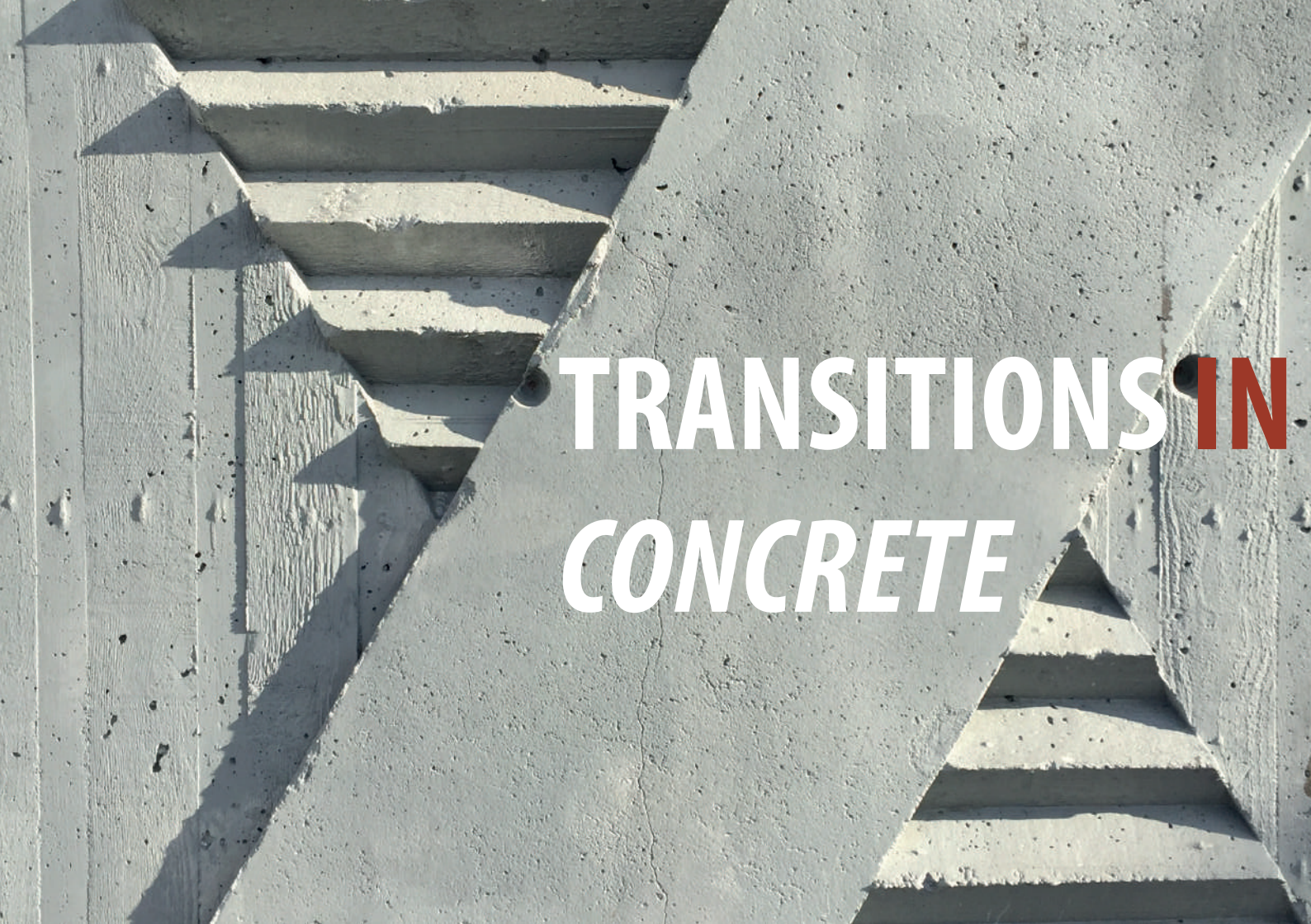
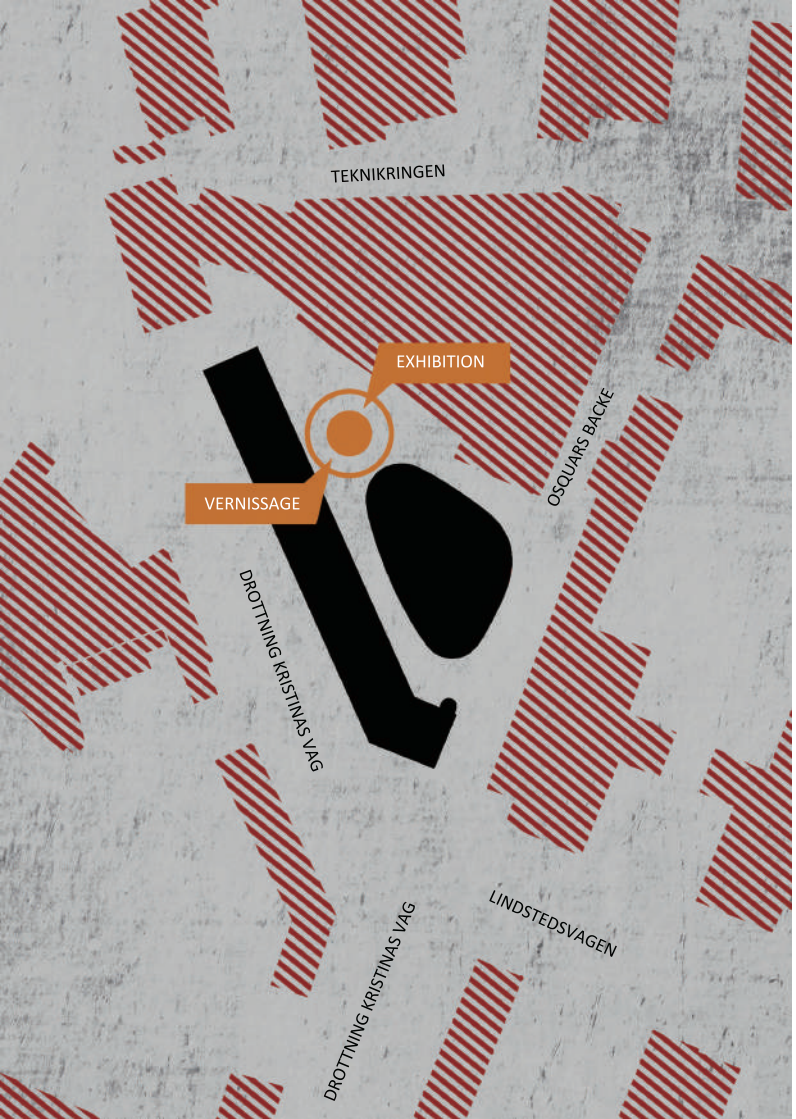

TRANSITIONS IN
CONCRETE



EXHIBITION, MASTER STUDIO 4

EXHIBITION CATALOGUE
STUDENT WORKS FROM STUDIO PROJECT 3, SPRING TERM 2018: CONCRETE EXPERIMENTS & GEISENDORF ARCHITECTURE

ELIN ANDERSSON
THERESE ANTMAN
LENI ELLBURG
CAROLIN FRÖGREN
PETER HÖGÅS
LEIF LINDELL
ANTON LINDHOLM
ROCCO ANTHONY PACINI
HAN XUE

Studio Project 3, spring term 2018
Concrete Experimentation and
Léonie Geisendorf Architecture

Master Studio 4 is a platform for architectural investigations closely connected to research and practice. Our studio seeks to push the boundaries of what architecture is, by exploring what architecture can be. We choose design topics that address relevant problems in society to make the studio a centre for design-led experimentation, prototyping and discussion on how we, as architects, can address the dynamic development that society is currently facing.

During the academic year 2017/2018, our two first studio projects focused a material that has been the basis for construction since the beginning of time: wood.

We believe there is still a lot to learn about the use of wood from the global history of architecture, and it is our expectation that the studio contributes future-oriented and innovative design approaches.

Our interest in materiality and tectonics also marks the third studio project, Concrete Experimentation and Léonie Geisendorf Architecture. While focusing on concrete and its potential applications for a sustainable future, we also stay closely connected to wood – given its close relationship, throughout history, to concrete formwork and casting.

As studio teachers and practicing architects, our view is that technology is inseparable from architectural design. –Name any architectural masterpiece, and we will point out its qualities in terms of structure, tectonics, and detail! Nevertheless, we know that students at this level of the education represent a broad spectrum in terms of architectural technology-based abilities. Since a few years, we have therefore experimented with a new course design for Studio Project 3 which specifically aims to strengthen students' skills in the technical field. While most students take an interest in materiality, they do not always get a chance to explore the material in depth or work with it in practice. With this course, we have wanted to create an opportunity to fully integrate materiality, tectonics and architecture in a course design that invites the students to carefully study a reference building and its details, then work with its tectonic qualities through a transition process.
This process leads to full-scale formwork

studies and, finally, to concrete casting in our lab on campus. The course has been informed by our respective expertise in the field: Dr Charlie Gullström is an international authority on Léonie Geisendorf's architecture and a researcher in architectural technology; and Kurt Lazzarini is an experienced Swiss architect with a unique expertise in concrete experimentation and whose works, in partnership with Mierta Lazzarini, have been published extensively.

Finally, our students have excelled by producing the exhibition we inaugurate today. Today, we are very pleased with the work achieved throughout the course and welcome you to take part of the architectural works achieved, nine fine benches that now await their final placement on KTH campus. Welcome, take a seat!

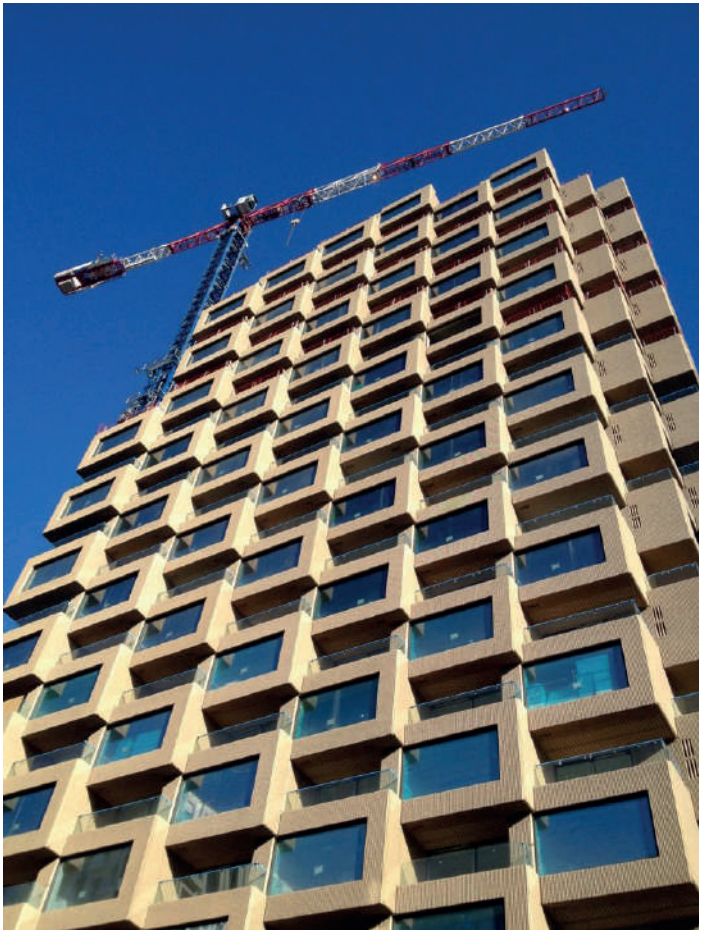
We are grateful for the help we have received from KTH university administration, especially from its Chief Architect Maria Granath and colleagues who helped us create a concrete lab; and we thank Akademiska Hus for quick arrangements regarding the placement of our works on campus.
We also want to thank Sven Ahlenius from AIX Architects, Mats Åhlander from Svenska Bostäder and the antiquarian Sven Olof Ahlberg for their valuable input to our initial study of the S:t Görans Gymnasium building, now refurbished to student housing. Equally, Peter Kjellgren from Oscar Properties gave us an inspiring tour of the Norra Tornen by OMA, currently in construction in Stockholm. We also received valuable input and practical contributions from our research colleagues in Architectural Technology, Vasily Sitnikov and Helena Westerlind. Frida Melin and Johan Örn at Arkdes helped with archive studies and, last but not least, we thank Träullit and Bromma Stål who contributed funding for the final exhibition.

