FORMING

Adhy Wibawa

Anastasia Borcheva

Asiya Salimova

Chun Shao

Dapeng Li

Jacob George

Mariia Potapova

Pavel Nikolaenko

Pavlo Zabotin

RuzhenZhang

Tan Li

Wangsaatmadja

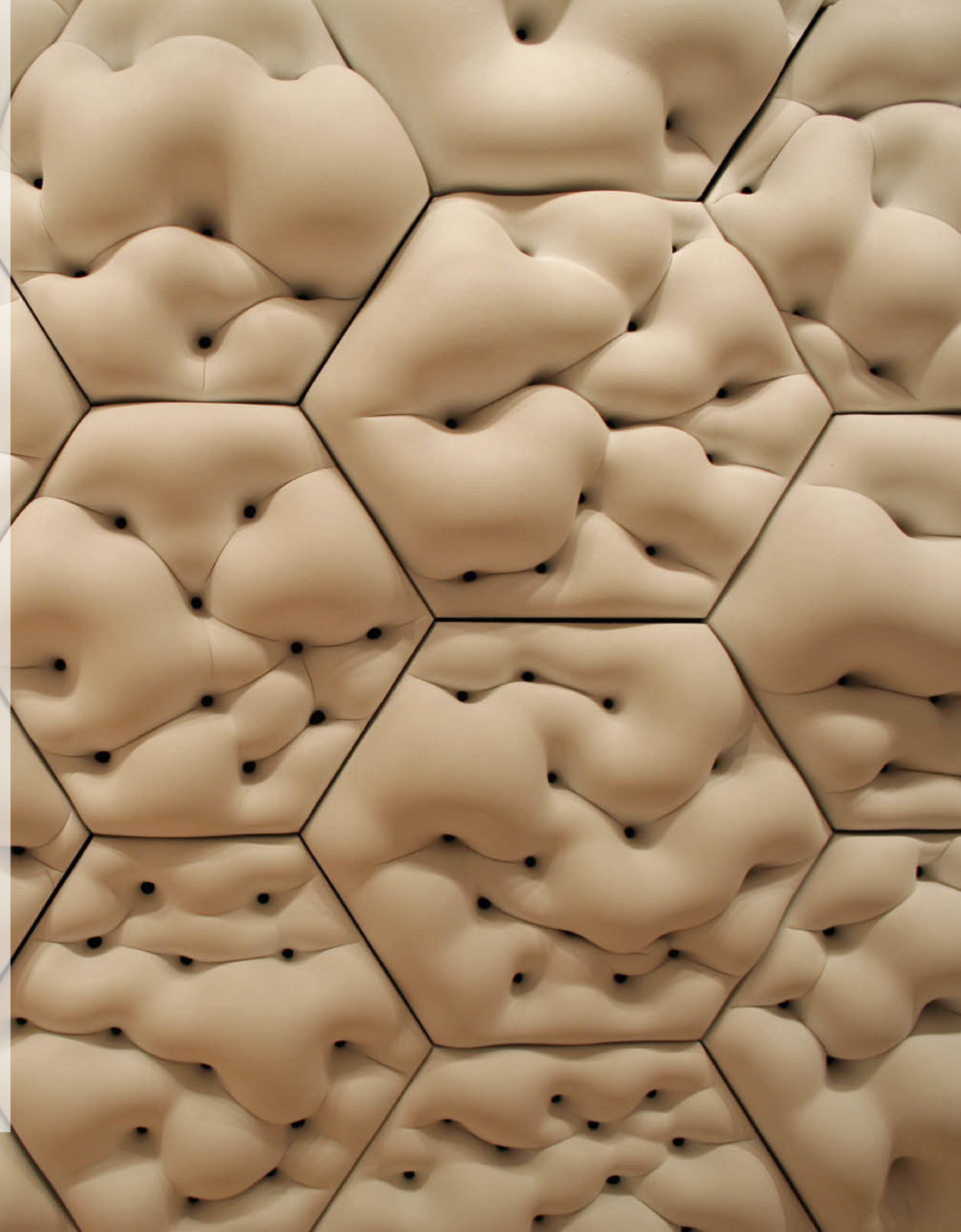
Xin Wei

Yu-Wei Han

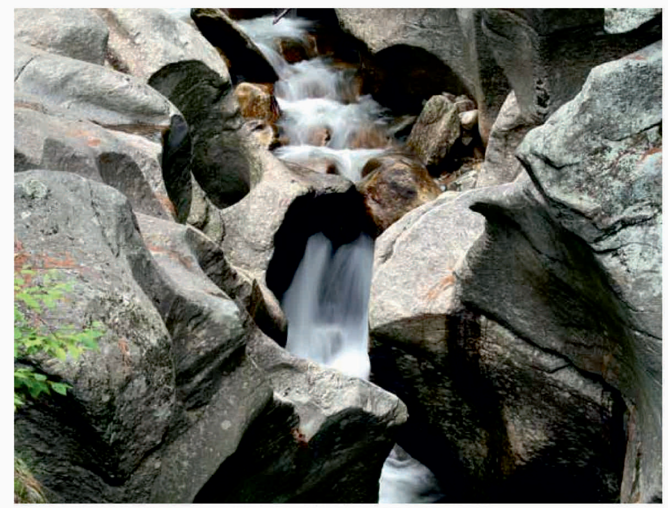
FORMING

DEFINITION

Forming employs an inherent economy of means – generating multiple parts from a small number of moulds or forms – mass produced products.
Hardware, façade panels, window mullions, precast panels, structural members, architectural ornamentation, thin-shell structures, uniquely formed cast-concrete buildings, stamped sheet-metal panels – everything can be made with the help of this multifunctional and diverse method of fabrication.
Forming is organic, natural, around us, environmental. The form mostly resembles us elements of nature around or everyday life details.
Forms are ultimately a means to an end. They may or not look like the final product.
The fabrication is based on making the mould – one or a few – for mass producing of units and creating of organic and complicated forms for short period of time.
Ways to leverage mould making to produce variation without sacrificing an economy of means. This effort most often implies that moulds are used repetitively, but it can also imply different relationships between part and mould or investigations into what forming can produce as a constructional system.
CNC router can be used for forming of pre-heated elements. Other projects draw out the sensual properties of forming - vacuum formed objects. Moulds can be used to create various typical components and ultimately produce a kit of parts.



FORMING
EXAMPLES FROM NATURE


Shaping by Water



Shaping by Wind

FORMING

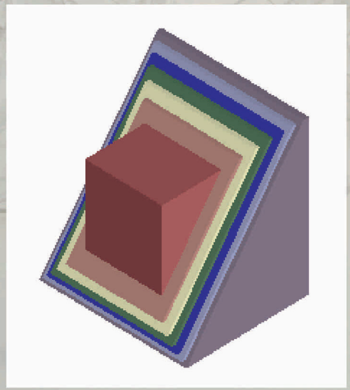
EXAMPLES FROM NATURE

Crystallization is the (natural or artificial) process of formation of solid crystals precipitating from a solution, melt or more rarely deposited directly from a gas. Crystallization is also a chemical solid–liquid separation technique, in which mass transfer of a solute from the liquid solution to a pure solid crystalline phase occurs. In chemical engineering crystallization occurs in a crystallizer. Crystallization is therefore an aspect of precipitation, obtained through a variation of the solubility conditions of the solute in the solvent, as compared to precipitation due to chemical reaction.

The crystallization process consists of two major events, **nucleation and crystal growth**.

Crystal growth

Once the first small crystal, the nucleus, forms it acts as a convergence point for molecules of solute touching – or adjacent to – the crystal so that it increases its own dimension in successive layers. The pattern of growth resembles the rings of an onion, as shown in the picture, where each colour indicates the same mass of solute; this mass creates increasingly thin layers due to the increasing surface area of the growing crystal. Growth rate is influenced by several physical factors, such as surface tension of solution, pressure, temperature, relative crystal velocity in the solution, Reynolds number, and so forth



FORMING
EXAMPLES FROM NATURE

MELTING

Melting is a physical process that results in the phase transition of a substance from a solid to a liquid. The internal energy of a substance is increased, typically by the application of heat or pressure, resulting in a rise of its temperature to the melting point, at which the ordering of ionic or molecular entities in the solid breaks down to a less ordered state and the solid liquefies. An object that has melted completely is molten. Substances in the molten state generally have reduced viscosity with elevated temperature; an exception to this maxim is the element sulfur, whose viscosity increases to a point due to polymerization and then decreases with higher temperatures in its molten state.

FORMING
EXAMPLES

FORMING

examples

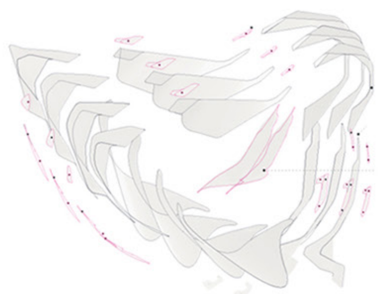
"Forms are ultimately a means to an end. They may or not look like the final product"

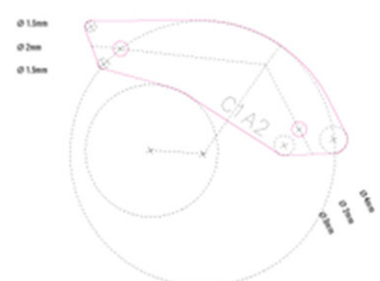
Forming – organic, natural, environmental around us.

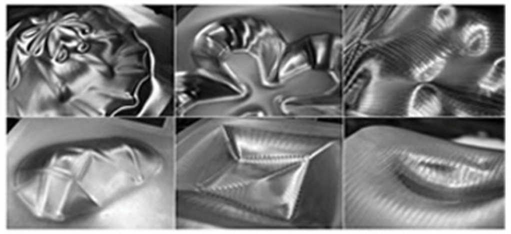
HYPERBODY DESIGN STUDIO
- deep forming
- vacuum forming
- 3D milling

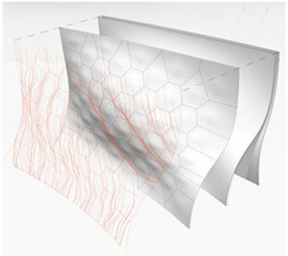
PER-FORMING
JAKE NEWSUM, AMMAR KALO
- metal forming
- prototyping by robotic

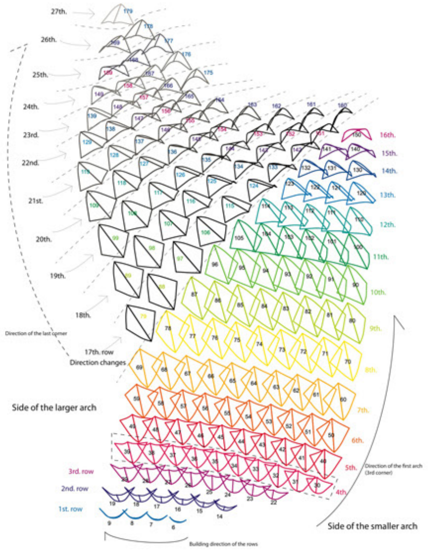
DRAGON SKIN PAVILION
LEAD
- CNC-router











FORMING
EXAMPLES

FORMING

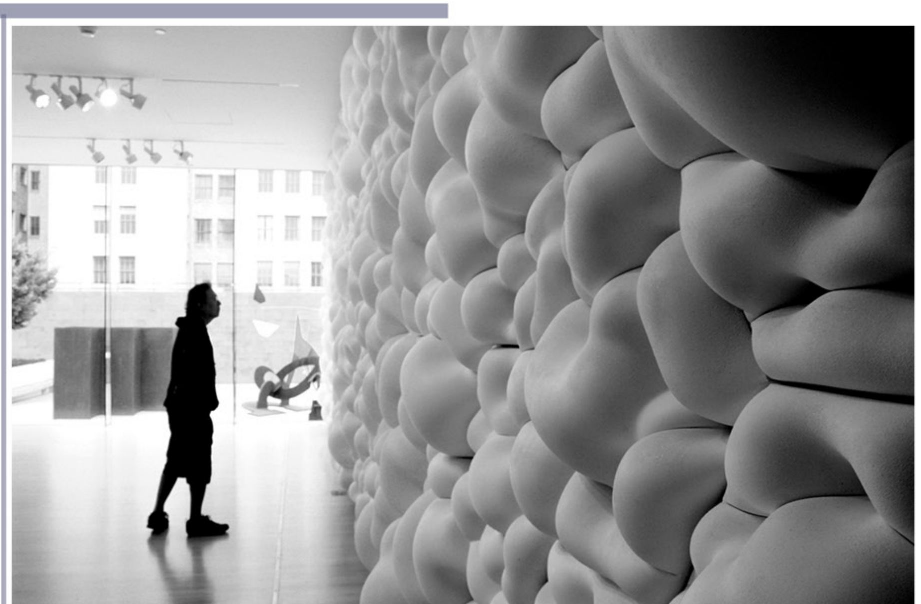
examples

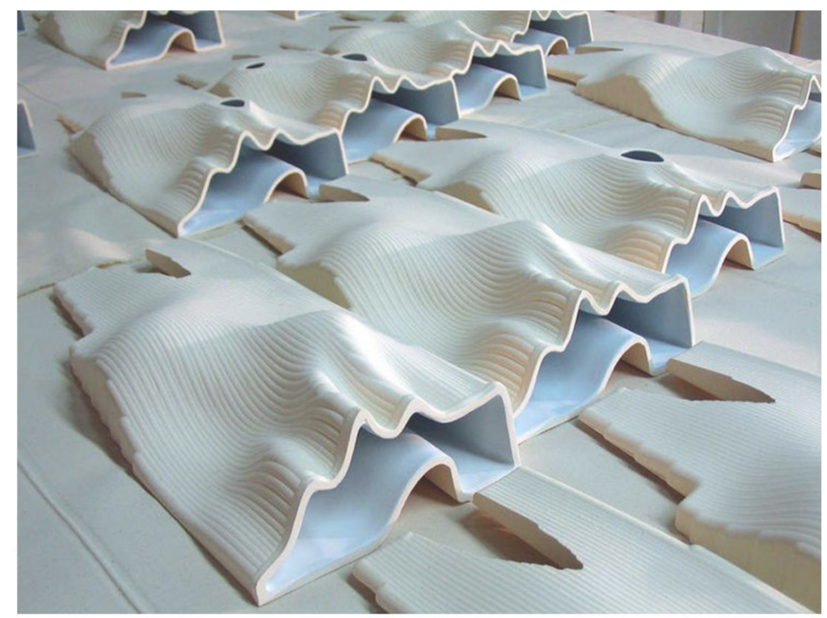
"Other project draw out the sensual properties of forming – vacuum-formed objects"

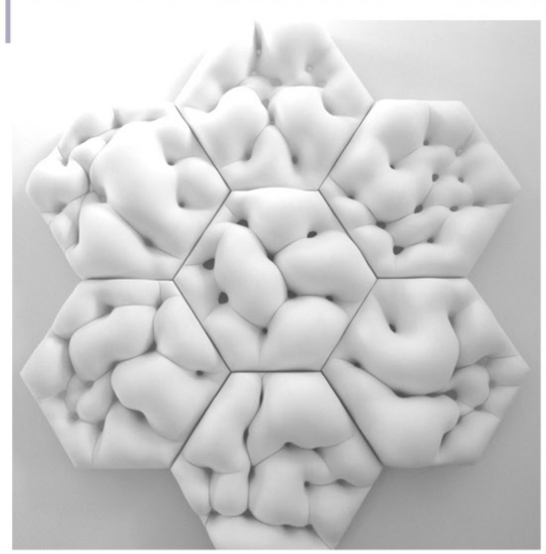
"Using of the same molds to form sets of identical panels that could ultimately produce a variable kit of parts."

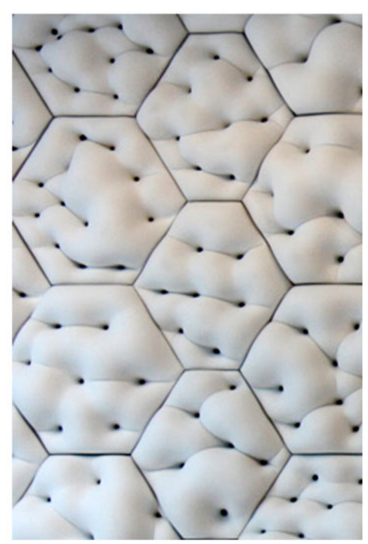
P-WALL
SFMOMA

DATA CLAY: DIGITAL STRATEGIES FOR PARSING THE EARTH



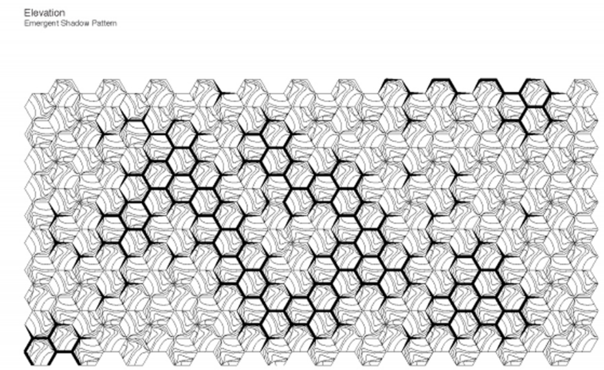


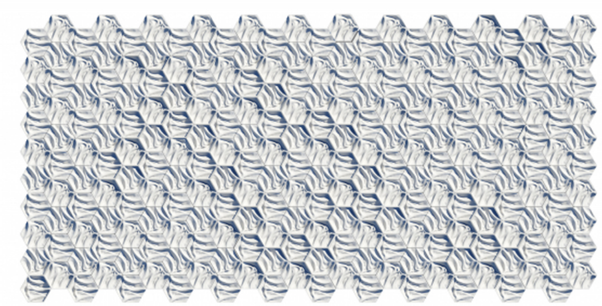


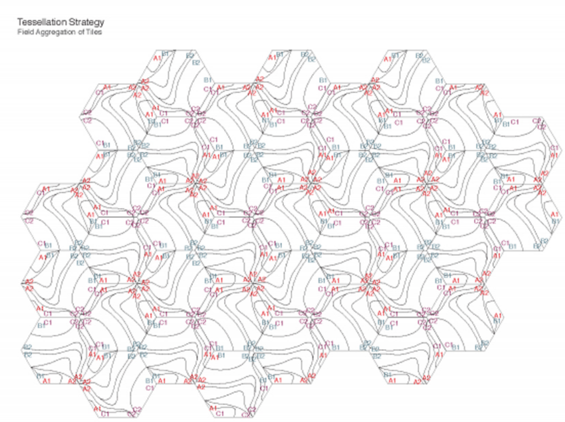


FORMING
EXAMPLES

[Academic]
UCLA - Spring 2008
Instructor Heather Roberge
Team Laura Goard Barabé, Chao Chen, Dan Rentsch, Kristin Willey

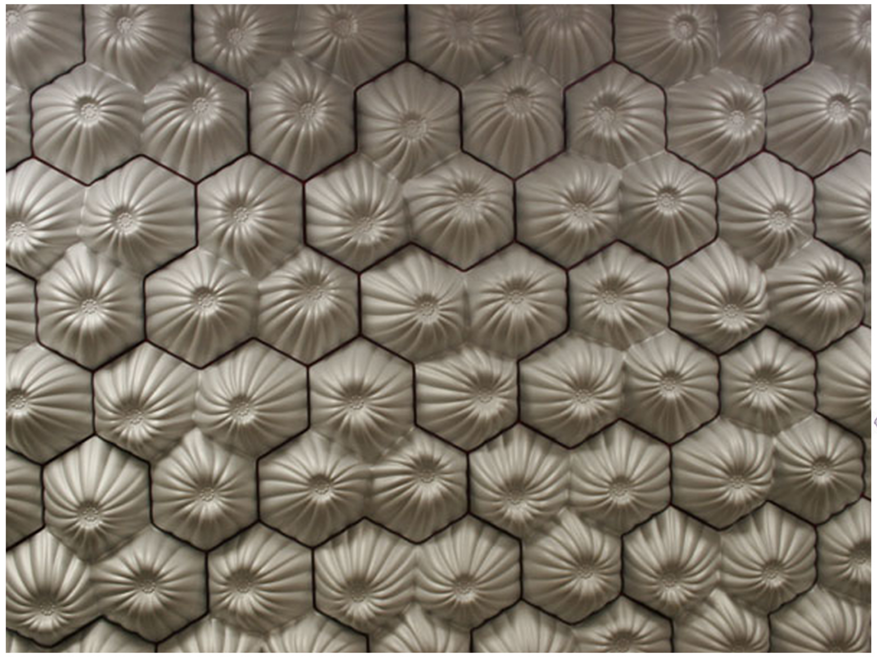
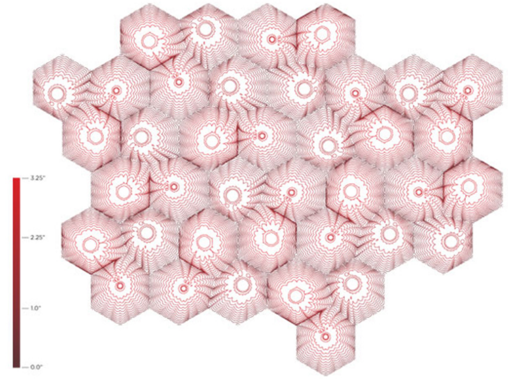
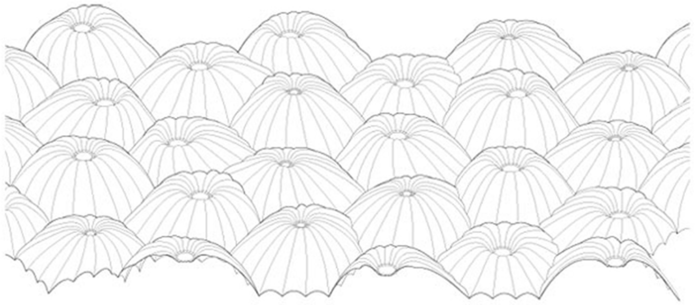
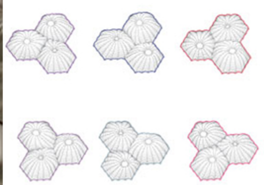
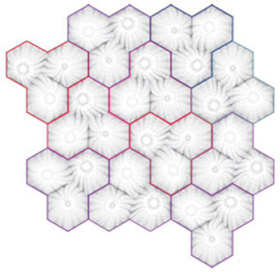


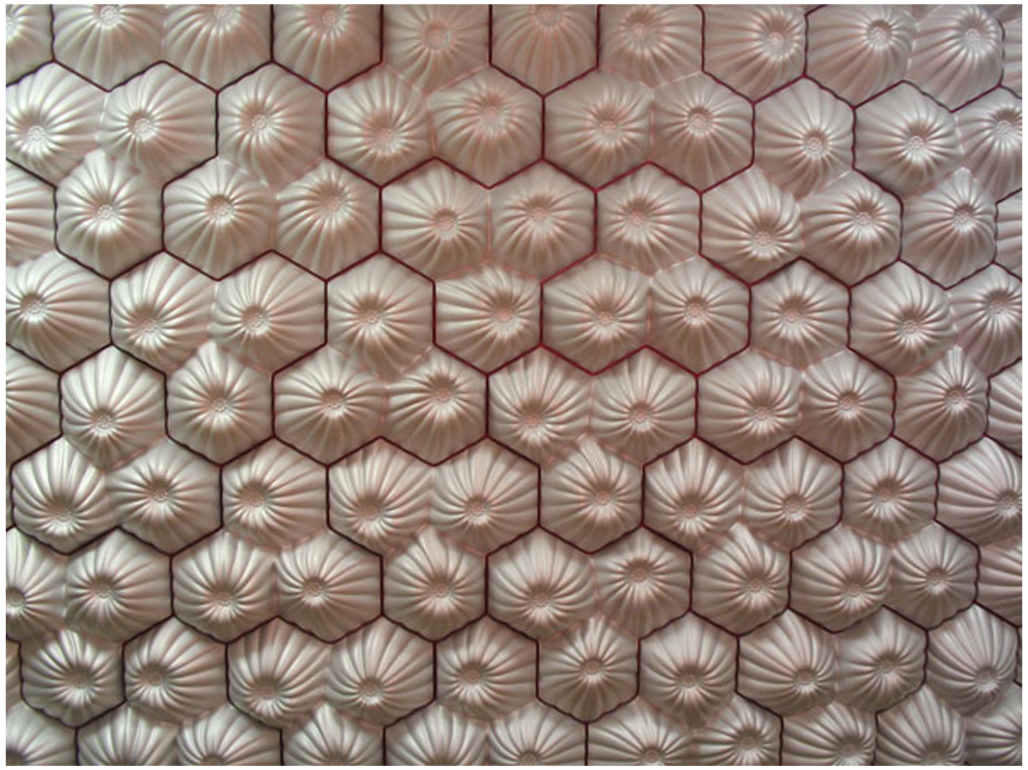




FORMING
EXAMPLES

Matters of Sensation at Artists Space Bioform
New York, NY 2008

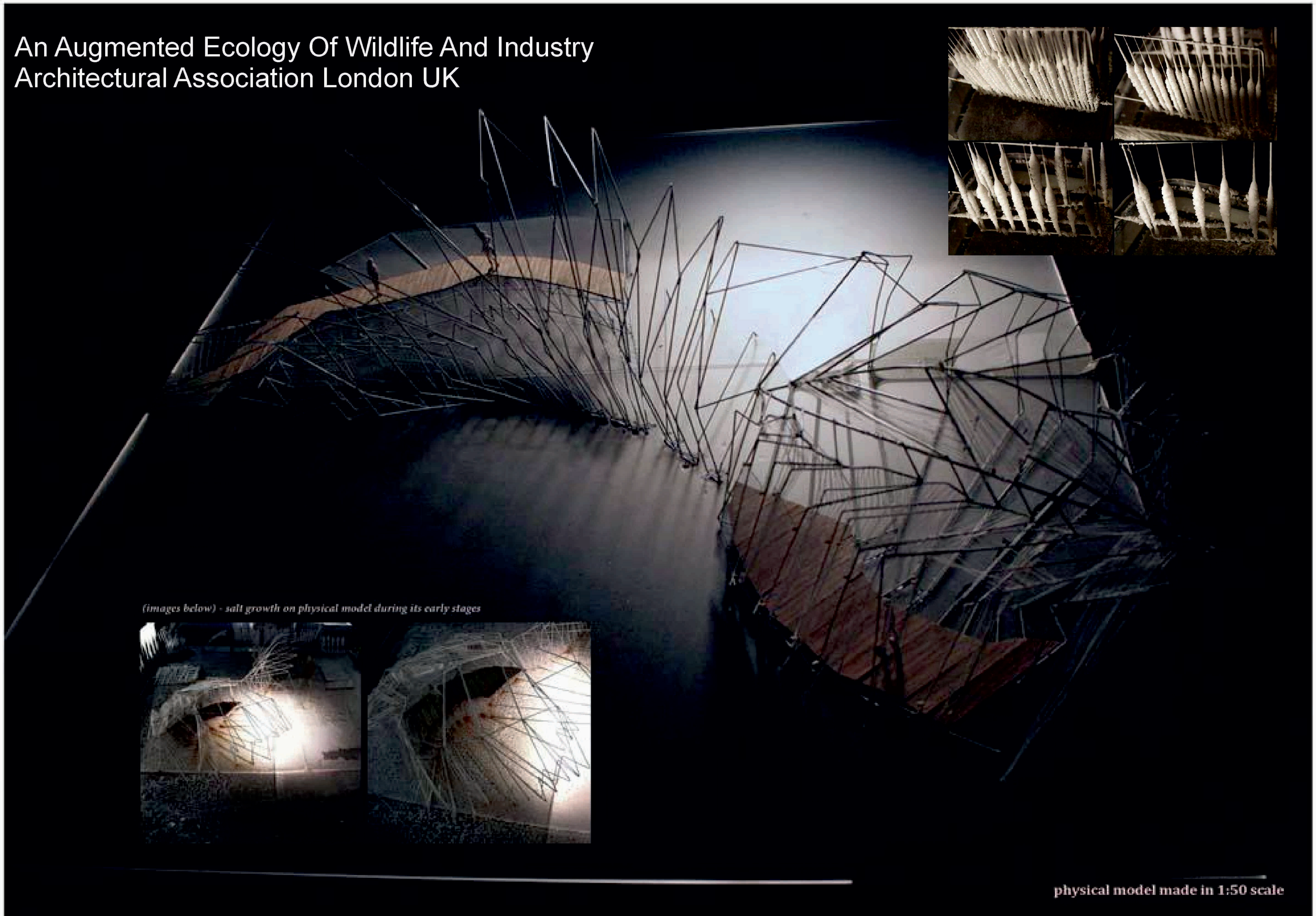






FORMING
EXAMPLES

Royal Ontario Musuem, Toronto
Daniel Libeskind

FORMING
EXAMPLES



FORMING
EXAMPLES

Sculpture from "Space crystallisation" cycle during "Farming with Mary" art Symposium in Mary Valley River, Tuchikoy, Queensland, Australia 2005

FORMING
INDIVIDUAL RESEARCH

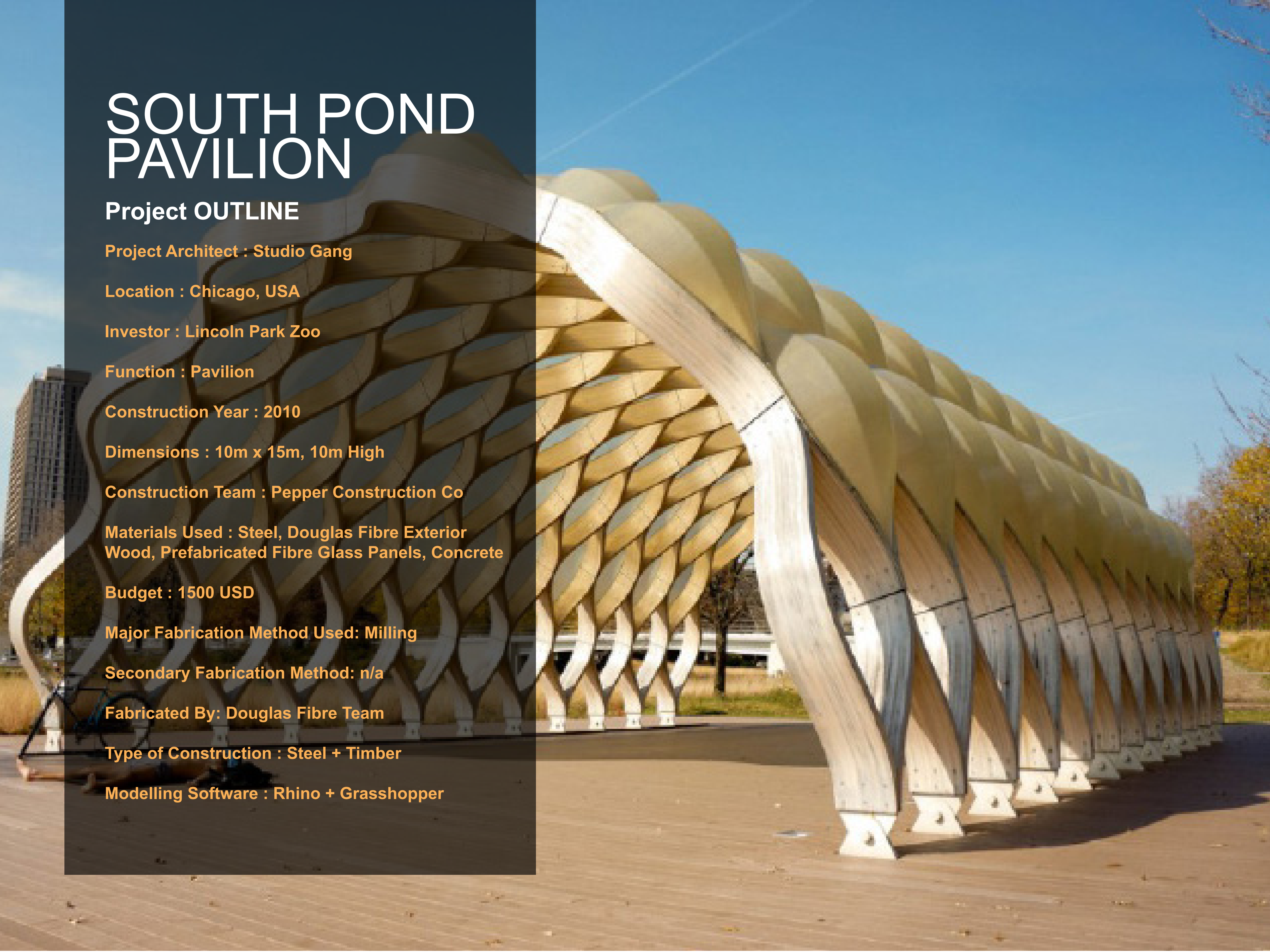
FORMING

SOUTH POND PAVILION

STUDIO GANG

Jacob George

Source: http://archdaily.com



SOUTH POND PAVILION

Project OUTLINE

Project Architect : Studio Gang

Location : Chicago, USA

Investor : Lincoln Park Zoo

Function : Pavilion

Construction Year : 2010

Dimensions : 10m x 15m, 10m High

Construction Team : Pepper Construction Co

Materials Used : Steel, Douglas Fibre Exterior Wood, Prefabricated Fibre Glass Panels, Concrete

Budget : 1500 USD

Major Fabrication Method Used: Milling

Secondary Fabrication Method: n/a

Fabricated By: Douglas Fibre Team

Type of Construction : Steel + Timber

Modelling Software : Rhino + Grasshopper

SOUTH POND PAVILION

Project DESCRIPTION

Part yoga pavilion, part outdoor classroom, the South Pond Pavilion at Chicago's Lincoln Park Zoo is a stunning architectural statement located along the Zoo's new Nature Boardwalk.

Designed by Chicago-based Studio Gang Architects, the prefab pavilion is part of a larger effort to rehabilitate the zoo's dilapidated pond into a natural habitat and exhibit of pond life.

Studio Gang Architects' design for the South Pond Pavilion was inspired by the tortoise shell.

It features pre-fabricated wooden planks that have been interconnected to form the curving structural members.

The top of the pavilion is covered semi-transparent fibreglass pods, which let light filter in while still protecting those underneath.



SOUTH POND PAVILION

Project FABRICATION

The wooden pieces are of Douglas Fibre, prefabricated possibly using Milling. These identical pieces are then brought to site and are fixed together in-situ. The fibre glass panels on the top have also been prefabricated and only assembled on site.

The video highlights the basic process of assembly of all the part on site.

Kindly click on the link below to view the assemvly process.

Source: http:// http://www.archdaily.com/83676/lincoln-park-zoo-

SOUTH POND PAVILION

Project MATERIALS

The wood pieces, of Douglas Fir, one of the strongest structural grade species are bent in forms, similar to the way you would make bent wood furniture. Layers of lamination are wetted and glued together. It's better for the environment because you're not cutting up large trees. More waste pieces can be used.

The pavilion consists of 276 wooden pieces of best quality Douglas Fir and 63 fibre glass panels.

The wood structure is bolted to steel structures anchored to a concrete foundation.

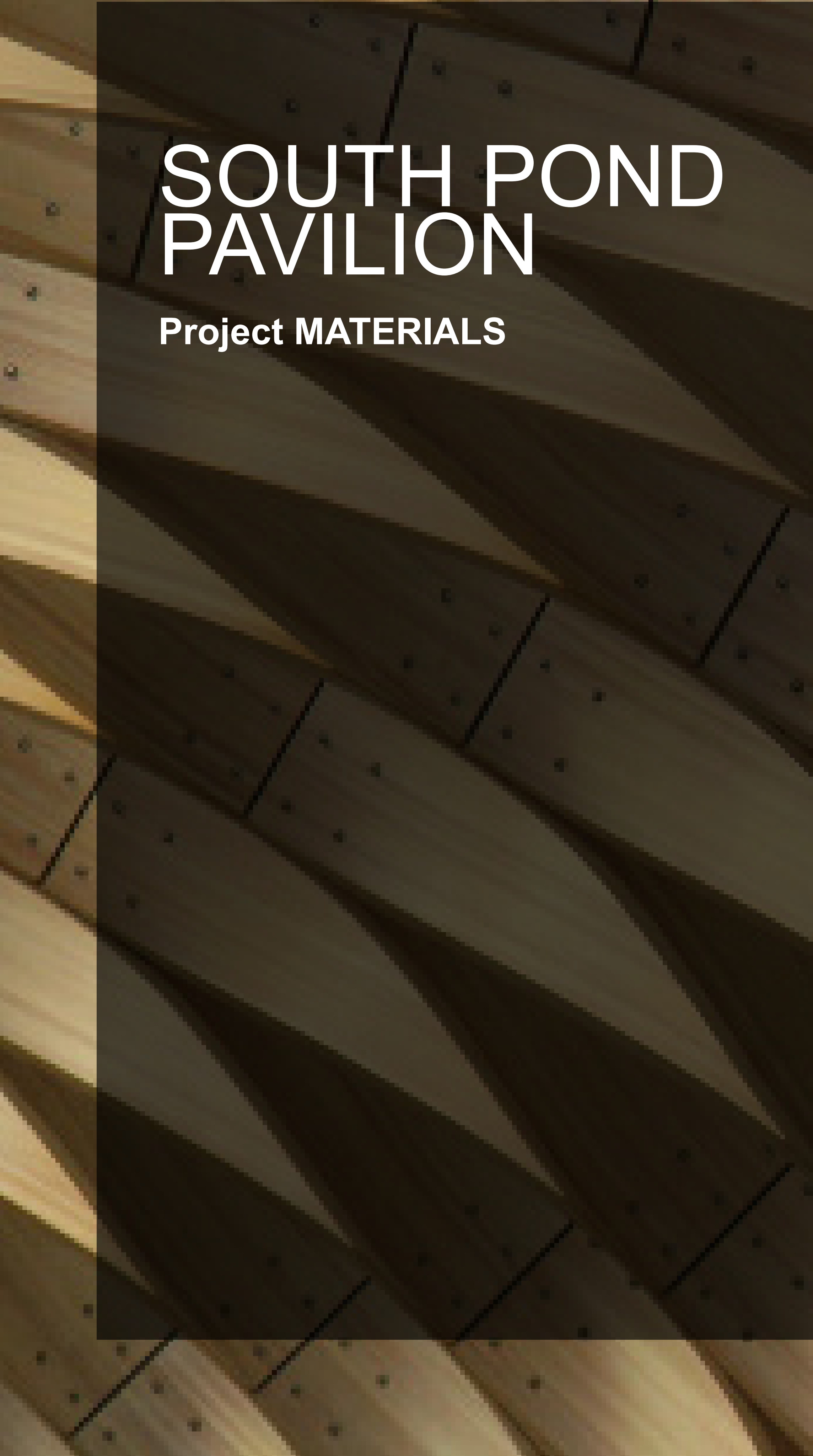
The fiberglas inserts use a UV inhibitor to avoid the yellowing and aging seen in older fiberglas.

The design of the inserts stretch all the way back to a sketch of a tortoise fossil form Gang made when teaching at Yale in 2004.

There's a dialogue of textures between the gnarled expanse of tortoise-shell fiberglas inserts and the elegant near-gothic-tracery of the wood structure.

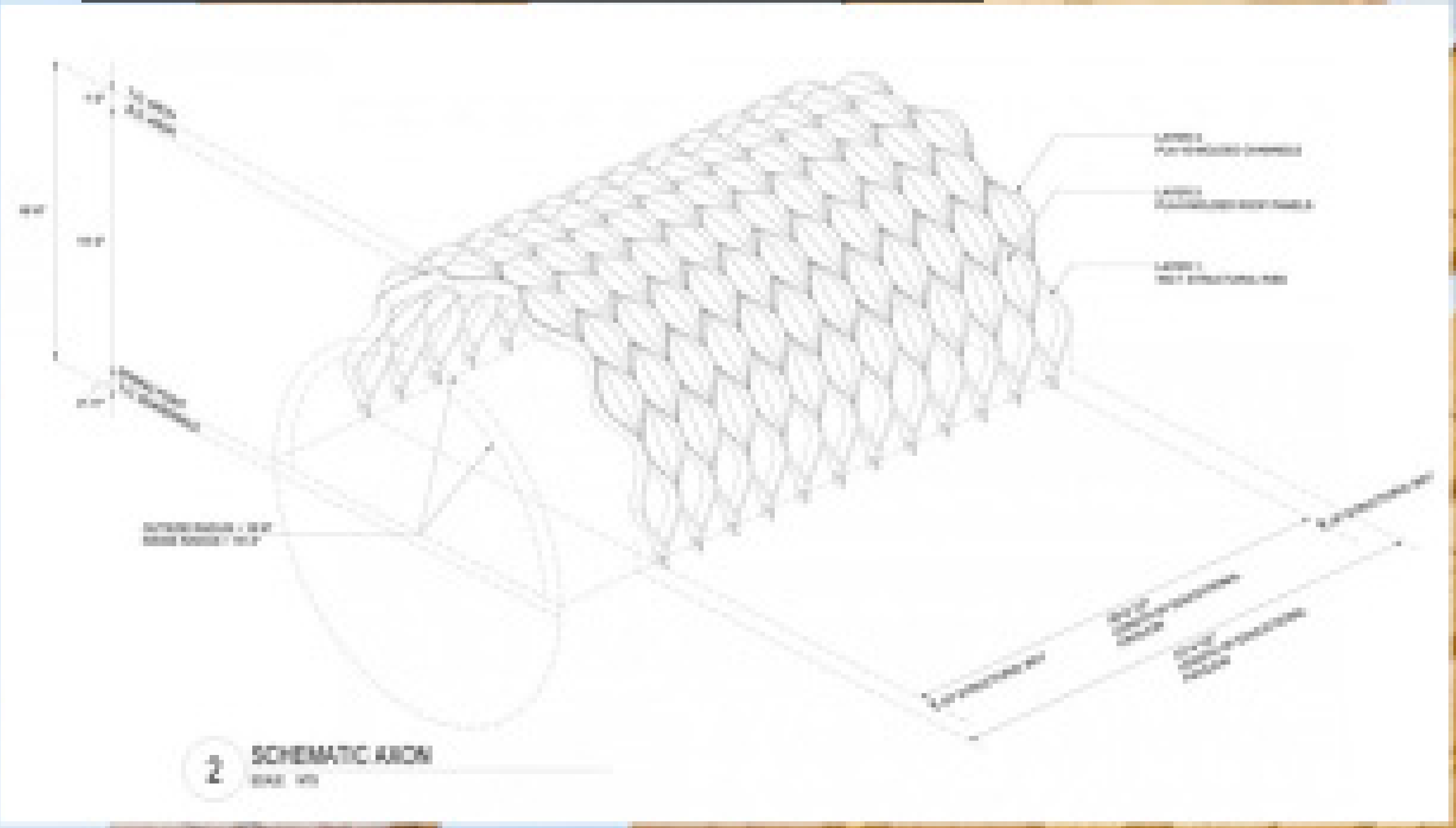
SOUTH POND PAVILION

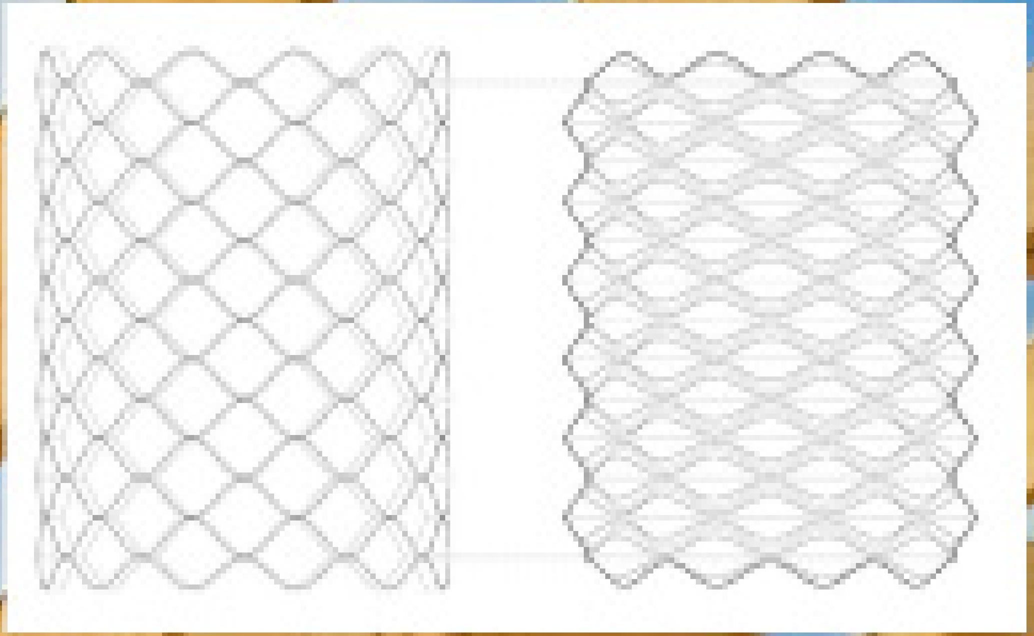
Project MATERIALS

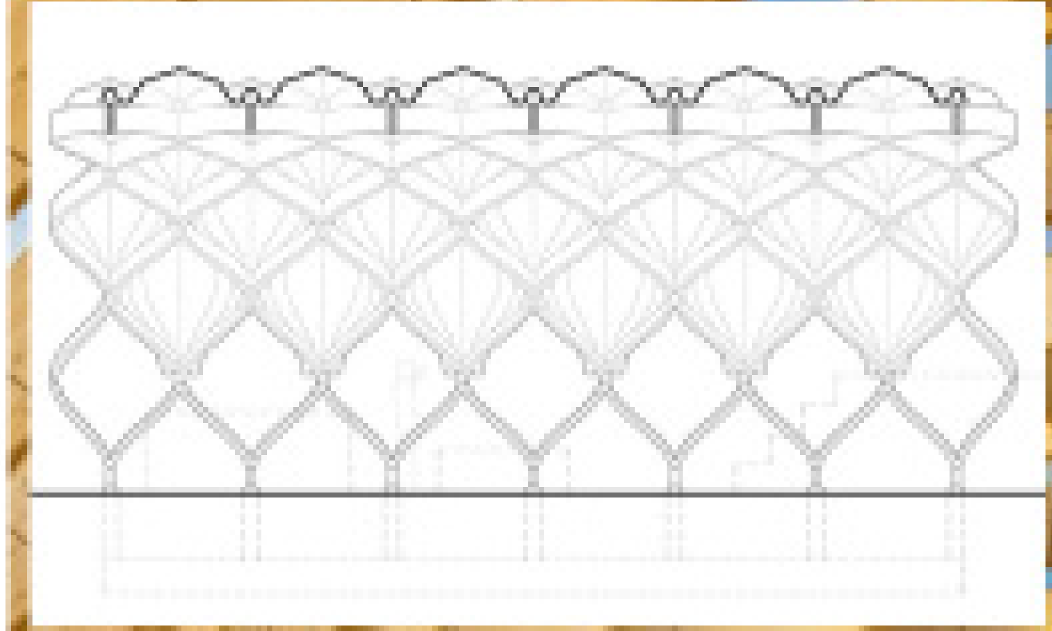


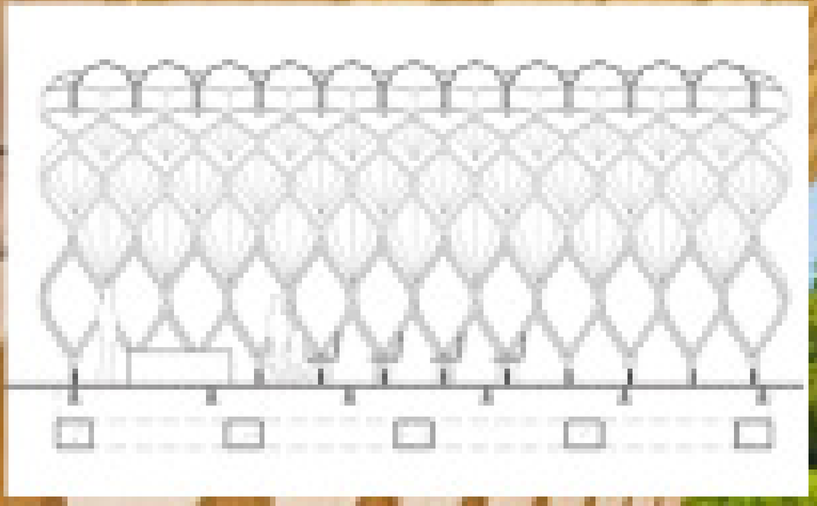
SOUTH POND PAVILION

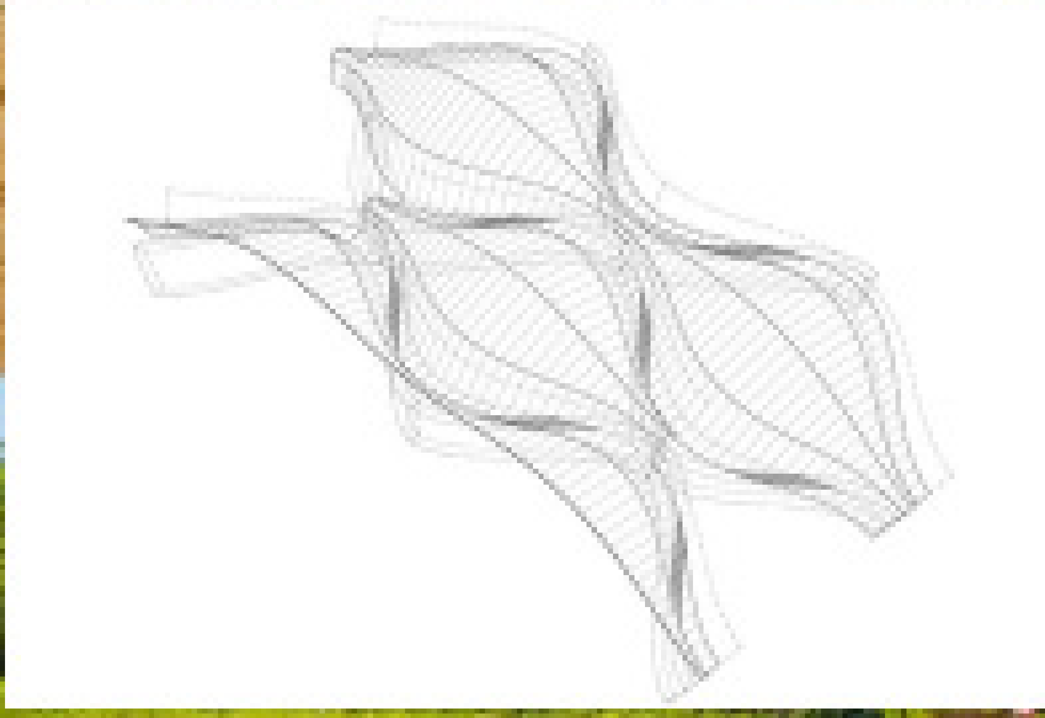
Project DRAWINGS





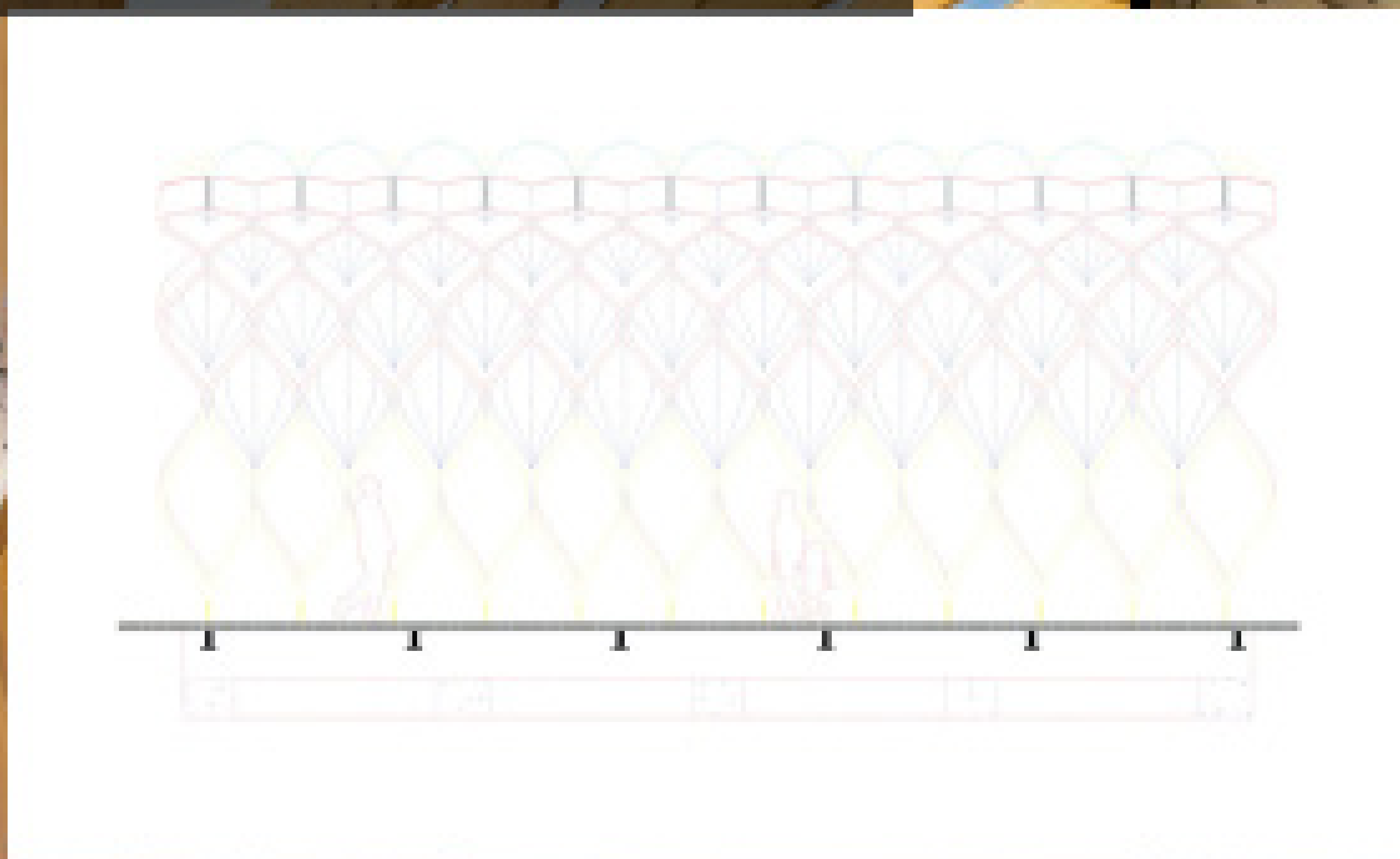


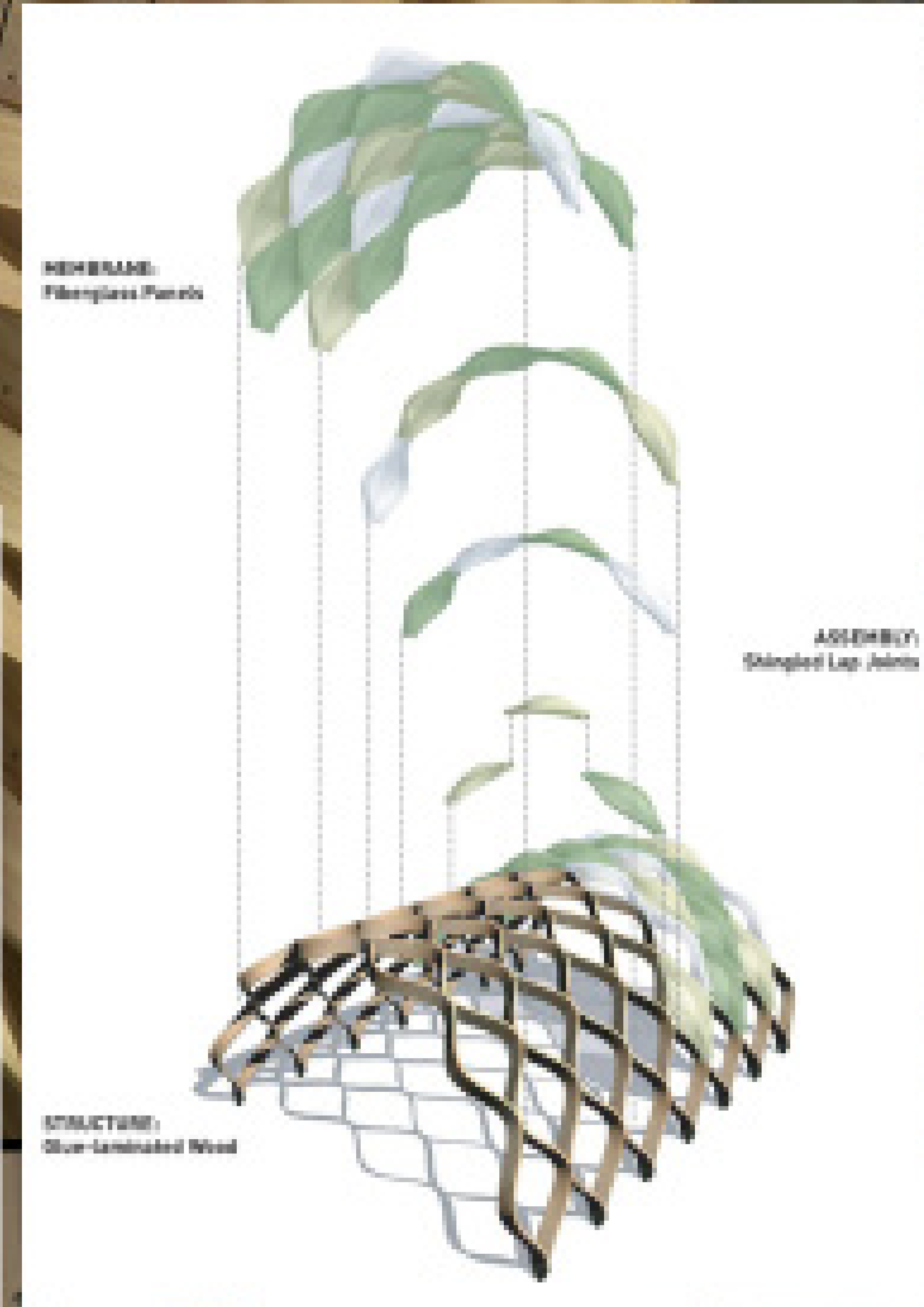


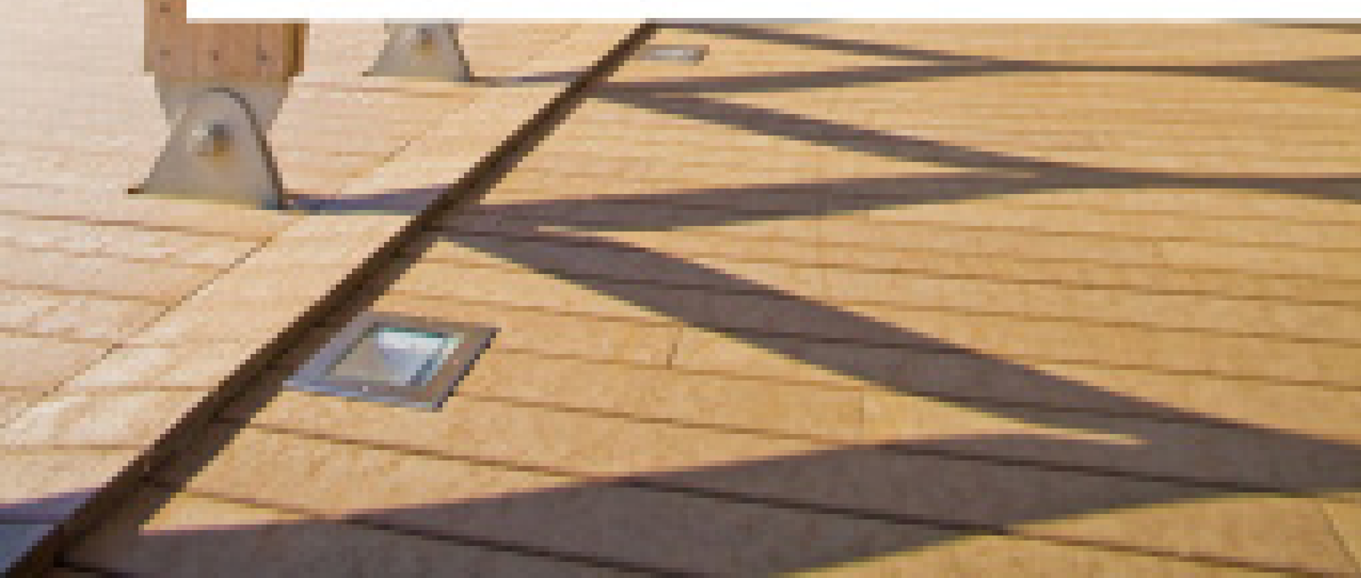


SOUTH POND PAVILION

Project DRAWINGS

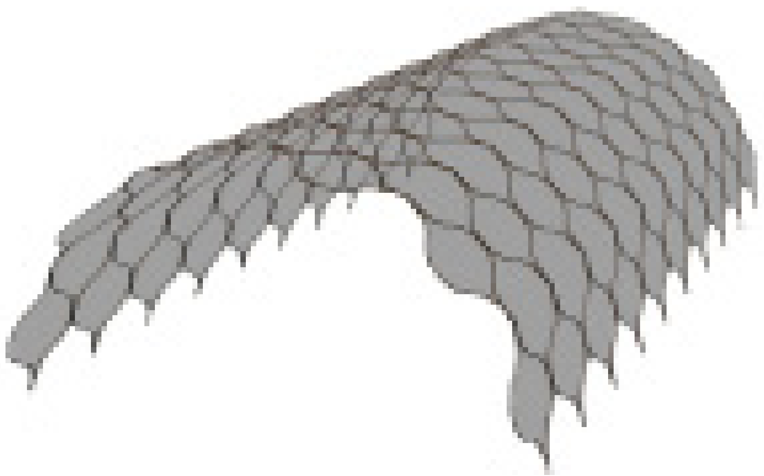


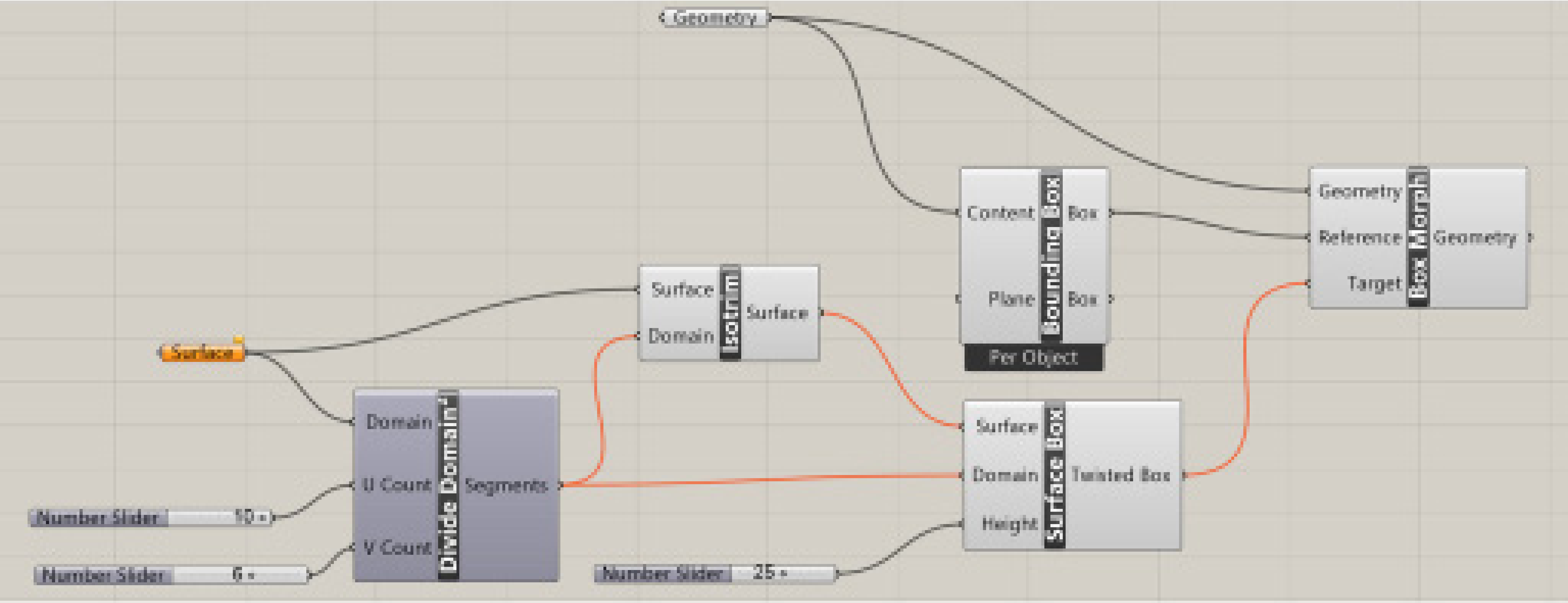




SOUTH POND PAVILION

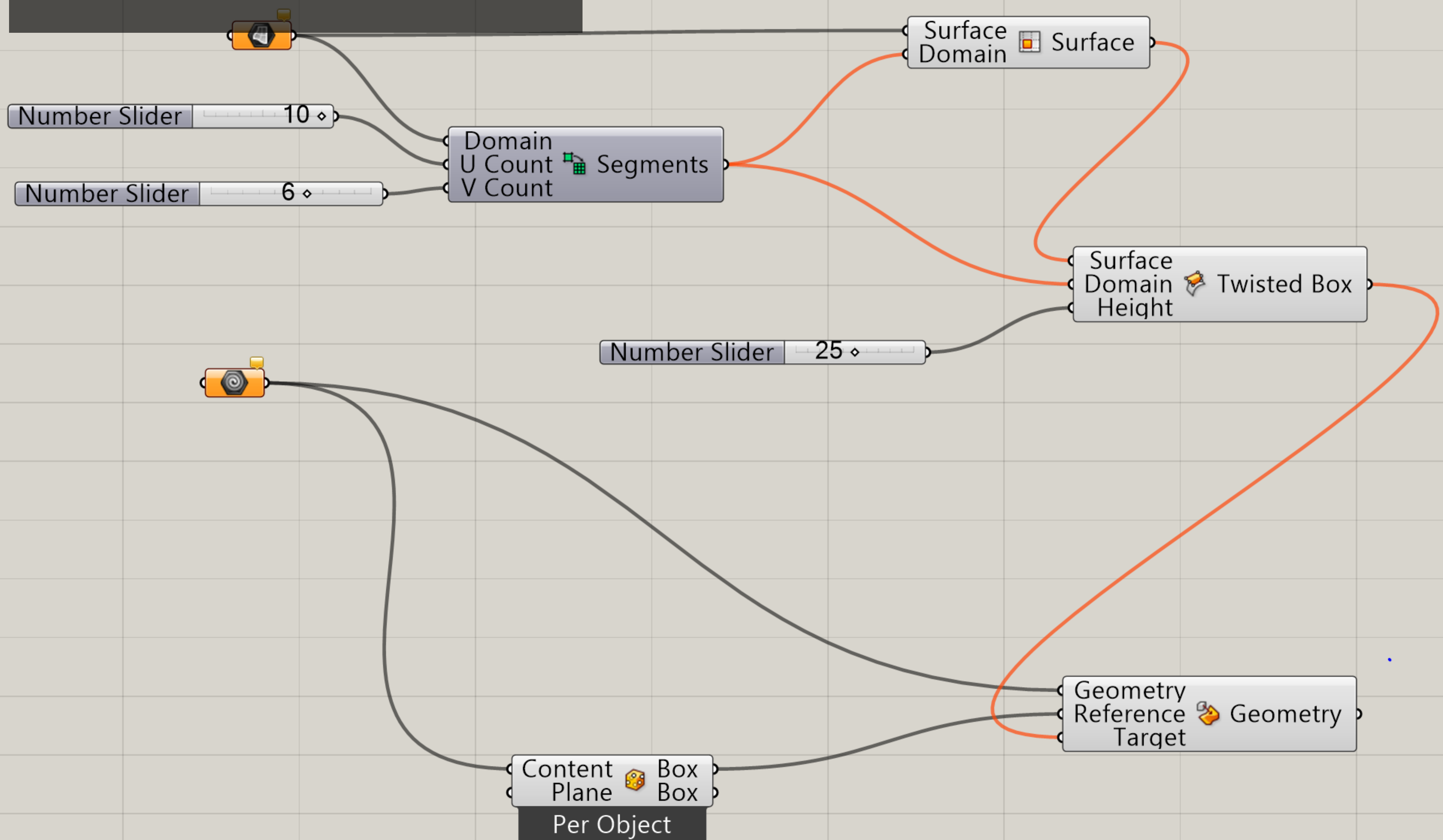
Grasshopper MODELLING





SOUTH POND PAVILION

Grasshopper MODELLING



SOUTH POND PAVILION

FORMING
AIA PAVILION
GERNOT RIETHER

4060693 Yu-Wei Han

Source: http://www.nomads.usp.br/virus/virus06/?sec=7&item=2&lang=en

AIA Pavilion

Project OUTLINE

Project Architect / Artist: Gernot Riether

Location: New Orleans, USA

Investor: American Institute of Architects (AIA)

Function: Pavilion

Construction Year: 2011

Dimmensions: 5m High, 18m^2

Construction Team: Gernot Riether and students in School of Architecture at Georgia Tech.

