BIO DESIGN LAB

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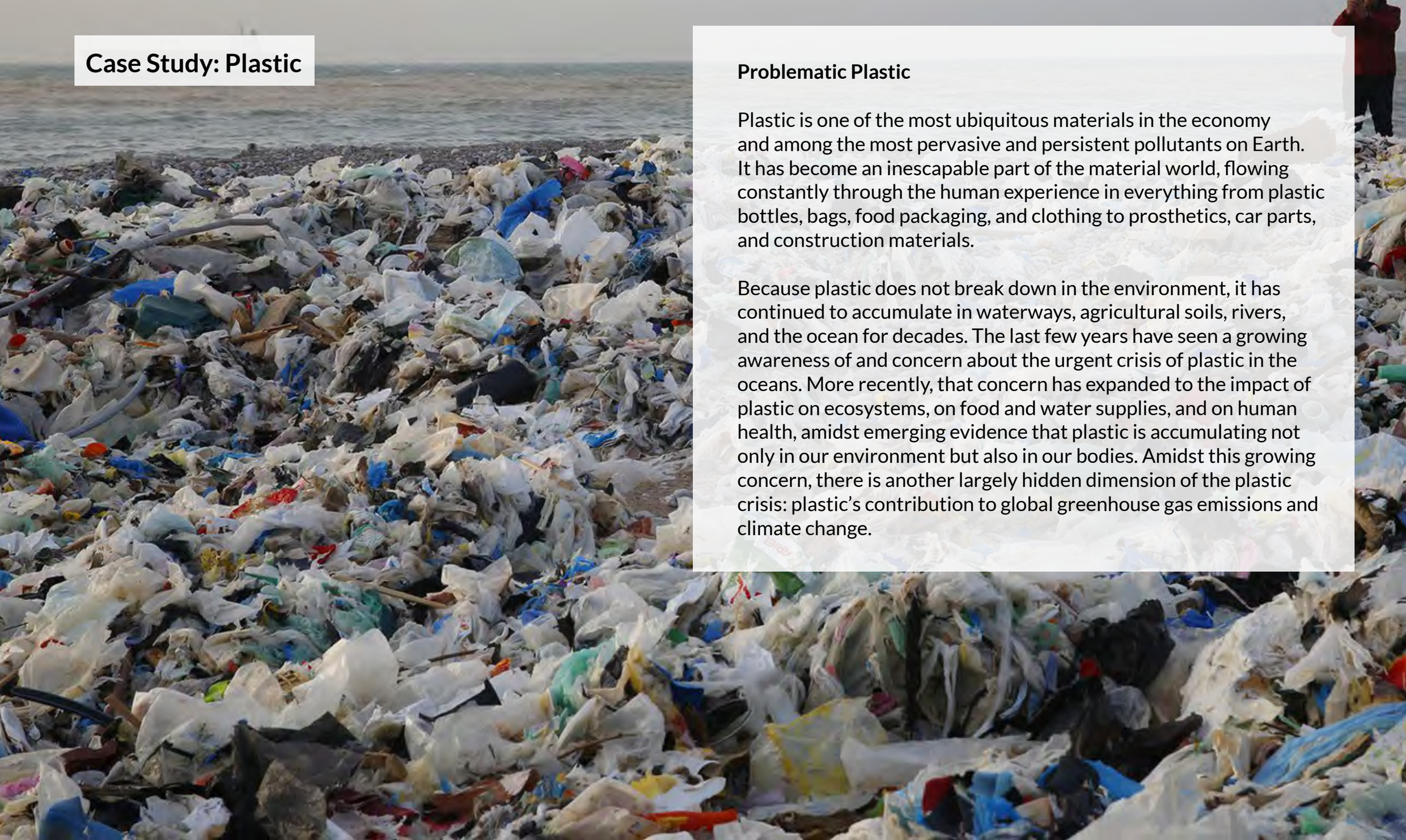
As part of the Research and Development project, financed with funds for R & D activities granted by the Ministry of Science and Higher Education of the Republic of Poland, Bio Design Lab conducts research on the use of materials based on renewable resources for the production of spatial forms.

Case Study: Plastic



Problematic Plastic

Plastic is one of the most ubiquitous materials in the economy and among the most pervasive and persistent pollutants on Earth. It has become an inescapable part of the material world, flowing constantly through the human experience in everything from plastic bottles, bags, food packaging, and clothing to prosthetics, car parts, and construction materials.