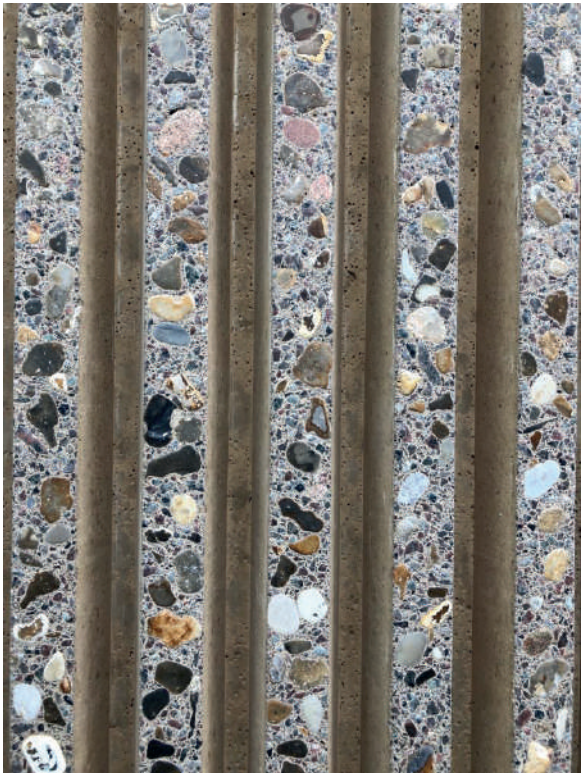
28 May 2018

Charlie Gullström
Kurt Lazzarini
Ori Merom
Responsible teachers for Master Studio 4 2017/2018

Léonie Geisendorf in 1961, with the first model of the S:t Göran Gymnasium composition.

The Entrance Hall of S:t Görans Gymnasium by L & CE Geisendorf Architects (1961), photographed by Sune Sundahl.





Photos from field study at Norra Tornen by OMA

Course design

Excellence in architecture means that architectural design and structural design are conceived together and completely connected: they need each other. In this course we want you to practice looking at buildings in that way, to improve your ability to integrate technology and architecture. You will do this by exploring how details are planned and studying how materials are combined, and what is involved in the fabrication and construction process relating to concrete production.

The main questions are:

- What can we, as architects, learn from the construction process in order to make excellent design work?

- How is it possible for an architect to closely follow the process all the way from design through construction in the factory or on the building site?

- What do we mean when we talk about “really good form work”?

- What are the different material qualities enabled by good form work?

- What is ‘state-of-the-art’ in concrete architecture today and what are the innovative technologies that could develop the use of concrete in architecture to reduce the impact on the environment. How can concrete be labelled ’sustainable’, for example in the area of energy and thermal storage?

The course is inspired by the architecture of Léonie Geisendorf (1914-2016). You will zoom in on the potential for cast-in-place concrete by studying the details of work drawings for the entrance hall of St Göran Gymnasium, originally a domestic sciences college in Stockholm (1961), now refurbished to student housing; as well as Villa Delin in Djursholm (1970). You will also study more contemporary examples where the architectural expression results from experimentation with concrete, for example the Giardin residential complex (2007) and Promulins sports and recreation centre (2012), both in Samedan, Switzerland by architects Kurt and Mierta Lazzarini; and the Norra Tornen residential tower by OMA, currently in construction in Stockholm.
Your own work will lead to concrete experiments and result in real-life prototypes.

How we will work

The course is based on individual work. We will use the first week for a study visit and introductory lab sessions: to get closer to the material. In the second week you will have a small design task that invites you to look back in history and especially to concrete experiments that took place in the 1950-1960s, illustrated by the excellence of architect Léonie Geisendorf's works. You will choose a detail from her work and compare it with a detail of a contemporary architect of your choice. In seminars and labs with Kurt Lazzarini you will become acquainted with different examples and methodologies for concrete architecture and you will choose a building from a set of 8-10 examples. You will analyse this building and formulate a strong concept idea relating to the materiality of concrete that you will explore throughout the course. The design task itself is small, A CONCRETE BENCH, but it should be seen as an articulation of an architectural design concept, an experimentation of materiality that can be used in a faced or similar - and the emphasis of the course is on experimenting with different methods and material qualities, in different scales, through model-making, sketching, illustrations and finally: real casting in a lab. As part of this, you will learn about the importance of good formwork, and you will learn from mistakes and, most probably, the experimentation with casting will inform your final designs.
When ready, your concrete benches will be placed in an outdoor location on campus We will finish off the course with a Vernissage of an ehxibition that you will produce together, followed by a reflection seminar on what we have learned together.

Selected projects by Mierta & Kurt Lazzarini Architekten

Neubau Hotel Longhin, Maloja (2014)

Promulins sports and recreation centre (2012)

Giardin residential complex (2007)

Shaped by fabric

Elin Andersson

Concrete can be more than just a hard, rough surface. It all depends on the formwork; the concrete shapes itself after the material you choose and this effects the form and texture of the result.

Why fabric casting?
- Gives another dimension to the concrete: Visible texture, you see where the fabric has folded itself.
- Looks more soft.
- 25-35% reduction in the carbon footprint of concrete constructions *
- Improves the structural efficiency
- Allows for a wider range of forms to be created

How did I do it?
By casting the bench upside down the concrete automatically place itself in a structurally efficient way, like the ”hanging chain method” when creating an arch. I used double layers of strong tarpaulin to carry the heavy weight of the concrete.

Weight: *96kg*
Measurements: *800x500x380mm*
Material for formwork:
- *Tarpaulin (8m^2)*
- *Wooden studs 45x45 (14m)*
- *Wooden board (1m^2)*
- *Screws (60)*

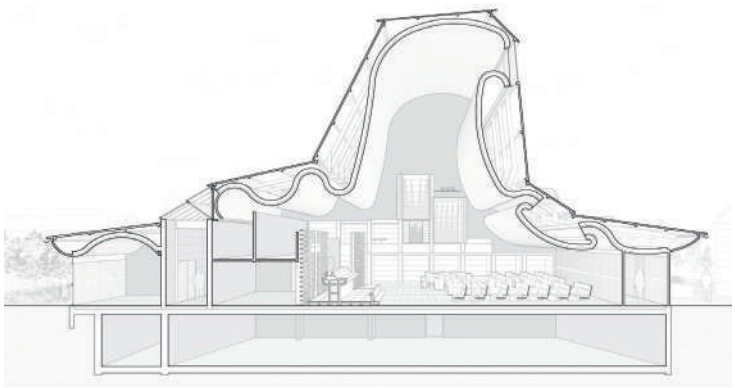
Material for casting:
- *Concrete (42L = 4 bags concrete)*
- *Reinforcement net (0.4x2m)*

* https://www.eca.ed.ac.uk/research/rethinking-concrete-formwork

References

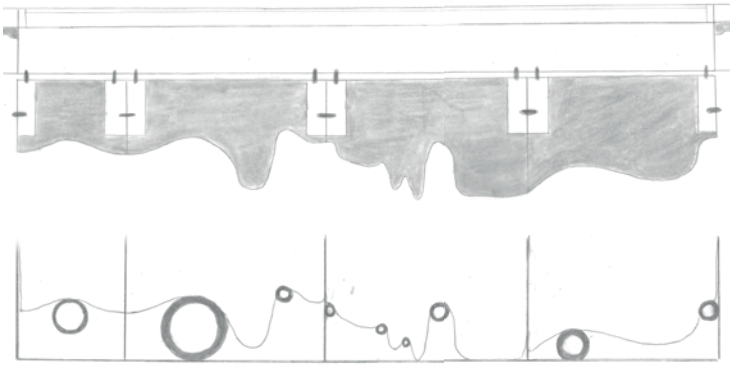
Bagsværd Church (1976)
by Jørn Utzon
Bagsværd, Copenhagen

- Inspiration from clouds
- Hand-crafted timber structure
- Casted on site. 8-10cm thin!
- Reinforced/sprayed concrete
- Efficient curvatures, 17m span



Hanil Visitors' Centre (2013)
by BCHO Architects
Chungbuk, South Korea

- Inspiration from tree trunks
- Fabric formed concrete wall
- Pre-casted on site
- Formwork: pipes and fabric
- Texture from the fabric visible



Drawings and photos from the two reference projects. Focus on curved concrete elements

Sketches and models and experiments





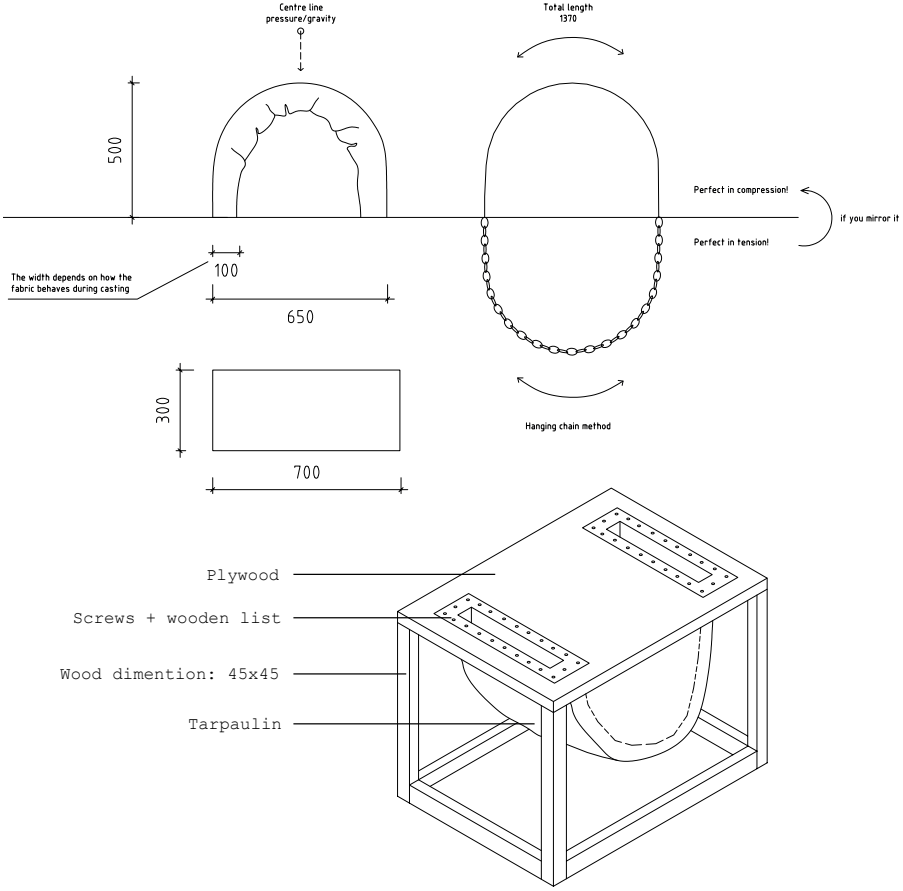

Experiments with shapes and textures

Formwork and casting

During the process I experimented with different types of formwork and materials to achieve curved shapes: plastic, wood, fabric etc. In the end fabric had the most advantages and I went on experimenting with different types of fabric; oilcloth, linen, cotton.. Oilcloth worked well in small scale but when scaling up I had to choose something stronger and went for tarpaulin.

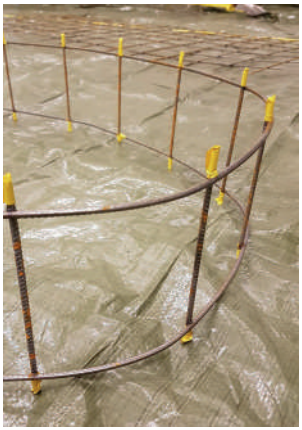
The bench is casted upside down to become structurally efficient (like the hanging chain method): When you hang it upside down it puts itself in the right position and becomes perfect in tension. If you turn it it´s perfect in compression.

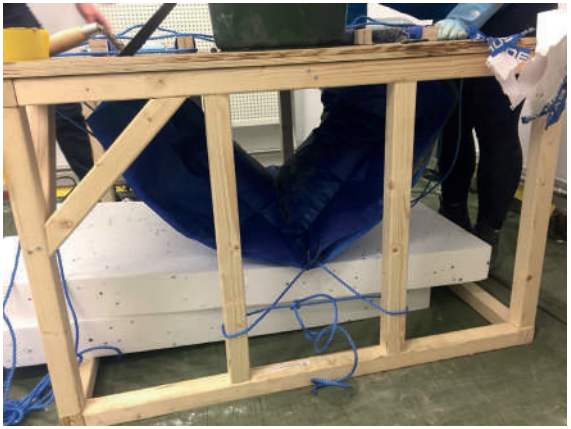
The tarpaulin is connected to a wooden structure to lift it from the ground and stabilize it.



Drawings of the bench and the formwork

Casting





Casting and removing the formwork. Had to use styrofoam in the end (not planned) to spread out the folds more evenly.

The Modulor bench

Therese Antman

In the early stages I looked and investigated Notre Dame du Ronchamp by Le Corbusier. Le Corbusier created this building between 1950-1955, during this time and before; between 1943-1955 he created The Modulor System. You find the Modulor system in Ronchamp, for example in the roof gap (2.26m), in the patterns on the floor and in the structure hidden inside the walls.

Le Corbusier said that this modular system was to make the architecture become more for the human. “The Modulor is about scaling architecture expression to human perception. To build houses for humanity”. One can argue how much for the humanity it developed to be since he bases his system on a man of 1.83 long.

