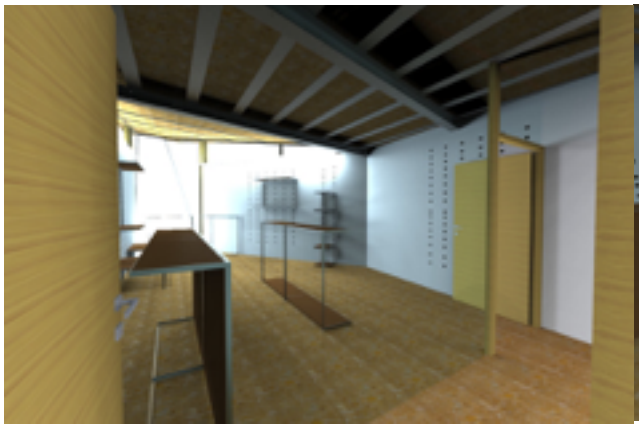
Section 11 Visualisation & Final Renders

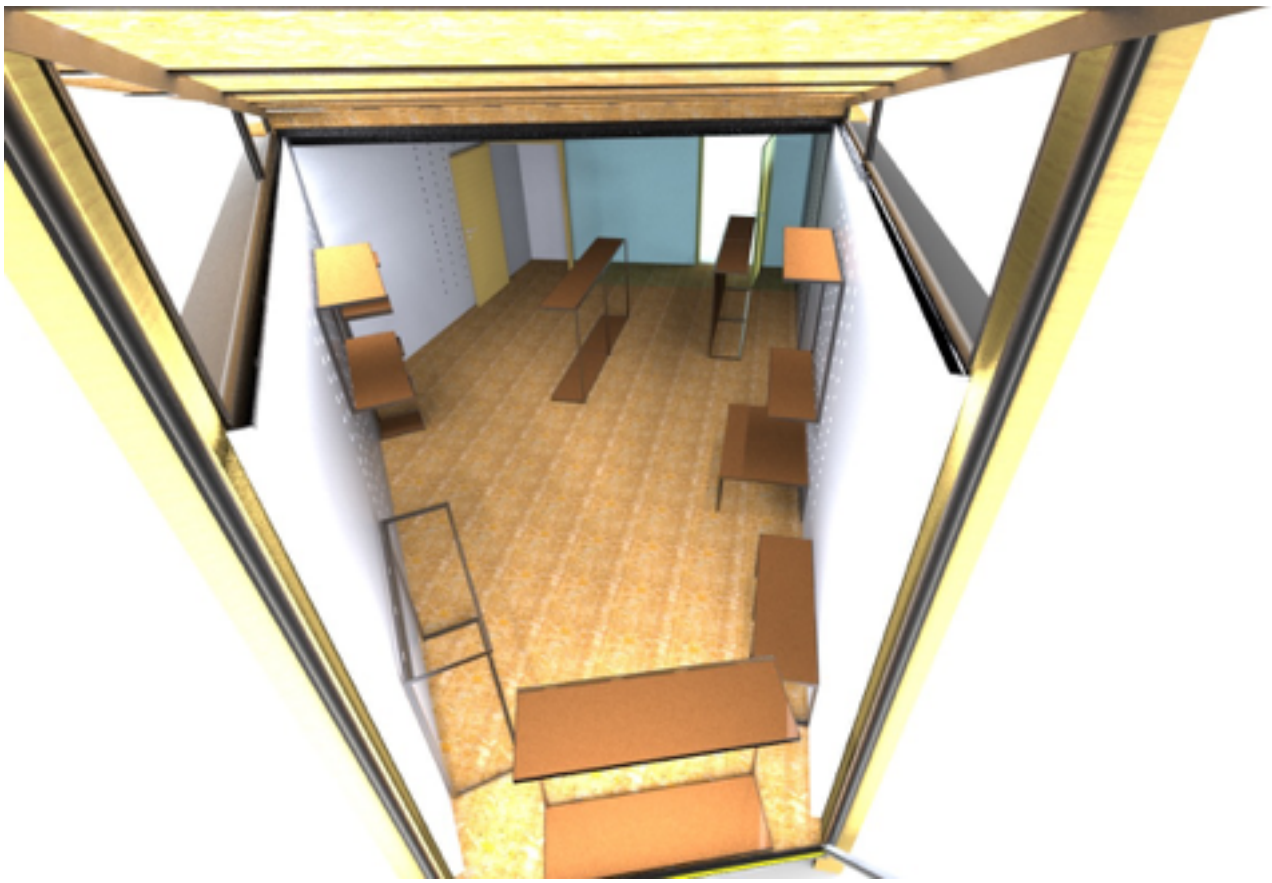
Once all aspects influencing the whole design of the Pop-up store have been defined, a final visualisation of all the parts implemented together could be made. Therefore, following there is a selection of images showing how the principal issues of the project were solved, more specifically:

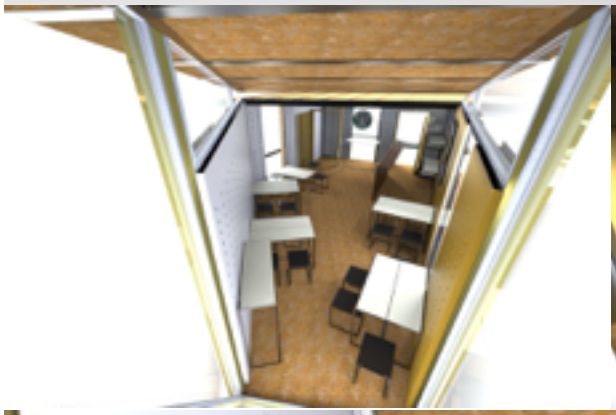
- How the building looks from the outside with all final materials and parts
- How the building and furniture are integrated together
- How the furniture solves all functions for the different businesses and how the interior distribution can be adapted
- How the identity tools for different brands are applied, both in the interior and exterior
- The building and furniture's usability
- How it is integrated in the Meir and Antwerp's environment

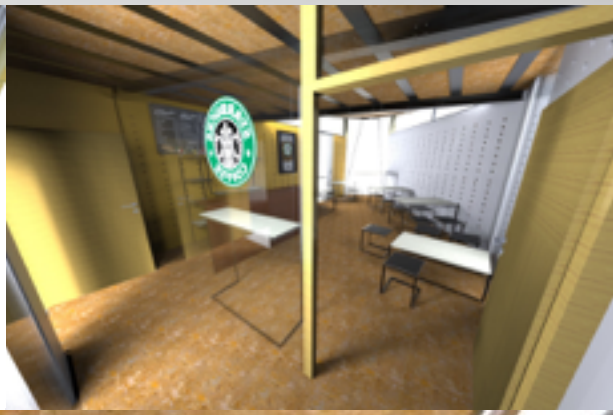













H&M


H&M

Section 12 **Cost estimation**

After defining all the Pop-up store, materials, pieces, dimensions, etc., it was time to calculate the costs so the estimated rent could be found, and it could be verified whether the whole project is profitable or not. These costs have been divided in different parts: the fix costs, all the materials needed and production parts; the variable costs, construction and labour costs; and finally the user costs, which is what the businesses will have to pay if they want to rent the Pop-up store.