Because plastic does not break down in the environment, it has continued to accumulate in waterways, agricultural soils, rivers, and the ocean for decades. The last few years have seen a growing awareness of and concern about the urgent crisis of plastic in the oceans. More recently, that concern has expanded to the impact of plastic on ecosystems, on food and water supplies, and on human health, amidst emerging evidence that plastic is accumulating not only in our environment but also in our bodies. Amidst this growing concern, there is another largely hidden dimension of the plastic crisis: plastic's contribution to global greenhouse gas emissions and climate change.

Looking for the material based on natural fibres: Hemp

Hemp can capture atmospheric carbon twice as effectively as forests while providing carbon-negative biomaterials for architects and designers.

Carbon-negative materials made from the plant can be used to replace fibreglass composites, plastic and other materials in a range of applications.

Hemp, or industrial hemp, is a variety of the Cannabis sativa plant but contains very low levels of the psychoactive compound tetrahydrocannabinol (THC) compared to marijuana, which is another variety.

The fast-growing plant has been grown for thousands of years for its fibres, which were traditionally used for rope, textiles and paper.

Case Study: Production

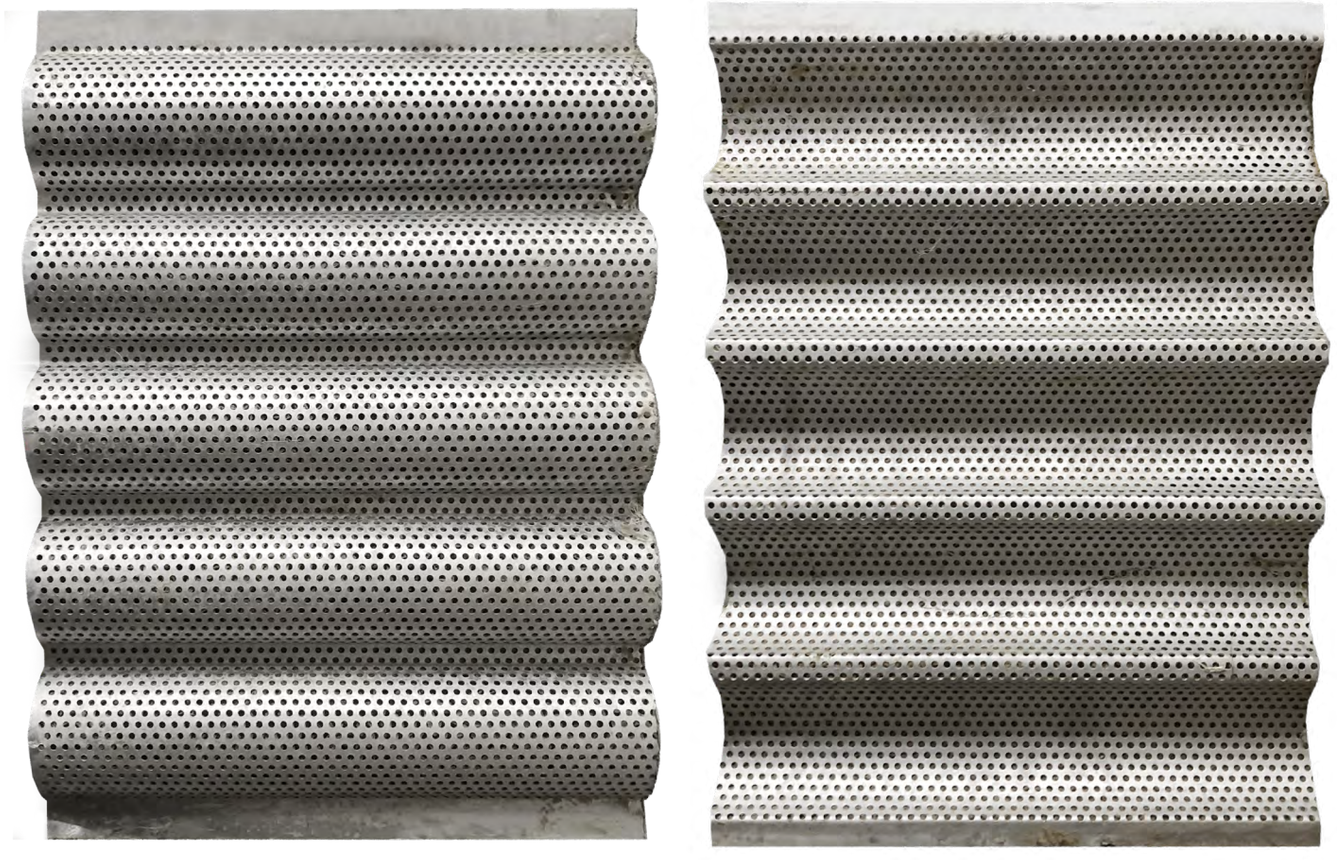
Project Agenda

The goal of the project is to develop the new production methods of biomaterials.
The core idea is to use a material based on renewable resources which is biodegradable.
There is a high probability that the biomaterials can be formed into any shape, using various processing techniques.
Biomaterials can obtain the broad spectrum of application.