I want to take this modular system with me when I start designing my bench. I want to see if I can create a bench, based on the Modulor system of Le Corbusier, which is accessible & comfortable for a diverse group of people?

Weight: 200kg

Measurements:
1320 x 834 x 45,47,48,53 mm

Material for formwork:
- 3 sqm of form playwood
- 5 meter wooden studs 33x33mm

Material for casting:
- 7 bags á 25kg of concrete
- app 1 sqm reinforcement
- 10 pieces of distance holders

References

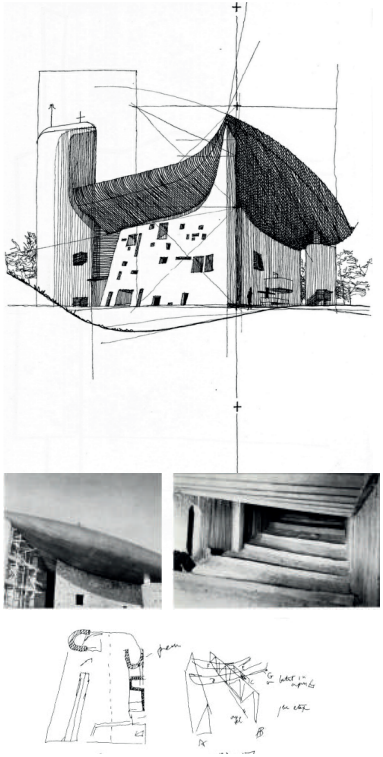
Notre Dame du Ronchamp

Architect, Le Corbusier
Built: 1955
Location: Ronchamp, France

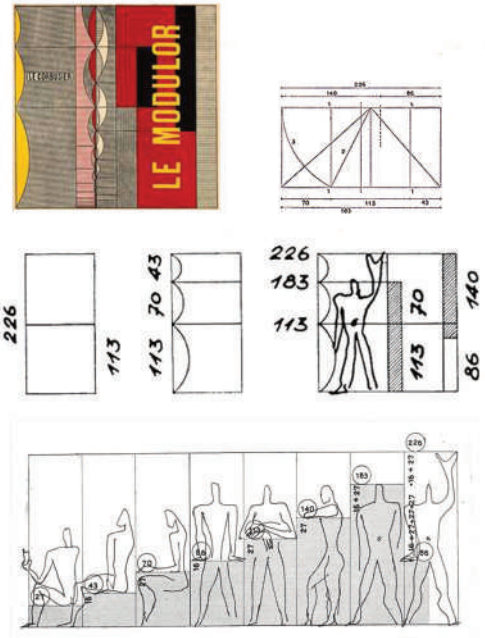
Ronchamp have a monumental curved concrete roof and the building under is like a large scale sculptural with concave and convex forms.

Le Modulor system

Le Corbusier said that this modular system was to make the architecture become more for the human. “The Modulor is about scaling architecture expression to human perception. To build houses for humanity”. One can argue how much for the humanity it developed to be since he bases his system on a man of 1.83 long.

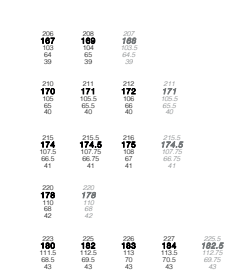


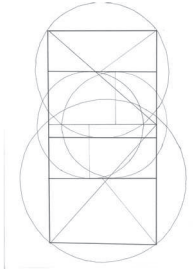
Notre Dame du Ronchamp, Le Corbusier

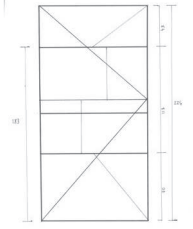


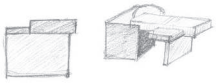
Le Modulor, Le Corbusier

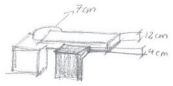
Sketches, models and experiments

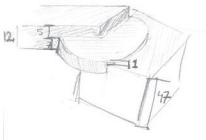












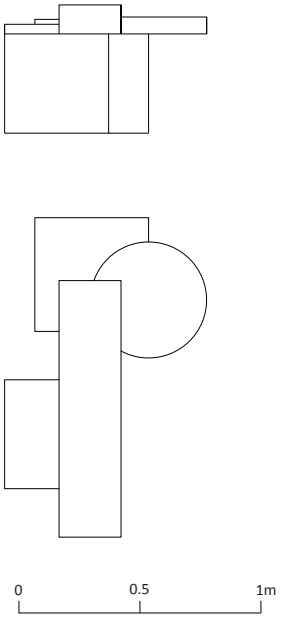
Studies of mesurments and test castings.

Formwork and casting

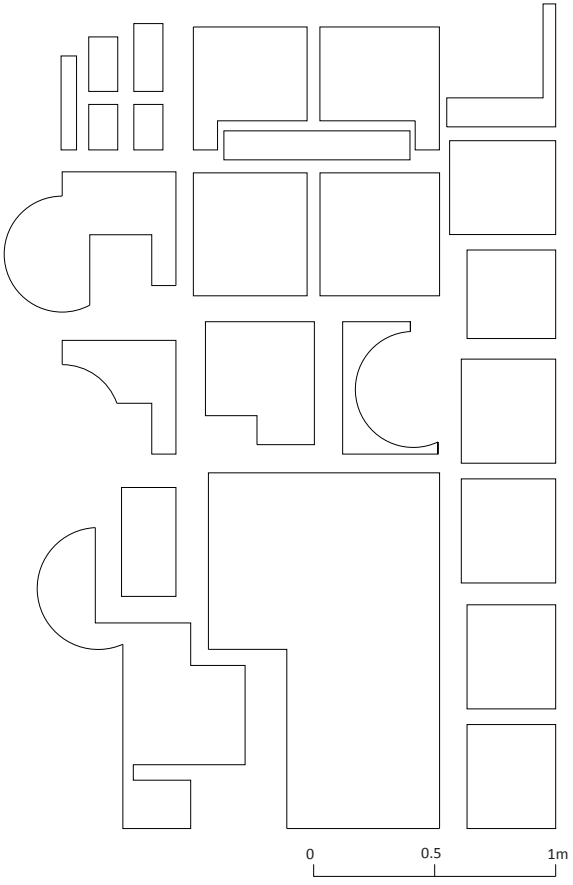
Instead of using the Modulor system I created my own library of measures. From my library I then choose 4 people with the most diverse measures and develop a bench using proportions from them. My bench was not only to be inspired from this measures and the Modulor system but also from The Ronchamp chapel. My bench does as Ronchamp change in character when you move around it. It opens up and feels lighter from one angle and more closed and robust from another.

Building the form took a lot longer time then I imagined in the beginning, 3 times more. And the casting was hard to vibrate enough and two refill castings were maid because the concrete didn't get to all places. Doing this again I would try to use a professional vibrater and making the concrete mix more fluid.

Drawing of bench & form



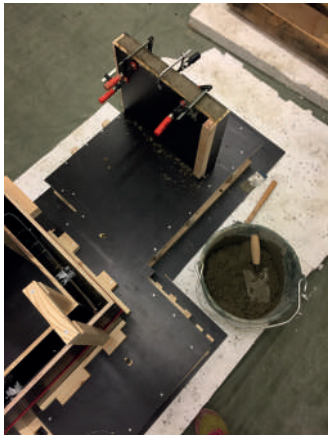
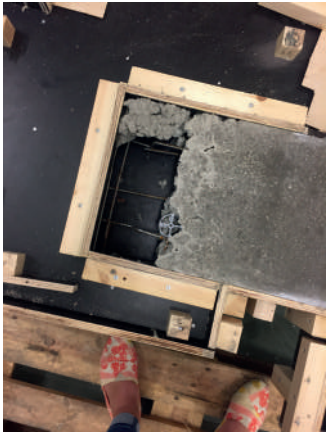
Drawing of bench

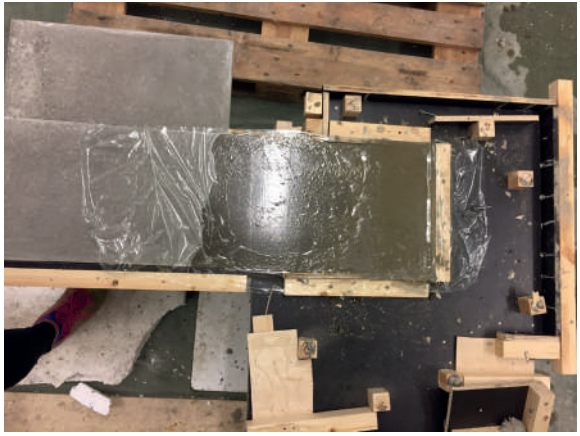


Drawing of formwork pieces

Casting





Formwork and casting process

Balancing act

Leni Ellburg

Inspired by the two monumental walls of the memorial Tulach a't Solais I began imagining the two blocks toppling over and falling towards each other. My vision has been to create a chair that expresses the point at which they find their balance, resting on each other. The two slates are united by a wedge, containing the reinforcement and preventing the chair from collapsing. The illusion of the chair being made up of two different elements is enhanced by the fact that the backpieces overlap only by 20 centimetres and the fact that the top pieces are clearly defined.

Sitting down at the same time as someone else is an intimate experience. Just like the chairs partly overlapping the ones who are seated will have to lean partly on each other. Backs touching but each one looking in a different direction.

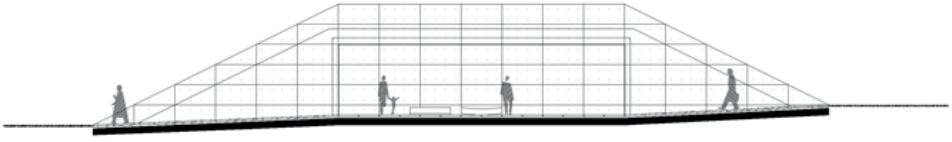
Weight: 110 kg
Measurements: 830x600x880

Material for formwork:
6,3 m2 formplywood
1,2 m2 plywood
approximately 200 screws

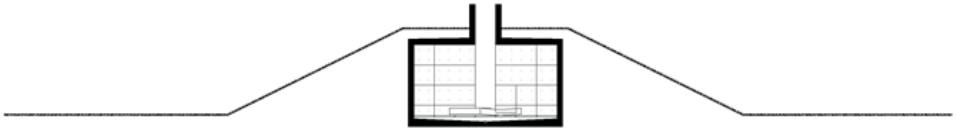
Material for casting:
100 kg concrete
0.64 m3 reenforcement net
2 m reenforcement bar

References

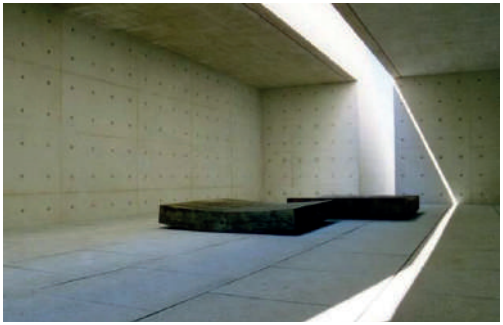
Tulach a'tSolais means mounds of light in Irish, the name refers to traditional Irish burial mounds. Tulach a'tSolais is a memorial built in comemoration of the 200th anniversary of the Irish rebellion of 1798, a rebellion inspired to the French and American revolutions and the ideals of the enlightment. It is set on Oulart hill where the rebellion that led up to the Irish republic took place and looks in a straight line towards Vinegar hill where the United Irishmen were defeated three weeks later. The two hills lie in a nearly perfect east-west alignment, giving the chamber an optimal illumination on the 21st of June, the commemoration date. The ratio of its height to width equals the ratio of its width to the sum of its height and width. It strives to invite contemplation rather than awe.



