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A large, colorful, woven sculpture of a tower, resembling a stylized, multi-colored vase or a modernist tower, is being transported on a black flatbed truck. The sculpture is made of a dense, interwoven mesh of orange, red, and purple fibers. It has a wide base and tapers towards the top, which is capped with a small, dark, rectangular structure. The truck is driving on a paved road lined with tall palm trees under a clear blue sky. The text "R+D Awards" is overlaid on the back of the truck.

R+D Awards

First Award
Pulp Pavilion
Ball-Nogues Studio

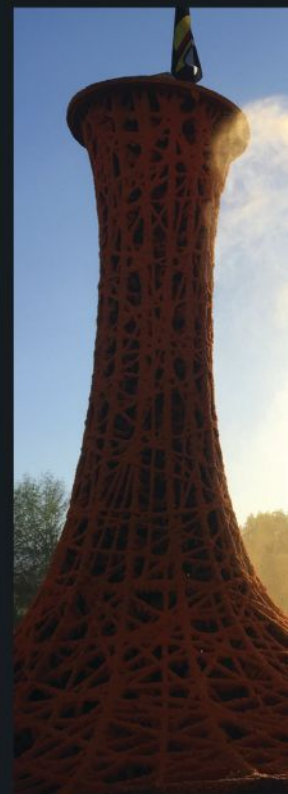




Since 1999, the Coachella Valley Music and Arts Festival has drawn the rich and the famous to the Southern California desert for a six-day party packed with stunning installations that give the live bands a run for their money. For Los Angeles design firm Ball-Nogues Studio, the event was ideal for debuting a building material it had been developing for years: recycled-paper pulp.

The inexpensive, abundant waste material has been used in everything from disposable drink trays to furniture and sculpture, but Ball-Nogues wanted to go further—much further. “We didn’t begin with a specific architectural objective,” says principal Benjamin Ball, ASSOC. AIA. “We wanted to see where the experiments would lead us.”

The studio started with shell structures. After mixing a slurry made from paper pulp and water, they used a homemade pressure sprayer to apply it to objects, tensioned fabrics, and even a Volkswagen Beetle, and then allowed it to harden.



Eventually, Ball says, “we had this intuition that we could spray the pulp over matrices or lattices of string.” By suspending rope between fixed armatures and adding layers of slurry, they could create a rigid, self-supporting structure. The rope gave the composite material tensile strength while the hardened pulp provided compressive strength. Weaving the cordage between fixed armatures, however, yielded the strongest structures. The studio could also produce structures that ultimately are in compression by flipping the entire assembly upside down.

For the 2015 Coachella festival, Ball-Nogues designed a pavilion made of seven 20-foot-tall woven “trees” that joined together in a latticed roof. To ensure their design could endure the highly public venue, they ran multiple failure tests on mock-ups to understand the composite material’s mechanical and structural properties. A finite element analysis of the entire pavilion helped simulate its performance under live and wind loads.

Construction took place near the festival site in Indio, Calif. Seven team members hand-wove jute rope around a removable metal-and-wood truss to create the initially upside-down trees. From the extensive experimentation and mock-ups, Ball says, “each of our staff became a specialist in a specific rule related to weaving” such as the density, porosity, and rope length within a given part of the tree.

The team sprayed 12 layers of paper pulp onto the ropes. Each layer was dyed with a different pigment, which became an indicator of how many layers each fiber had accumulated. Additional finish coats enhanced the structure’s multicolor effect. Cranes transported the trees from the staging area to the site, where the team flipped and anchored them, and then removed the trusses.

The pavilion was a hit. Covering 1,300 square feet, it offered a shady and joyful respite from the raucous event. After the event, but still at Coachella, Ball-Nogues and their structural engineer conducted



destructive tests with the pavilion to validate the hypotheses of its properties. The pavilion was then sent through a wood chipper and composted.

The project's innovative design, ambitious scale, and novel use of a recycled material wowed the jury. "The team took a huge risk," juror Steven Rainville said. "I've never seen this before." Juror Marc Fornes appreciated the studio's approach to discovery. "It's fresh and exciting," he said. "It drives you to go out and do research."

Ball-Nogues' co-principal Gaston Nogues says the technique can be used for indoor structures or as a temporary shelter—but only in dry climates, for now. In its current formulation, the composite material would dissolve in a rainstorm. With additives and waterproof coatings, however, it may be possible for future structures to withstand the elements. Juror Joyce Hwang, for one, wants Ball-Nogues to continue their exploration. "I can't wait to see another project made with the same method," she said. —C.H.

Judges

French architect **Marc Fornes** is the principal and founder of TheVeryMany in New York, as well as a self-described connoisseur of computer science. His work focuses on investigating design through codes and computational protocols. He received a master of architecture and urbanism from the Architectural Association School of Architecture in London.

Joyce Hwang, AIA, is an associate professor of architecture at the University at Buffalo, the State University of New York, and the director of Ants of the Prairie, a research and practice firm in Buffalo, N.Y., that confronts contemporary ecological conditions through creative means. She received an M.Arch. from Princeton University and a B.Arch. from Cornell University.

Steven Rainville, AIA, is a principal at Seattle-based Olson Kundig Architects, which he joined in 1996. He is also the director of the firm's R&D department as well as the founder of Mind Mine, the firm's forum for crowd-sourced ideas that break down boundaries between industries. He received his B.Arch. from Washington State University.