Following examples briefly present the development of biodegradable hemp-based composite material.

Composite no.1

Step #1
Perforated aluminum moulds used for pressed composite production



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Step #2
Dried hemp composite material released from the mould

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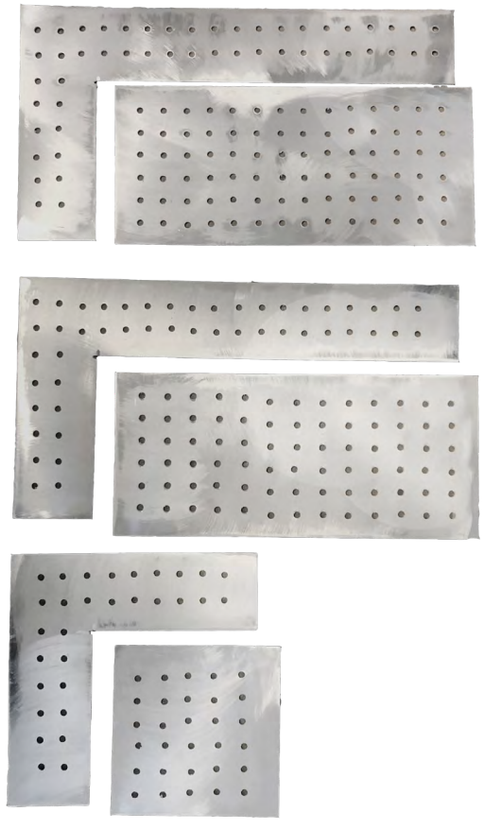
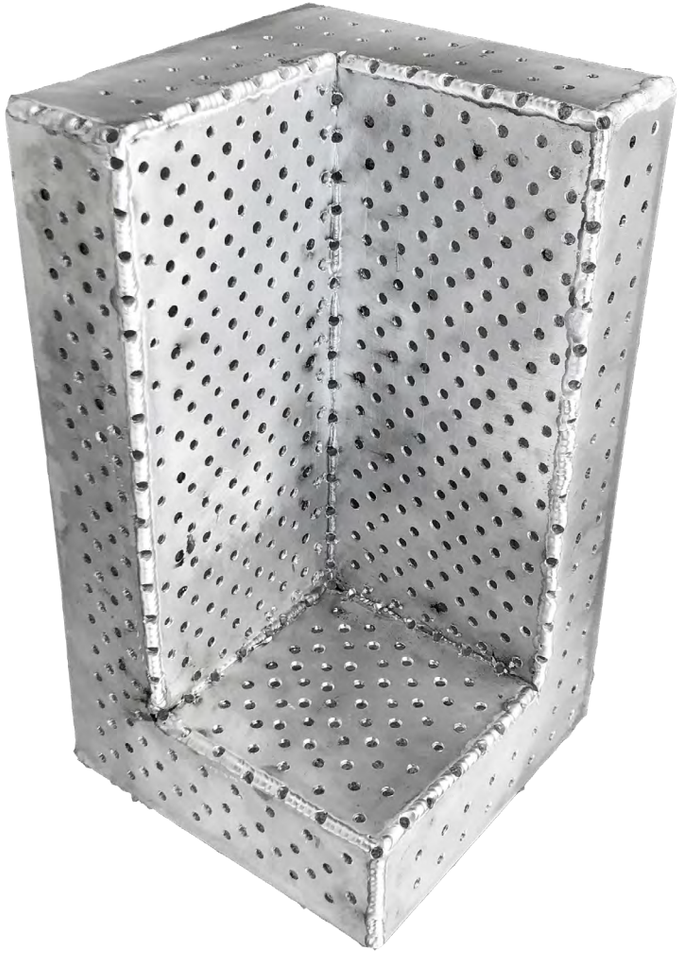
Composite no.2





Perforated aluminum elements are welded together in order to create a three dimensional mould for more complex hemp-based composite production.

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Composite no.2

The form of the composite is dependent on the mould construction technique.