In the materials part, the production costs are also considered taking into account the workers' salary and the time taken to manufacture each part. This is calculated with average references, taking a salary of 2781€/month, and considering that a panel takes 15 minutes to be completed and the windows cutting one day.

In the user costs is included the rent price of the space for one year, the transportation to the desired location (counted twice in case the Pop-up store is used for two different businesses, six months each) and the energy supply. This gives a total of around 15500€, which is considered a good rental price for the companies.

Apart from this, there is a cost that would have to be equally divided by all the times the Pop-up store is used without being deconstructed. This is the cost of building and assembling the store, which is nearly 5000€ more, calculated with five workers and three days of work. However, considering that for example, the store is used five different times without the need of disassembling it, 1000€ would have to be added to the rent price, which would still be a good price to make it profitable for the businesses.

Material costs

Account	Amount	Price/ €	Labour cost	Final price
WALL				
Metal beam	6m	80,90		21357,60
OSB/ m2	1 m2	4,26		1298,43
Wood fiber	2,8 m2	48,77		1072,94
Wood beam	63mm*160mm*3m	15,67		2507,20
Hardboard	1 m2	6,50		416,00
Eco sheet	2440mm*1220mm*18mm	64,47		1482,81
Screw	1 st	1,99		1910,40
Natural rubber	1000mm*600mm*6mm	49,99		5698,86
Steel pipe	60,3mm*4mm*12m	155,00		310,00
Wood pilar	150mm*150mm*1m	13,56		230,52
			2663,766	2663,77
FLOOR				
Metal beam	6m	80,90		10678,80
OSB	1 m2	4,26		736,98
Wood fiber	2,8 m2	48,77		634,01
Wood beam	63mm*160mm*3m	15,67		1222,26
Ground beam	100mm*100mm*1000mm	5,35		256,80
Screw	1 st	1,99		1194,00
Natural rubber	1000mm*600mm*6mm	49,99		3649,27
			1621,09188	1621,09
WINDOWS				
ETFE foil	100µm	16,94		592,90
Pump	1 st	973,56		973,56
Steel pipe	6m	149,00		1043,00
			761,076	761,08
ROOF				
OSB	1 m2	4,26		225,78
Wood Fibre	2,8 m2	48,77		926,63
EPDM	1 m2	12,57		666,21
Screw	1 st	1,99		398,00

			205,49052	205,49
DOOR				
Front door	1 st (2040mm*1200mm)	395,96		791,92
			761,076	761,08
Taxes	21%			13920,35
TOTAL PROJECT COST				**66287,38**

User cost per year

Account	Amount	Price/ €	Labour cost	Final price
Rent of the space	35m2	875,00		10500,00
Cash register	1 st	345,49		690,98
Transportation	1 truck	955,00		3857,50
Electricity/ energy	4000 kWh	0,14		568,80
Taxes	21%		3279,6288	3279,63
TOTAL PROJECT COST				**15617,28**

Assembly cost

Account	Amount	Price/ €	Labour cost	Final price
Labour cost	1 h	23,49		2818,8
Transportation	1 st	955		1928,75
Taxes	21%		996,9855	996,9855
Total project cost				**4747,55**

Conclusions

It has been realised that it is really expensive to build a sustainable store because of the difficulty of finding 100% ecologic materials, and what is more, these are usually more expensive. For the energy part, it is also hard to be efficient with cheap systems, such as passive energy, because although technologies for achieving this goal exist, they are very expensive and need a long time to be profitable.

Thinking from the businesses perspective, the Pop-up store helps them continue with their sales meanwhile their building is being renovated, which can take between three and six months. Therefore, if the earnings made during this months are calculated, taking some references as examples, it is seen that the use of the Pop-up store is profitable, and that it will avoid losing profits and also clients. Plus who knows, it can attract new customers as well.

Section 13 **Conclusions**

Once the project has been finished, the results can be analysed and it can be verified whether the initial requirements have been accomplished.

First of all, it has to be mentioned that the final solution for the Pop-up store offers a good flexibility and modularity, allowing the brands to adapt their identities and also to arrange the space in the way they need. It is considered that all the needs for the three chosen businesses (clothes, accessories and coffee shop) can be satisfied, thanks to the multifunctional furniture designed and the possibilities that the building offers, such as different sizes and dispositions.

An important feature that has been very challenging, is the design of a sustainable and energy efficient building. It was proved that for a temporal store it was not profitable to use very expensive technologies to make it 100% eco-friendly; this reason is why energy passive systems have been applied as well as a focus on not losing energy instead of producing it. With this, the final results may not be totally efficient, but because of its characteristics it is considered the best way to carry out the project.

The materials have been selected taking into account the sustainable matter, on one hand, the function they have to fulfil, and on the other hand, their possibility to be reused or recycled later. Firstly, it was planned to calculate the Eco labels of each material, but at the end it was not possible to make such deeply accurate calculations and thus this was discarded.

Also with sustainability in mind, the whole design was done thinking in its easy disassembly and transportation, achieving a construction method where all elements can be quickly separated without any damage, making it easier to reuse the parts in the future.

From all the research, some reflections can be done. To start with, this was a big scale project which was carried out with a limited time; because of this, some parts were only developed to a concept level or were not deeply defined. However, all the decisions have been made in a way so the design can be modified or improved in the future.

Another issue is that it is very difficult to make a fully sustainable product, because the materials are not 100% ecologic, as they always have some finishing or they are produced with glues. Moreover, many materials with good properties that are also ecologic are quite expensive, as well as technologies to make the building self-sustainable. Because of this, it is believed that in the future there will be better solutions to outweigh the financial cost with new eco-materials.

Section 14 **Reflections**

Agustín Castiñeira Fernández

This semester has been one of the best in my life. There were many positive experiences related with the Erasmus Project Semester (EPS) and also with the fact I am living in Belgium. But in the other side there were some disappointing moments.

The EPS programme had two different sides for me, one of them was de academic side, which was probably the one that made me feel sometimes disappointed. The enthusiasm I arrived with in the first weeks crashed into the wall of the assignments, the full schedule, the absence of stakeholders and, in our case, the non very well defined project.

Even so, there were some interesting concepts in the classes we get. For example some management techniques and life advices from Philippe, some cross media tools, or some educational researches from Stephen. From this lessons I obtained in some cases also the motivation from the teacher, for me there is no better motivation than a motivated person.