Materials Used: Plastic elements (PEGT) and aluminum strips

Budget: $2,500

Major Fabrication Method Used: Thermoforming (drape forming, vacuum forming and draping.

Fabricated By: CNC and Thermoforming machine in DFL at Georgia Tech.

Weight: 120 Kg

Type Of Construction: Self-supporting geodesic dome

Modelling Software: Rhino + Grasshopper

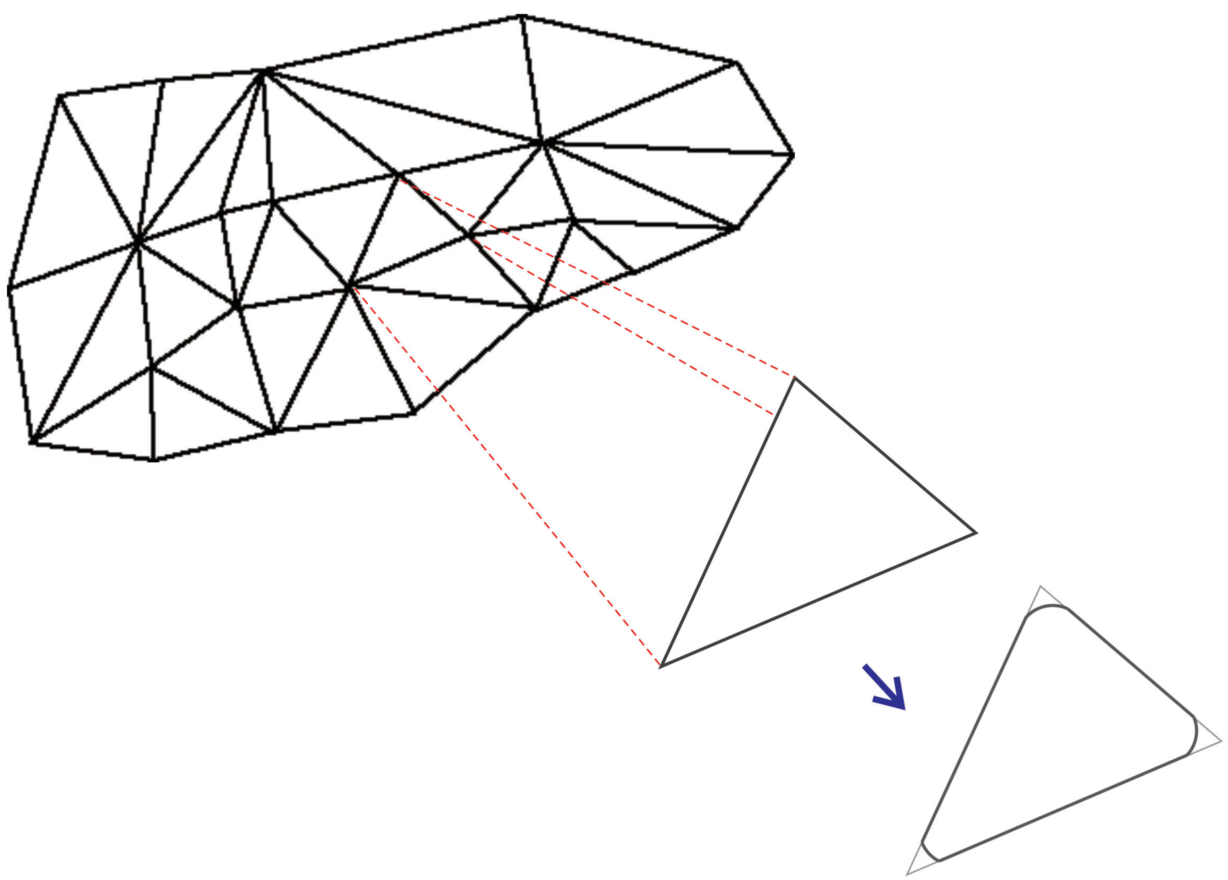
AIA Pavilion

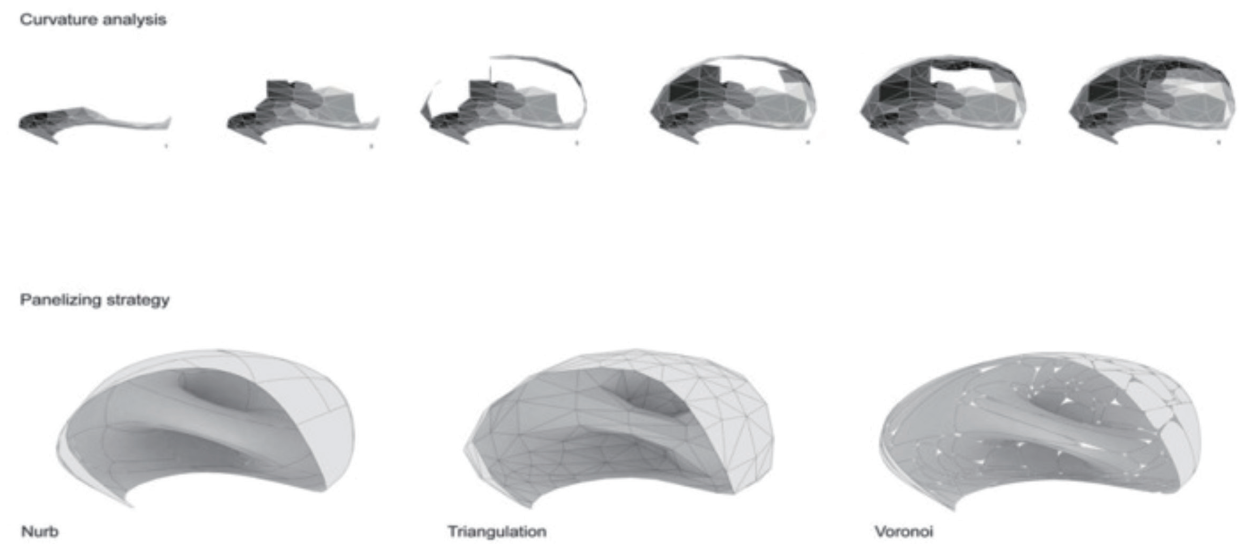
Project DESCRIPTION

Every year, the AIA stages a competition for an intervention that brings to life the historic city of New Orleans. This year the institute selected a scheme by Gernot Riether that proposed a series of glowing spherical enclosures sited within the hidden courtyards of the city’s distinctive French Quarter. They would be illuminated in the evening, dramatically modulating the host environment and bringing attention to these romantic, mysterious and usually private spaces, typically located deep in the block, away from the street.

The pavilion not only demonstrates the work of the digital design build studio that Riether leads at the Georgia Institute of Technology in Atlanta, but also uses glycol-modified polyethylene terephthalate (PETG). This material can either be produced from recycled plastic, or more pertinent to this location, from sugar cane: a plant that has been an integral part of the culture of Louisiana for over 200 years.

AIA Pavilion
Project FABRICATION



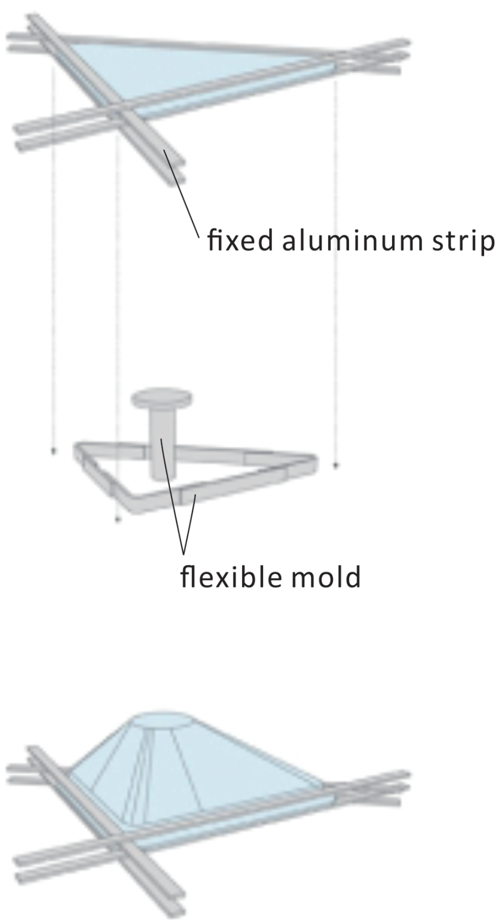


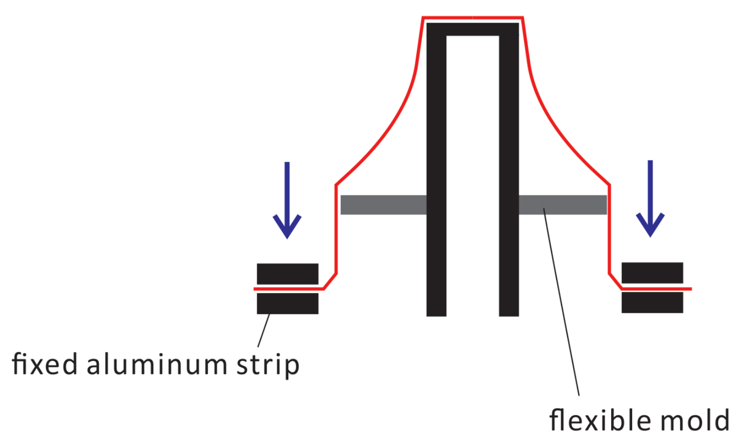
-The geometry was formed by triangles
-It was built in 320 triangular plastic sheets

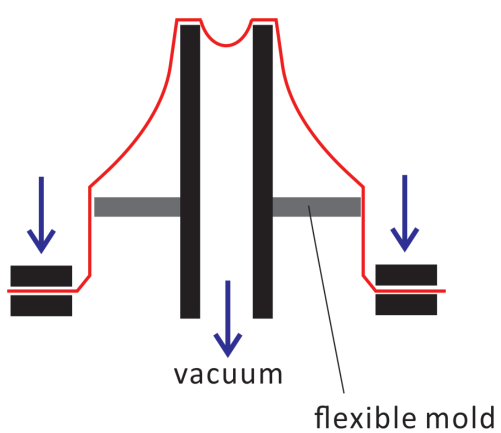
EKKO Pavilion

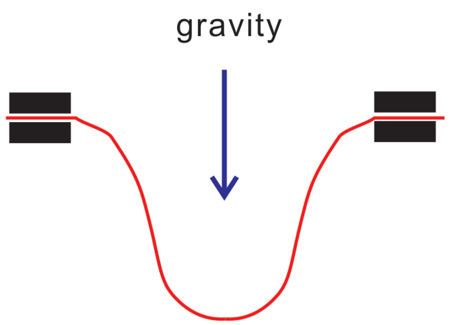
Project FABRICATION

-Structural analysis









A flexible mold was developed that could produce different shapes from different triangles.

-Three different thermoforming techniques: drape forming, vacuum forming and draping.

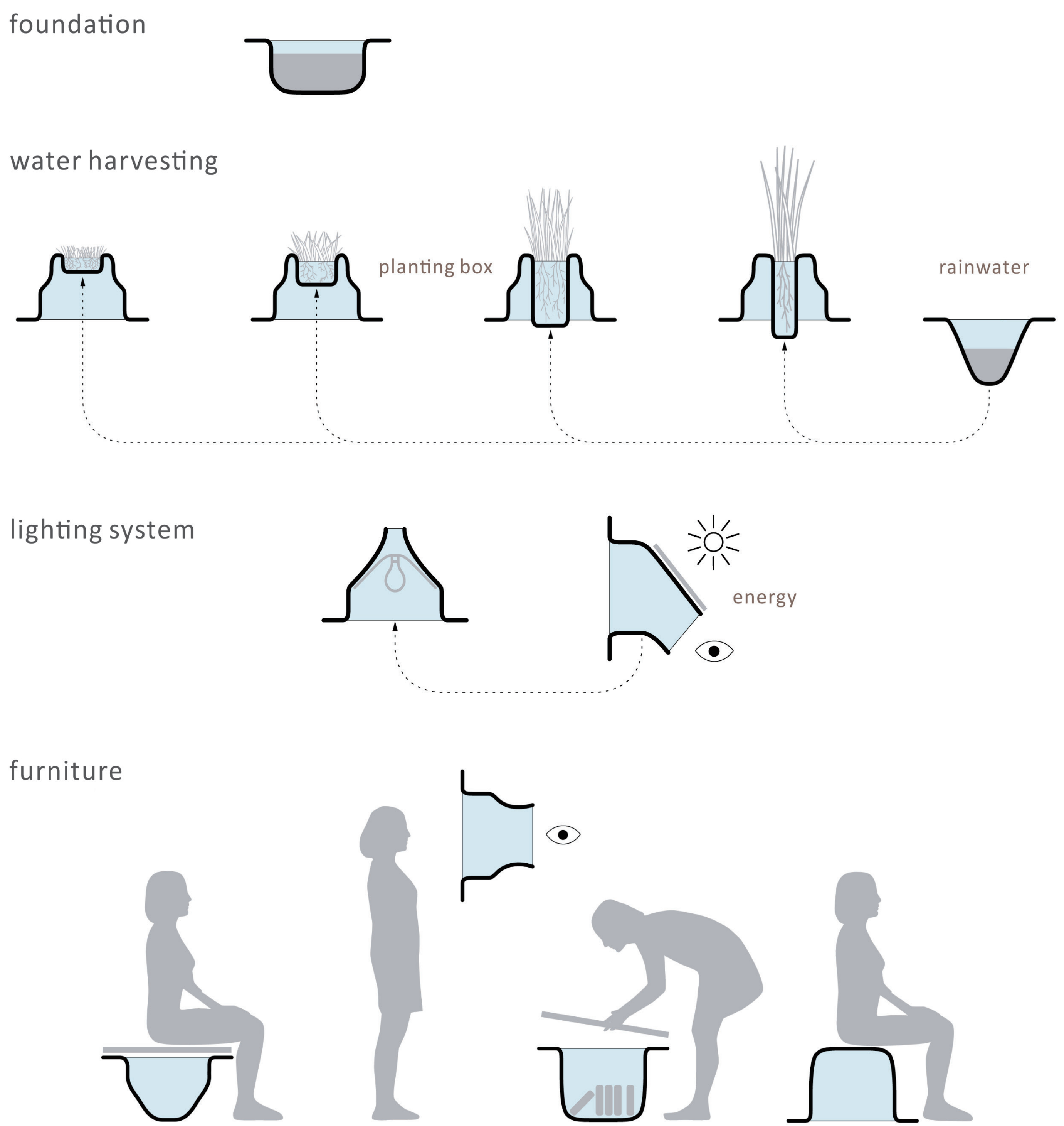
-Advantages: precise, save material, reduce cost and effective production

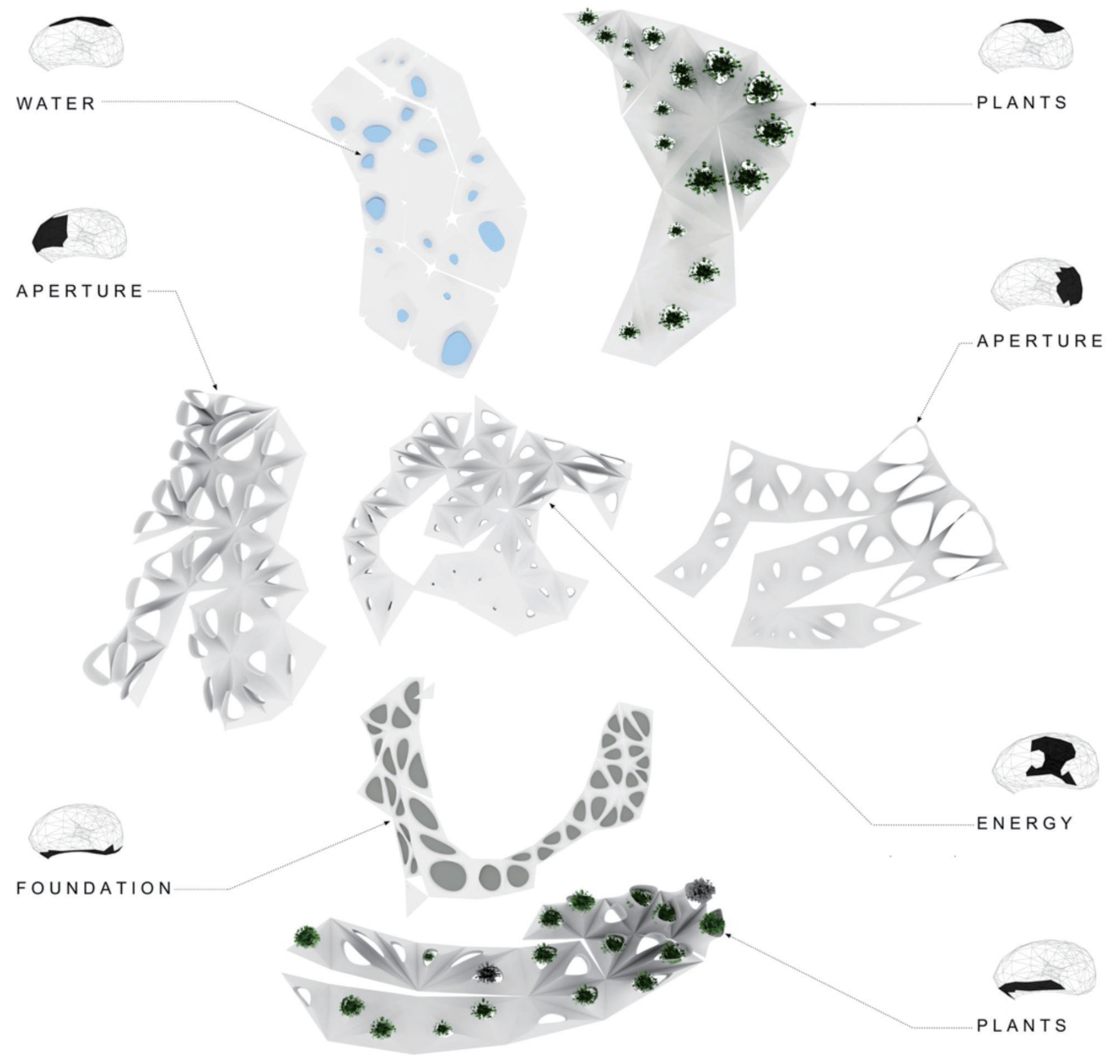
All elements were prefabricated and assembled into 6 larger components for east to transport.

EKKO Pavilion

Project FABRICATION

-Structural analysis





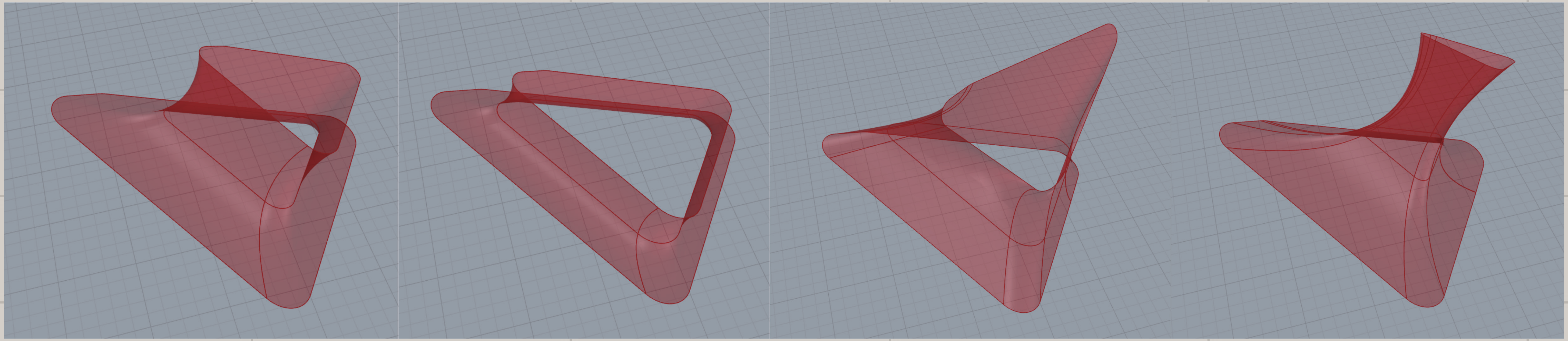
- -foundations filled with sands
- -vessel to collect rainwater
- -planting box
- -solar modules
- -light fittings
- -furniture

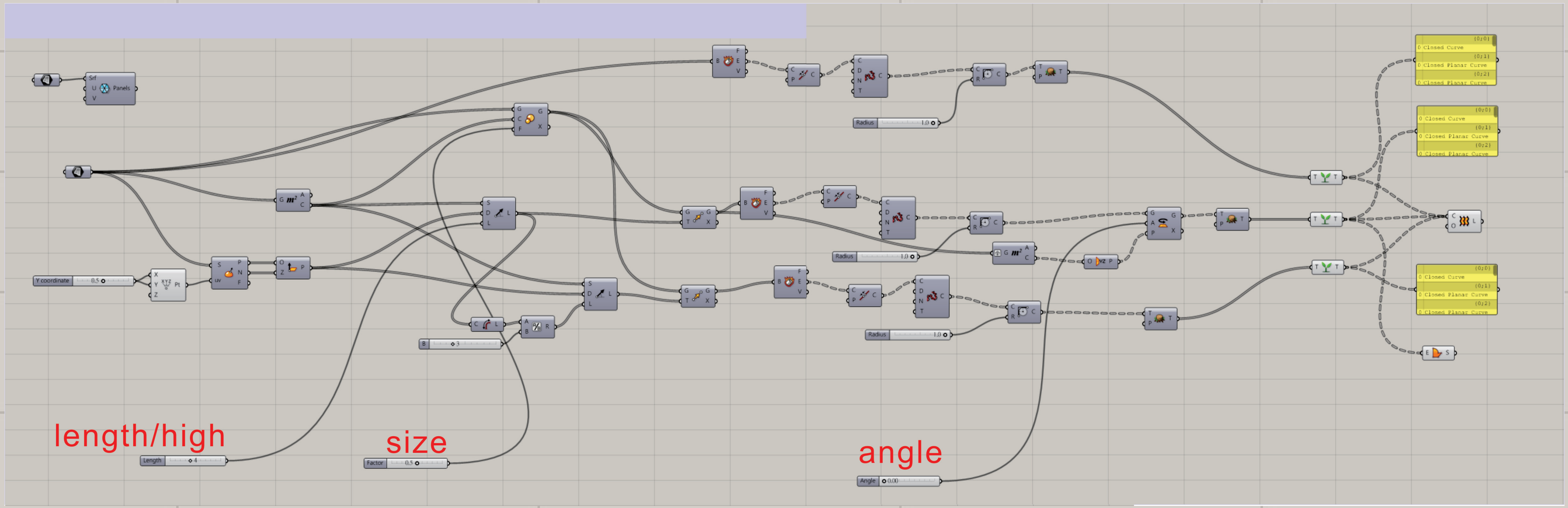




AIA Pavilion

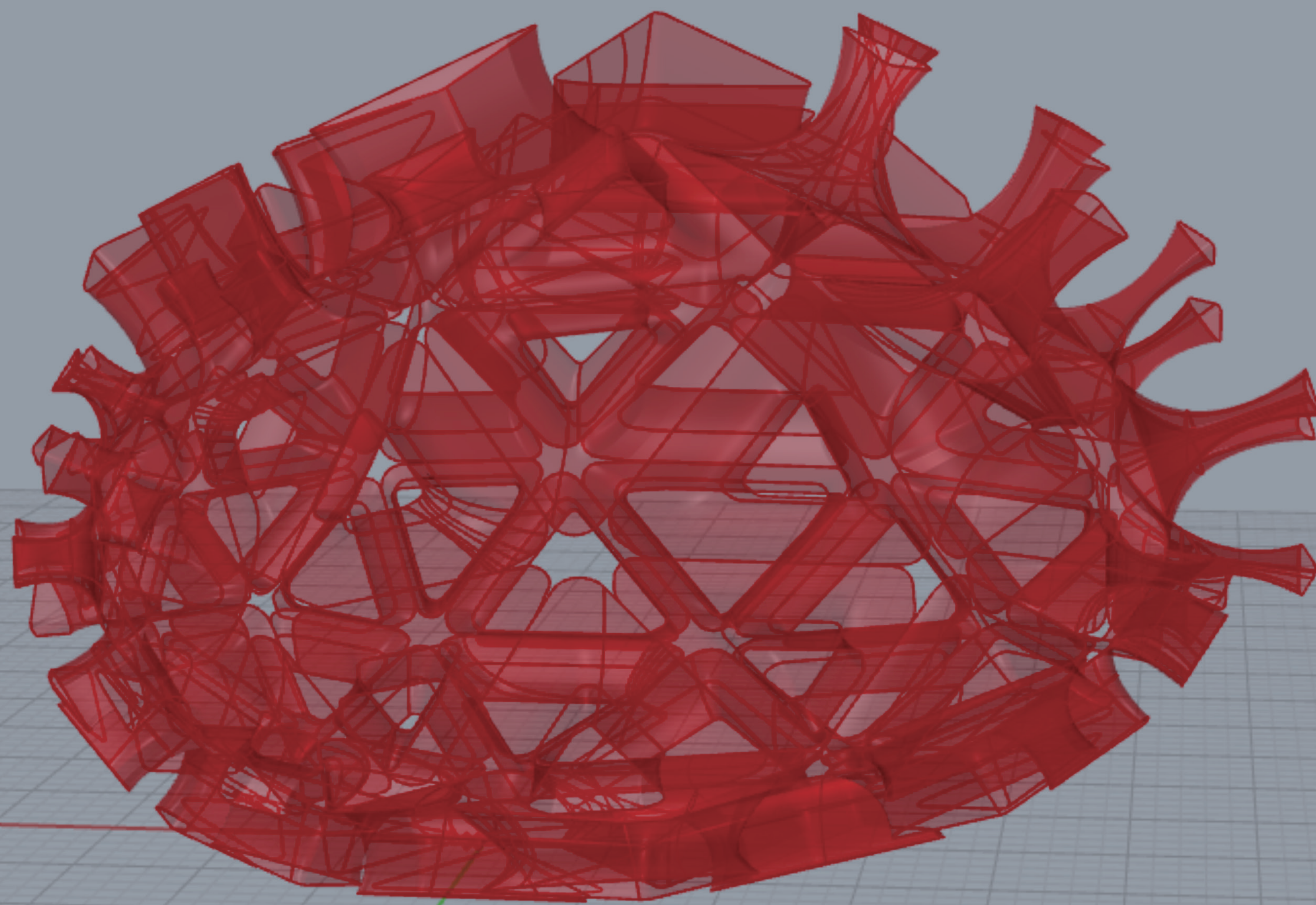
GRASSHOPPER
Modelling





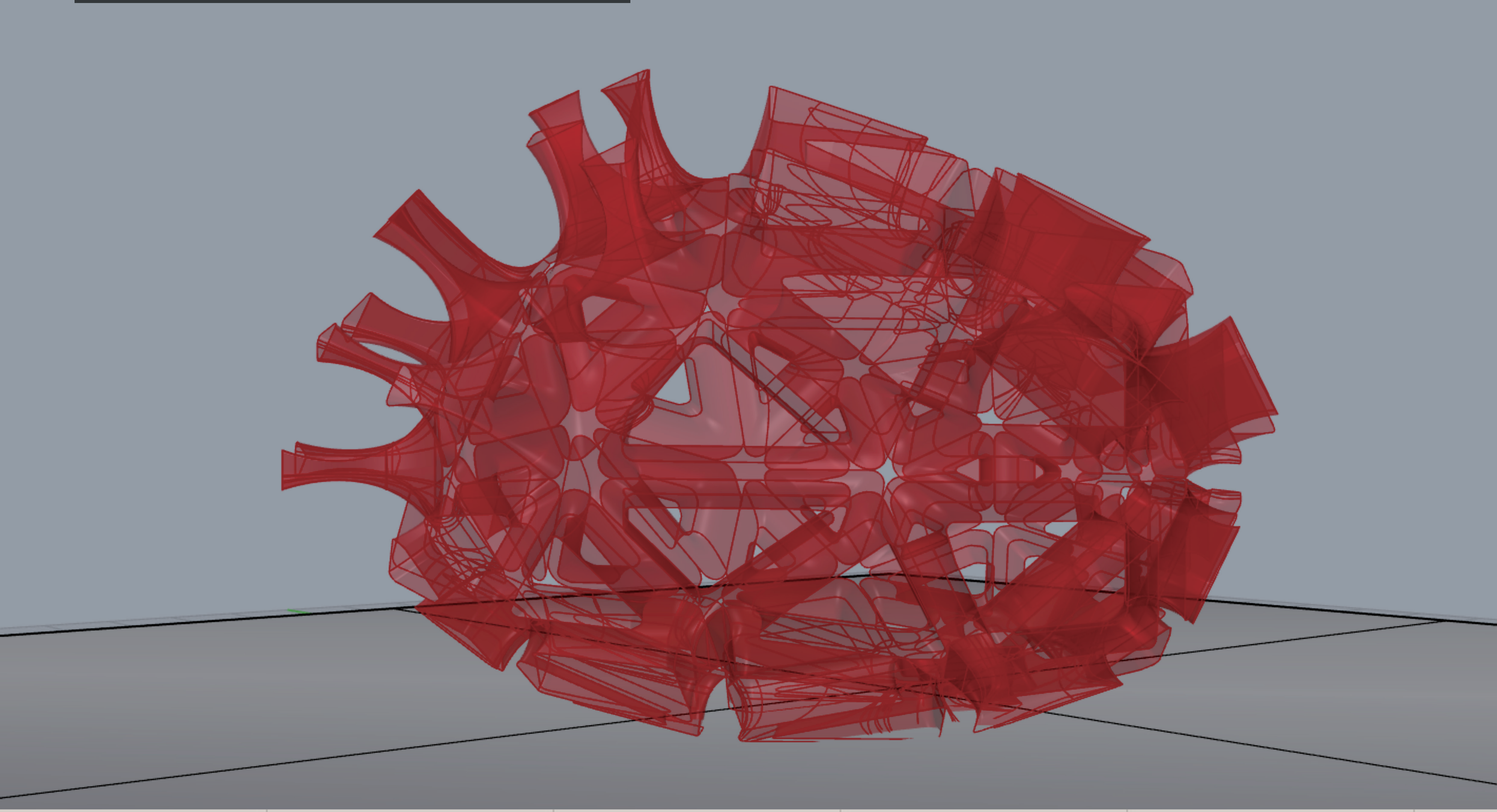
AIA Pavilion

GRASSHOPPER
Modelling



AIA Pavilion

GRASSHOPPER
Modelling



AIA Pavilion

Forming

Echoviren 3d-printed PAVILION

Smith Allen

TAN LI

Source: http://www.dezeen.com/2013/08/21/california-duo-create-worlds-first-3d-printed-architecture/

Echoviren Pavilion

Project OUTLINE

Project Architect / Artist: Smith Allen

Location: oakland, california, USA

Function: Pavilion

Construction Year: 2013

Dimensions: 10 x 10 x 8 feet

Construction Team: Project 387

Materials Used: PLA bio-plastic

Major Fabrication Method Used: 3D printed

Secondary Fabrication Methods: XXXXXXXXXX

Fabricated By: Type A Machines desktop 3D printers

Type Of Construction: bio-plastic Frame

Modelling Software: Rhino + Grasshopper

Source: http://www.dezeen.com/2013/08/21/california-duo-create-worlds-first-3d-printed-architecture

Echoviren Pavilion

Project DESCRIPTION

Spanning 10 x 10 x 8 feet, Echoviren is a translucent white enclosure, stark and artificial against the natural palette of reds and greens of the forest. Walking around and within the structure, the viewer is immediately consumed by the juxtaposition, as well as uncanny similarity, of natural and unnatural: the large oculus, open floor, and porous surface framing the surrounding coastal landscape.

Echoviren was fabricated, printed, and assembled on site by the designers. Through the use of parametric architectural technologies and a battery of consumer grade Type A Machines desktop 3D printers, Smith|Allen has constructed the world's first 3D printed, full-scale architectural installation. Made of over 500 unique individually printed parts, 7 3D Printers ran constantly for 2 months for a total of 10800 hours of machine time.

Source: http://www.dezeen.com/2013/08/21/california-duo-create-worlds-first-3d-printed-architecture/

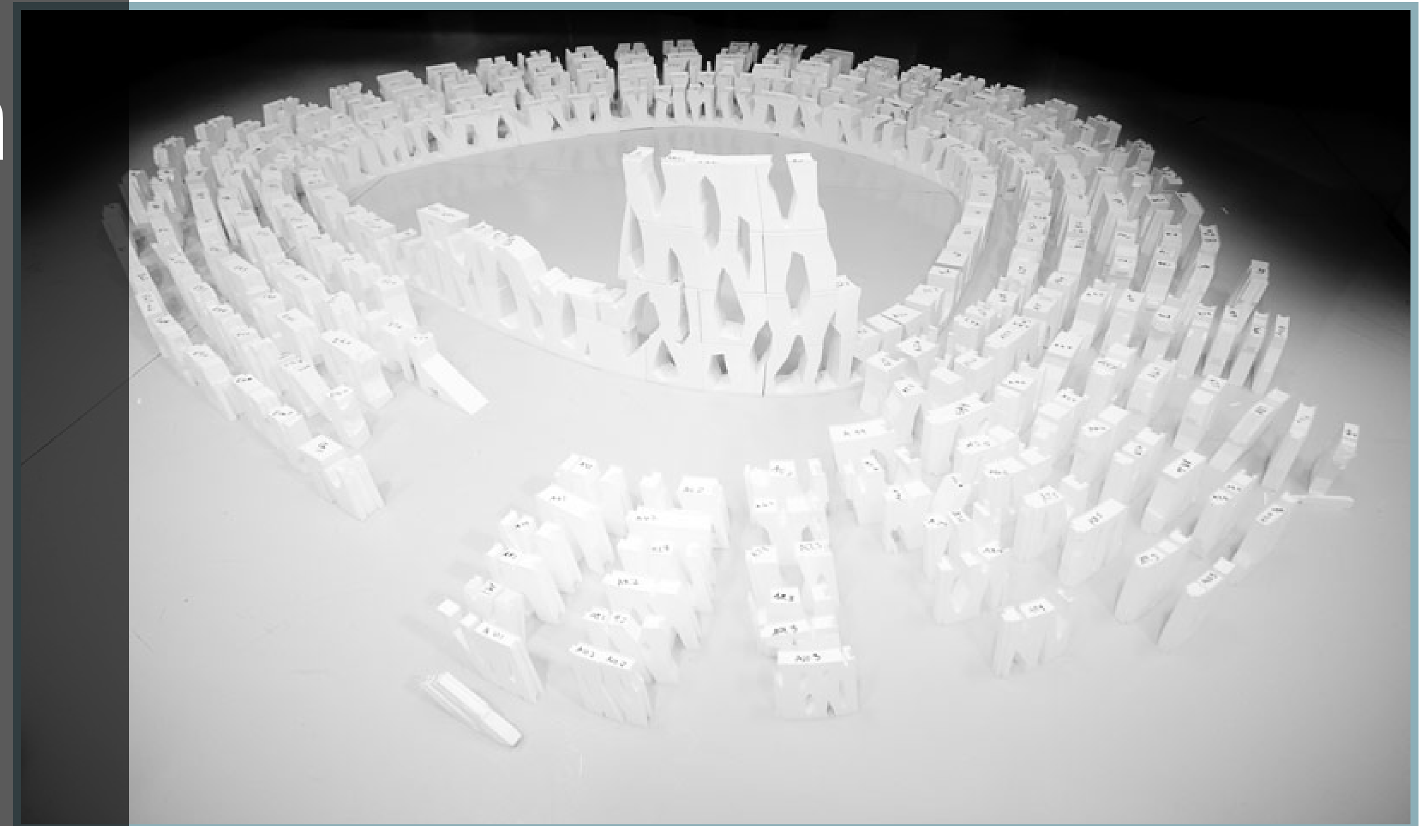


Echoviren Pavilion

Project FABRICATION

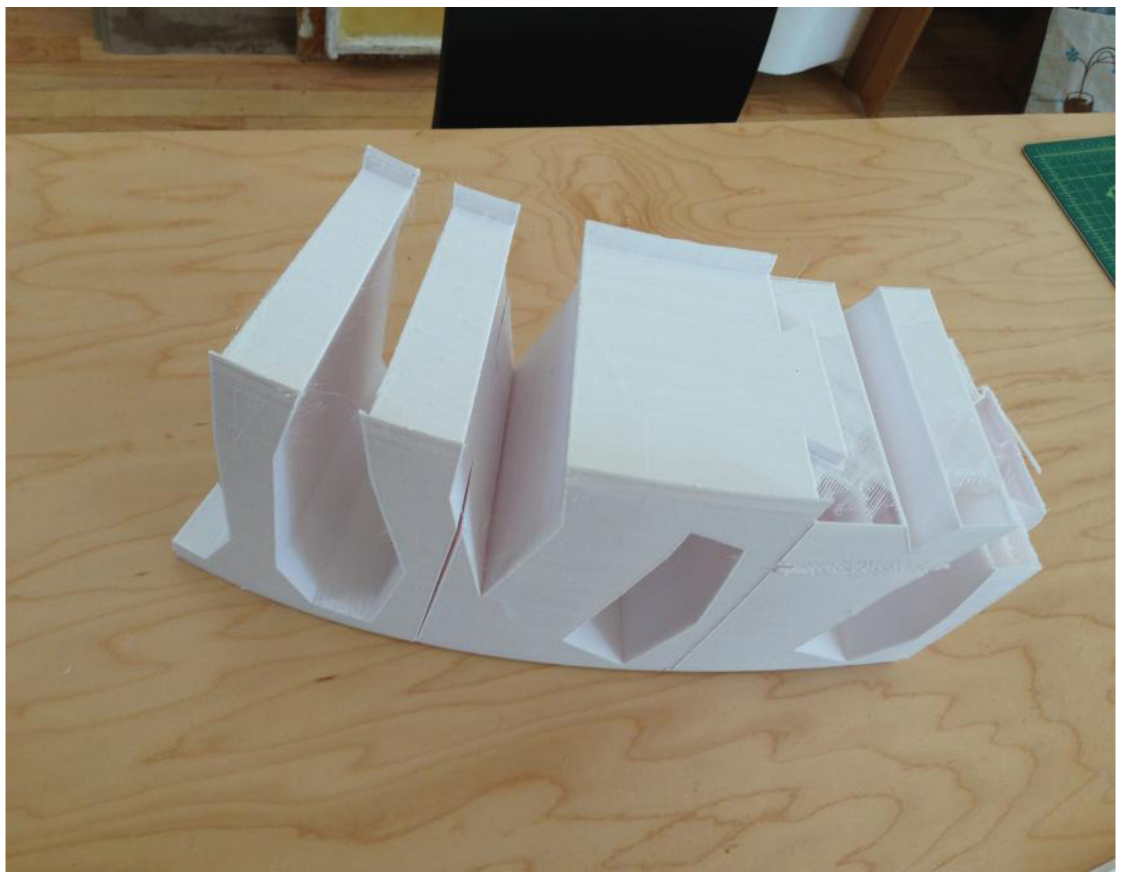
The structure was assembled though a paneled snap-fit connection, merging individual components into a monolithic aggregation. From breaking ground to finish the prefab 3D printed construction technique required for only 4 days of on site building time.

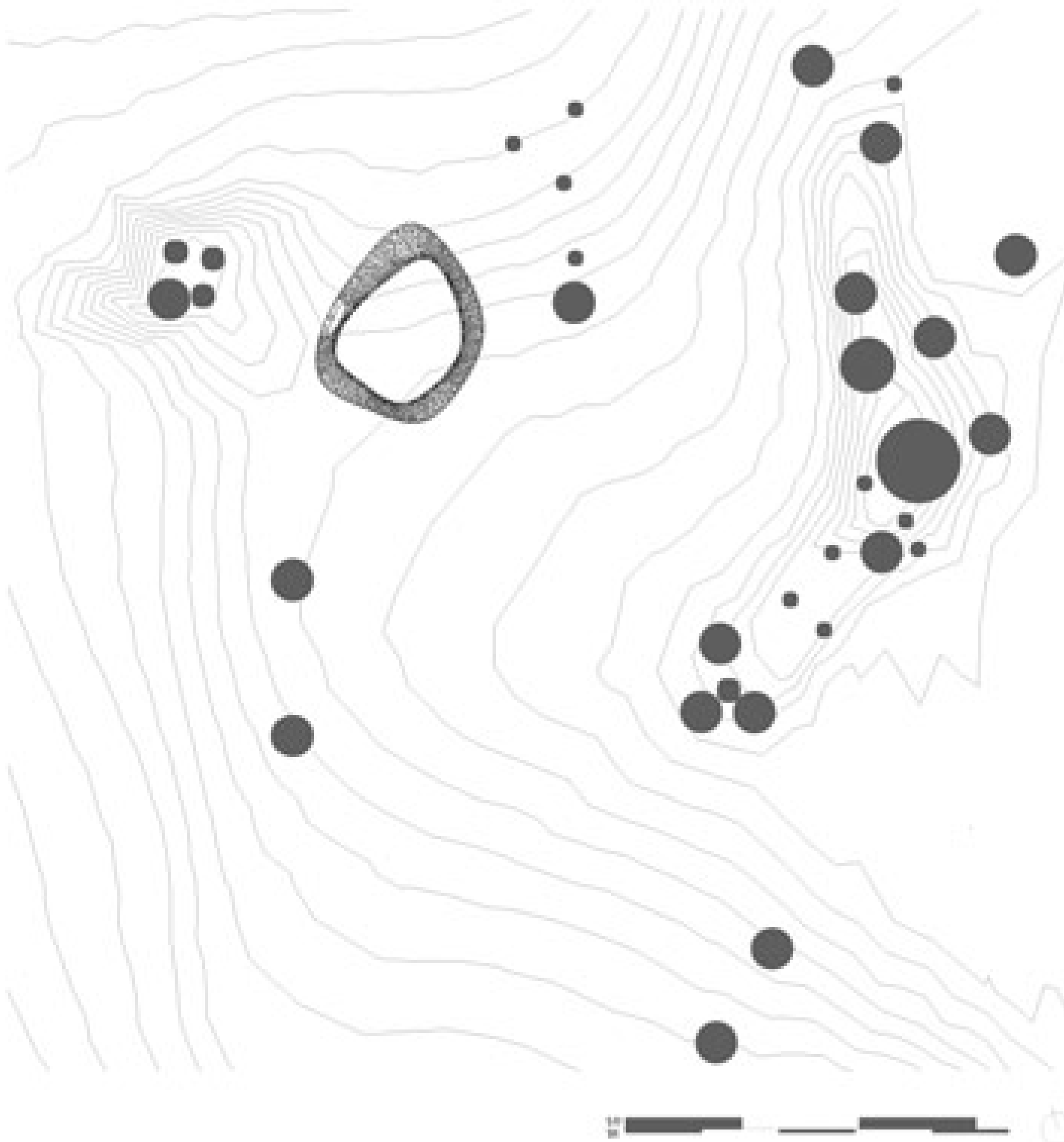
Entirely composed of 3D printed plant based PLA bio-plastic, the space will decompose naturally back into the forest in 30 to 50 years. As it weathers it will become a micro-habitat for insects, moss, and birds.

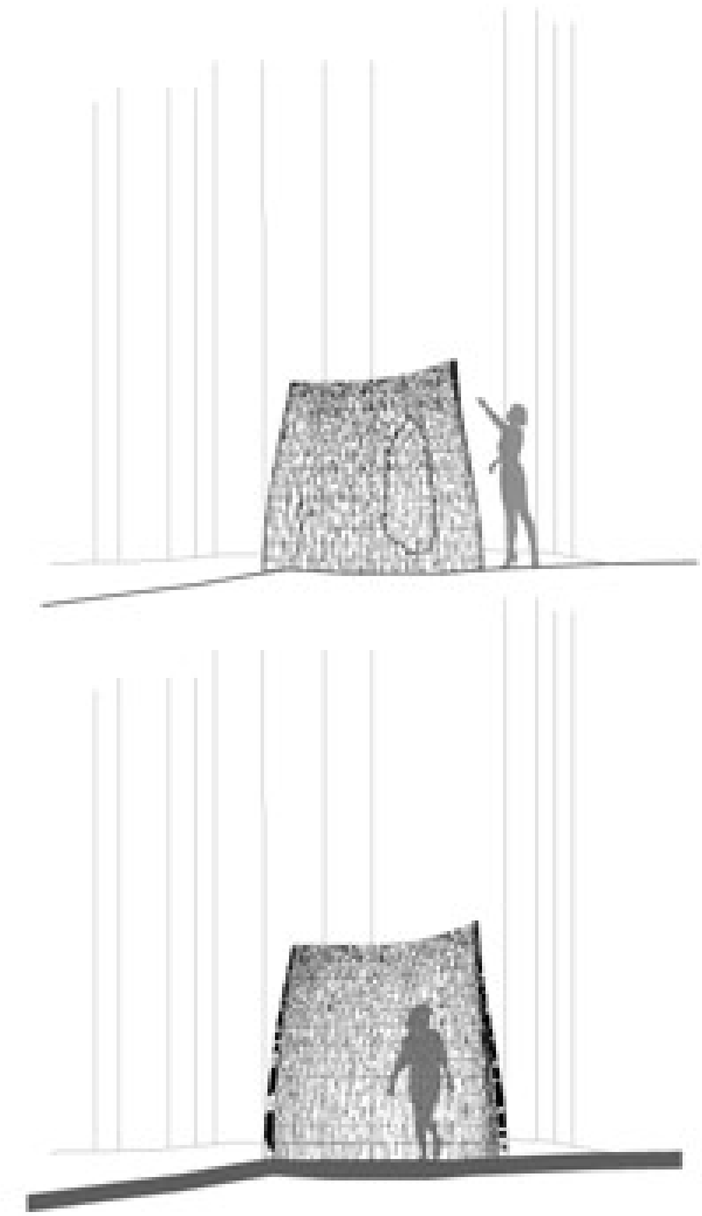


Echoviren Pavilion

Project FABRICATION

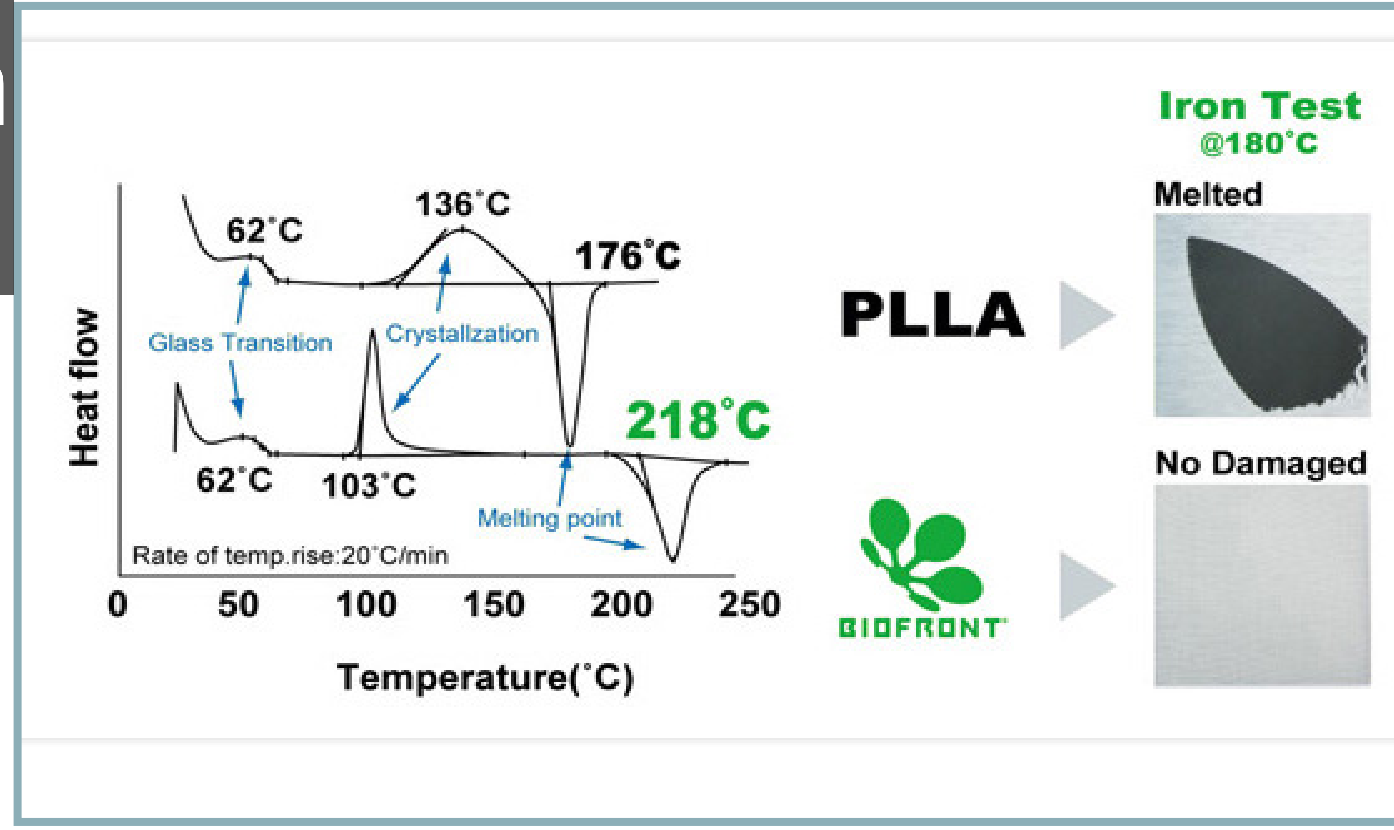






Echoviren Pavilion

Project MATERIALS



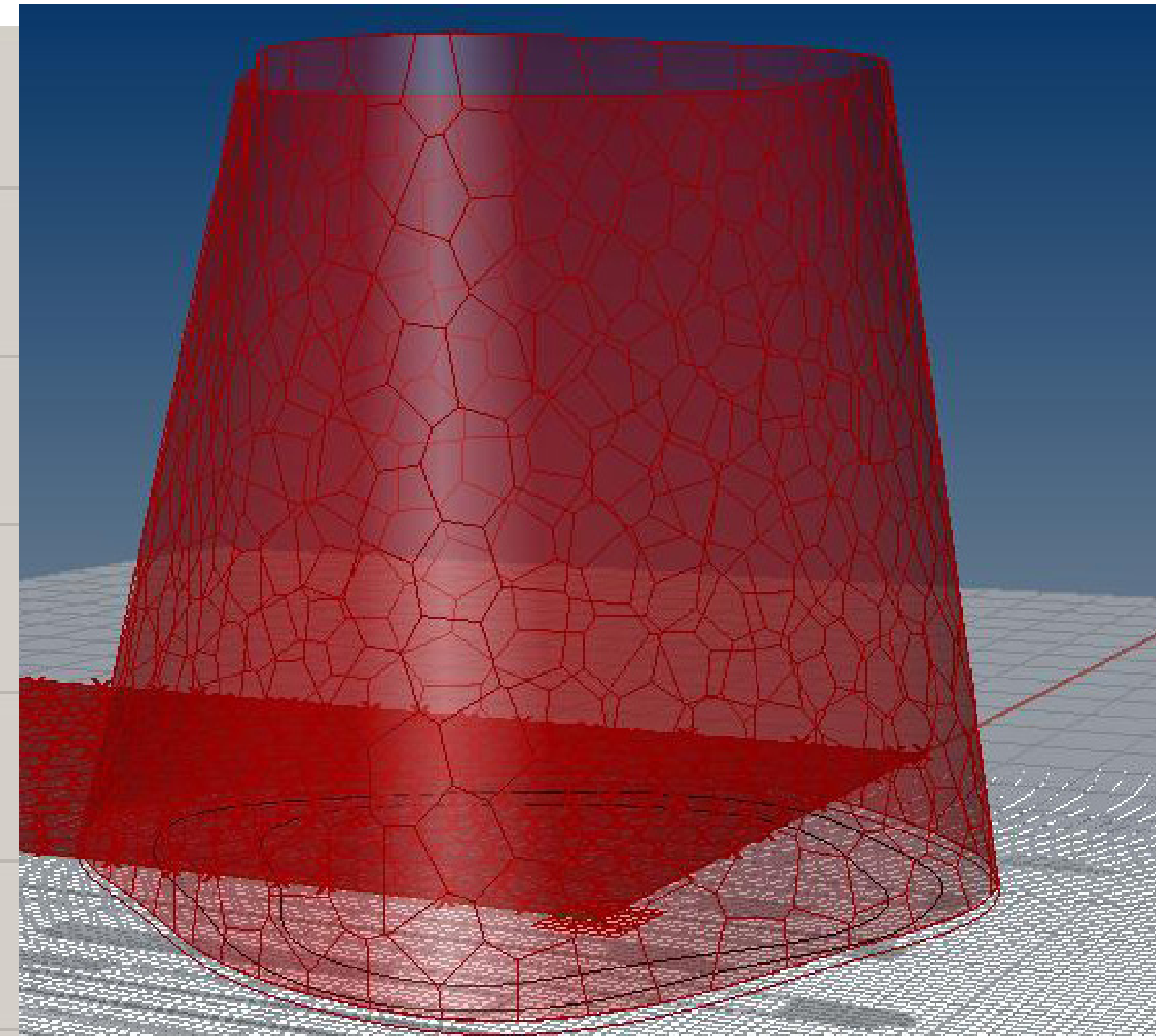
Echoviren Pavilion

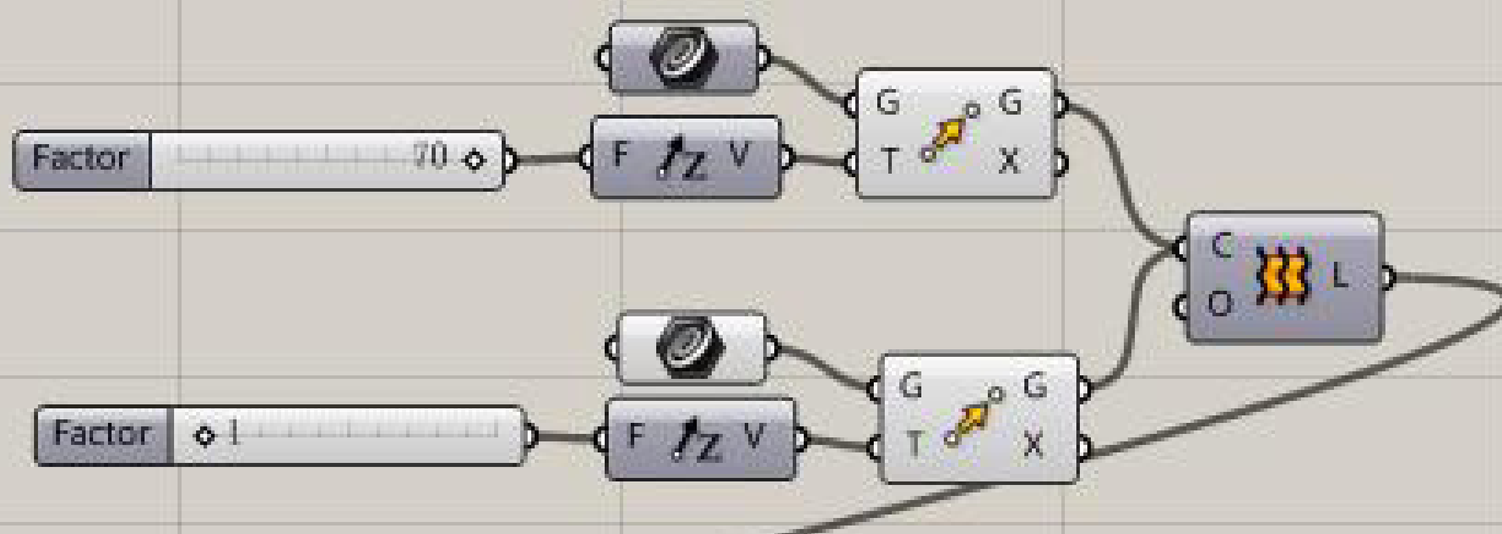
Project MACHINE / SOFTWARE

Through the use of parametric architectural technologies and a battery of consumer grade Type A Machines desktop 3D printers