SECTION

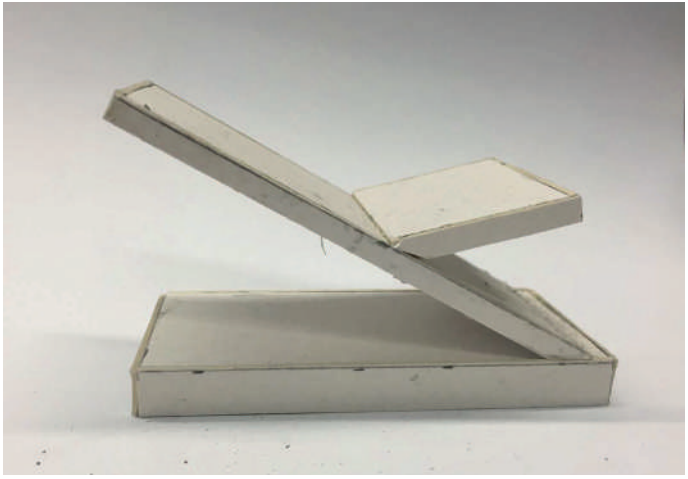


CROSS SECTION



Top to bottom , left to right: Section, Cross section, exterior, interior

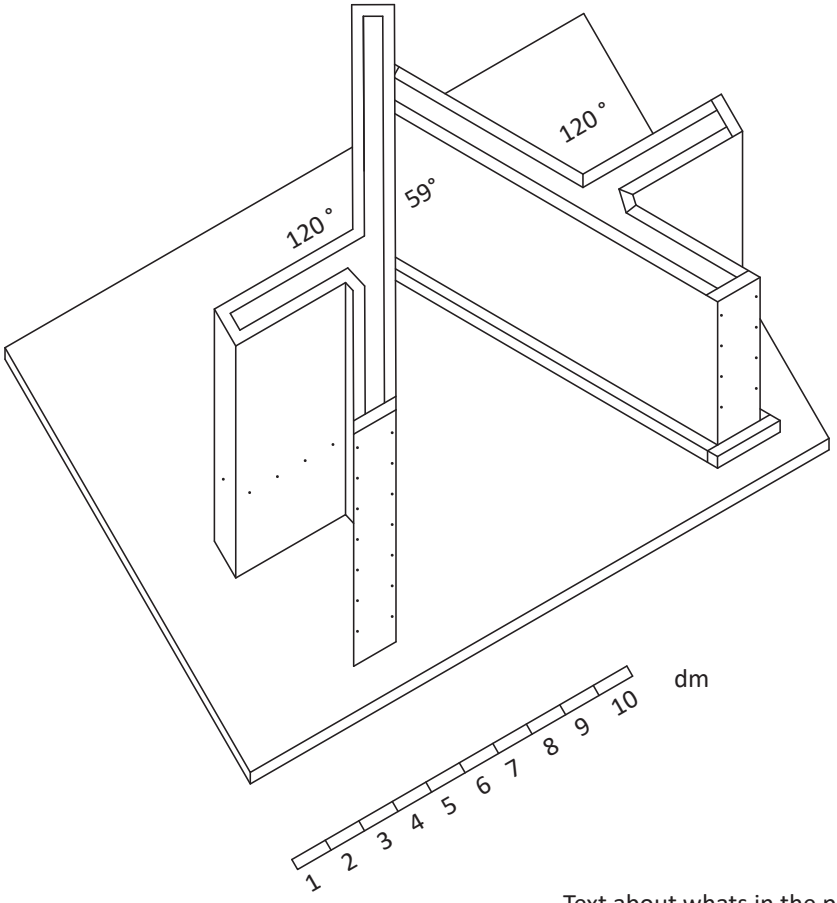
Sketching through models



Left side shows first drafts of the chair and i concrete prototyop 1:5, right side shows final model 1:10

Formwork

The construction of the formwork presented a number of difficulties. The partial overlap of the chairs meant the bottom of the mould had to be elevated 20 centimetres on one side, meaning I had to make an extra bottom that fit perfectly into the formwork so that it could be screwed together without leaks. The number of different angles demanded a high precision in sawing the different pieces so that it would all come together in the end. In putting together the separate pieces adjustments still had to be made. To resist the force of 100 kilos of concrete being poured into it the formwork had to be strenthened in order to not collapse outwards, which can be seen in the picture on the right.



Text about whats in the pictures above

Casting

Left side: reinforcement Right side: Formwork after pouring the concrete and adding additional support

Roundcrete

Carolin Frögren

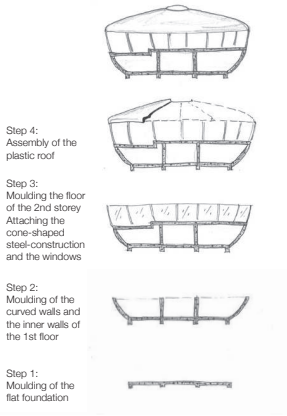
Inspired by my references, the study of the formwork and my own process, I tried to answer questions like:

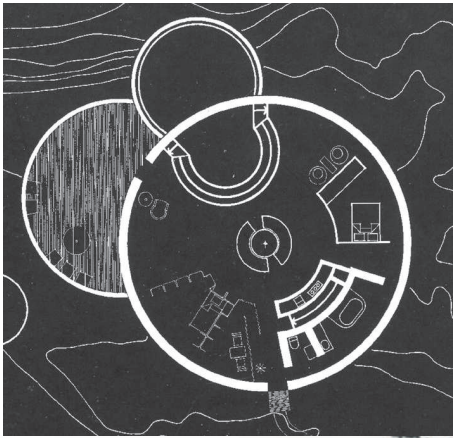
”How can I design and mould this solid and heavy material so it can be perceived as lighter?” and ”How can I incorporate this in a round or curved shape?”

Weight: ca 115 kg
Measurements:
W: 360 L: 650 H: 500 mm
Material for formwork:
- 2 mm thick sheets of styrofoam x 10
- 40 mm thick styrofoam-sheets x 11
- 10 mm thick sheets of styrofoam x2
- glue
Material for casting:
- 6 mm bars of reinforcement x 10
- 8 mm bars of reinforcement x 1
- 4 bags of concrete

References

I have studied several references, such as S:t Görans Gymnasium and Villa Delin by Léonie Geisendorf. I explored the very basics of concrete, like understanding the differences in formwork and final results between in-situ concrete and pre-casted. With its circular forms, the reference Villa Spies intrigued me. By studying the construction it was clear that the formwork is an art in itself. With my final reference in mind, I was now aiming to answer questions like: ”How can I design and mould this solid and heavy material so it can be perceived as lighter?” and ”How can I incorporate this in a round or curved shape?”. By studying these references, developing more ”hands on” experiments on a smaller scale, and by doing a lot of sketching, I eventually found my final design.





Villa Spies, Torö, Stockholm archipelago

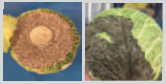
Sketches, models and experiments

- How detailed can the formwork be?
- How do you create a round shape?
- Leafes from cale creates the texture
- Two bowls creates the shape

R: Very detailed!

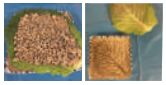

- How detailed can the formwork be?
- How do you create a round shape?
- Leafes from cale creates the texture
- One bowl and a candle creates the shape

R: Very detailed!




- How detailed can the formwork be?
- Leafes from cale creates the texture
- Casted on a paperplate with stones pushing down the leaf during casting

R: Very detailed! + Don't use too much water when casting




- Casting with different materials
- Styrofoam and small sheets of thin wood, clued on a paperplate and then moulded

R: Needs some sort of realease for the edges to be sharp


- How does concrete work with fabric?
- A cotton-cloth drenched in concrete and put over a tin can to dry

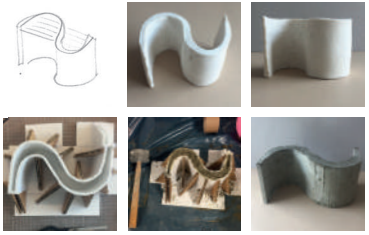
R: Looses a lot of the stability

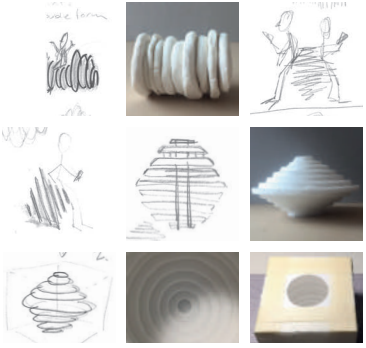
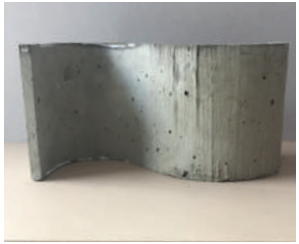

- How detailed can the formwork be?
- How much water do you need for it to dry hard?
- Casted on a paperplate with small dots of clue, extra stones and minimal amount of water

R: Very detailed! + Don't need much water


- How does concrete work with color?
- Black and blue pigment mixed in concrete and casted on a paperplate

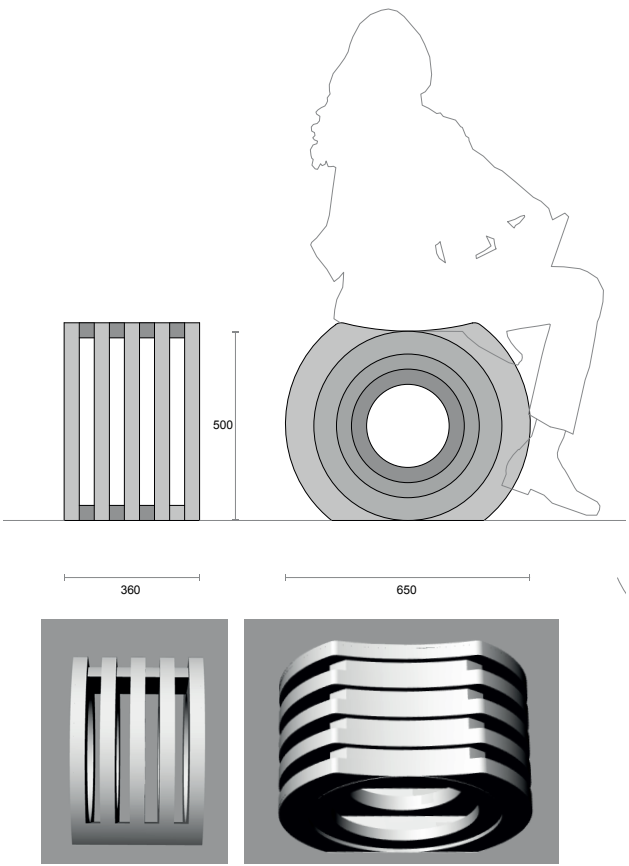
R: Seems to keep it's stability but you need a lot (!) of color and it still looks muted

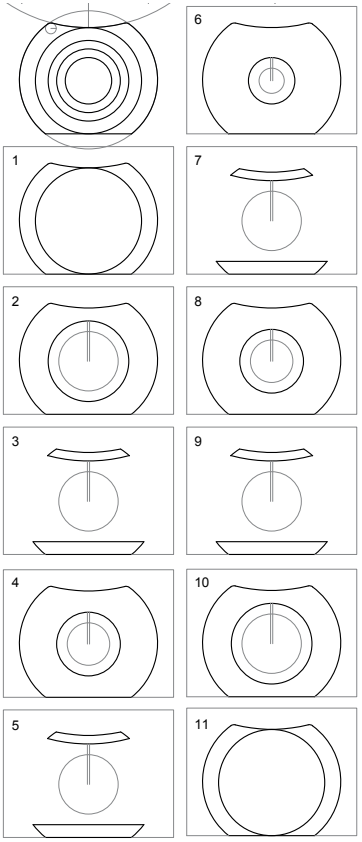



Formwork and casting

I needed a material that would be easy to control and shape. I decided that it was best to work with sheets of styrofoam. The sheets had to be 40 mm thick to fit my design, but the ones I found didn't have the smooth finish that I needed. I therefore had to cover these with smaller, smoother, sheets of styrofoam. All sheets were glued together one by one, and the rebar reinforcement was built simultaneously. This assembly was crucial but also difficult, since I couldn't damage the sheets while fixing the reinforcement and the spacers. I did the casting upside down, vibrated the form and prepared holes for the air to escape. Still, there were some holes created by air-bubbles which I evened out with another casting. The second casting was done after I got the bench out of the mould…

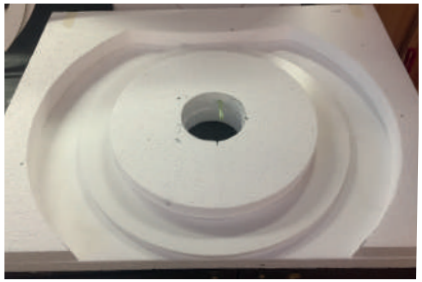
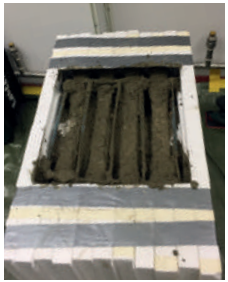


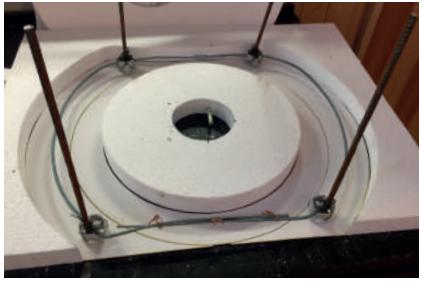
The drawing of the bench



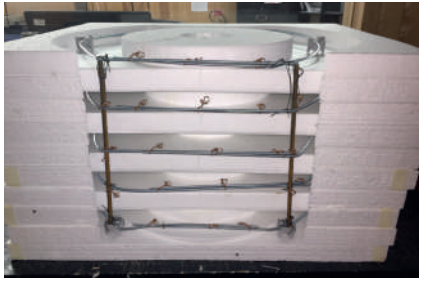
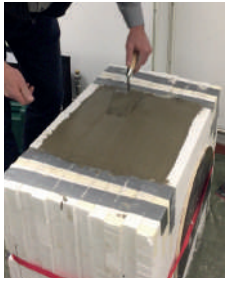
The drawing of the casting mould

Casting





Process of casting the bench, building and opening the mould

DSXSD

Peter Högås

Weight : 200 kg

Measurements: 1200 x 500 x 400 mm.

