

Winter meeting of SG Sustainable Construction
17-19 February 2020 - Venice

Digital fabrication on site

state of the art and future developments

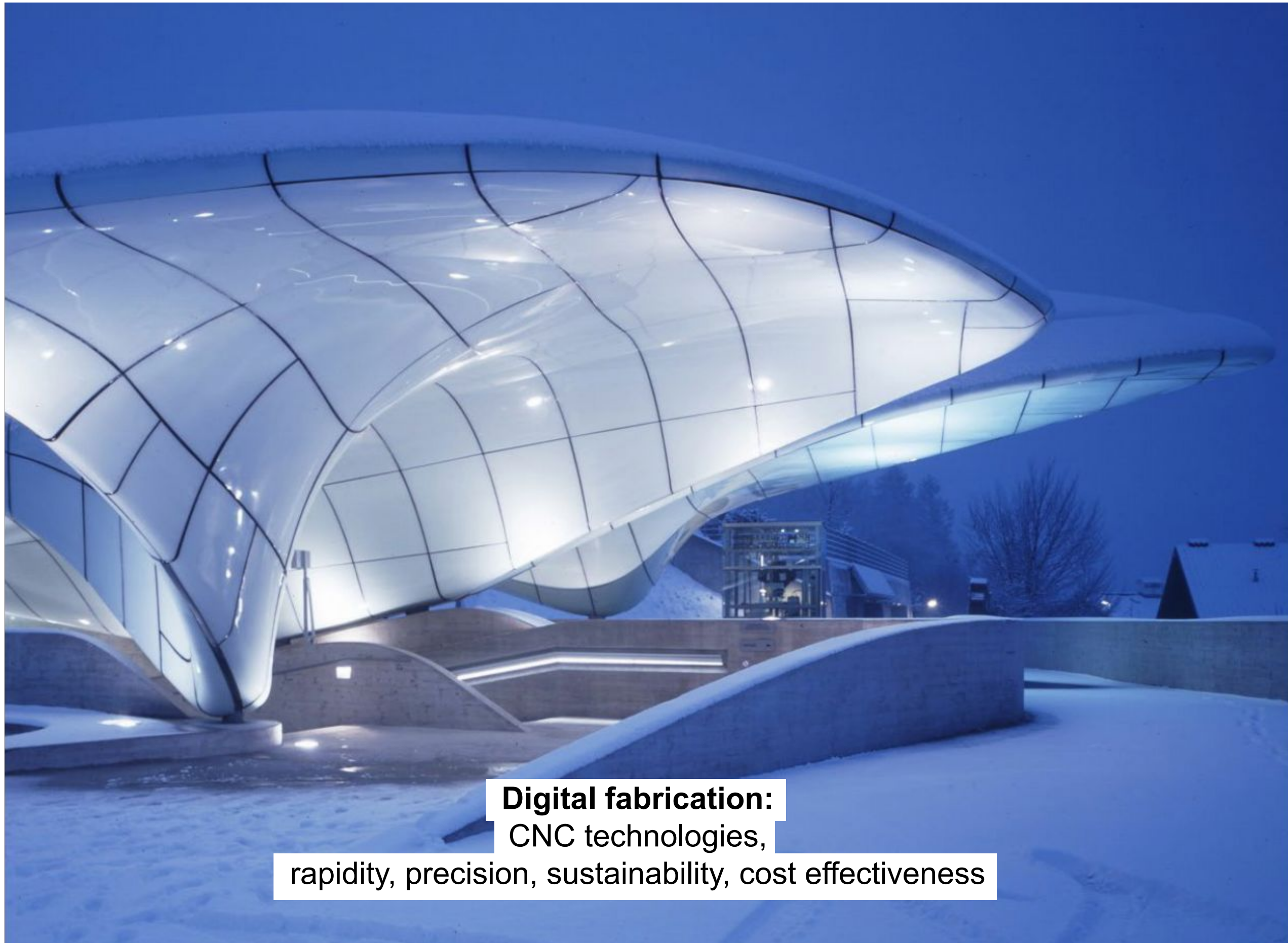
Fablab Venezia srl
Leonidas Paterakis - technical director



Fablab Venezia: a digital fabrication and social innovation laboratory, an infrastructure for enterprises and institutions to develop their digital potential



**Mission: product development, process innovation, sustainability
made possible through digital technologies**



Digital fabrication:
CNC technologies,
rapidity, precision, sustainability, cost effectiveness



Innovating through:
parametric modeling/algorithmic design,
form optimization through simulations,
additive manufacturing,
innovavite materials.

Digital Fabrication + Building Industry: numbers

3D printing market in the building industry:
40 billion \$ till 2028 (worldwide)

(source SmarTech)

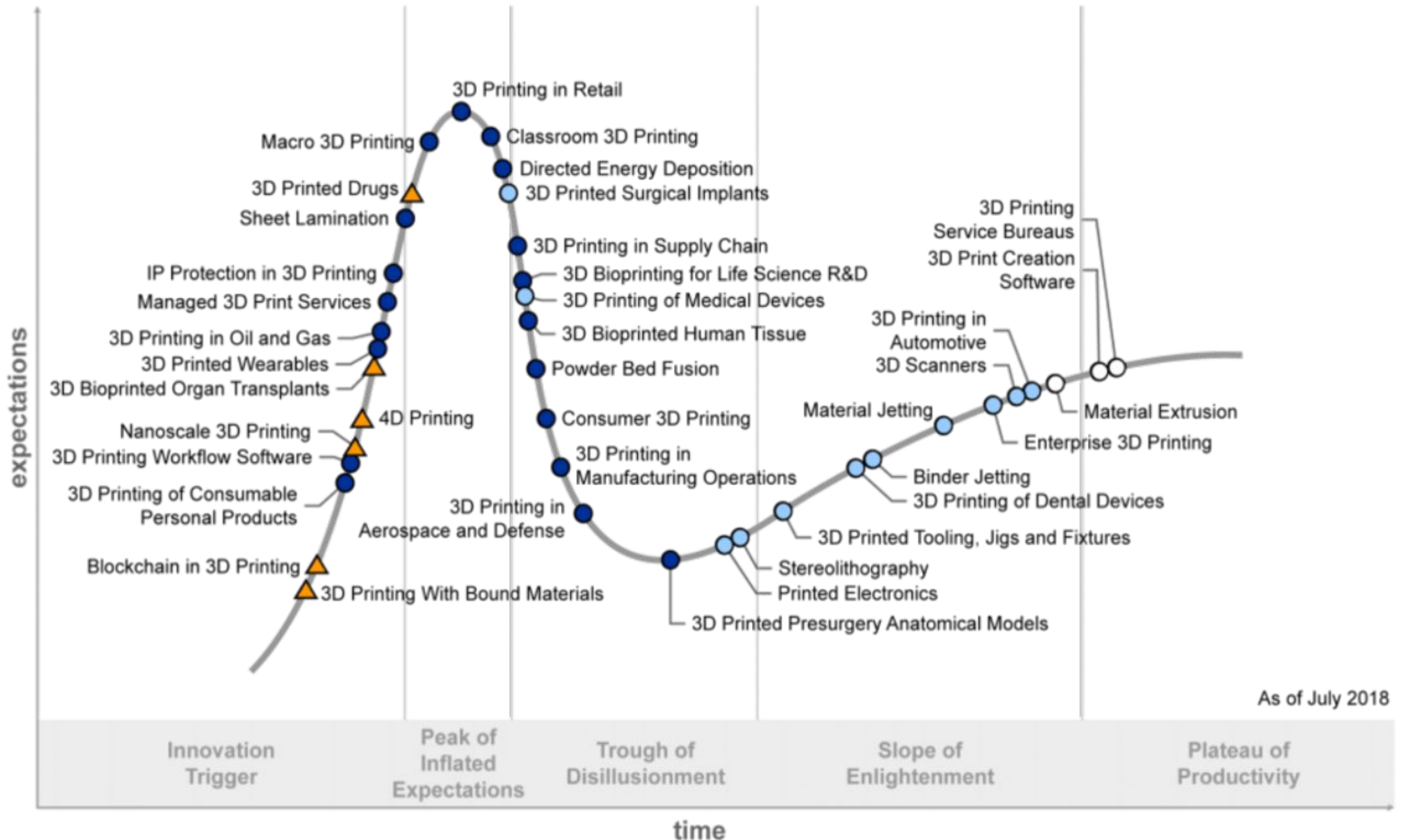
Concrete usage: 3 ton. pro capite/year
responsible for 8% CO2 emission.

3D Printing + Form optimization: -70% of the needed quantity.

(source Chatham House, WWF)

3D printing can reduce up to 60% the cost of concrete
since there's no need of molds

(Review of Emerging Additive Manufacturing Technologies in 3D Printing of Cementitious Materials in the Construction Industry - via ResearchGate)



Plateau will be reached:

- less than 2 years
- 2 to 5 years
- 5 to 10 years
- ▲ more than 10 years
- ⊗ obsolete before plateau

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From vision to building site: The road for a new way of manufacturing

1st phase. Testing potential applications, experiments, proof of concepts and examples, find gaps on existing regulations and bureaucratic limitations.

output: realization of experimental spaces

2nd. Collaboration with construction companies and technicians: involve practitioners in the evolution of the process. introduction of “green” principles in a broader sense; bio-materials

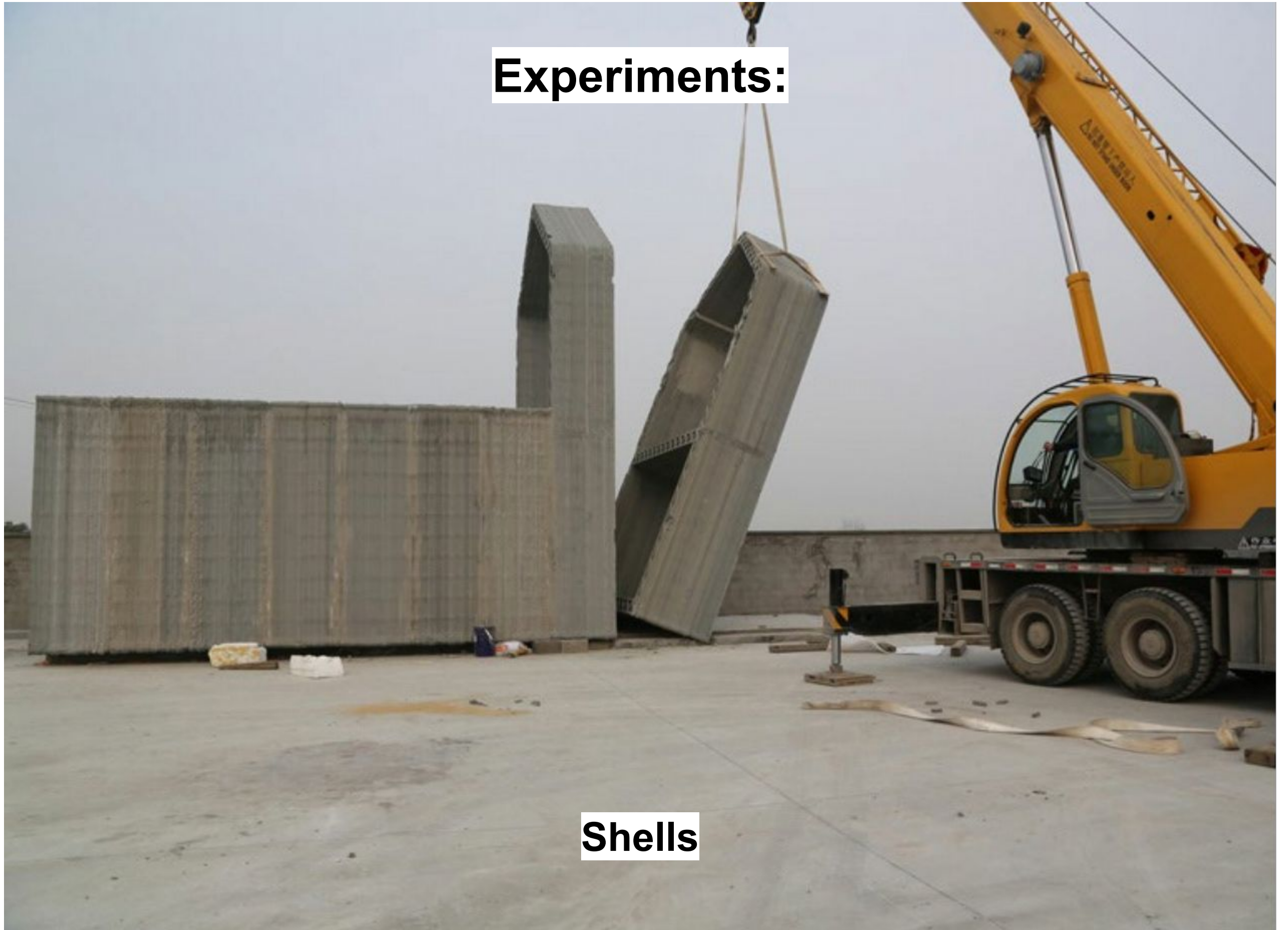
output: regulation-wise non-complex buildings

3rd. Process tuning: Wide availability of materials and techniques able to deliver the requested outputs. New materials and technologies are part of the constructive techniques abacus.