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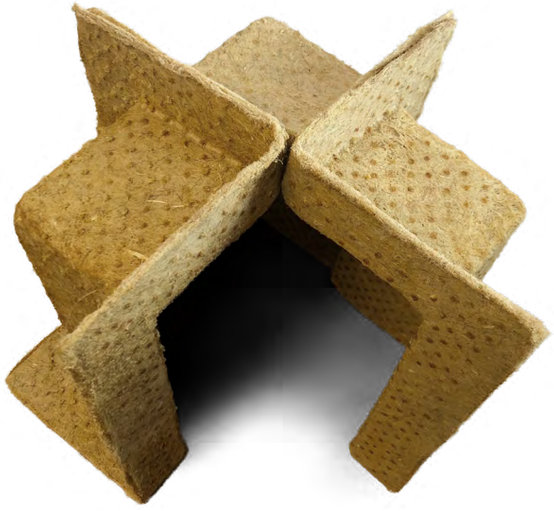
Composite no.2 Assembly

2 modules



3 modules

4 modules

Efficient production is based on the multiplied modules.
Prefabricated elements are connected to create a strong load-bearing surface resistant to loads.
The relatively weak material is smartly shaped to meet the specific design requirements.

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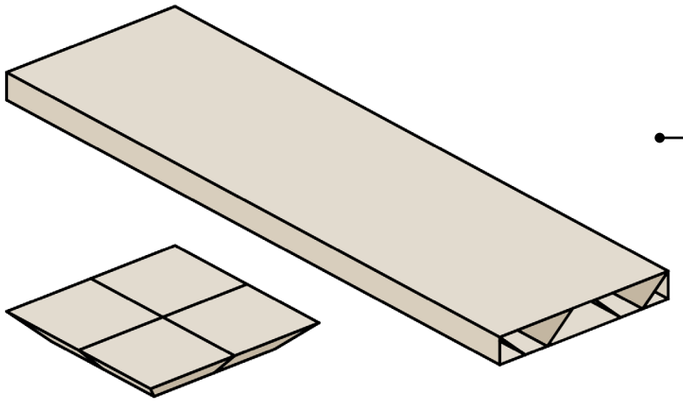
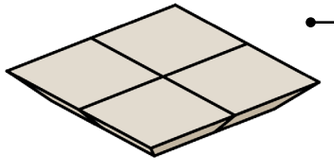
The Rule of Sustainable Object Assembly

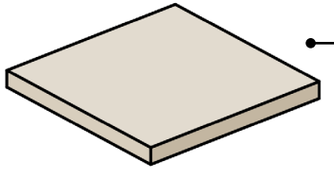


Horizontal elements (Composite no.1):
Corrugated elements are characterized by increased stiffness ready to withstand a specific load.

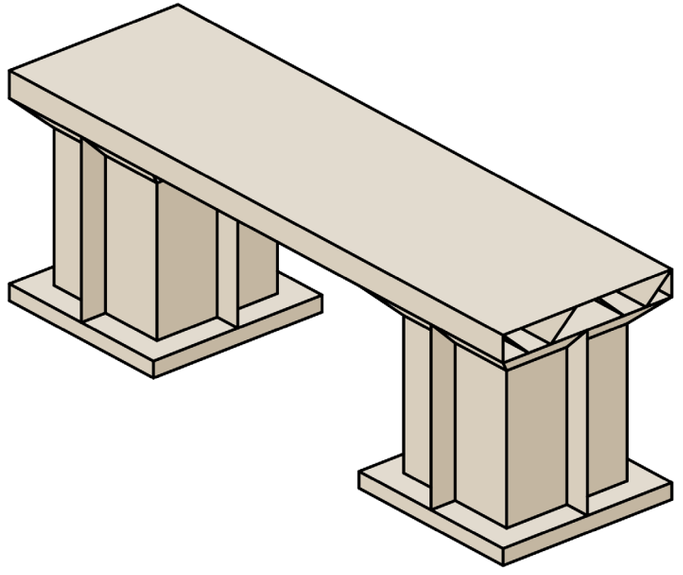


Support:
Made of compressed hemp fibers to increase the compressive strength of the element.

Vertical elements (Composite no.2):
In order to obtain the maximum stiffness of the composite, it is necessary to develop structurally optimized shapes.



Plinth:
Made of compressed hemp fibers to increase the compressive strength of the element.



Fully assembled form:
Built out of construction-optimized natural composite material.

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Photos
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Page 5-11, Jan Ankiersztajn