Echoviren Pavilion

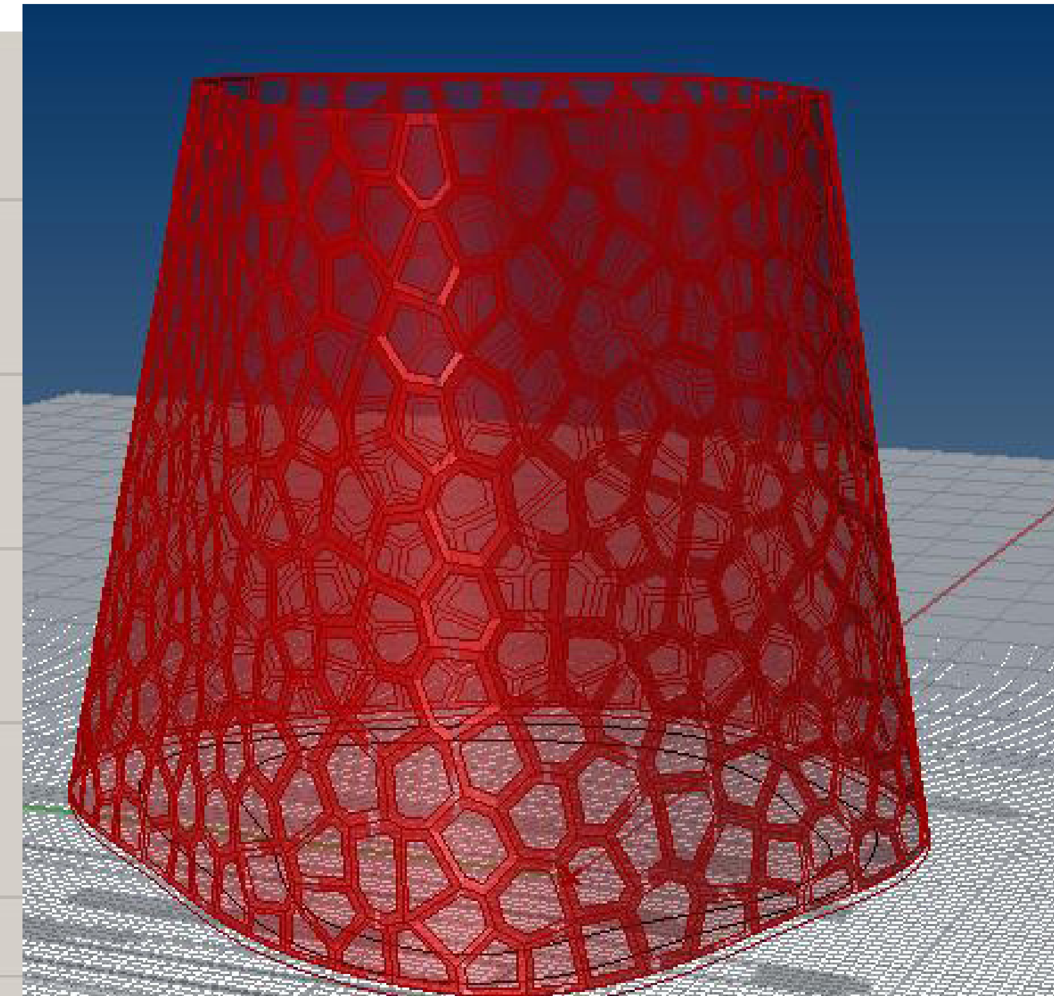
GRASSHOPPER
Modelling

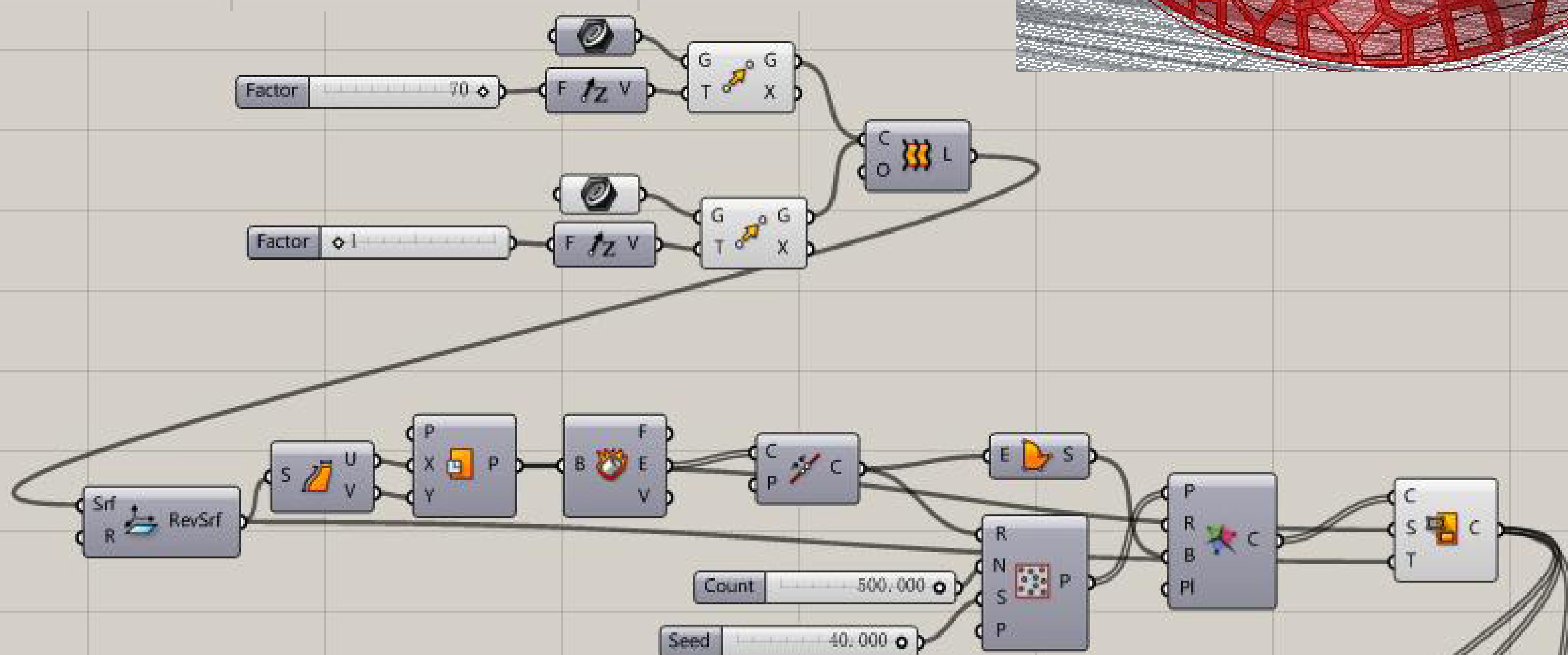




Echoviren Pavilion

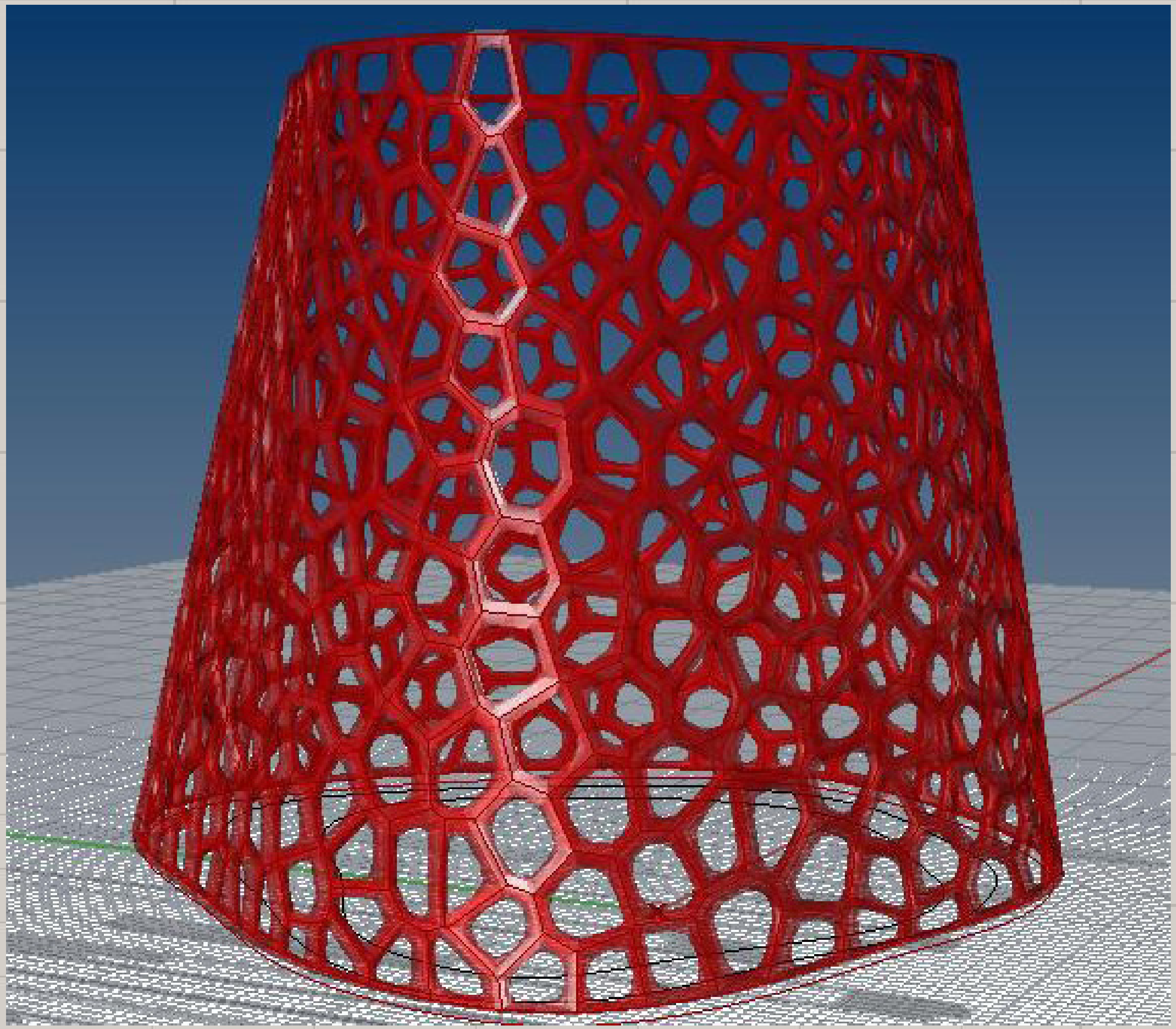
GRASSHOPPER
Modelling

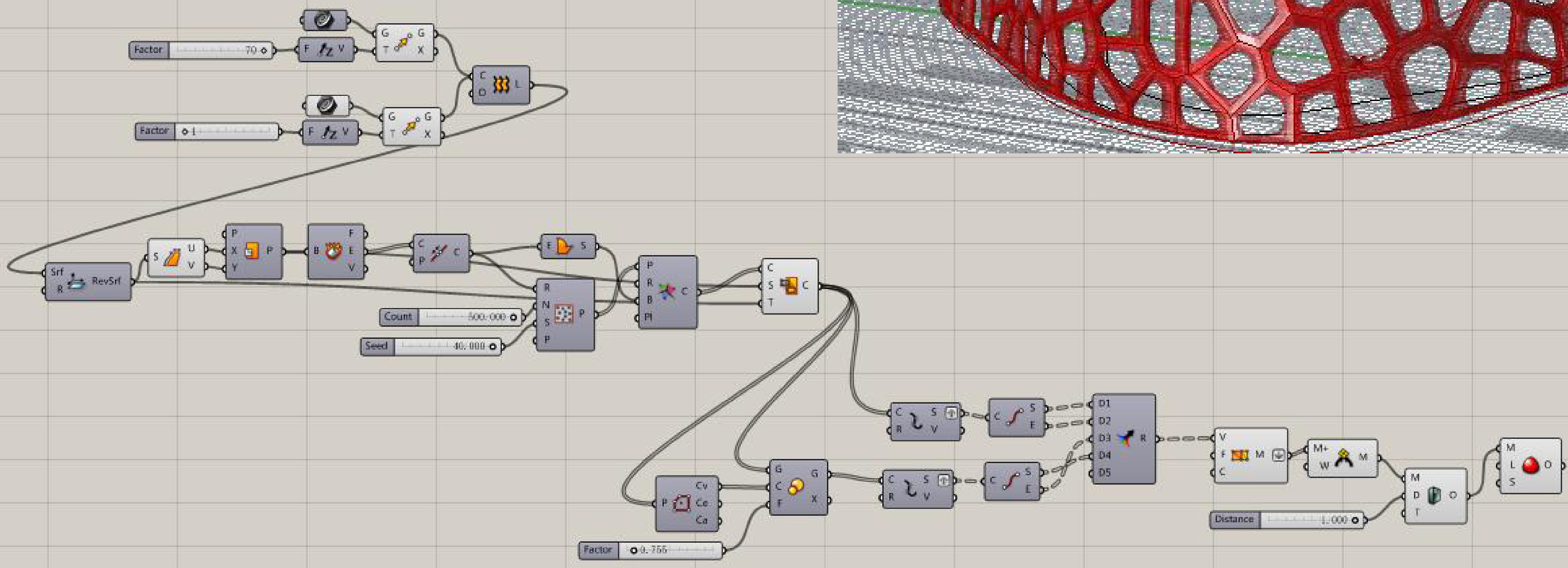




Echoviren Pavilion

GRASSHOPPER
Modelling





Echoviren Pavilion


Forming
Trifolium
AR-MA
Shao,Chun
Source: http://www.archdaily.com/533942/trifolium-ar-ma/

Trifolium

Project OUTLINE

Project Architect / Artist: AR-MA

Location: 16/18-20 Goodhope Street, Paddington NSW 2021, Australia

Investor: Sherman Contemporary Art Foundation

Function: A meeting place, an auditorium

Construction Year: 2014

Dimmensions: 60.0 sqm

Design Team: Robert Beson, Gabriele Ulacco, Tony Ho, Guido Maciocci, Nono Martinez Alonso, Simon Vor-hammer

Materials Used: Self-supporting Corian, Mirror-poli-shed stainless steel panels

Major Fabrication Method Used: CNC routing, la-ser-cutting, welding and thermo-forming

Fabricated By: CNC

Type Of Construction: Steel Frame

Modelling Software: Rhino + Grasshopper

Source: http://www.archdaily.com/533942/trifolium-ar-ma/

Trifolium

Project DESCRIPTION

AR-MA's design, "Trifolium", is a fluid, continuous, event-space composed of self-supporting Corian with an interior of curved, black, mirror-polished stainless steel panels. Fabricated like a jewellery box, with over three-thousand unique parts, it is designed to less than 1mm of tolerance.

The pavilion is organised as three curved vaults which come together in a continuous and seamless surface. The three leaves are designed to divide the courtyard into smaller, more intimate spaces both within and outside the pavilion.

From the exterior, the self-supporting envelope is composed of 152 thermo-formed and CNC cut Corian panels. Each 19mm thick panel is rebated and slots together to form a water-tight surface. AR-MA worked with Alex Edwards from ARUP to engineer the surface using a finite element analysis model to monitor the material stiffness and strength.

Source: http://www.indesignlive.com/articles/in-review/trifolium-by-ar-ma#axzz3YYSqbfX6


Source: http://www.archdaily.com/533942/trifolium-ar-ma/


Source: http://sherman-scaf.org.au/wp-content/uploads/2014/03/FS_2014_TextSpreads_v9.pdfv


Source: http://www.archdaily.com/533942/trifolium-ar-ma/v

EKKO Pavilion

Project FABRICATION

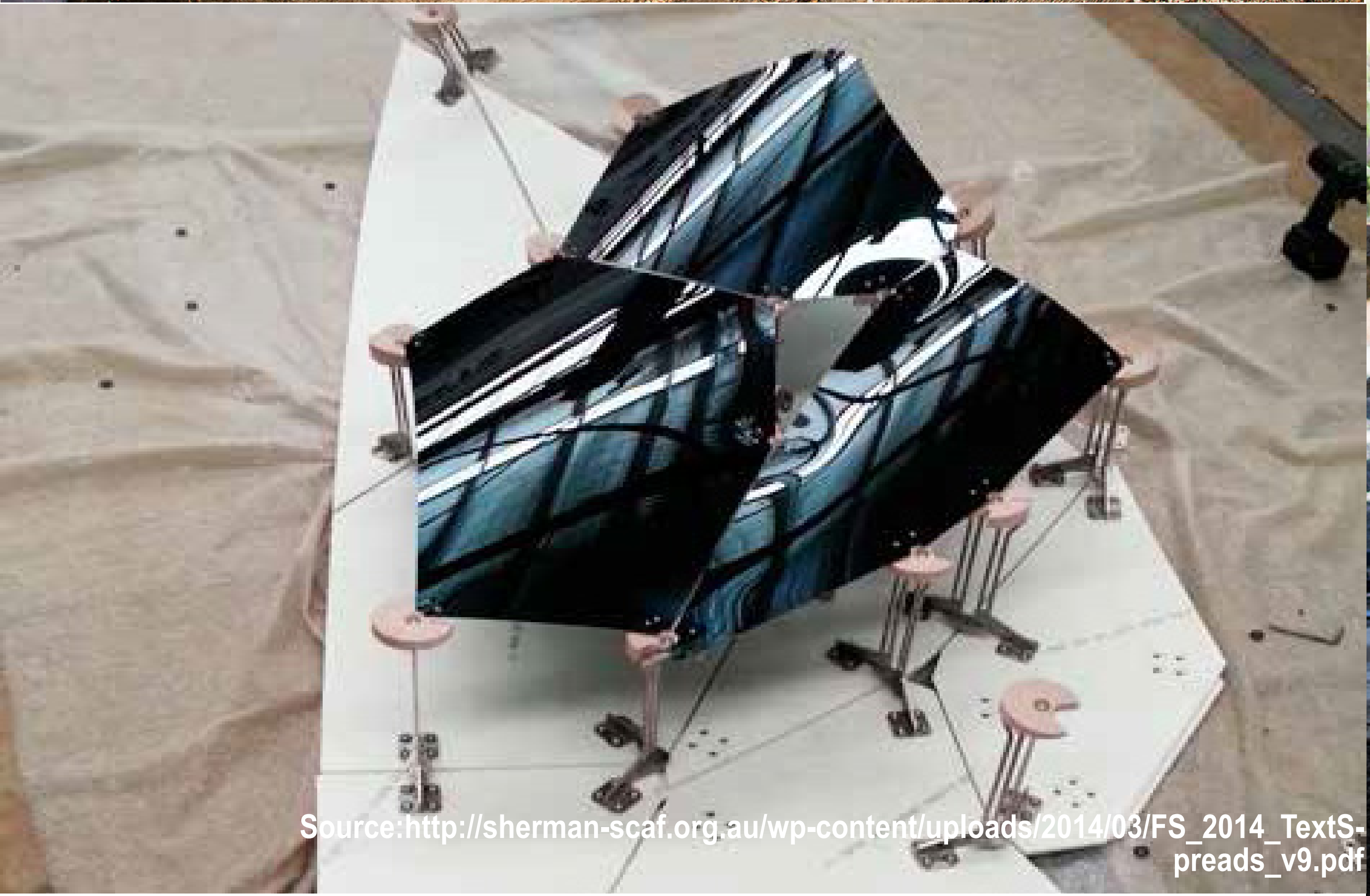
EKKO Pavilion utilizes traditional wood framing techniques as well as poured concrete and a metal framework with hangers for the wood frame to tie into.

The site was first prepared for construction ensuring a level. A steel form was then created for for the concrete pathway to be poured into. Attached to this formwork are metal hangers which will allow the wood frame to be attached to the metal frame. The concrete was then poured and allowed to set. Following this, the wooden structure is constructed one frame at a time and attached to the metal frame. The surrounding fence is then added. Finally, the landscape is filled in around the site.

Trifolium

Project FABRICATION

Source: http://img2.adsttc.com/media/images/53e0/2785/c07a/80bf/0200/00bc/large_jpg/AR-MA_Trifolium_Construction-1.jpg?1407199092v

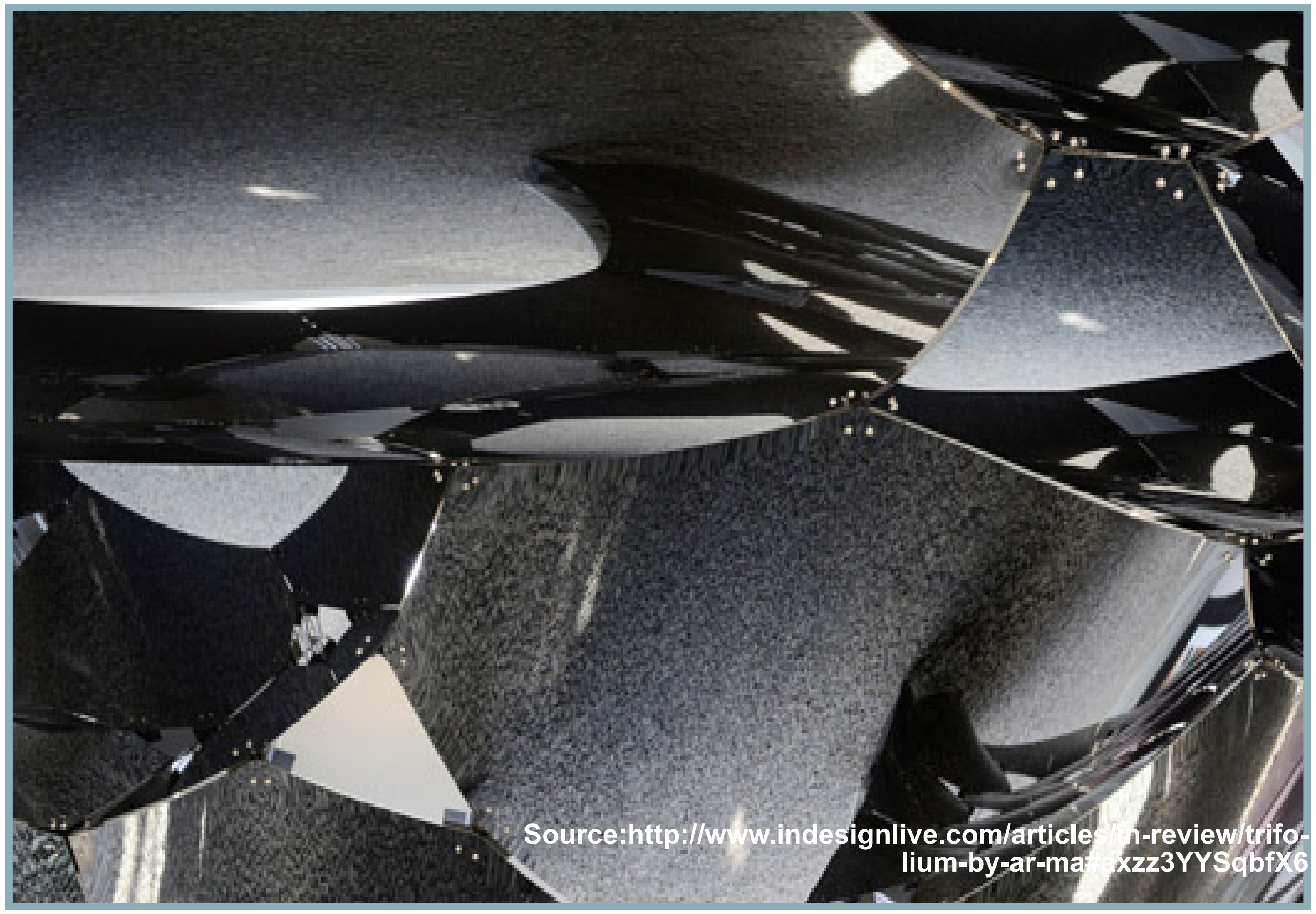


Source:http://sherman-scaf.org.au/wp-content/uploads/2014/03/FS_2014_TextSpreads_v9.pdf

Source: http://img1.adsttc.com/media/images/53e0/2788/c07a/8018/7400/0112/large_jpg/AR-MA_Trifolium_Construction-2.jpg?1407199092

Trifolium

Project MATERIALS



Trifolium

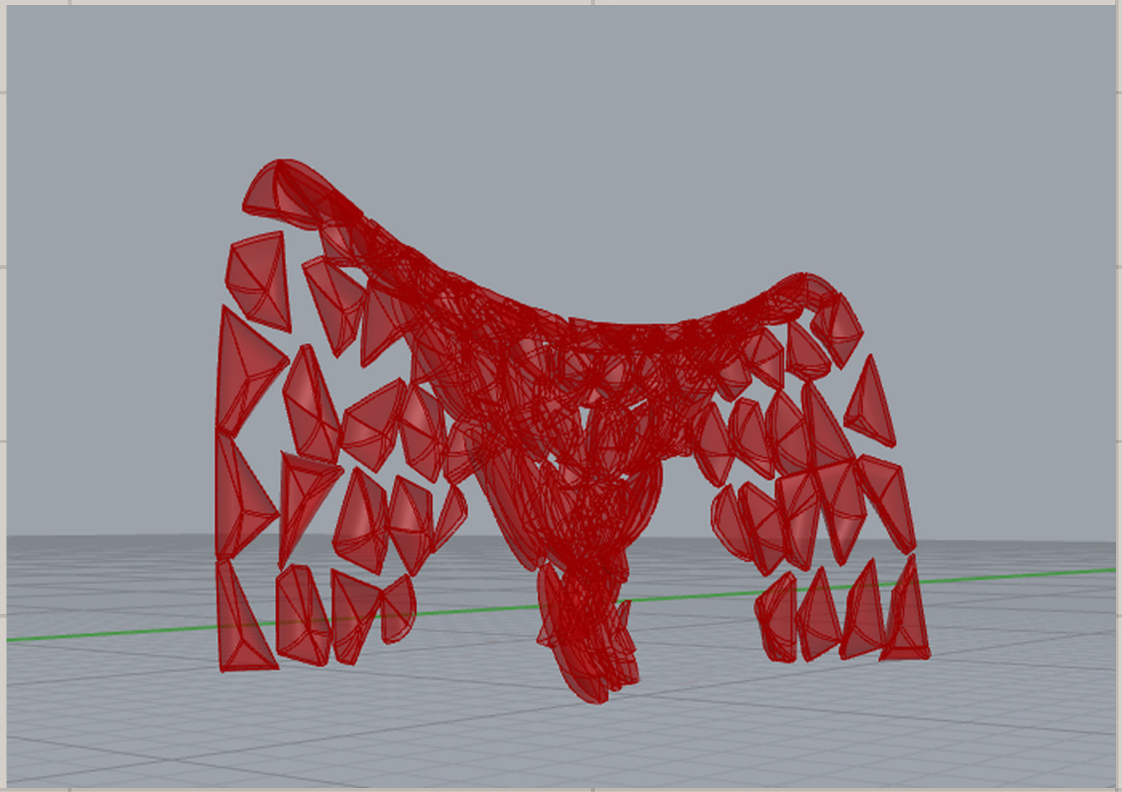
Project MACHINE / SOFTWARE

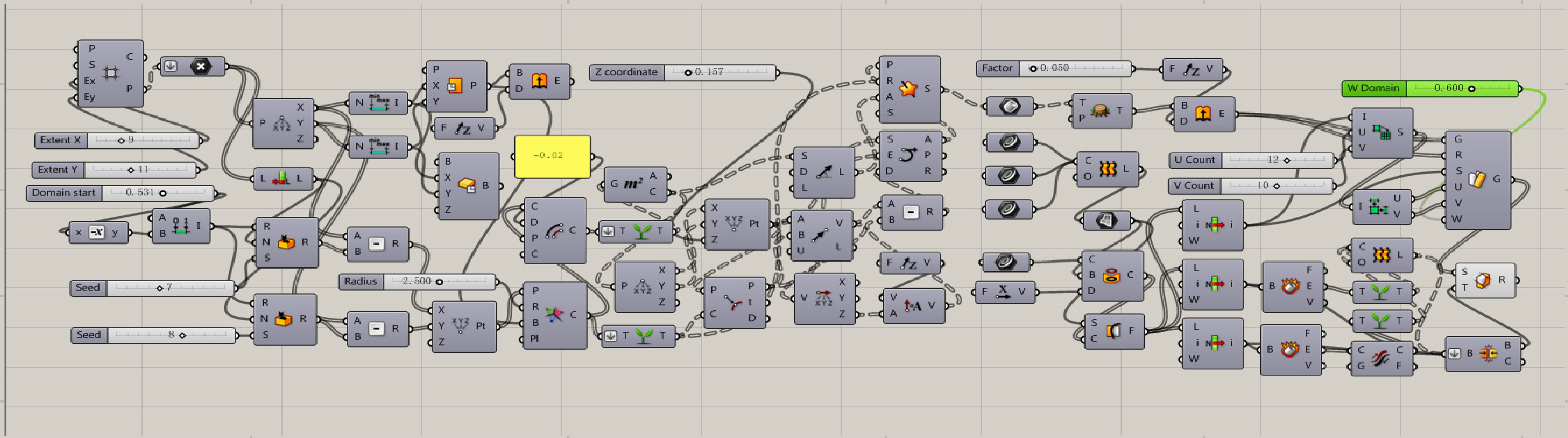
The pavilion required custom coded software in order to design and fabricate. For each project, depending on the concept and complexity, AR-MA will write small scripts, plug-ins or even stand-alone programs that help model and interrogate the design, and ultimately link it to computer controlled fabrication.

The fabrication took three months of CNC routing, laser-cutting, welding and thermo-forming at Ox Engineering in Sydney, with the architects taking part in the fabrication and installation themselves. AR-MA had a team at the factory programming and running the 5-axis CNC router and a team on-site. With over three-thousand unique pieces, the architectural project became a logistical one of getting the right material to the right place at the right time.

Trifolium

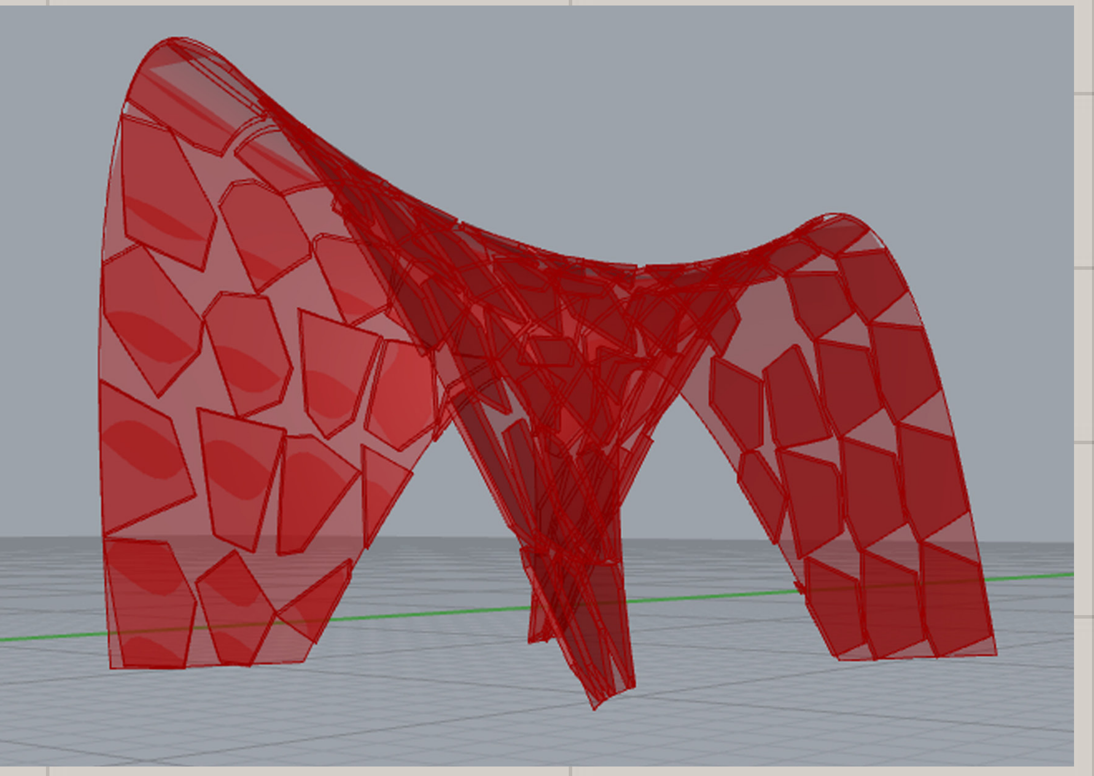
GRASSHOPPER
Modelling

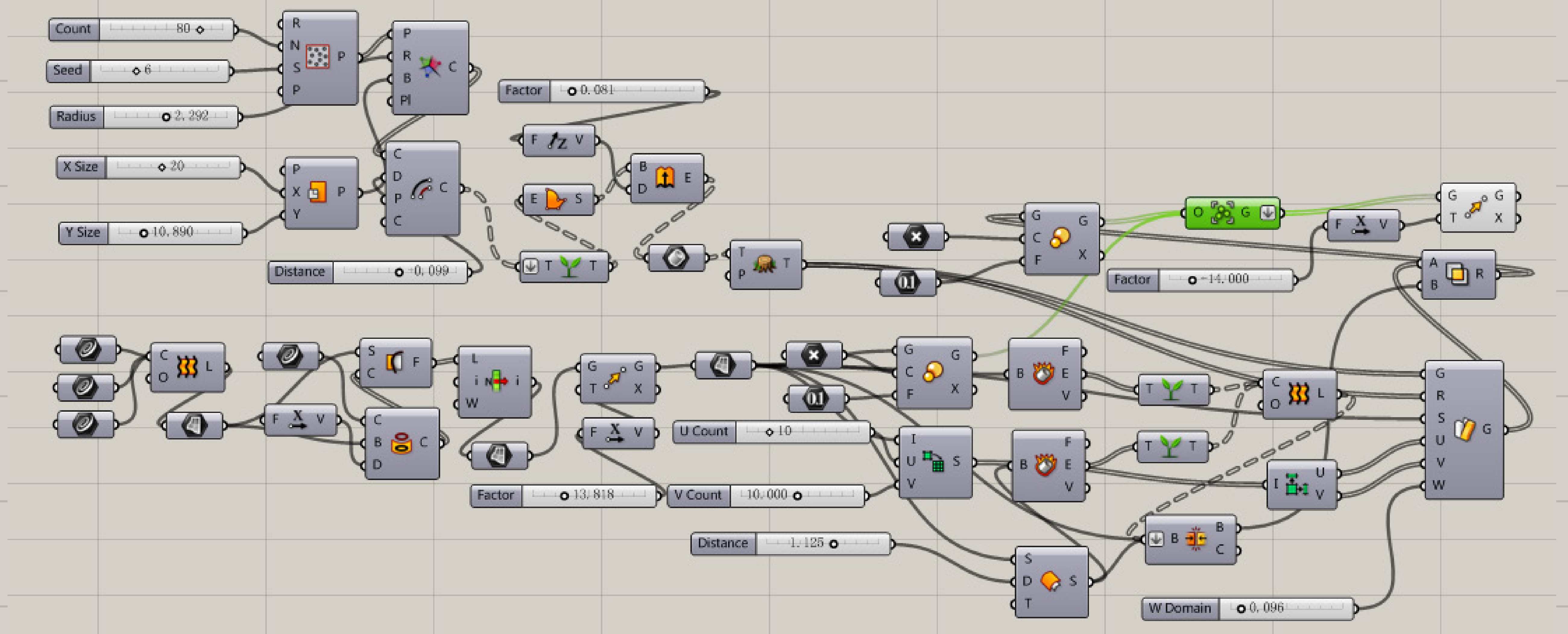




Trifolium

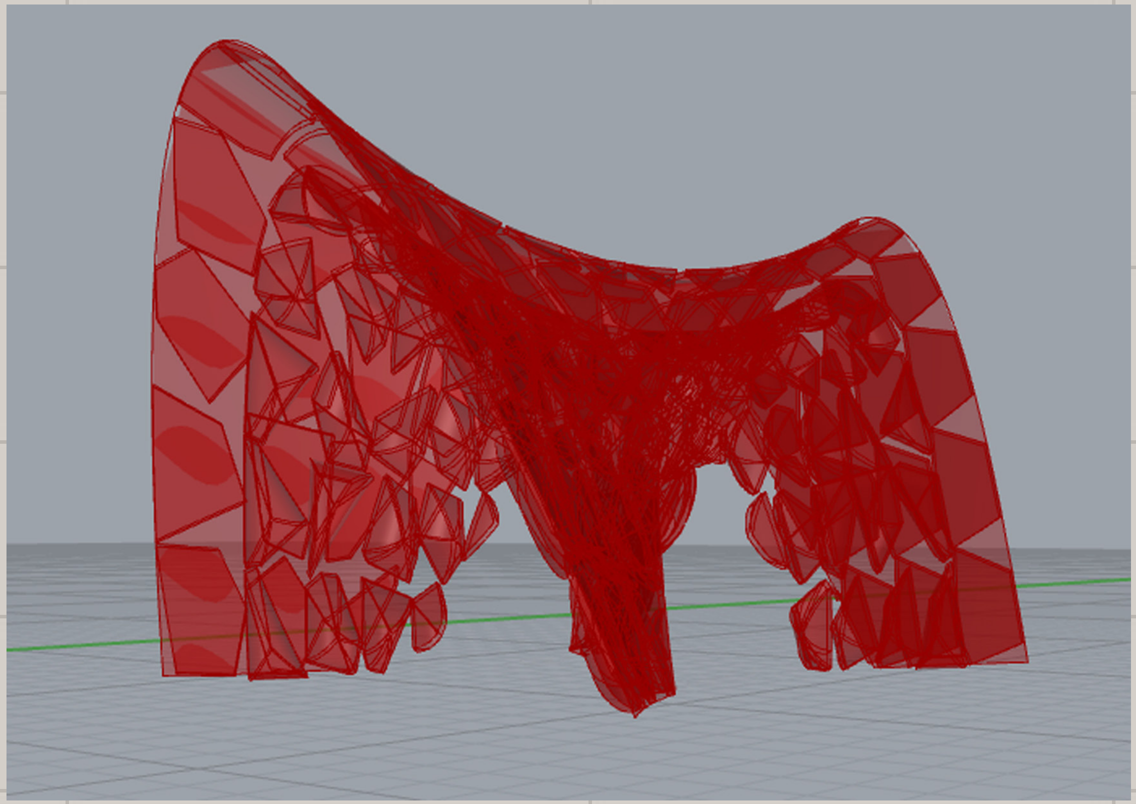
GRASSHOPPER
Modelling

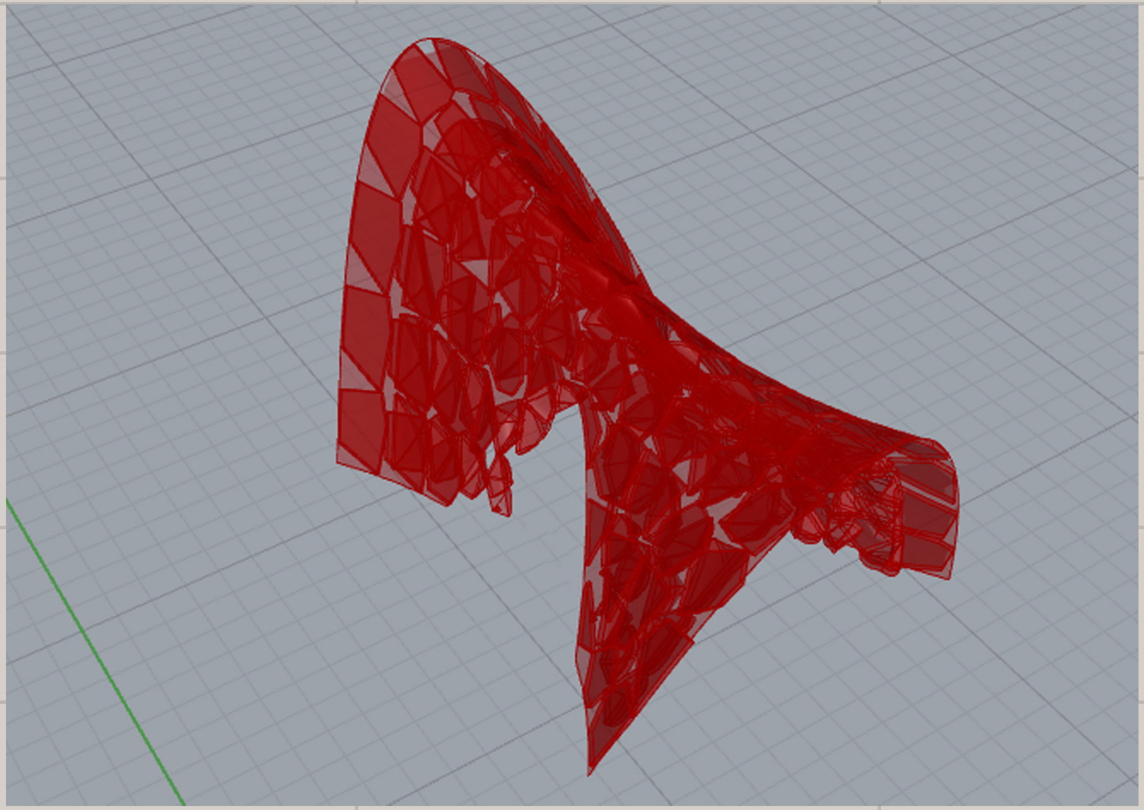


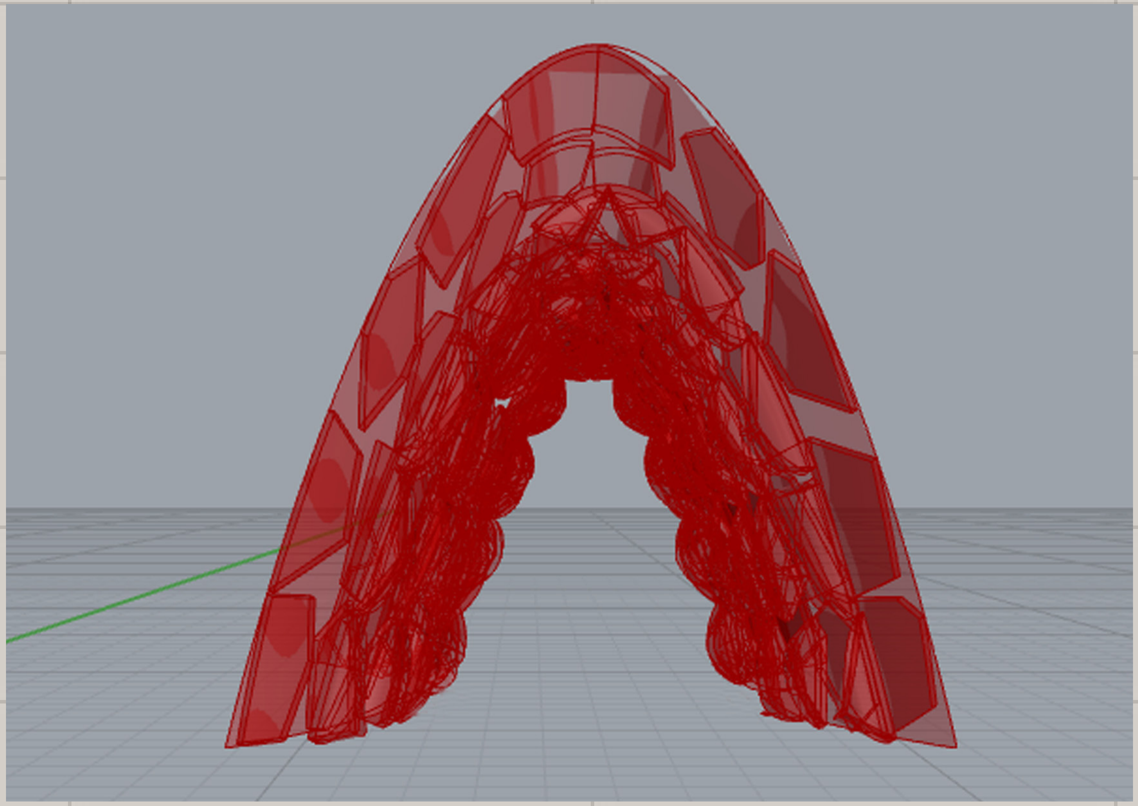


Trifolium

GRASSHOPPER
Modelling







Trifolium

Source: http://img4.adsttc.com/media/images/53e0/2822/c07a/80bf/0200/00c0/large_jpg/AR-MA_Trifolium-19.jpg?1407199244

Source: http://img2.adsttc.com/media/images/53e0/28d1/c07a/80bf/0200/00c4/large_jpg/detail_(4).jpg?1407199428

Source: http://img2.adsttc.com/media/images/53e0/283b/c07a/80bf/0200/00c1/large_jpg/AR-MA_Trifolium-22.jpg?1407199273


FORMING
DRAGON SKIN PAVILION
LEAD & EDGE
Anastasia Borcheva
Source: http://dragonskinproject.com/

The Dragon Skin Pavilion

Project OUTLINE

Project Architect / Artist: Lead & Edge

Location: Kowloon Park, Hong Kong

Investor: Hong Kong & Shenzhen Bi-City Biennale of Urbanism\Architecture

Function: Pavilion

Construction Year: 2012

Dimmensions: 4.5m (width) x 3.5m (depth) x 2.5m

Construction Team: XXXX

Materials Used: Grada Plywood

Budget: XXXX Euro

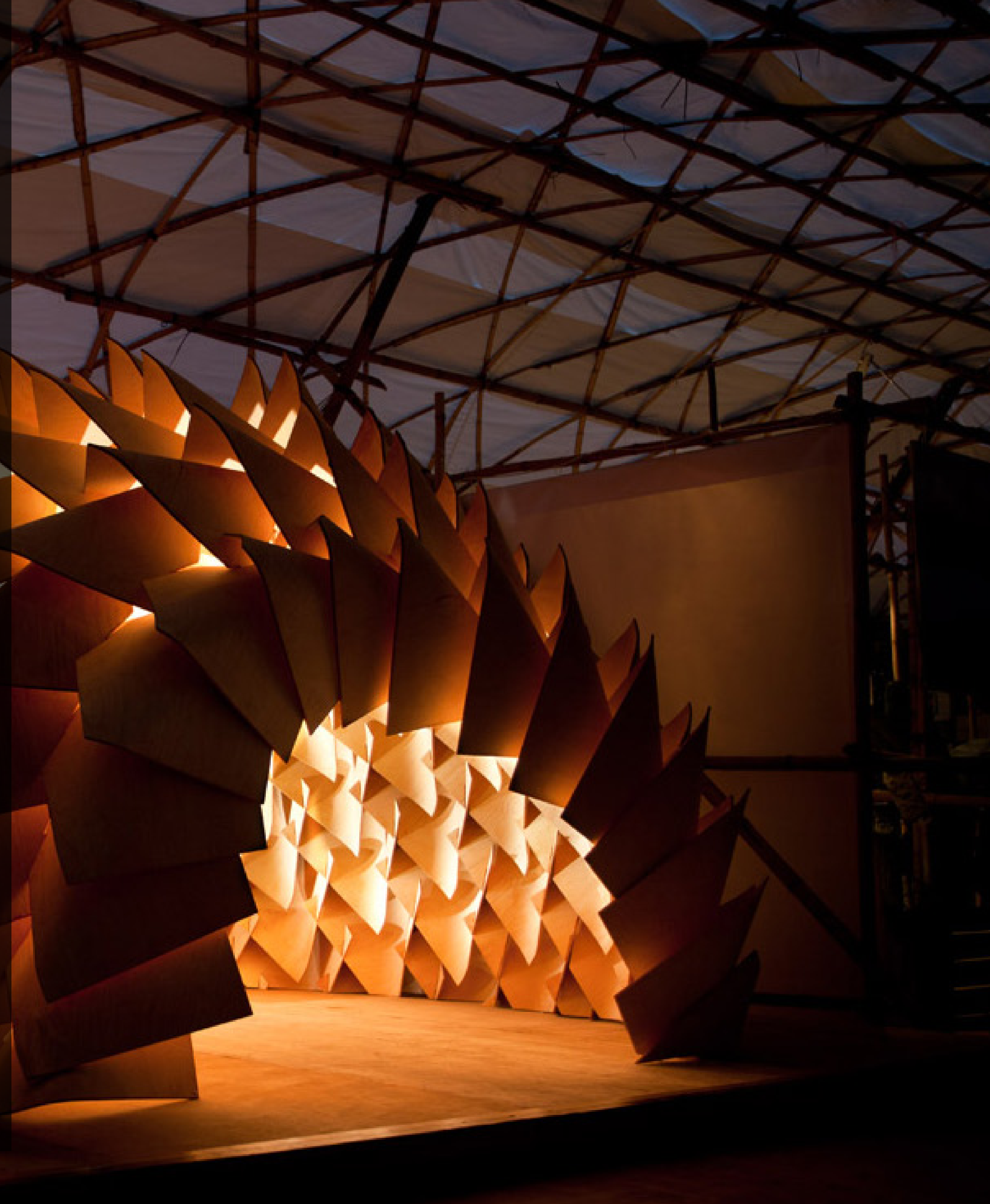
Major Fabrication Method Used: Forming

Secondary Fabrication Methods: Tesselating

Fabricated By: CNC-router

Type Of Construction: Wooden Framework

Modelling Software: Rhino + Grasshopper



Source: http://dragonskinproject.com/

The Dragon Skin Pavilion

Project DESCRIPTION

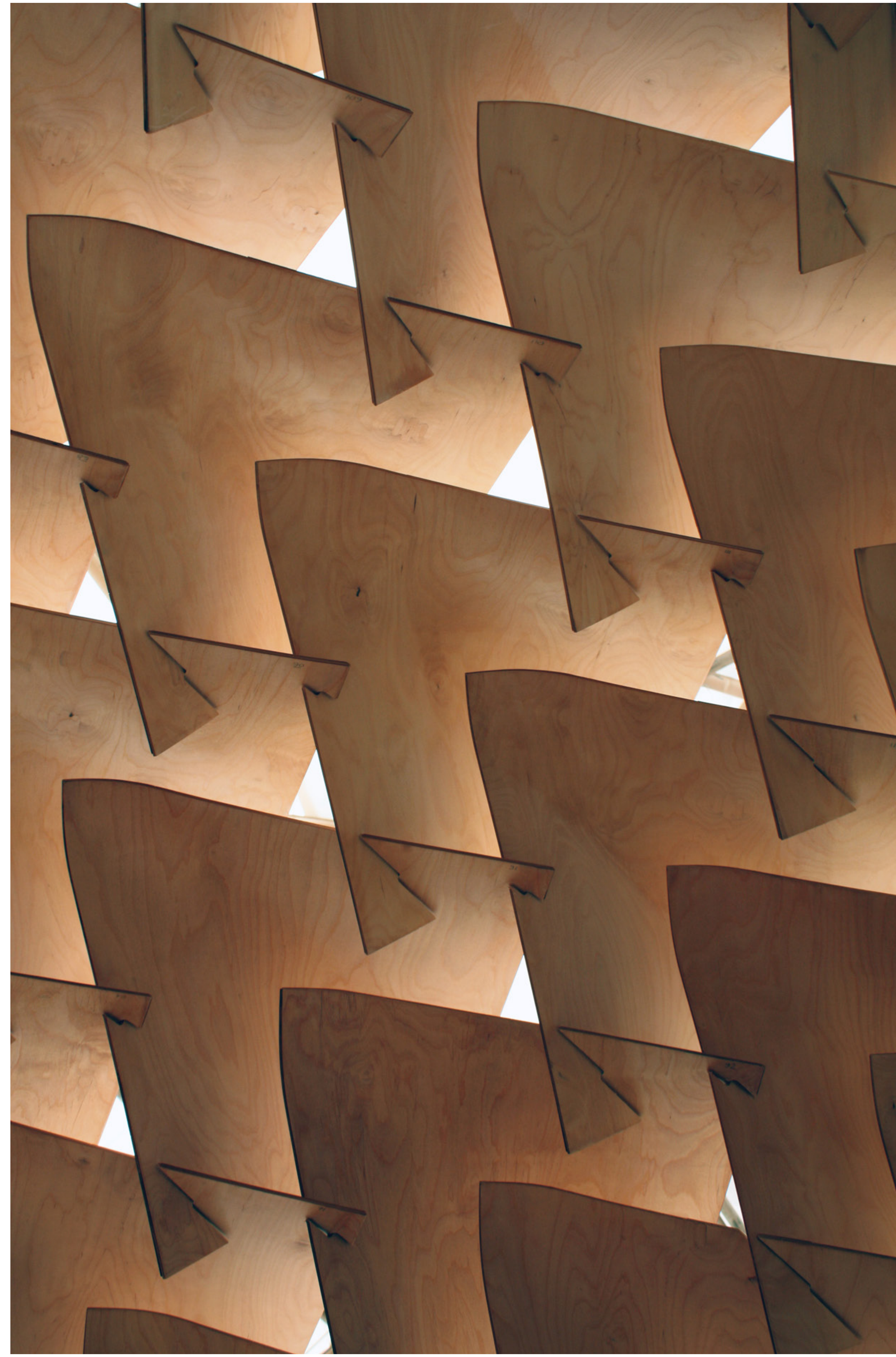
The Dragon Skin Pavilion is an architectural installation designed and built for the 2011-12 Hong Kong & Shenzhen Bi-City Biennale of Urbanism\Architecture. The structure challenges and explores the spatial, tactile, and material possibilities that architecture can offer by revolutions in digital fabrication and manufacturing technology. It inspires passers-by to reimagine the space we live in today if tomorrow's technologies are combined with industries present in this region – "made in Hong Kong", and later "made in China".

The installation is a highly experimental temporary structure designed from 163 unique pieces of post-formable plywood, a brand new and environmentally friendly material.

The emerging patterns and rhythms of the pavilion challenge the perception of structure versus structurally defined ornament. A careful balance takes place between the regular, repetitive framework of the rectangular panels and their gradually irregular interconnections as they configure the overall shape. The combination of a new material and contemporary digital design and fabrication methods allowed

Source: http://dragonskinproject.com/

Source: http://www.archdaily.com/215249/dragon-skin-pavilion-emmi-keskisarja-pe-kka-tynkkynen-lead

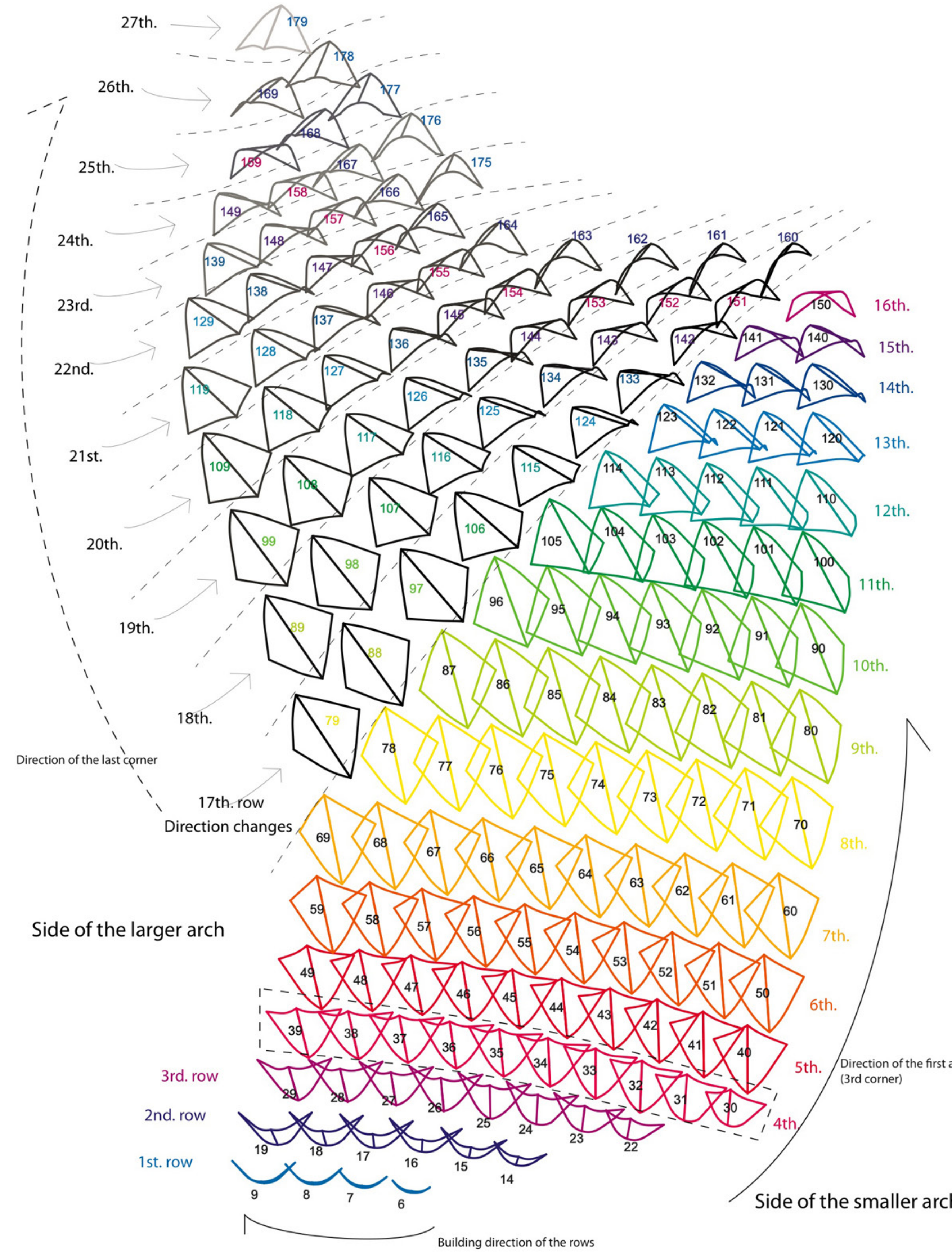


The Dragon Skin Pavilion

Project FABRICATION

A CNC-router was used to make a wooden mould in which pre-heated flat rectangular pieces were bent into shape. A computer programmed 3D master model generated the cutting files for those pieces in a file-to-factory process: algorithmic procedures were scripted to give every rectangular component their precisely calculated slots for the sliding joints, all in gradually shifting positions and angles to give the final assembled pavilion its curved form.

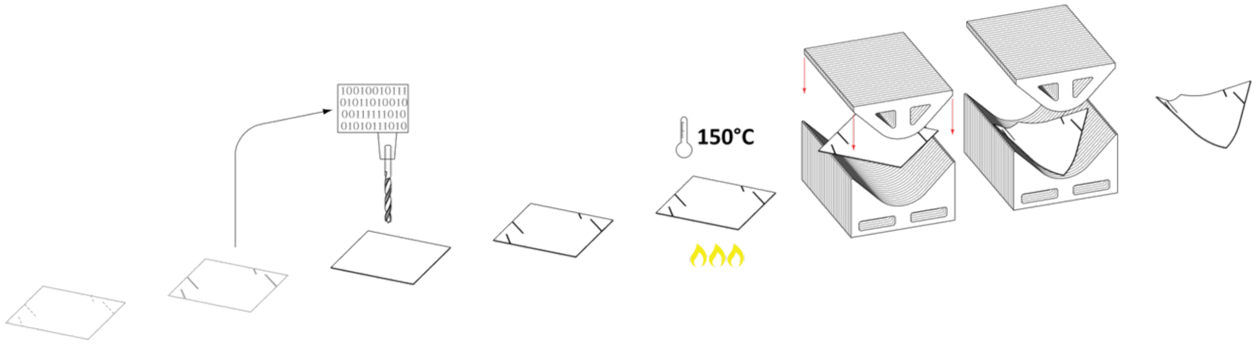
A meticulously pre-choreographed montage sequence required all components to be uniquely labelled and numbered for assembling or dismantling the structure. The 163 plywood components were manufactured in Finland at TUT and shipped to Hong Kong, where team assembled the pavilion on the exhibition area situated in Kowloon Park.



Source: http://www.archdaily.com/215249/dragon-skin-pavilion-emmi-keskisarja-pekka-tynkkynen-lead

The Dragon Skin Pavilion

Project FABRICATION



Source: http://www.archdaily.com/215249/dragon-skin-pavilion-emmi-keskisarja-pekka-tynkkynen-lead

The Dragon Skin Pavilion

Project MATERIALS

The sole material used in the pavilion is post-formable Grada Plywood, a brand new material that seems to revolutionize the bent plywood industry.

