

Vectorial system, improving accesibility with a sustainable solution

TAGS: Recycled materials, recycled plastic, sustainable design strategies, modularity, design for all



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1. Project definition

Vectorial system (Spain) June 2009 - June 2011

Vectorial ® is a modular system to improve the use of space, accessibility and mobility in cities. It was designed and developed by Zicla, a Spanish company located in Barcelona.

Guided by the desire to protect the environment and promote sustainable development, Zicla contributes to transforming cities into more sustainable, inclusive and friendly places. Since 2005, they have been working to convert waste generated by the cities and their own activities, into new materials for industry and new products for these cities.

Vectorial is a modular platform for bus stops made with recycled and recyclable PVC. The purpose of the project was to make the bus stops of the metropolitan area of Barcelona more accessible and sustainable in several aspects. Vectorial is a compact solution adjustable to the existing pavement structure with an easy assembling/disassembling. Due to its features, it can be installed and removed easily with only one operator, avoiding heavy machinery and its economical disadvantages and allowing quick adaptation to urban mobility changes. Moreover, its price is competitive against the permanent work and also against other existing prefabricated systems.

Therefore, it is a good example of how eco-design strategies can be applied to almost any product to make it competitive in terms of sustainability but also in functionality or price, getting an objectively better result than the products that the market was already offering.

The motor group (MG) that promoted the project and connected all of the network of advisors, partners, suppliers, etc was the company Zicla.

They are a multidisciplinary team formed by a product designer, an engineer in industrial design, a commercial manager and a civil engineer.

However, the project needed also the participation of a plastic injection company to recycle waste into new plastics.

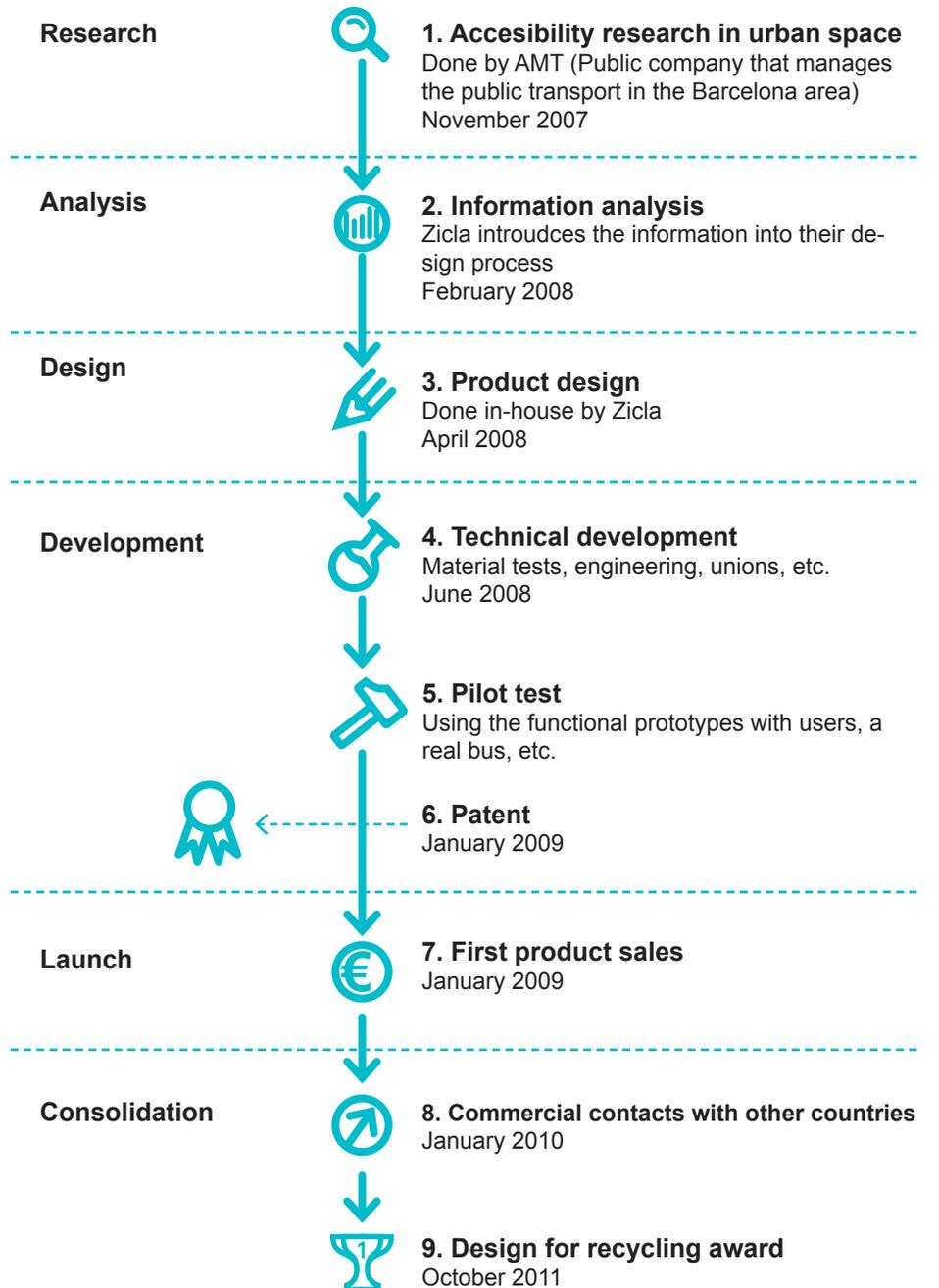
Additionally, the project had the participation of AMB (Metropolitan Authority of Barcelona) the public company that manages the public transport network of Barcelona, that did a lot of research about accessibility and functionality that became extremely helpful to develop a product to accomplish the requirements of public space.