Output: Free form, fully customizable, optimized elements shift the traditional paradigms of the construction industry on another level.

Experiments:

Shells

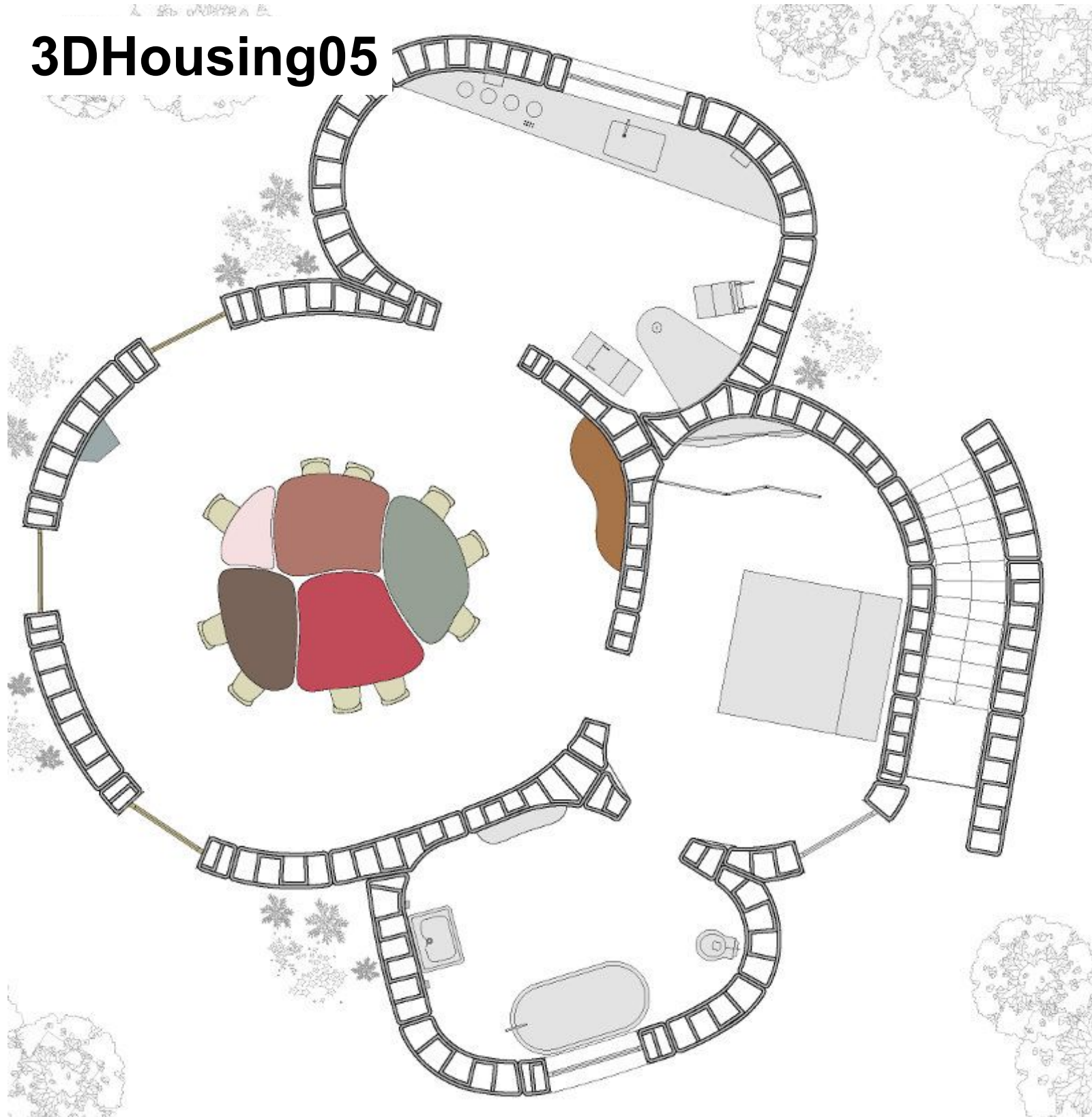


3DHousing05



Massimiliano Locatelli & partners + Italcementi + Arup Group + Cybe construction
Milano Design Week 2018

3DHousing05

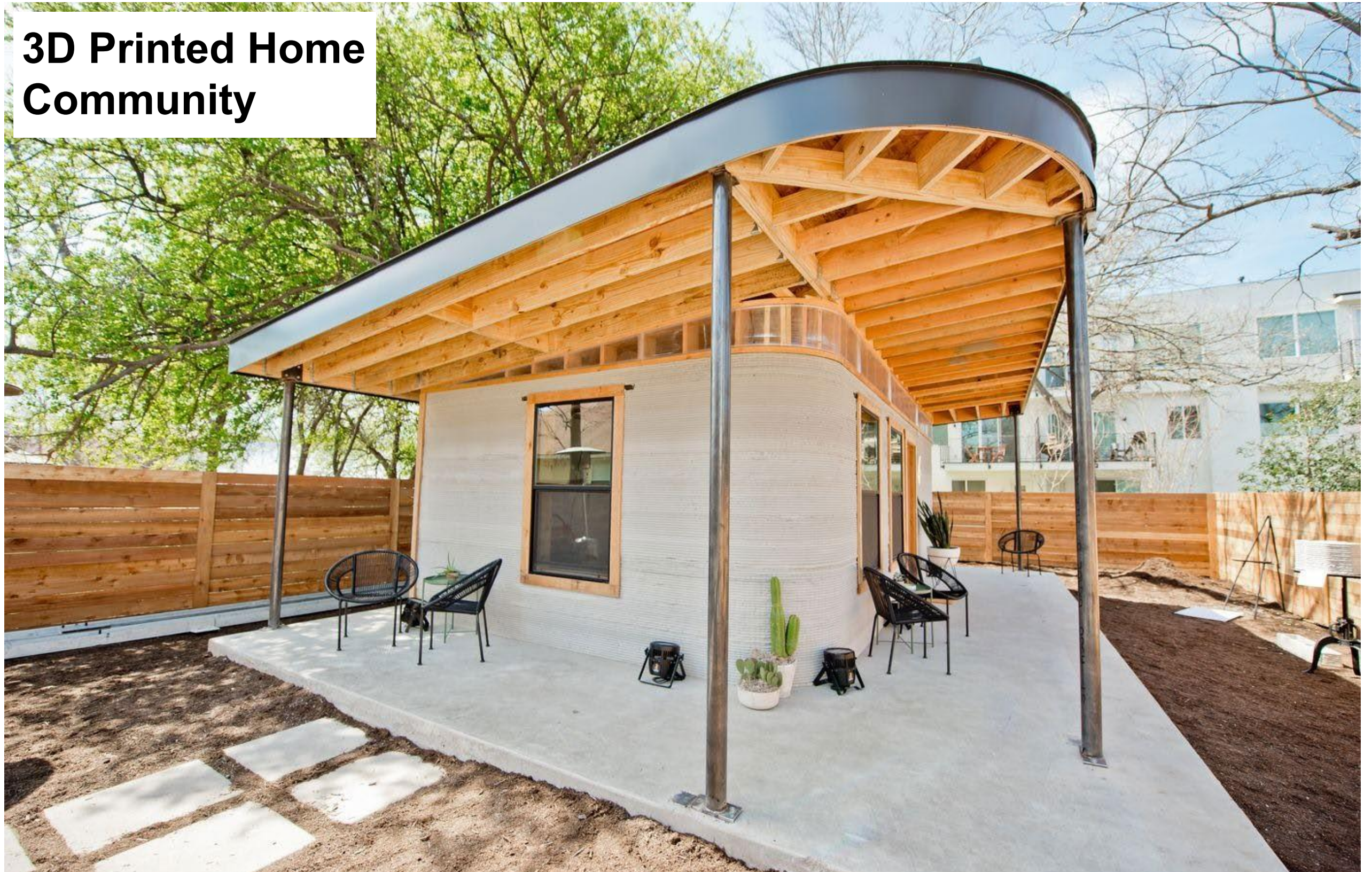


100 square mt - printed on site in one week - concrete powder, binder, inerts
the material can be reused for other constructions

3DHousing05



3D Printed Home Community



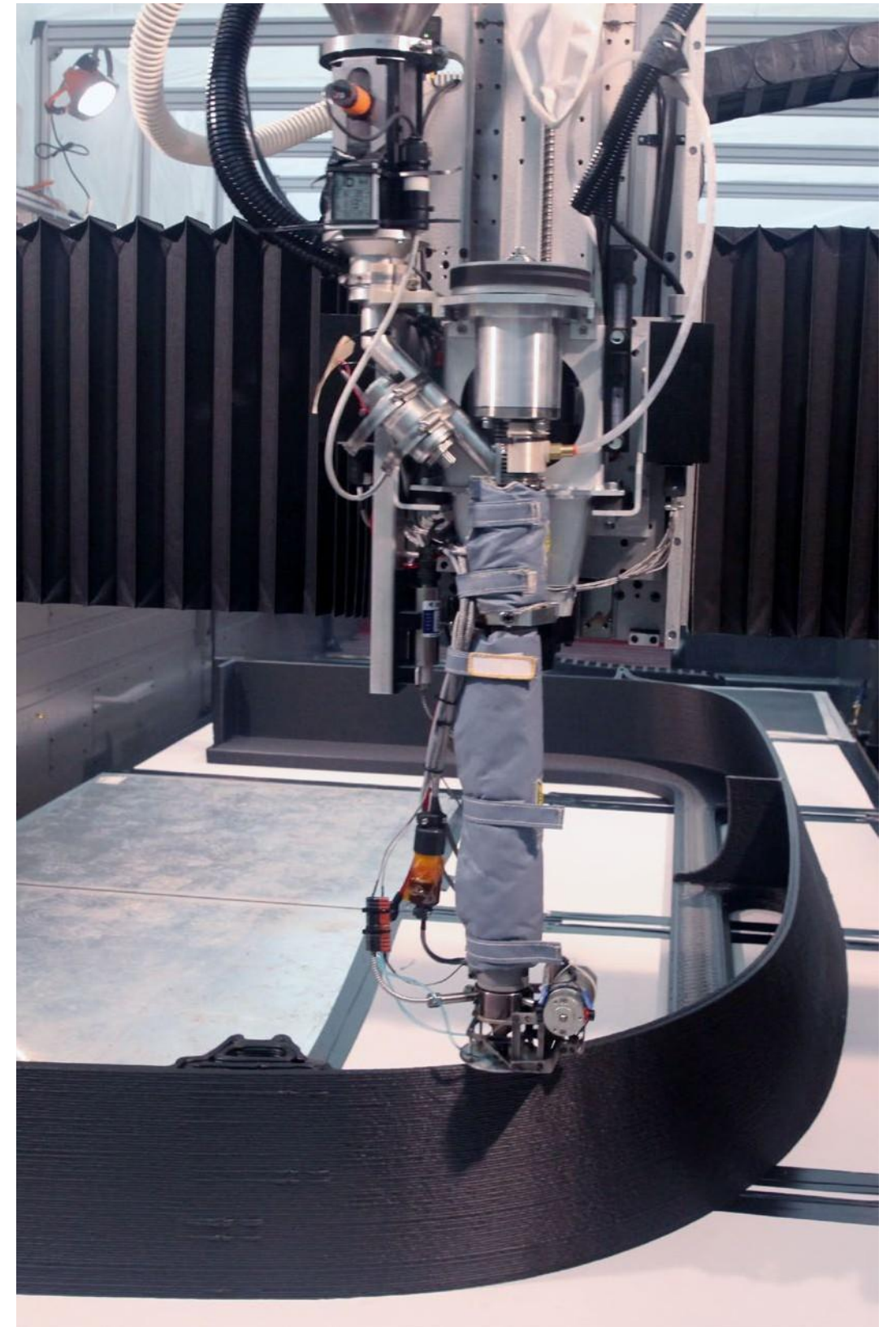
Yves Behar + New Story + ICON - Sud America
50 houses pfor low income people, co-designed, printed in 24h each