The other side is of course is the human experience with all the students, teachers and supervisors. In this case mostly all I have to say is positive. I was in Antwerp also the first semester attending the regular course and I can see the huge difference in the people's behaviour. The EPS programme mix the Belgian students with a lot of nationalities, and it make the people to be more open. Of course meet around twenty five students from many nationalities every day helps you to be more open to the different cultures' perspectives.

Thinking about my specific project and team there are some important things I would like to say. The first one is, of course, I really enjoyed the experience. But while passing the weeks I have realised that the result of the project is not similar to the result I was expecting the first days. Sadly I have to say that the project itself is less developed than I would like to, and I feel that the main reason is the knowledge of some of the participants in the team. In my home university my international coordinators help us to be prepared, they push us to study English, to take a look in our last projects and to prepare a good portfolio. All this make you be confident and try to do your best. And I could not perceive that in some of the people in my team. But far from look at this as a problem, I tried to see it as a challenge and face it by applying managements concepts and get a good experience motivating the team.

All this managements methods have been one of the main things I learnt this semester in the academic field. As a person, I learnt how to interact with people from different cultures speaking in English, to see how important is the way the people communicate into a team and the big difference in the results you get, and I learnt to enjoy my life in many different ways.

As a conclusion, I think one of the valuable things in this programme is exactly the things that probably everybody is complaining about. The real life is not as the student life. The projects are never well defined. The schedule is always full of things to do. The comprehension of the rest of

the people is crucial to succeed. Everybody is not able to do the same things. The problems should be understood as a challenges... this project semester prepare the students for the real life, it gave us an introduction to our early future life.

Arjen Timmerman

The explanation they gave me about EPS(European Project Semester) was, a project for a company with an interdisciplinary team of students from all over Europe. The result was, an awesome project without a company but with a super cool team. So the start of the EPS was partly good. At first we weren't aware of the problem of not having a company. But after some classes the teacher told us we had a problem for our requirements. We as a team managed to produce our own requirements and from that moment on we could start where other groups had already started from. We had a bit of a false start, but it turned out to be ok.

We have some really good and enthusiastic supervisors, who help us a loth throughout the project. They have a lot of knowledge about sustainability and construction part of building a building.

If I look at the EPS so far(midterm), I can reflect about the EPS as following: The projects that were introduced at the beginning of the EPS were really cool and promising. Working with people from other countries is a really good experience and I would certainly do it again!

There is one aspect, where I think, the EPS fails. The information they want to give us with the classes are interesting to a certain extent. The part where the classes lose their value, is where they only give information to the students and give us an assignment. They don't use the class to add value to the project. And most of them don't help us with our progress of the project. They only slow us down and distract us from our project. This I find really disappointing because my team and me are/were really motivated to work on our project. Don't get me wrong, there are some classes/subjects that are really interesting and useful for the EPS, but the way it's given now, is not the way I think it should be done.

After the easter holidays there was a "slight" change in schedule. The classes disappeared and there was time for project work. Finally we could start to work on the project. And the funny thing is, from this moment, our supervisors got the idea that we found our motivation for the first time. While in the beginning of the project we we're really motivated to start. But because of all the classes we totally lost that. Which I think is a real flaw of the organisation of EPS. This perfectly shows the major problem for the organisation, in my opinion. The communication to the different parties is very bad. We got a 10 for the "assessment by supervisor" and we discussed it with our supervisor. The worst part of the justification was the motivation..... We talked about it and I understood their point of view, but I totally disagree with the 10 and especially with the motivation part. We we're working really hard in the beginning of the project, to use the little project time we had, to get some good results. The only way I can explain this is, lack of communication. If our supervisors had known about how the schedule was, they could have changed their expectations and gave us a grade that would fit our work. If I would have

known that I would have gotten a 10 for my assessment by our supervisor, I would have worked for a 10. I really feel bad about this part..

Enough about the 10! I really enjoyed the EPS!! I had a great semester! There we're so many nice people with a lot of positive energy. I improved my english just by speaking with other people. Words I already knew, but I forgot about, came back to me. I would like to go abroad after this bachelor, so this is a really good aspect about this semester.

I even went to Spain with one of my group members! This is something that would't have happened if i didn't join the EPS program. I would definitely do it again!

If I look at my own work in a team and with this project, I am pleased with myself and my work. I'm not the most punctual guy, but I try to do my work the best way I can. I'm easily distracted, but sometimes it gives me new inspiration, so it can also be a good thing. I know my flaws and I'm working on it. The first step of changing something is to know it's there. After that the only way is to keep trying. Overall I think we are a good team that can inspire each other and work together in a pleasant way.

I learned a lot about myself during the EPS. How I work in a group, what happens when the deadline comes close, see how other group members use their skills, get inspired by other members, learn and get inspired about your own life and how to live it!

I would really like to thank the people who made the EPS possible! Please use my reflection to improve the EPS and don't feel bad about things that weren't perfect!

Maria Vakkuri

The whole EPS (European Project Semester) is a really nice way to work with people from different countries and fields of studies. For that reason, you can get other perspectives on how to see things and work in different ways, as well as improve your skills and learn something new. Teambuilding is important, getting to know the members well and to trust them makes everything way easier. It is easy to share information and the more time the team spends together, the closer it becomes.

I think my contribution to the project is to be a team worker, I am really honest and conscientious person, that is why all the tasks I get I do them well and try my best. I have a bit of experience in project work from previous school, so I have an idea of how to deal with a team, but my studies are not directly related to this project and therefore I could only be fully involved in the calculation part, which is the closest to my field, and some materials research .

I am not a very good performer and I always feel stressed before the presentations. In the EPS we have many presentations so I hope that I could get more confident by practising. In this case I knew that my weakness is my English and I really wanted to improve to have a good level, so I do not have to think all the time what I am saying. In the beginning it was hard to be myself because I was unsure about my English and scared to say my opinion if I could not say it right. Of course, everything depends on yourself but still it took time to manage that. From my point of view my English has improved from the first day until now, I can speak more fluently and

be relaxed in a conversation. I do not try to be perfect in this language, as I know myself and one spring is too little time to do that. I try my best and hope it is enough for everyone.

After the midterm presentation the actions I took to improve were to justify and make arguments for every choice the team did. In the midterm presentation and before that, we had lots of good ideas but did not give enough arguments to explain why the choices were good. During the first weeks we had many classes of different subjects which interrupted our working time/ possibilities. We had a lot of assignments which we had to do and hand in before a deadline, and these hours of working were out of our real project time. And for my English I watched more films and read a book in my free time (as much as I had).

My opinion about the work process is that our team has worked really hard. In the beginning, we worked more together but after the midterm presentation we changed and spilt our team into three, so we could be more efficient: one pair worked on the furniture and the rest two worked on the building definition. Depending on the situation, we worked during the weekends if it was necessary. My opinion is that the achieved results are very good, we accomplished all the requirements that we initially established. The project was not the easiest one, as the topic of the project was not defined that accurately and we had a huge scale of possibilities to do.