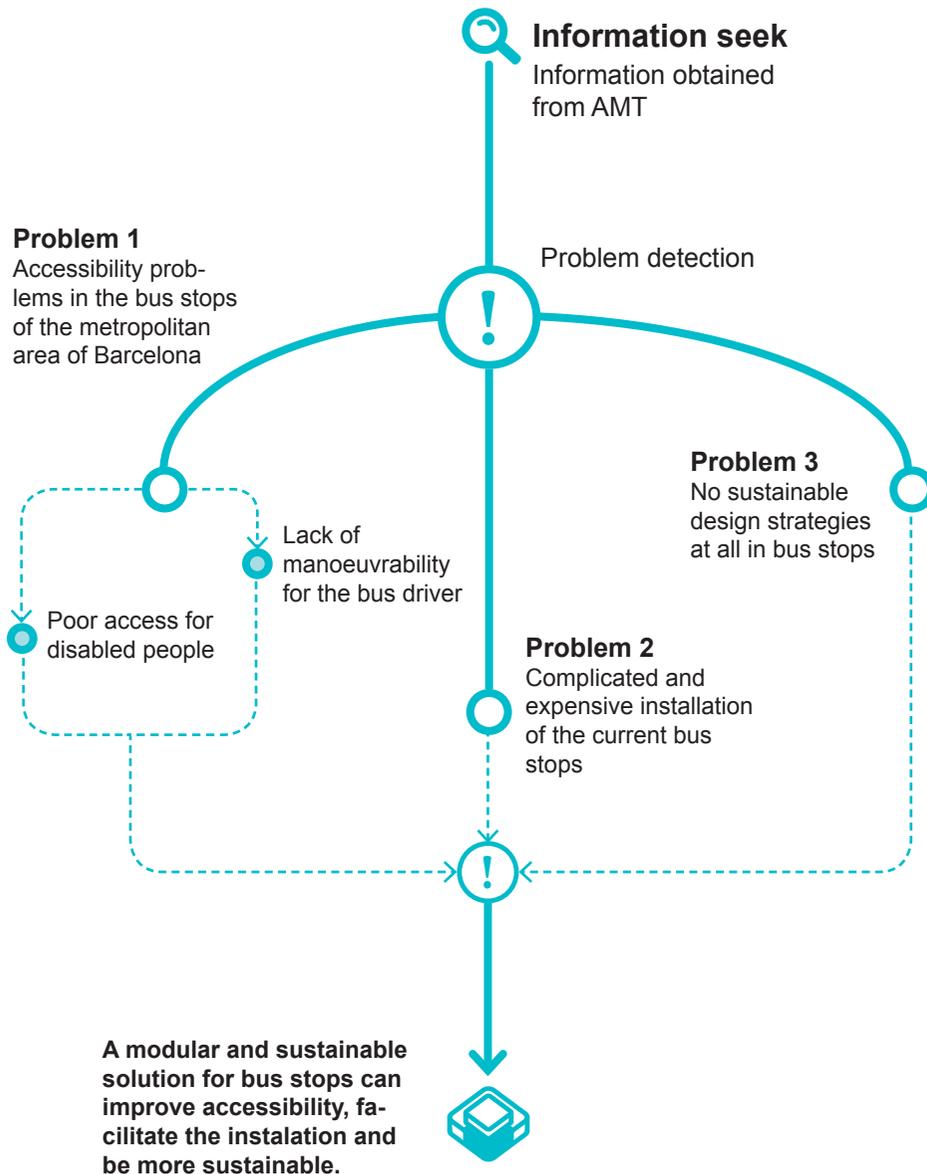
Vectorial system has achieved an Eco-label which warrants its environmental quality and it's considered Good Practice by the Design For All Foundation. It also won the Design for Recycling prize given by the Catalan Waste Agency in 2011.