AMIE Demonstration Project



Skidmore Owings & Merrill + Oak Ridge National Laboratory
Tennessee

AMIE Demonstration Project



Autonomous prefab shell, it can produce, store and exchange energy with electric vehicles

BOD - Building On Demand



Cobod Int. + Danish government
Danimarca

BOD - Building On Demand



50 square mt. - first partly printed building in Europe to follow law regulations: walls and foundation are 3d printed



Experiments:

Bridges, modular structures, pavilions

Red Light Steel Bridge



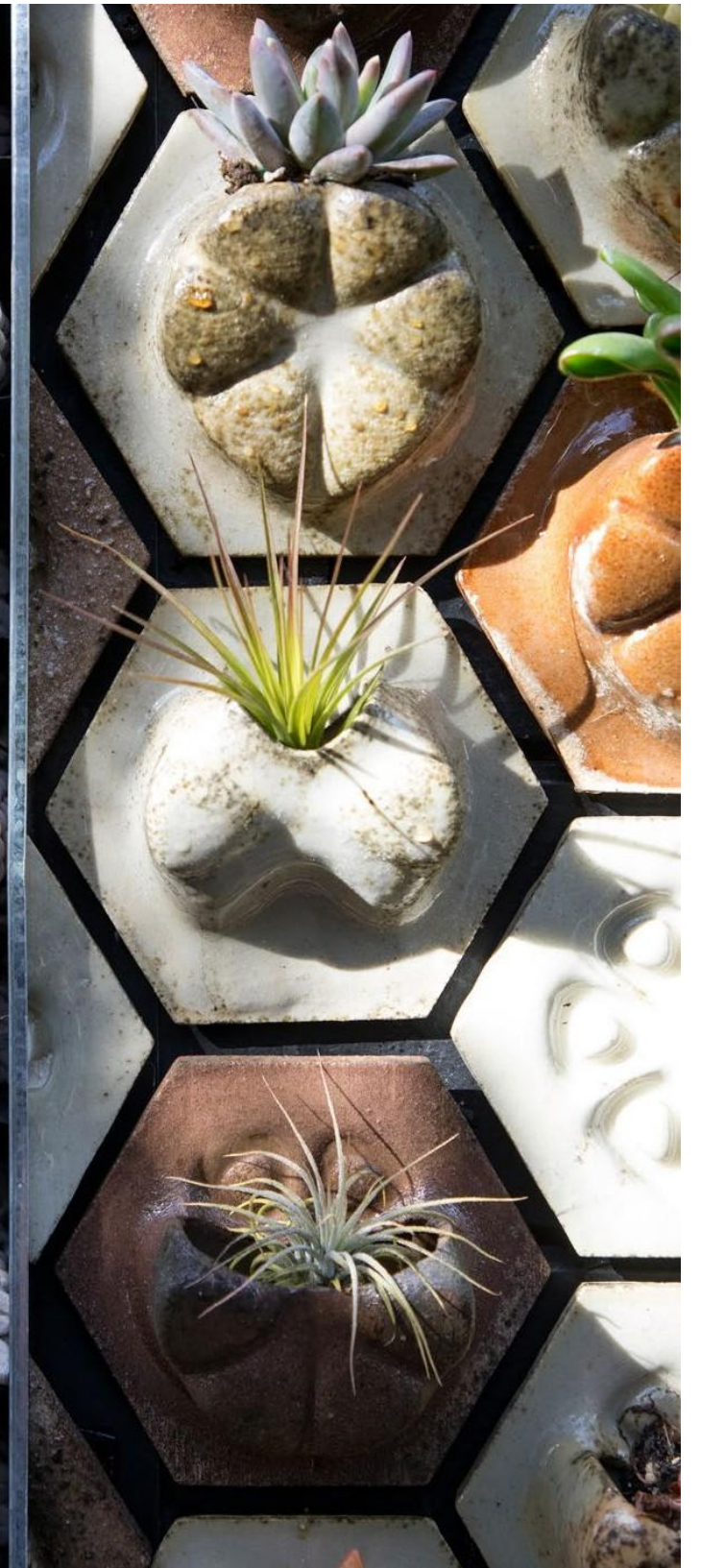
MX3D - Joris Laarman Lab + Arup + ArcelorMittal + ABB
Amsterdam

Red Light Steel Bridge



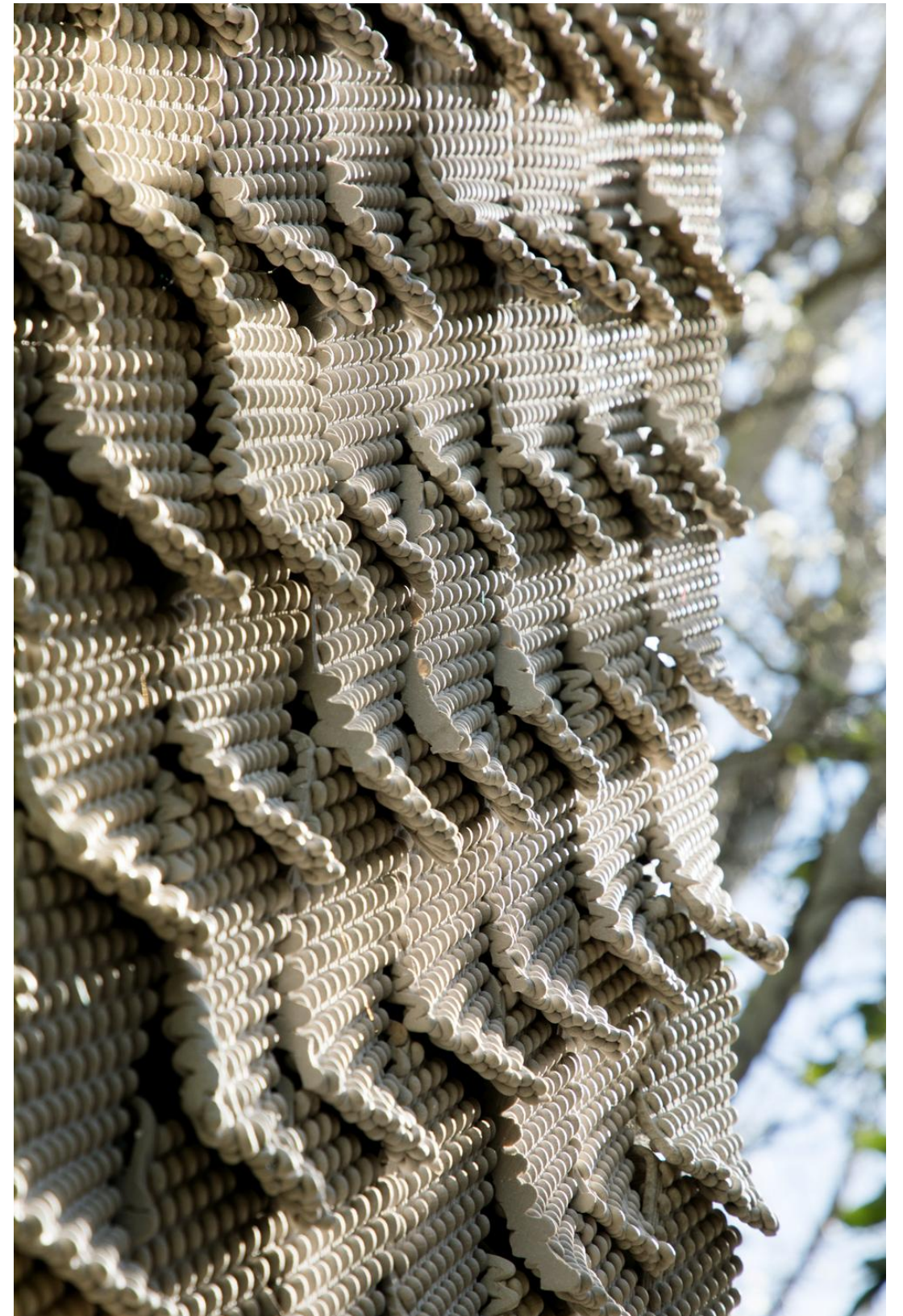
entirely made of 3d printed stainless steel, using 4 robotics arms
4.500 kg of materila, 6 months long printing process, tested for a 20 tons reach

3D printed Cabin



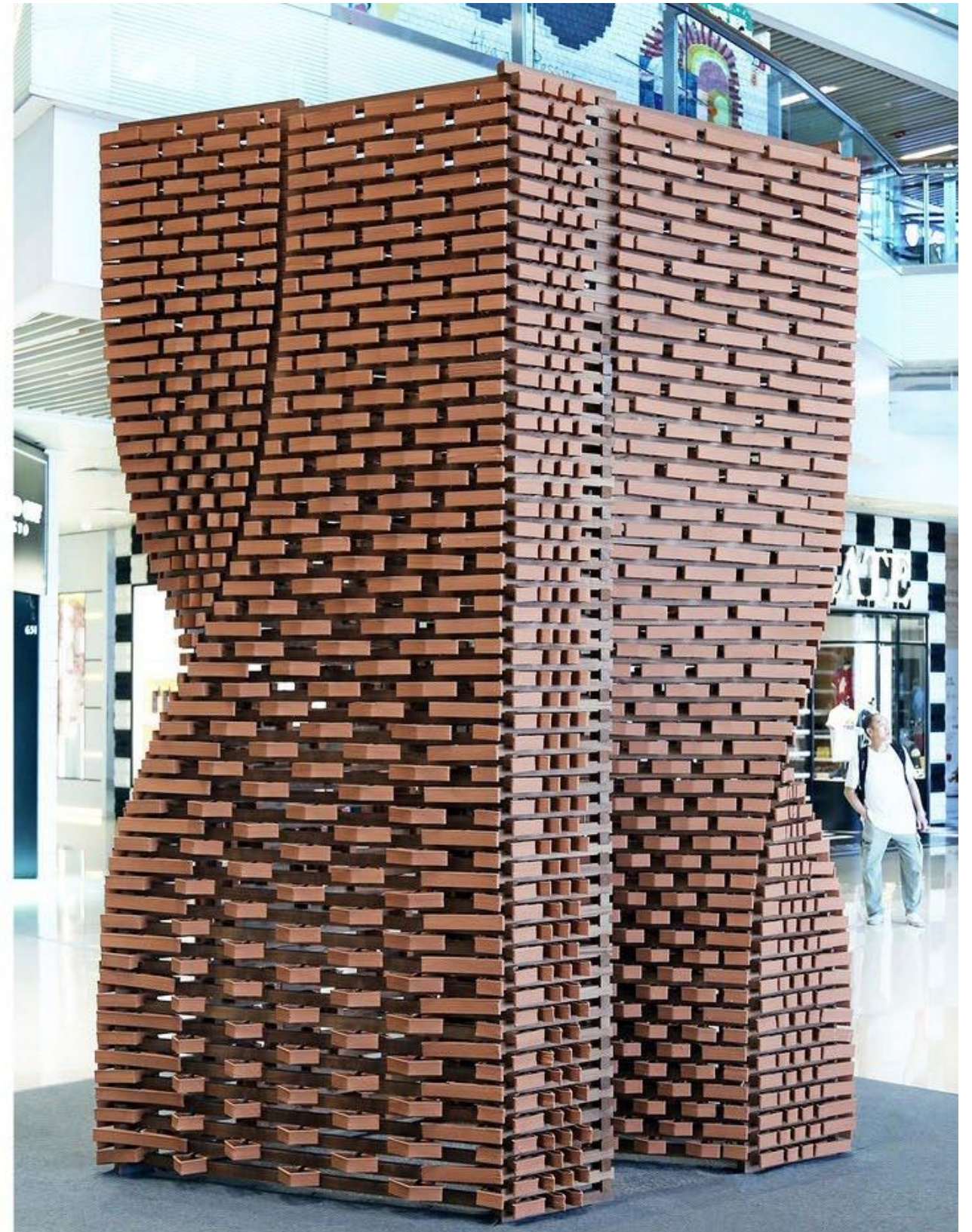
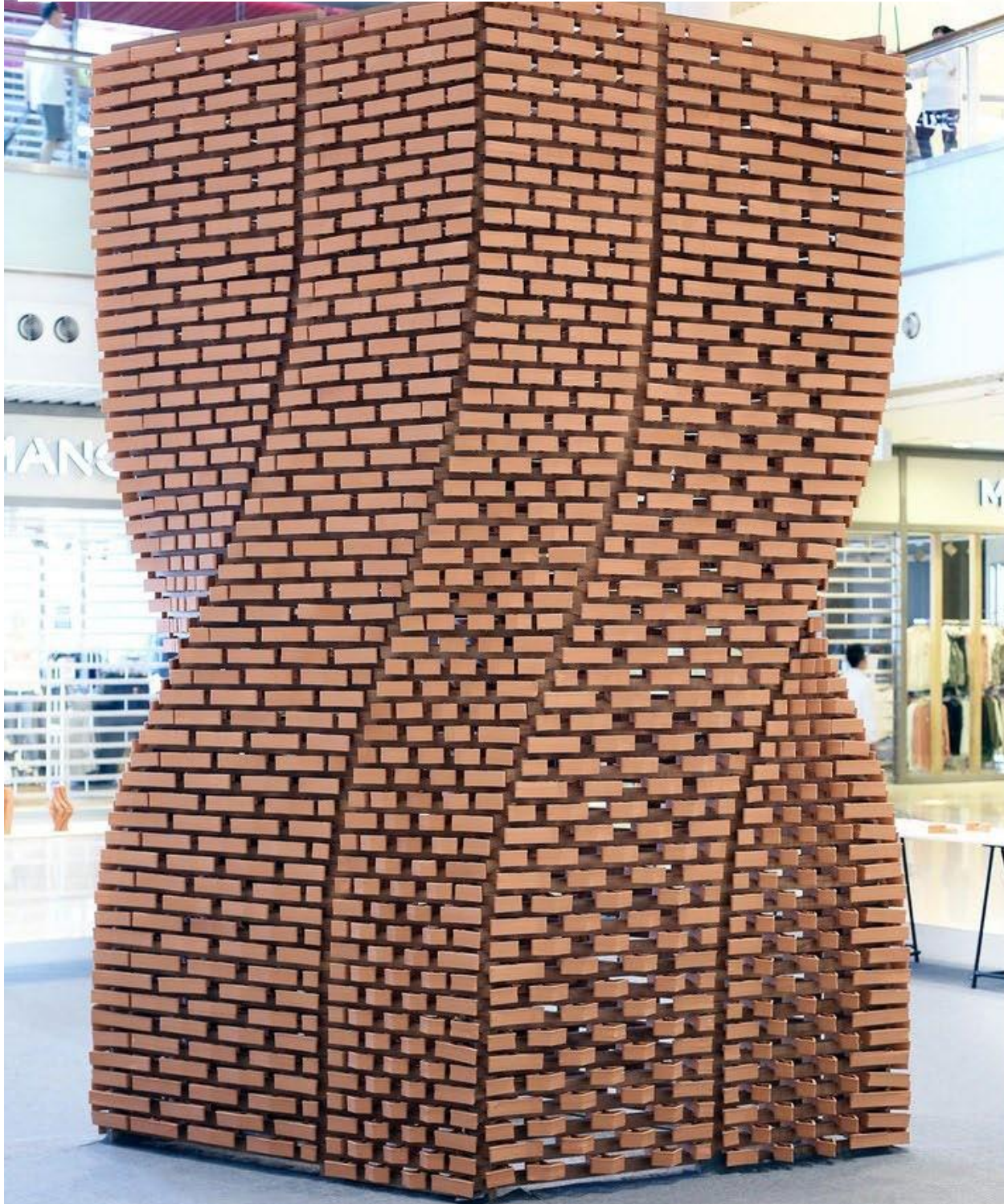
Emerging Objects - Rael San Fratello
Oakland