Dragon Skin Pavilion Quantity Survey		
Plywood		
	Material	**Quantity**
Main structure	8x9 meters	21

Source: http://www.archdaily.com/215249/dragon-skin-pavilion-emmi-keskisarja-pekka-tynkkynen-lead

The Dragon Skin Pavilion

Project MATERIALS

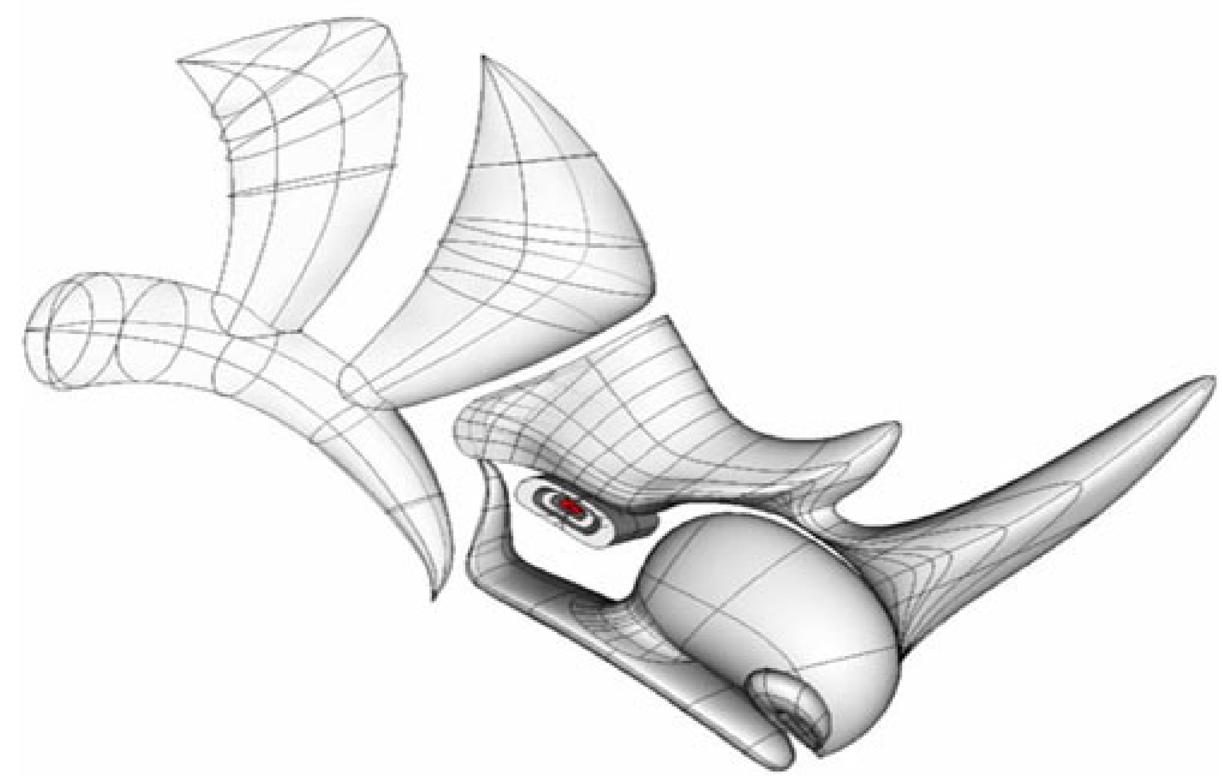
Source: http://www.archdaily.com/215249/dragon-skin-pavilion-emmi-keskisarja-pekka-tynkky-nen-lead

The Dragon Skin Pavilion

Project MACHINE / SOFTWARE

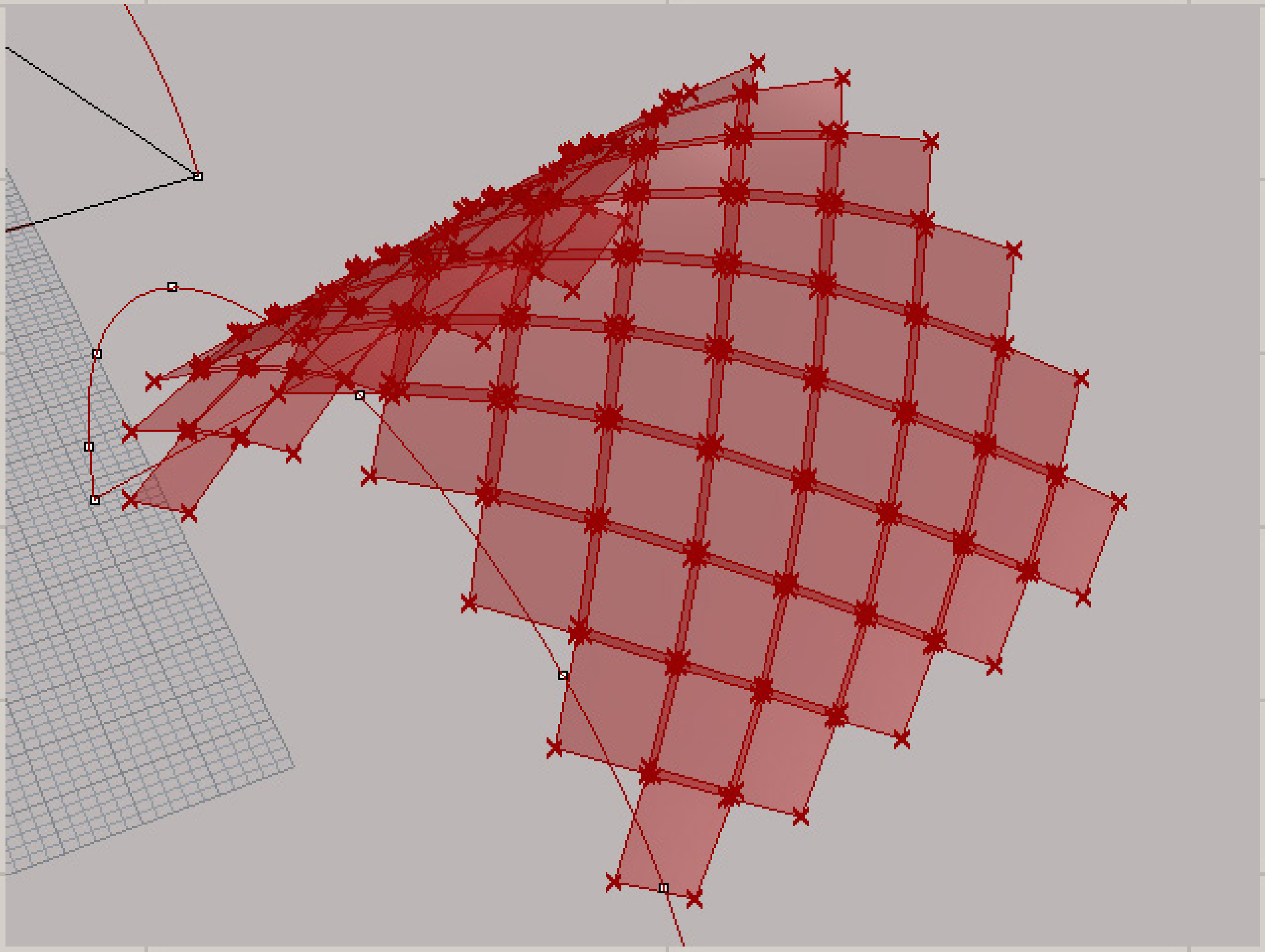
As mentioned before, CNC-router was used to make a wooden mould.

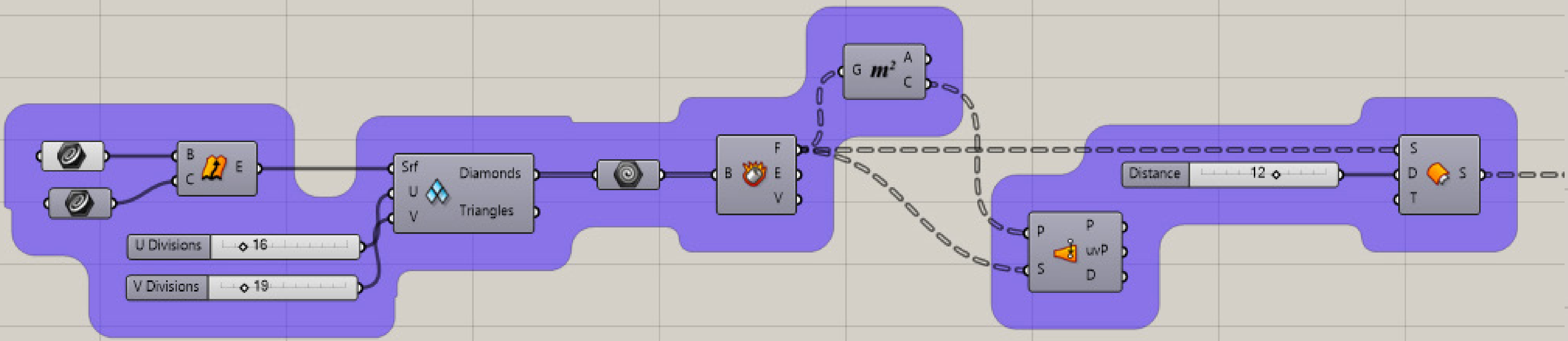
Rhinoceros and Grasshopper plugin were used to design geometry of pavilion and for getting intersections to assemble elements together.



The Dragon Skin Pavilion

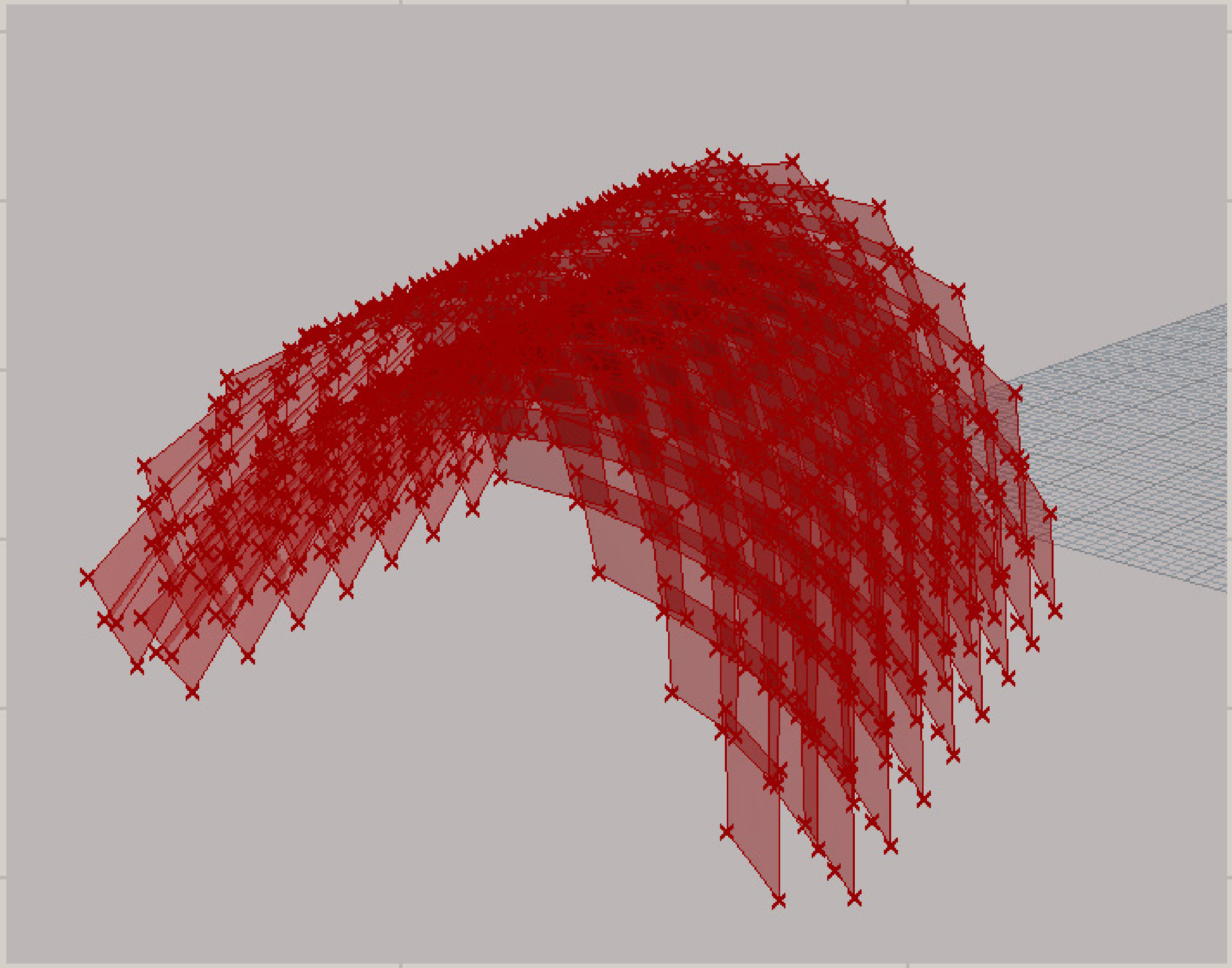
GRASSHOPPER
Modelling

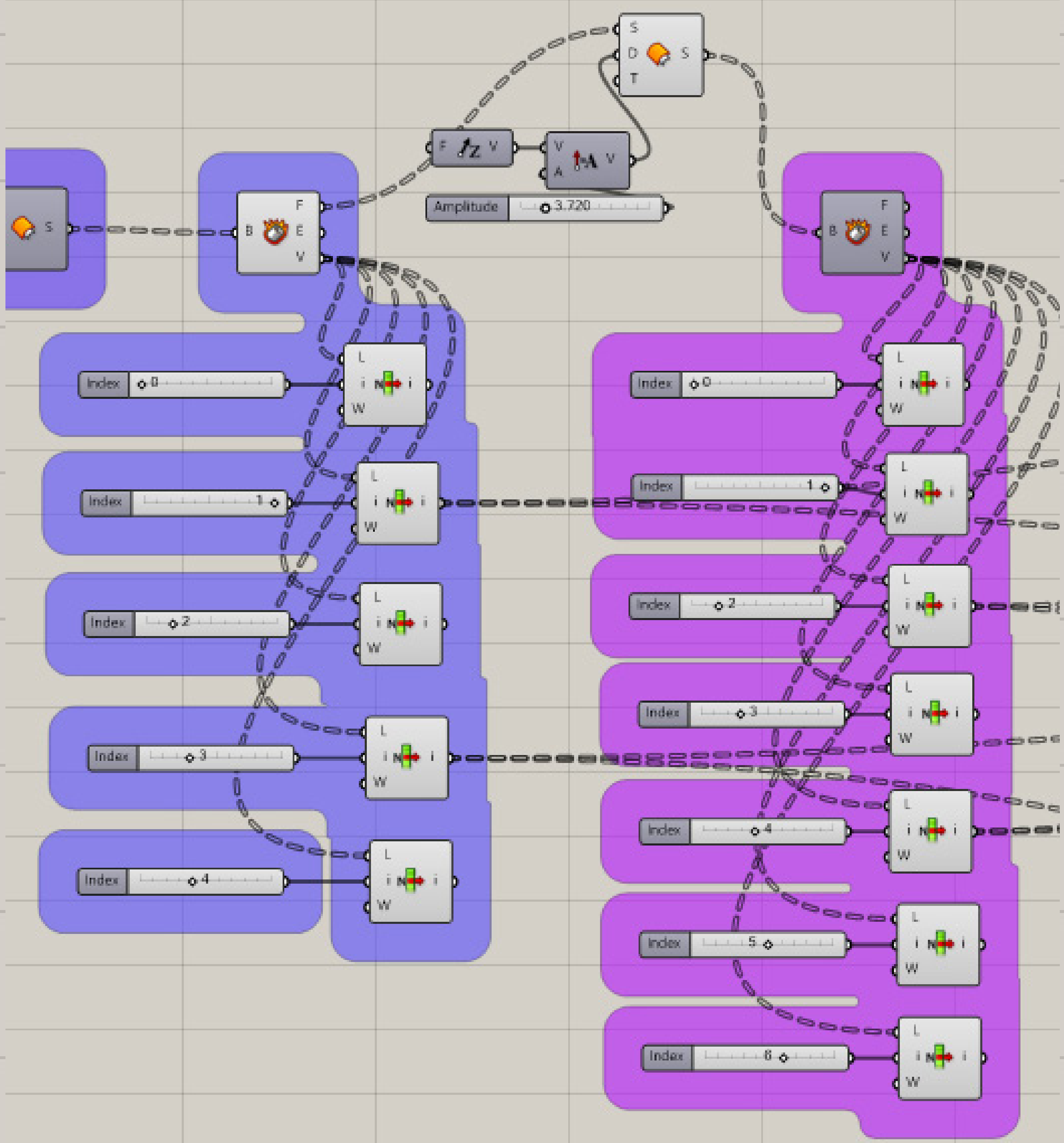




The Dragon Skin Pavilion

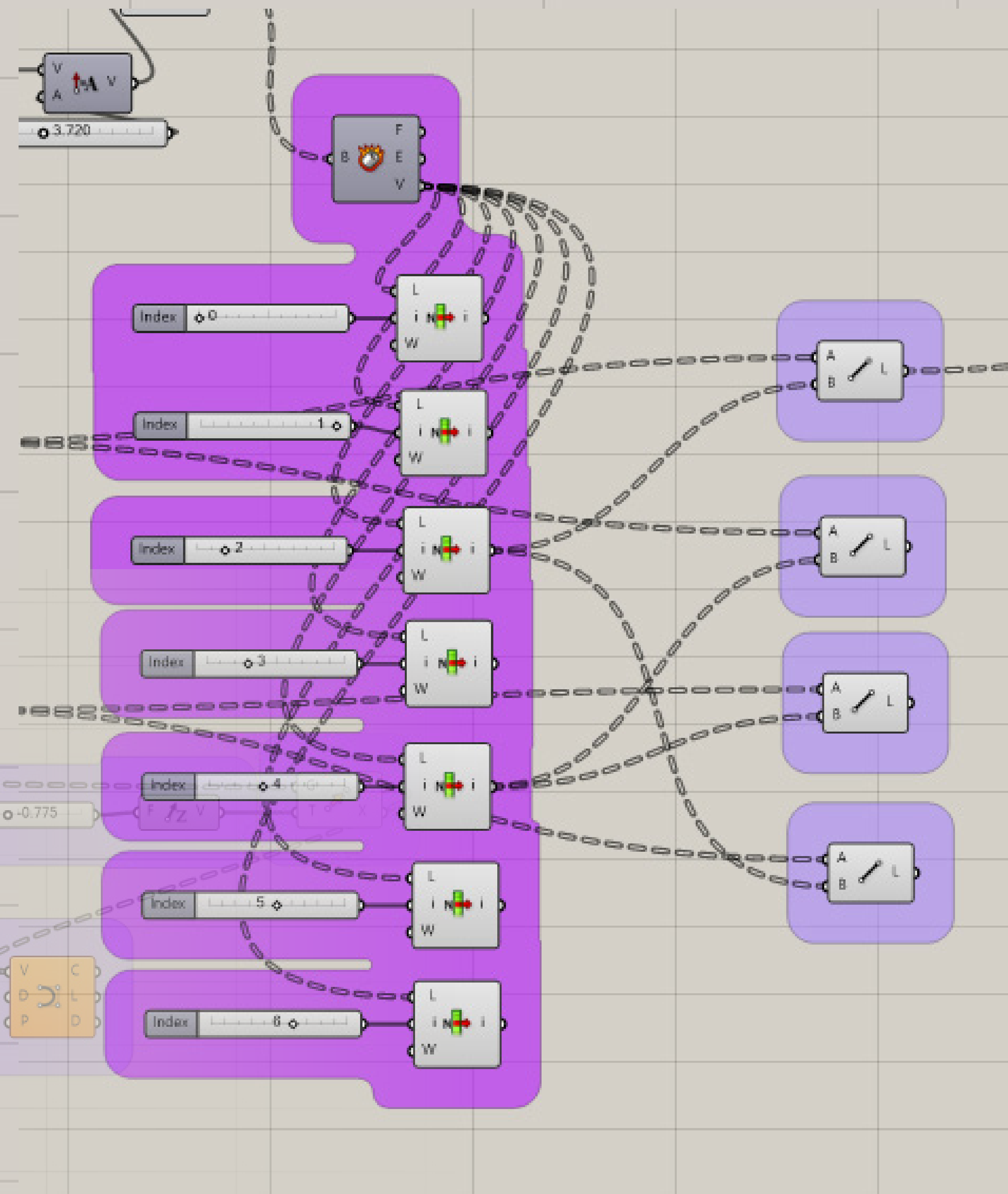
GRASSHOPPER
Modelling

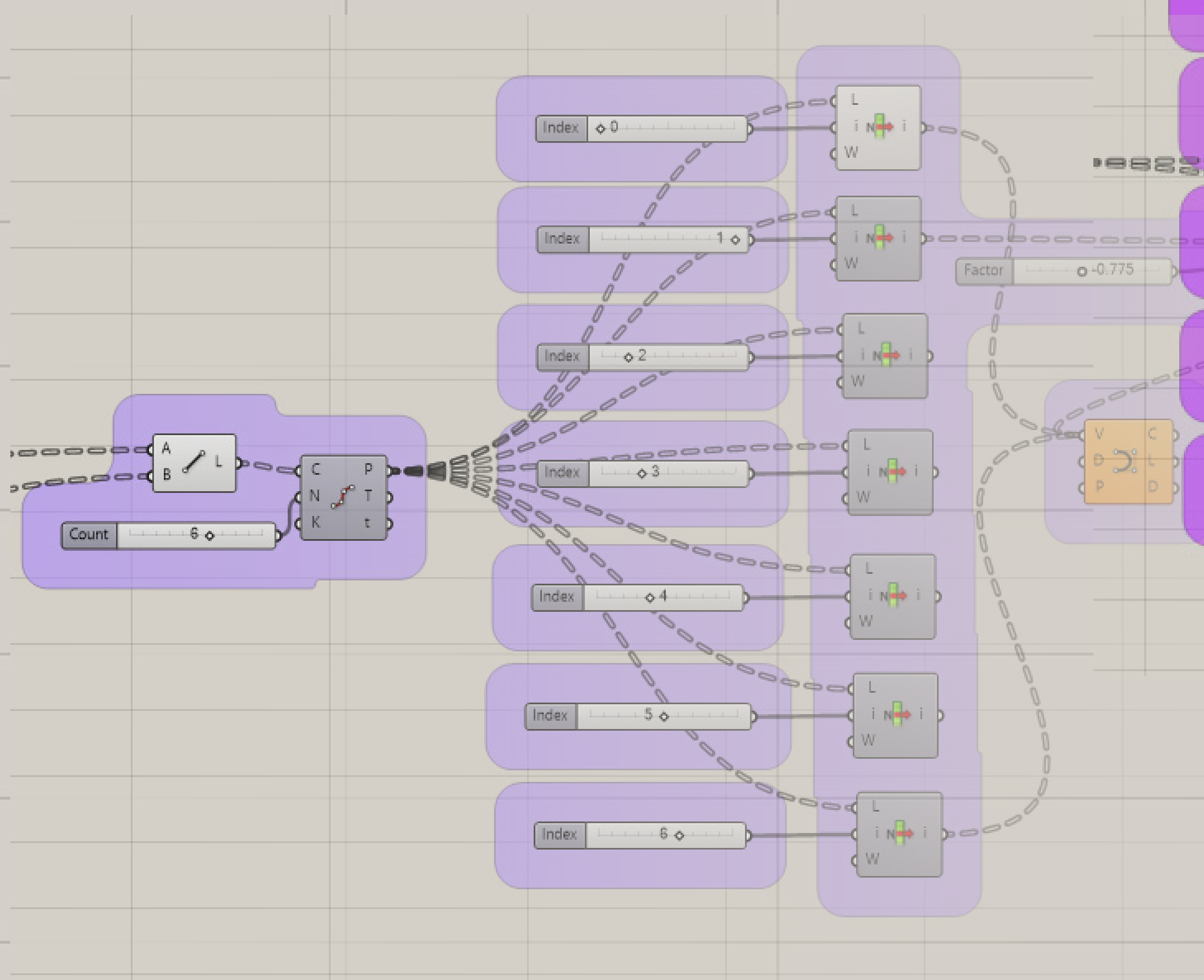




The Dragon Skin Pavilion

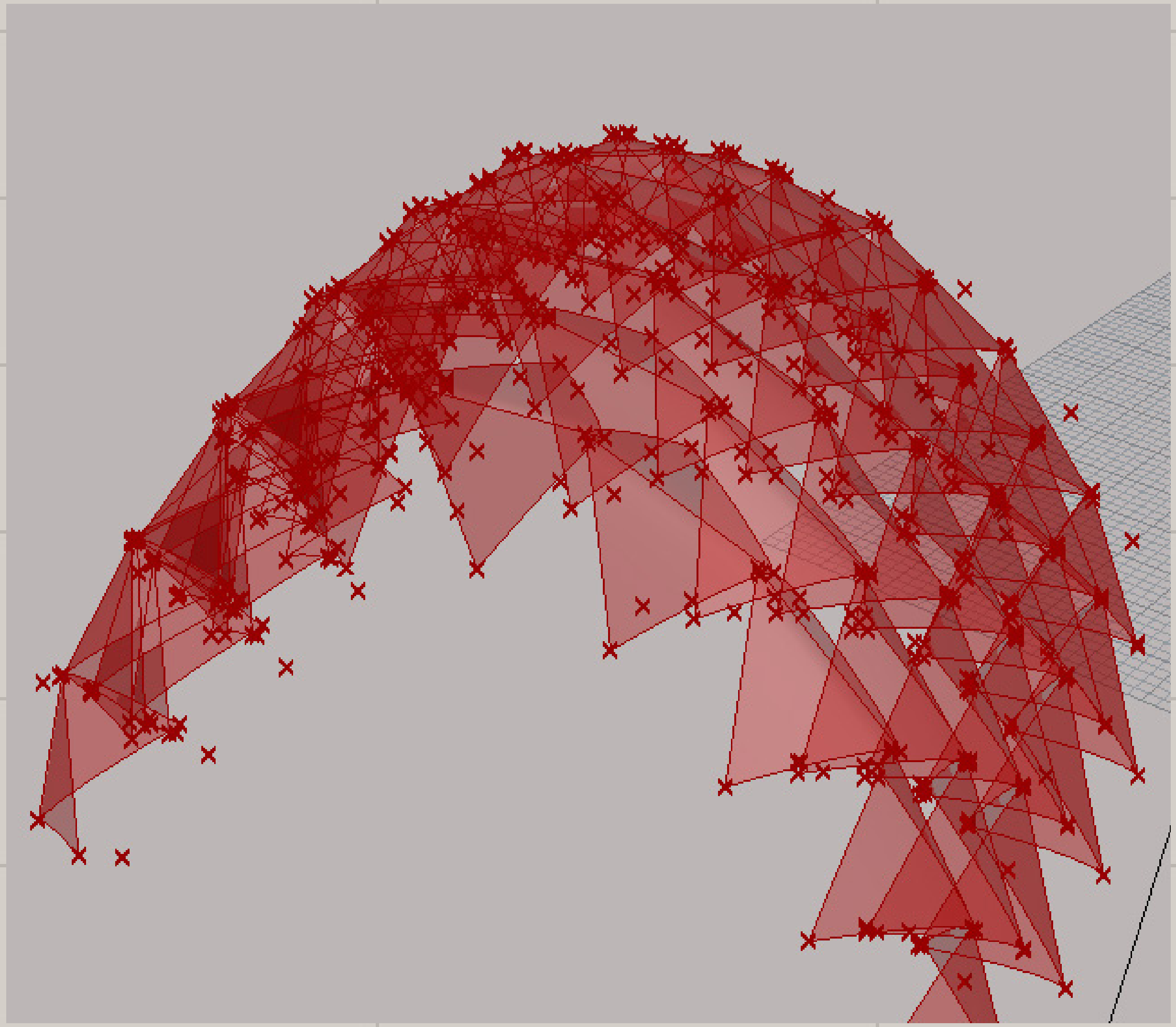
GRASSHOPPER
Modelling

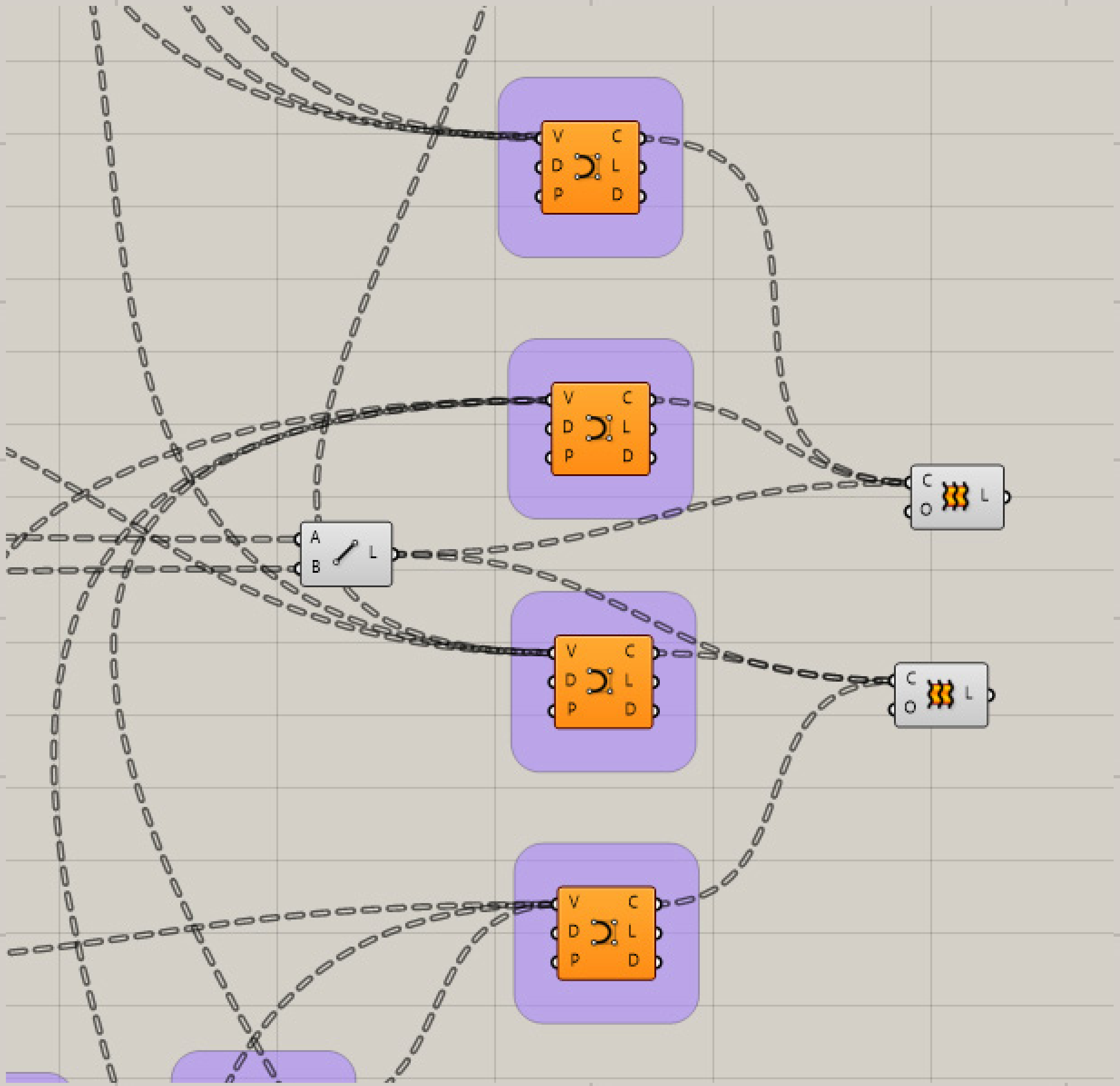




The Dragon Skin Pavilion

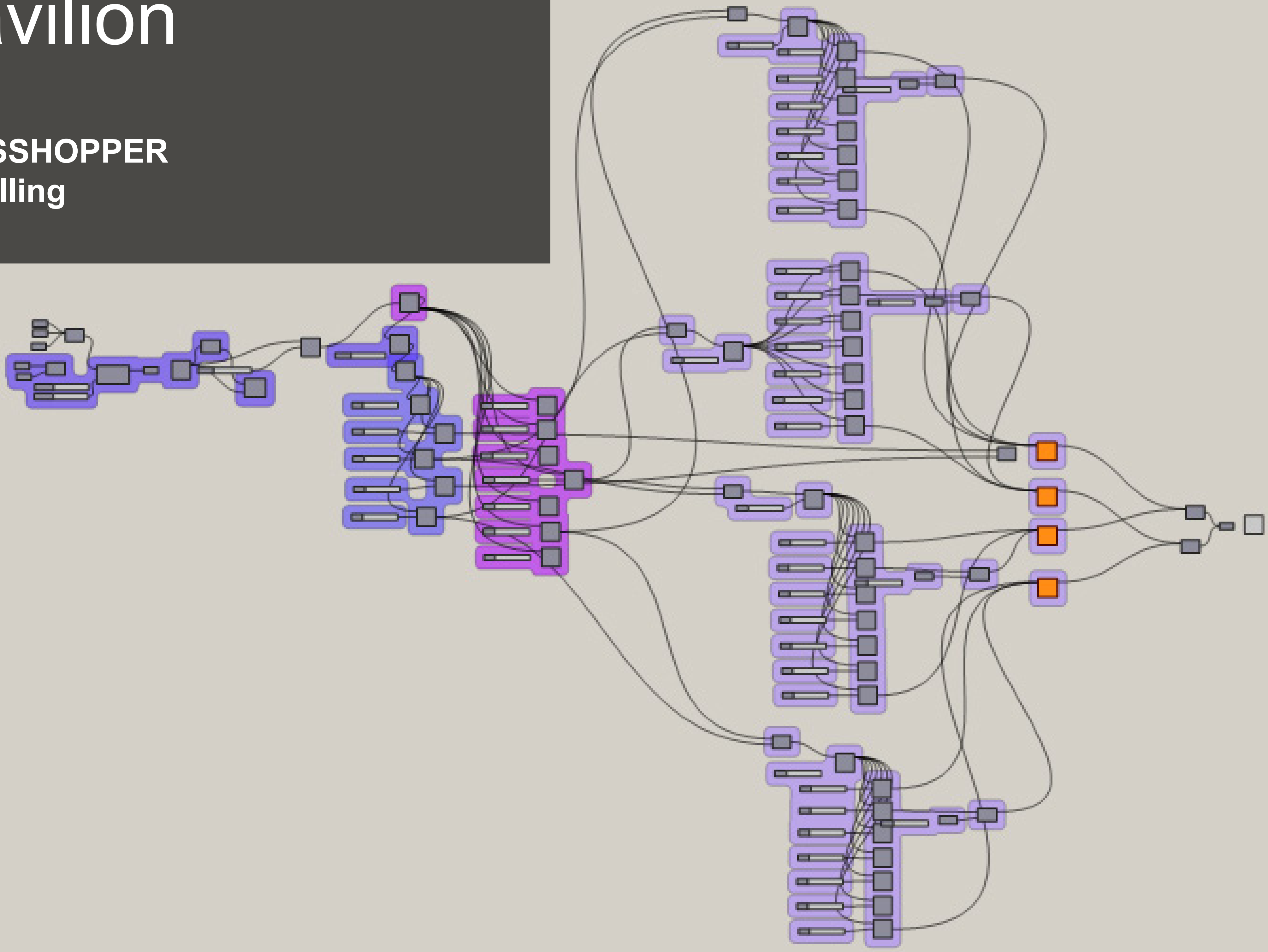
GRASSHOPPER
Modelling



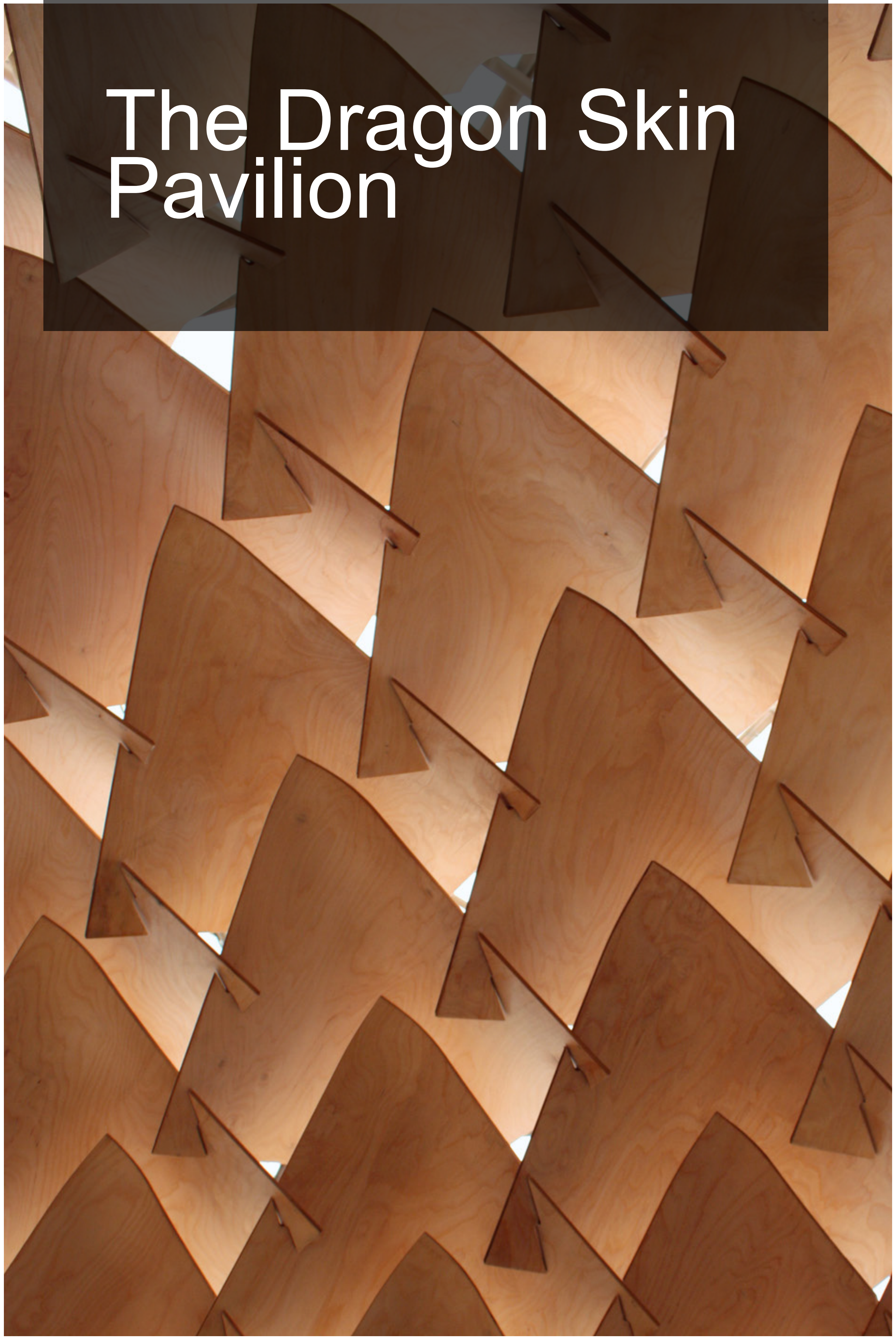


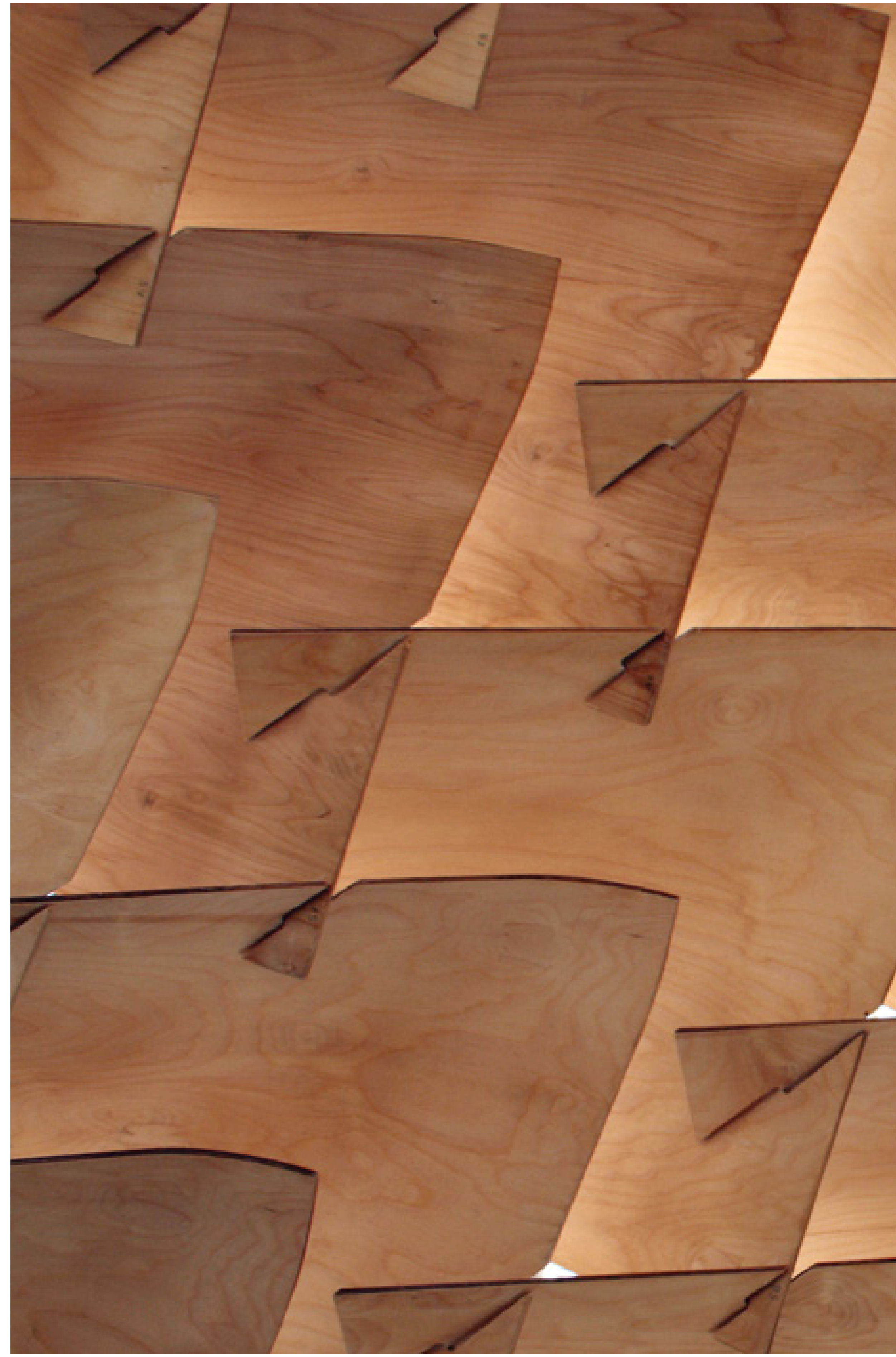
The Dragon Skin Pavilion

GRASSHOPPER
Modelling



The Dragon Skin Pavilion





Source: http://www.archdaily.com/215249/dragon-skin-pavilion-emmi-keskisarja-pekka-tynkkynen-lead-


FORMING
UHGBC SOLAR
TOPOCAST
Pavel Nikolaenko
Source: h p://topocastlab.com/uhgbc-solar/

The UHGBC Solar Panel

Project OUTLINE

Project Architect / Artist: Topocast

Location: Dallas, TX

Investor: UHGBC

Function: Solar panel

Construction Year: 2012

Dimmensions: XXXX

Construction Team: XXXX

Materials Used: Silicone, wood, concrete

Budget: XXXX Euro

Major Fabrication Method Used: Forming

Secondary Fabrication Methods: Tesselating

Fabricated By: CNC machine

Type Of Construction: XXXX

Modelling Software: Rhino + Grasshopper

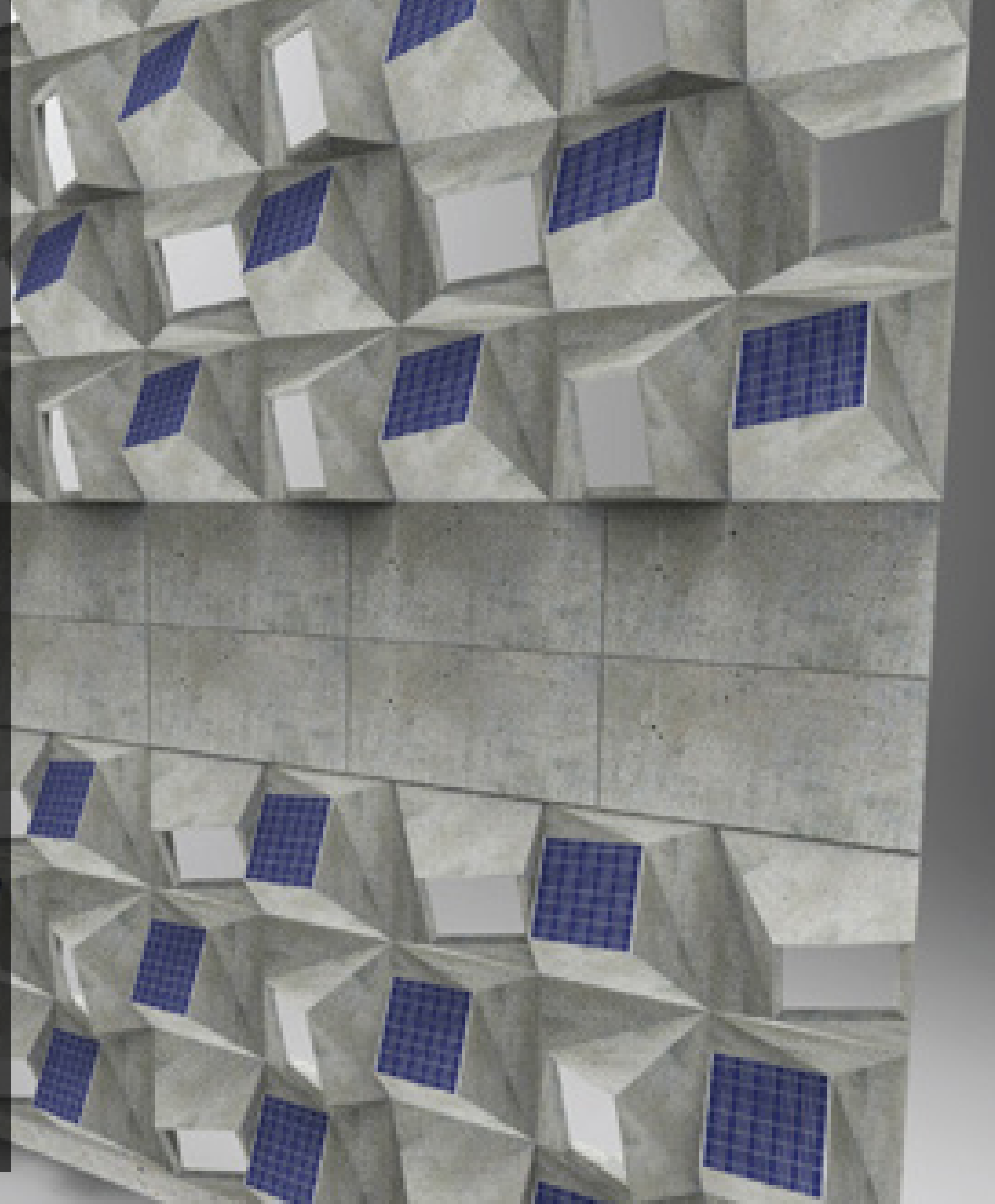
Source: http://topocastlab.com/uhgbc-solar/

The UHGBC Solar Panel

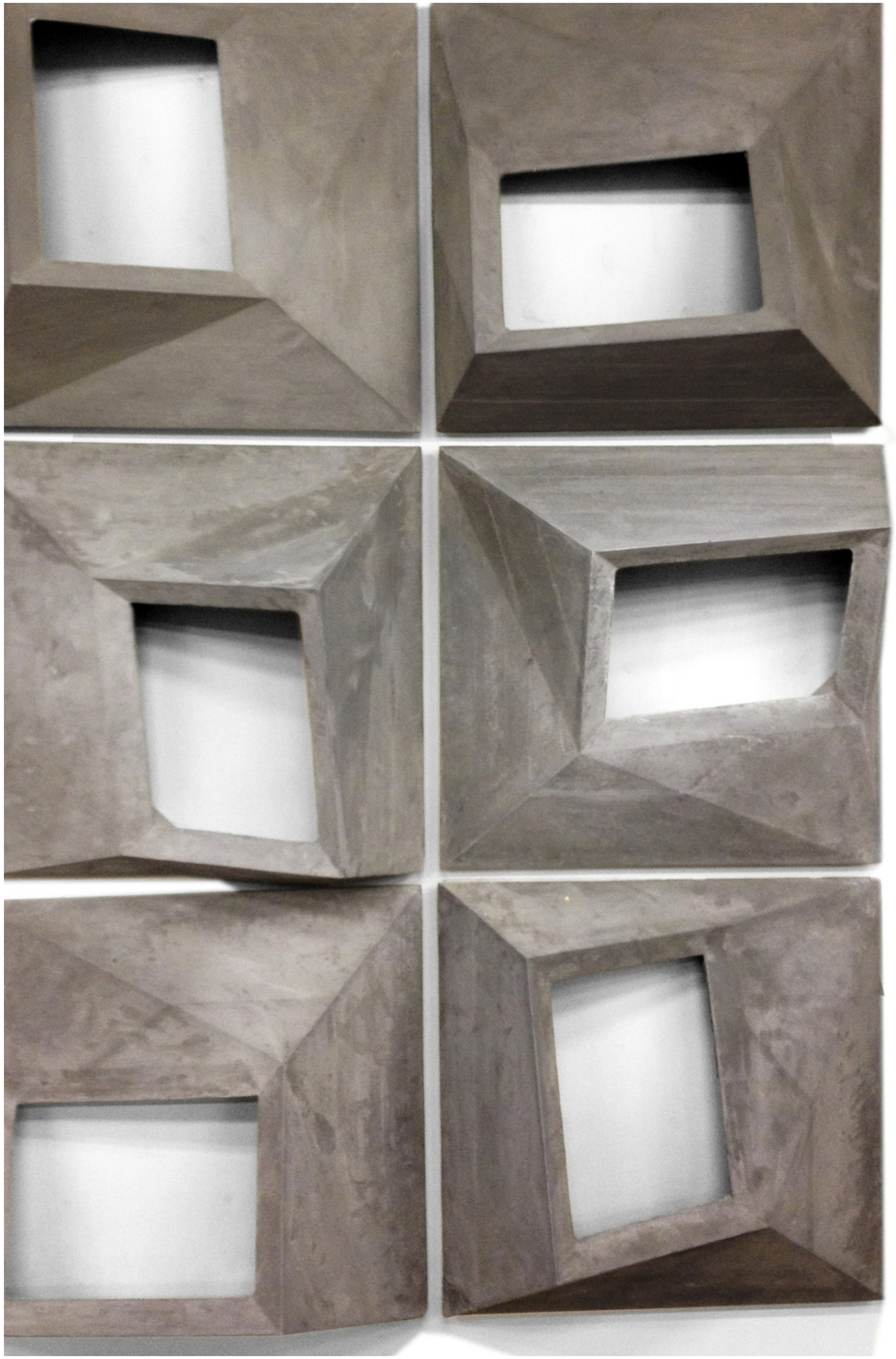
Project DESCRIPTION

The examination of the solar panel provides an opportunity to coordinate the geometry of the precast panel to very specific data. Optimal performance of the solar panel requires precise alignment with correct sun angles. Extrinsic factors like project latitude or energy needs might suggest one configuration scenario within the parameters of design while intrinsic factors such as project orientation or aesthetic considerations in matrix sequence might produce a different configuration scenario.

These forces on the design process -external and internal- are not diametrical, but rather are now able to be more seamlessly integrated through the use of parametric software. User interface and calibration, based on objective or subjective criteria, may now be coordinated through the singular model and resolved, tested and reworked according to the essential requirements of the parametric functions.



Source: http://topocastlab.com/uhgbc-solar/



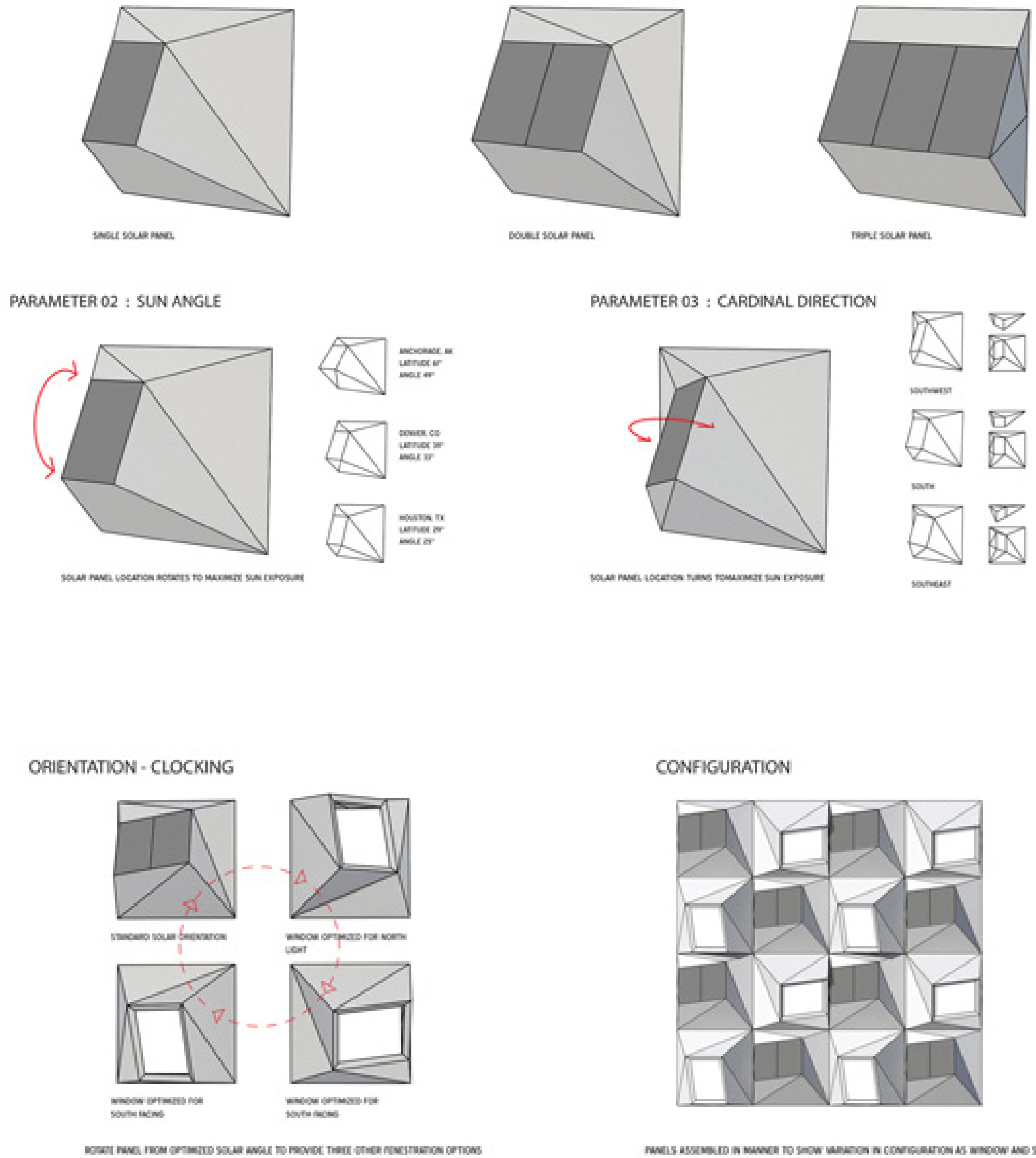
Source: http://topocastlab.com/uhgbc-solar/

The UHGBC Solar Panel

Project FABRICATION

First generation photovoltaic (PV) technology is initially explored for how it might afford other opportunities in creating fenestration within the panel. PV panel sizes can be coordinated as one of the parameters with specific sizes from various manufactures even being directly fed into the model to control the geometry. Beyond the use of the PV application, the panel still provides shading benefits when rotated to two other directions. In this regard, the fenestration is implemented simply by exchanging the PV panel with glass and changing the orientation of precast panel.

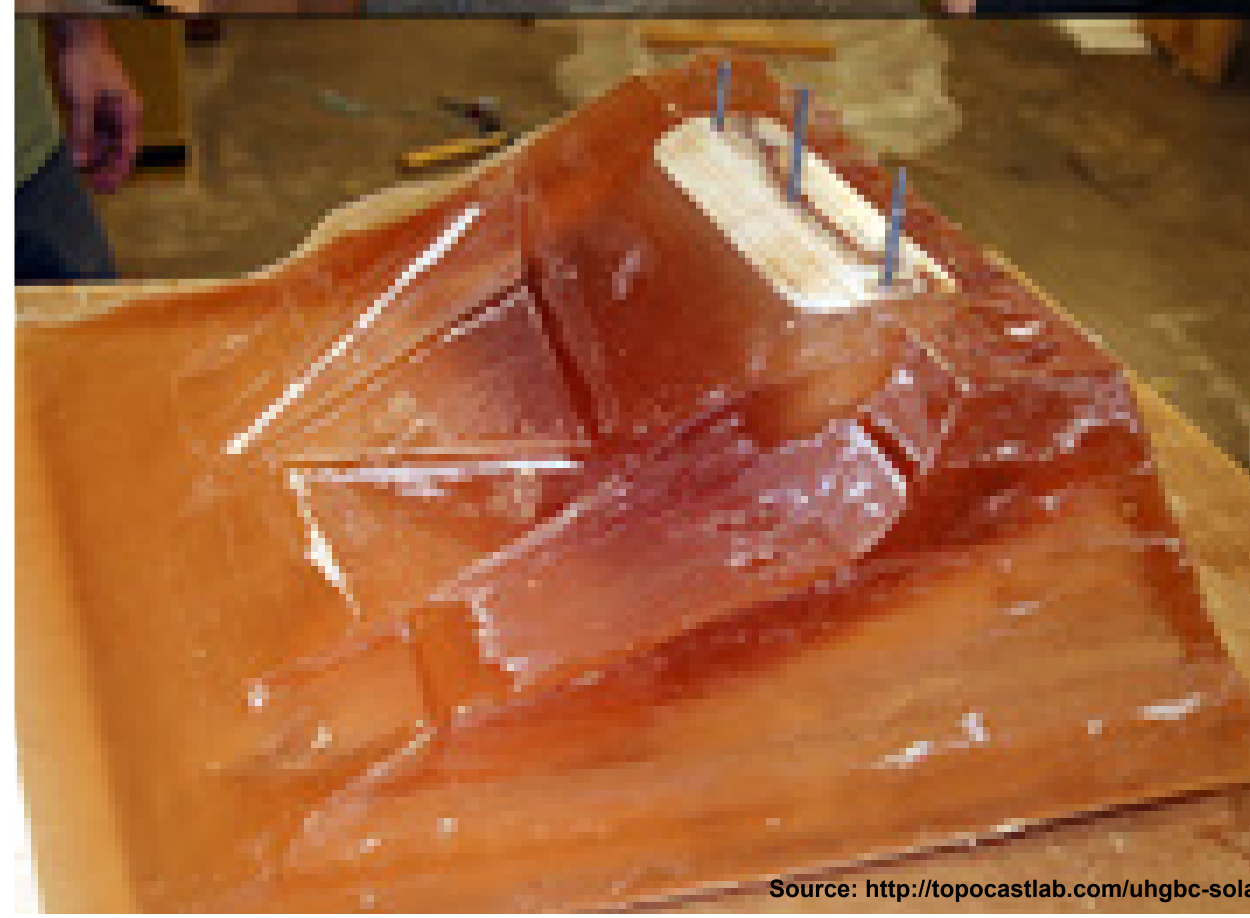
As a mechanically stabilized earth (MSE) panel the introduction of PV provides an interesting opportunity of integrating large quantities of energy corridors along the seemingly endless miles of expanding freeway and infrastructure found in most major urban centers. The opportunities to utilize these panels as energy sources to provide urban lighting through vehicular corridors or peripheral event activity spaces.



Source: http://topocastlab.com/uhgbc-solar/

The UHGBC Solar Panel

Project FABRICATION



Source: http://topocastlab.com/uhgbc-solar/

The UHGBC Solar Panel

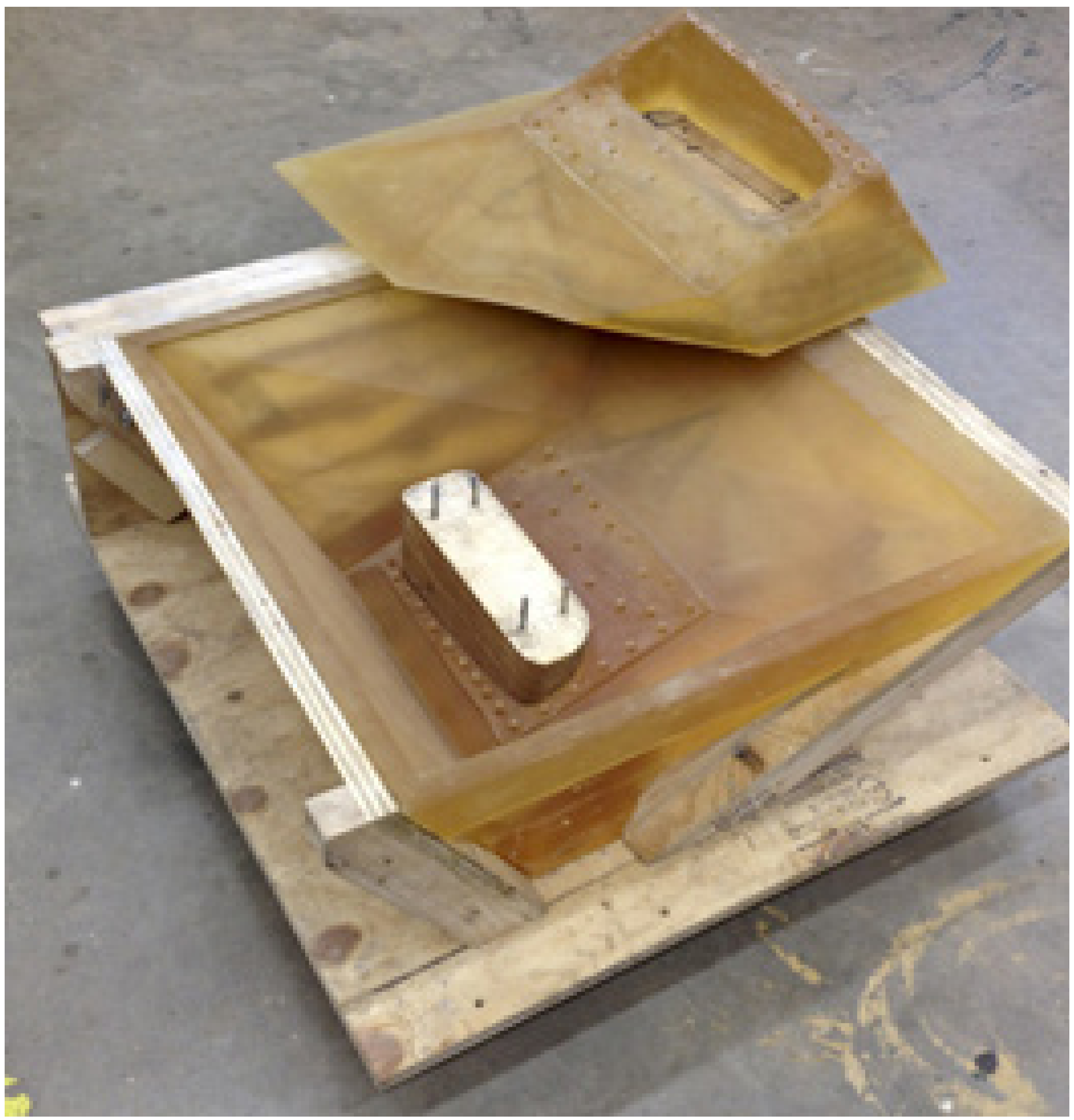
Project MATERIALS

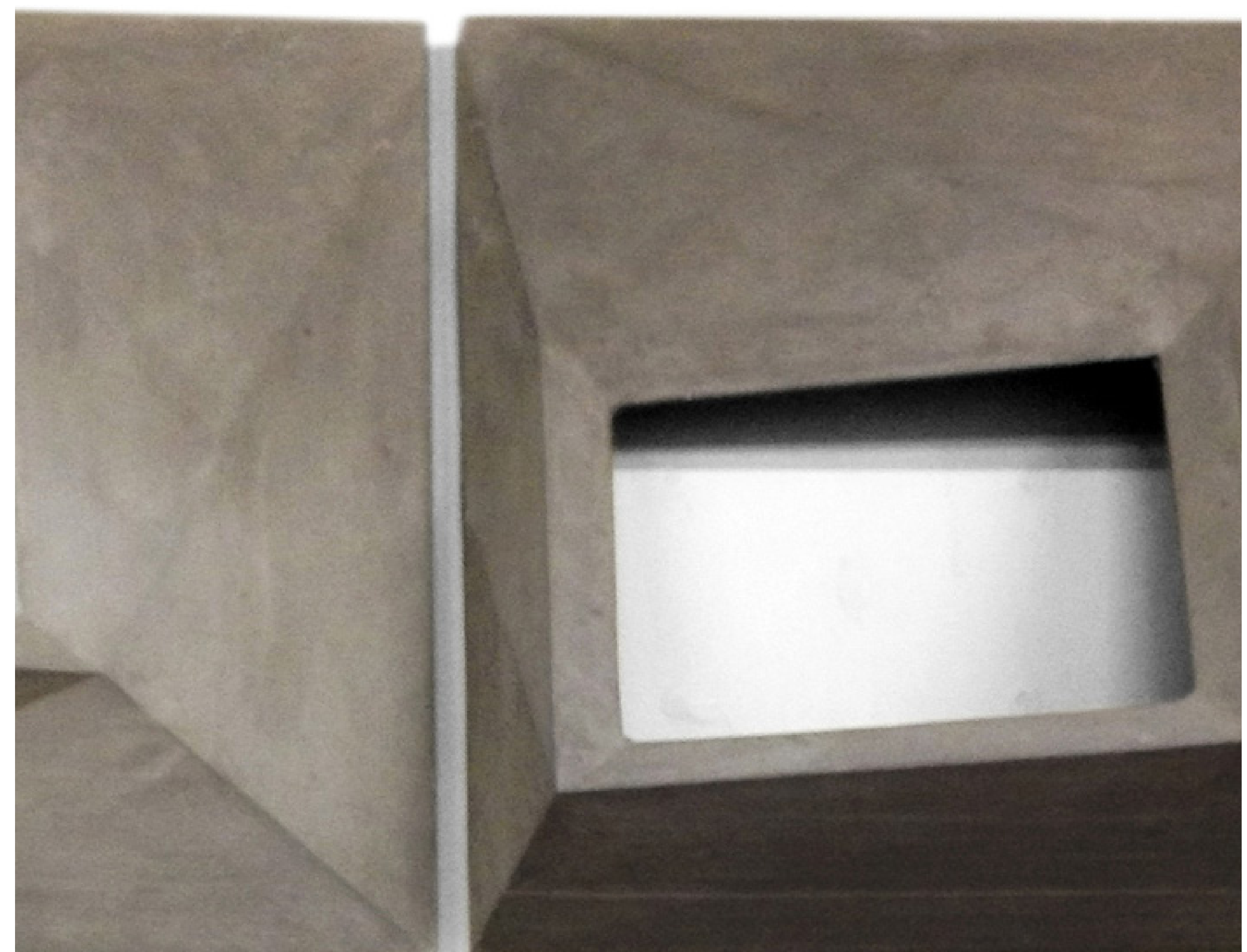
The PV panel cast is a complex two-sided mold requiring a two-part silicone form. While prototyping thus far has undertaken the implementation of computer-numerically-controlled (CNC) to the fabrication of the mold, continued scalar increases would necessitate additional examination of mold making possibilities beyond silicone. However, it is conceivable that with additional axis capability that direct “mill to mold” formation might be possible.