The Vectorial system has been installed by cities of France, Spain, USA, Chile, etc. demonstrating that its modularity, functionality and sustainability makes it perfect for many different urban realities.

KEYWORDS: Waste material, business alliances, multidisciplinary team, B2C.

Timeline





2. Research

This project has become an important tool inside the Universal Accessibility Plan being carried out in the municipalities which belong to the Metropolitan Area of Barcelona. Barcelona is working to become a 100% accessible city by the end of 2026, and a comfortable and safe access to public transport is a crucial point within this plan, to allow people in any physical condition or age to have the maximum independence and freedom of movement.

In this context, the Barcelona City Council developed a program to collect data about the current performance and requirements of public transport stops. This research demonstrated that there were several problems of accessibility at the bus stops, such as, lack of manoeuvrability for the bus driver and poor access for disabled people.

Moreover, the idea was to make the bus stops of the metropolitan area of Barcelona not only more accessible, but at the same time, more sustainable. The city was exploring the idea of reducing environmental impact and, as a first step, they were installing solar panels at the bus stops to generate electricity for the electronic information displays. Therefore, all the improvements to be done should be in accordance with this environmental policy and committed to the prevention of environmental impact.

In the market, there were some solutions like pavement expansion or standard pre-fabricated concrete platforms. However, neither alternative would fully remedy the accessibility and sustainability problems. Specially the concrete platforms, a closer concept to the Vectorial system, were really heavy, making necessary to cut

streets and to use heavy machinery for the installation, and despite being composed by parts, with not good modularity because of their size.

Thus, with the aim of obtaining innovative improvements and solutions, Vectorial was born, a tailored solution for each bus stop of the metropolitan area of Barcelona that became also perfect for many other urban contexts.

KEYWORDS: Direct observation, information from reputable sources



Vectorial system is produced with recycled PVC from cables, thanks to a recycling process developed by Zicla and a plastic injection company that has as a result a plastic capable of resisting really hard conditions for outdoor uses.



3. Analysis

As already explained, the MG of this project was a multidisciplinary team of specialists, responsible for the product design phase and the management of the stakeholders and suppliers. Different profiles and backgrounds made the team not only more innovative, but also capable of covering all the requirements and needs of the project, from the commercial to the technical or the creative aspects, and to manage more easily the other actors involved.

As we said before the main stakeholder that participated in the project was a public institution, the AMT. In some ways we can say that they laid the foundations of the project, thanks to their big research about accessibility. The research made by AMT about the performance and requirements of the public transport of the city, became the previous step to the design process, giving Zicla first hand information.

Thanks to these data, the design team identified the problems and needs of the actual transport system and were able to define the insights of the product and to come up with improvements. In this case, there were two different areas to be designed: on the one hand the physical characteristics of the product (size, joints, etc.) and on the other, the material, that had to be made to measure to the specific needs of the project.

Regarding to the product, it had to meet some requirements: it should be easily adjustable to the existing pavement structure, it should allow an easy and quick installation, it should have drainage capacity and allow rainwater to flow underneath, it must comply with the regulations, it should allow a canopy to