3D printed Cabin



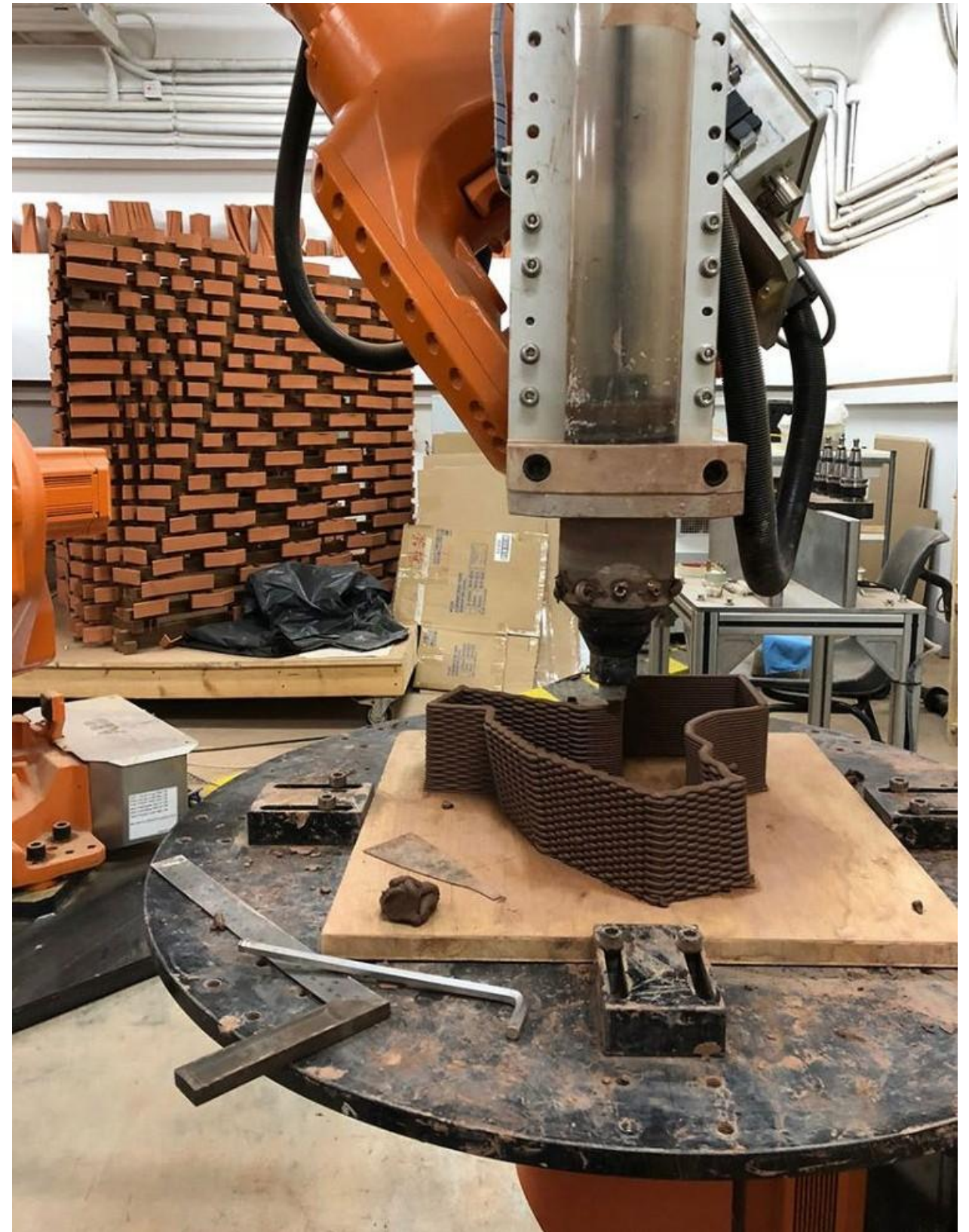
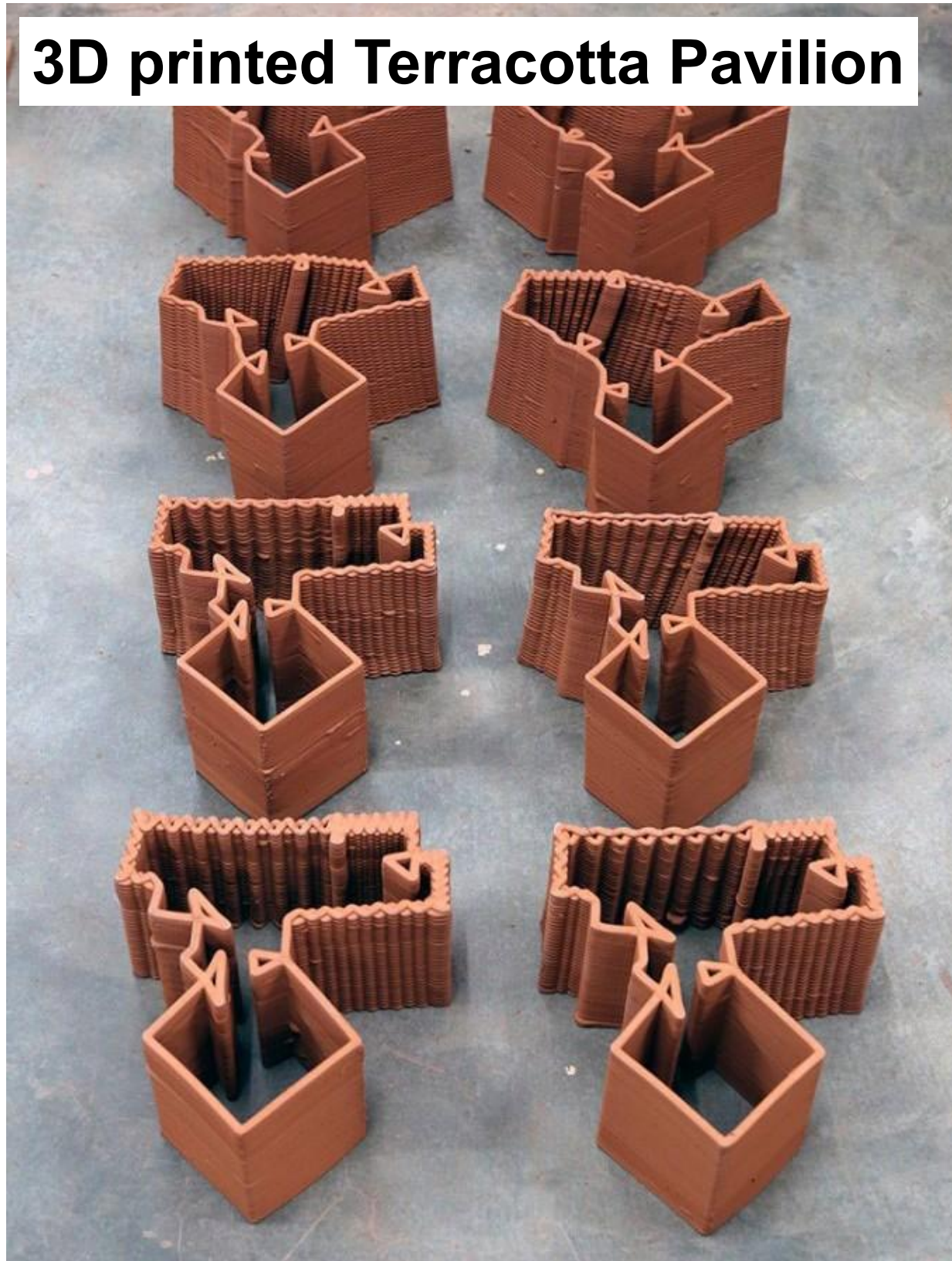
a modular structure with an external cladding of 4.500 terracotta 3d printed tiles
the interior is out of bio-plastic

3D printed Terracotta Pavilion



students of the HKU Architecture University + Sino Group
Shenzhen

3D printed Terracotta Pavilion



2.000 unique terracotta pieces, printed by a robotic arm, wooden structure,
total height 3.8 m

Earthquake-proof Column



Emerging Objects - Rael San Fratello
San Francisco

Earthquake-proof Column



modular 3d printed elements using sinterization technique

Concrete pillar



XtreeE - Marc Dalibard
Aix-en-Provence

Concrete pillar



4 meters height concrete pillar, disposable 3d printed formwork, pured cement,
4 prefab elements assembled - printing time 15.5 h