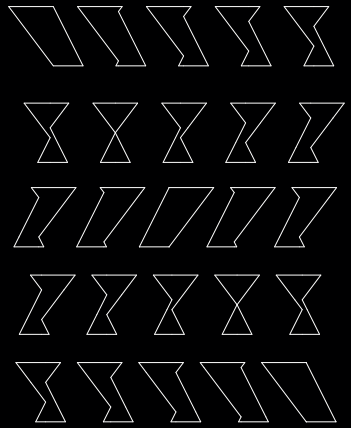
Material for formwork : Casting plywood,
pine wood beams & 45-60mm screws.

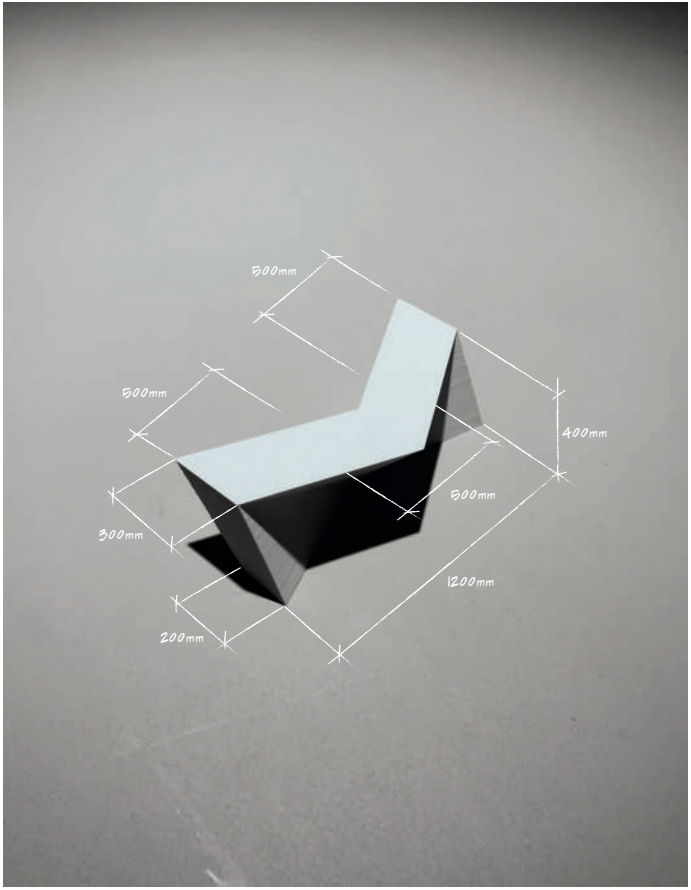
Material for casting: 180kg concrete &
4x 1200mm reinfrorcing iron.

The shape of the bench come from a mirrored shape I discovered after investigating the Indian Jali bricks patterns. The goal with the design was to create a powerful shape that is solid with big volume and low mas with seating for 3 people.

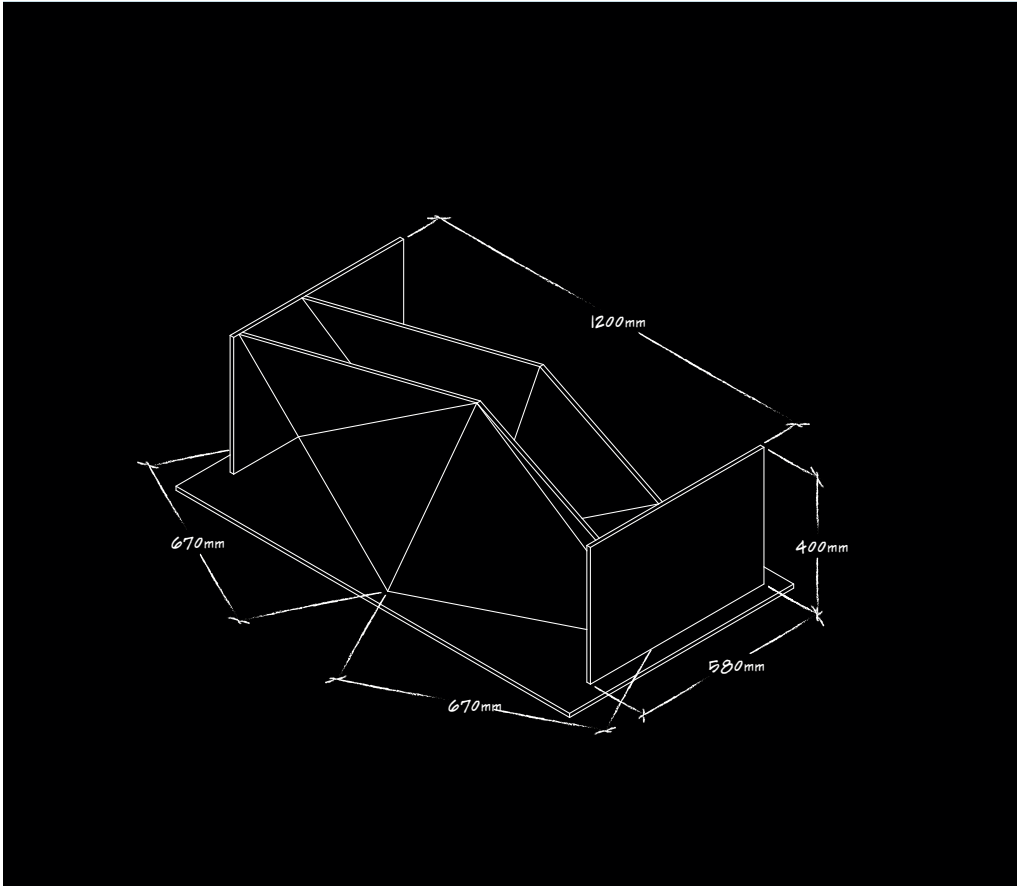
By distorting the top and bottom side, the room for legs and seating increases and also creates a cross in the structure that lower the volume of solid concrete.

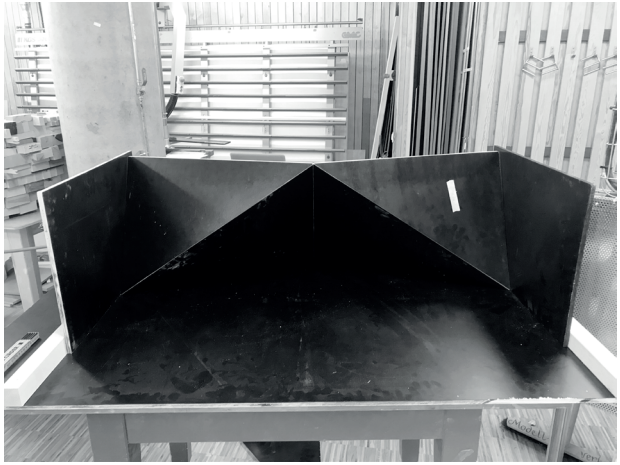
SECTIONS

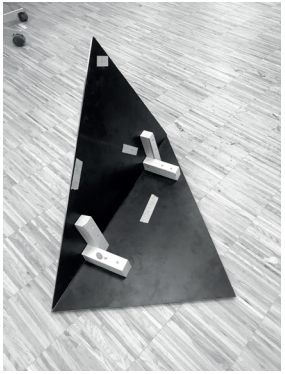


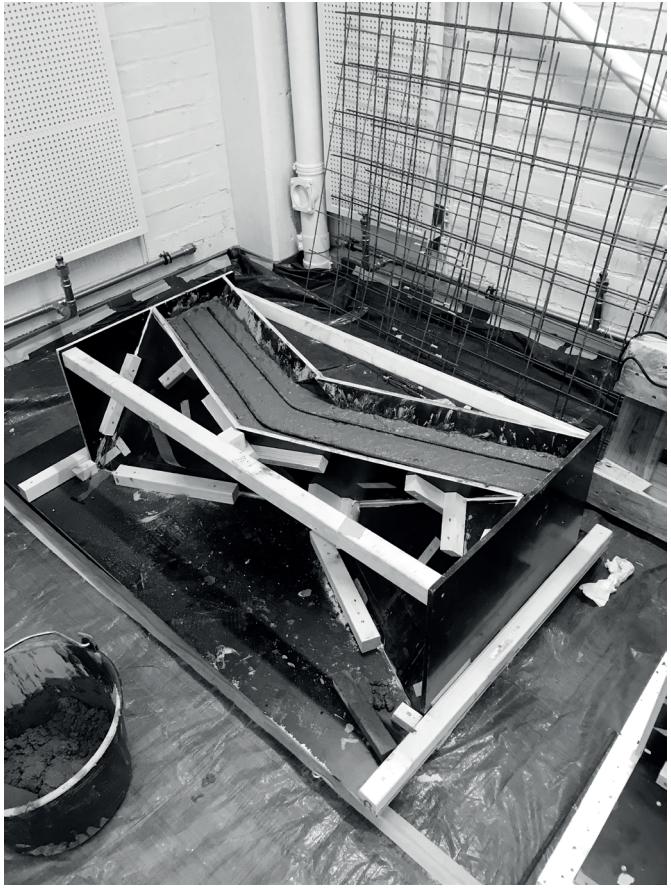


The formwork was made out of 8 peaces of casting plywood carefully cut with the right angles to fit the static bottom and short sides where the pressure from the concrete will push the long sides to its right position, reinforced with four 8mm iron 70mm from top and bottom.









Spiral movement

Leif Lindell

The spiral bech is a investigation on how its possible to express immateriality in concrete. More specificly I'm thinking off a immateriality that can be described as flighty, gas like, evaporating, fleeting, a slow kind of movement. To create this i wanted to explore the metod that the architect Kazunori Fujimoto have used in his spiral staircase. To explore the way he hide, or minimalise, both the amout of concrete use and how he hide the costruction is interesting.

In my investigation I use his metod and transcribe the spiralstaircase into the shape of a bench in reinforced concrete. To reach the fluid, lightweight movment I neded a slim construction with as little mass as possible. And I also had to use the illusion of lightweight. That is done by placing the necessary mass were they do the best effect and to put it were the eye doesn't see it and to keep the edges thin. The bech design also stretches the limits of balance, creating a expression of lightness.

Weight: 121 kg (113 concrete, 8 steel)
Measurements: 217x70x47 cm
Material for formwork: Wooden joists; 45x45 11m, 45x70 8m, Plywood 15mm 2 sheets. Screws, 40mm, 70mm, 12mm around 600. Mounting glue and silicone.
Material for casting: 4-5 25kg concrete bags, 0-4mm, 4-8mm and fluid concrete. Extra sudstance for fluidity, drips of detergent. Steel reinforcement 8mm, 36m. Handmade concrete distances 100 ex.

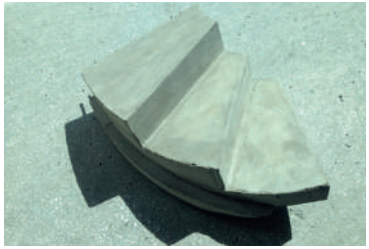
References

The architect Léonie Geisendorf created St: Görans gymnasium in the 1960's, one of her spiral staircases inspired me and became part of my concrete investigations. The elegant movement, the smart construction that hides the robustnes makes it look more slim and lightweight than it actually is and has a playfullness to it. When comparing the Léonie Geisendorf staircase with a contemporary, I chose a spiral staricase by the architect Kazunori Fujimotos from his house in Akitsu in Japan. The swirling movement is there. And its has really thin construction. The construction, facshinated, how was it acctualy made? After investigating the to staircases in smal scale, an investigation process for the bench design started, first in clay, then transcribed into paper and after that I casted one of the ideas in the scale of 1:5.