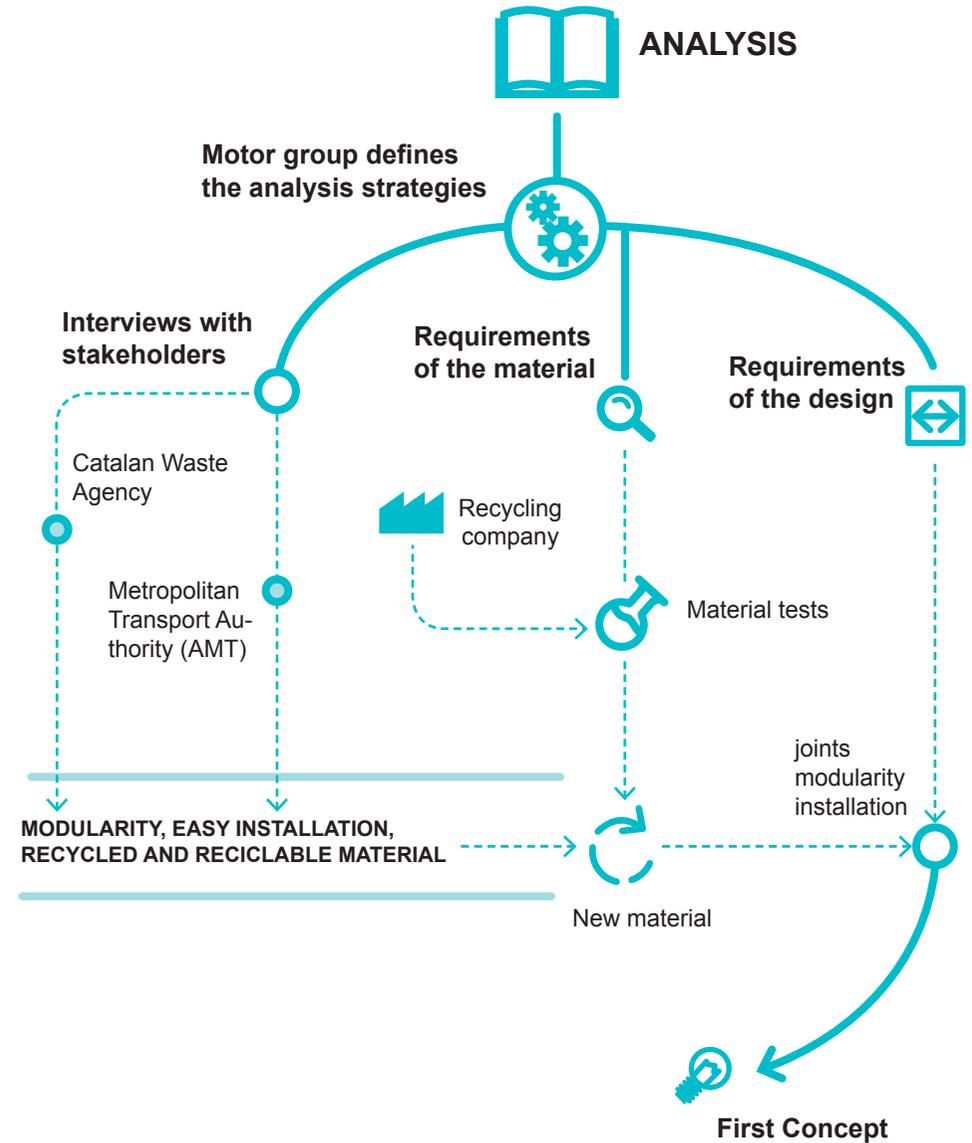
be installed on it, and finally, it should be easily seen at night.

Regarding the material, they decided to use a recycled and recyclable PVC. The design team had previous experience in implementing recycled plastic in their designs, thanks to projects of the same nature already developed, so they started with the same material, suppliers, etc. they used for other projects and they introduced new specifications to adapt the plastic and the value chain to the new functional requirements