My biggest intended point of improvement on a personal level was my language. One of the reasons why I came here was English, and it is improving all the time, which is good. Our project is a design project, which is not exactly the same as my studies, so my areas of expertise are more on the calculation aspect, the economic part of the project, thus I try to teach some little tips/ things to others. We split tasks for everyone and each of us has to do their own part properly and on time. Every one works in a different way, so it would be nice if others can get some good tips from how I work as well, give more feedback to others, tell them my opinion and how they can continue their work, but of course vice versa.

In conclusion, this project is a really good experience thinking about the future, and it might help me getting a good job.

Melissa Colot

This EPS is a really interesting programme for people who want to discover, learn and develop new skills. As expected we all got groups and a specific subject to work on during five month. It is always a little bit scary to have a team project because you never know with which kind of people you are going to be. In my case, I am quite grateful to be with people who have interest in what they do and who have the wish to accomplish a good project. It is also interesting to get to know people from abroad but above all, to learn how to work with them. Because there are six members in the team, there are many ways to get richer from the knowledge of the others which is good in the case of my studies, and helps me to become more curious and more polyvalent.

Of course, we set goals and we work hard to reach our final project and to do so, we need to divide the work and contribute to it with the skills we have. I want to contribute to this project in many ways, but because of my skills and expertise in different domains, I decided to focus more

on the design of the furniture, the sketches, the 3D modelling and the report. As a team member I am open to all other kinds of tasks from which I could learn and get experience and somehow, we all do. While working in a team, I am usually the one who reminds the others how far we are in the project and what needs to be done. I am conscious of the amount of work and I do my best to get it done before the deadline. It is challenging to be flexible with everybody's way of doing but at some point, we need to find compromises to have a proper way of work as a team and not as an individual member.

So far I got a lot of information from different kinds of subjects with the lectures and classes we have been following. Some of them are more interesting than others since not all of them concern our project but I keep in mind that it might be useful in the future for other projects. I am glad we can also improve our English by speaking with the team, making presentations and having English classes. The writing assignments are not always useful or interesting; nevertheless it helps me to improve my writing skills.

I have the feeling that the real project only started after the Midterm Presentation which is when the various lectures finally came to an end. Afterwards, we could really spend time thinking about the project and see some progress of it. That is when the team members actually had to improve their knowledge and working skills. To be more efficient, the team was divided into duos and each of them had specific tasks to accomplish. I believe this decision separated the team somehow, but I do not see how all this work could have been done otherwise. As always there were harder times because a lot of aspects of the project needed to be justified and it slowed down the working rhythm. Nonetheless, we might have worked slowly but we never stopped and that is the main part to keep in mind.

Since I am a perfectionist person I found it frustrating to have to adapt myself to people's timing. Patience is not part of my qualities but I tried my best to keep calm because I think it is part of a team project to stay diplomat and to put aside your personal thoughts and emotions. I also got frustrated with the grades. A month before the end, we finally got a summary of all the grades since the beginning of EPS and the results were quite disappointing. We all are aware that the grades in Belgium are usually low but still, I do not like to get grades without any justifications. By doing that, I cannot improve myself because I do not know what I did wrong, and therefore it is quite useless. We did all the assignments following the criteria of each of them and asking questions to the teachers, but still the grades were not higher than 13/20. Then the question I wonder is, how is that supposed to motivate us?

However, I enjoyed sharing time with amazing people from my team and others. I liked the cultural richness of the group and the fact that local people got to integrate the foreigners' group. It is also enjoyable not to have exams, firstly because it allows spending more time on the final project and because it is less stressful.

Our project was a good challenge and I think we managed it in the best way we could. I am sure everybody learned something new and gained some experience. I hope everyone will go back home with good memories because one thing that I am sure about is that I definitely will.

Núria Vilarasau Creus

he most valuable aspect of the EPS in general, from my point of view, is the fact of working and having contact with so many different people from different study fields, culture, language, habits, tastes… Thinking of my studies, Engineering in product design, this experience is very enriching because we need to be open-minded, learn new things and try to see the world from numerous perspectives, so this helps us with it.

I enjoy talking a lot with other people about design and ways of perceiving it, I have noticed that each of us looks at it differently and has learnt similar concepts but in many diverse techniques and methods. This is something very positive, I believe, therefore we can learn a lot from each other and see in which aspects we need to improve, though also realise that we were not that bad at doing something. I am also discovering that I may be interested in things that I did not know before and I become more motivated in improving and deepening in my skills even more.

I think my contribution to the project starts from the coordinating point. I have by nature a skill to manage things and organise quite efficiently, and I think people sense that when starting working with me, in the way that they choose me, without realising, to be kind of the guide of the project. This has always been more or less the same for me at my former university, but here the paper has changed a little bit in the way that there are other members in the group who are also good at this role and so this task is evenly distributed. I appreciate that so thus I can practice to be involved in other roles and improve some skills or maybe acquire new ones. It is as well a good way to change my manner of working and my habits totally, challenging myself and making myself more flexible.

As a product designer I have some contributions to the team; although there are three more product designers (two of whom are also mechanical engineers), each of us has very different skills and perspectives. I can bring some creativity in the ideation process, attention for the details and some realistic thinking when taking into account the manufacturing process. I am also a complete finisher, this means that I am very hard-working and perfectionist, and will spend as much time as needed to complete a task until there are no mistakes and everything is correct.

After the midterm presentation we got a good feedback that made us improve a lot in our project. We realised we were not being efficient and that we needed to justify our decisions and have arguments to discuss them, which is why we have been progressing much better. There is just one thing that I have missed, which is the group has split in three and the tasks have been done separately, a fact that was not very good because we did not know what others were working on, and what is more, we have wasted time waiting for some definitions to be finished before we could continue with issues that were influenced by that.

Another restriction that I found in the teamwork was the communication, not only from the language aspect but from other abilities. There are some members that have a lot of initiative and give their opinion at all times, they know what they have to do and collaborate in anything possible. Meanwhile, there are others that do not dare to do a task without others approval and

do not participate that actively. Finally though, the result has turn out very successfully, as some of the team members have been working very hard to put everything together and make it work.

Thinking about the schedule we have had during these 5 months and the overall organisation, it has to be said that the EPS programme needs improvement. It is impossible to carry out a big scale project when there are too many assignments to hand in and many weeks full of classes and workshops. Some of these workshops have been quite useful and we have learnt from them, however, they could be better related to the project and help in its development instead of taking time away. Therefore, I am a bit disappointed with the system's coordination and I expected better results even though the whole experience has been very positive.

Paula Piotrowska

In my opinion, the main purpose of the EPS is the possibility of meeting and working together with people from various fields of study, people with different languages, cultures or habits . Working with people from other countries or places generally, let us share the different points of view or improve our skills by learning from each other. Each of us see things at variance, even if it is about the same thing. Erasmus teaches me how to live on my own, far from the family and the things I know. It is a great opportunity to learn a lot of new things, self-supporting and make new friends from all around the world.

