

Cast & Place Pavilion: Transformation from Structure to Other Objects

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IDENTIFYING THE NEED FOR REUSE

Buildings live longer than their makers. It is not uncommon to see historic buildings reuse elements from older structures. In contrast, contemporary construction produces a significant amount of waste. While recycled materials are part of current discussions on sustainable building design, the recycling process requires additional resources and energy to produce an element with reliable behavior and performance. The direct reuse and reclamation of existing elements requires different considerations. Designing for reuse recognizes that a building is not born in a design, but only reincarnated; old parts may have incurred flaws during an unknown past, and must also survive to perform in the future.

PAVILION AS OPPORTUNITY AND CONCEPT

City of Dreams is an annual design competition sponsored by FIGMENT, the Emerging New York Architects Committee (ENYA) of the American Institute of Architects New York Chapter (AIANY), and the Structural Engineers Association of New York (SEAoNY). The competition winner then builds a temporary pavilion for the New York City community on Governors Island.

Cast & Place (Figure 1), the winner of the 2017 City of Dreams design competition, investigated how recycled aluminum could be transformed into an architectural structure using an experimental fabrication method.¹ The panels were fabricated by drying clay in trays (Figure 2) and then casting aluminum in the network of cracks that formed (Figure 3). On-site clay was placed adjacent to the finished structure and allowed to wet, dry, and crack to demonstrate to visitors the process used to develop the patterns. While installed on the island from June to November 2017, the pavilion provided a gathering place under the trees.

Following the disassembly of the pavilion, the panels were intended to be repurposed into furniture, rather than disposed of or recycled. This post-pavilion life was considered during the

project's design phase. Proceeds raised from the pre-sale of the repurposed objects helped fund the pavilion's realization. At the start of the project, the team was able to raise over \$30,000 through support provided by the New York City community and beyond via Kickstarter.

FROM STRUCTURE TO FURNITURE

Aluminum is lighter than steel and infinitely recyclable, but varies considerably in quality depending on its metallurgical make-up (alloyed with other metals) and its tempering process.² The aluminum sourced for this project was primarily recycled ingot, but also low strength and highly malleable food-grade disposable aluminum products, such as beverage cans and foil packaging. Consequently, the material's strength varied and was accounted for in the pavilion's structural design.³

Since the transformation of the panels into furniture such as stools (Figure 4) and benches (Figure 5) was anticipated from the beginning, the full seated load on a bench was evaluated and compared to the pavilion's anticipated loads. Due to the pavilion's site and the events scheduled near the pavilion, it was expected that malicious loads (climbing, shaking, etc.) would act on the structure. Neither ASCE 7⁴ nor the New York City Building Code (NYCBC)⁵ provide explicit loads for event pavilions, but do specify 50 lb/ft line and 200 lb concentrated loads for handrails. To resist these loads the pavilion structure could rely upon steel plate frames tucked between and tying the panels together.⁶ However, NYCBC specifies a 250 lb concentrated live load for seats.⁷ Once the panels were converted to furniture, there would no longer be supporting steel framing, with the aluminum panels attached instead by wood screws to red oak legs. These connections to the wood introduced other challenges. Though oak is strong, timber connections necessitate subtracting material and often the connection can govern the system. Ultimately, the dimensioning of the panels themselves was governed by this future post-pavilion object, but consideration of the connections would have facilitated the conversion process.



Figure 1. Cast & Place (New York, NY, 2017)



Figure 2. Trays of dried and cracked clay



Figure 3. Aluminum panel cast in cracked clay



Figure 5. Aluminum panel transformed into a bench. credit: Philip Segal

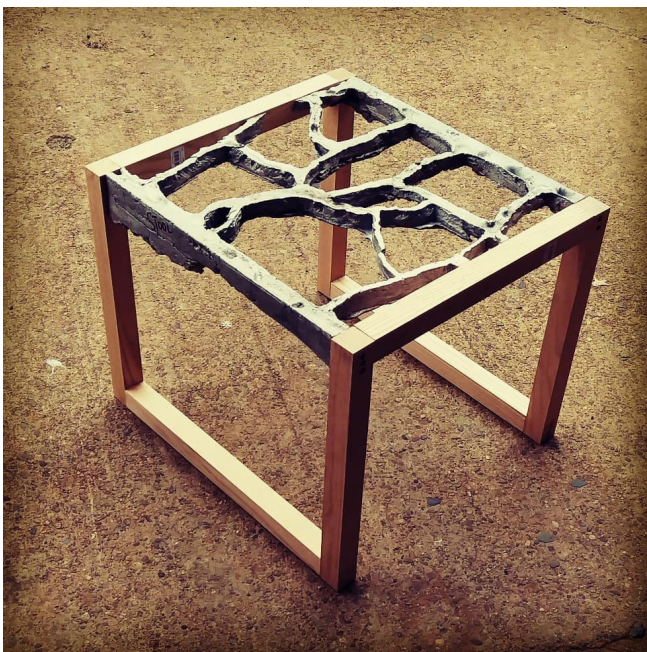


Figure 4. Aluminum panel transformed into a stool



Figure 6. Aluminum panels on display at *Osmunda: (Re)Wild*



Figure 7. Aluminum panels configured into an arbor

FROM STRUCTURE TO ARTWORK

Artistic applications were not considered structurally during the initial design, but present potential new directions for future projects. A few of the panels remained intact and were sold as works of art to individuals. These were briefly publicly displayed at Gallery 151 in New York, NY during a 2018 event, *Osmunda: (Re)Wild*, that was part exhibition and part laboratory (Figure 6). The panels were displayed with a wide range of pieces by other designers that combined design, technology, education, and performance, with the intent to provoke greater interest and deeper consideration for sustainable practices. The event also presented the opportunity to extend conversations about recycling and up-cycling in the building industry with show attendees.

In another case, three intact panels were combined to form an arbor (Figure 7). The casting method could be utilized to directly create panels for this application or more generally, lattice structures that have reached the end of their lives could be disassembled and reconfigured.

CONCLUSION

Just as temporary pavilion-scale projects provide excellent opportunities to experiment with materials, forms, and structures, they can also be a testbed for developing a range of disassembly and re-use practices that can then be investigated at larger scales. The successful conversion of the Cast & Place pavilion's panels into other objects demonstrates how a temporary pavilion can be designed such that its components have a second

life when end-of-life uses are considered early in the process. Reuse could be further ensured in future designs by considering not only primary members, but also connections and their placement for multiple uses.

ENDNOTES

1. Edward M. Segal et al., "Clay Cracking: A Natural Process Guiding a Design-to-Fabrication Method for Cast Aluminum Panels," *Technology / Architecture + Design* 4, no. 1 (2020): 106-114, <https://doi.org/10.1080/24751448.2020.1705722>
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3. Alexandra A. H. Cheng et al., "Structural Design of Cast & Place, a Cast Aluminum Pavilion," in *Proceedings of the IASS Symposium 2018*, eds. Caitlin Mueller and Sigrid Adriaenssens, Cambridge, MA, 2018.
4. American Society of Civil Engineers, "Chapter 4: Live Loads," in *ASCE Standard ASCE/SEI 7-10: Minimum Design Loads on Buildings and Structures* (Reston, 2010), 13-16.
5. New York City Department of Buildings, "Chapter 16: Structural Design, Sections BC 1607.7.1.1-1607.7.2," in *New York City Construction Code: Building Code* (New York, 2014).
6. Cheng et al. *Proceedings of the IASS Symposium 2018*.
7. New York City Department of Buildings, "Chapter 16: Structural Design, Sections BC 1607.7.1.1-1607.7.2."