Trabeculae Pavilion



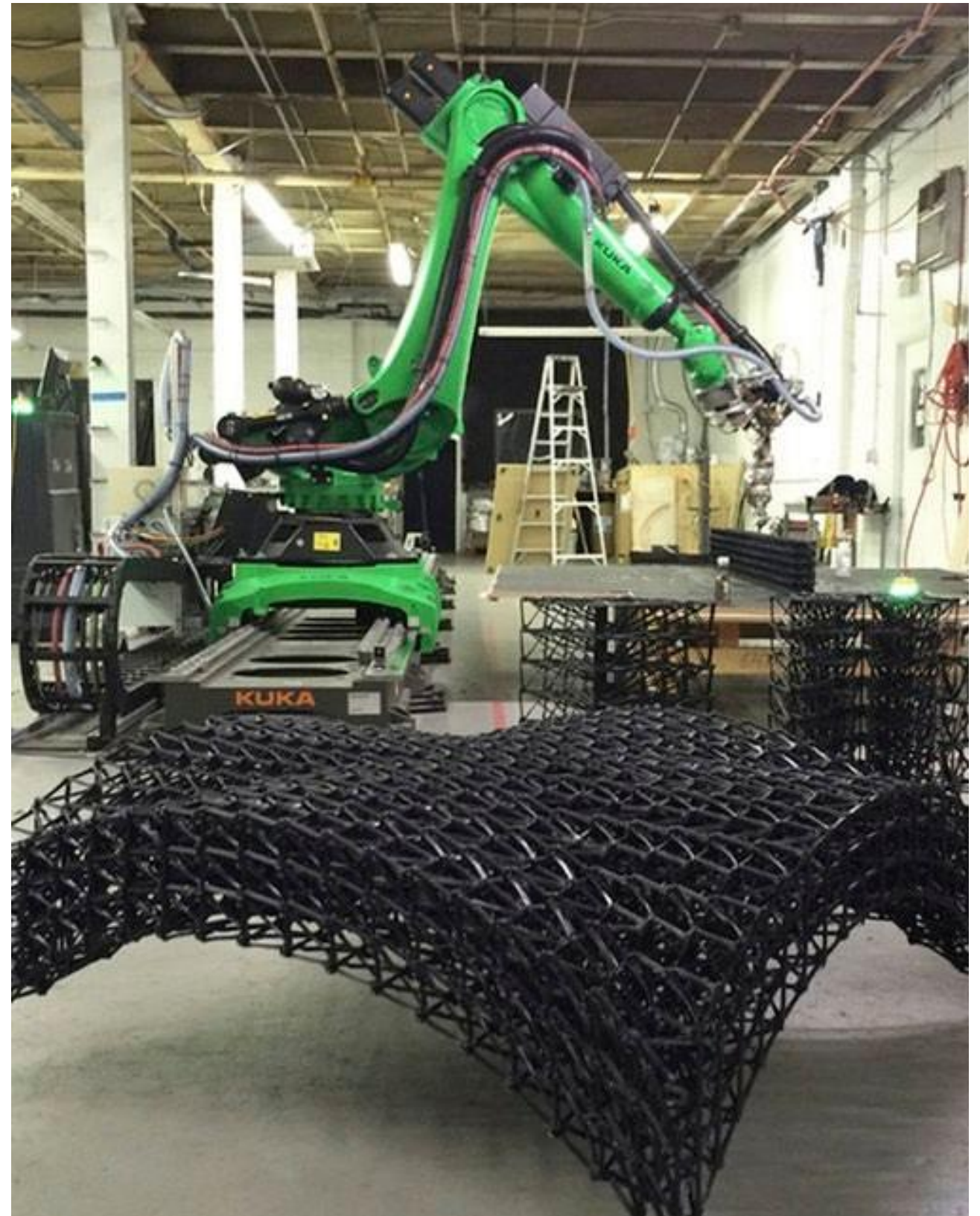
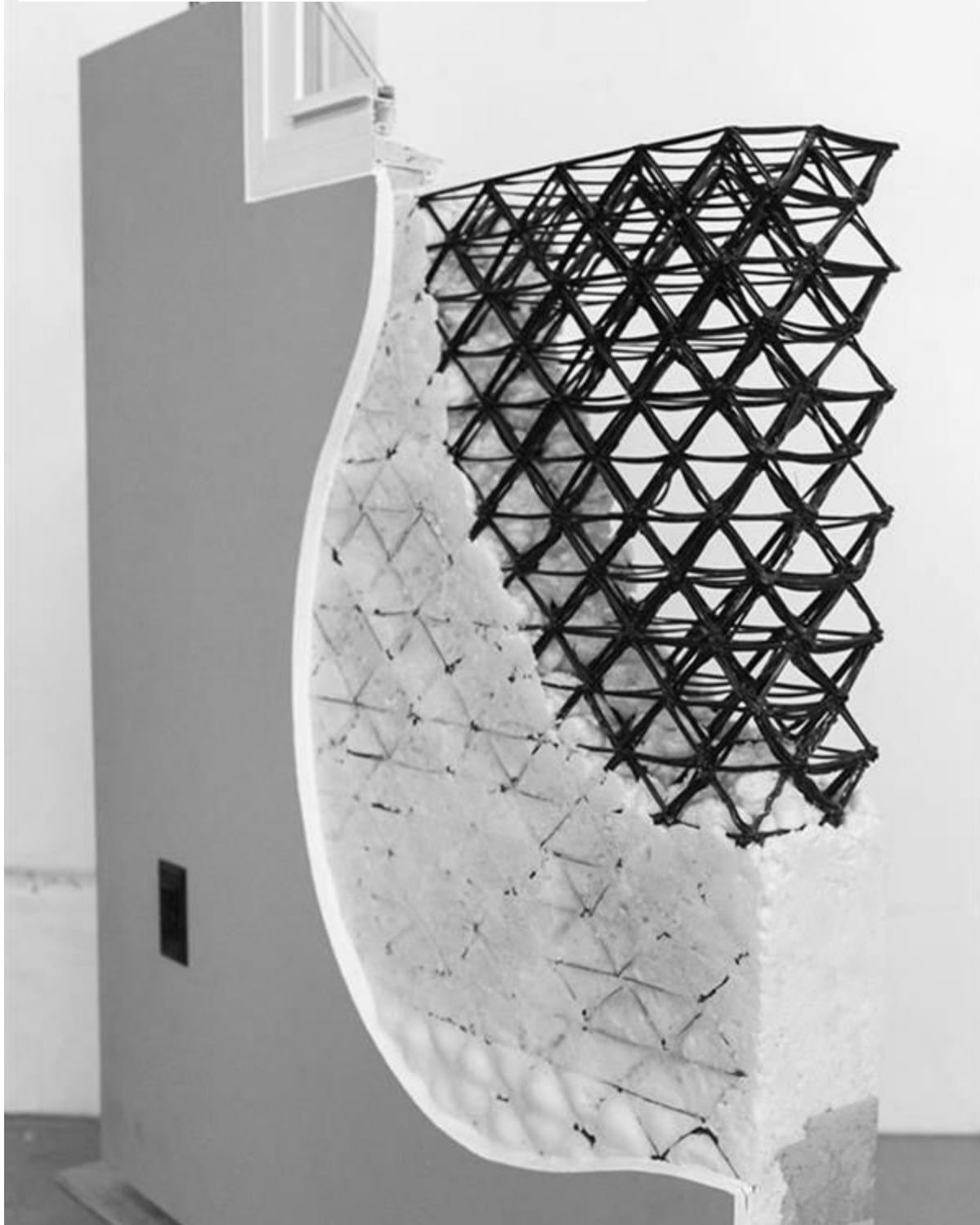
ACTLAB Dpt. Politecnico di Milano - proff. R. Naboni e I. Paoletti
Milano

Trabeculae Pavilion



padiglione interamente stampato con Delta Wasp 4070 in termoplastica
4352 ore di stampa, 6 mq. e 335 kg di peso

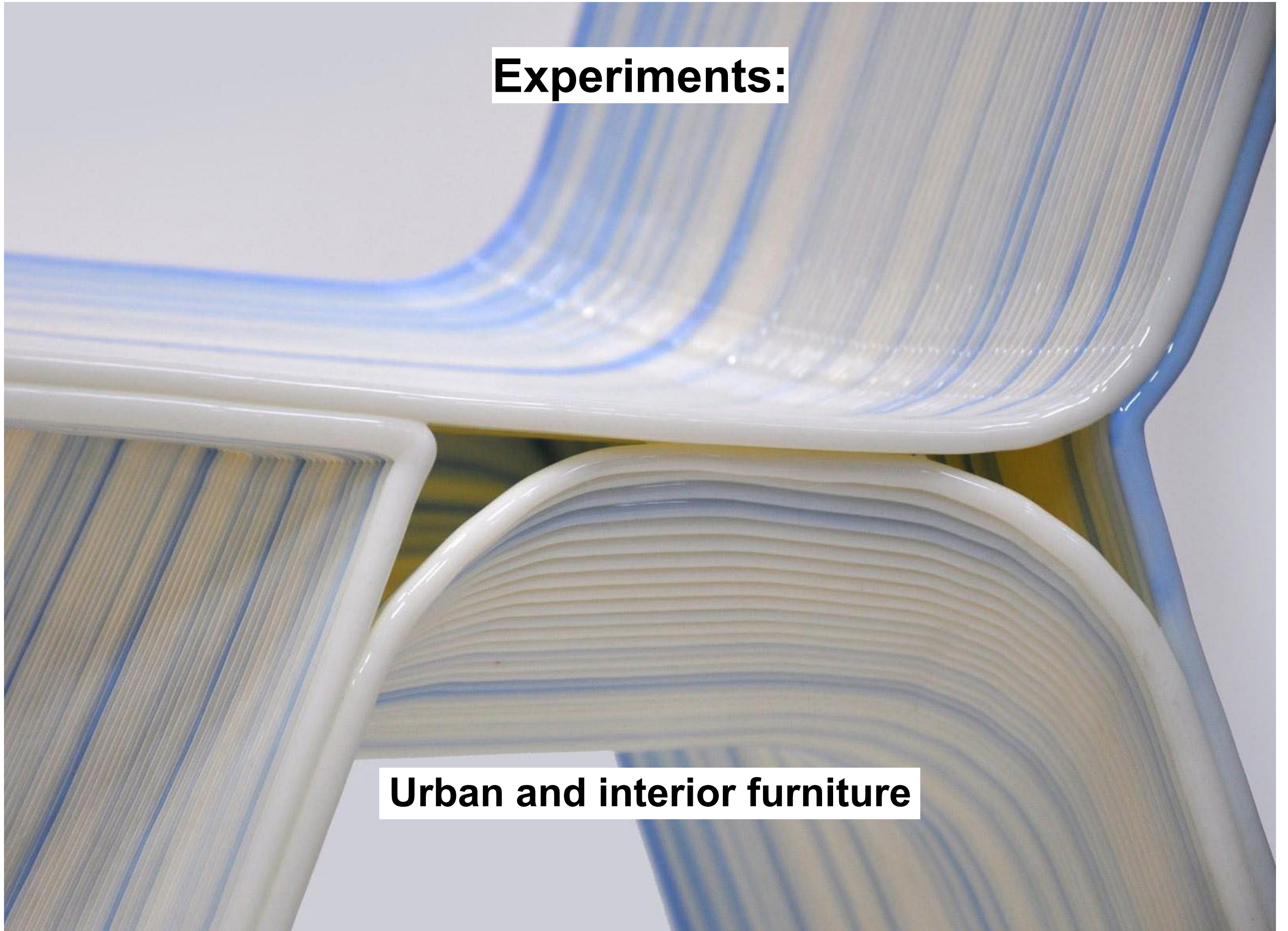
Cellular Fabrication



Branch Technology - C-Fab™
Integrating traditional techniques and digitally fabricated components

Experiments:

