RESEARCH OPEN HOUSE 2021

STUCKEMAN SCHOOL
Architecture
Landscape Architecture
Graphic Design

USING WASTE CARDBOARD TO BUILD & SUSTAIN THE RESILIENT CITY

AN EXHIBITION FOR THE 2021 SEOUL BIENNALE OF ARCHITECTURE AND URBANISM (2021 SBAU)

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RESEARCH OVERVIEW

Rethinking the use of existing resources is one of the biggest challenges to build and sustain a resilient city. Waste collectors in urban areas cannot afford to buy high-quality building materials and do not have industrial means to transform waste into resources for construction. They do have easy access to waste cardboard — one of the most abundant material components of the urban solid waste stream — by employing informal collection methods; however, they still need support to "reprocess/repurpose" this material and reuse it to complement do-it-yourself (DIY) housing construction or improvement. They also need to see waste cardboard as a useful resource and not simply as an unwanted material. In this scenario, the project could motivate communities of waste collectors —and, hopefully, people in general — to rethink the value of waste cardboard by demonstrating that it is feasible (and relatively easy) to use waste cardboard to construct durable housing.

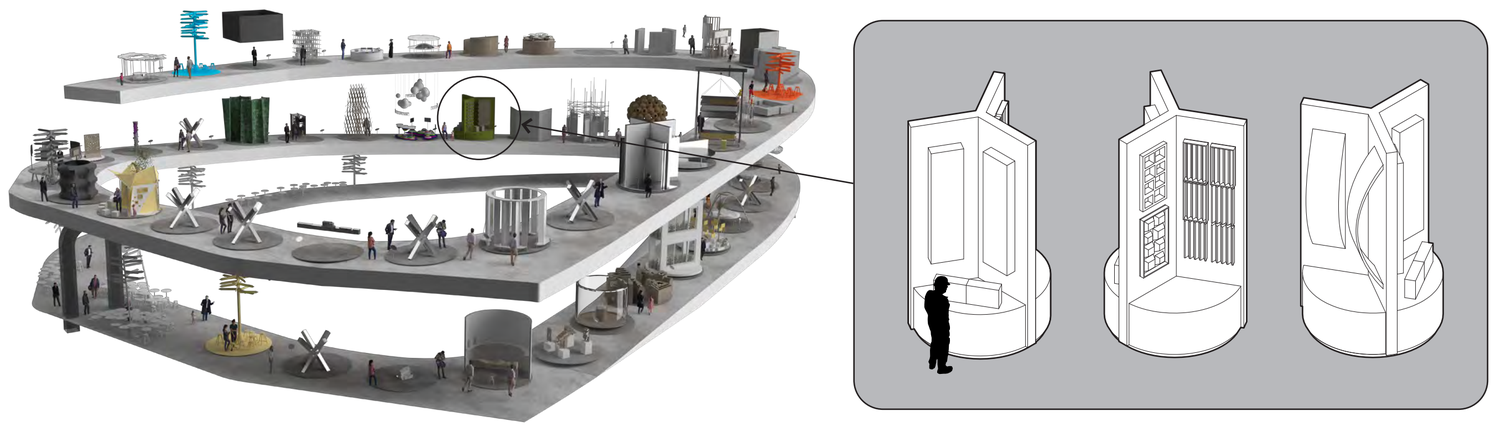
Our SBAU 2021 Resilient Cities project combines craft-based/low-skilled methods with computational design practices and tools in the design, prototyping, and production of building elements made with sheets of waste cardboard and reclaimed wood.

We take human-made resources (waste cardboard) widely available at any urban waste stream worldwide and design open-source tools that can be transferable to people who need the technology in a similar context. The tools and fabrication methods present some degree of flexibility for adaptation to different settings. The system is efficient (low-cost production and maximum productivity), durable, easy-to-make, easy-to-use, and easy-to-maintain. The digital component of the project supports the design and fabrication process of building elements. These components mediate between the material, the building element design, and the building system. Digital tools help configure housing parts using waste cardboard sheets and generate the fabrication instructions necessary for their assembly, adding "smartness" to the low-tech system.