Source: http://topocastlab.com/uhgbc-solar/

The UHGBC Solar Panel

Project MATERIALS



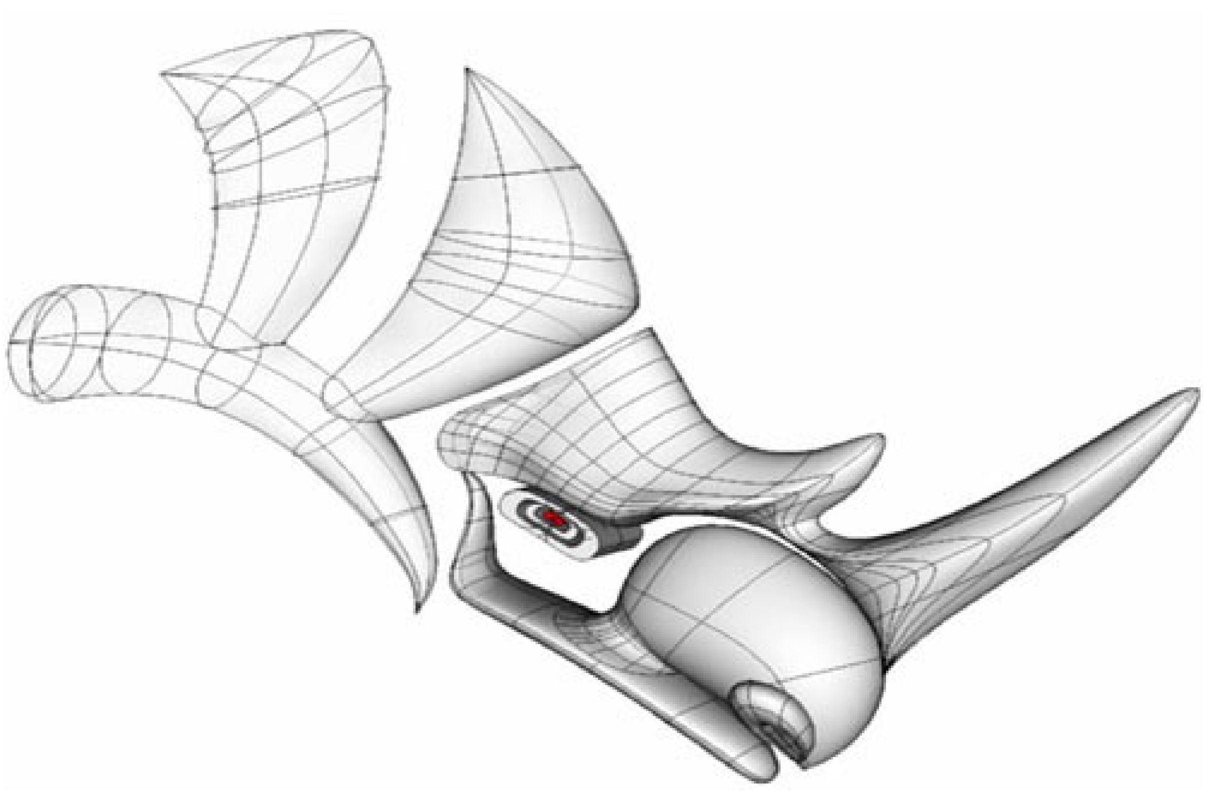


Source: http://topocastlab.com/uhgbc-solar/

The UHGBC Solar Panel

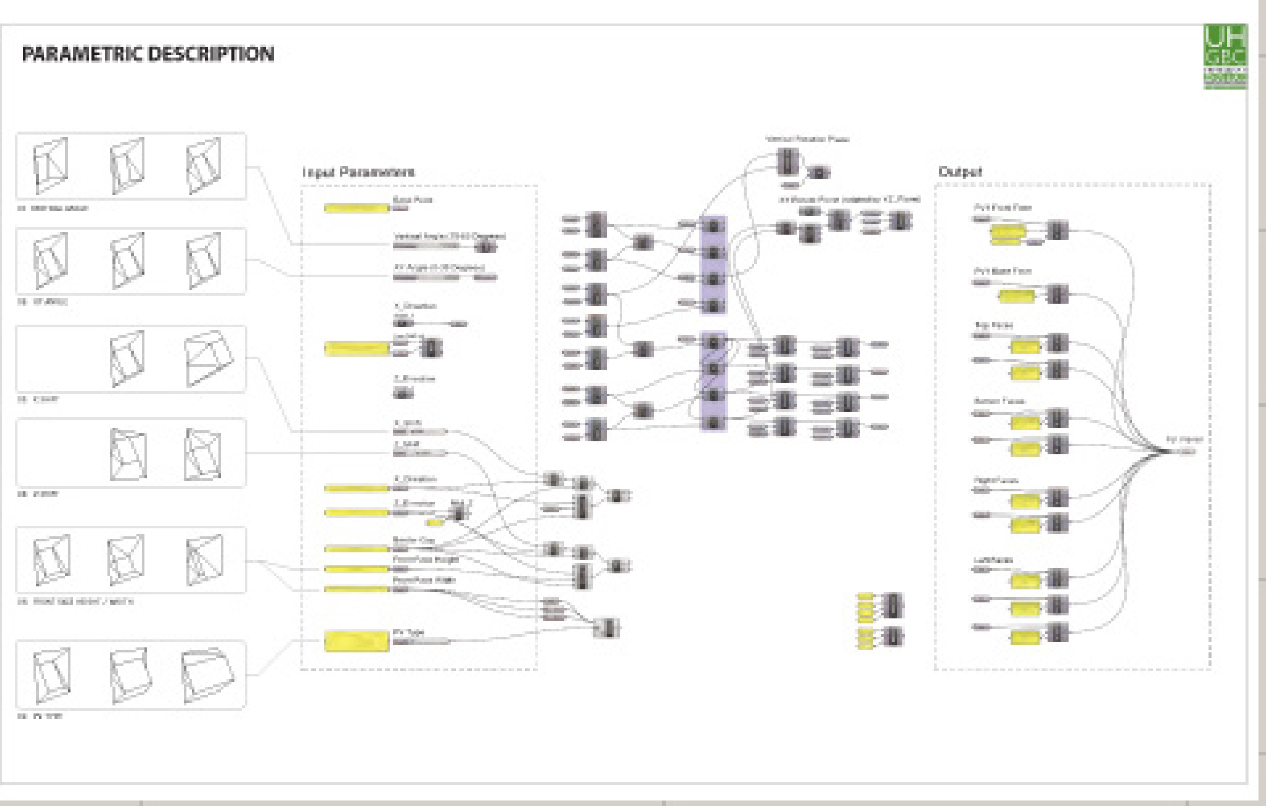
Project MACHINE / SOFTWARE

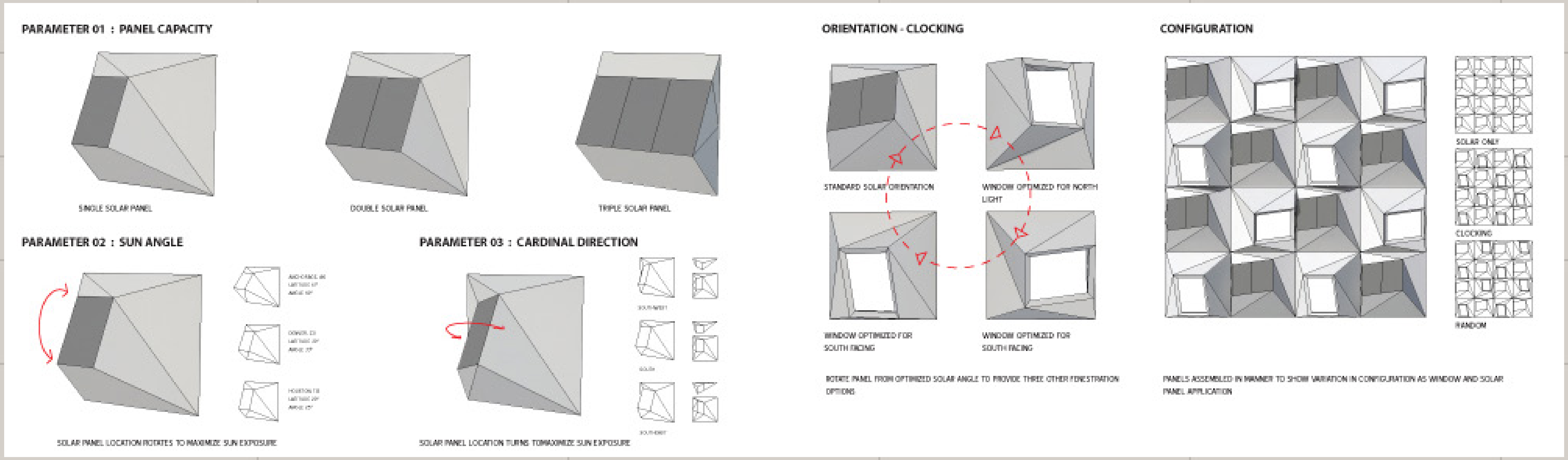
Rhinoceros and Grasshopper plugin were used to design geometry of pavilion and for getting intersections to assemble elements together.



The UHGBC Solar Panel

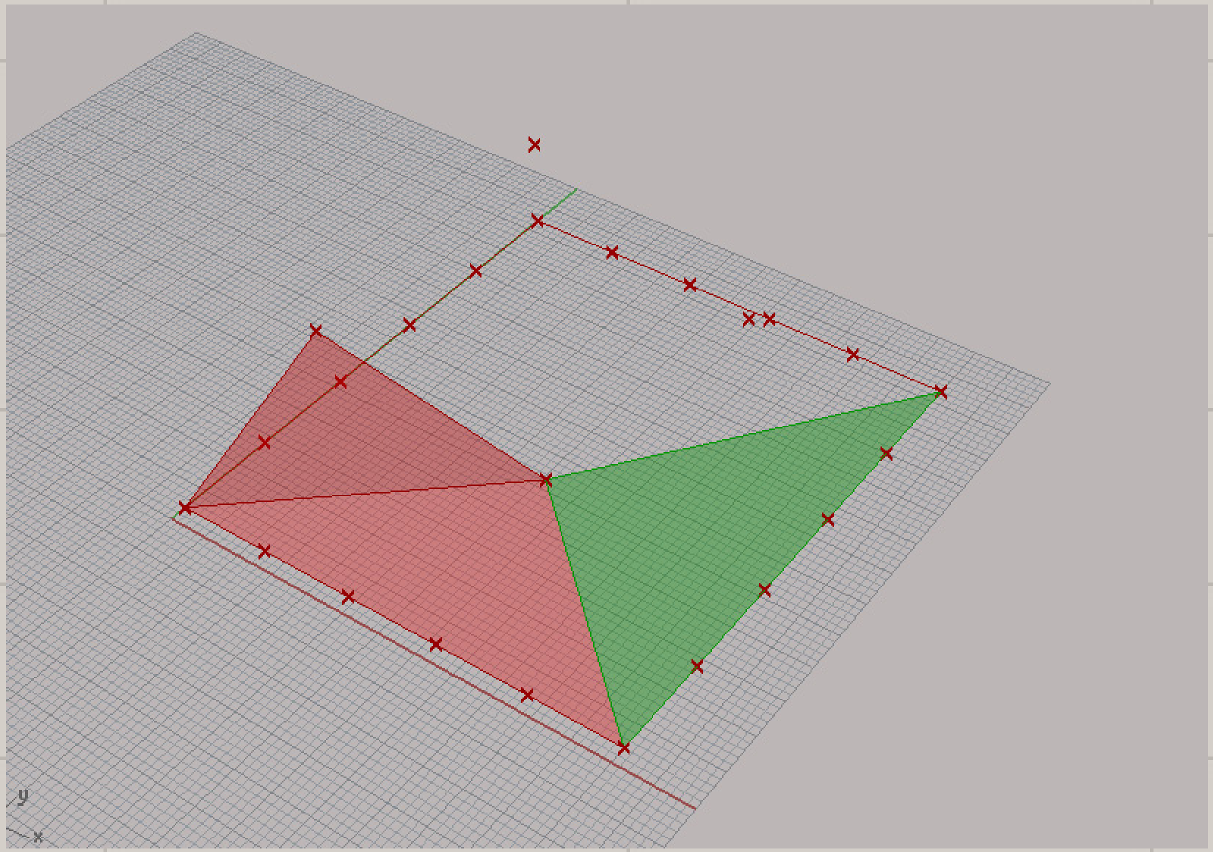
GRASSHOPPER
Modelling

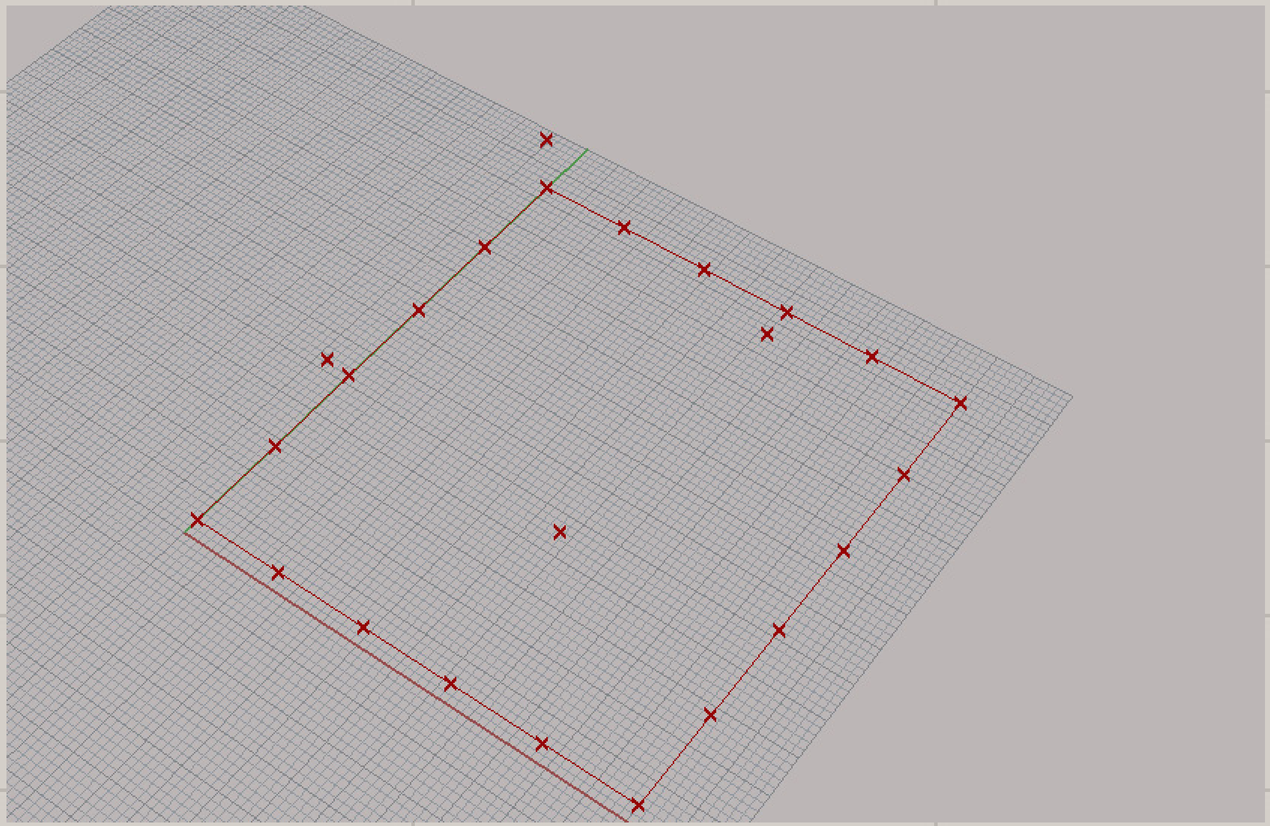


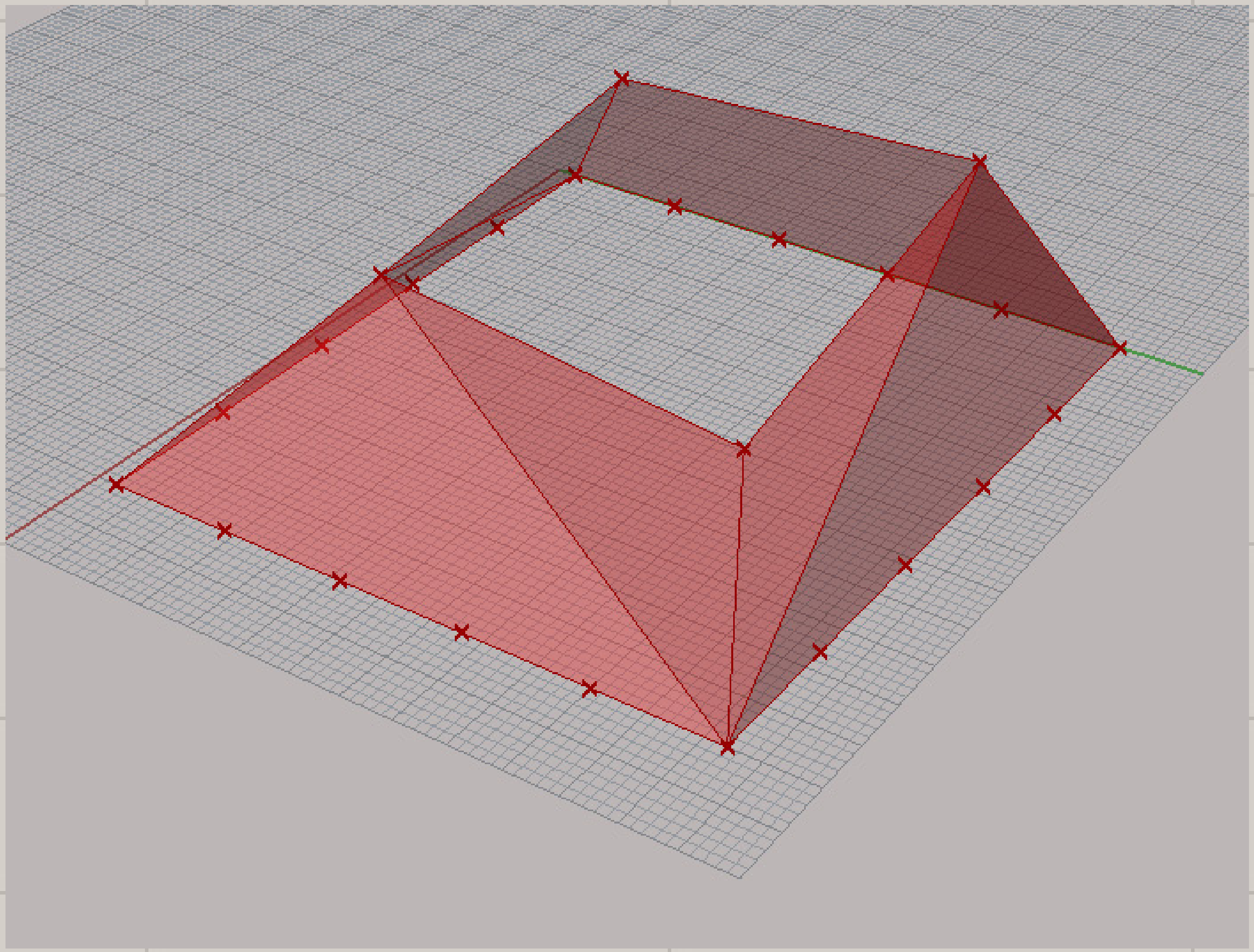


The UHGBC Solar Panel

GRASSHOPPER
Modelling

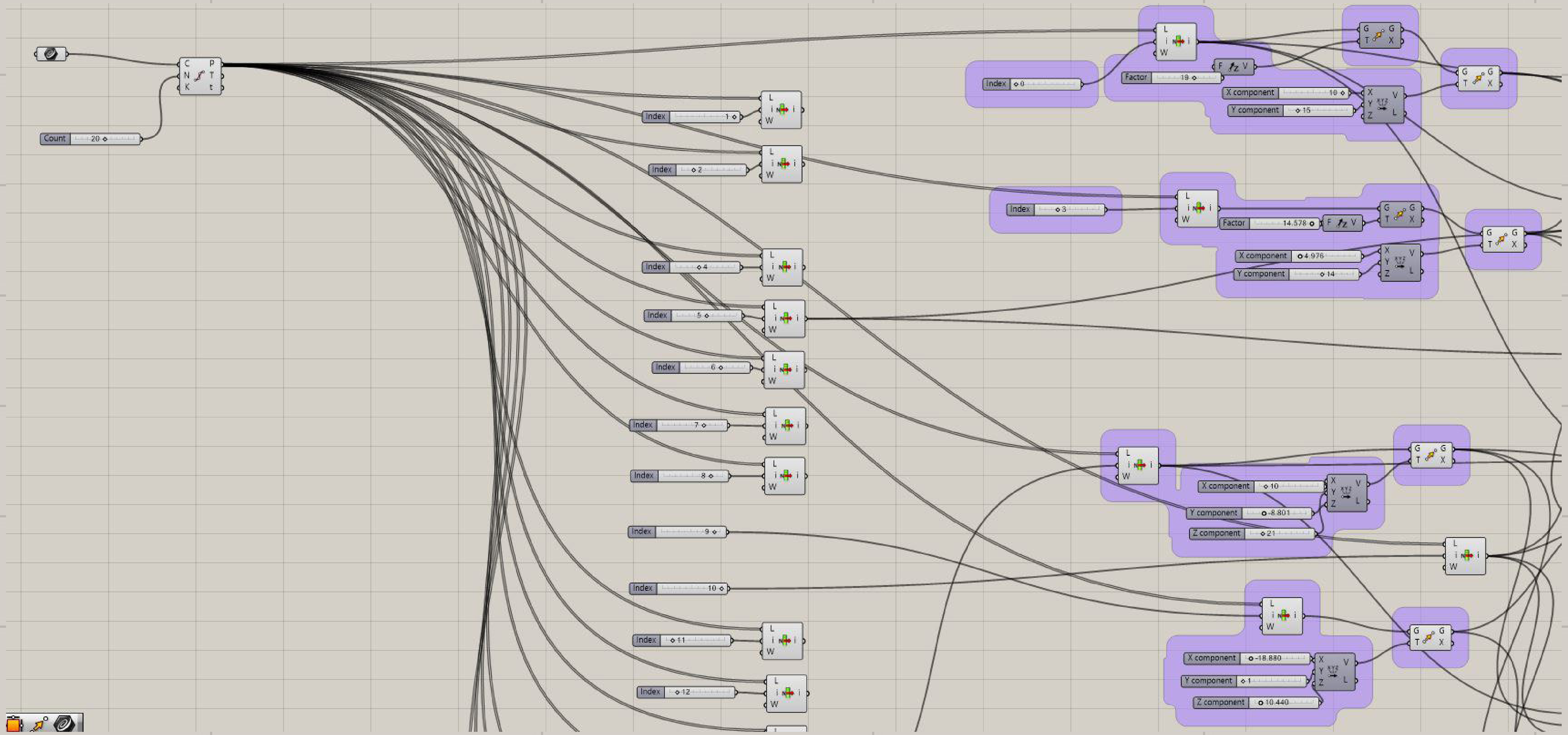






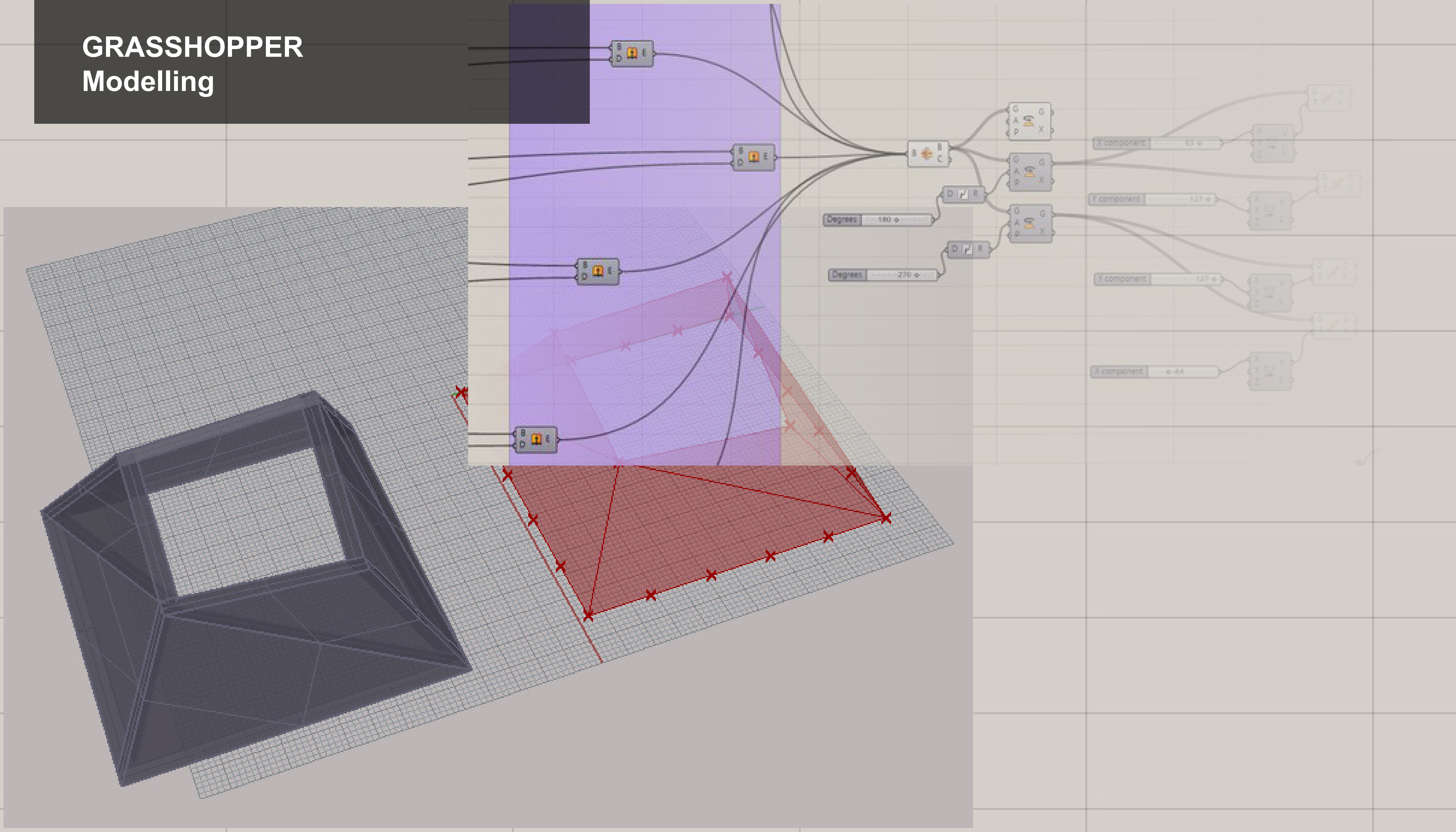
The UHGBC Solar Panel

GRASSHOPPER
Modelling



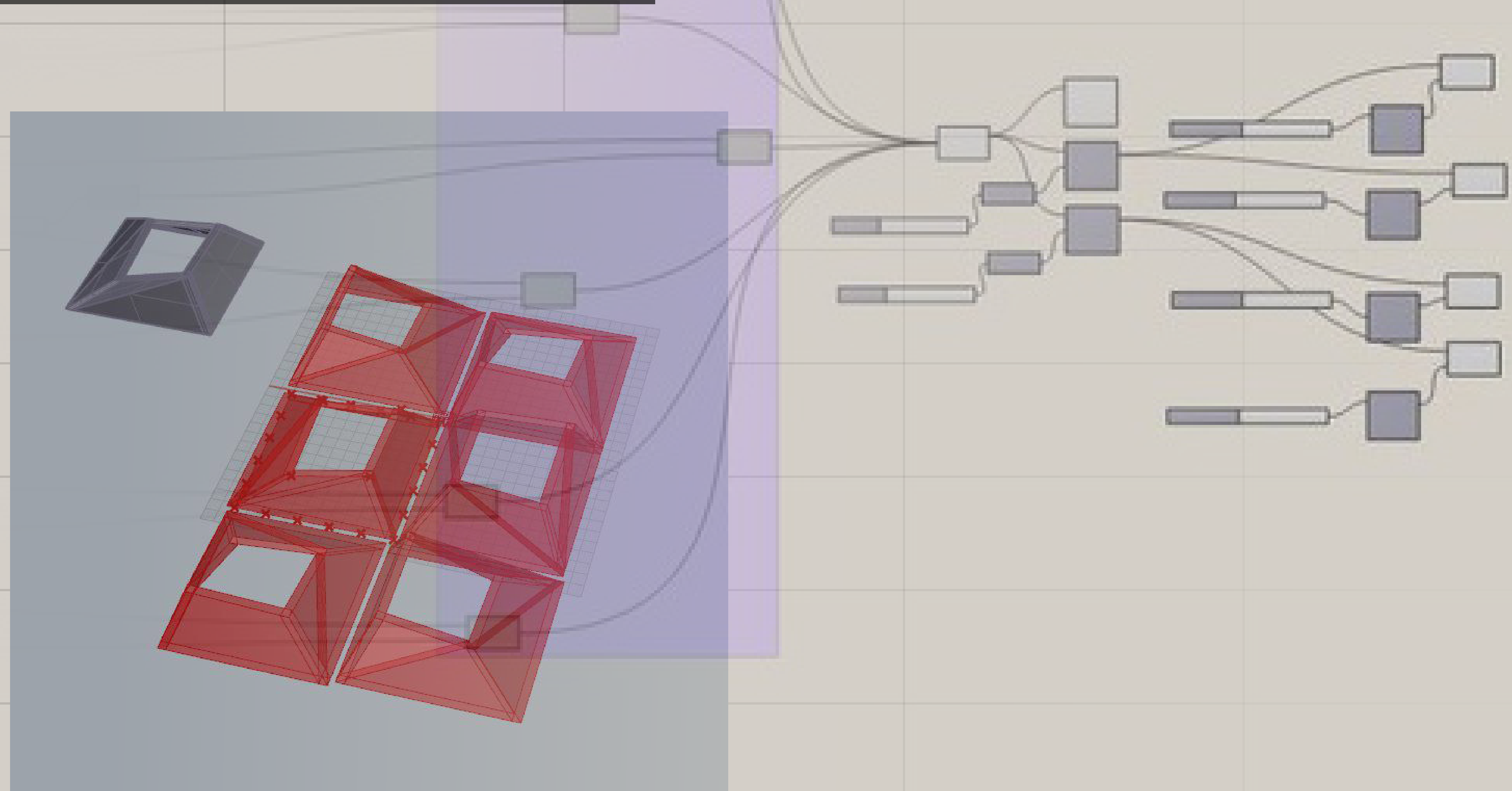
The UHGBC Solar Panel

GRASSHOPPER
Modelling

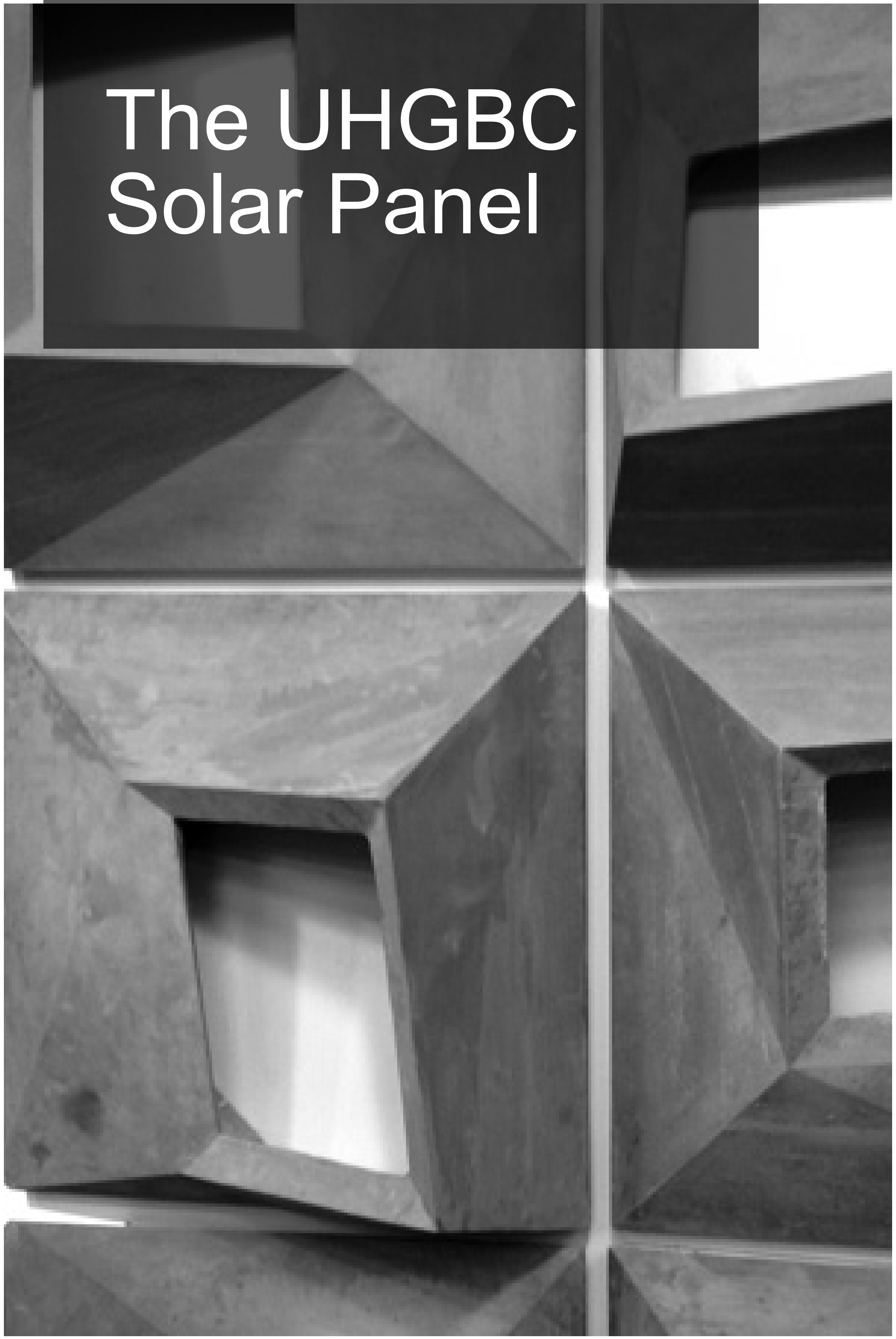


The UHGBC Solar Panel

GRASSHOPPER
Modelling



The UHGBC Solar Panel



WAVE PAVILION

MacDowell.Tomova

Wei Xin 4061399

Source: http://www.archdaily.com/79693/wave-pavilion-macdowell-tomova/

WAVE Pavilion

Project OUTLINE

Project Architect / Artist: MacDowell.Tomova

Location: The campus of the University of Michigan Taubman College of Architecture and Urban Planning

Investor: University of Michigan

Function: Pavilion (a gathering space & a didactic tool within the dialogue of digital fabrication)

Construction Year: 2010

Dimmensions: XXXX

Construction Team: XXXX

Materials Used: ½ inch steel rods

Budget: XXXX

Major Fabrication Method Used: Forming

Secondary Fabrication Methods: Sectioning

Fabricated By: CNC rod-bending device

Type Of Construction: Steel Frame

Modelling Software: Rhino + Grasshopper

Source: http://www.archdaily.com/79693/wave-pavilion-macdowell-tomova/

WAVE Pavilion

Project DESCRIPTION

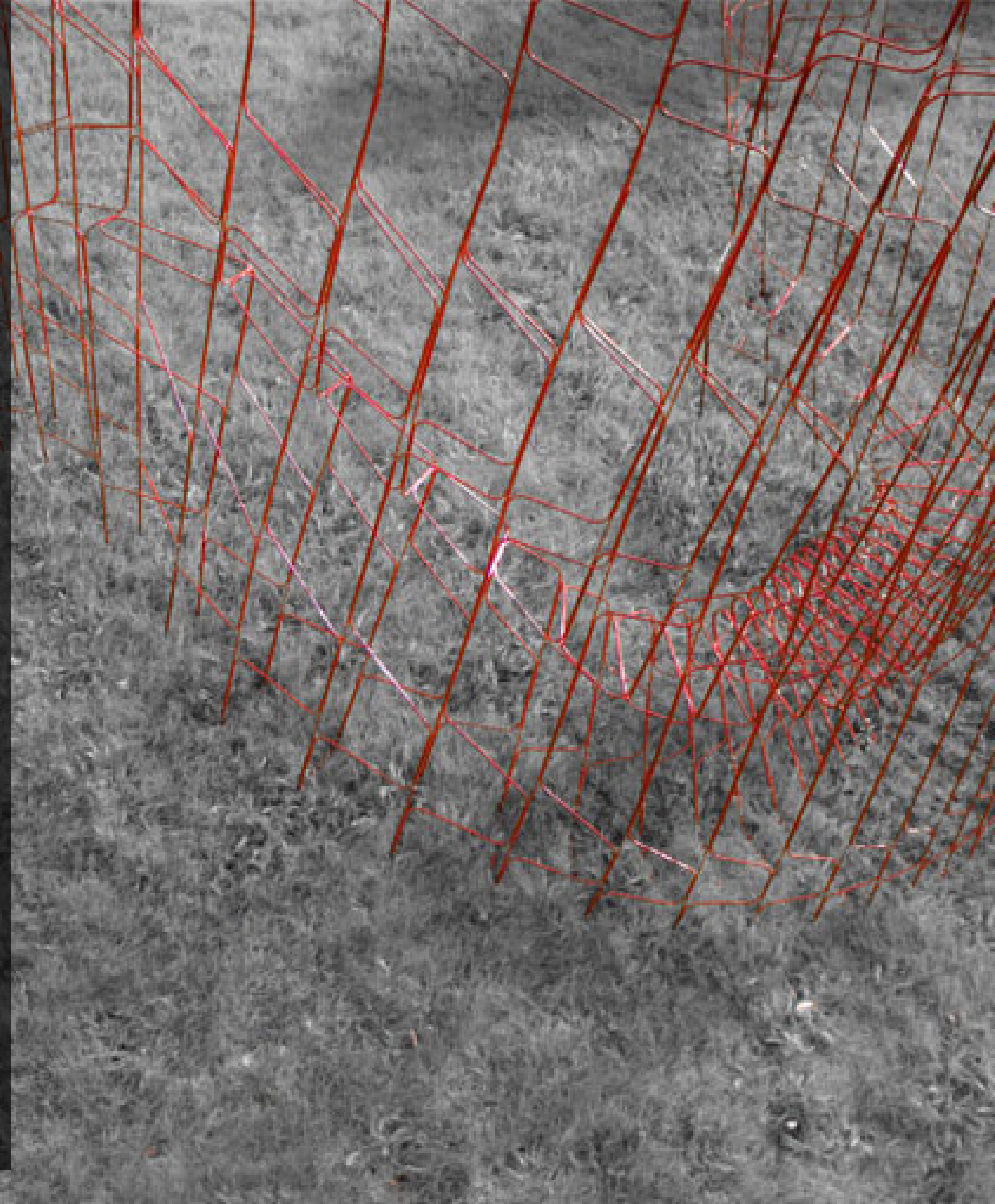
Wave pavilion, by Macdowell.Tomova, acts as both a pragmatic and conceptual testing ground, leveraging scripting and advanced digital fabrication toward the expansion of disciplinary modes of design and construction.

The pavilion operates as a piece of landscape furniture, an occupiable space of gathering and leisure.

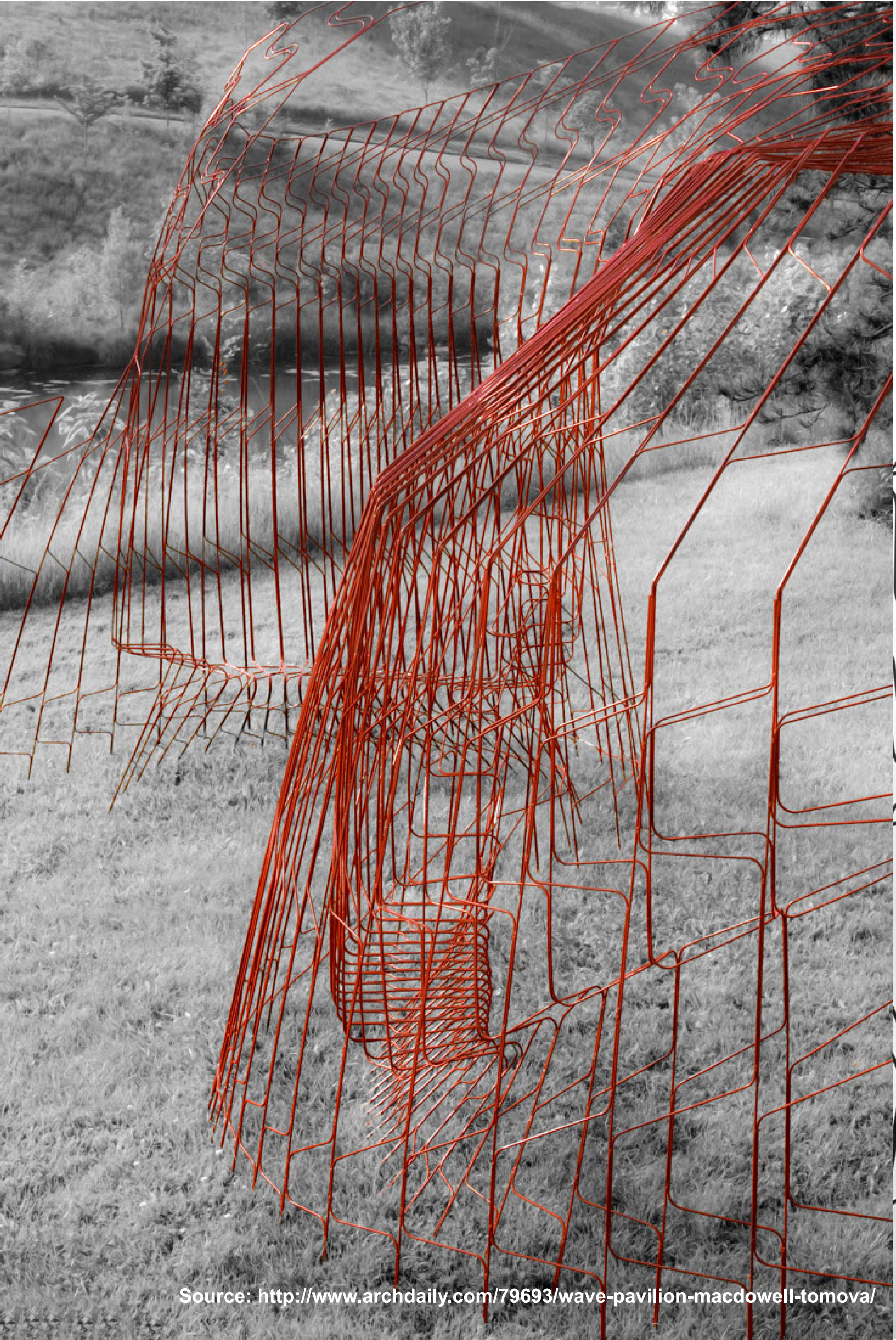
Set on the grounds of the university of michigan, taubman college of architecture and urban planning, the wave pavilion serves both a functional role as a place for student discussion groups or private reflection and a didactic one within the dialogue of digital fabrication.

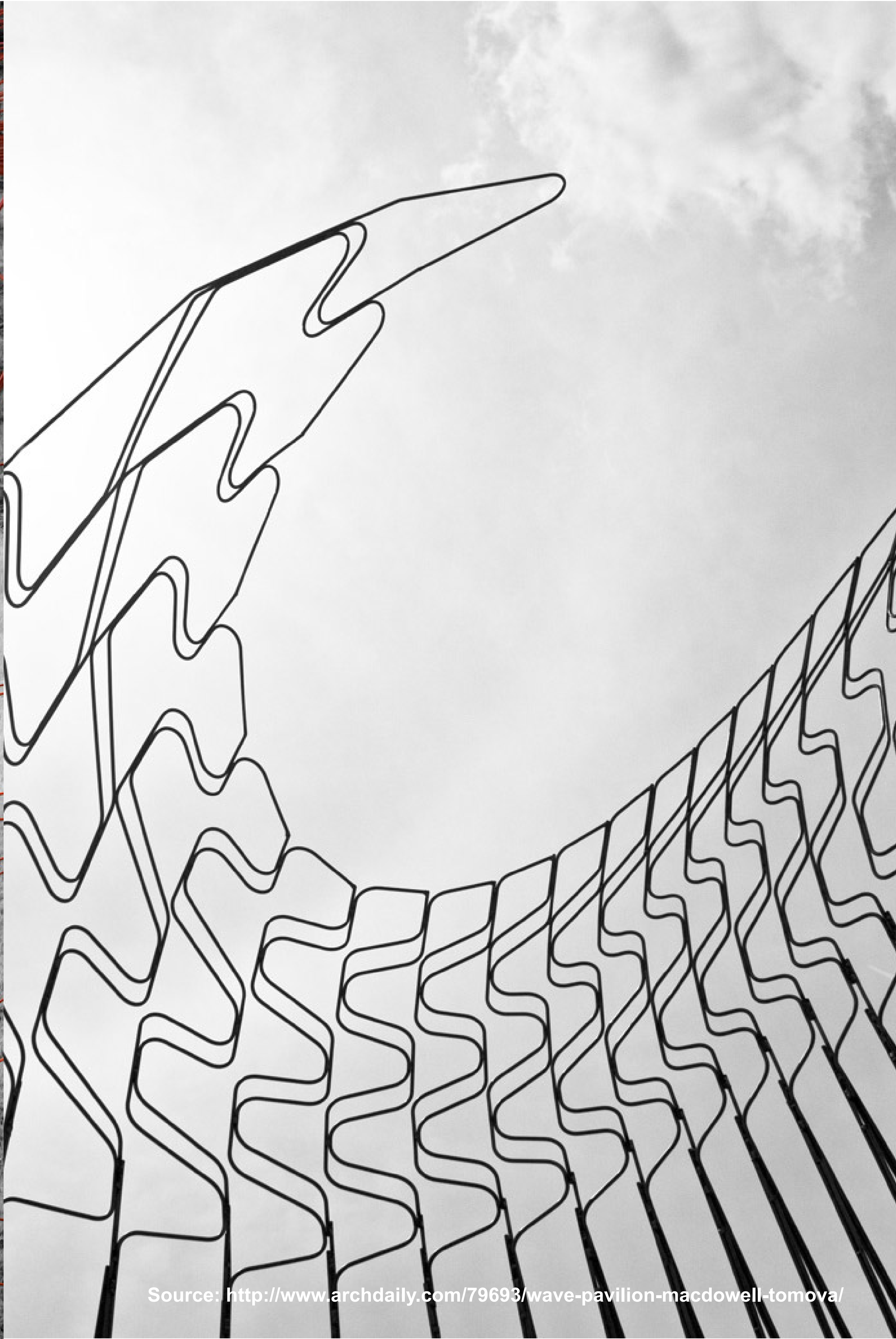
The line is made real in the form of slender steel rod. gradients of pattern read across the breadth of the pavilion, but moments of eccentricity i.e. phase shifts, highlight the composite relational processes of the underlying system.

The project relies on the precise fabrication and assembly of its constituent elements. to this end, the architects designed and built a CNC rod-bending device that operates in tandem with a multi-use 7-axis robotic arm to shape the pavilion components.



Source:http://www.designboom.com/architecture/macdowelltomova-wave-pavilion/


Source: http://www.archdaily.com/79693/wave-pavilion-macdowell-tomova/

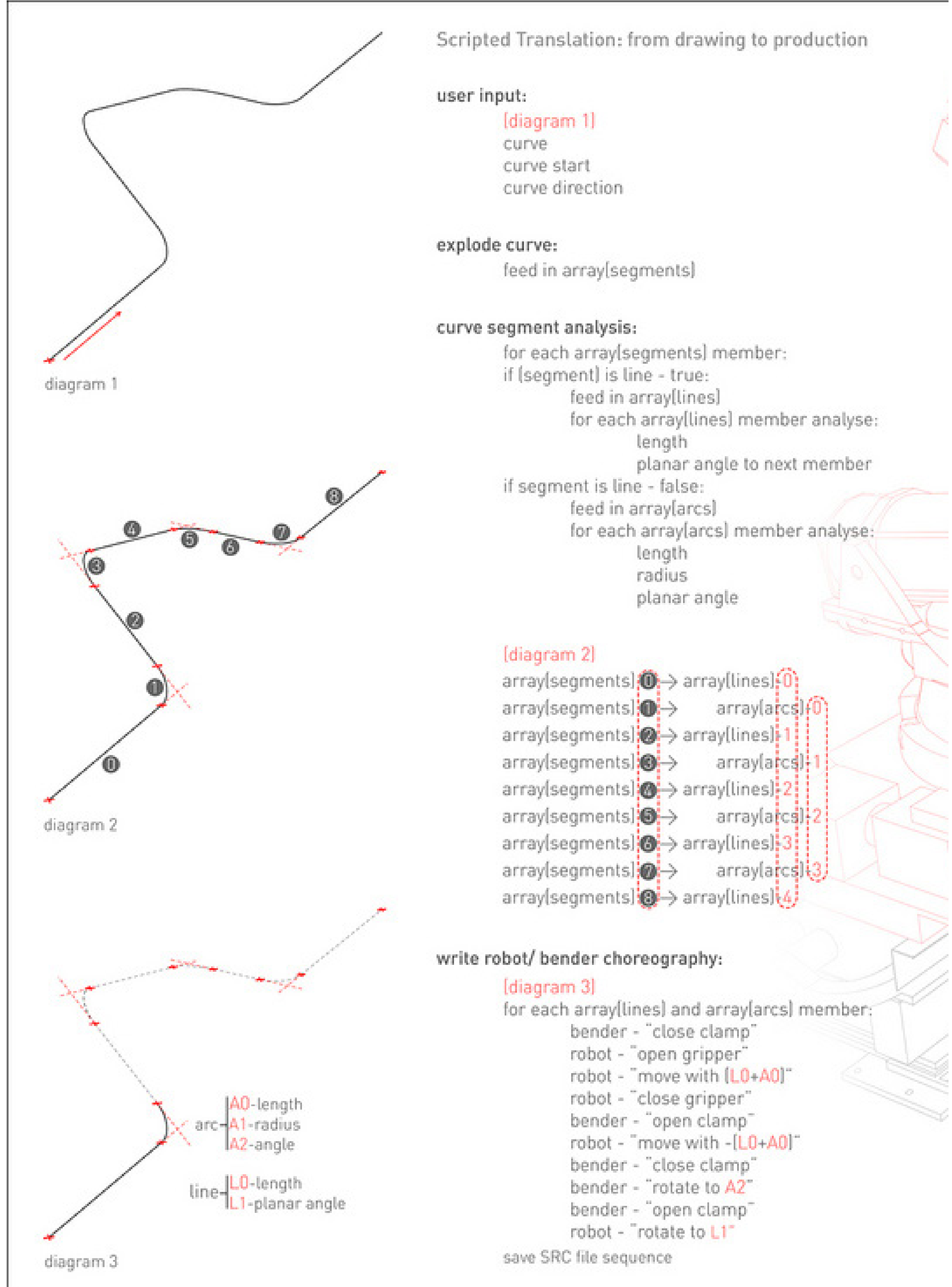

Source: http://www.archdaily.com/79693/wave-pavilion-macdowell-tomova/

WAVE Pavilion

Project FABRICATION

The proliferation of digital fabrication within the discipline of architecture carries the promise of ultimate customization, the built realization of previously untenable forms, and unprecedented fluidity between design and construction. In practice, however, there seems the tendency to exploit only a small fraction of the potential afforded by this technology. As an alternative to the oft-explored strategies of sectioning and panelization—the ‘go to’ moves for rationalizing complex form—we propose a new tectonic mode, one in which the architectural vehicle of the Line is explicitly leveraged toward the nuanced description of space.

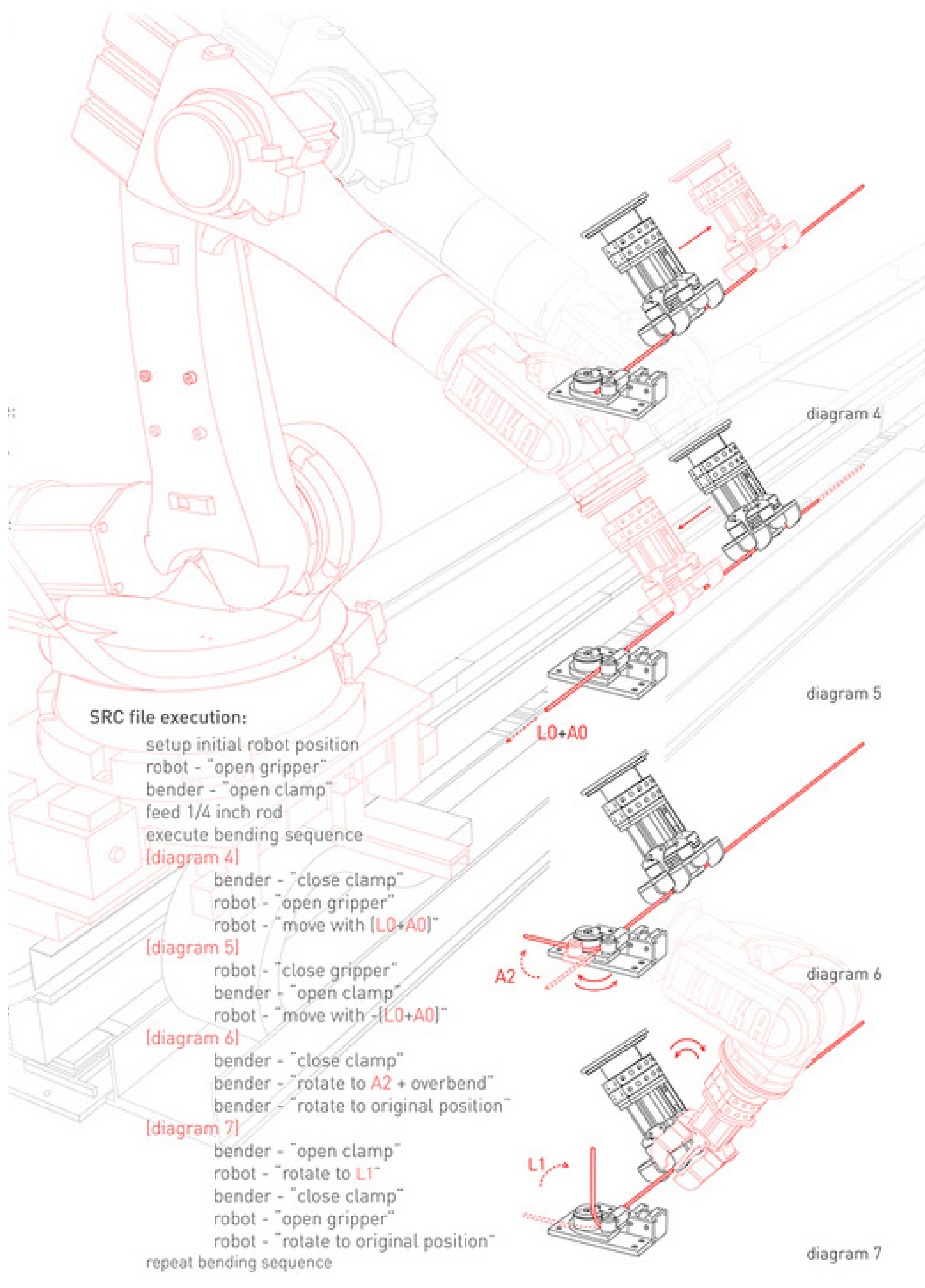
Grounded in traditions of drawing, this new morphology rises from a monad of simple linear geometry. This crude but variable base unit, deployed within an assembly via complex relational logics, emerges as more than just Line, instead evoking surface, becoming atmosphere. The Wave Pavilion instantiates these aspirations.



WAVE Pavilion

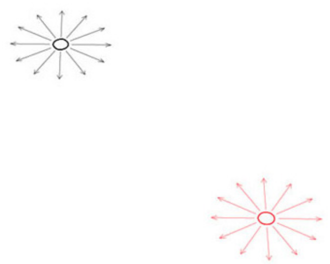
Project FABRICATION

Here, Line is made real in the form of slender steel rod. By a scripted strategy of geometric evolution, the individual members of our line species coalesce into a form-society, one in which the intrinsic behavioral tendencies of the species compound with environmental motivators linked to the spatial and programmatic needs of the project. Gradients of pattern read across the breadth of the Pavilion, but moments of eccentricity—phase shifts, vestigial phenotypes, dormant features—highlight the composite relational processes of the underlying system. Here Line becomes a means of challenging the ubiquity of the Blob within scripted/parametric form-making; geometric composition supplying all the complexity and nuance for which we have become enamored of calculus-dependent design.

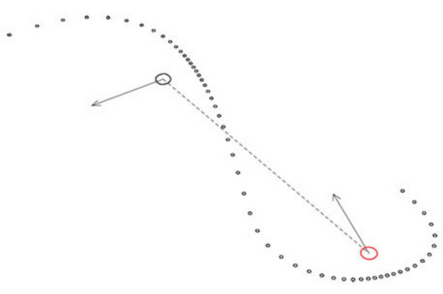


WAVE Pavilion

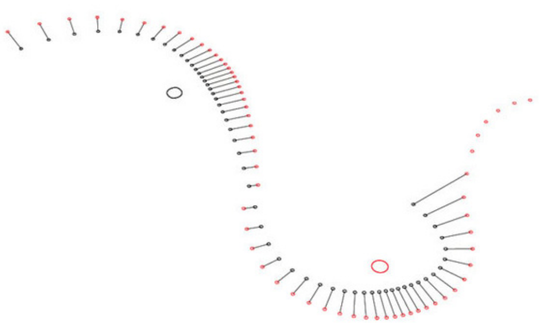
Project FABRICATION



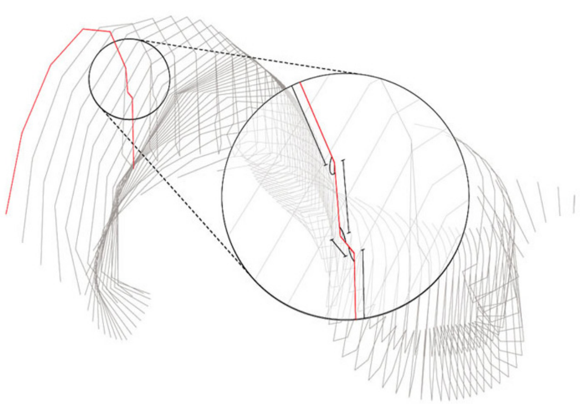
The meta-site in which the pavilion form-script operates is seeded with critical nodes. These nodes embed information tied to real-world spatial and programmatic requirements. The process generates a field of vector impulses, influencing the tendencies of the form-script.



The pavilion form-script tracks a course within data-environment of the established vector field, creating a line of primary structure that describes two zones, each with distinct views and directionality. The resultant spaces are both connected and autonomous, a perception reinforced by the modulating density of the pavilion form.

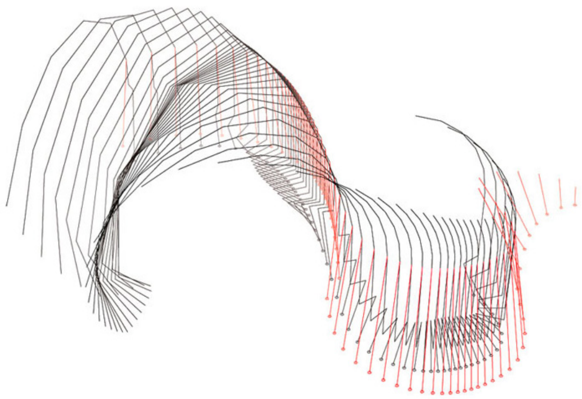


A secondary line of form develops, acknowledging the primary curve - for which it provides structural support - but following its own logic. At the end of its trajectory, this new layer delaminates from the primary form in an expressive move that highlights the internal variation invested within the single form-making strategy.

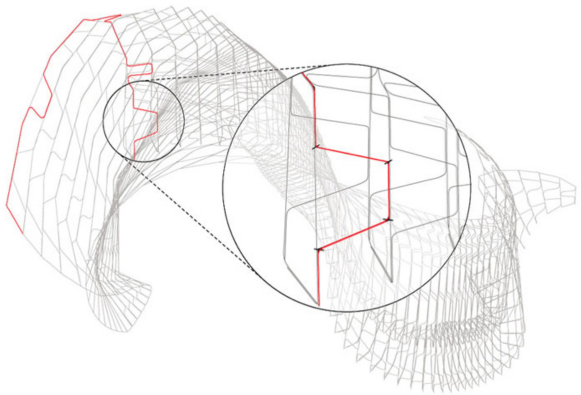


A network of 3-dimensional polylines emerges from the preparatory geometry on the groundplane. Each segment of these polylines develops with a specific scale and direction via a geometric negotiation between the innate tendencies of the form-script and the specific environmental parameters resulting from the critical nodes.