Urban and interior furniture



Print your city project



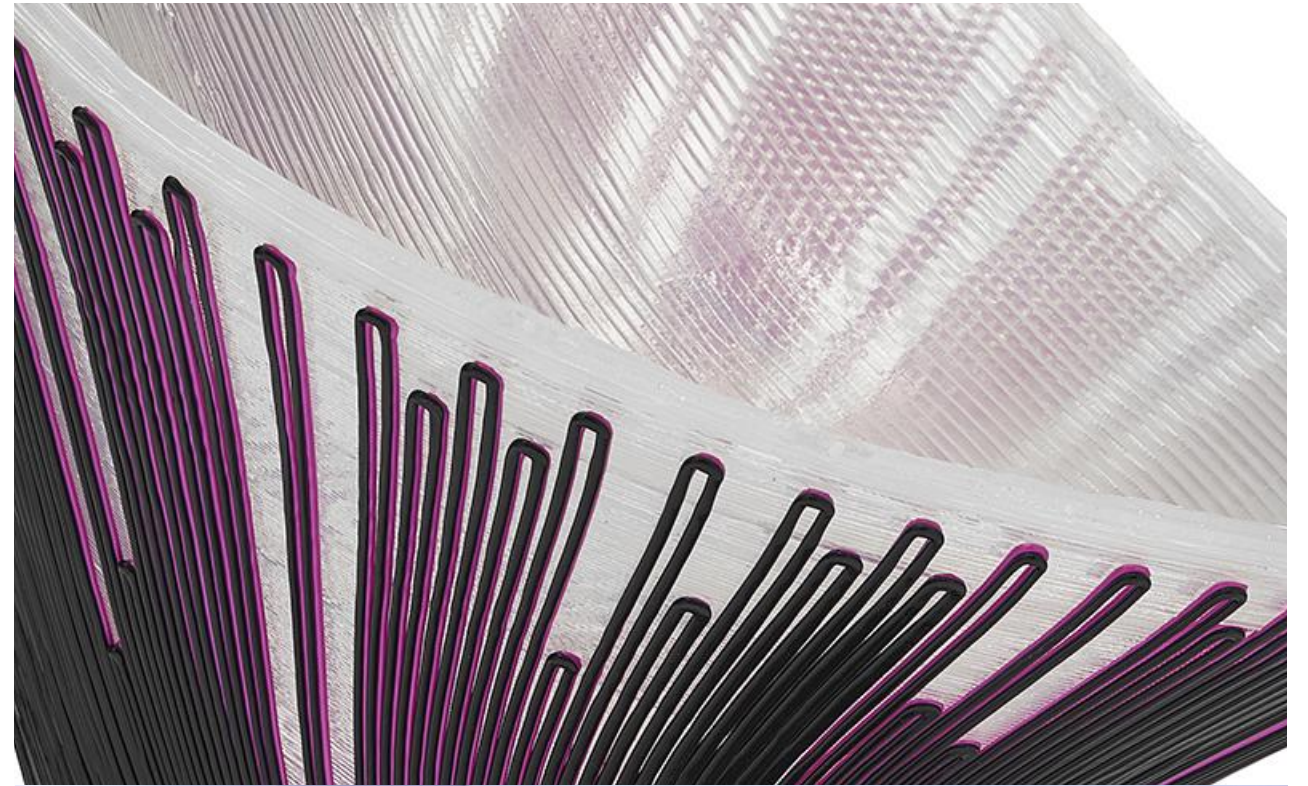
The new raw - Amsterdam // Zero Waste Lab - Thessaloniki
3D printed urban furniture using the city's trash

ICE - Dream



WASP e Fabio Novembre per Sammontana
outdoor furniture printed in recycled bio-plastic

3D Printed Chairs



Nagami - design: Zaha Hadid,
3d printed chairs using pellets

A 3D printer is shown in a factory setting, printing a shell-like structure. The printer is a large, industrial machine with a vertical column and a rotating platform. The printed object is a series of stacked, circular layers, resembling a shell or a honeycomb structure. A worker wearing a white hard hat is visible in the background, looking at a smartphone. The scene is dimly lit, with a bright light source illuminating the printer and the printed object. The overall atmosphere is industrial and focused on manufacturing.

Focus

Biomaterial made shells

building architectural habitats using low cost and ultra low impact materials, produced locally
Alternative solutions to demographic and environmental crisis

Around the world



Mud Frontiers - Emerging Objects
Raw earth structures printed with a portable robot

Around the world



Terraperforma
OTF - IACC Postgrad Programme, Barcellona



WASP's research

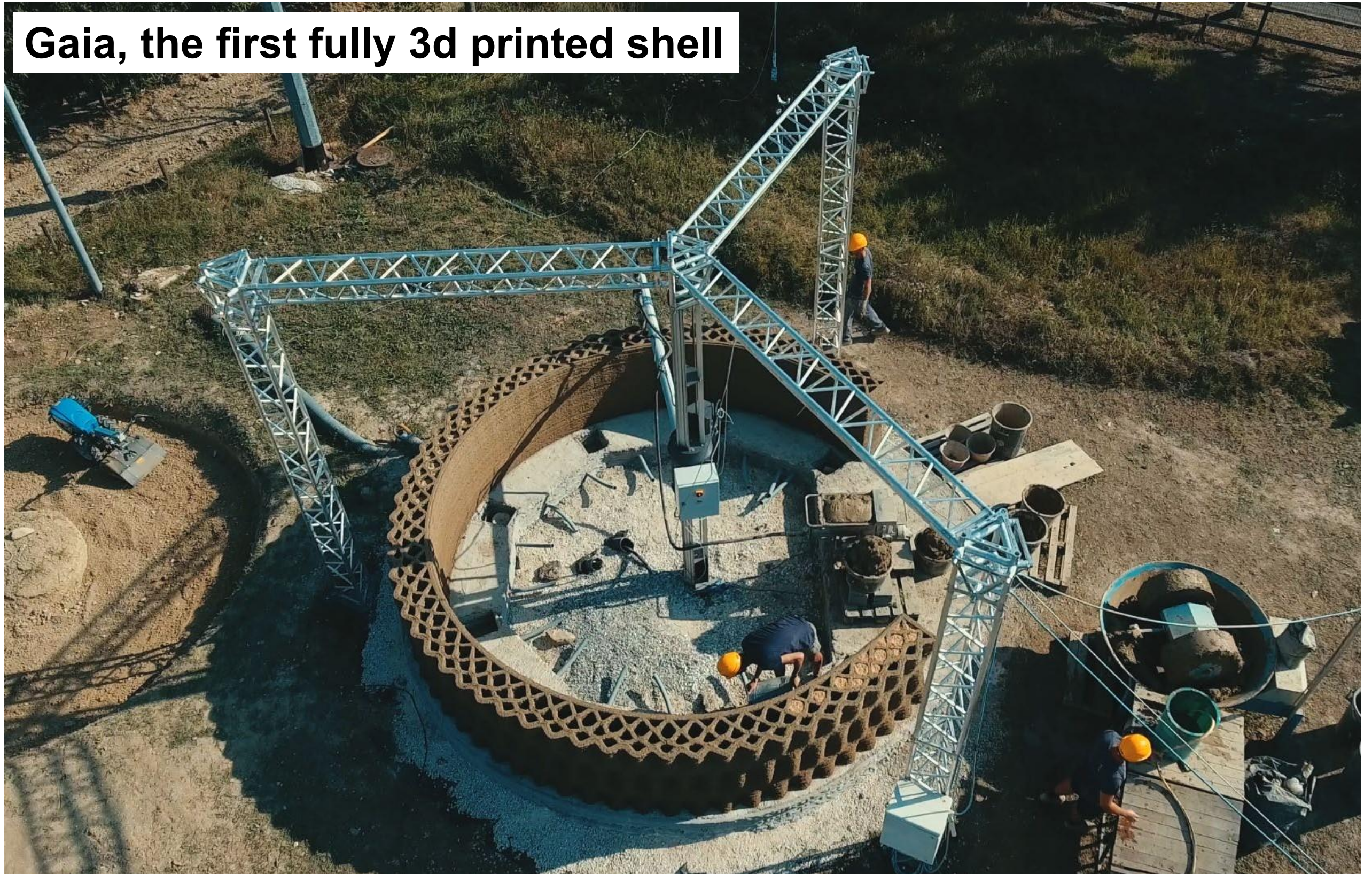
Shamballa vision and the Maker Economy Starter Kit
the studies on raw earth structures

Shamballa, the vision



A shelter for humans, economic, sustainable: A dream for a system for living, that integrates human necessities , technology e enviromental respect.

Gaia, the first fully 3d printed shell



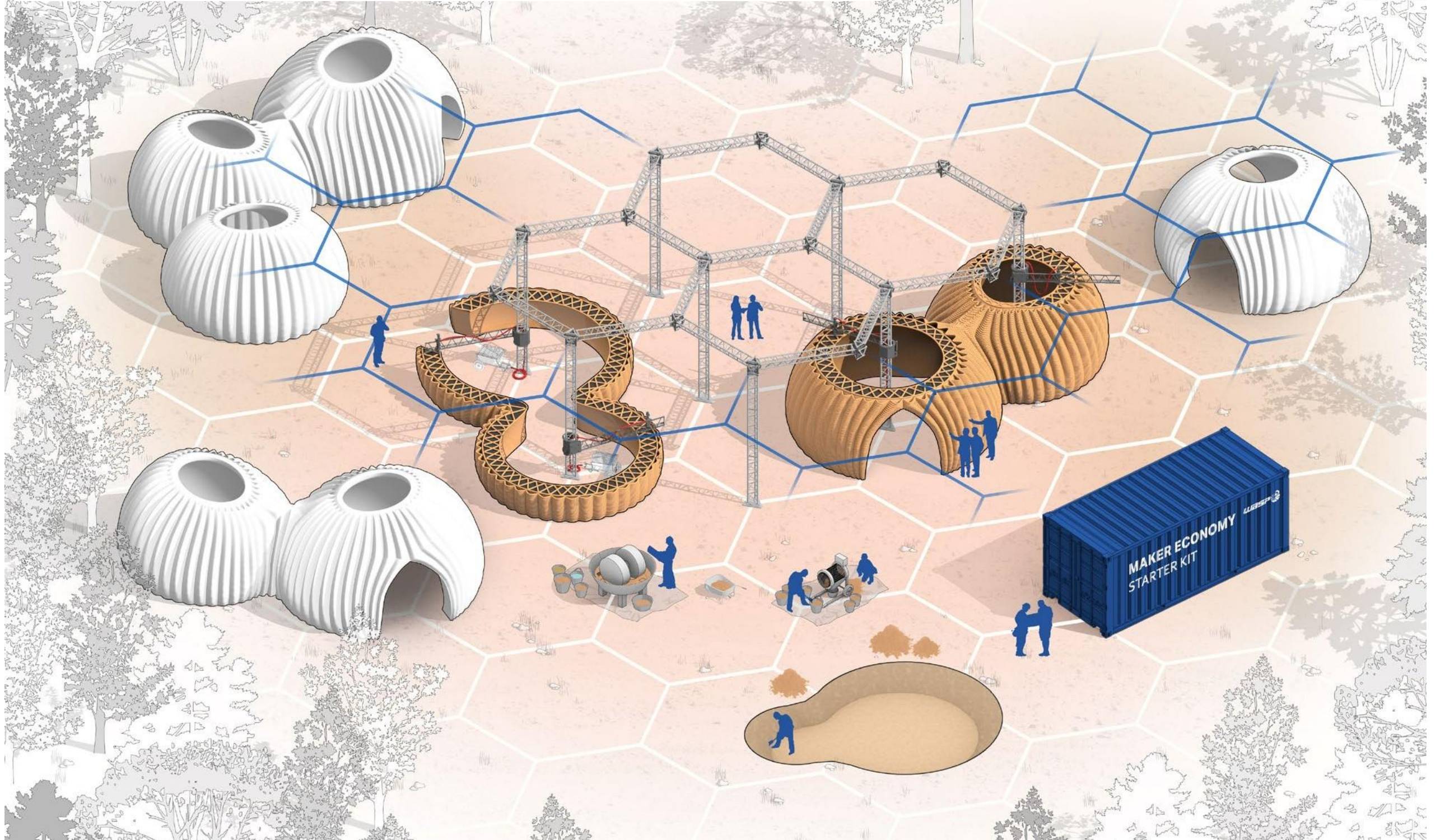
2018 - CRANE modular printer system

Gaia, the first fully 3d printed shell



25% local soil (composition: 30% clay, 40% loam e 30% sand), 40%da paglia di riso trinciata
5% rice chaff (by RiceHouse) e 10% Hydraulic lime