Credits

Pulp Pavilion, page 104

Client: Coachella Valley Music and Arts Festival
Design Firm and Fabricator: Ball-Nogues Studio, Los Angeles · Gaston Nogues, Benjamin Ball, ASSOC. AIA (project leads/designers); Rafael Sampaio Rocha (project manager); Ricardo Garcia, John Guinn, Fernando Marroquin, Rafael Sampaio Rocha, Forster Rudolph, Corie Saxman, Nicole Semenova, Ethan Schwartz (onsite project team); Andrew Fastman, AIA, Michael Anthony Fontana, Cory Hill, James Jones, Mora Nabi, Jacob Patapoff, Allison Porterfield (support)
Lighting Programming: F. Myles Sciotto
Structural Engineer: Nous Engineering · Omar Garza
Funding: Commission from Goldenvoice
Size: 1,300 square feet

Pure Tension Pavilion, page 108

Client: Volvo Car Italia
Design Firm: Synthesis Design + Architecture, Los Angeles · Alvin Huang, AIA (principal); Filipa Valente, Chia-ching Yang, Behnaz Farahi, Yueming Zhou
Structural Engineer: BuroHappold Engineering
Electrical Engineer: Ascent Solar

Bar Raval, page 110

Client: Grant van Gameren, Mike Webster, and Robin Goodfellow
Design Firm: Partisans, Toronto · Alexander Josephson, Pooya Baktash, Jonathan Friedman, INTL. ASSOC. AIA, Ivan Vasylyv, Ariel Cooke
Consultant and Fabricator: Millworks Custom Manufacturing
Special Thanks: Klaudiusz Kociolek, Gregory Rybak, Nick Savage, CNC Software/Mastercam
Size: 1,500 square feet

Co-Robotics and Construction, page 112

Design Firm: Rust Belt Robotics Group, University at Buffalo, State University of New York (SUNY)

OSCR-1 and OSCR-2 Team: Ball State University · Mike Silver, Mahesh Daas, Josh Vermillion (faculty); Yevgen Monakhov, Jason Foley, Matthew Fullenkamp, Assoc. AIA, William Zyck, Justin Krasci, Michael Bolatto, Tyler Cox, ASSOC. AIA, Glenn Cramer, ASSOC. AIA, Robert Cichocki, Antone Sgro, Derek Anger, Tianxia Peng, Derek Newman, David Smith, Yao Xiao, Matthew Wolak, Thomas Friddle (students)
OSCR-3 Team: University at Buffalo, SUNY Team · Mike Silver, Karthik Dantu (faculty); Colin Jacobs, Tim Ruhl, Albis Del Barrio, David Heaton, Gary Chung, David Lin, Georine Pierre, Robert Miller, Johnny Lynch, Daniel Fiore, Dylan Burns, Jia Jian Feng You, Marc Velocci (students)

Queen Richmond Centre West, page 113

Client and Funding: Allied Properties REIT
Design Firm: Sweeny & Co Architects, Toronto
Structural Engineer: Stephenson Engineering
Fabricators: Cast Connex, Walters Group
Construction Management: Eastern Construction
Electrical Engineer and Lighting Designer: Mulvey & Banani International
Mechanical Engineer: The Mitchell Partnership
Special Thanks: Michael Emory, Hugh Clark, John Stephenson, Jeffrey Stephenson, Carlos de Oliveira, Frank DeCaria, Renato Tacconelli, Tim Verhey
Size: 302,000 square feet

Radical Railbanking, page 114

Design Team: Master of None, Ann Arbor, Mich. · McLain Clutter (project adviser); Sehee Kim (student research assistant)
Funding: University of Michigan Office of Research, funding for Artistic Productions and Performances, 2011; University of Michigan Taubman College of Architecture and Urban Planning
Special Thanks: Syracuse University School of Architecture · Mark Linder

Bands, page 115

Client: Samitaur Constructs · Frederick and

Laurie Samitaur Smith
Design Firm: Eric Owen Moss Architects, Culver City, Calif. · Eric Owen Moss, FAIA (architect); Dolan Daggett, Vanessa Jauregui, Nicholas Barger, Zarmine Nigohos, Sean Briski, Raul Garcia, Scott Nakao, Richard Yoo (project team)
Structural Engineer: Arup
Size: 183,000 square feet

Philip J. Currie Dinosaur Museum, page 116

Client: Philip J. Currie Dinosaur Museum
Design Firm: Teeple Architects, Toronto · Stephen Teeple, Martin Baron, Mark Baechler, Will Elsworth, Lang Cheng, Carla Pareja, Gloria Perez
Architect of Record: Architecture | Tkalcic Bengert
Structural Engineer: Fast + Epp
Mechanical Engineer: Hemisphere Engineering
Electrical and Civil Engineer: AECOM
Exhibit Consultant: Reich+Petch
Landscape Architects: Scatliff+Miller+Murray
LEED Consultant: Enermodal Engineering (now part of MMM Group)
Contractor: PCL Construction Management
Fabricators: StructureCraft Builders in collaboration with Fast + Epp
Size: 42,000 square feet

Breathe Brick, page 117

Design Firm: Both Landscape and Architecture, Charlottesville, Va. · Carmen Trudell (primary investigator)
Collaborators: California Polytechnic State University, San Luis Obispo (Cal Poly) · Tracy Thatcher (consultant); Natacha Schnider, Kate Hajash, Cameron Venancio, Justin Wragg, Jennifer Thompson, Michelle Kolb (student research assistants); Rensselaer Polytechnic Institute · Kateri Knapp, Kyleen Hoover (student research assistants)
Funding: Cal Poly College of Architecture and Environmental Design's Planning, Design and Construction Institute