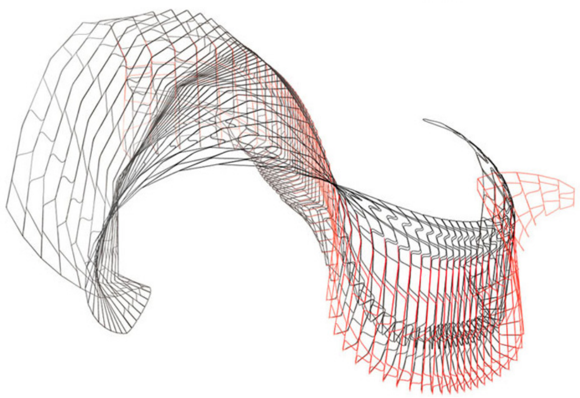
As a kind of 'ancestor' geometry for the final pavilion form, these polylines are the simple progenitors of a lineage from which more complex descendents evolve. The ancestor geometry establishes the board morphological characteristics of the pavilion, but lacks the sophistication to address issues of structural integrity and user occupation.



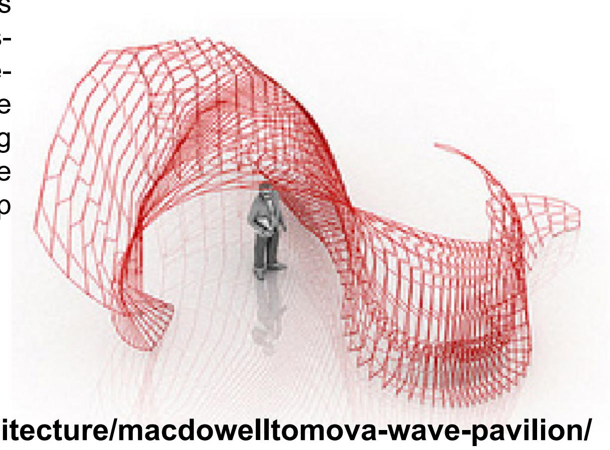
The descendent geometry takes the crude form of the ancestor geometry and augments it with a more nuanced understanding of its proximal neighbors engage in physical exchange with their neighbors, forming aesthetic and structural alliances toward the development of a cohesive 'society' of form.



The late-stage form-society displays board networks of structural affiliation while maintaining a high degree of local diversity. Behavioral gradients read across the breadth of the pavilion, but moments of eccentricity-phase shifts, vestigial phenotypes, dormant features-highlight the complex relational processes of the underlying system.



In such a way, the final pavilion form emerges as an index of its own phylogeny, physically expressing its internal logics while satisfying its pragmatic requirements as landscape/furniture. As built form, the project challenges the reductive breadth of prevailing digital fabrication strategies, presenting a new mode of spatial description and an accelerated relationship between concept and instantiation.

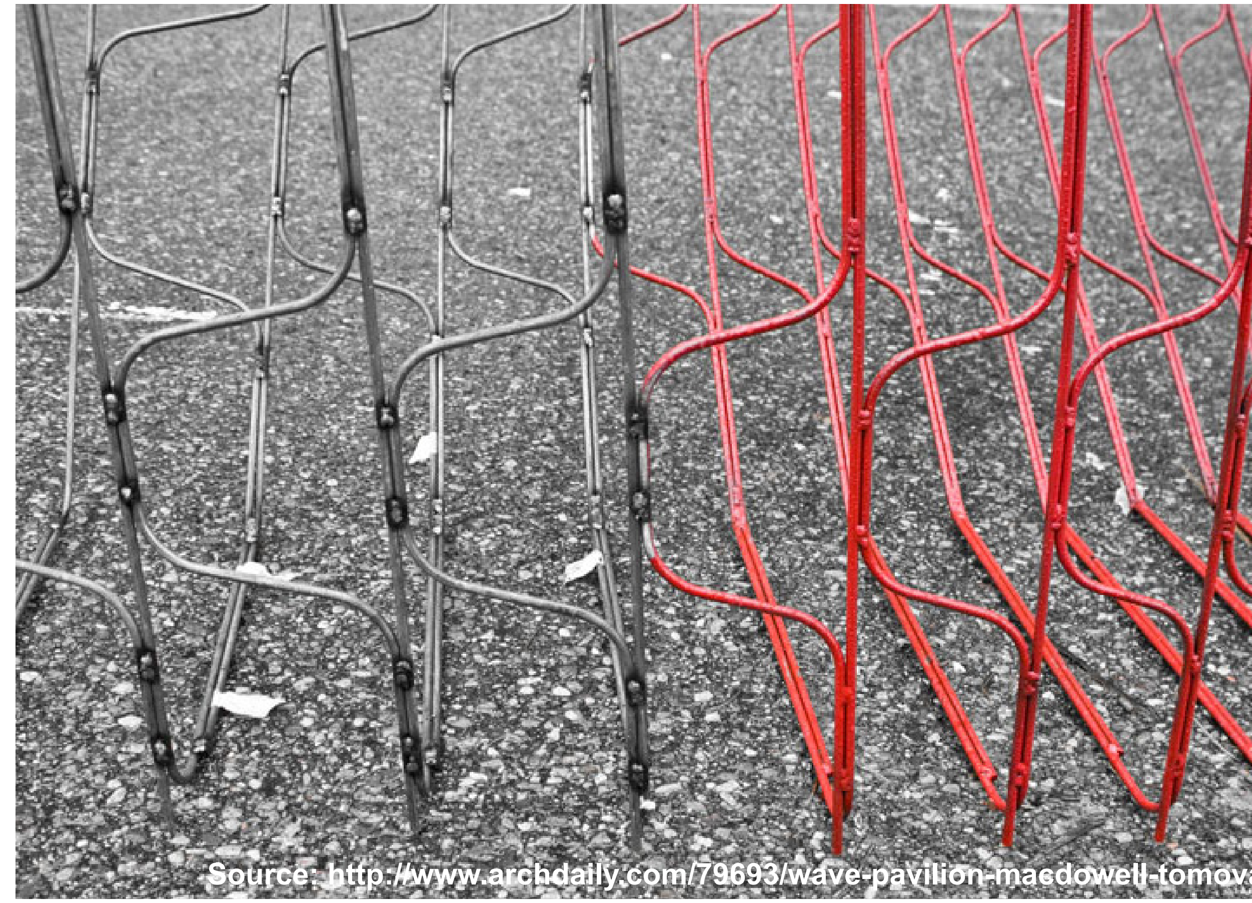


http://www.designboom.com/architecture/macdowelltomova-wave-pavilion/

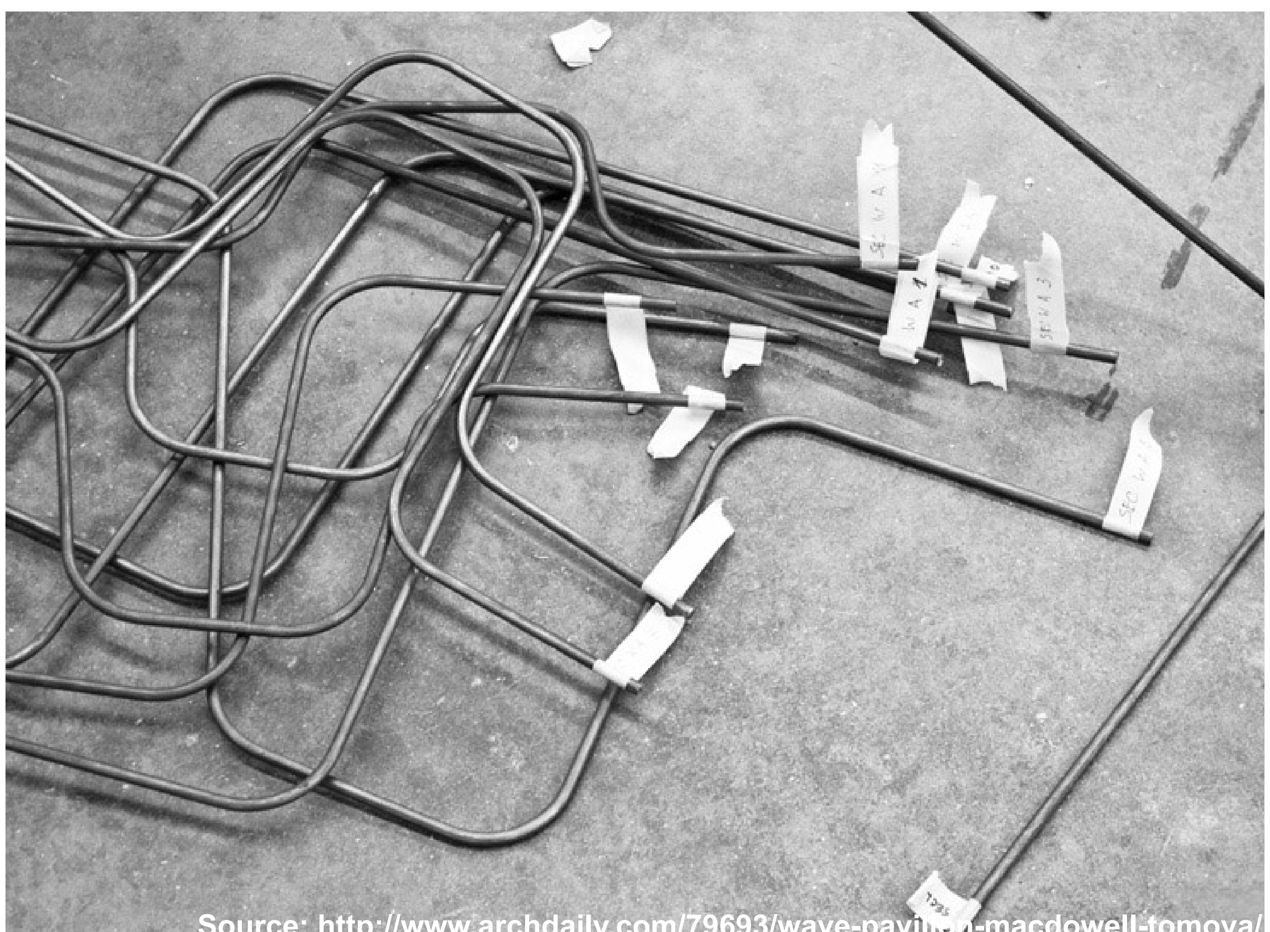
EKKO Pavilion

Project MATERIALS

½ inch steel rods
paint



Source: http://www.archdaily.com/79693/wave-pavilion-macdowell-tomova/



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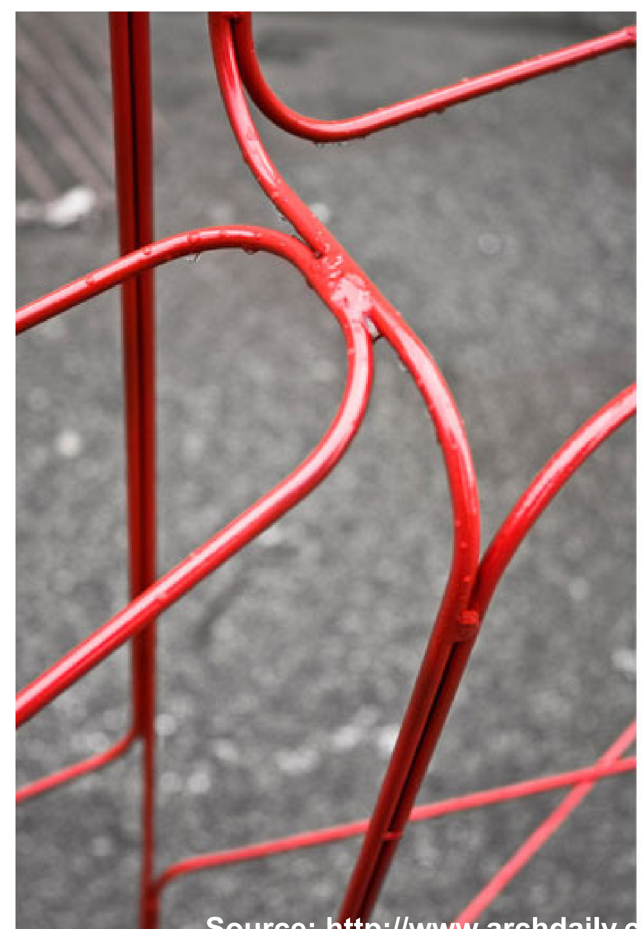
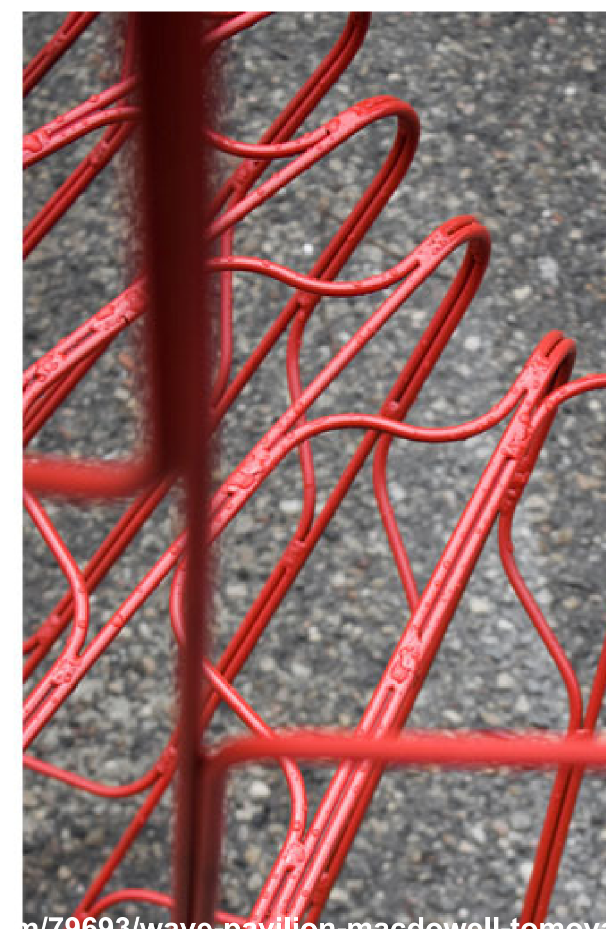


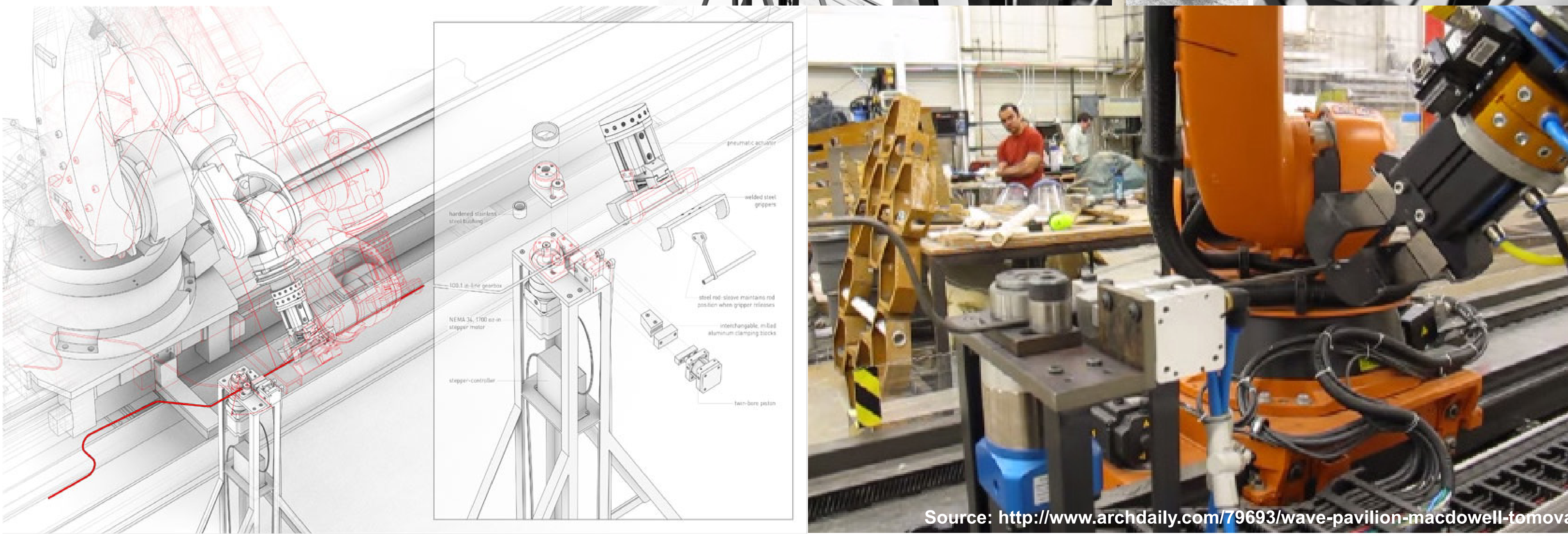


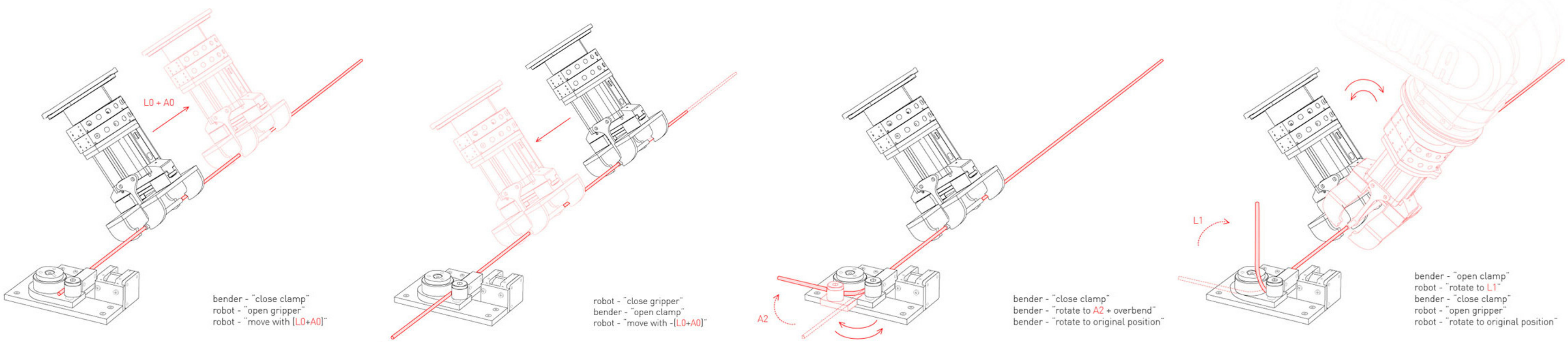
Source: http://www.archdaily.com/79693/wave-pavilion-macdowell-tomova/

EKKO Pavilion

Project MACHINE

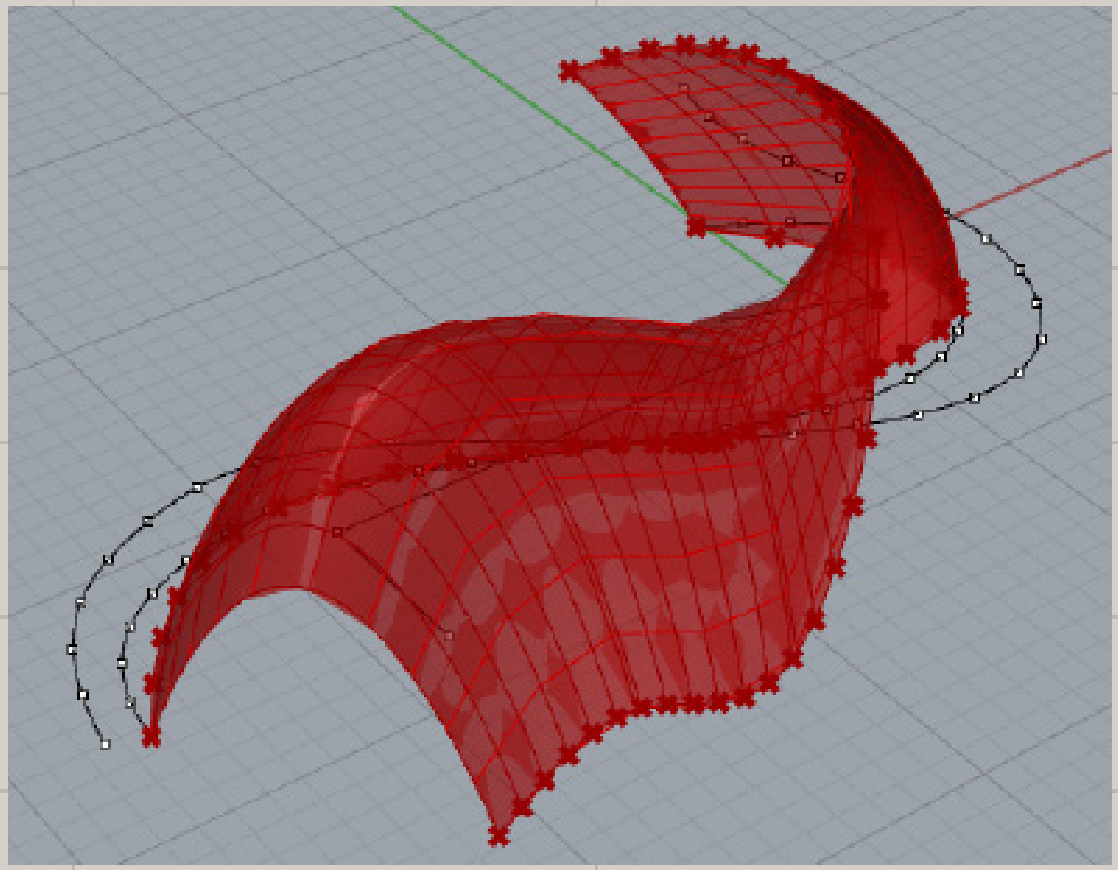
CNC rod-bending device

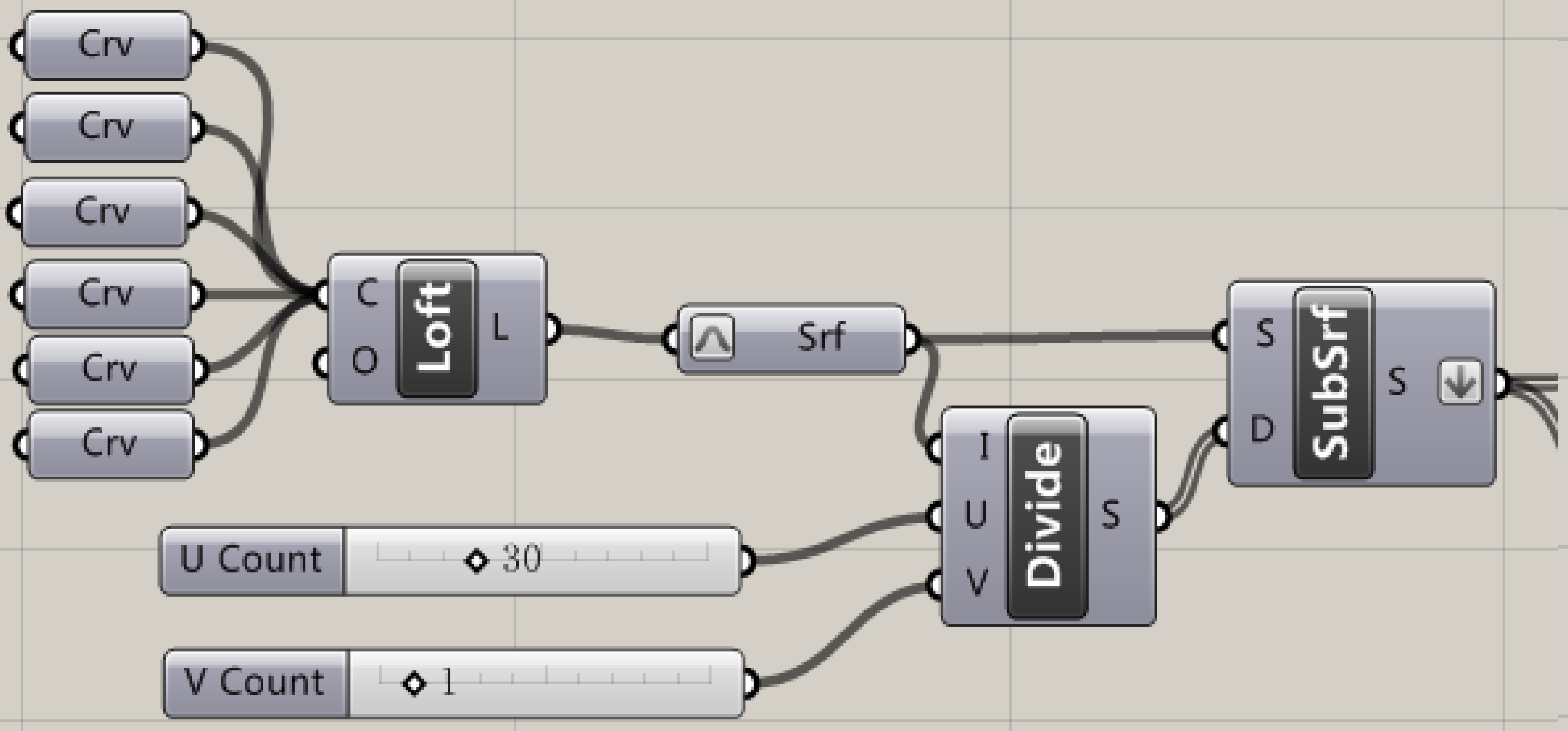




WAVE Pavilion

GRASSHOPPER
Modelling





WAVE Pavilion

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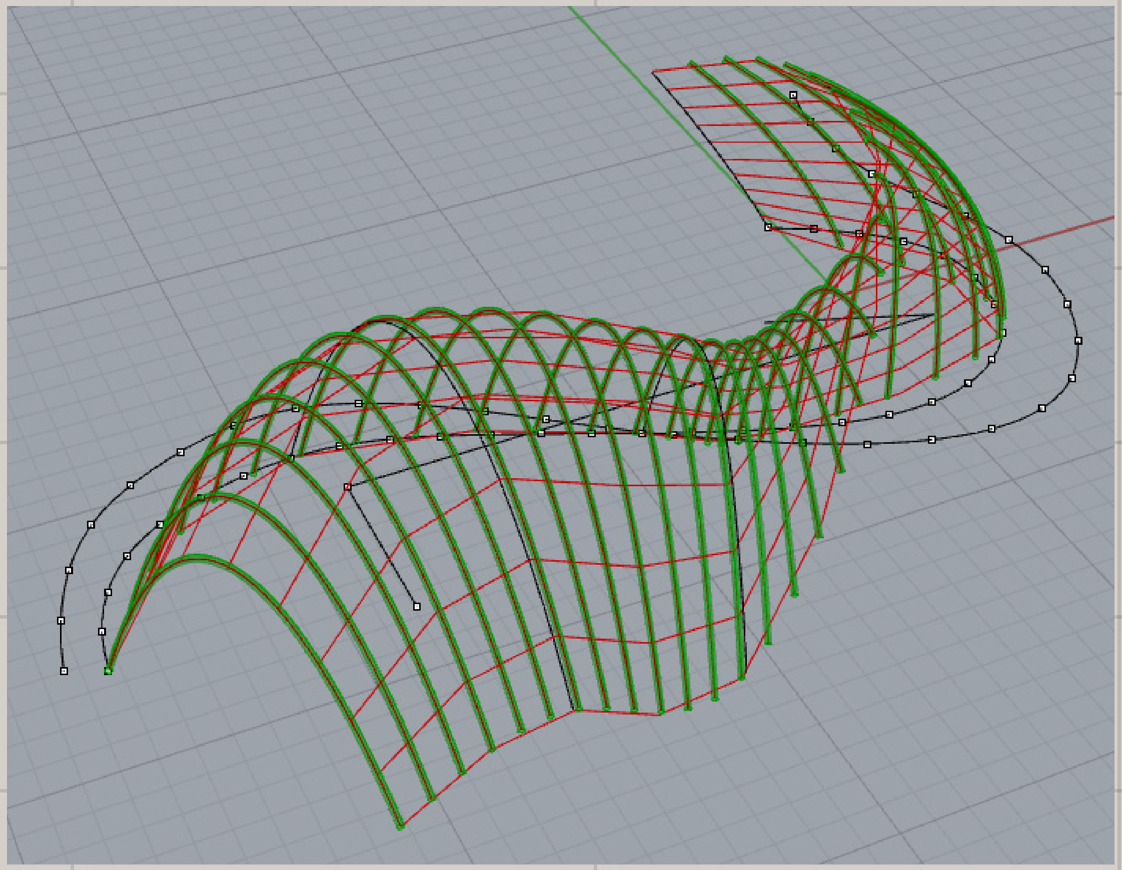
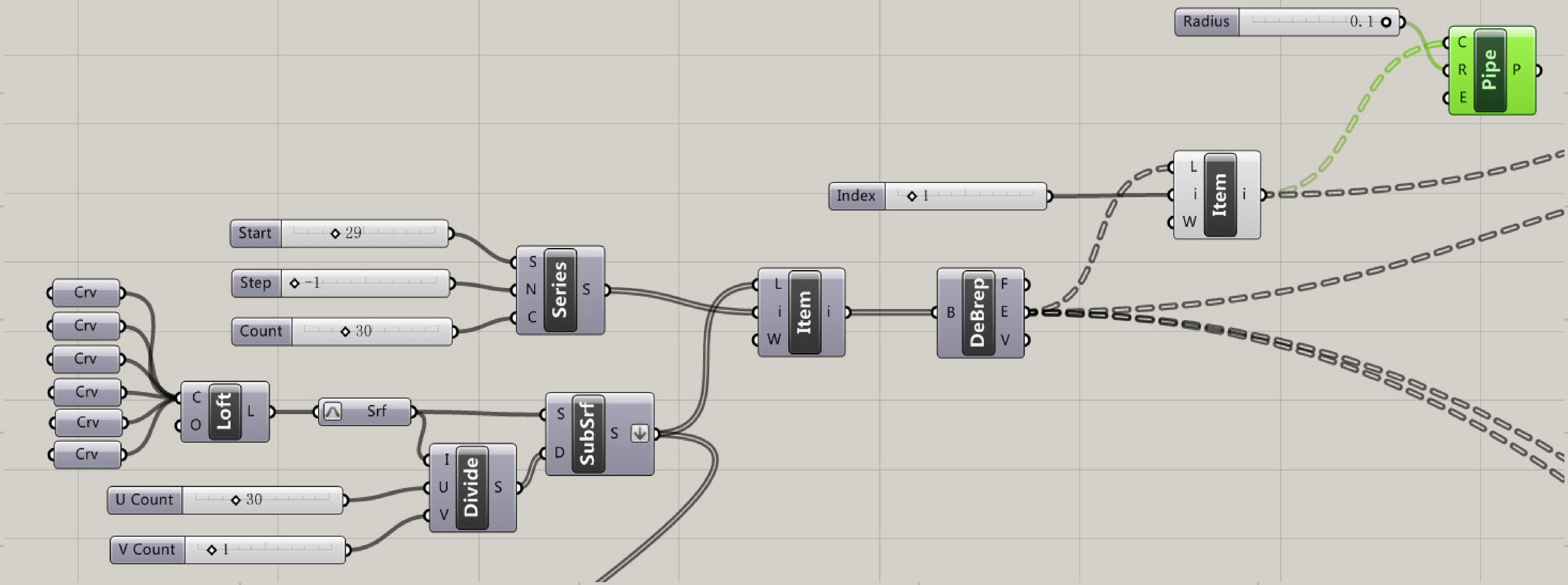
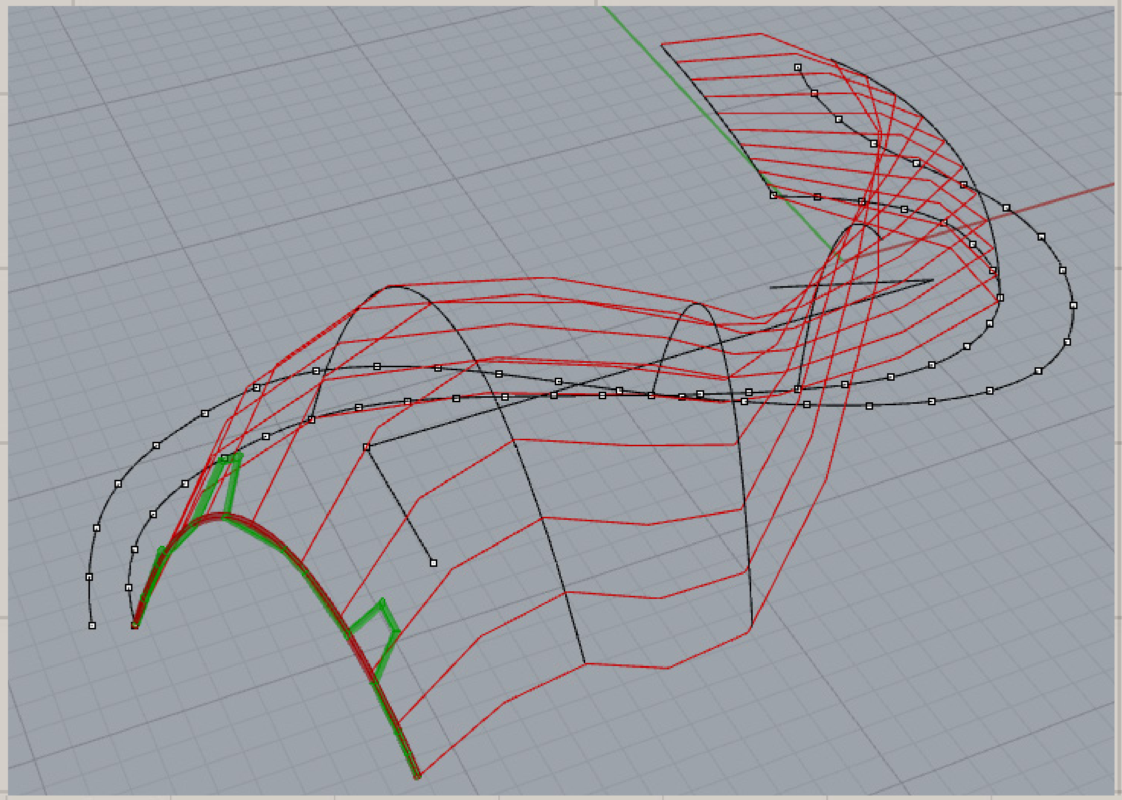


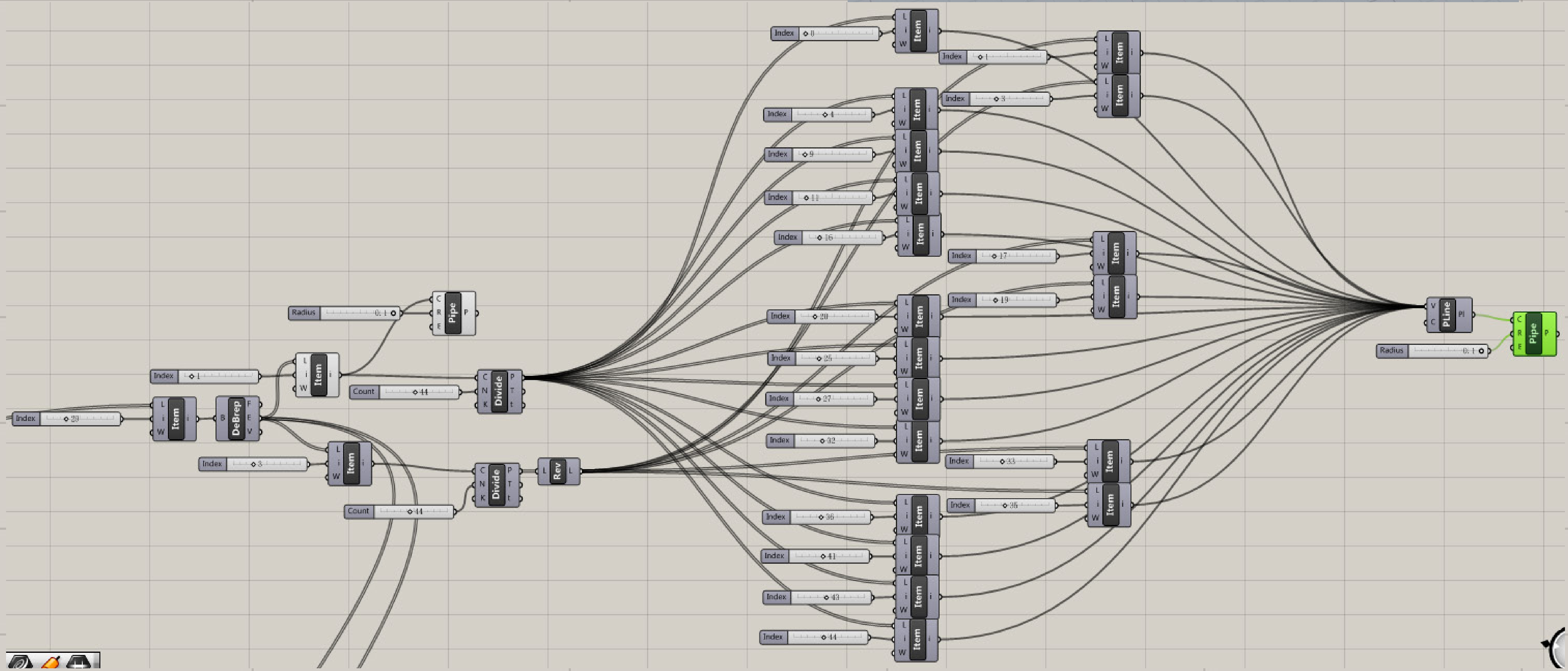


WAVE Pavilion

GRASSHOPPER

Modelling





WAVE Pavilion

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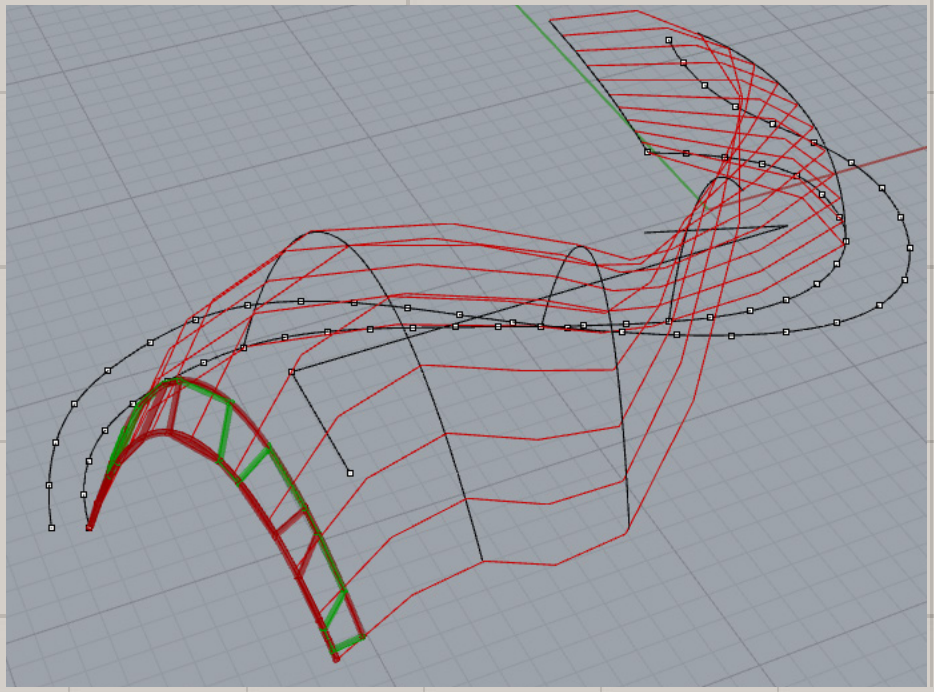
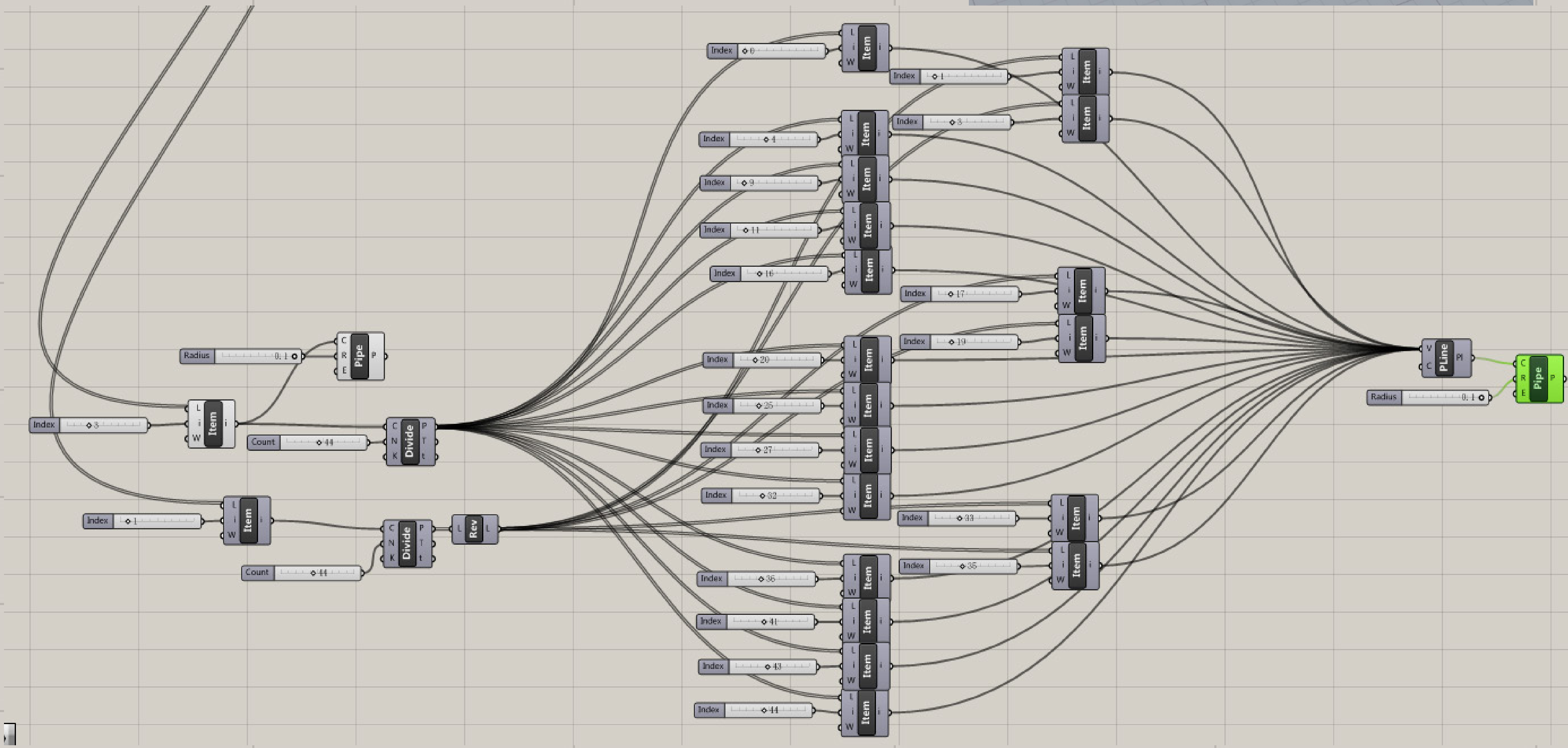
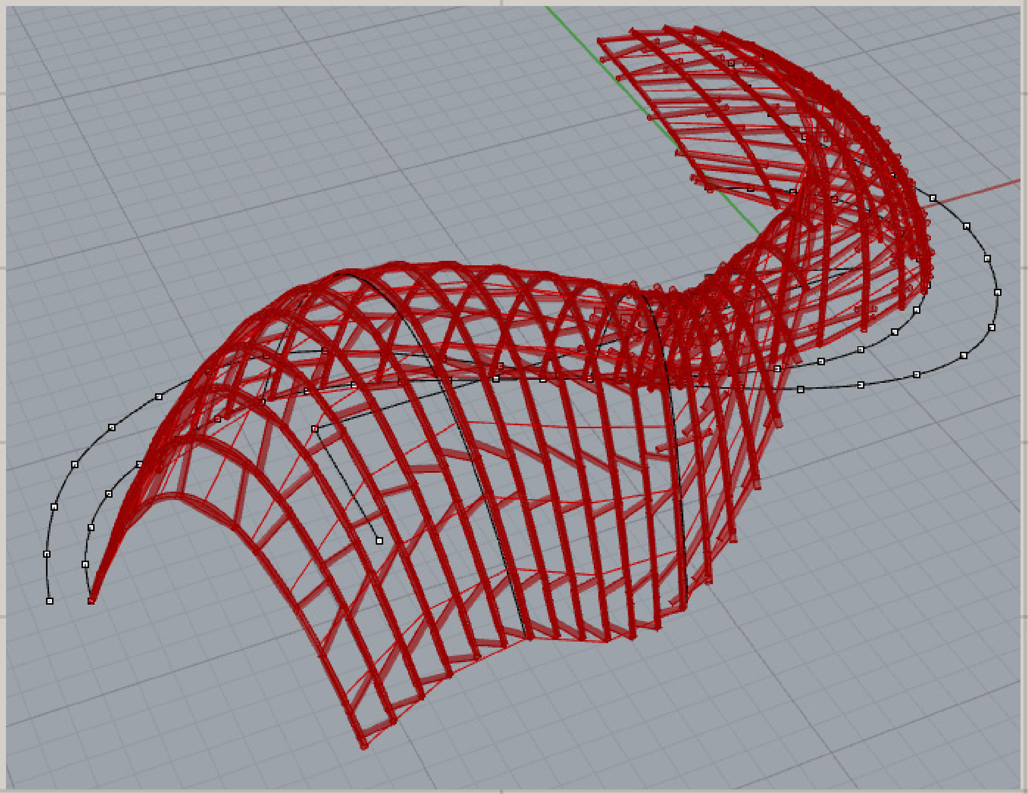
Modelling

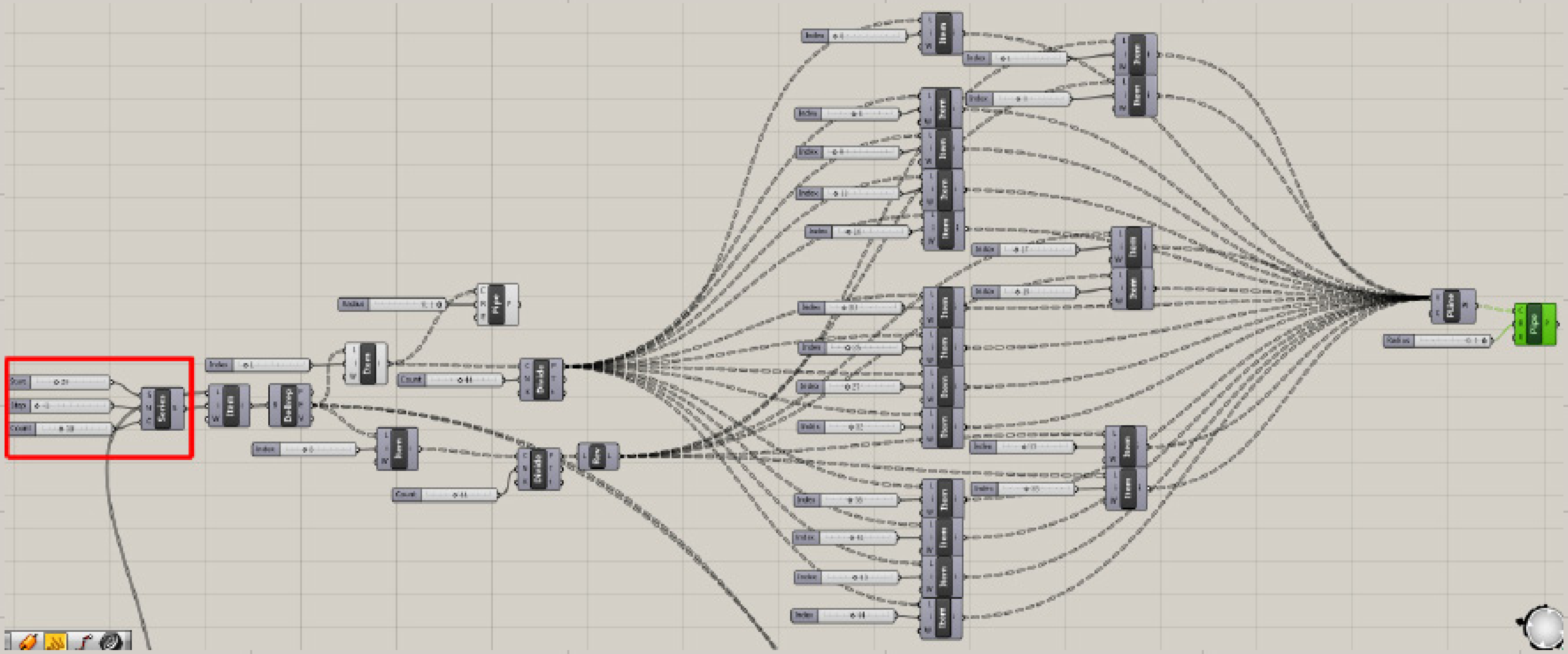




WAVE Pavilion

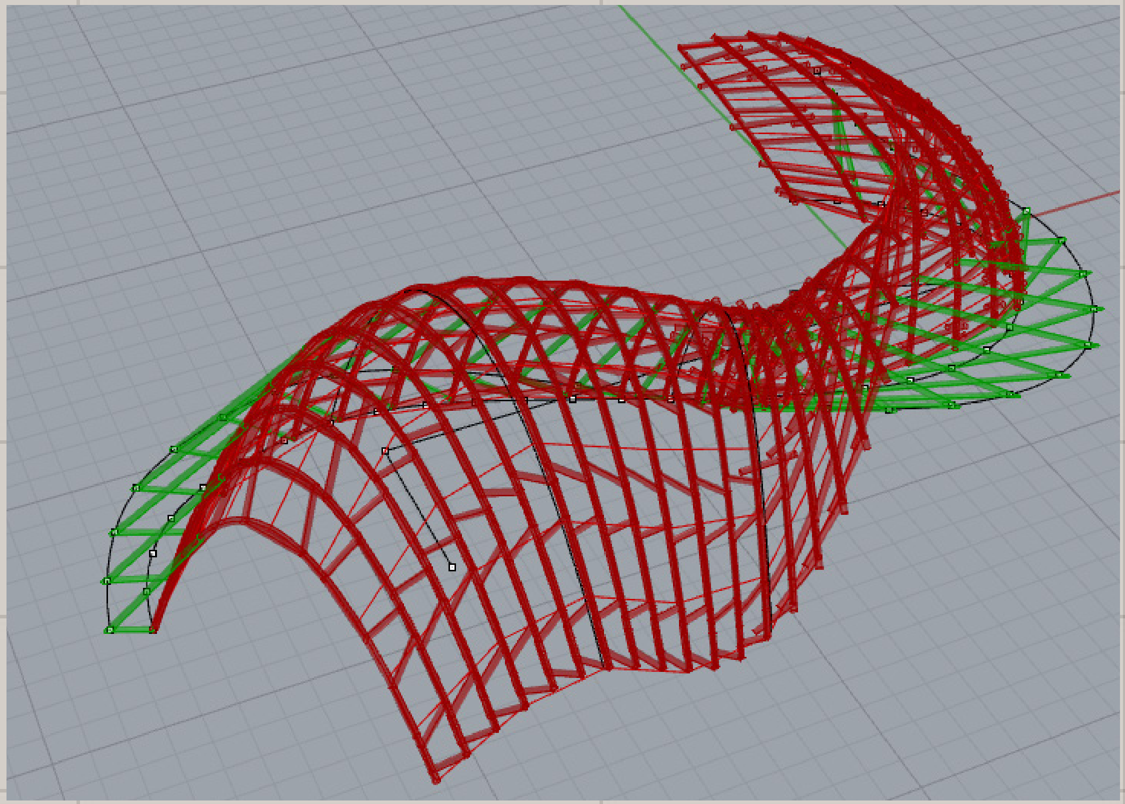
GRASSHOPPER
Modelling

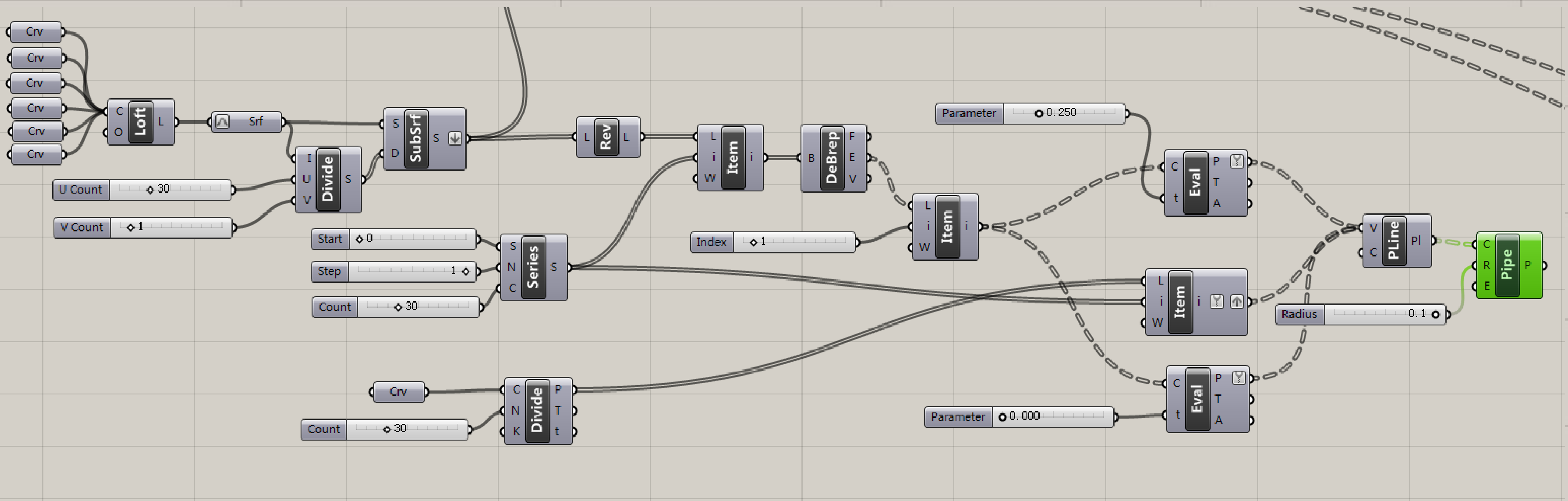




WAVE Pavilion

GRASSHOPPER
Modelling

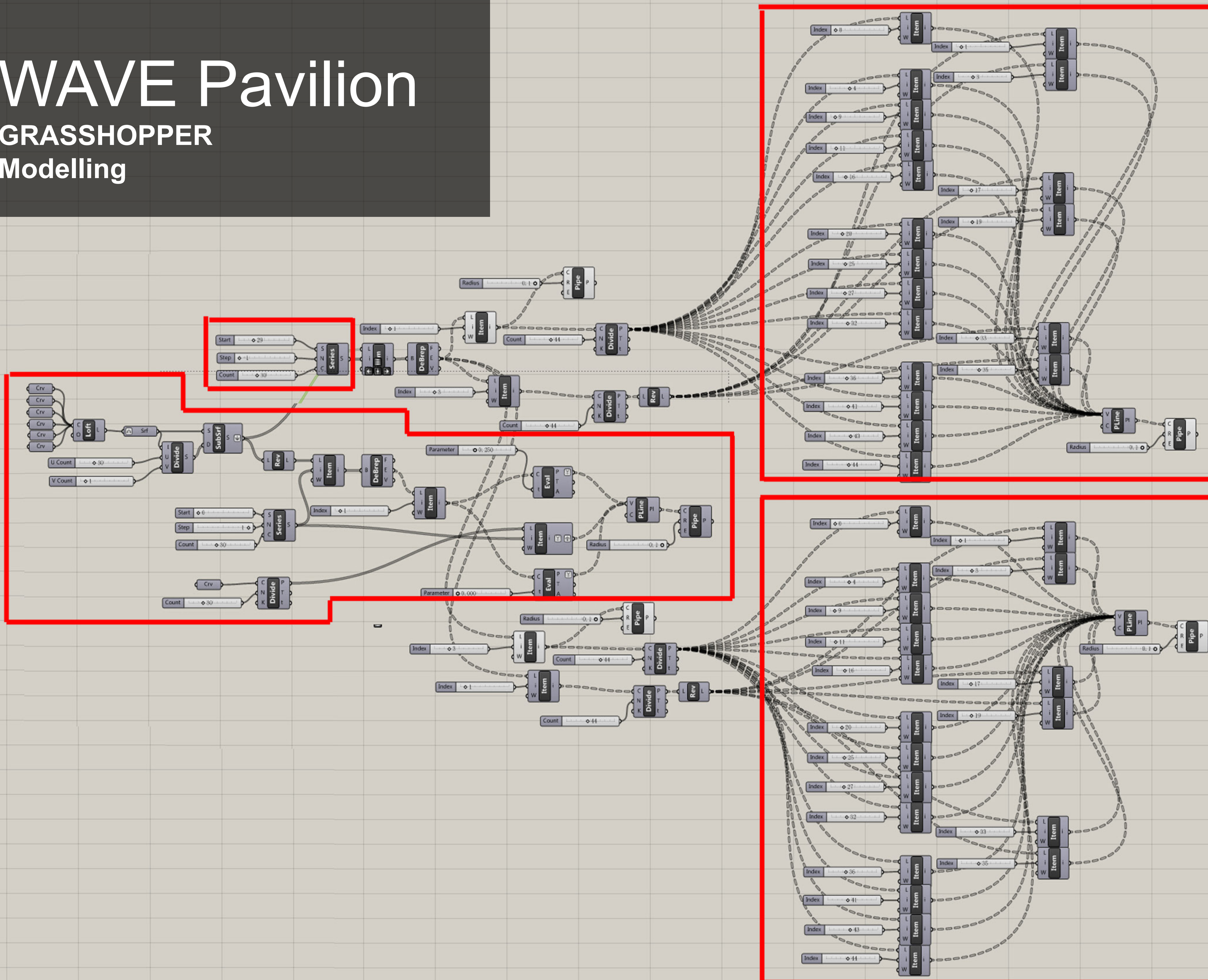




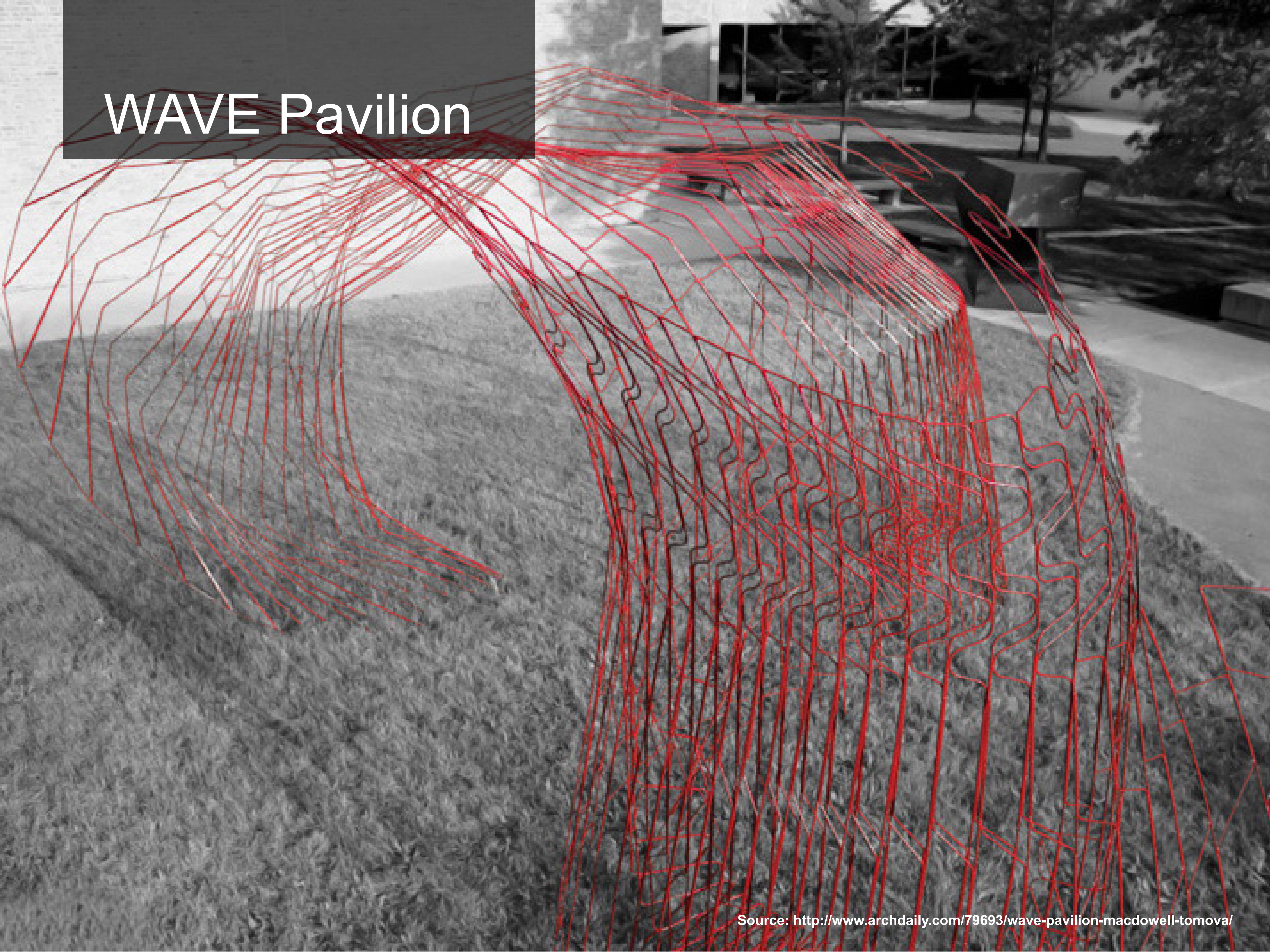
WAVE Pavilion

GRASSHOPPER

Modelling



WAVE Pavilion



Source: http://www.archdaily.com/79693/wave-pavilion-macdowell-tomova/

FORMING
SHELLSTAR PAVILION
ANDREW KUDLESS / MATSYS

PAVLO ZABOTIN 4061265

SHELLSTAR PAVILION

PROJECT DESCRIPTION

Shellstar is a lightweight temporary pavilion that maximizes its spatial performance while minimizing structure and material. Commissioned for Detour, an art and design festival in Hong Kong in December 2012, the pavilion was designed to be an iconic gathering place for the festival attendees. Located on an empty lot within the Wan Chai district of Hong Kong, the design emerged out of a desire to create a spatial vortex whereby visitors would feel drawn into the pavilion center and subsequently drawn back out into the larger festival site. Working fully within a parametric modeling environment, the design was quickly developed and iterated with the 6 weeks of design, fabrication, and assembly. The design process can be broken down into 3 processes that were enabled by advanced digital modeling techniques:

FORMFinding

The form emerged out of a digital form-finding process based on the classic techniques developed by Antonio Guadi and Frei Otto, among others. Using Grasshopper and the physics engine Kangaroo, the form self-organizes into the catenary-like thrust surfaces that are aligned with the structural vectors and allow for minimal structural depths.