I really liked working in a team. I did not really have much experience with it before, only like two persons maximum. Here I have six people in my group including me and I noticed I am more efficient when I work together with them. It is a big pleasure for me. These people are really helpful, honest, kind, cheerful and really motivated. My contribution to the project is mostly based on the design part since architecture is my field of study. I could be useful in graphic work, drawing, 3D modelling and making visualisations after. If there are more things that need to be done, I am ready for the new experience. By working together with my team, I learn a lot about teamwork. By dividing tasks to every person in our team, we get an opportunity of joint responsibility of the project. Every person gives their own ideas or possibilities to the project which makes it much more interesting. Working in a team has taught me that everyone is responsible for the final project of our final product which can be got by working together.

I enjoy the pop-up store concept project I have been working on since the beginning of the semester. It is closely connected to my field of study. Because of this project which is focused on design, I have learnt and realised a lot of things. Mainly, how to design a building from the beginning including justification for every step of the design process. I am not used to this way of designing a building. In my school in Poland, we do not really focus on the justification of everything, it is more like we do what we like including the idea that the building has to stand. Referring to this, I realised it was a wrong way of designing things. I think it is better to know what am I doing and why, than just because I like it. I am sure it will influence my carrier in a good way.

I have also learnt many other, useful things during the EPS. With assistance of my group and lecturers, I learnt new software, new ways of doing things like for example digital painting. I have

found it really nice and entertaining and I am sure I will carry on improving my skills in this area after coming back to my country. It might be really useful for my studies, carrier and in my private life as well.

I am a really bad performer, I cannot get over the stress. Fortunately, all the presentations which have to be done for our project, let me improve my skills and I think, I am slowly becoming more confident.

The main disadvantage of EPS is that we have too many other activities, classes which require attention. We have a lot of assignments. We spend too much time on other things instead of working on our project which is not good. Because of that, we cannot do the project as good as we want using the time left between the classes. Despite of this, we give the best of ourselves.

My English competences are getting better and better by using the language since I am living in Antwerp, Belgium. I learn new words everyday by talking to people about anything that comes to my mind. I am also removing the language barrier by using the language all the time. English became the main language when I start a conversation. My English competences which I gain during the EPS will bring a lot of benefits. I will be able to not only realise my architectural project in my country where I come from but also internationally. Despite of this, I will be able to gain inspirations and technology news to my work from a variety of websites not only in my mother tongue but also English.

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Section 16 **Annexes**

Usability

Users' description

Customers →

According to the dictionary, a customer is a person who buys goods or services from a store or business[10], that is why it was considered that the customers for the Pop-up store are people who have an income (temporal or fixed) and thus they can afford to buy its goods. Their age is comprised between 16 and 70 approximately.

However, the gap between this two ages is very big, which means that there will be different necessities and ways of using the shop, and therefore the usability will be adapted depending on the kind of products sold. (Ex: a shoes store for adults/elderly people will have a different usability approach than a clothing shop for teenagers)

Knowledge:

There is no need of a specific knowledge to shop in the Pop-up store, the only general requirement is to have basic notion of how to look for the products you need, the price or sizes, etc. (which is information also given in other stores and which can always be asked to the staff).

This knowledge does not have any impact on the usability of the building or the furniture (Pop-up store project), but only on the products itself, which will vary depending on the business. We consider that it is not our responsibility but the shop owners one.

Shop owner →

The age of the shop owners does not have to be specified but they are people who own a business and are willing to rent the Pop-up store for their sells. Therefore, the age does not have any impact on the usability of the store. However, the kind of business does: the furniture will have different usability for a café than for a clothing or accessories shop, in that way it can be considered that the shop owner will have an impact on the Pop-up store.

Knowledge:

Some people, specially the younger ones are more passionate and motivated which makes them into trying new things although they may not have a good knowledge of businesses. On the other hand, older people are more experienced which makes it easier to open a new business or continue their already existing one. This means that no explicit knowledge is needed to use the Pop-up store but only the already needed to run a business: management, marketing, commercial notions…

[10] Oxford dictionary

In this aspect it is believed that this knowledge will have an impact on the usability of the identity tools and the disposition of the furniture. A professional seller will know how to present the products and how to use the space to attract the customers and sell more; meanwhile a non-experienced one will require more intuitive tools to achieve the same goal. This is why it is needed to pay attention to the usability of the whole Pop-up store.

Needs

The shop owners will need a place to continue their sales while their main shops are being renovated. This place will have to be profitable, which means it needs to be cheap to rent and help not to lose clients. The selection of materials and construction method will influence in the renting cost, and the usability of the building, whether the customers feel comfortable buying there, will influence in the income of clients.

The business requirements will have to be implemented in the Pop-up store to make it useful and to allow to sell all kind of products as well as identify the brand of the business placed. The usability, therefore, plays an important role in the design of the Pop-up store, specially in the furniture, as this will be used differently depending on the type of shop: the same piece of furniture will serve as a shelf or hanger for a clothes shop and as a table for a café.

Functions of the product/service

The main function of the pop-up store is to provide a space to keep selling the products of a business during its renovation. It also helps to show the customers the compromises the shop is taking to become environmental friendly.

One of the services of the project is the modularity, which means it can be adaptable to different kind of shops while integrating the identity of the brand/shop, and the size of the store can also be flexible. The purpose is to attract the clients with the promotion and the awareness.

The pop-up store will be considered successful when any kind of business that would like to rent it, can satisfy all their needs with the tools offered:

Their identity is well represented and the brand can be easily identified.

The furniture solves all functions needed (shelves, hangers, sit, etc.) and the space is well distributed to allow a good customers' flow.

The building provides a good shelter of rain and wind, it insulates so there is a comfortable interior temperature even during summer and winter time, and also protects from street noise.

There is good lightning and a cozy inside environment that allows to shop comfortably.

The staff can work safely and in good conditions, they can use the store intuitively and they have all the tools needed for their activities.

The goods are displayed in a way that they catch customers attention and they can be seen from the outside so it is known what the shop sells before coming inside.

Expressive requirements of the product

Visceral: With the structure of the building (shape or material) the curiosity of the people passing by is created.

Behavioural: The construction of the building and the manipulation of the furniture (as one furniture will have different functions depending on how it is positioned) are thought to be intuitive and simple to use after taking knowledge of the user manual.

Environmental: The Pop-up store will have to be sustainable and energy efficient, as it will raise awareness of the environment concern of the business and its willingness to transform their shop into an energy efficient local. The customers will receive some information about the whole project and its relation with the environment.

Interaction requirements

Builders: They need a basic knowledge of how to construct the building because it may not be a traditional method and they will have to make a reasonable effort to carry or fix some parts of the building. The construction method will have to be as easy as possible and require the least tools, but still some expertise may be needed. The construction period of the entire building will take an estimated time of three days.