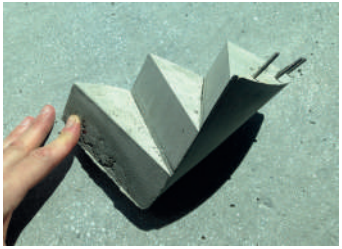
Léonie Geisendorf spiral staircase 1960

Kazunori Fujimotos spiral staircase 2016

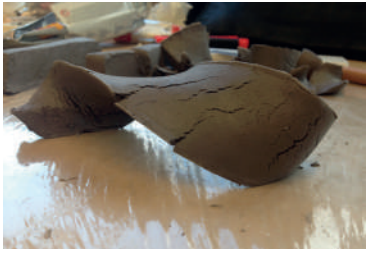
Sketches and models and experiments



Casting of Geisendorf staircase

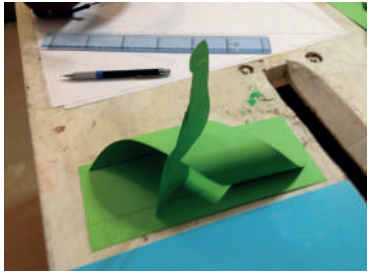


Casting of Fujimotos staircase

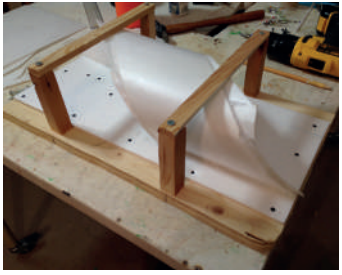


Searching an idea

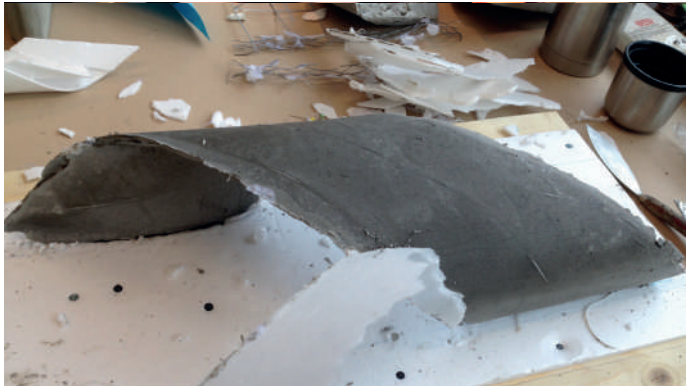
Translating into paper



The main concept in paper



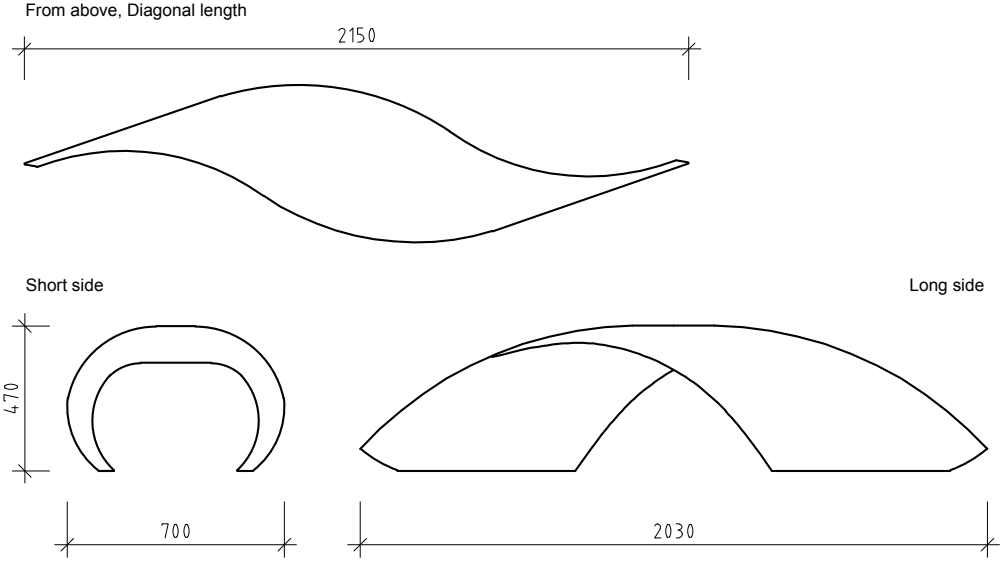
1:5 casting form



The 1:5 concrete sketch is uncovered

Formwork and casting

The formwork was a combination of sheetmetal and wood construction. Closest to the casting surface was the shell of sheetmetal that was cut and shaped by hand. The inner and outer shell was connected with screws. Between the border of inner and outer shell was a foam material placed that was part of the shaping of the concrete edge, the egde was designed to give a tactile sensation when touching the edge with ones hand. The casting shell was stabilised by a wooden platform and a wood outer skeleton. Inside the empty metal shell, I placed reinforcement, shaped to maximalise the strenght and connecting the to legs as much as possible. Special distance holders was handmade in concrete, and placed on strategic places. Before the actual casting the sheetmetal was connected by mounting glue to prevent concrete leakage from the casting form.

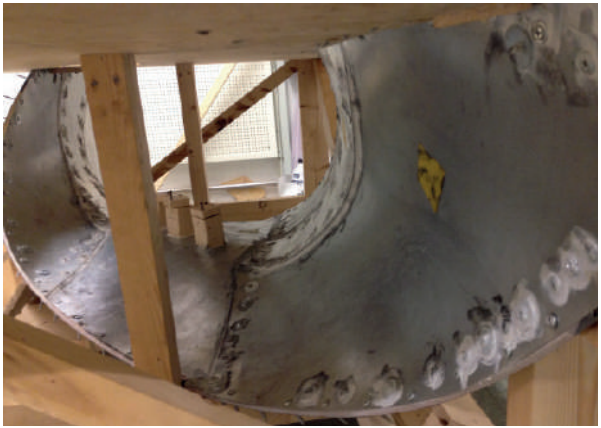


The spiral bench

Casting

1

2



3

1 Reinforcement and foamborder. 2 Inner shell connected with screws, waterproofed. 3 The formwork during casting.

Static To Dynamic

Anton Lindholm

This project investigates different ways of adapting concrete and tries to answer questions regarding its qualities and limitations.
Concrete is one of the most common materials in the building industry as it offers exceptional durability and long life in any structure. This non organic material suites perfect for foundations and load bearing contructions but how could it become more dynamic/flexible?

This project goes against the conventional ways of using materials. The visual perception contrast the the user experience, from static to dynamic.

A special thanks to Bromma stål that provided the steel.

Information

Dimension: 830x620x450 mm

Material
- Galvanised steel (5 mm)
- Steel cables 24 m (D=2 mm)
- Concrete 20 L
- 1 mm plastic
- MDF-board
- Wood glue
- Steel wire

Sponsor Bromma Stål

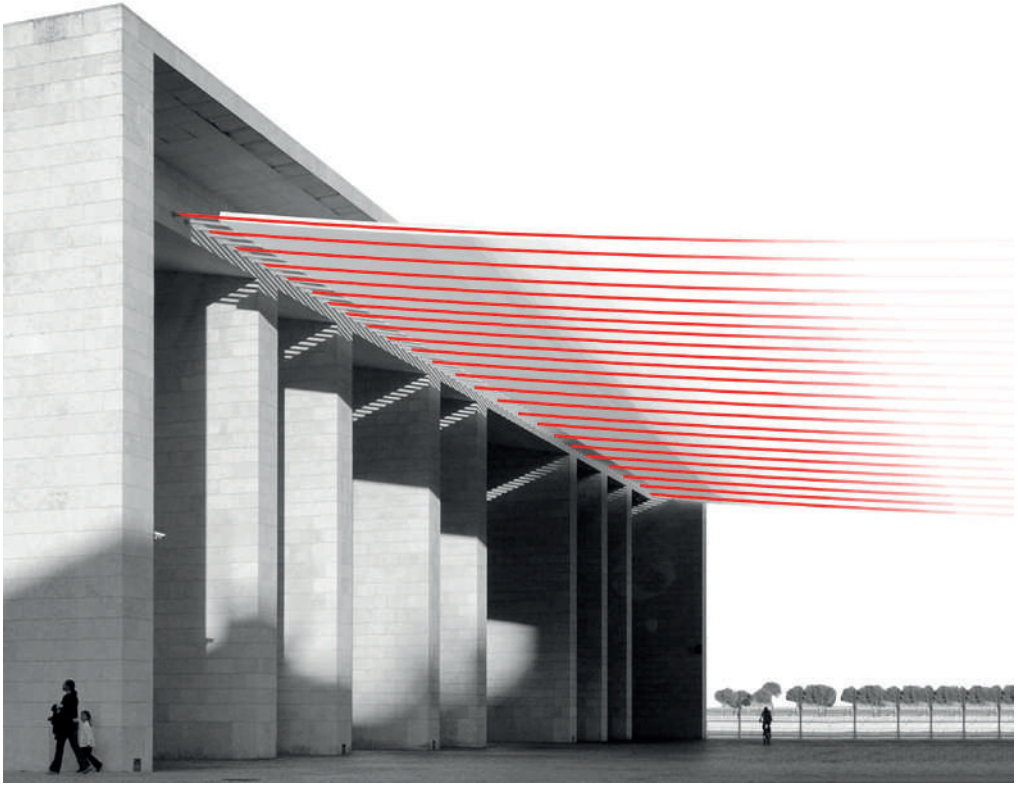
Portuguese National Pavilion
by Álvaro Siza

This building was planed for the 1998 Lisbon World Exposition and was designed to host the festival. The heart of the building is an enormous concrete canopy, draped between two walls.

The canopy spans an area of 70 meters by 50 meters and gives the visitor a feeling of weightless. Siza really emphasizing the connection between the space and the view beyond, wanted to frame the river with an enclosed and column-free space.

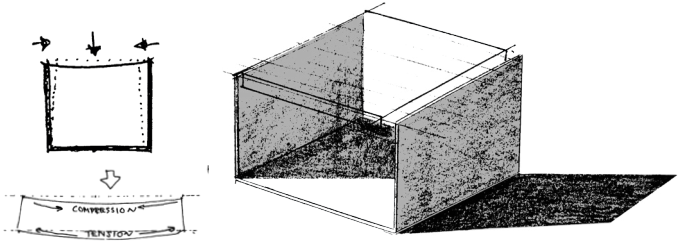
This enormous concrete roof stops abruptly before the wall and reveals the thin cables that connect the canopy to its supports. This gap enables the roof to sway and bounce and does also prevent it to crack.

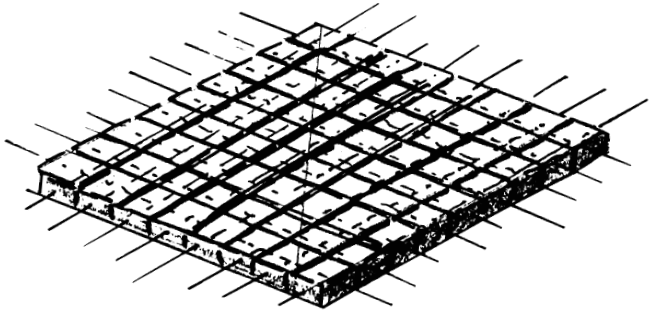
This detail served as the generator in this project.

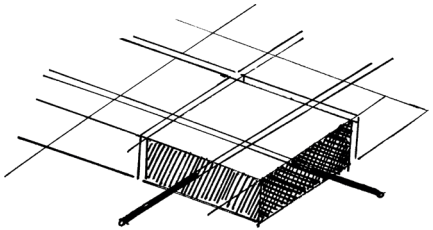


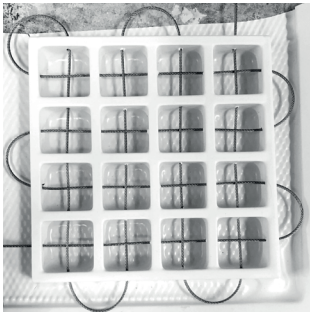
Collage showing the connection

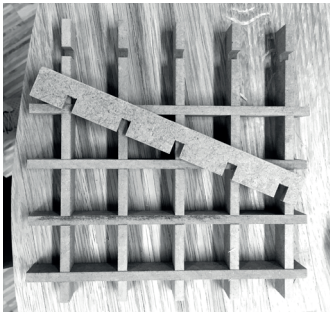
Sketches and models and experiments











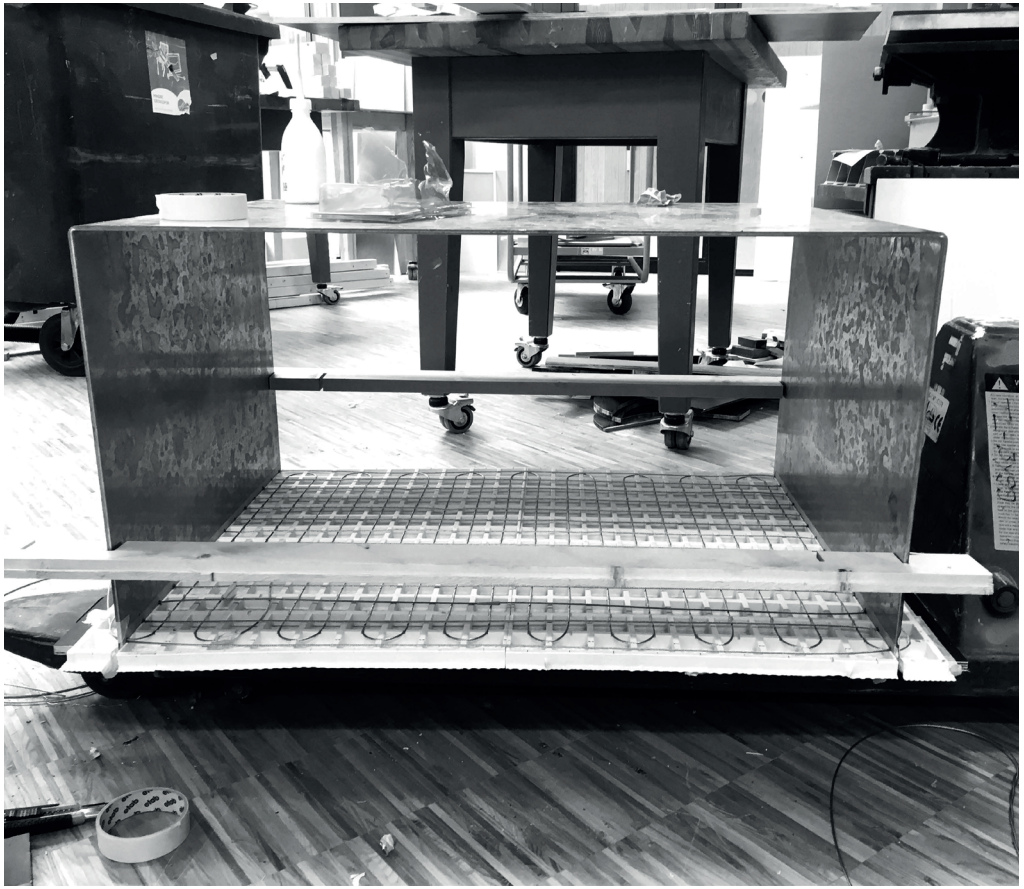
Left: Sketches of construction, Right: Exploring flexibility, casting mold