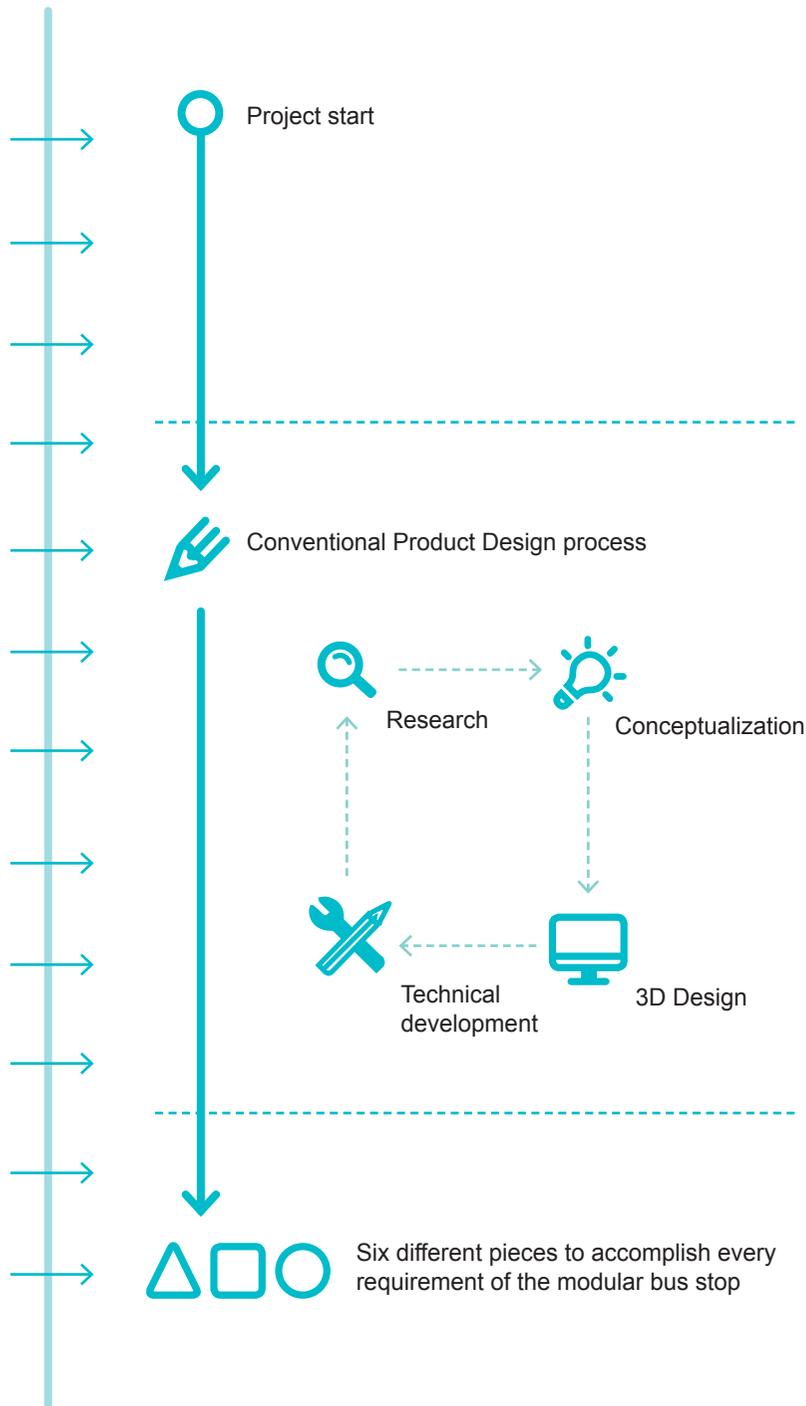
Because of the high specialization required in the plastic sector, it's usually necessary to be associated with a company with high expertise in it, to get the recycled material. Therefore, the MG worked with a plastic injection company that obtained the PVC waste and recycled it, collaborating with them hand in hand to obtain an homogenous material with the required physical properties and appropriate to be injected. This company allowed also to accomplish the rigid waste traceability and management policies.