Learning curve: short

Ergonomics: The pop-up store will be accessible for everyone who wants to go in, so it will need to be adaptable to everyone's necessities. The furniture will be thought to be easily manipulated in an ergonomic way, as the shop owners can quickly transform it into the function they need most in each moment, and also the customers feel comfortable and use it intuitively.

Context requirements

The context will depend on the type of shop and the location of it, but the main placement will be in the Meir Street of Antwerp, a very commercial area with lots of businesses and people.

A flat surface will be needed to place the building, and if there is a slope on the terrain a straighten elevation will be used. Also, a big free area will be required as one module of the building is 35m2 and all sides need a minimum space for people flow and good exposition view.

The use of the Pop-up store will last between one to six months according to the renovation period.

There is a possibility to use the pop-up store around special events to attract more clients (Christmas market, parks, festivals...), this will modify the context from a commercial area into a different environment with more leisure.

The inside will be well insulated and adapted to different types of weather, the noise and the comfort of the workers and the customers will be considered. The pop-up store will have natural and artificial lighting. The wish of using colours and wood are meant to introduce a healthy looking and remind of fresh and eco-friendliness.

The outside of the building will not have a big impact in the place where it is located, as not to alter the environment, but it will catch people's attention and make them feel curiosity to go in. The wooden aspect will reflect the sustainable approach, and the materials will be suitable for all weather conditions.

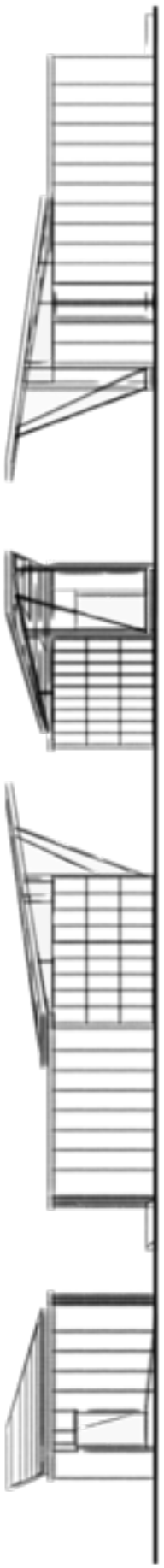
Team work

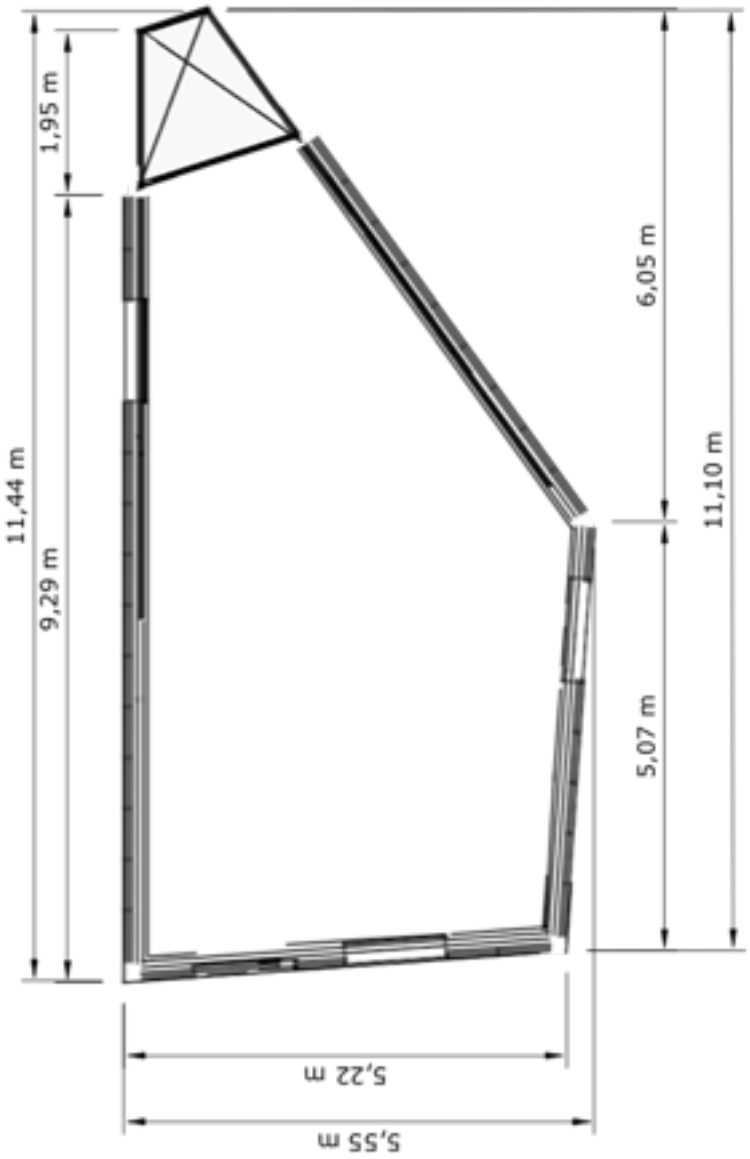
As this was a group project it was considered interesting to show how the team worked and which techniques were used to organise the tasks, to share information with each other, validate the decisions and develop the whole Pop-up store. Therefore, here below is a compilation of photos taken during this time while the group was working. It can be seen that the teambuilding was well applied and it helped the team to be more efficient, to work better together, to understand each other and to take everyone's ideas into account.

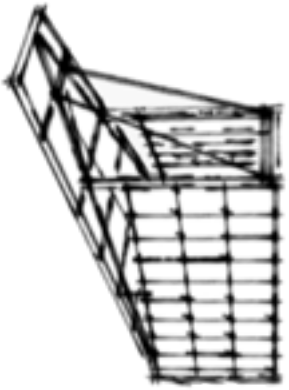
The team feeling at the end of EPS programme is, although of course some little problems occurred during the process, the team managed very well, no arguments arose and whenever it was noticed that someone did not work properly, it was communicated to this person in a good manner.

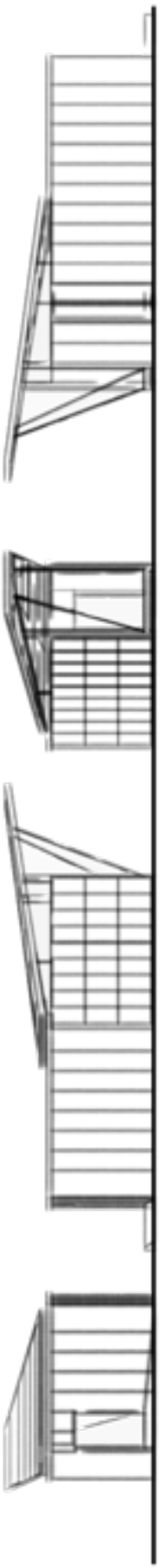
Another good point is what each member of the team has learnt. Since everyone is from a different background, the knowledge differs a lot, that is why the team tried to teach new techniques to others, practice aspects that needed improvement and ask help. This way, everyone could get new skills and learn things from other fields. Apart from this, everyone has practiced a lot their communication abilities and their English.