Casting

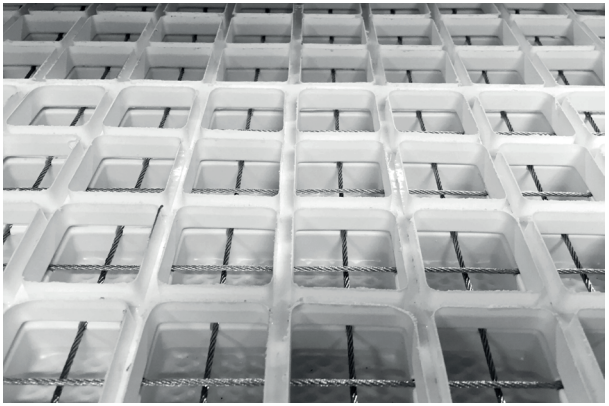
I casted it upside down to prevent any stress in the cables and to ensure a smoother top surface.
Then I used a pallet truck to cast on. Whith this method I could easily vibrate the concrete simply by dragging the truck over the floor tiles.

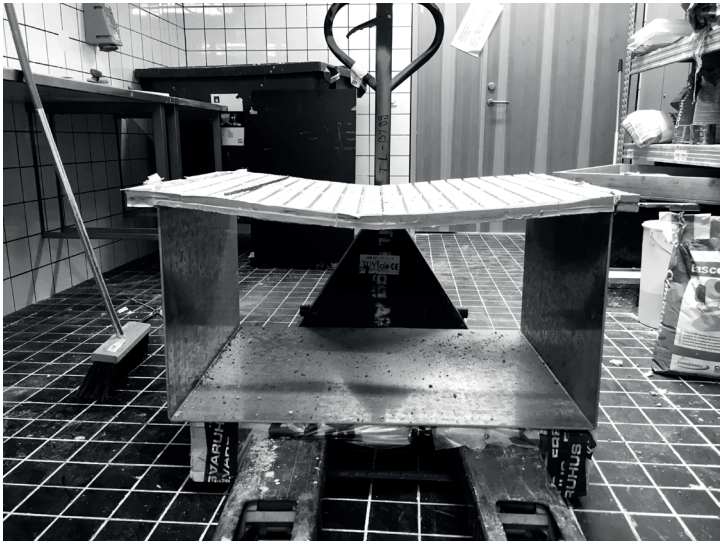
Construction

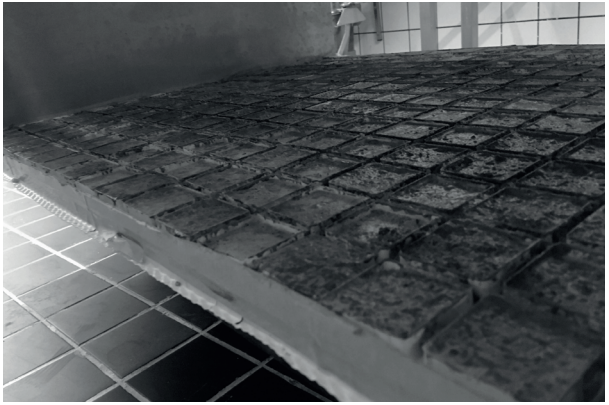
The base is made of a 5 mm galvanized steel profile which is holding up a grid of concrete. The grid consists of 280 pieces of 40x40 mm concrete cells which are connected with a steel cable. The cable is weaved through every cell in a continuous way creating a strong cohesive unit.
The metal frame together with the cables gives the user a feeling of flexibility and softness and at the same time a high comfort.
The distance between the cells prevents the metal to stretch beyond the yield point.

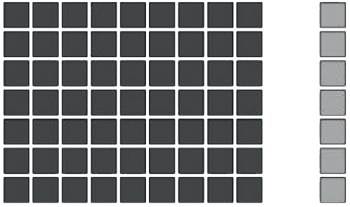


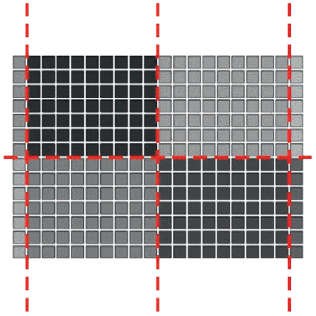
Preparation before casting











Top left-right: Plastic mold, After curing Bottom left-right: close-up casting, Separation

Title: 15°

Rocco Anthony Pacini

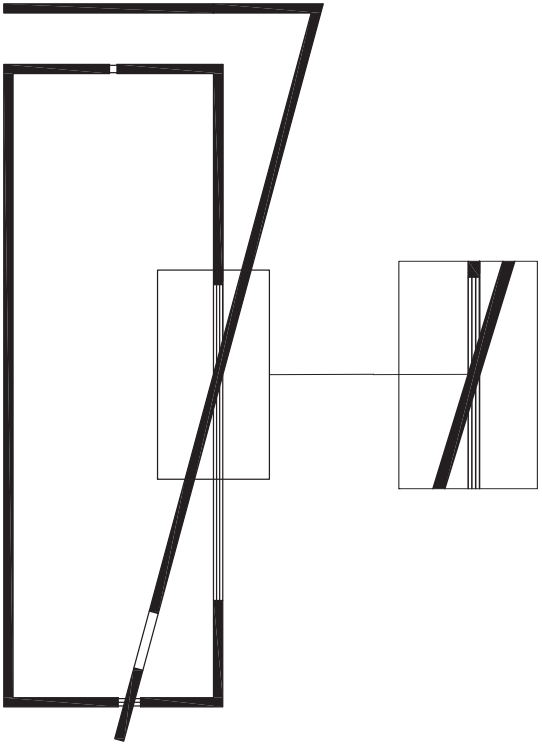
The focus for this project was to investigate how the 15° angle meets the perpendicular axis. The investigation highlighted *hidden complexities* during the fabrication that proved to be extremley difficult and challenging.

Concrete Bench Statistics:
Weight: ≈ 110 kg
Measurements: 200x71x48 cm
Formwork Materials:
1 sheet av form plywood 2.5m x 1.25m x 12mm (3,13 sq m)
Fasterns: 150-200 varied lengths
Rebar: 2 lengths 4m x 6mm
Concrete netting: ≈ 2m x 0.5m
PVC concrete spacers: 7
Concrete: ≈3.5 bags á 25 kg/b
(pre-mixed-rough concrete)
FACTOID:
Formwork/Casting: The formwork was fabricated in reverse i.e. upside down.

References:
The Church of Light (1989)
Location: Osaka, Japan
Architect: Tadao Ando

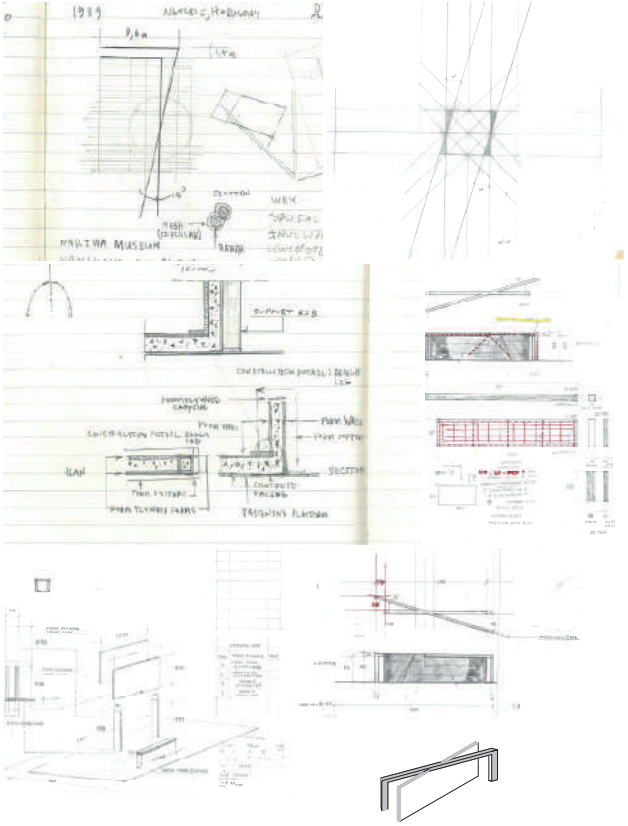
CONCEPT:
To transform an building element into an concrete element suitable for sitting.

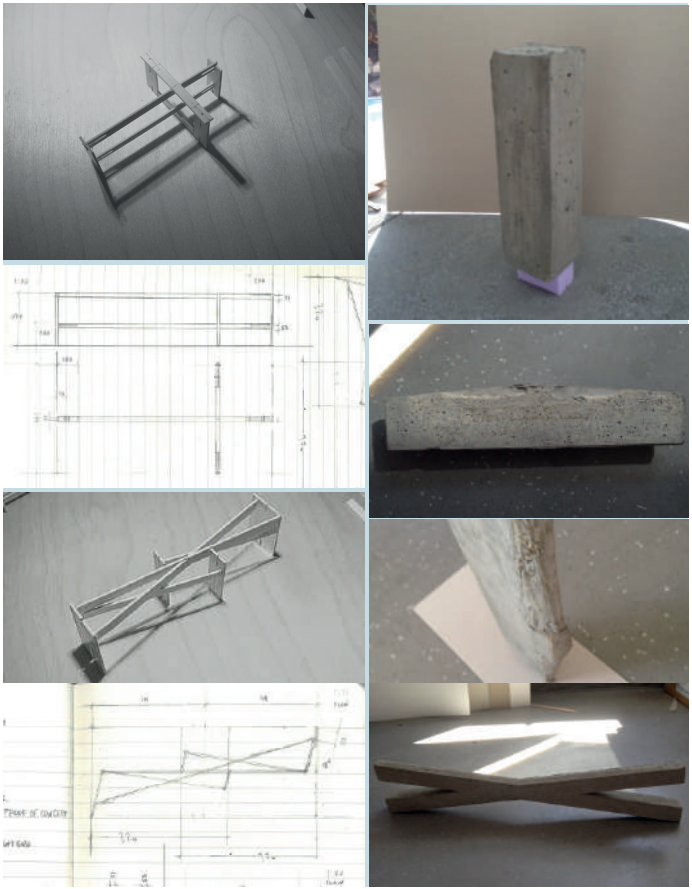
Key Words:
Formwork preparation
Tectonics
Investigate the 15 degree intersection
Thin
Quality of the casting
Daylight
Light weight
Harmonic
Water element
Negitive spacing



Plan - The Chruch of Light + an highlighted detail of the 15°. Interior image of the intersection.

