



Project

Location: Etma, Vila Viçosa, Portugal

Dates: Completed June 2016

Participating Organisations: OBU, SoAD, Freehaus Design, CG Architecture, Solubema, Etma.

Participating Disciplines: Architecture, Geology,

Project Leaders: C. Godiksen, M. Brown & M. Howe

Tutor Names / Team: M. Brown, C. Godiksen, J. Hagos, M. Howe, T.Yudin

Team: see film credits & www.cg-architecture.com/research



Description

In the town of Vila Viçosa, Portugal, where everything from castles to kerbstones are made out of marble, our pavilion is the first non-reinforced marble structure for over a century, and the first to be exclusively built from marble waste and with this type of structural system. The design research has from the beginning been integrated into undergraduate teaching. Students have lead particular lines of enquiries and collectively worked directly with the Quarries, Marble factory, Geologists and the community. We are inherently motivated by culture. Methodical knowledge exchange year on year, critical reflection, debate and further experimentation are the core components to the research lead teaching and praxis. (Patti Lather 1986 Research as Praxis) (Venturi & Scott Brown, Yale, 1969). Leading to the design and construction of our first architectural scale experiment.

The pavilion is fabricated and installed in Etma a Portuguese marble factory with Marble from Solubema. The pavilion's intended use post construction is as an educational tool for employees, local students, international architects, engineers, clients and not least for our on going research. The structure, at only 2-3cm thick and comprising of just two layers of laminated marble, springs from one curved wall before forming two sweeping catenary vaults. The spatial experience, with views framing distant waste marble mounds is formed with an attitude to scale and sequence, curated around the simple movement from one vault to another. The snake-skin effect on the surface showcases the full breath of the material, making

the solid structure seem lighter and accentuate its appearance of being 'paper thin'.

Cultural Geometries has been working in the historic marble region of Alentejo since 2011. We have been testing architectural ideas for the quarried yet unused marble blocks. It is our aim to find contemporary relevance of marble as a primary building material. Working with local expertise, alongside the factories growing fabrication capacities and ambitions, the pavilion is the first architectural scale prototype of the residency. Our quarry and factory partner Francis is a geologist and also the managing director with a great innovative attitude. He has initiated several software and machine innovations, which they are testing and refining in the factory. Francis' extensive knowledge of the material and the history of its uses has been invaluable throughout the process. The factory workers are of all ages and used to routine. They met the project with scepticism and curiosity, which meant we had a steady stream of visitors through the build including their families. The project engaged the factory workers at all stages of the process; cutting the unused blocks down to tiles and building. In the office we would work with the factory architect Nuno and his assistant. They supported the digital side of cutting the stone and plywood guide work. Communicating with a mixture of languages, arm gestures, a paper model we exchanged many ideas and heard many stories about marble throughout the process. The project was the talk of the town and all of these exchanges of great educational value to us.

Evaluation

Aims: The design aimed to test marble's contemporary relevance to architecture by testing at 1:1 a) marble as primary architectural structure, b) the feasibility of reusing waste marble c) the feasibility of building method & instruction of building method. **Methodology:** Creativity: stimulate remote associations & lateral thinking through 'out of the ordinary' environments and 'on the spot' problem solving. (K.Sawer "Creativity & Development", 2003) Participation: Engage communities, experts & governing authorities (J. Gehl, "Human Scale" 2012) Time: Projects builds on from previous through continuity and reflection. (S.Egashira, Koshirakura 1996) This project was an experiment. We had no precedent for laminating natural stone. We studied references like Gustavino 'tile arch system' patented in 1885, Anthony Gaudi's chain models 1889 and more recently the ceramic tile work of work of Block Research Group ETH (and others) to give us theoretical certainty. We also compared fabric folds in marble sculptures (e.g. Veiled Christ). Everything was cross-referenced with the marble factory experience and our own 1:1 testing. The project was achieved through 3 design workshops, 4 building trips within and outside semesters. **Findings:** We planned 3 layers of laminate and designed 3 tile patterns. When working 1:1 we judged 2 layers would suffice (less material). We designed the tile to fit a variety of marble waste, machinery and design typology. Other factors were handling weight and structural integrity. The 10x10x1cm was quick to cut for the factory. It took them 2 days to cut 10,000 tiles involving 4 different people. We discovered the

material had retained some translucency, visible at night when lit up from inside (to be explored in future work). Factors influencing building accuracy were skills, guide work, weather and construction time (four trips). Being able to discuss and 'sketch' 1:1 proved very useful as we could make decisions based on actual experience in relation to design. **Outcomes:** The pavilion was completed successfully and is weathering well. The 2-3cm thick non re-enforced laminated structure is thin for masonry construction. The building method could well mean that marble has a structural future in architecture. We also believe this experiment is transferable to other natural stone types. The feasibility of using waste marble has been proven and was far more efficient than we had anticipated. The 3rd ambition was harder to achieve. Building accuracy and time of construction need to improve. We suggest improved guide work design, construction training and working with the same construction team though build period. **Impact:** The impact of the project is primarily regional but has global relevance in dealing with stone waste and innovation in architecture. The pavilion's primary purpose is as an educational tool within the quarry and factory. The pavilion is also used educationally externally (American Architects visited June 2016). The engineering firm BuroHapold is now a research collaborator. A reflective exhibition was part of London Festival of Architecture 2016. The work is also listed under AJ's small projects. A film of the project is available on YouTube along side a film about the marble from quarry and through factory to tile.

For Education And Research

Marble Pavilion

"Architecture Connects" association of architectural educators conference, 6-9 September 2017, Oxford Brookes University, UK