Finally, at the last phase of the project, for the implementation of it, other actors were involved, such as, urban planners, transportation companies and installation technicians.

KEYWORDS: Interviews with stakeholders, search of qualified partners.



The briefing based on the information of the accessibility analysis influences the whole design process, managed and developed by the motor group.



4. Concept

Once the design team had spoken with the different stakeholders of the sector, they moved forward with the design process and designed in detail the features, the manufacturing process and the implementation of the final product.

They applied a conventional design process, from basic sketches to a final full developed product ready to be produced and implemented.

They decided to create a bespoke solution adjustable to the requirements and constraints of each bus stop of Barcelona, creating a modular and compact platform made with recycled and recyclable PVC.

In order to allow quick adaption to urban mobility changes and make the system more efficient in terms of installation, Zicla designed six different pieces that could solve the needs of the bus stop in many different situations in public space.

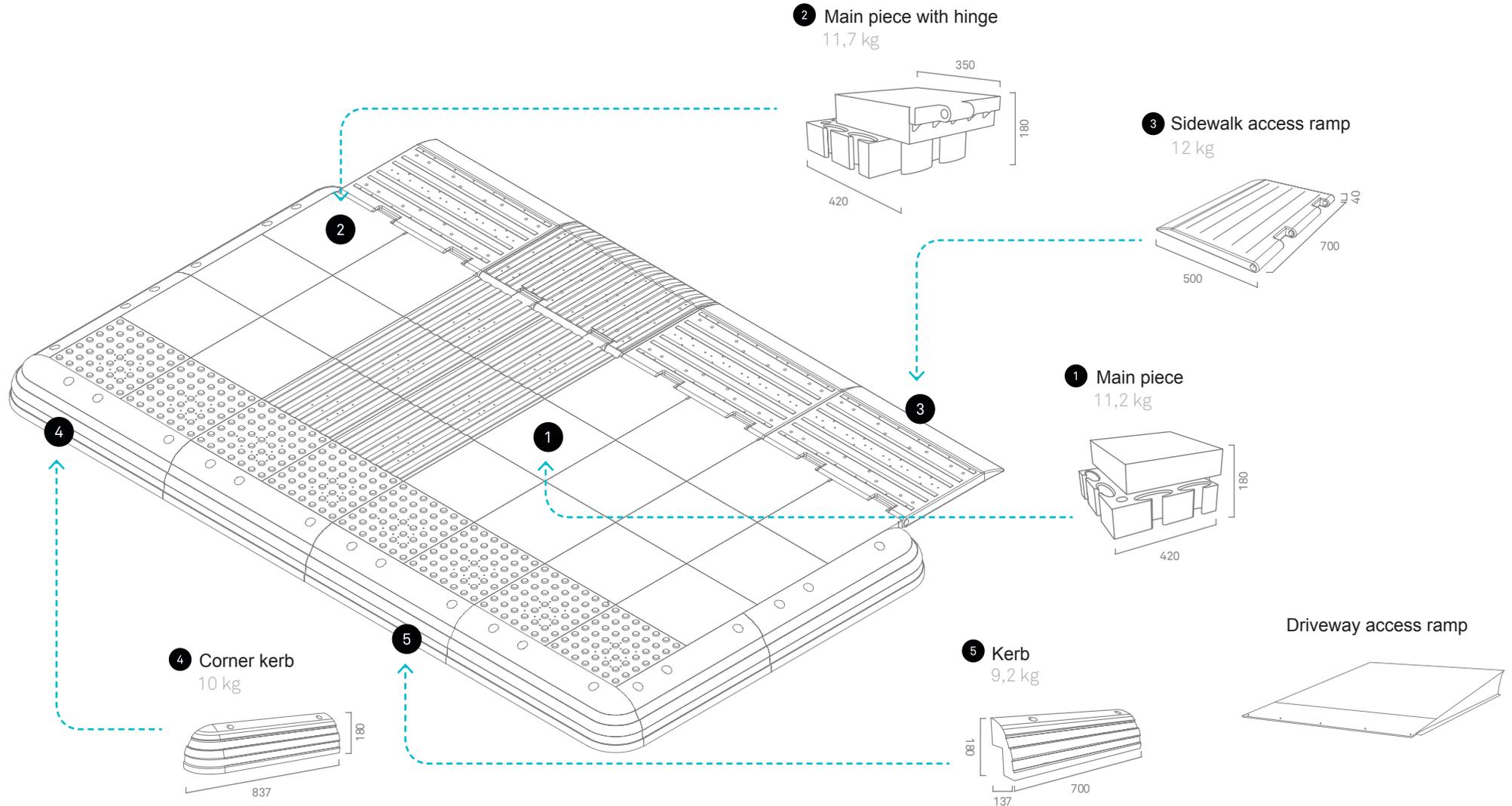
These pieces allowed the bus stop to have a better integration with other elements of public space, like for example bike lanes. Another piece was designed to serve as a finishing element to offer a resistant element to the eventual impact of the wheel of the bus or a car, while incorporating color bands that help to its visibility, others had of course the function to create the general structure of the stop, while adding different superficial textures in order to give tactile information to blind people.

To combine these elements, they also developed a series of joints that like a sort of construction game had an easy assembling/disassembling that can be done with only one operator, with no ma-

chinery needed. Moreover, thanks to its modularity, Vectorial System was going to be mounted and extended in a piecemeal way.

KEYWORDS: In-house design, modular design

In order to accomplish the tight requirements that Zicla established at the beginning of the project Zicla designed six different pieces that could be connected between them as a sort of construction game. Thanks to them the bus stop became a very flexible system capable of working perfectly well in many different public spaces.



5. Prototyping

After the design process got as a result 3D models designed by computer Zicla jumped to the prototyping phase.

The 3D models were used to produce the molds, so we can say that this stage was done with almost final pieces or 100% functional prototypes, as once the molds were produced they just could introduce small changes in them.

For the first samples they used the same plastic composition they used for other projects, and with this mixture Zicla noticed that the bus stop was too soft when stepping on it.

This made necessary to add additives to make their material harder, but being careful to not to make it too hard to not provoke fragility problems due to fracture at below freezing temperatures. They also noticed that the bus stop could be too slippery with ice on it, so they had to develop a surface coating to solve it. Once this relatively small changes were done the prototyping phase jumped to a next step.

Zicla took the risk to invest money and resources to produce the first series of Vectorial system that were tested in L'Hospitalet, a city near from Barcelona.

To try the bus stop they used a regular public transport bus, that allowed them to test if it was easy to go in/go out to it, and specially if we bus stop was strong enough to resist the impact of one of its wheels in case the approach of the bus to the bus stop was not accurate, etc.