Sketches and models and experiments

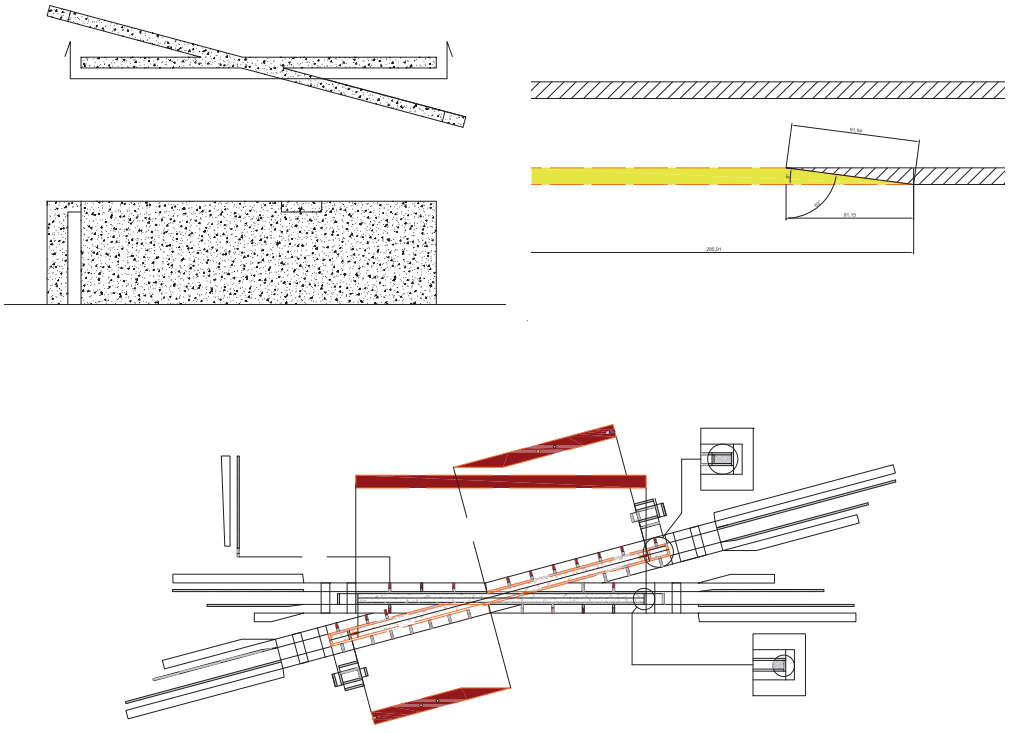




Design process diagrams. Working models and test elements. Prototype casting 1:1.

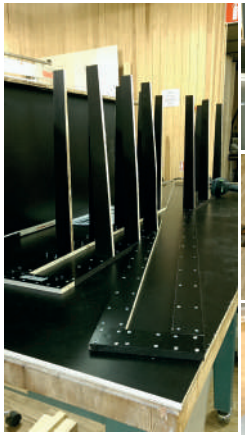
Formwork and casting

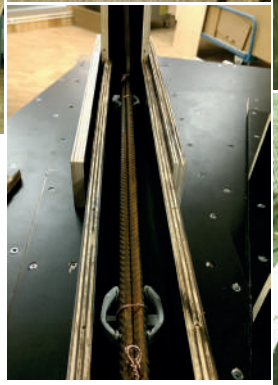
The formwork for this project 14 days and was build in reverse, i.e. upside dwon. This type of fabrication technique is required to have the best possible casting results.

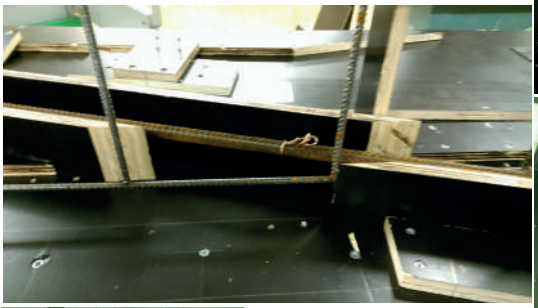


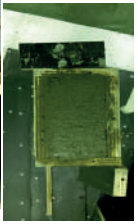
Plan, Long section, detail cross-section at the 15° crossing. An exploxed plan + components.

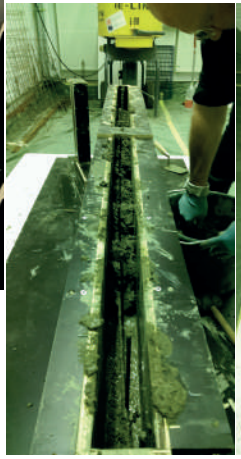
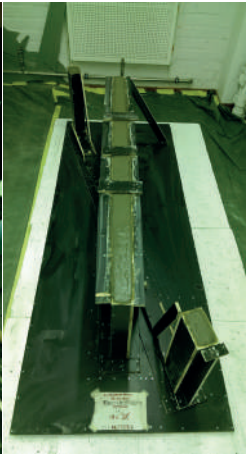
Casting





Formwork fabrication + components. Casting process and a casting sequence.

ARCH BENCH

Han Xue

Arch: From Architecture to Furniture

“Arch, in architecture and civil engineering, a curved member that is used to span an opening and to support loads from above. The arch formed the basis for the evolution of the vault.”

It plays an important role in the history of architecture. This graceful structure support concrete and bricks for thousands of years.

Nowadays, arch develops with new technology and it becomes more and more graceful and stable.

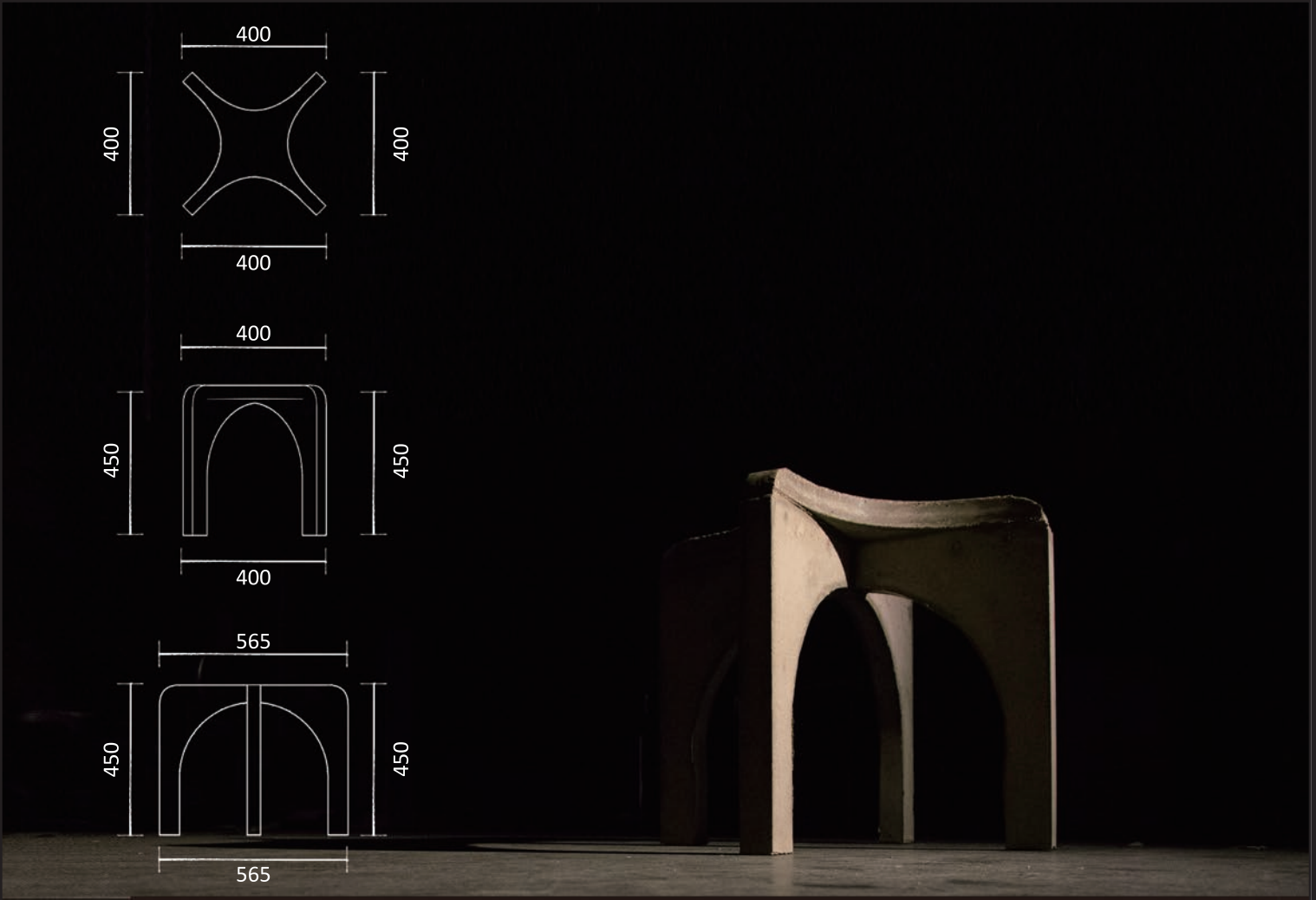
This bench is inspired by arches in Tama university library. It got the concept from intersecting arches with reinforce steel bar inside to make the structure stronger.

Weight: 30kg

Measurements:
400mm*400mm length 450mm height

Material for formwork :
plywood 12mm thickness
& plactic 2mm thickness

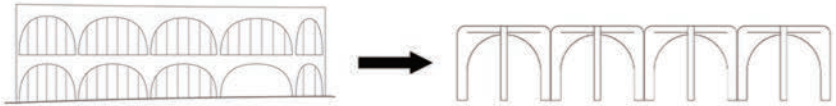
Material for casting:
concrete
reinforcement steel bar
10mm diameter


400
400
400
400
400
400
450
450
400
565
450
450
565

References

This bench is inspired by arches in Tama university library. The stucture in Tama is com[osed of 12mm thick steel plates reinforced with 75mm wide flanges. This steel is covered with concrete that serves both to prevent bucking and as firepoofing, resulting in an extremely thi reinforced concrete wall.

TAMA ART UNIVERSITY LIBRARY



TAMA UNIVERSITY LIBRARY
ARCHITECT: TOYO ITO
LOCATION: TOKYO, JAPAN
TIME: 2017

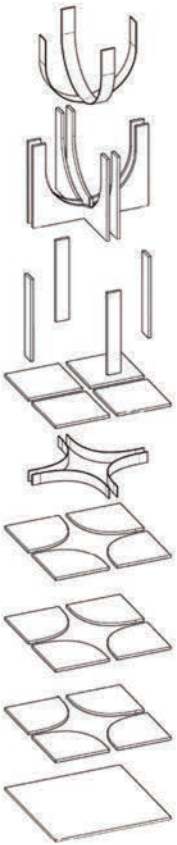
Models and experiments

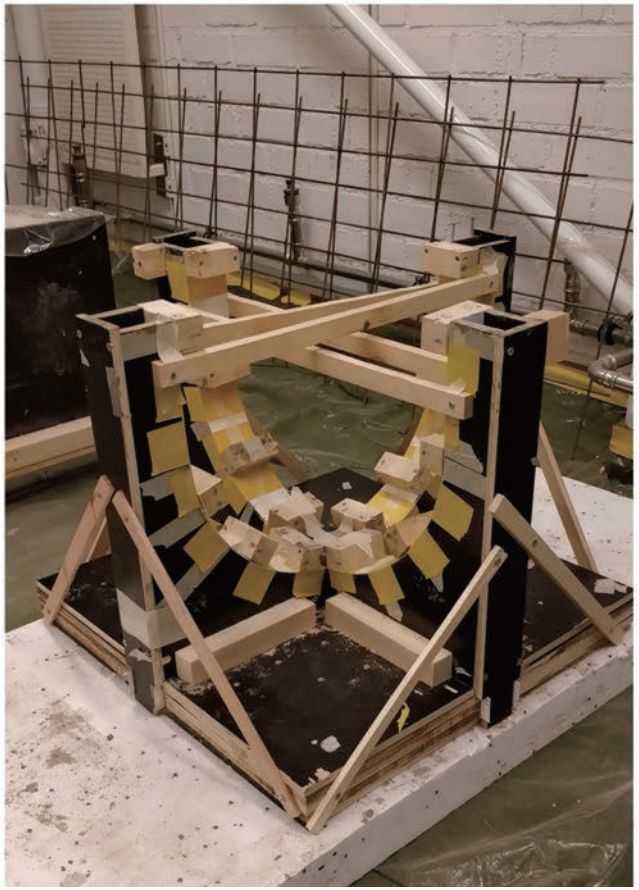
Formwork and casting

The formwork uses 12mm plywood and 2mm plastic, also 10mm diameter reinforcement steel bar inside to make the bench stronger.

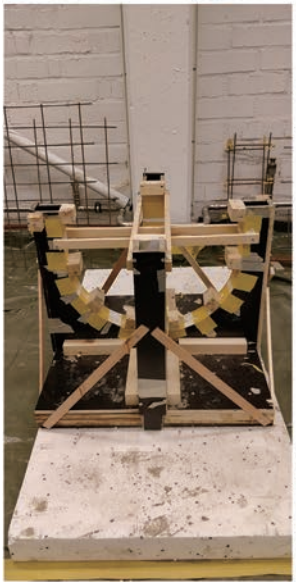
The casting process experience a lot of failure. At first time, the formwork was broken and concrete flew out of the formwork. So the first bench is something like rough and unbalance. Then I had to take another week to fix my formwork and cast again.

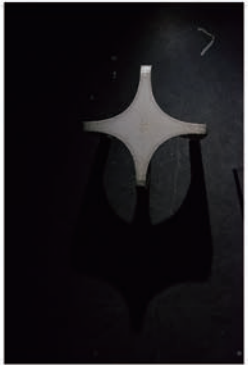
The result is good, at least , my benches will not feel longly, they have each other.





Casting & Photos





KTH Royal Institute of Technology
School of Architecture

www.arch.kth.se

For more information, please contact
Charlie Gullström (charlieg@kth.se)