Tecla, a whole 3d printed earth dwelling



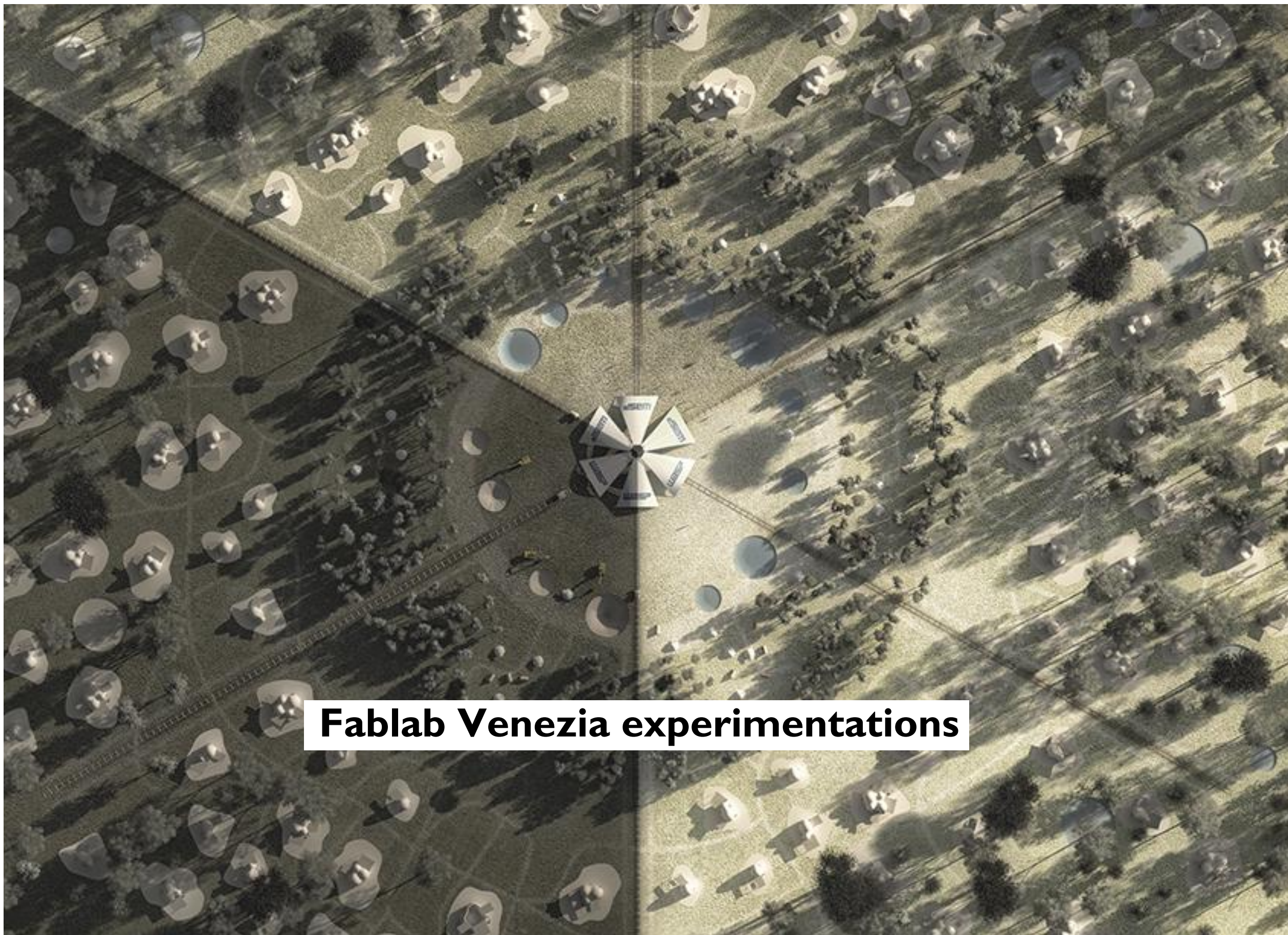
WASP & Mario Cucinella Architects with Milan Ingegneria, Mapei, RiceHouse, Capoferri, Frassinago.



Winter meeting of SG Sustainable Construction - 18.02.2020



Fablab Venezia - digital fabrication on site

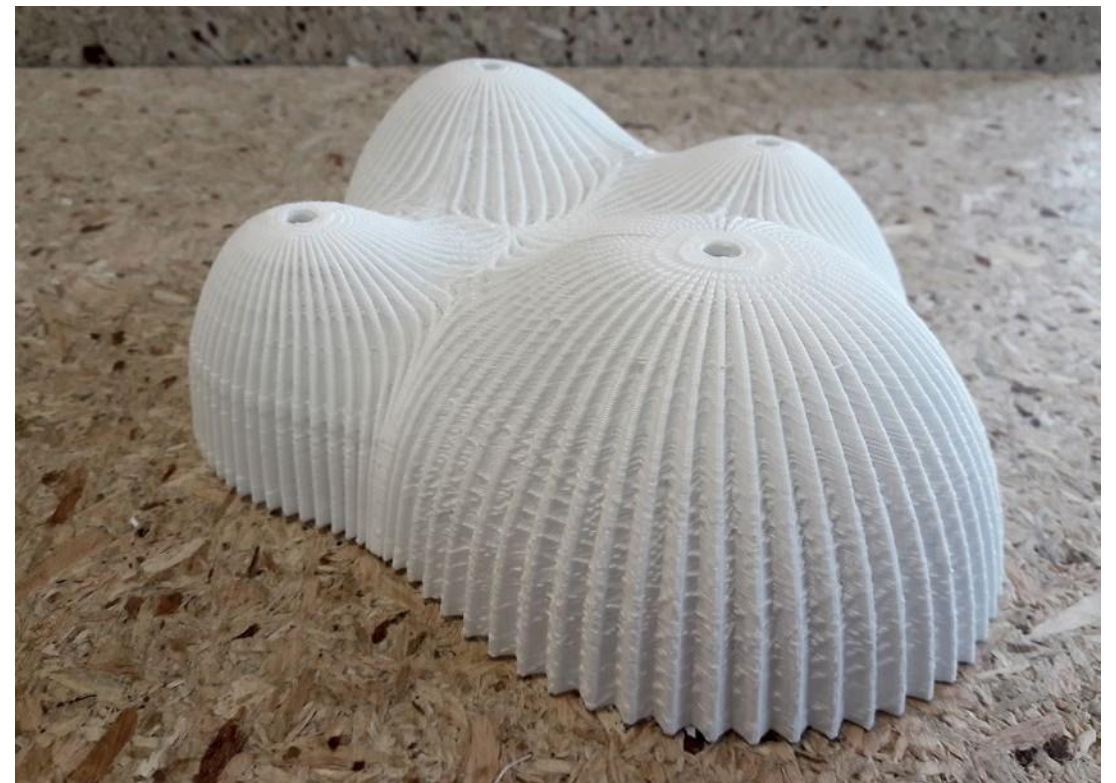
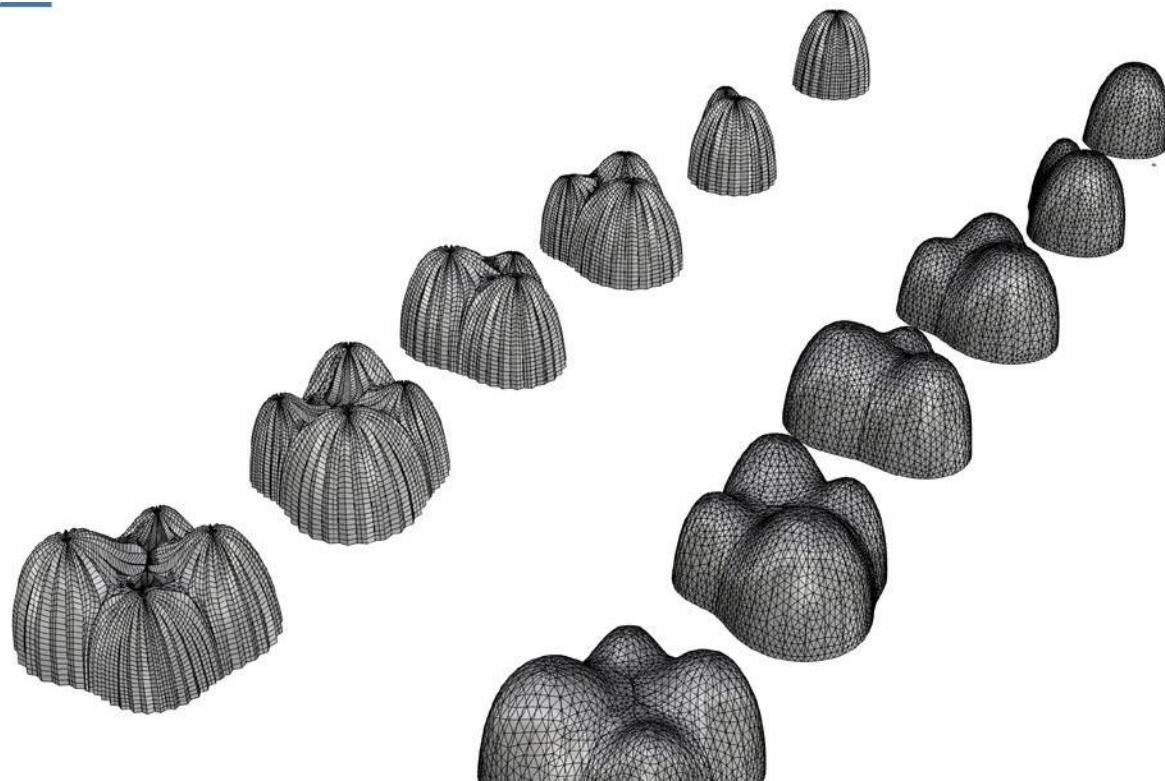
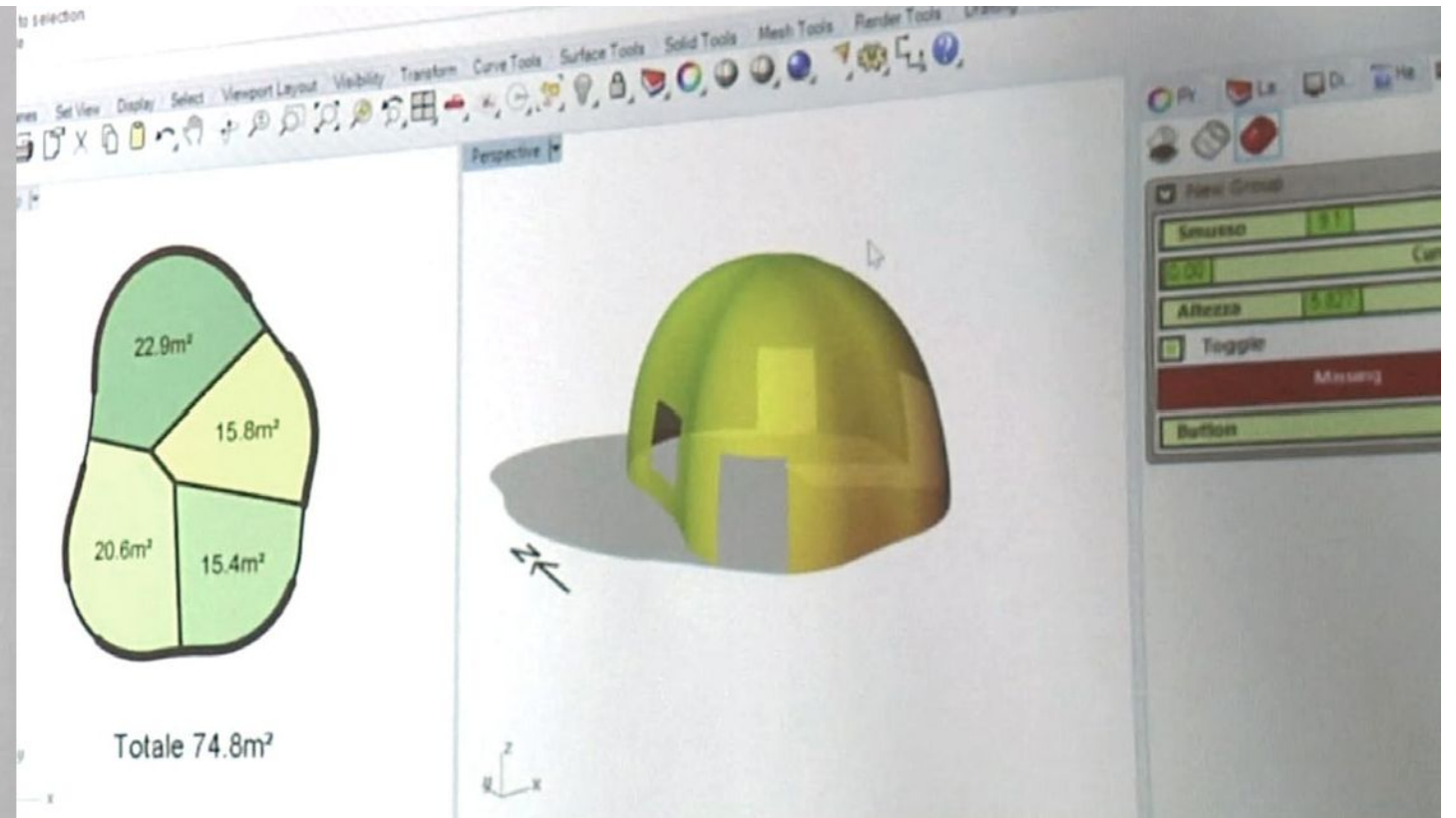
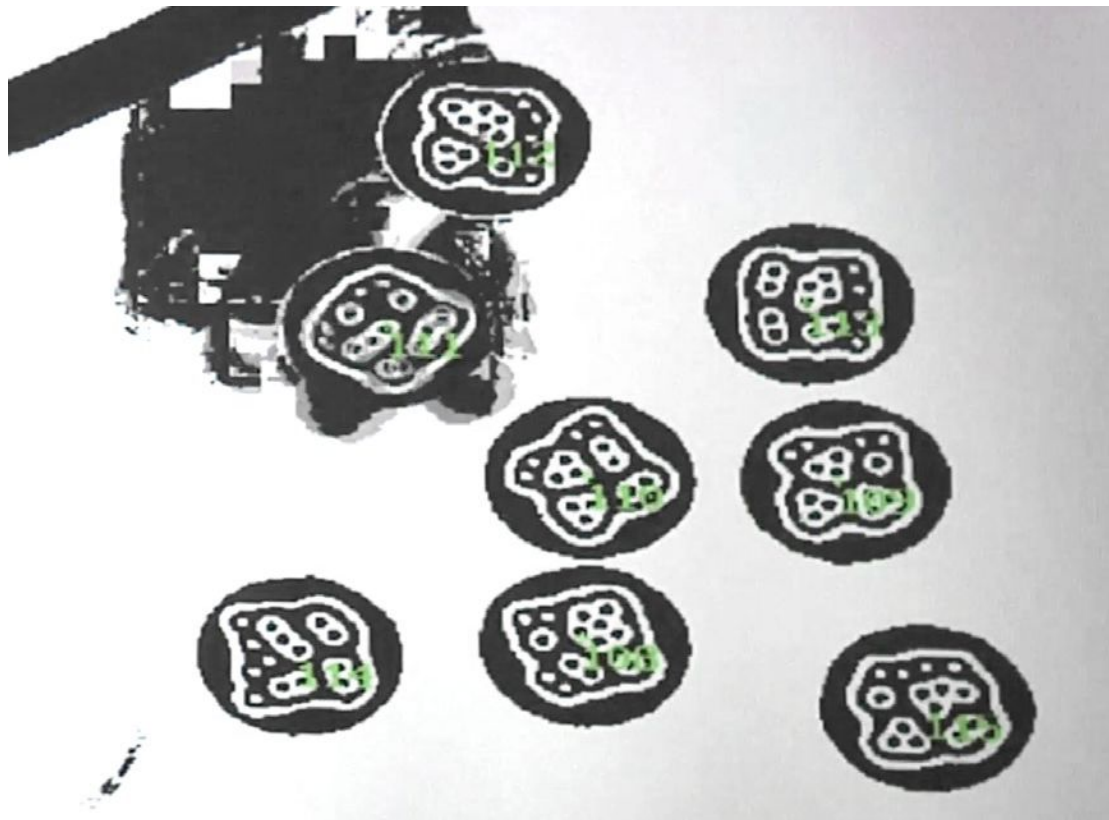