SHELLSTAR PAVILION

PROJECT OUTLINE

Project architect: Andrew Kudless / Matsys

Location: Wan Chai, Hong Kong

Function: Experimental pavilion

Construction Year: September 2012

Construction Time: 3 weeks

Dimmensions: 8x8x3 m

Materials: 4mm Translucent Coroplast,
Nylon Cable Ties,
Steel Foundations, PVC and Steel Reinforcement

Budget: 12.000 Euro

Major Fabricatio Method used: Forming

Modelling Software: Rhino, Grasshopper, Kangaroo, Python, Lunchbox, Rhinoscript


PLC

SHELLSTAR PAVILION

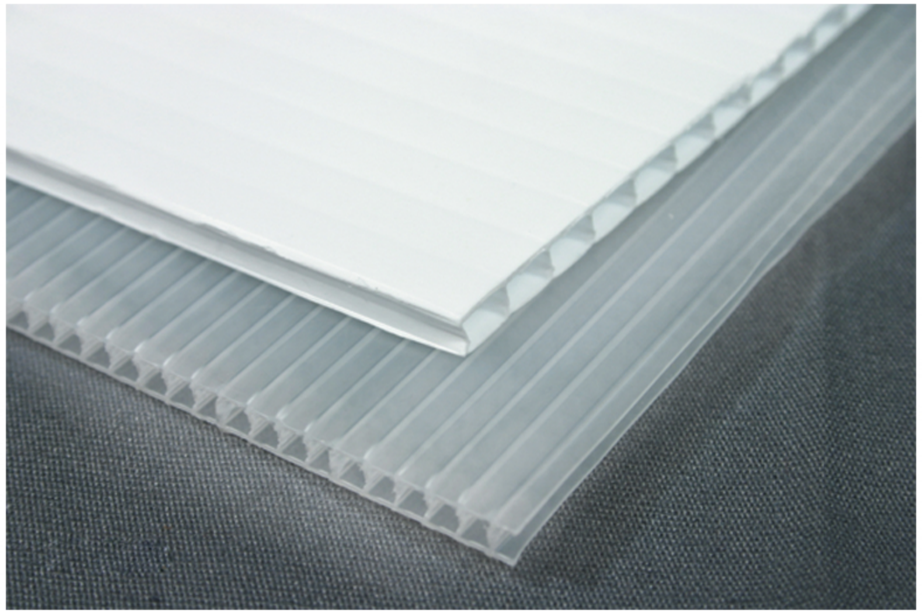
PROJECT FABRICATION

Using more custom python scripts, each cell was unfolded flat and prepared for fabrication.
The cell flanges and labels were automatically added and the cell orientation was analyzed and then rotated to align the flutes of the Coroplast material with the principal bending DIRECTION of the surface.

SHELLSTAR PAVILION

PROJECT MATERIALS

Materials: 4mm Translucent Coroplast, Nylon Cable Ties, Steel Foundations, PVC and Steel Reinforcement



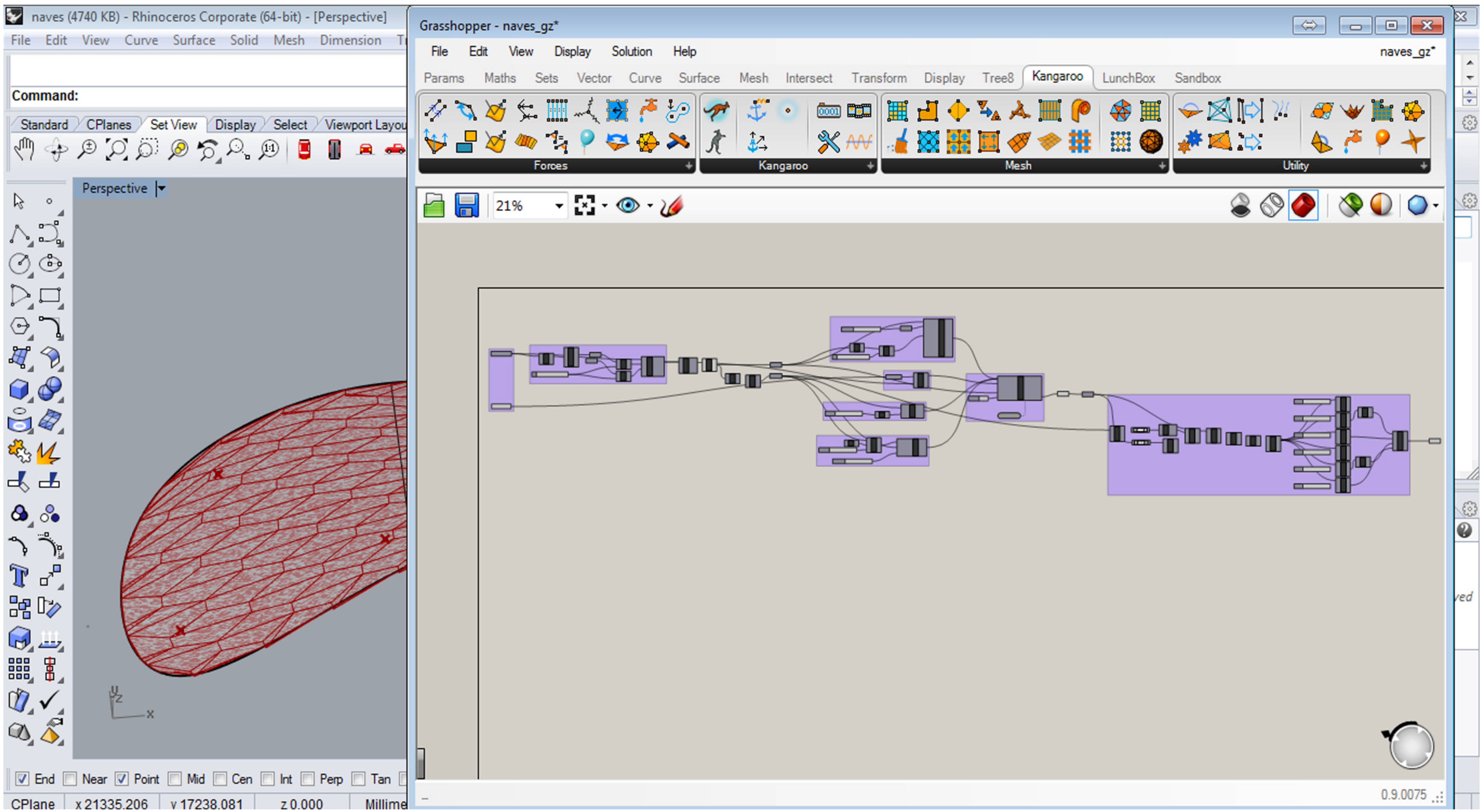
SHELLSTAR PAVILION

PROJECT SOFTWARE

The form emerged out of a digital form-finding process based on the classic techniques developed by Antonio Guadi and Frei Otto, among others. Using Grasshopper and the physics engine Kangaroo, the form self-organizes into the catenary-like thrust surfaces that are aligned with the structural vectors and allow for minimal structural depths.

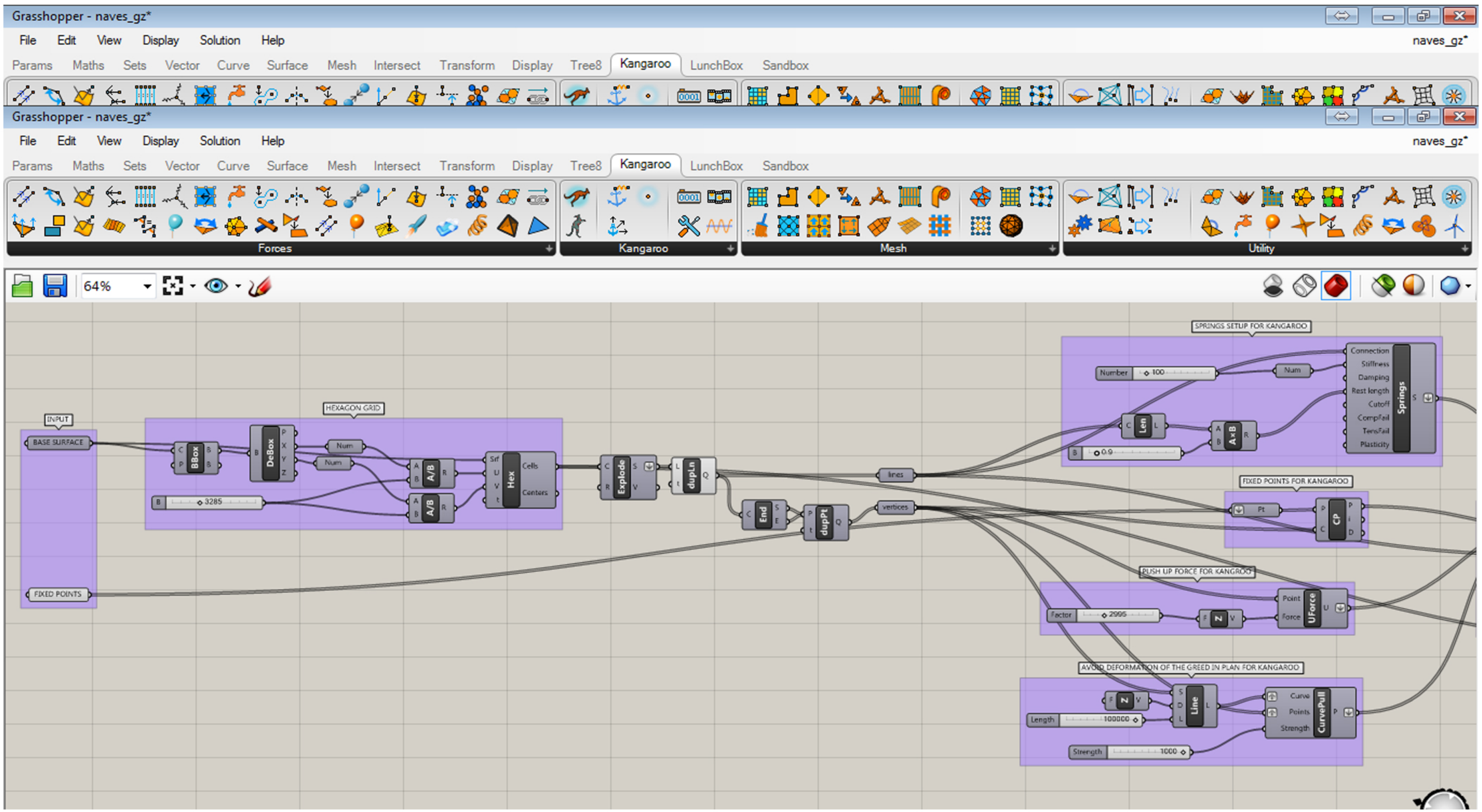
SHELLSTAR PAVILION

GRASSHOPPER MODELLING



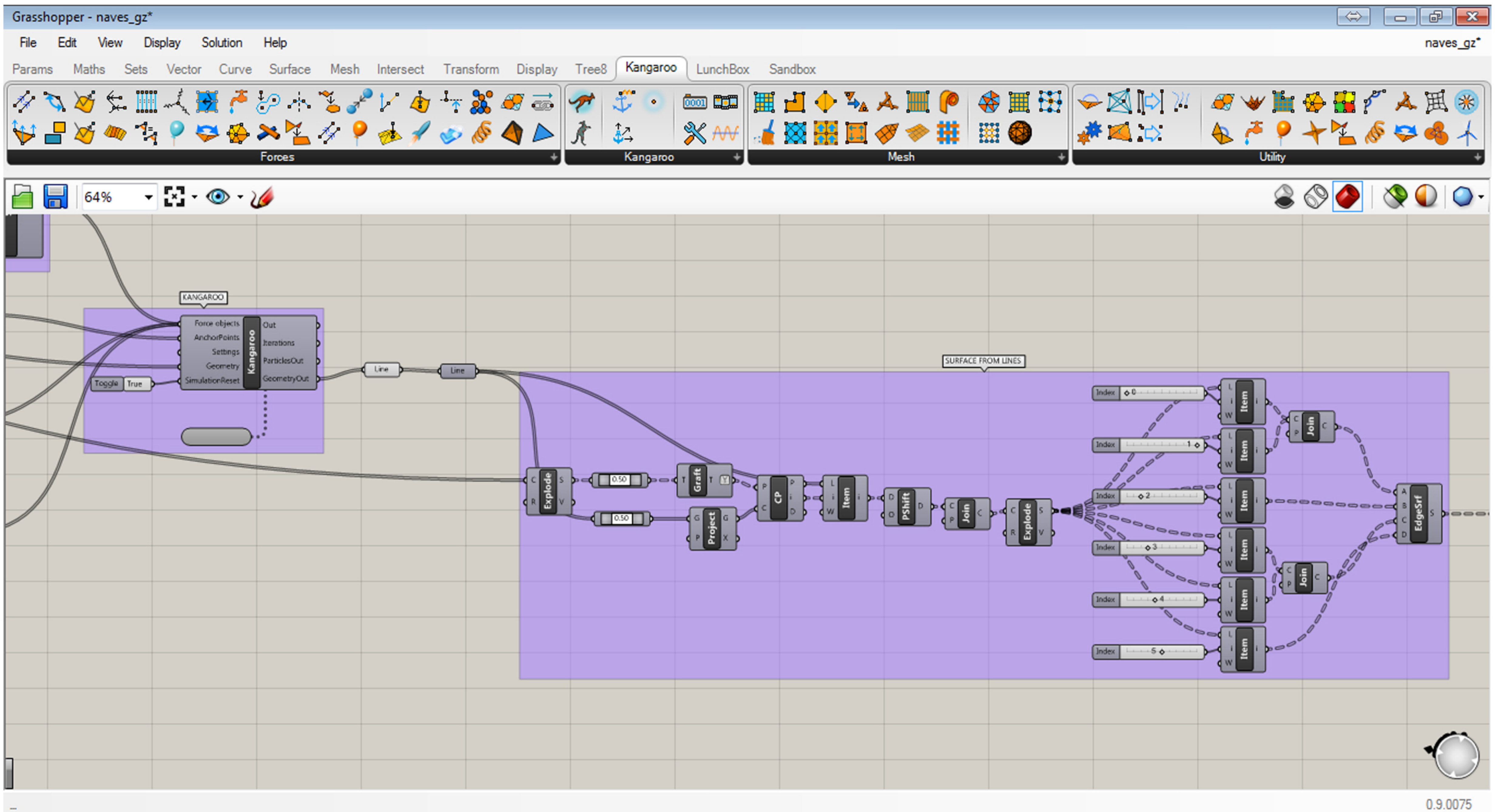
SHELLSTAR PAVILION

GRASSHOPPER
MODELLING



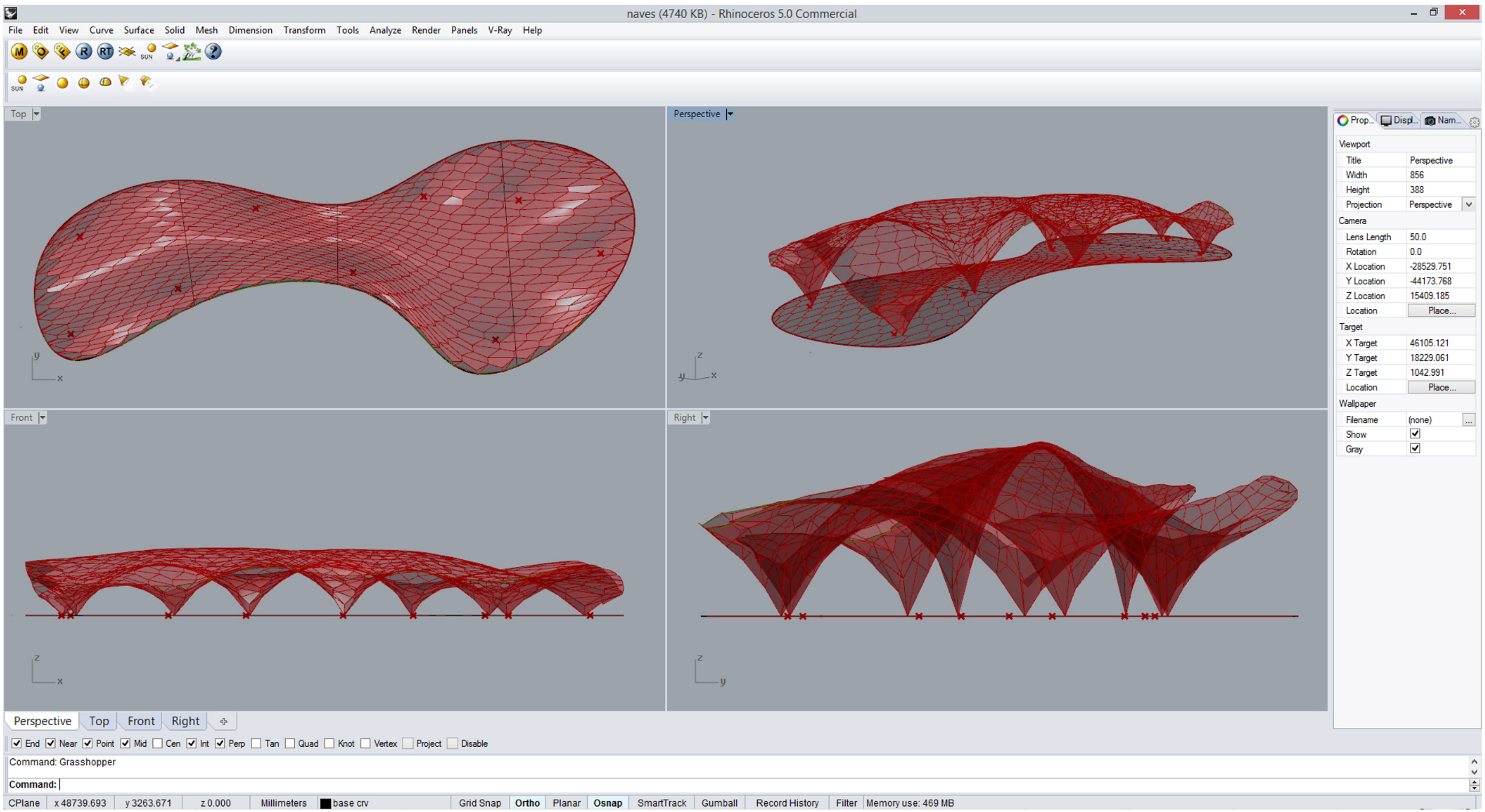
SHELLSTAR PAVILION

GRASSHOPPER
MODELLING



SHELLSTAR PAVILION

GRASSHOPPER MODELLING



Forming Pangdoranée

KimNyoung, Jeju Island,

Asiya Salimova

Source: http://hg-architecture.com/?ckattempt=3

Pangdoranée

Project OUTLINE

Project Architect / Artist: Ju-Yong Park(Scientist), Byeong-Sam Jeon(Artist)k

Location: KimNyoung, Jeju Island, Korea, 2015

Investor: posco (www.posco.com)

Function: Permanent Installation

Construction Year: 2015

Dimmensions: height 2,7 m, width 3 m

Construction Team: Byeong-Sam Jeon and 2 more persons

Materials Used: Steel panels, steel anchors.
Budget: 1500 Euro

Major Fabrication Method Used: Forming

Secondary Fabrication Methods: tessellation

Fabricated By: Laser Cutter

Type Of Construction: essellated formed steel panels.

Modelling Software: Rhino + Grasshopper

Source: http://hg-architecture.com/?ckattempt=3

Pangdoranée

Project DESCRIPTION

rmanent Installation, KimNyoung, Jeju Island, Korea, 2015

Collaboration with Ju-Yong Park(Scientist) + Byeong-Sam Jeon(Artist)

The project located on Olle Trail around Kim Nyoung-Lee, Jeju Island, represents a meaning of healing to encourage community people and tourists to relax at the inside of ‘Pangdol’.
This project provides the public space for resting for everyone including community and tourists.

the idea came from the appearance of the Pangdol stones that are part of the environment in the area

Sponsors : posco (www.posco.com)

Commission : Arts Council Korea, SCALe – Nature + Media Anualle

http://hg-architecture.com/?ckattempt=3

Pangdoranée

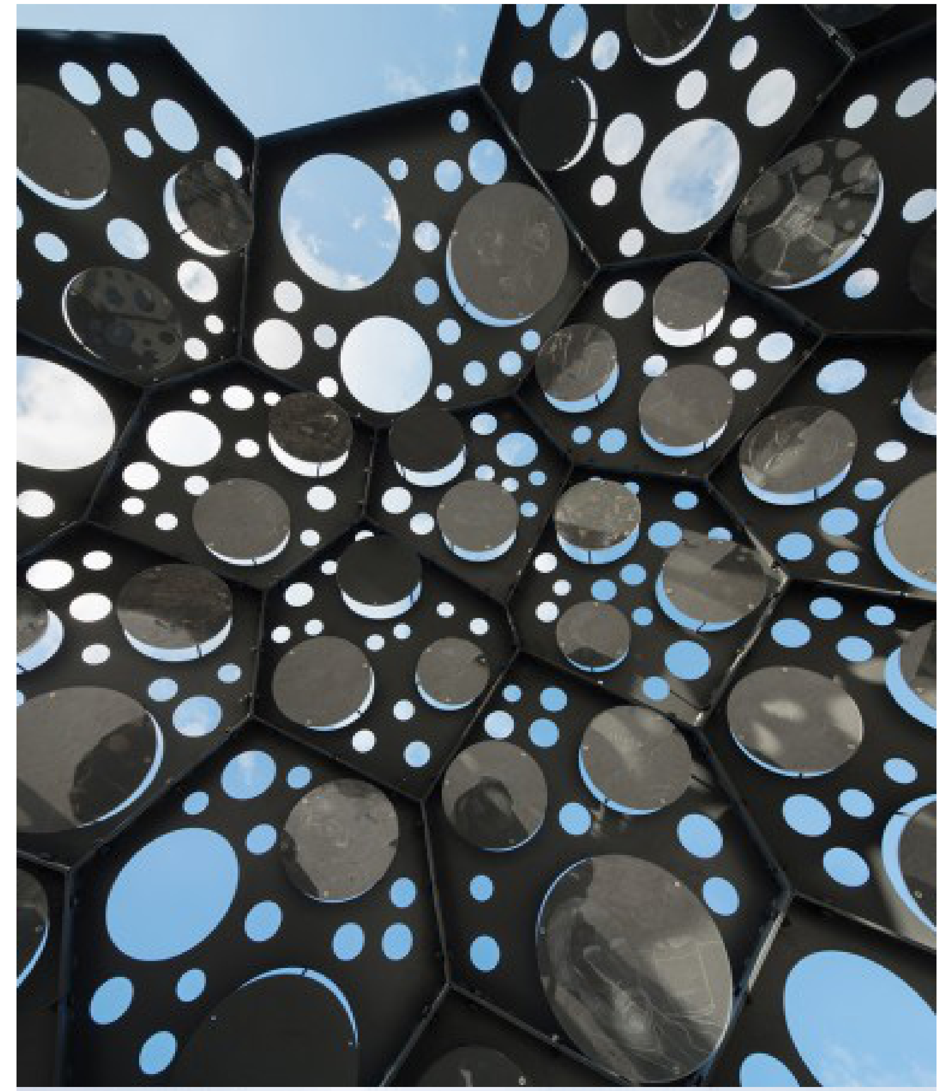
FABRICATION

http://hg-architecture.com/?ckattempt=3

Pangdoranée

Project FABRICATION

All steel panels are fabricated with a help of Laser Cutter. Units module composed of Hexagon and pentagon were pre-fabricated at factory and assembled on site just for a day.
The structure consist of: steel panels (perforated),
steel framing (engird perforated steel panels)
subtracted surface (moved inside the shape)
steel belt (basement)



http://hg-architecture.com/?ckattempt=3

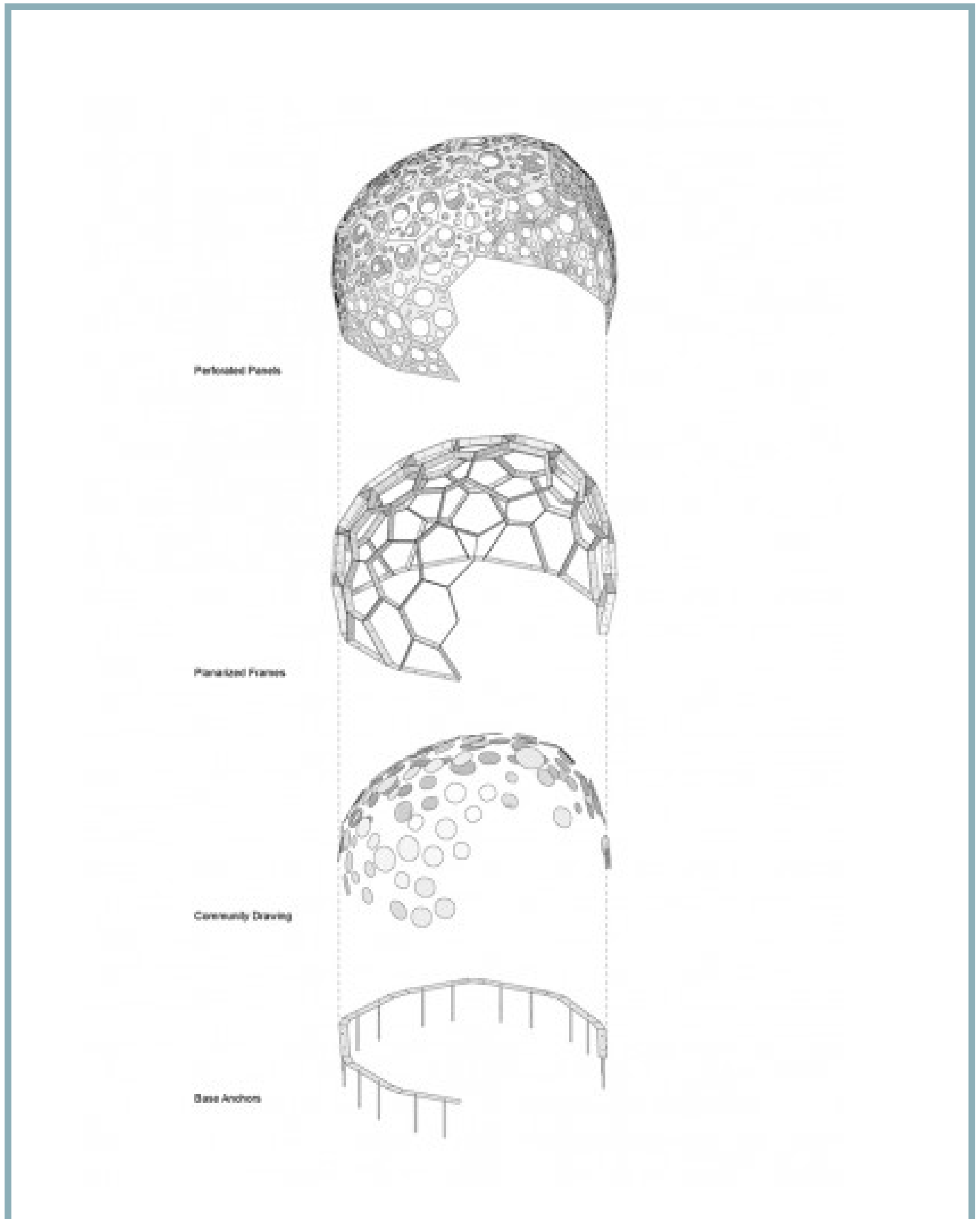
Pangdoranée

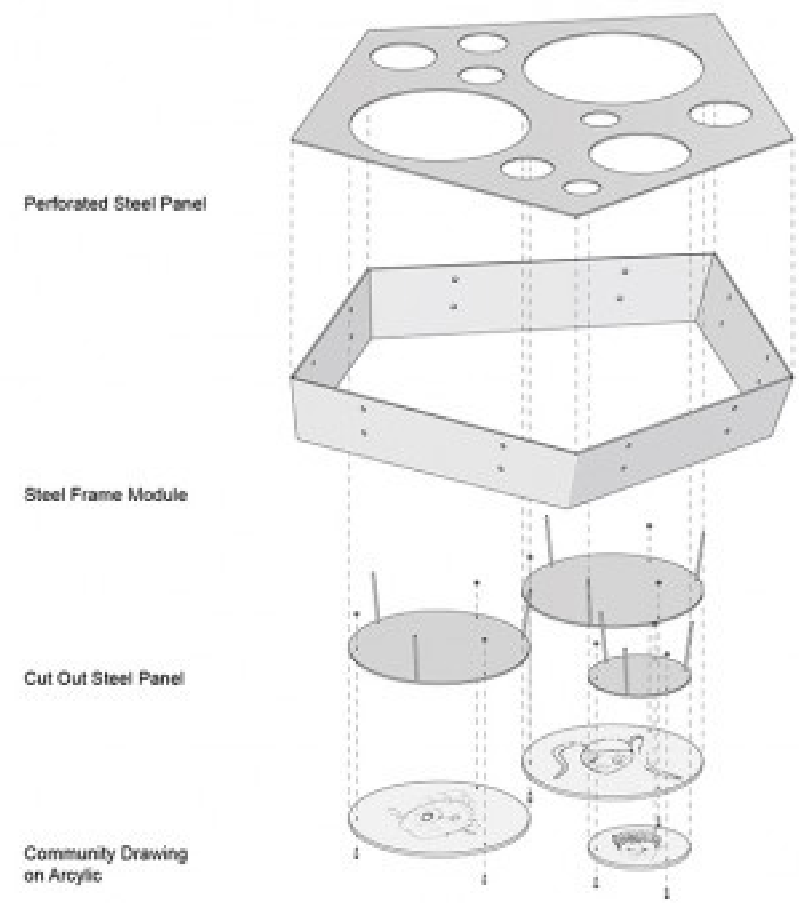
Project MATERIALS

Pangdoranee Pavilion Quantity Survey		
Steel		
	Material	**Quantity**
The shape	0 . 3 3 - 0.66sqm	66
Supporting structure	0.15*0.66-0.33	396
Size	2.7*3m	
Metal screws		
		1386

Pangdoranée

Project MATERIALS

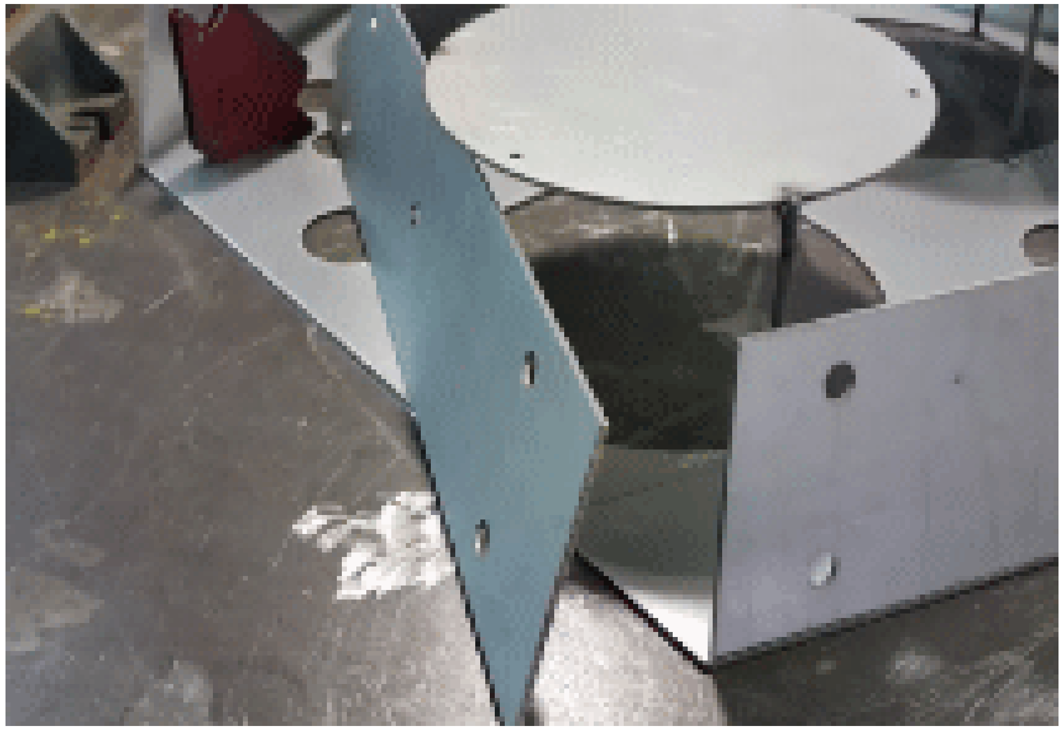


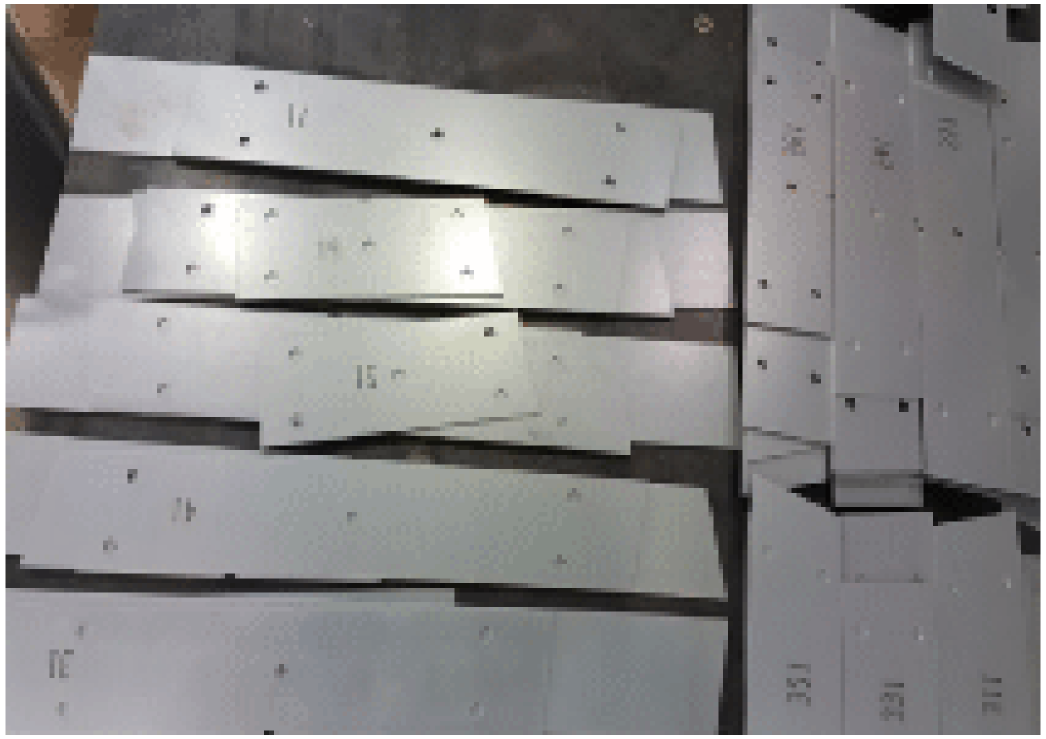


Pangdoranée

Project MACHINE / SOFTWARE

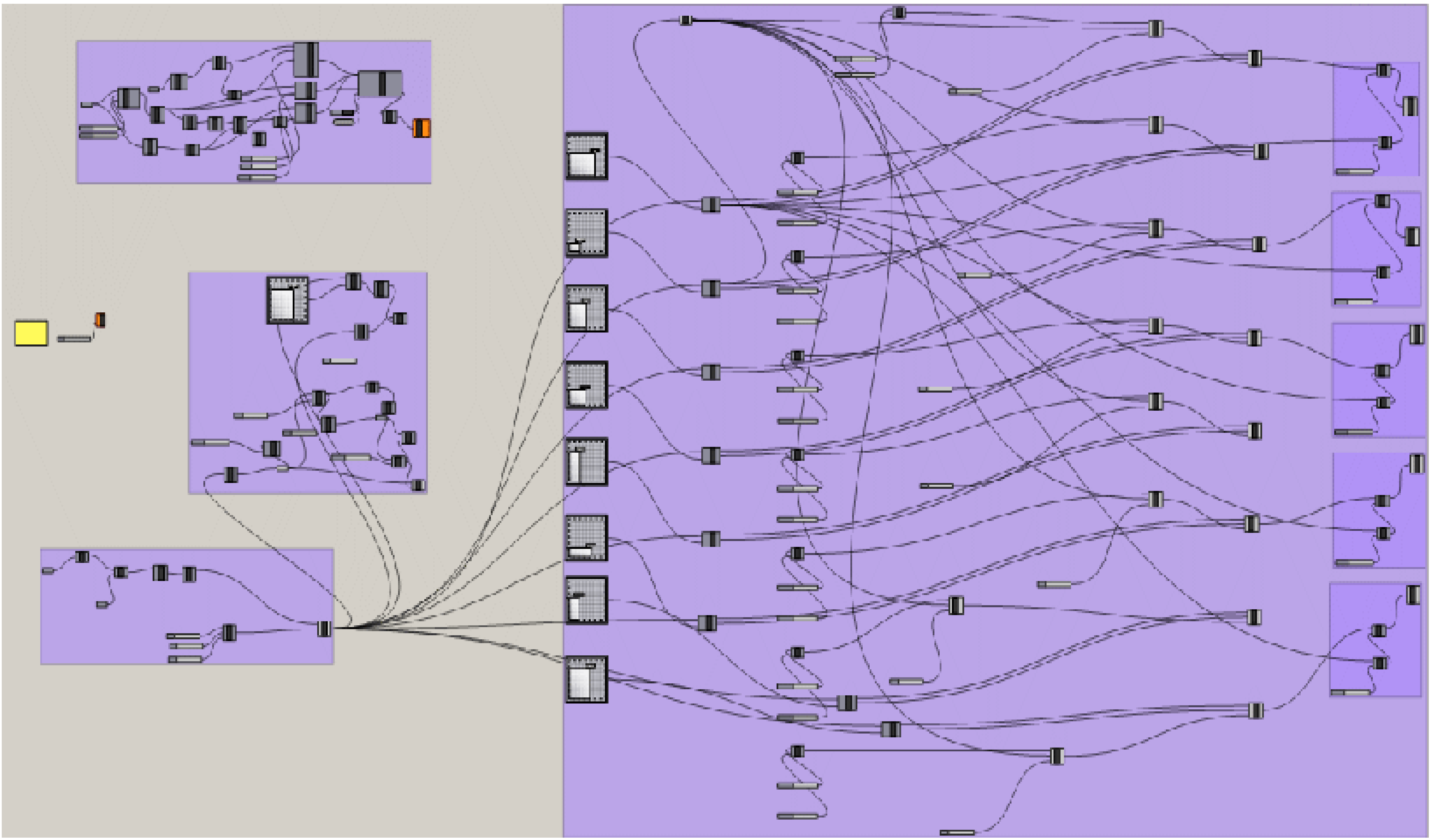
Laser Cutter





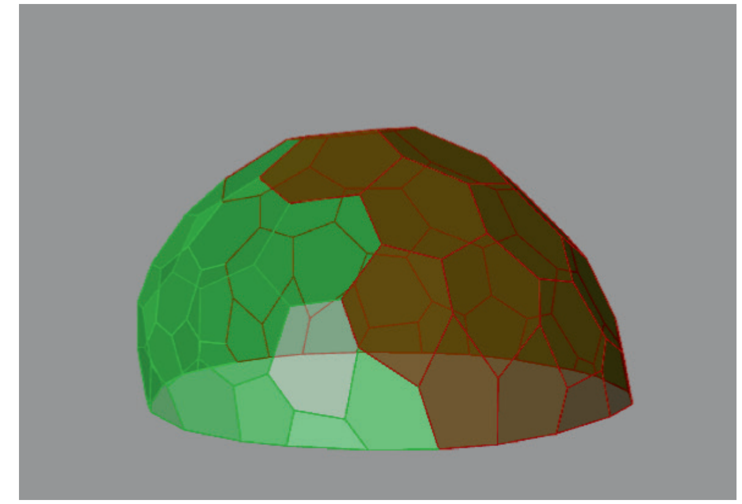
Pangdoranée

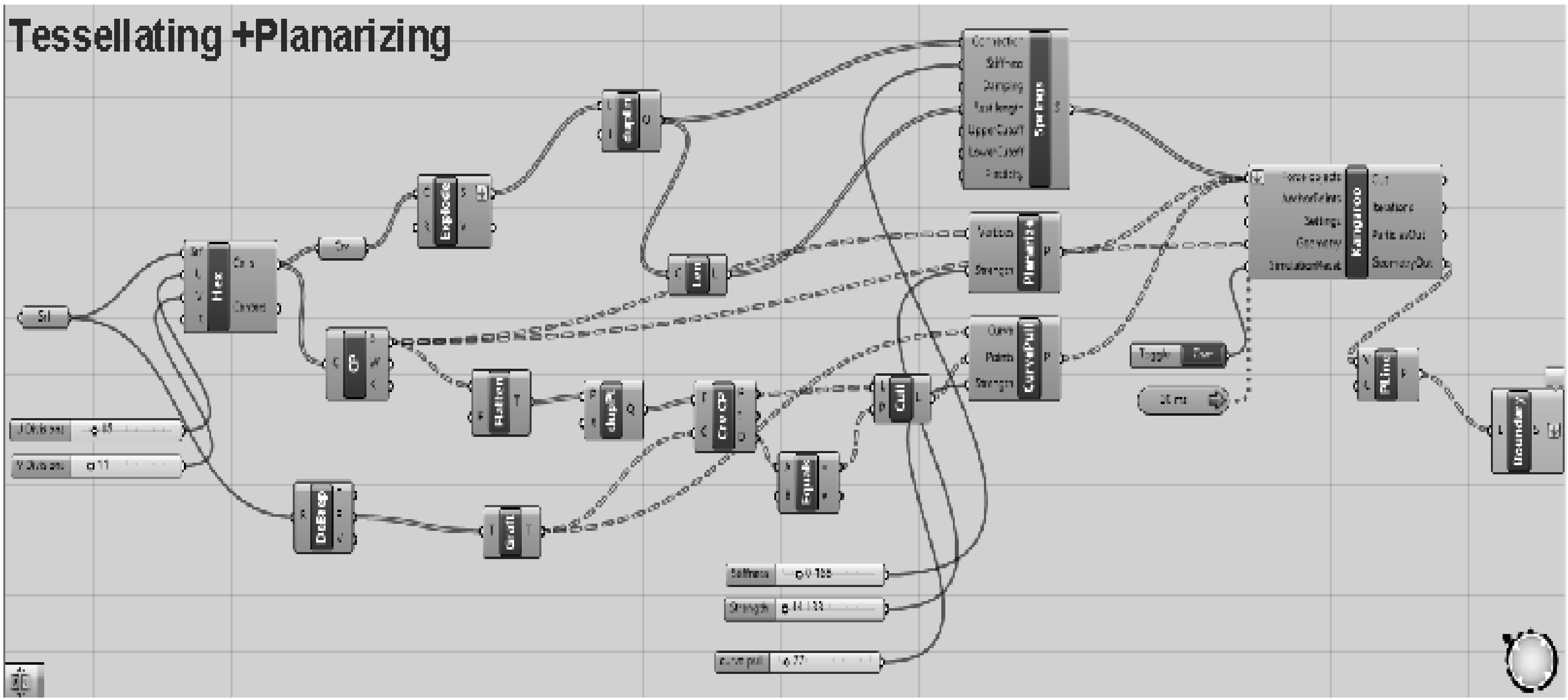
GRASSHOPPER
Modelling



Pangdoranée

GRASSHOPPER
Modelling

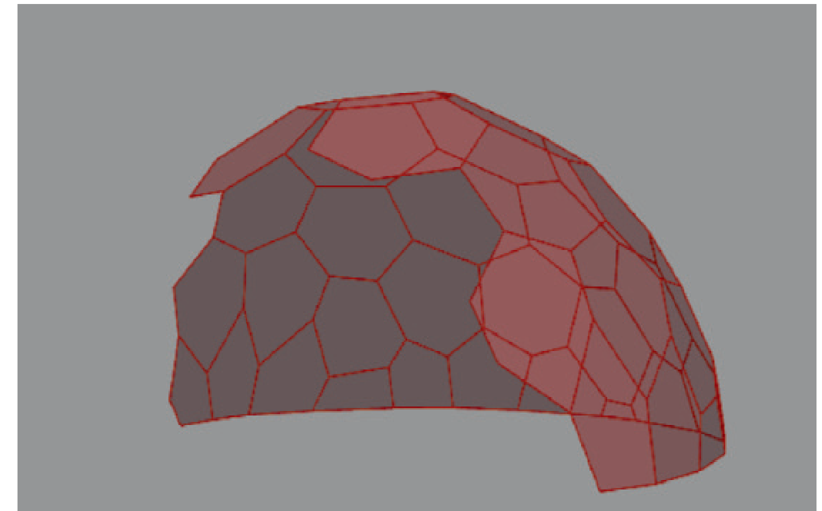


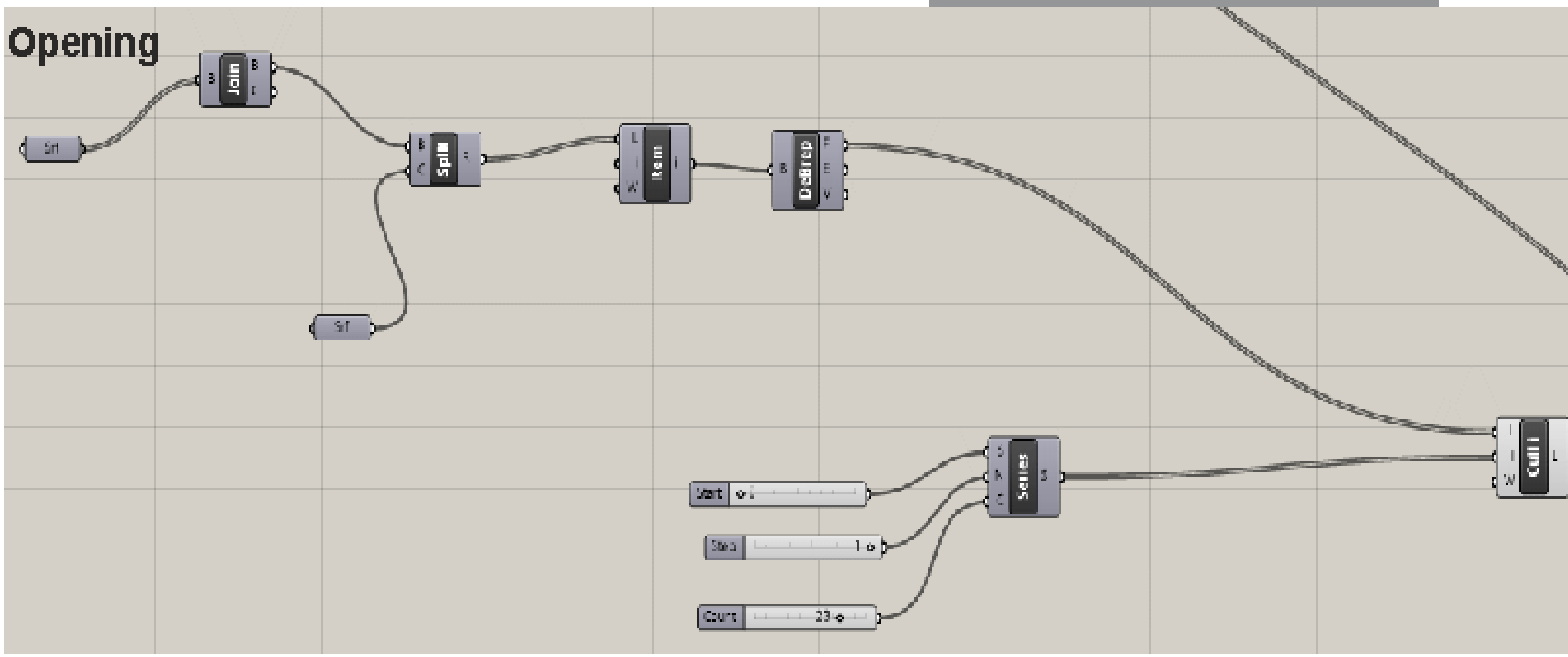


Planarizing has been done by Kangaroo plugin “Kangaroo physics”
The component Boundary gives absolutely is orange because it’s necessary to turn Toggle to “False” to make it work.
Once there is planarized surface, it is possible to make openings, the perforating and layering.

Pangdoranée

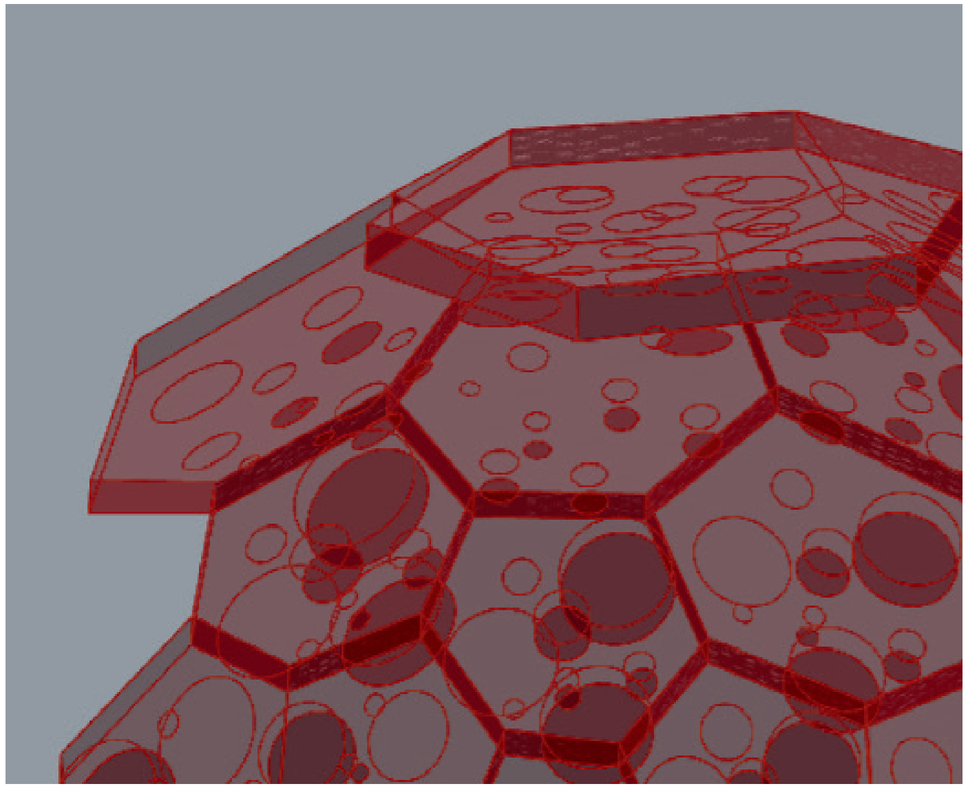
GRASSHOPPER
Modelling

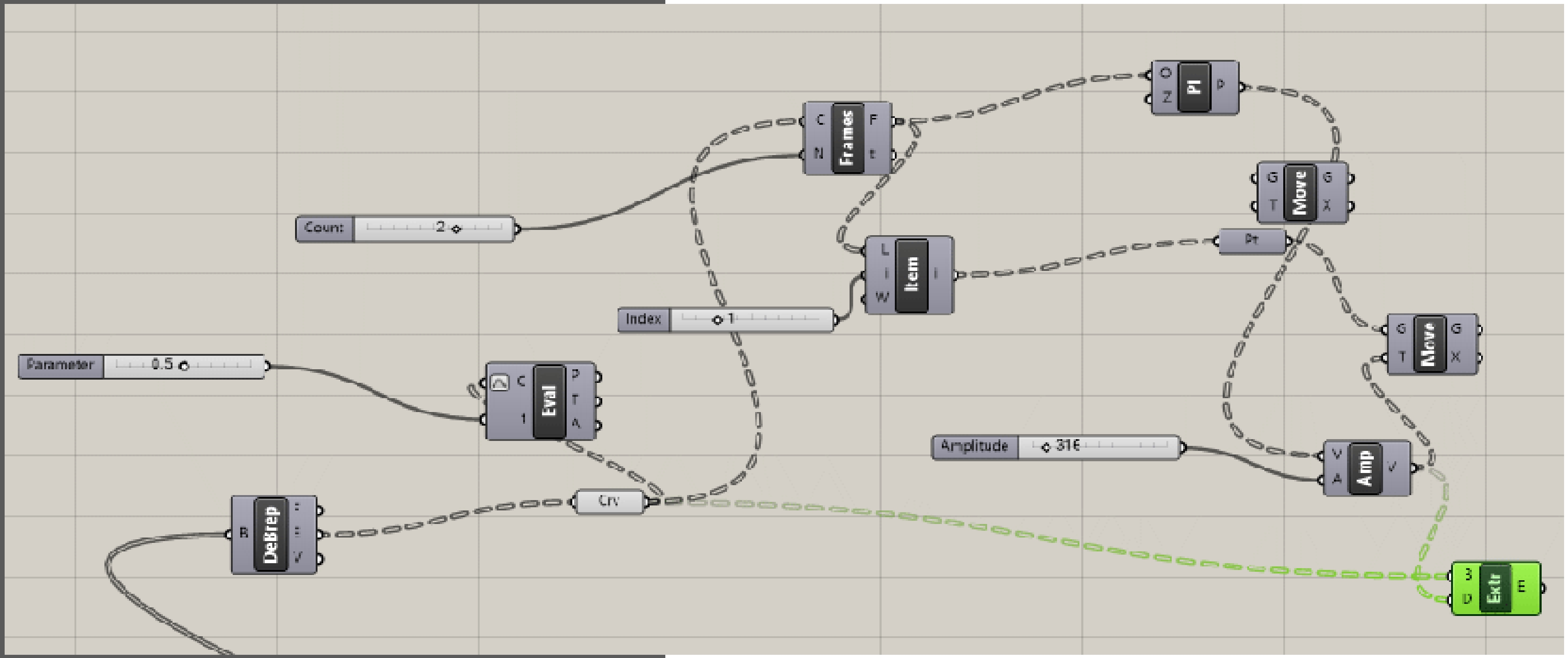




Pangdoranée

GRASSHOPPER
Structural Analysis





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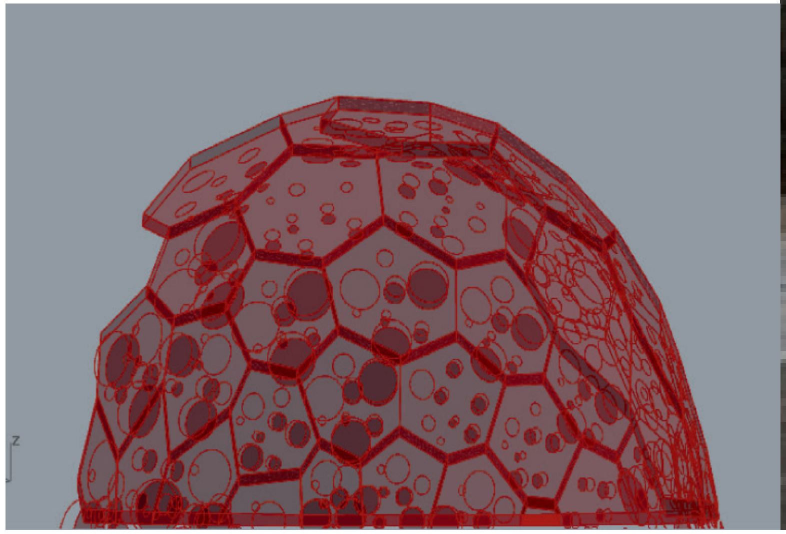

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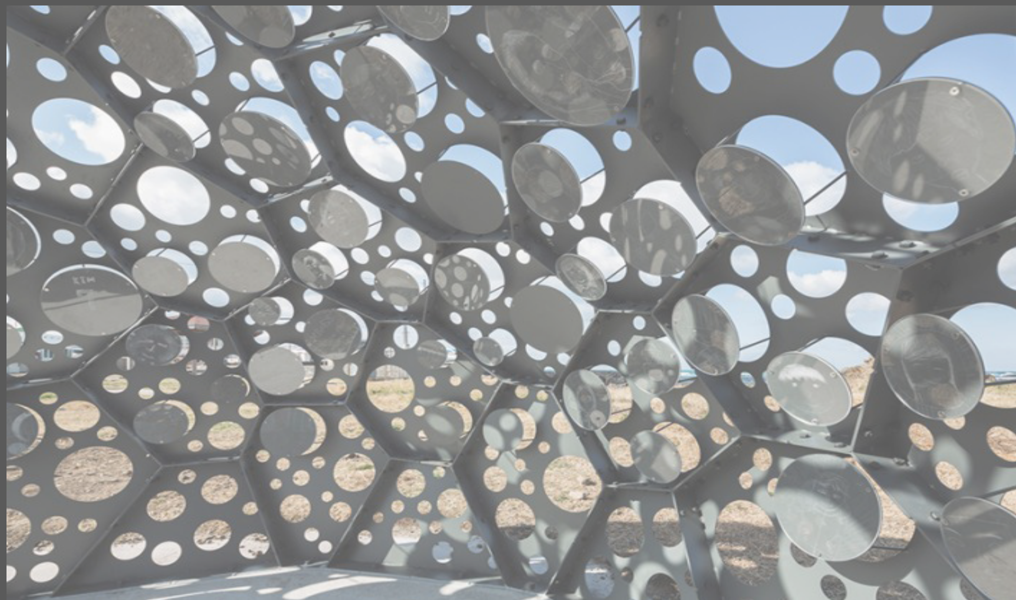
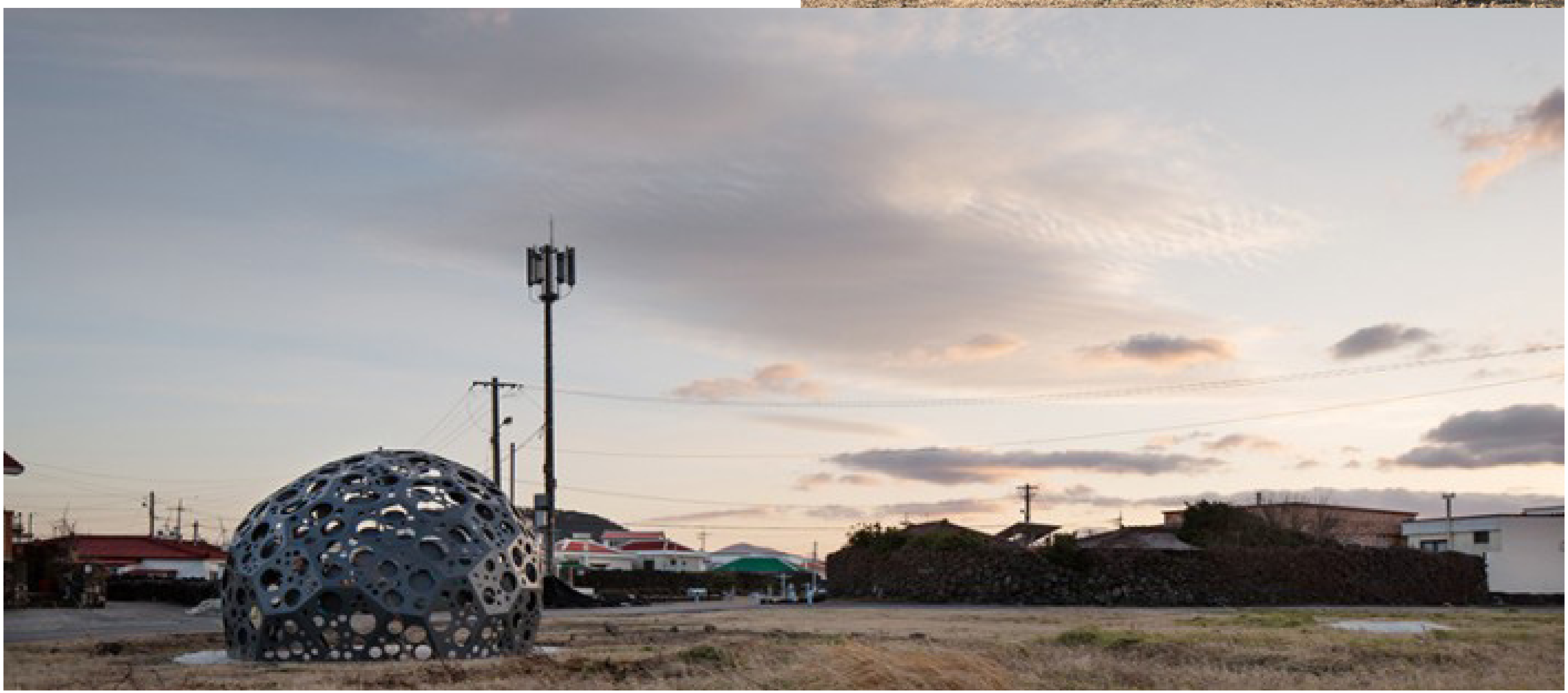





FORMING
The Singapore University of Technology and Design (SUTD) library
CITY FORM LAB PROJECT
Mariia Potapova
http://cityform.mit.edu/projects/sutd-gridshell.html

SUTD Library Pavilion

Project OUTLINE

Project Architect / Artist: City Form Lab

Location: Dover RD, Singapore

Investor: Arina International Hogan (AIH), ARUP, Autodesk

Function: Pavilion

Construction Year: 2013

Dimmensions: 5m High, 15m Length

Construction Team: Arina International Hogan (AIH) and SUTD students, staff

Materials Used: Unique plywood panels, Unique steel cladding tiles, Unique plywood spacer blocks

Budget: XXXX Euro

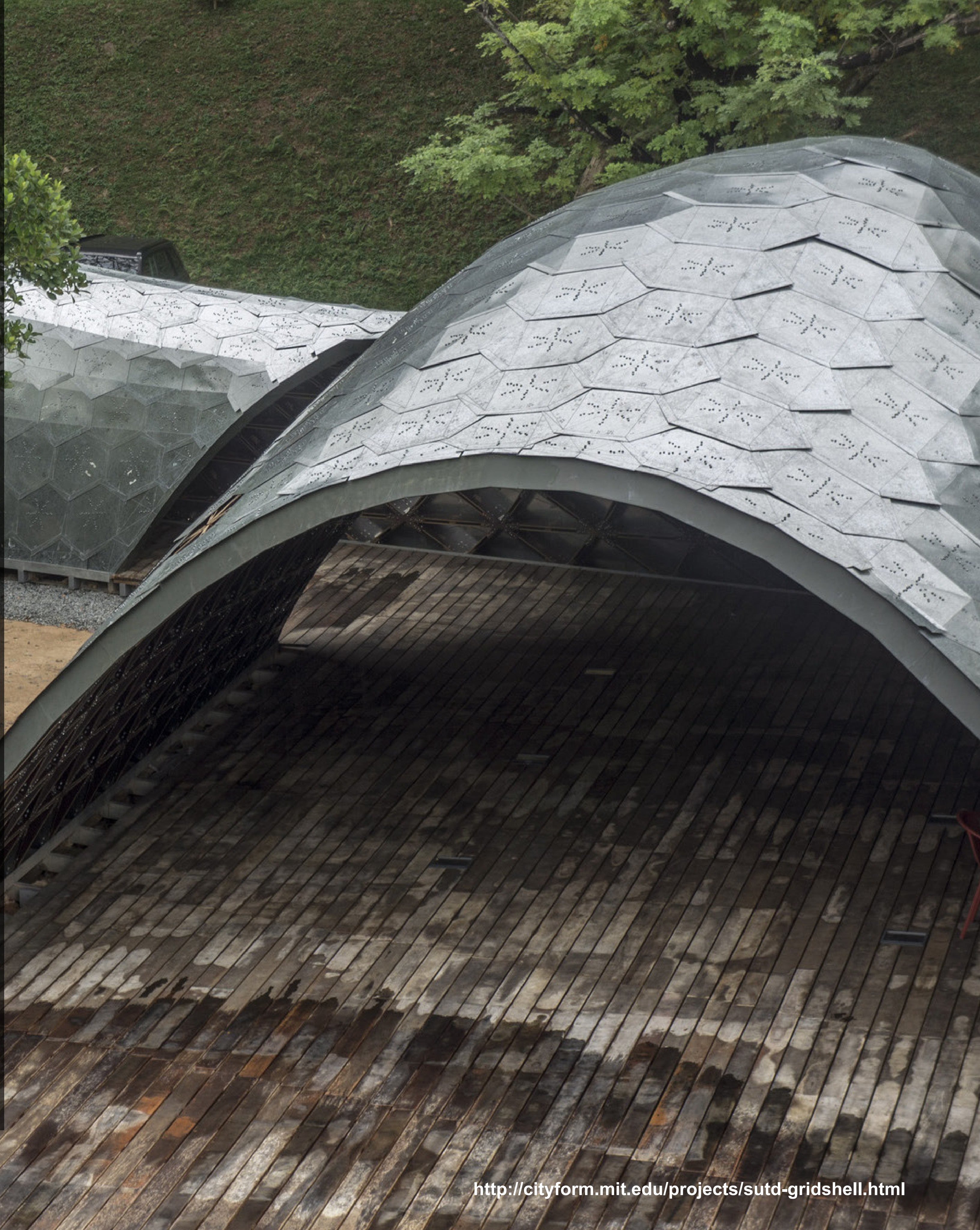
Major Fabrication Method Used: Forming

Secondary Fabrication Methods: Teseleting

Fabricated By: (CNC, laser cutter)

Type Of Construction: Wood Frame

Modelling Software: Rhino + Grasshopper

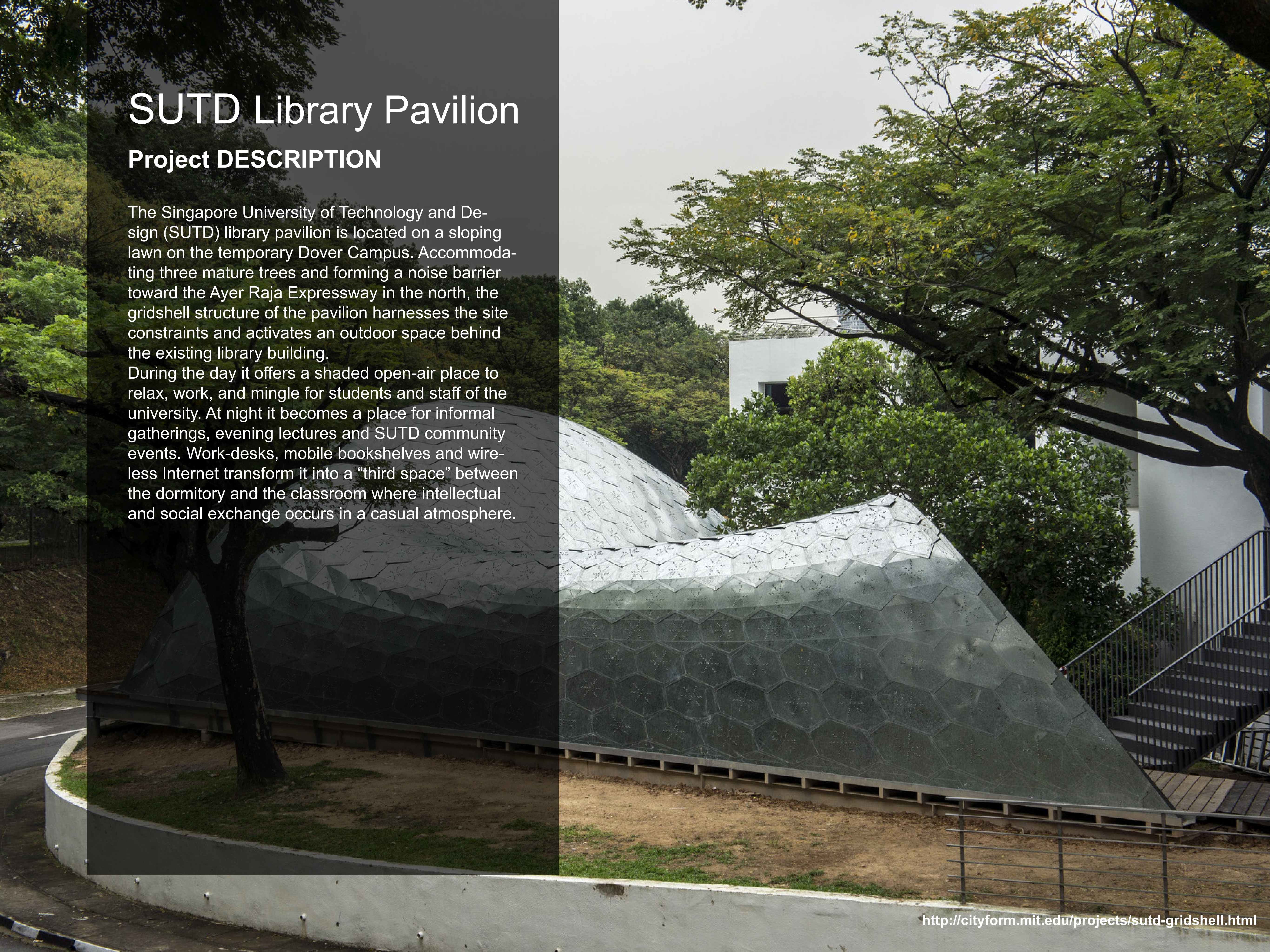


SUTD Library Pavilion

Project DESCRIPTION

The Singapore University of Technology and Design (SUTD) library pavilion is located on a sloping lawn on the temporary Dover Campus. Accommodating three mature trees and forming a noise barrier toward the Ayer Raja Expressway in the north, the gridshell structure of the pavilion harnesses the site constraints and activates an outdoor space behind the existing library building.