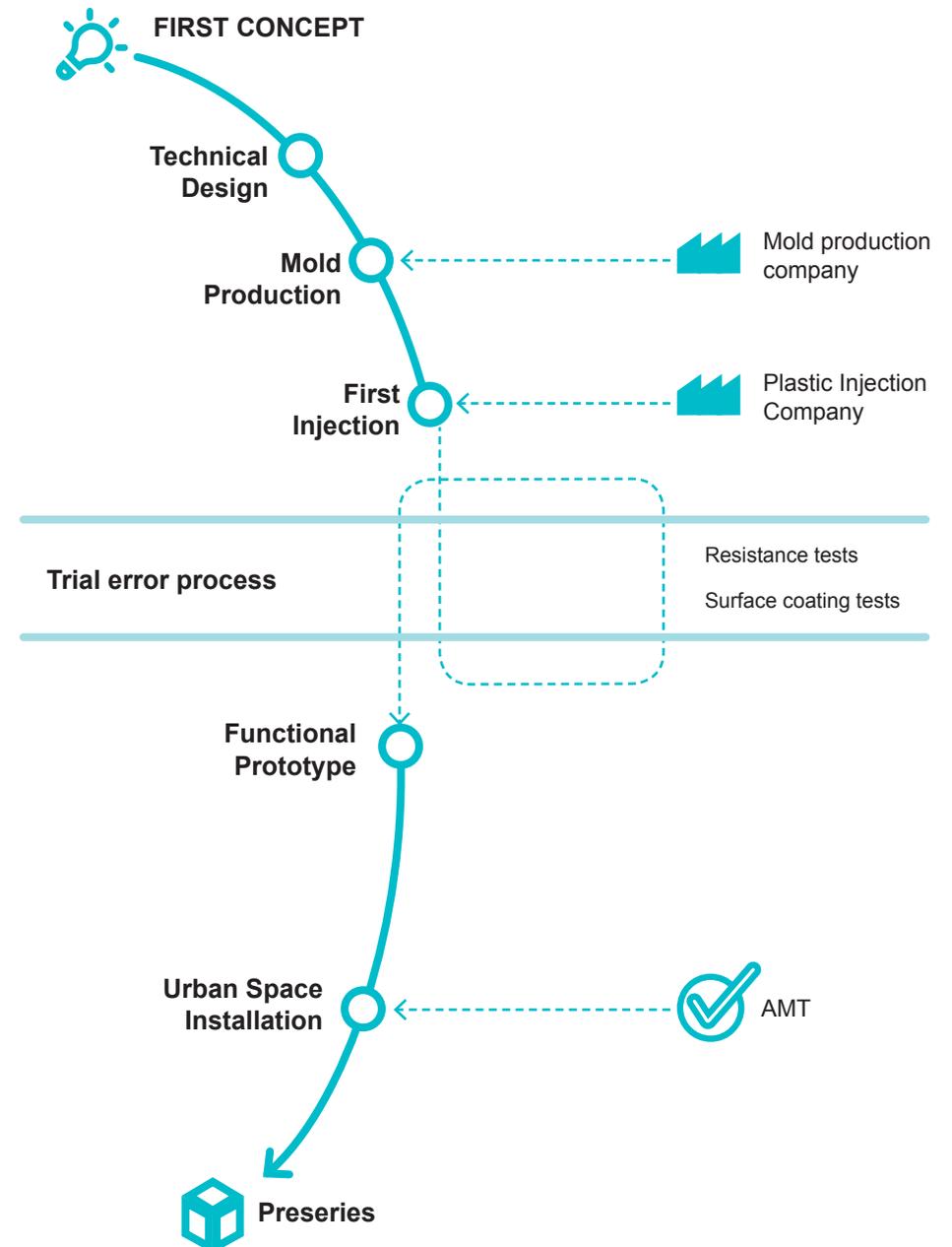
They also learnt that not as many joints with the floor were necessary, because it was more than enough to resist the

impacts of the bus only with the perimeter ones. This made the installation faster and less harmful for the asphalt, because it was not necessary to drill as many holes in it.

In addition to the technical tests done by the motor group, the prototyping phase served to receive the approval of AMB, the public company that manages the public transportation in the Barcelona area, accepting the product as a standard that fit perfectly with the requirements analyzed in the previous studies.