Fablab Venezia experimentations

Conifera - COSxMamouMani

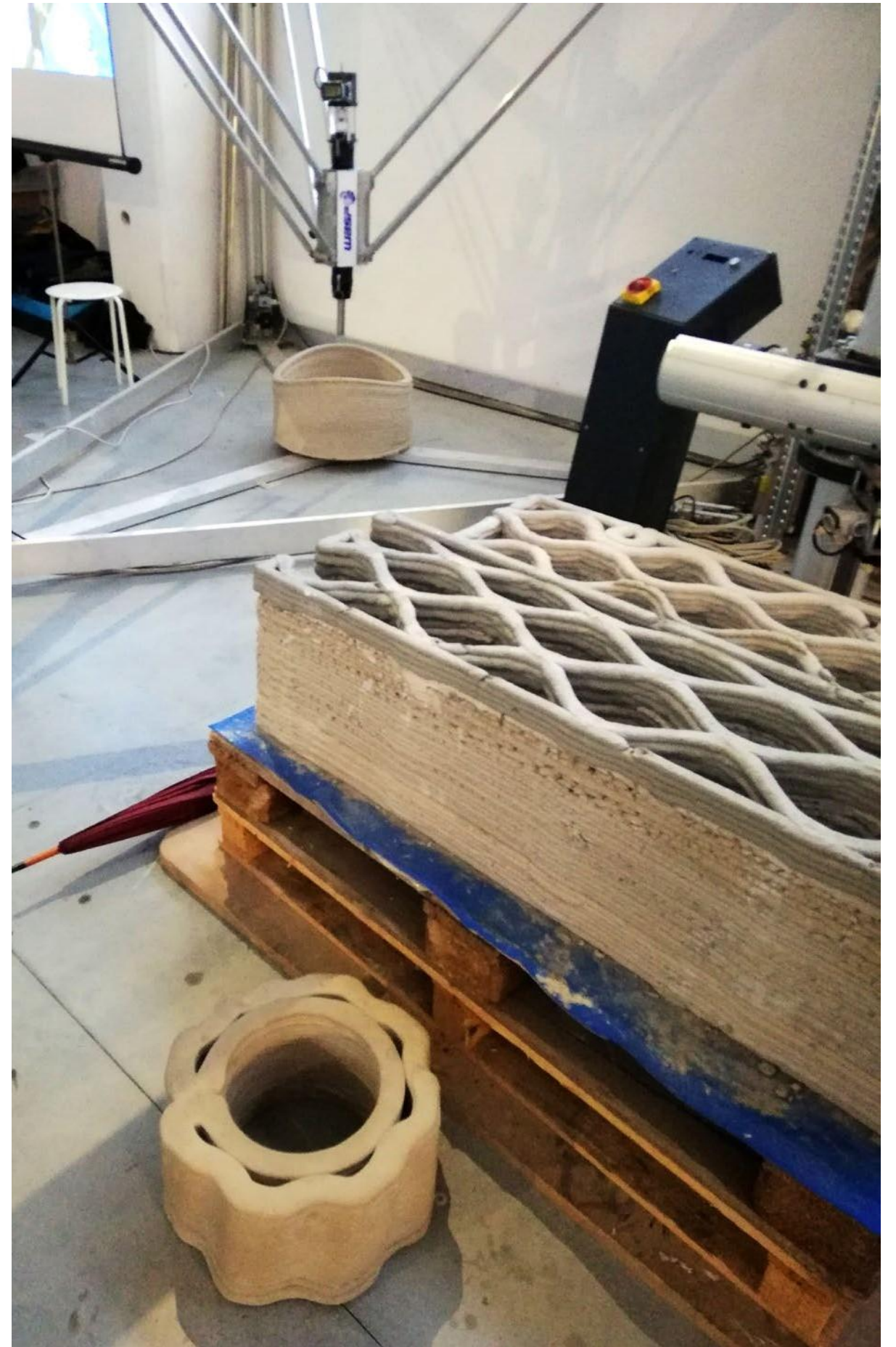
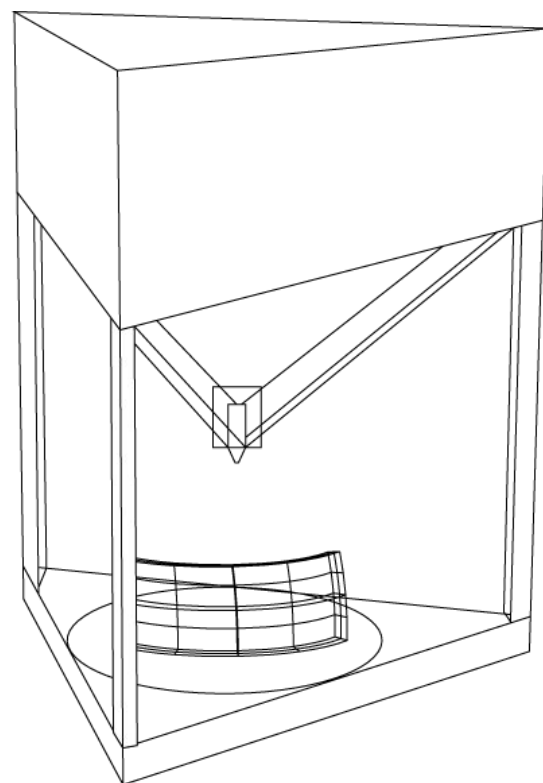
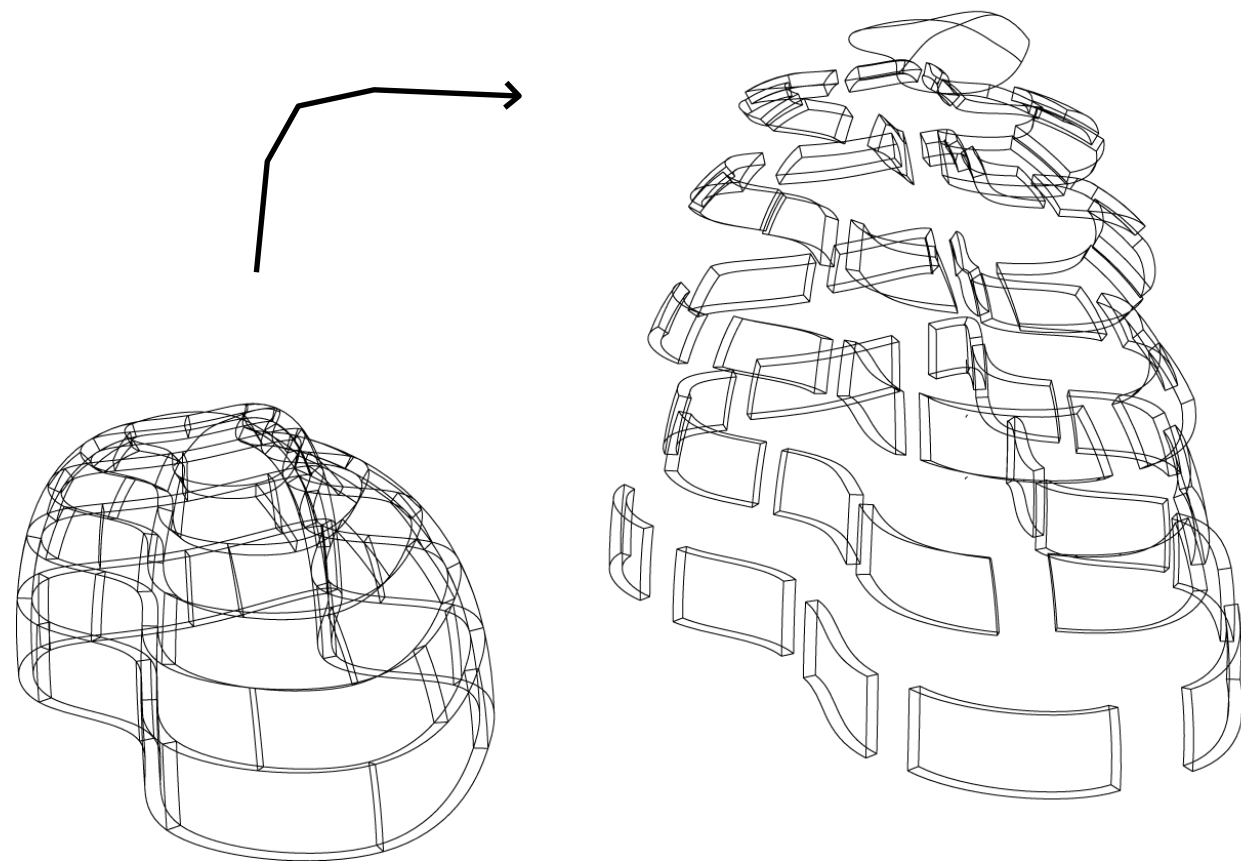


Fuori salone Milano 2019, 700 modules printed in 3d in bioplastic + wood fibre
Collaboration between Wasp Hubs, Fab.Pub London, Superforma Milan, Fablab Venezia,
Design for Craft Macerata



A project of customizable parametric bio-spaces, generated by an algorithm and 3d printed in transportable blocks





Digital manufacturing, additive manufacturing and new advanced analysis and design tools can become valid supports for more **sustainable, rapid and economically advantageous designs.**

Materials and processes are not yet mature and verified, but in the coming years there will be a huge growth in the application of these technologies and **the future of the sector also passes through the new digital processes.**

Thank you!



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