The system is significant for waste collectors because it will guide them to reuse waste corrugated cardboard sheets as a building material and divert materials from waste to resources for construction.

More info at:
https://seoulbiennale.org/exhibition/c36

EXHIBITION DISPLAY AT THE DONGDAEMUN DESIGN PLAZA

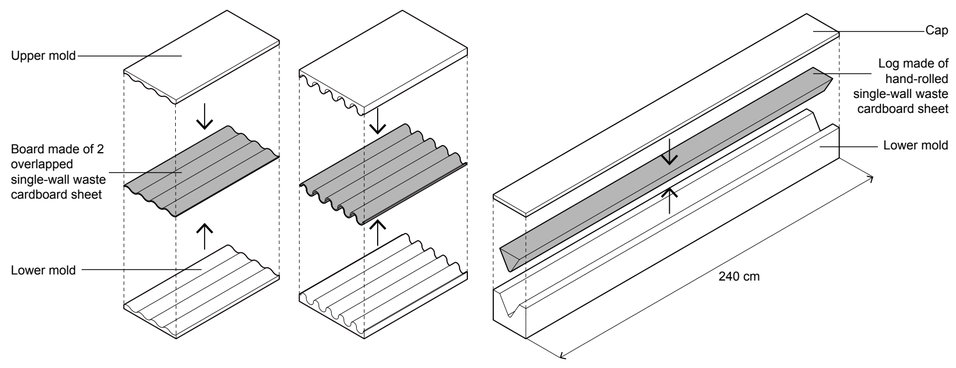


Left: Artwork location at the SBAU Cities Exhibition at the Dongdaemun Design Plaza. Right: Different views of the exhibition display showcasing different prototypes of cardboard formwork and concrete building elements.

BUILDING ELEMENT TYPES SHOWCASED

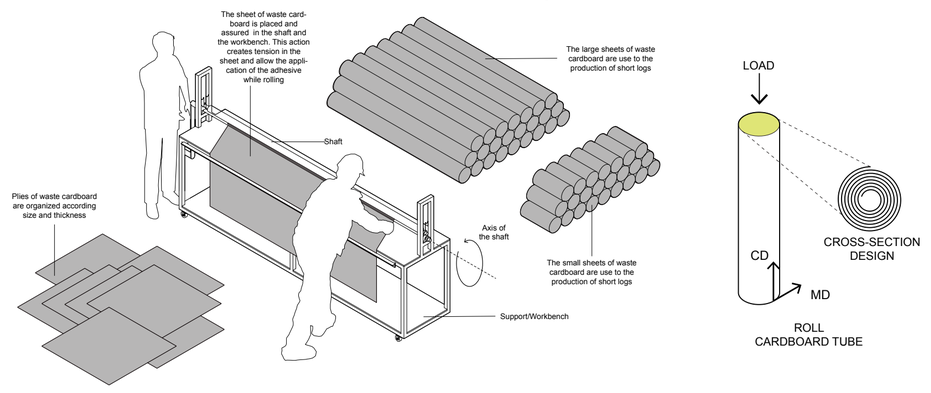
MOLDED BOARDS

The molds increase the density and stiffness of the waste cardboard by applying mechanical pressure to overlapped sheets of waste corrugated cardboard joined with conventional glue on each layer. The molds can produce any kind of board, from corrugated boards to compressed logs. These elements can be used as infill or to produce formwork for casting concrete.