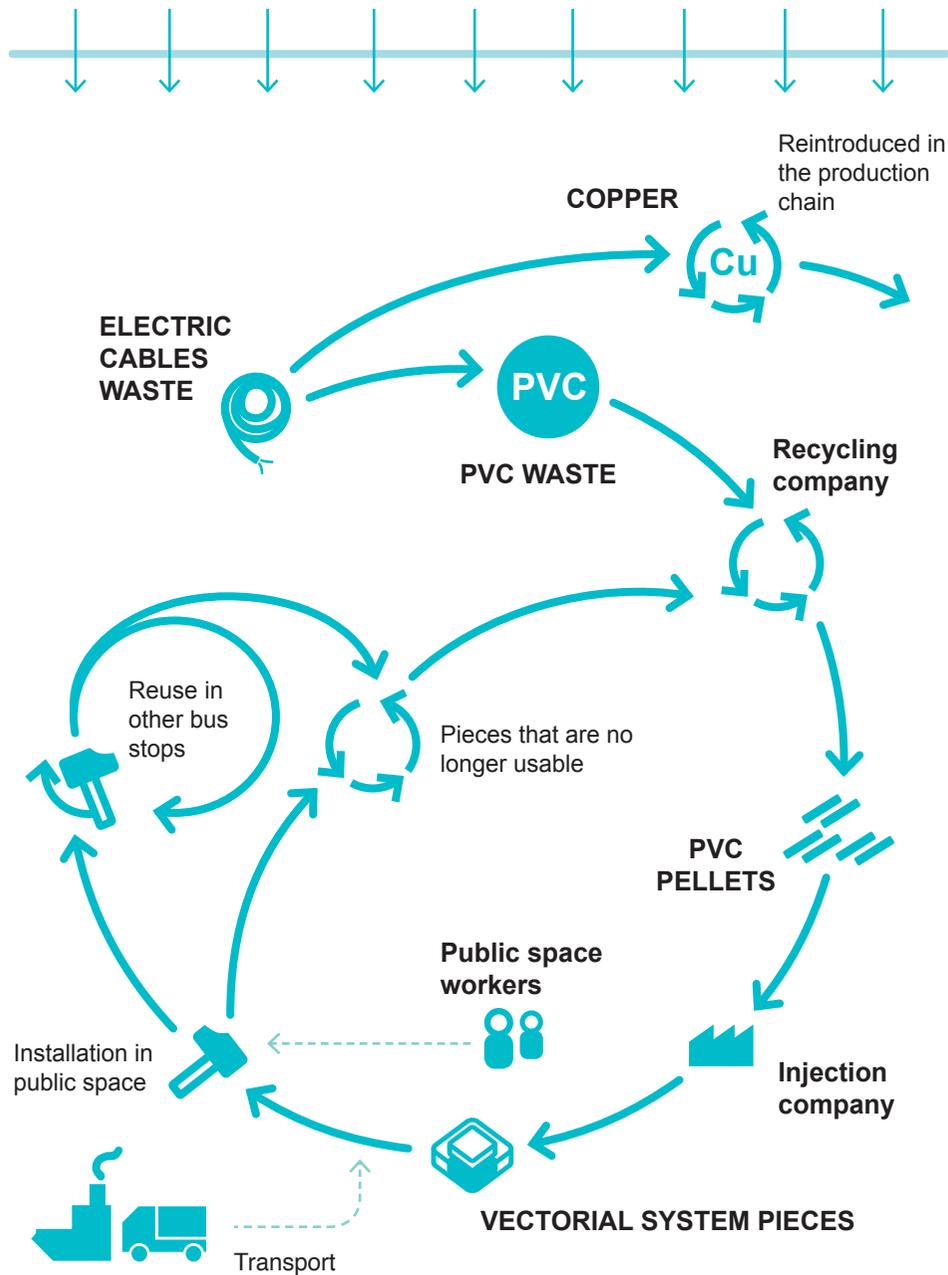
We can say then that the prototyping phase became helpful not only for Zicla, but also to the client that was going to buy the bus stops.

KEYWORDS: Functional prototype, material tests, tests with users.



Zicla

The MG coordinates the project and the role of the different actors.



6. Project

To design the Vectorial system has meant also to design its production system. The material they use for the production is recycled PVC, that comes from the recycling of cables, where the copper has been already removed to be reintroduced in the system through a different recycling channel.

To have the most homogeneous and cleanest possible plastic the plastic waste needs to be washed and treated before being converted again into PVC pellets. These pellets are transported to the plastic injection company, where the different pieces of vectorial system are produced.

Once the injection is done the pieces are transported from the injection company to the city that buys them. Thanks to its modularity, the square shape of the different pieces and their manageable size the transport is very efficient, much more than the concrete versions you could find in the market before.

As we said before the last stage of the process is the installation, really easy in terms of labor and resources involved, since the pieces are manipulated by hand and installed by fitting one in another, with joints with the floor around the perimeter, which are made by drilling holes that allow them to be screwed to the asphalt.

If the bus stop needs to be moved because of changes in the design of the public transport lines or in the street where it's installed, the modularity of the

system allows the pieces to be 100% functional in a different configuration, a fact that makes the product to last longer. The modules allow a bus stop to be repaired piece by piece, making the system more efficient and environmentally friendly. For those pieces no longer useable, Zicla offers a recycling service.

The final price is also competitive against the permanent work and other prefabricated systems available in the market.

The life cycle analysis that zicla and the catalan waste agency have done measured that the carbon footprint of the vectorial system is 104,41 kg de CO2 eq/m2. In comparison of the use of raw PVC, using the recycled one that Zicla and their recycling partner has developed saves to the environment 124 kg CO2 eq/m2.

Analyzing the production system that Zicla has created as the final product that results from it, we can conclude that Vectorial System is a project that both functionally and environmentally far exceeds products that existed in the market at the time of its launch. Also, no less important, it critically improves access to the bus for people with disabilities with the positive social impact that this entails, and speeds bus stop times, achieving greater efficiency in this important public service.

KEYWORDS: Recycled materials, circular design strategies, accesibility, social impact, sustainable growth

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