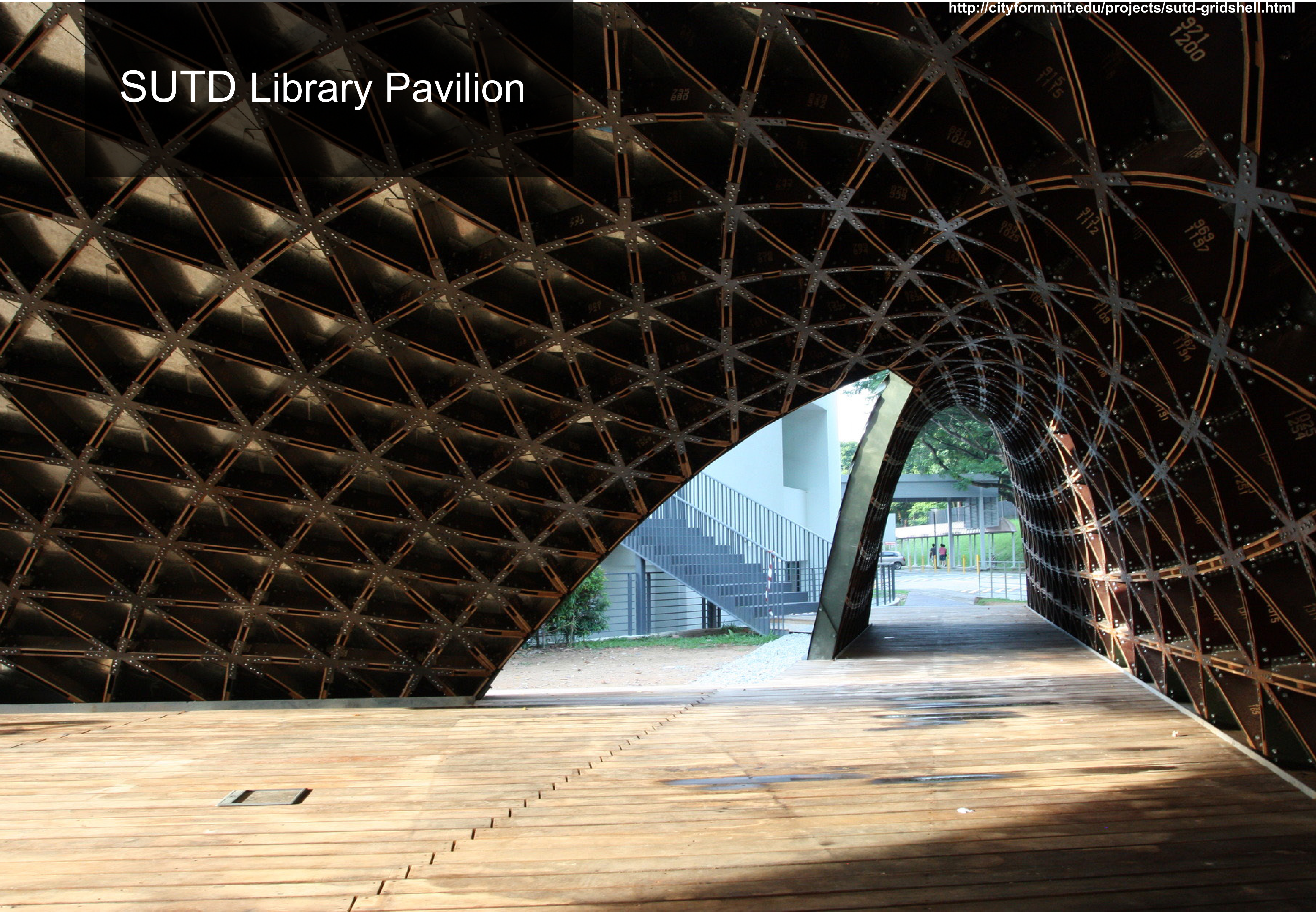
During the day it offers a shaded open-air place to relax, work, and mingle for students and staff of the university. At night it becomes a place for informal gatherings, evening lectures and SUTD community events. Work-desks, mobile bookshelves and wireless Internet transform it into a “third space” between the dormitory and the classroom where intellectual and social exchange occurs in a casual atmosphere.



http://cityform.mit.edu/projects/sutd-gridshell.html

SUTD Library Pavilion

http://cityform.mit.edu/projects/sutd-gridshell.html



SUTD Library Pavilion

Project FABRICATION

Using computational design and computer controlled fabrication allowed the pavilion's complex three-dimensional form to be achieved with readily available materials and a streamlined assembly process at minimal cost. Unlike steel gridshells, it has no complex three-dimensional structural joints – all of its elements were prefabricated from strictly flat plywood and galvanized steel sheets on CNC machines in Singapore.

The site work thus comprised an orderly assembly of 3,000 unique plywood and 600 unique sheet-metal tiles based on only one drawing – the numeric map of a three-dimensional puzzle indicating which pieces fit next to which other pieces. ID numbers were engraved in the cutting process on each plywood and cladding element, which remain visible in the finished structure as ornament. First year SUTD students assisted with the pre-assembly of the pieces and the contractor erected the structure on site. The pavilion is designed to be dismantled and recycled after two years.

http://cityform.mit.edu/projects/sutd-gridshell.html

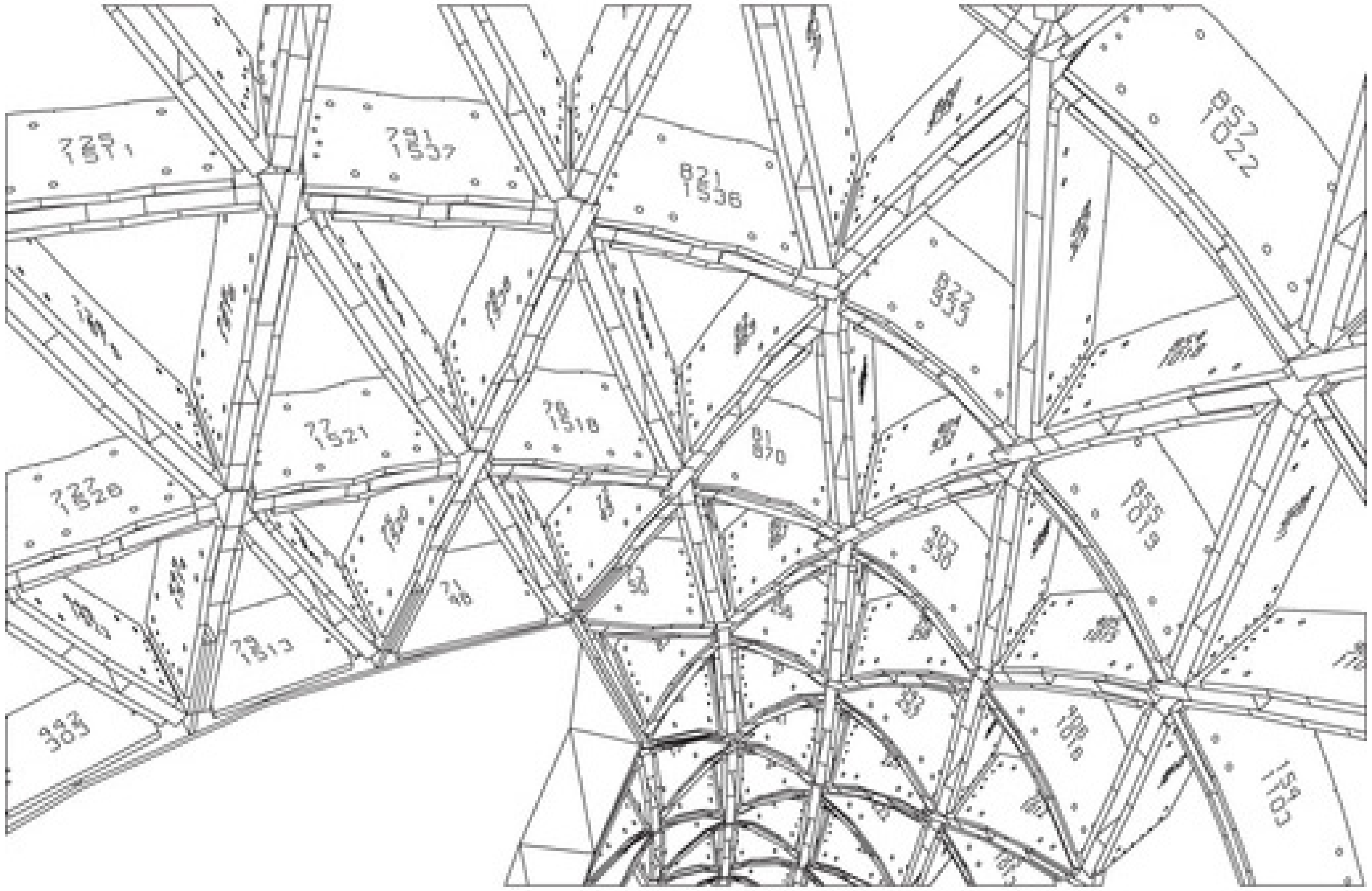
SUTD Library Pavilion

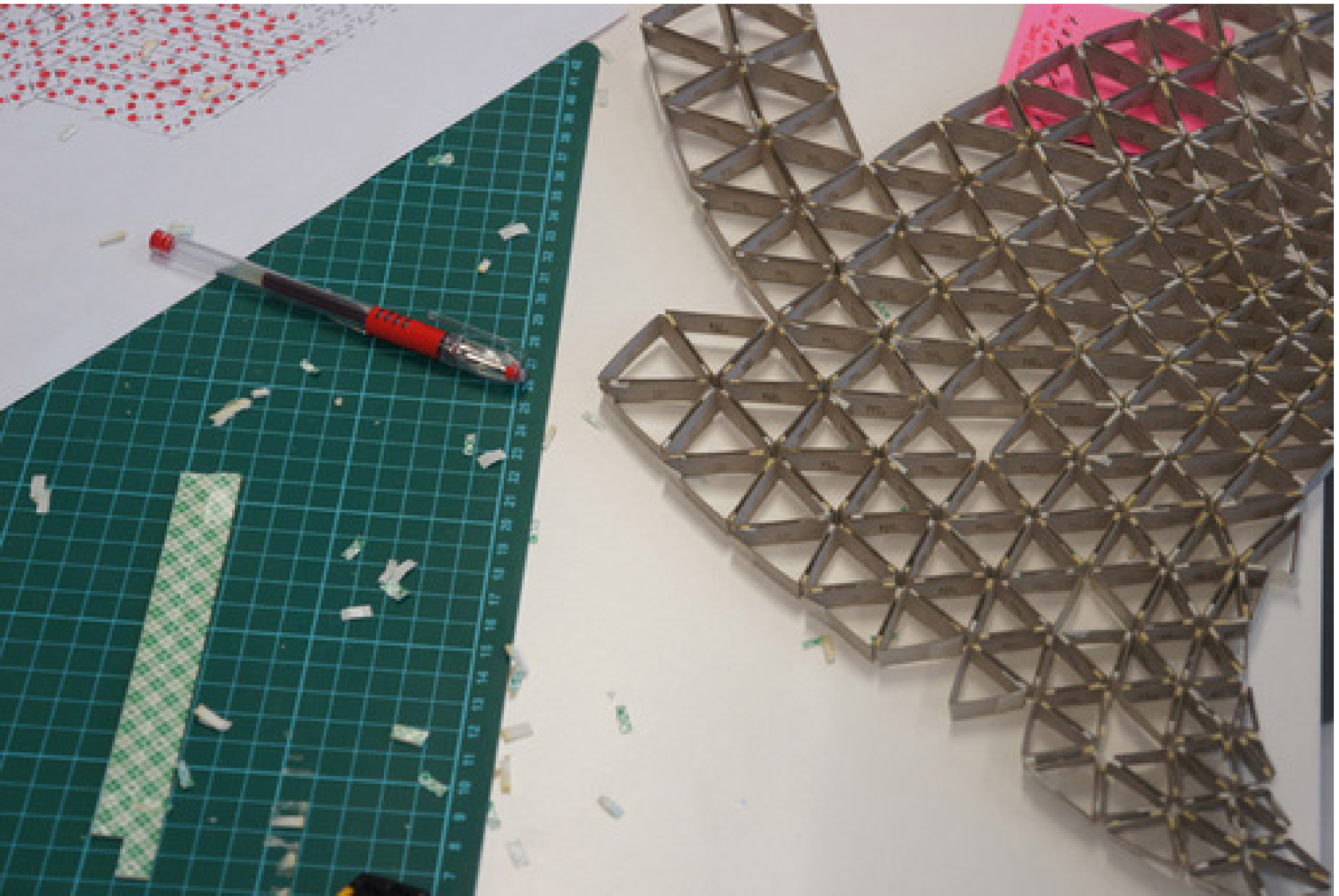
Project FABRICATION

SUTD Library Pavilion

MATERIALS

Library Gridshell Pavilion		
		Quantity
Unique plywood panels		3,008
Unique steel cladding tiles		585
Unique plywood spacer blocks		3,255
Bolts		192,562
Screws		30,039
Area (covered)		200 m2
Area (deck)		300 m2





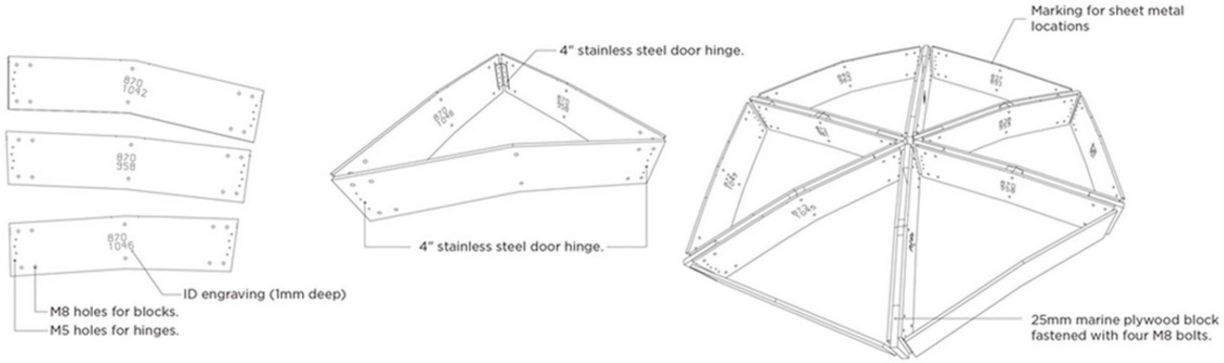
SUTD Library Pavilion

Project MATERIALS

SUTD Library Pavilion

Project MACHINE / SOFTWARE

Description of machine (laser cutter, CNC)



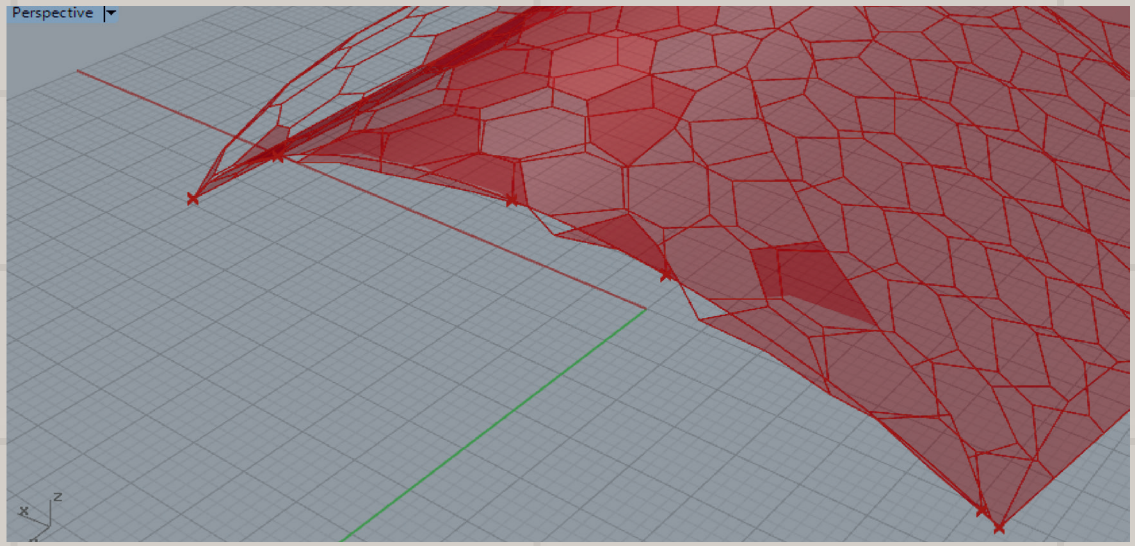
Individual plywood elements (12mm marine ply)

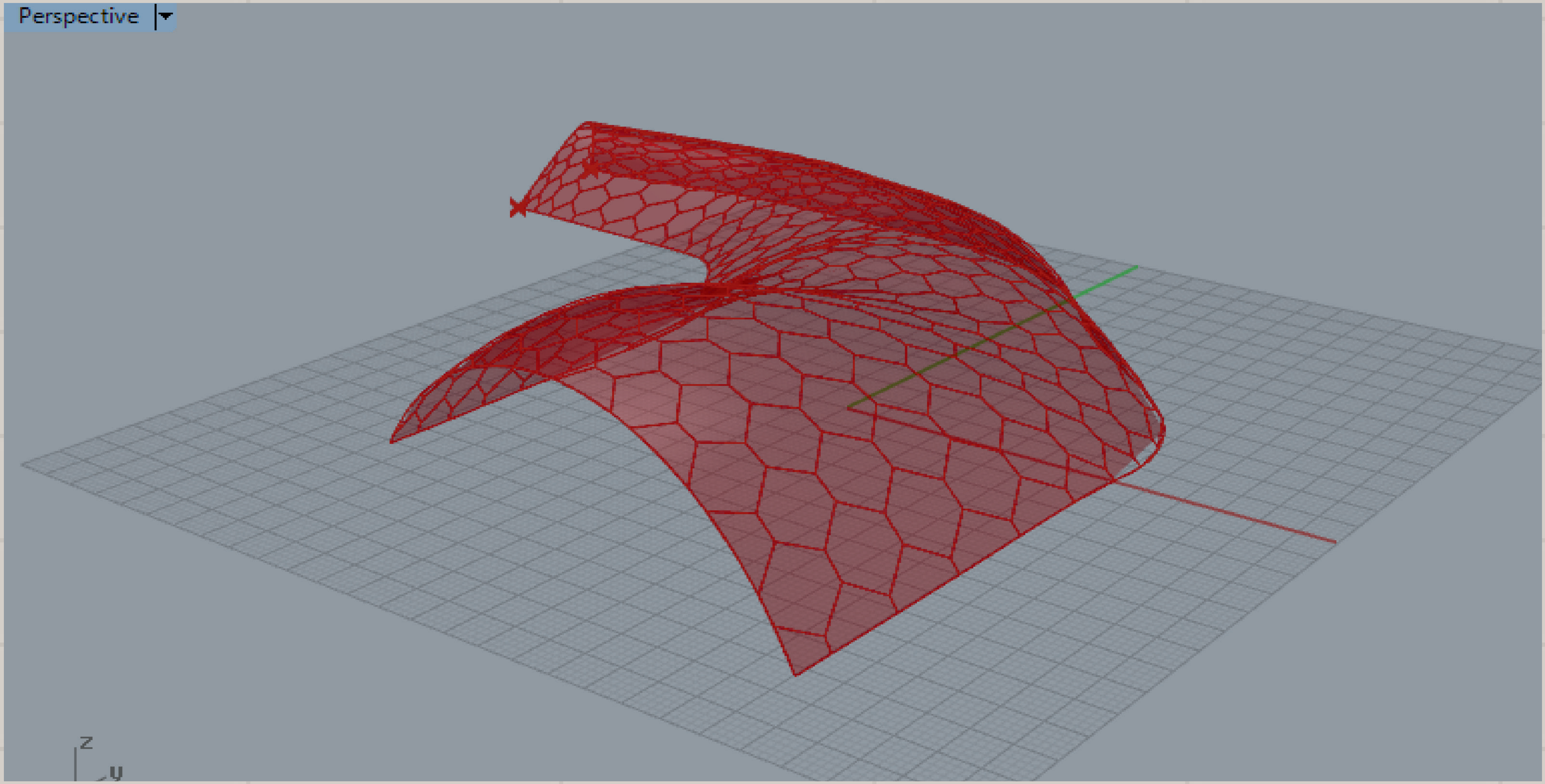
Plywood elements joined into a triangle with 4"stainless steel door hinges

Six triangles aggregated into a hexagon via 25mm marine plywood blocks, fastened with four M8 steel bolts each. For edges longer than 1300mm, additional 25mm blocks are added in the middle, fastened with two bolts each.

SUTD Library Pavilion

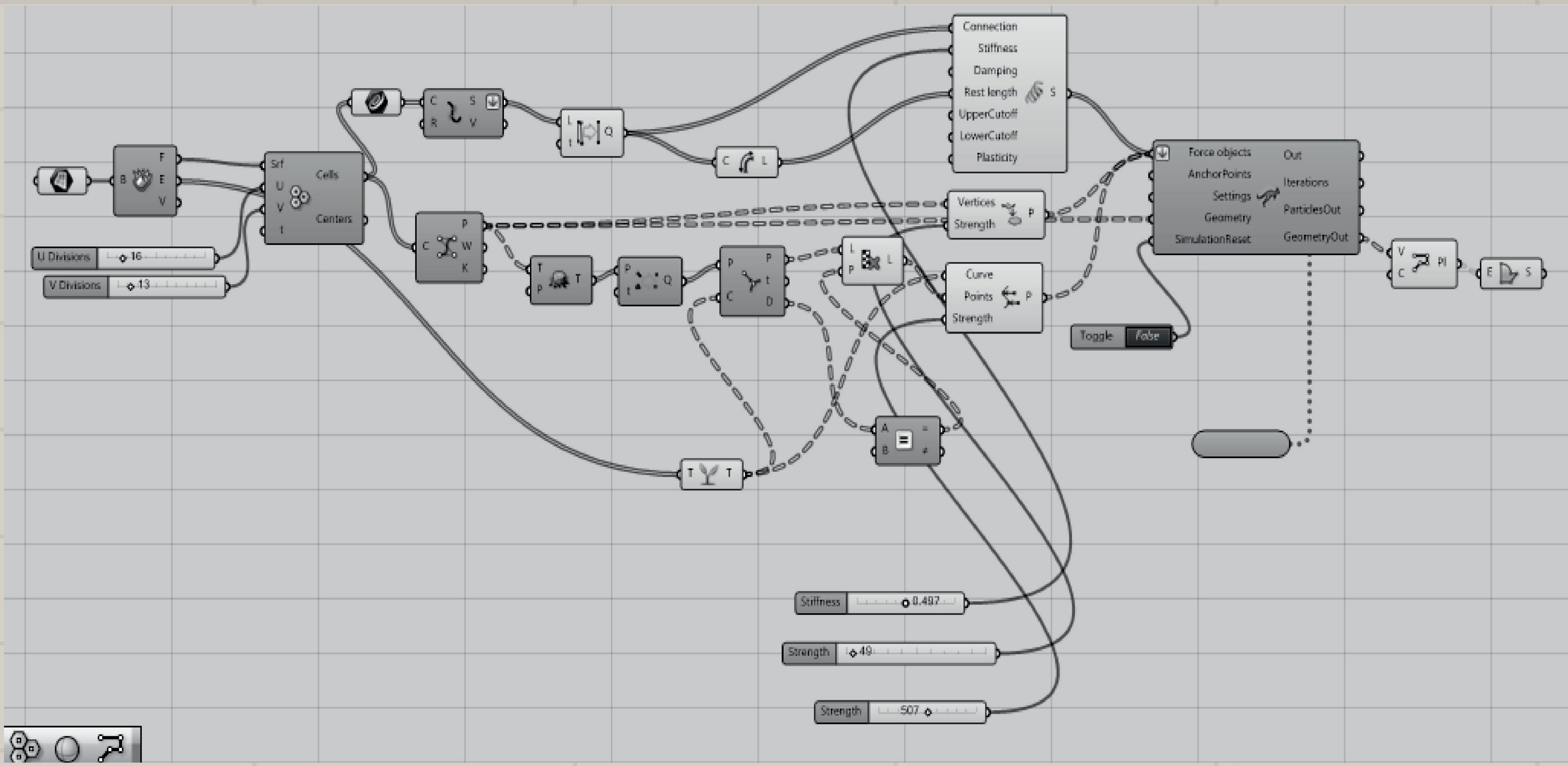
GRASSHOPPER
Modelling





SUTD Library Pavilion

GRASSHOPPER
Modelling



SUTD Library Pavilion

archdaily.com/387696/sutd-library-pavilion-city-form-lab

http://cityform.mit.edu/projects/sutd-gridshell.html

http://cityform.mit.edu/projects/sutd-gridshell.html

FORMING
TOOLS AND MACHINES

Tools for forming

FORMING
SOFTWARE USED

MODELLING SOFTWARE

AUTODESK® 123D® DESIGN

Autodesk 123D Design

AUTODESK® 3DS MAX®

Autodesk 3DS MAX

Rhinoceros®
NURBS modeling for Windows

grasshopper
GENERATIVE MODELING FOR RHINO


Forming
Pavilion
Gernot Riether
Oles Horalevych
Source: http://www.archdaily.com/137993/aia-pavilion-gernot-riether

PROJECT OVERVIEW

ProjectArchitects:
Gernot Riether

Location:
New Orleans, Louisiana, USA

Investor:
AIA New Orleans | American Institute of Architects

Function:
Urban private space

ConstructionYear:
2011

Dimensions:
18 sqm

ConstructorsTeam:
Riether and eight students

MaterialUsed:
glycol-modified polyethylene terephthalate (PETG).

MaterialSpent:
320 different PETG cells

Budget:
$2,500

MajorFabricationUsed:
Unrolling

OtherFabricationUsed:
xxxxxxxxx

FabricationBy:
CNC: 25 hours machining time

SoftwareUsed:
Rhino, Grasshopper, AlphaCAM

http://www.archdaily.com/137993/aia-pavilion-gernot-riether

FABRICATION METHODS / process

Thermoforming:
Techniques used: drape forming, vacuum forming and draping

Number of pieces:
320

Portability:
The pavilion can be disassembled.
The pavilions cells can be stocked and moved with a mini Truck

Assembly:
Bolt connections.

Assembly time:
2 days

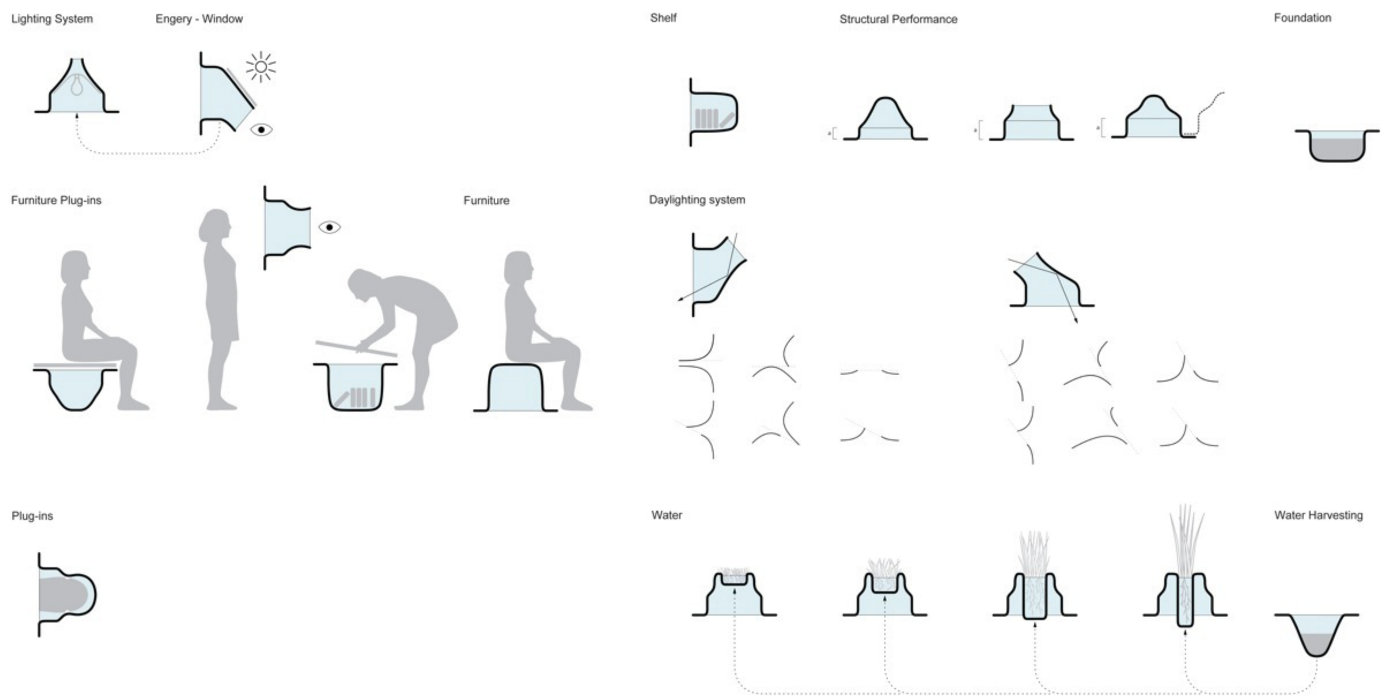
Fabricated at: DFL, Digital Fabrication Laboratory at Georgia Institute of Technology

The pavilion not only demonstrates the work of the digital design build studio that Riether leads at the Georgia Institute of Technology in Atlanta, but also uses glycol-modified polyethylene terephthalate (PETG). This material can either be produced from recycled plastic, or more pertinent to this location, from sugar cane: a plant that has been an integral part of the culture of Louisiana for over 200 years.

http://www10.aeccafe.com/blogs/arch-showcase/2011/05/31/aia-pavilion-in-new-orleans-la-by-gernot-riether-architects/

FABRICATION METHODS / process

The pavilion's geometry distorts in response to specific site conditions, solar orientation and programmatic requirements, such as lighting, seating, viewing, planting and water harvesting, with each of the cells shaped by scripted rules. Using CNC technology, each template was cut from PETG sheets, before being thermoformed into shape using a neatly designed adaptable mould.



FABRICATION METHODS / process

The pavilion is build from 320 different triangular cells. The edges of each cell are folded. Connecting the cells the folds form a complex geodesic system. The surface within the cell is transformed to respond to different functions such as seating, support for light fixtures, plant holders of rainwater collectors. The complex geometry of the cells allowed combiningstructure and envelope in a single material system.

Using scripting to design the pavilion and using a flexible mold to thermoform each cell allowedto customize each cell according to different functions and context.

To minimize the amount of material used for the envelope and to create a light-weight structure the envelope generates wormholes that act brace- and column-like and increase the surface tension. The formation of wormholes within the surface allowed to light weight structure of total 123 kg.

http://www10.aeccafe.com/blogs/arch-showcase/2011/05/31/aia-pavilion-in-new-orleans-la-by-gernot-riether-architects/

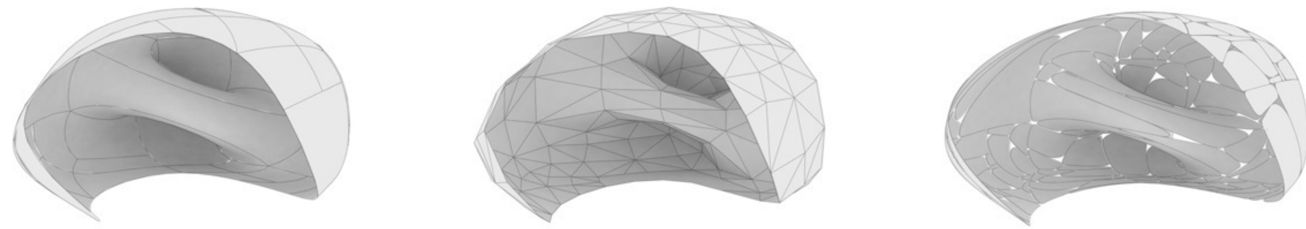
MATERIALS AND MACHINES

Pinching and reconnecting the surface was used as a technique to increase the structural performance of the envelope. At strategic locations the skin morphs into bracing and column like systems. Structure and building envelop are combined into a single material system.

Using PETG as a material suggests a negative carbon footprint. According to one of it's world's largest manufacturer, "Dow Chemicals" every 0.5kg of PETG produced from sugar cane represents a total gain of almost 1kg of CO^2 removed from the atmosphere. Since the AIA pavilion used 123kg of material, the production of the pavilion would remove 246kg of CO^2 from the atmosphere. This demonstrates that producing PETG from sugar cane has tremendous environmental benefits that might make plastic the building material of the 21st century.

Curvature analysis

Panelizing strategy

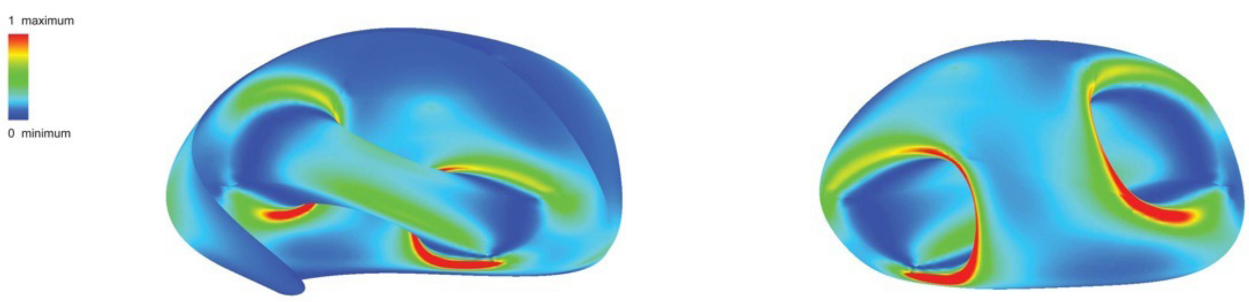


Nurb

Triangulation

Voronoi

Structure



MATERIALS AND MACHINES

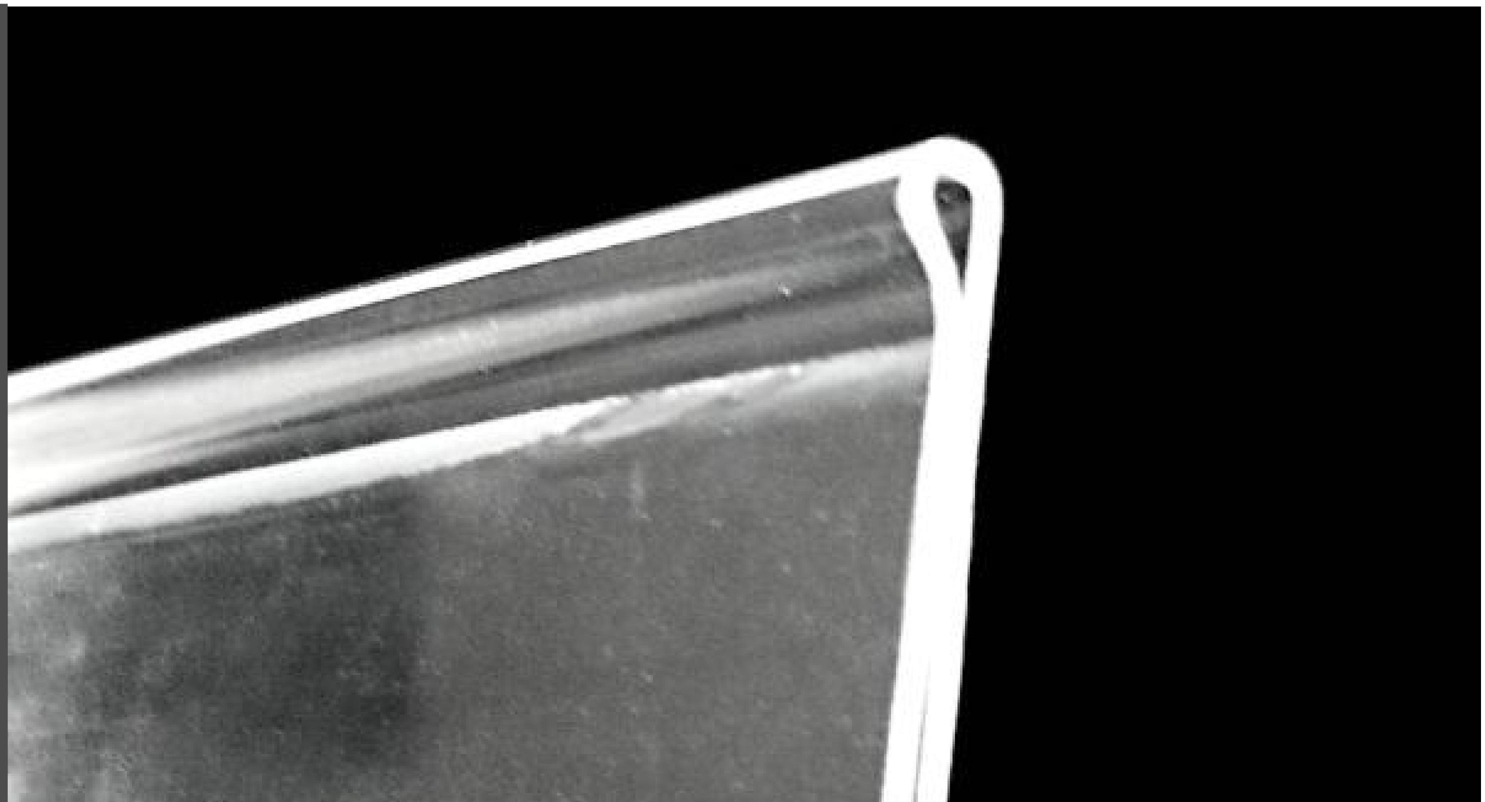
PETG
Transparent plastic sheet with good impact resistance and outstanding thermoforming characteristics
PETG has outstanding thermoforming characteristics for applications that require deep draws, complex die cuts and precise molded in details, without sacrificing structural integrity. It is used often in the O&P market for fabricating face masks, and burn management and upper limb (HO, WHO) orthoses. PETG is FDA compliant.

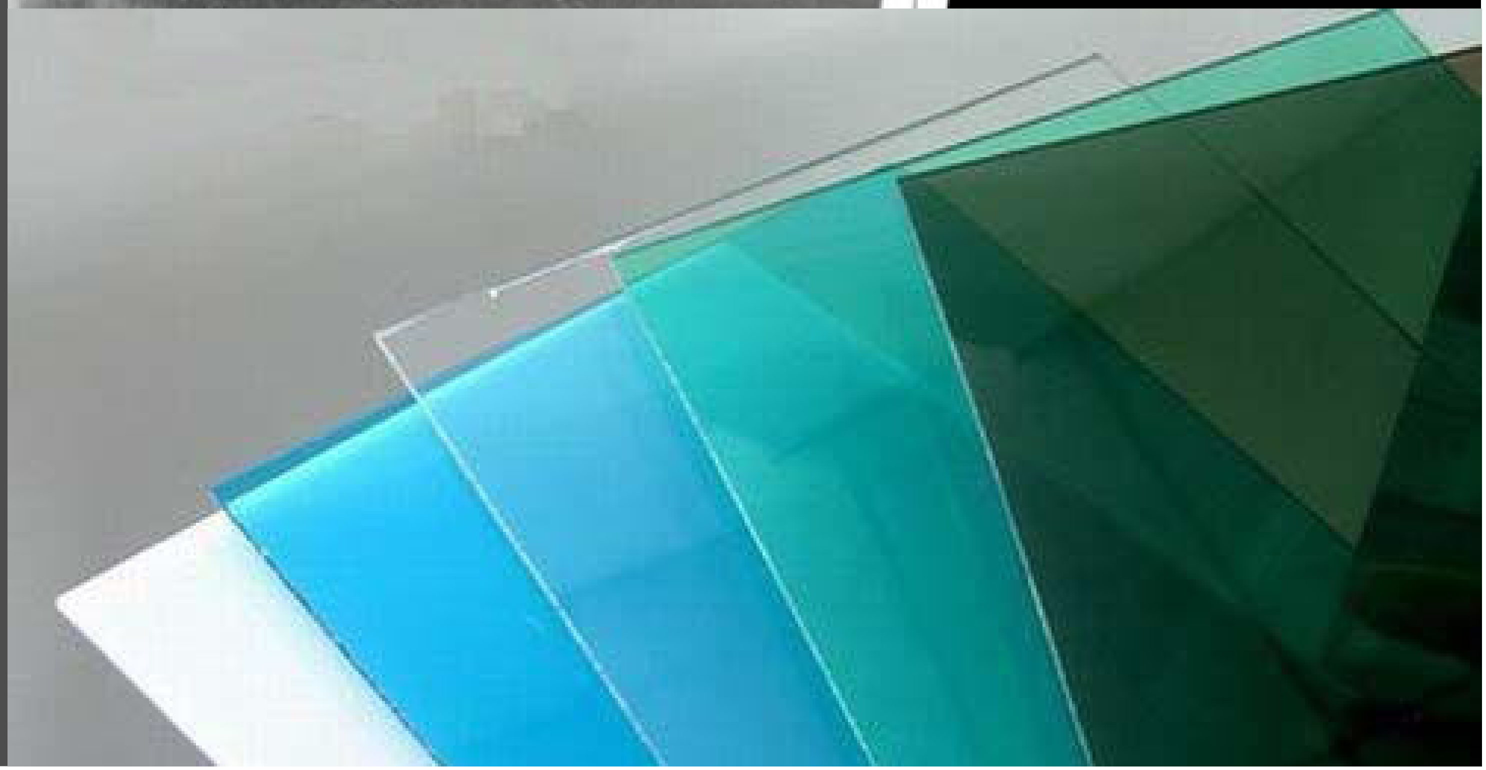
PETG IS OFTEN USED FOR:

Signs
Sign and graphic holders
POP displays and store fixtures
Product and table top displays
Thermoformed trays
Prototypes and models
Orthotic and prosthetic devices
Machine guards and housings
PERFORMANCE CHARACTERISTICS:

Outstanding deep draw thermoforming
Good impact resistance
Chemical resistant
Easy to fabricate and machine
Good clarity
COMMON BRANDS:

Spectar®
VIVAK®
https://www.curbellplastics.com/Research-Solutions/Materials/PETG





MATERIALS AND MACHINES

CNC Machining is a process used in the manufacturing sector that involves the use of computers to control machine tools. Tools that can be controlled in this manner include lathes, mills, routers and grinders. The CNC in CNC Machining stands for Computer Numerical Control.

On the surface, it may look like a normal PC controls the machines, but the computer's unique software and control console are what really sets the system apart for use in CNC machining.

Under CNC Machining, machine tools function through numerical control. A computer program is customized for an object and the machines are programmed with CNC machining language (called G-code) that essentially controls all features like feed rate, coordination, location and speeds. With CNC machining, the computer can control exact positioning and velocity. CNC machining is used in manufacturing both metal and plastic parts.

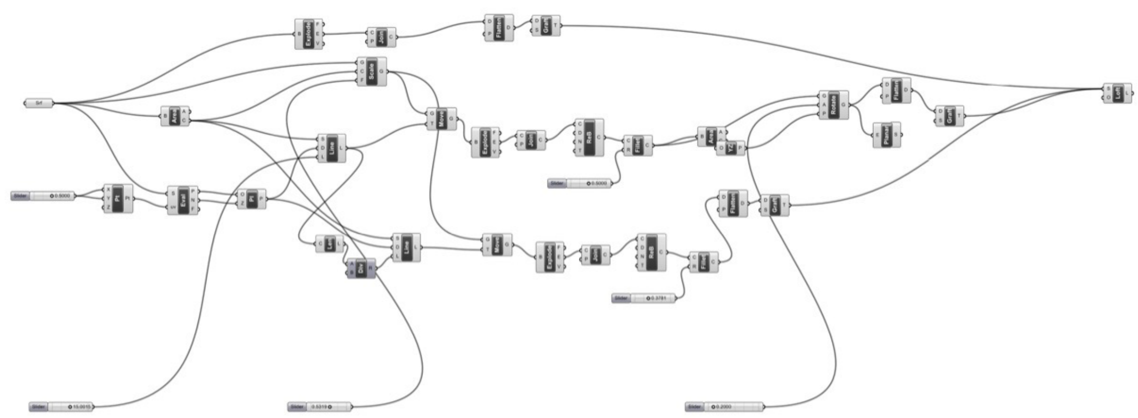
First a CAD drawing is created (either 2D or 3D), and then a code is created that the CNC machine will understand. The program is loaded and finally an operator runs a test of the program to ensure there are no problems.

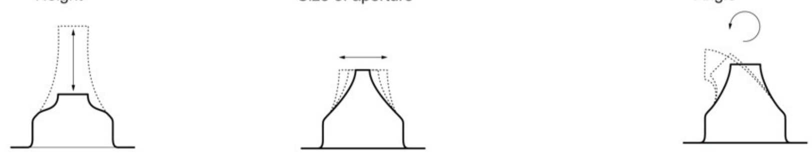
https://www.curbellplastics.com/Research-Solutions/Materials/PETG

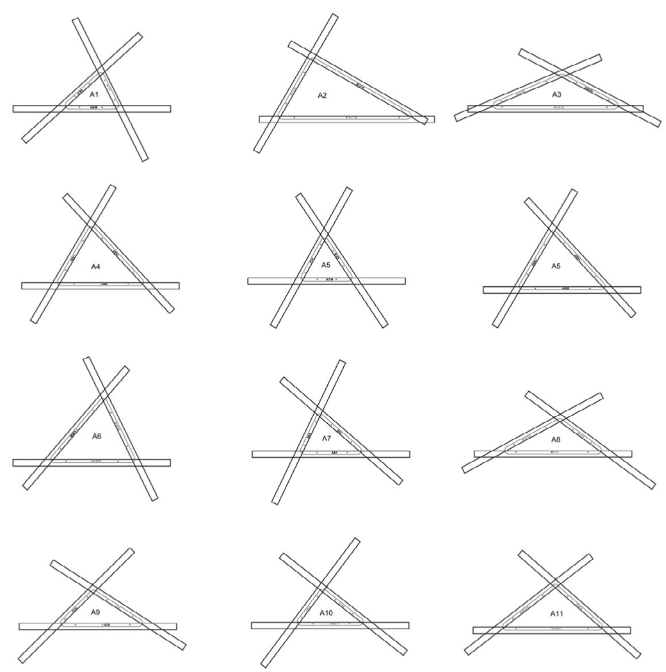
GRASSHOPPER MODEL / def.

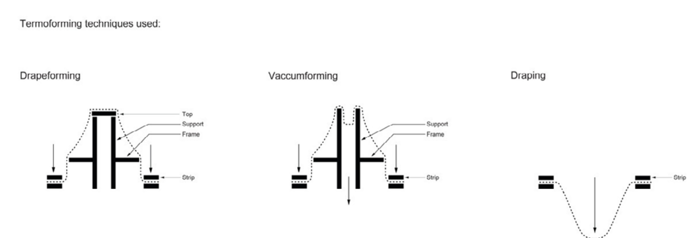
Creating the shape

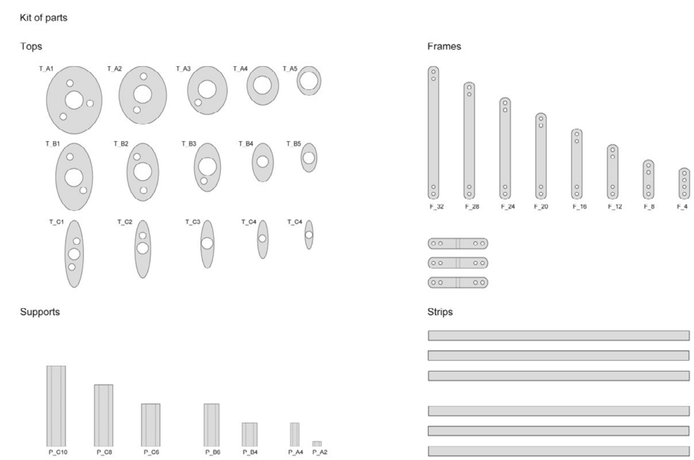
Digital model







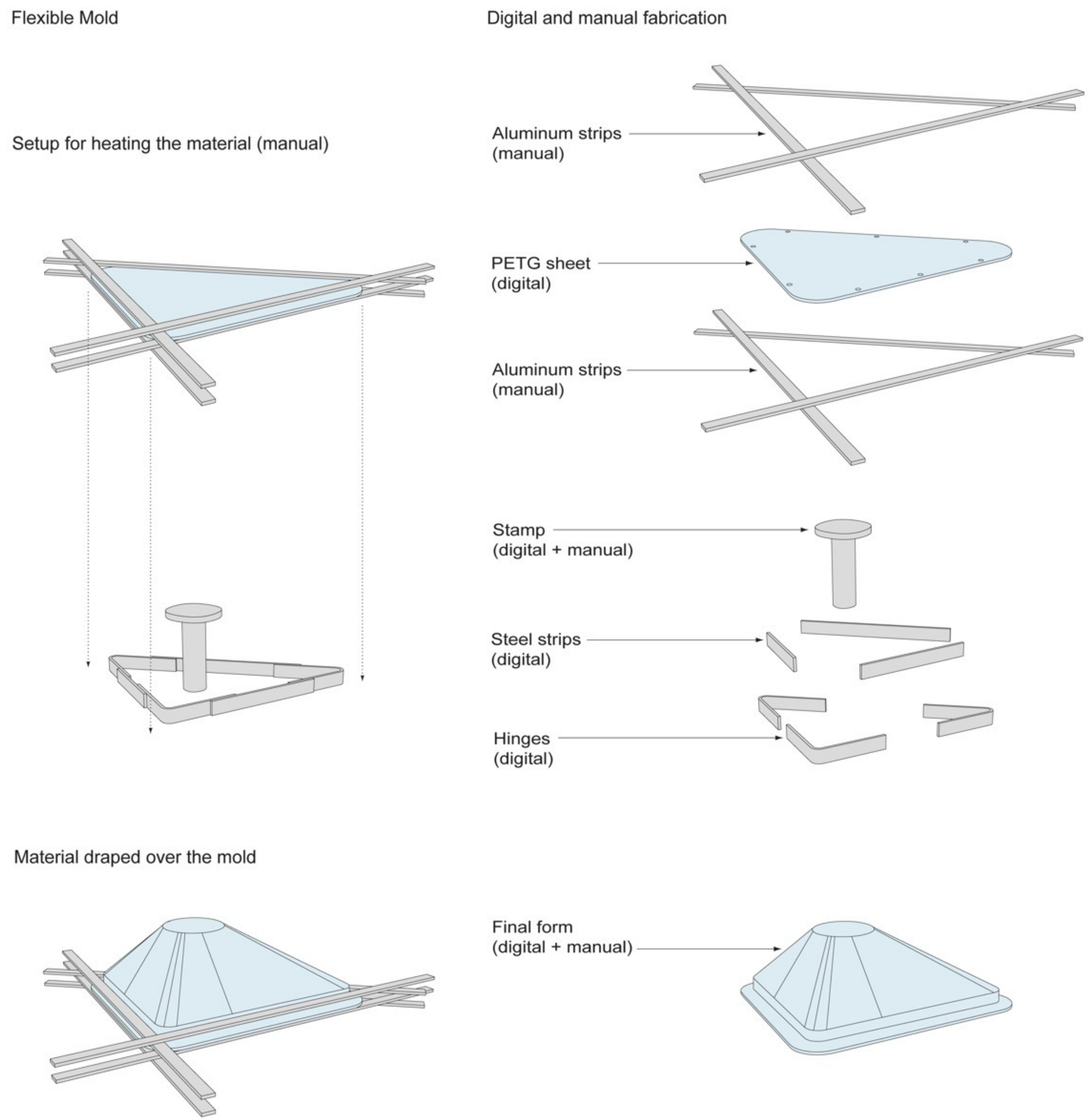




http://www.archdaily.com/137993/aia-pavilion-gernot-riether

GRASSHOPPER MODEL / def.

How details are connected to each other.

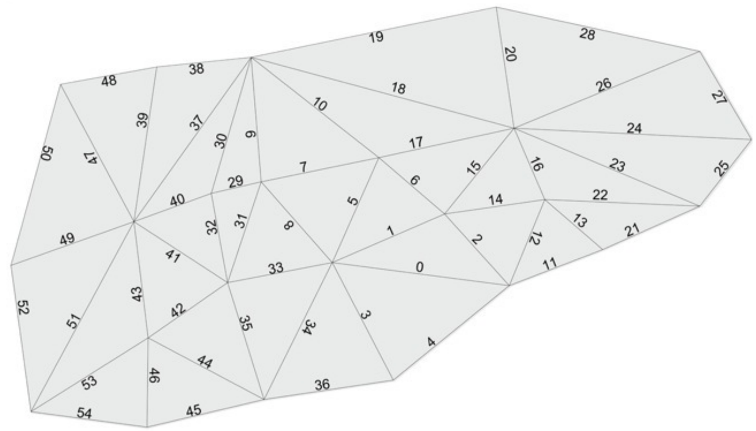


http://www.archdaily.com/137993/aia-pavilion-gernot-riether

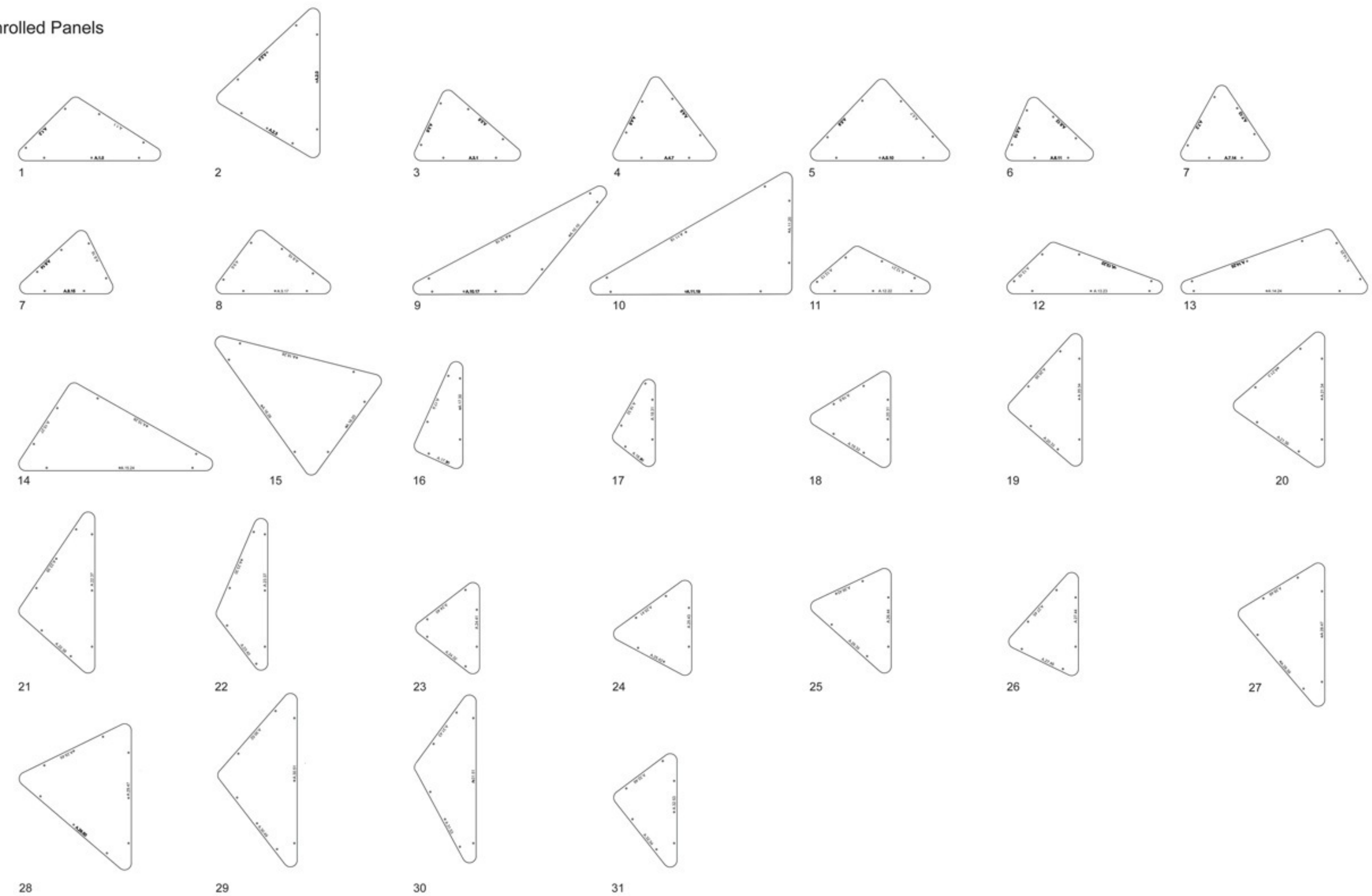
GRASSHOPPER MODEL / def.

Unrolling of panels

Unrolling



Unrolled Panels



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