Waste Vault
The ETH Zürich Pavilion at the IDEAS CITY Festival in New York City

Felix Heisel

For the IDEAS CITY Festival in New York on 28-30th May 2015, ETH Zürich constructed a 90 m² pavilion made from recycled beverage packaging. The project, led by ETH Zürich’s Assistant Professor Dirk E. Hebel and Professor Philippe Block, aims to show the immense potential of waste for the construction sector.

A pavilion made from beverage packaging

ETH Zürich participated in the 2015 IDEAS CITY Festival from 28-30th May through the construction of the ETH Zürich Pavilion, an event location for seminars, lectures and exhibitions, jointly organised by the university and the New Museum. Following this year’s festival theme “The Invisible City”, the program addressed waste as an overseen building material of future cities. While waste grows steadily, it is typically suppressed and is therefore almost invisible as a resource. Designed as a collaboration project between the Block Research Group – BRG, and the Assistant Professorship of Architecture and Construction Dirk E. Hebel, the pavilion highlights various ways in which waste material – obtained here from discarded beverage cartons – can be used to build wide-spanning and load-bearing structures.

Shredded and pressed

In 2013, an estimated 178 billion beverage cartons were consumed worldwide (Tetra Laval 2014). In theory, the materials (paper 74%, polyethylene 22%, and aluminium 4%) can be re-separated relatively well. But this task requires a special machine and uses large amounts of water and energy. Recycling rates have climbed substantially in recent years. Nevertheless, some 430,000 tons of beverage cartons were thrown away in 2010 in the United States alone (Miller 2013). In cooperation with U.S. company ReWall, the beverage cartons for ETH Zürich’s pavilion first have been chopped up with a shredding machine. Subsequently, they were pressed into panels on a conveyor belt using heat and pressure. Neither
The pavilion activated the First Street Garden as an event location for the festival, especially in the evenings.
water, glue nor other additives are required, as the mixed material made up of aluminium, paper and polyethylene combines to form a waterproof entity. The surface reveals the source material through speckles, which stem from the coloured printing and shiny foil (The ReWall Company LLC 2015). A crucial factor in the choice of materials was the fact that the three substances used by the food packaging industry do not contain any harmful substances. Following their use in the pavilion structure, they can be fully re-integrated into the firm’s regular recycling process, as it happened already a couple of days after the dismantling of the pavilion. As one can speak of a down-cycling process from a drinking carton to a panelised version of the material, the re-cycling of the panels can be done as often as required with no diminishing of its mechanical quality.

Fig. 02  The surface reveals the source material through speckles, which stem from the coloured printing and shiny foil.

Fig. 03  The compression-only shell consists out of 34 pre-stressed catenary arches.
Material to design

Until now, the material was produced for interior panelling and used as a substitute for plasterboard in dry-wall construction. The ETH Zürich Pavilion however deployed ReWall for the first time as a load-bearing construction material in exterior use. As the sheets can warp and possess weak properties in terms of tension and bending, the team optimised the structure’s form to account for compression forces only. The 90 m² compression-only shell is composed of 34 single, pre-stressed catenary arches, which follow the flow of forces. Assembled from 2000 unique, single sheets, the discrete, triangular building blocks enlarge the static height, reduce the structure’s weight and make prefabrication possible. Respecting these structural constraints, the expressive pavilion was designed to appear to float in the narrow slot between the buildings of the First Street Garden, allowing and visualizing the use of a non-standard, weak material in construction.

The dry-assembled pavilion utilized industrial packaging straps to keep the thin, CNC cut sheets together in triangular blocks. Being extremely lightweight, the arches were tied down using straps. This strap-only construction process also enabled efficient disassembly. Without the need to remove or dispose of metal fixings, glue or non-recyclable materials, the structure’s components could subsequently be fully returned to the recycling process in a straightforward manner. The pavilion’s arches touched down on temporary support structures made of industrial pallets. The weight of these modules additionally anchored the shell to the ground without leaving invasive marks on the site after the pavilion’s removal. Finally, these support structures were elements of the spatial layout, forming the bar and exhibition areas, providing seating, and creating divisions or wall spaces.

For prefabrication of the elements, ETH Zürich opened a pop-up storefront workshop across the street from the festival’s site. During the month of May, this gallery was used to assemble all bricks for construction and build the bases for the arches. The final assembly on First Street Garden lasted 5 days leading up the pavilion’s opening and was executed by the ETH design team in collaboration with local contractors. Underneath and within this structure, ETH Zürich curated a program following the theme of the pavilion. The exhibition ‘Building from Waste’ displayed over 25 construction materials derived from waste, activating resources within our cities that have remained invisible until now. A covered area for about 30-40 people provided space for invited guests from ETH Zürich and its partners to organize lectures and seminars for the general public. Finally, the pavilion was dismantled in only two days, leaving no waste material on the site, as all substances were only “borrowed” for a short period of time before they went back to their regular recycling loops.
The structure rested on 400 industrial pallets that were returned into their regular cycle after the exhibition.
The expressive pavilion is designed to appear to float in the narrow slot between the buildings of the First Street Garden, allowing and visualizing the use of a non-standard, weak material in construction.
The interconnected single bricks and arches act as a 3-dimensional compression-only shell; picture taken during construction.
References


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Project Credits

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Fig. 07 Structure seen from underneath
Colophon

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