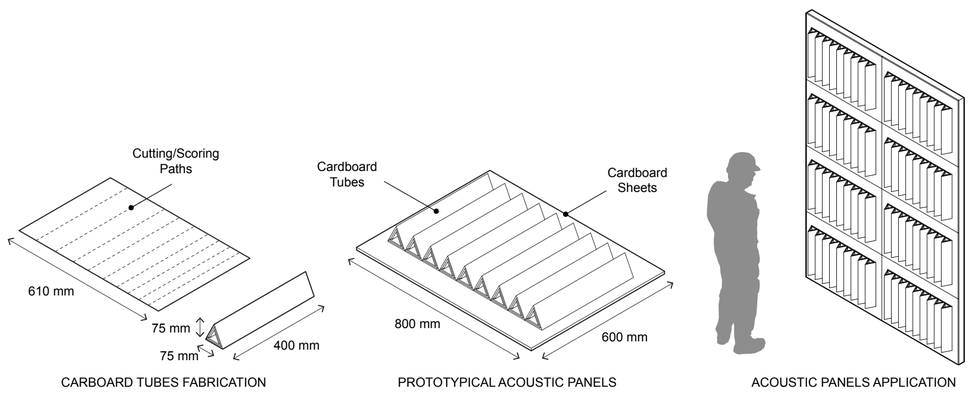
ROLLED LOGS

Inspired by standard paper tubes used in the packaging and construction industries, the goal is to make logs that could resist a load that is parallel to its length by itself or in combination with other materials. The logs can vary in diameter and length depending on the available material. These logs can be used as panel infill to improve strength and acoustic and thermal resistance, or as a structural element in combination with wood parts.



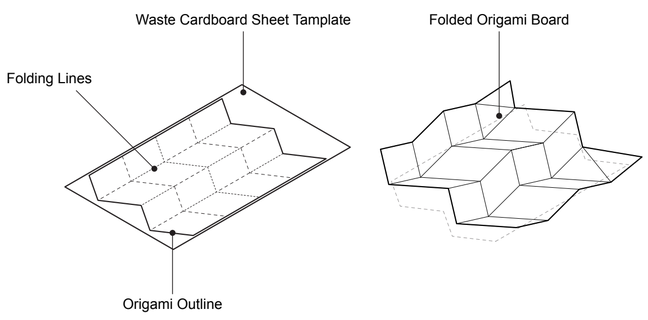
FOLDED TUBES

This is the easiest way to transform waste cardboard sheets into building elements. Using templates obtained with a digital-based tool and a knife, the fabricator cuts the pieces and folds by hand. The example shows a triangular-shaped tube that was used as an acoustic panel for a wall or ceiling. When waterproofed, the same panels can be used as formwork for casting concrete to make decorative facades.



ORIGAMI MOLDS

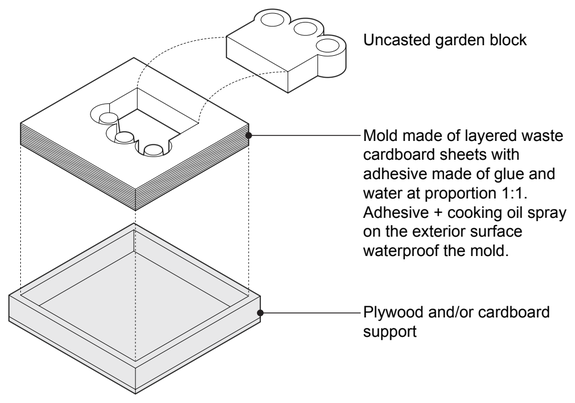
Wood formwork for casting concrete is expensive everywhere. However, making the molds with waste cardboard sheets could be inexpensive, recyclable, and easy to make. In this example we used simple cardboard sheets to cut and fold origami patterns designed with a digital-based tool. We included vinyl on the top surface to waterproof the panel and reuse the mold. The result is a smooth, folded surface ideal for a decorative facade.



Step 1: Cut Sheet

LAYERED MOLDS

If cutting and folding cardboard sheets is easy, layering and gluing is even easier! We made boards of 100mm thickness with layered sheets and cut them with conventional carpentry tools to make a mold to cast concrete blocks/planters. The blocks follow the traditional Korean block dimensions and the little planters can help to build a very refreshing wall-garden to cool down exterior spaces in the hot summer days in Seoul.



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