Dimensional drawings

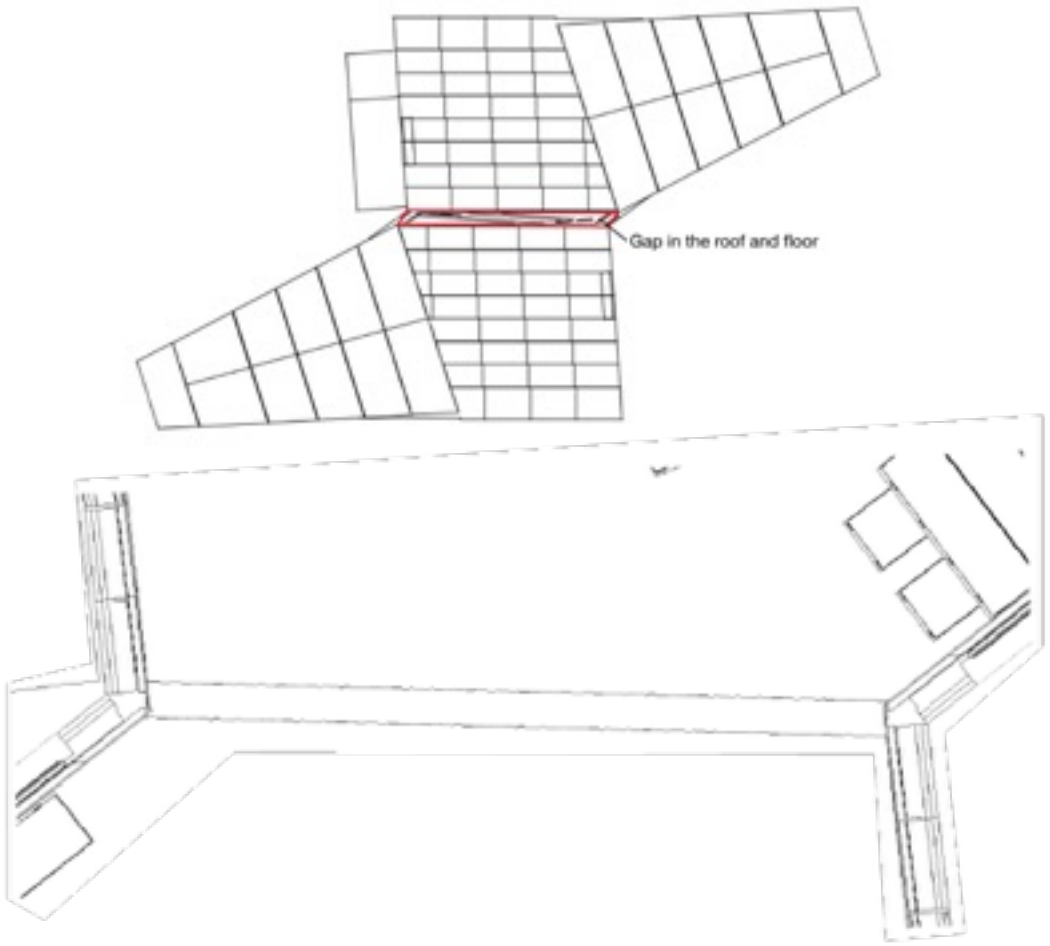


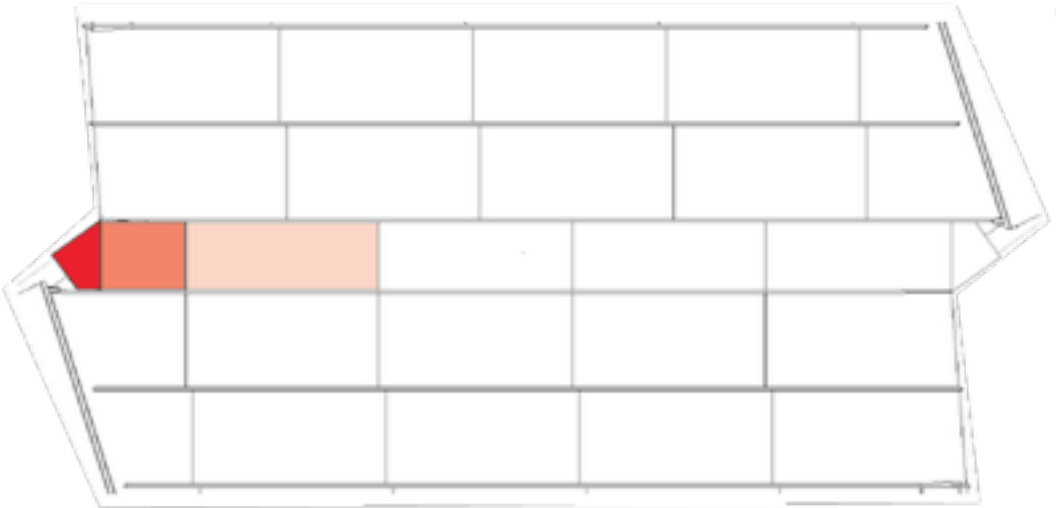


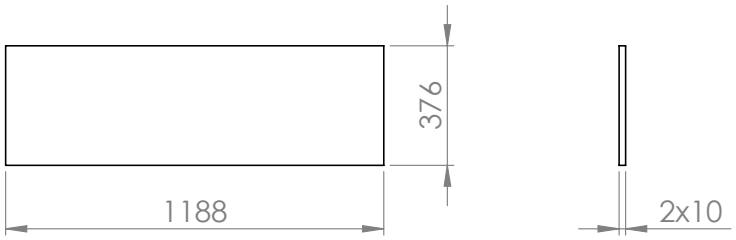


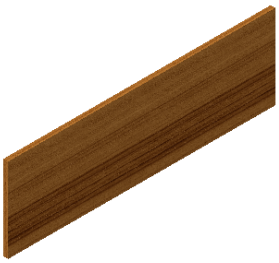



1,27 m
3,23 m
4,23 m
4,52 m

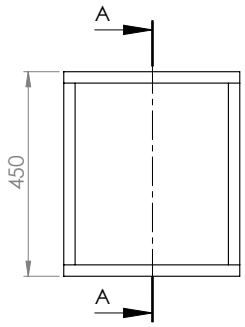

Gap in the roof and floor

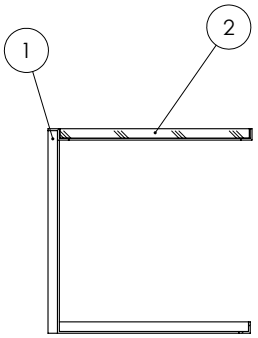






1. Steel frame
2. Wooden board





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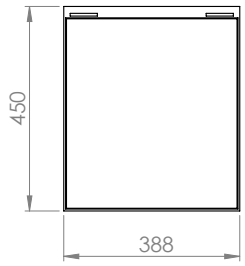
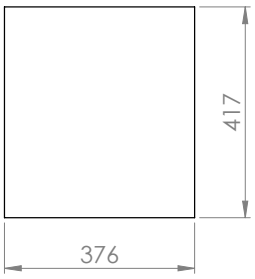
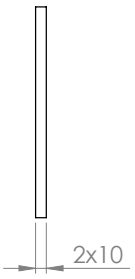
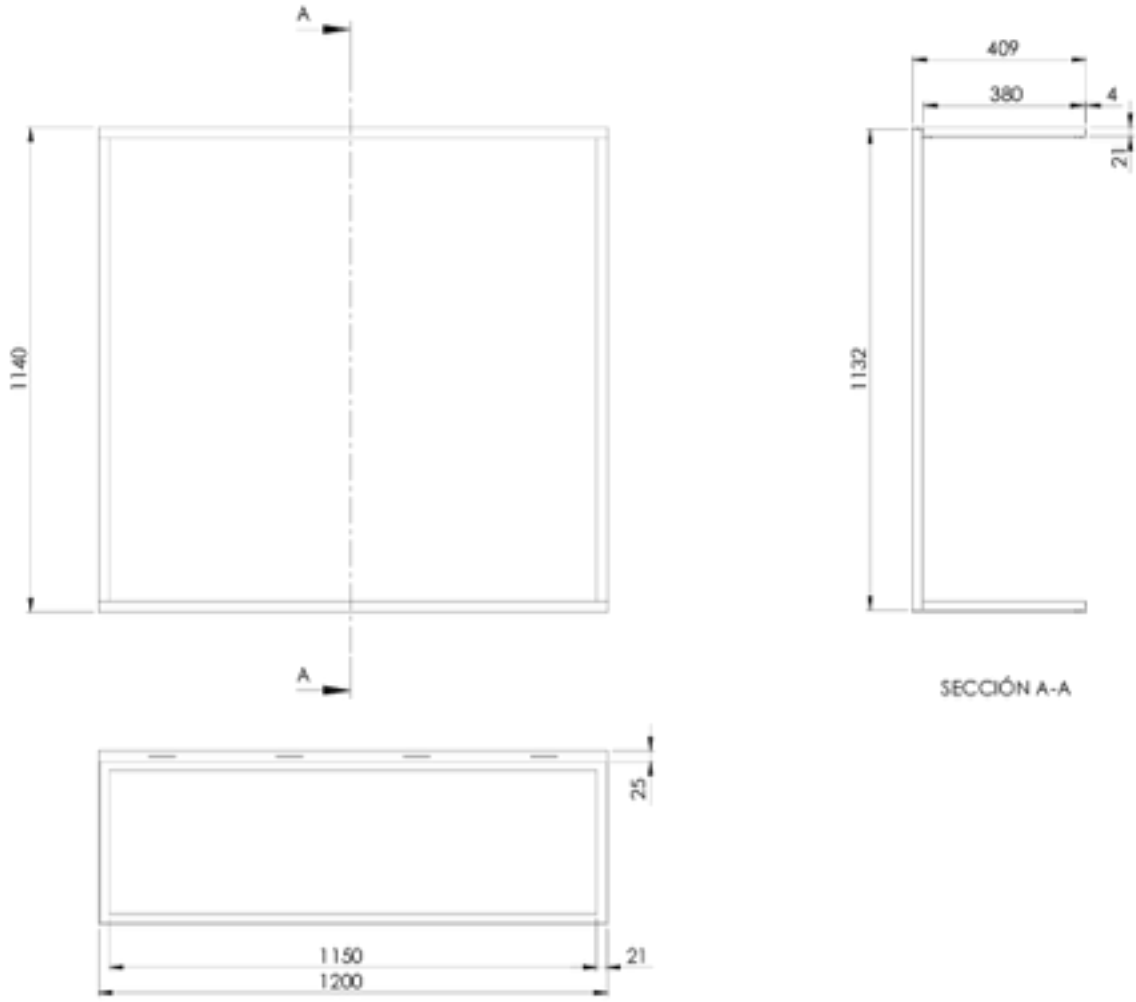


1. Steel frame
2. Wooden hardboard



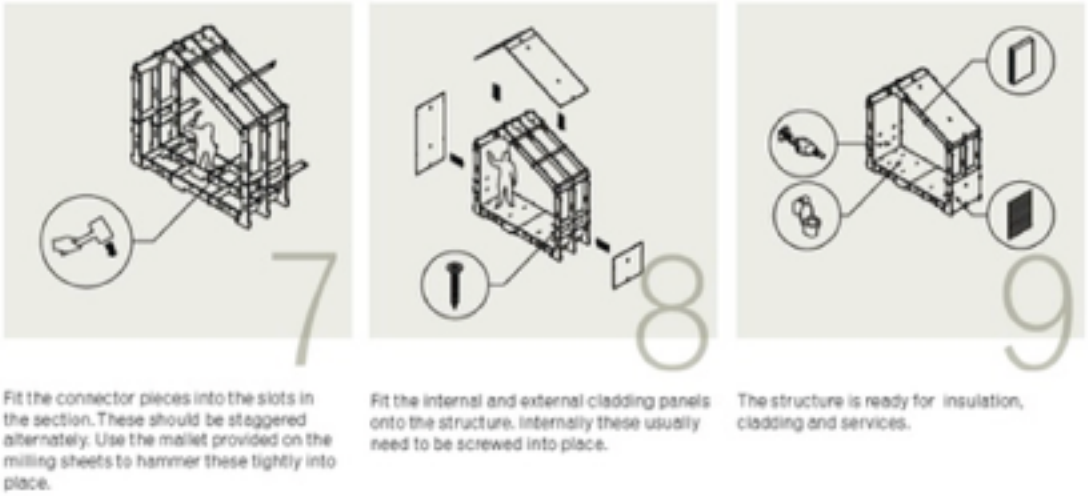



A
1140
A
25
1150
1200
21
409
380
4
21
1132
SECCIÓN A-A

Extra Inspiration Projects

Below, more specific examples of projects has been chosen as an inspiration:

2. WikiHouse



Boucher Wikihouse.

2. Alternative structures systems

Cmax System by Nicolás García Mayor.

This project was designed to dignify and improve the quality of life of people made homeless by natural disasters and wars.

Final Year Masters of Architecture Project by Callum Dowie

The Prefabricated Parts of this hut are being assembled for display at the Unitec Grad show November 2009. The hut is erected by tensioning cables around the outside of the structural panels. The applications of this type of structure includes disaster relief housing and remote location shelters.