STARGAZING STRUCTURE IN RINDAL

AAR 4565 - TIMBER CONSTRUCTION 2014

NTNU FACULTY OF ARCHITECTURE AND FINE ART

NTNU – Trondheim
Norwegian University of
Science and Technology

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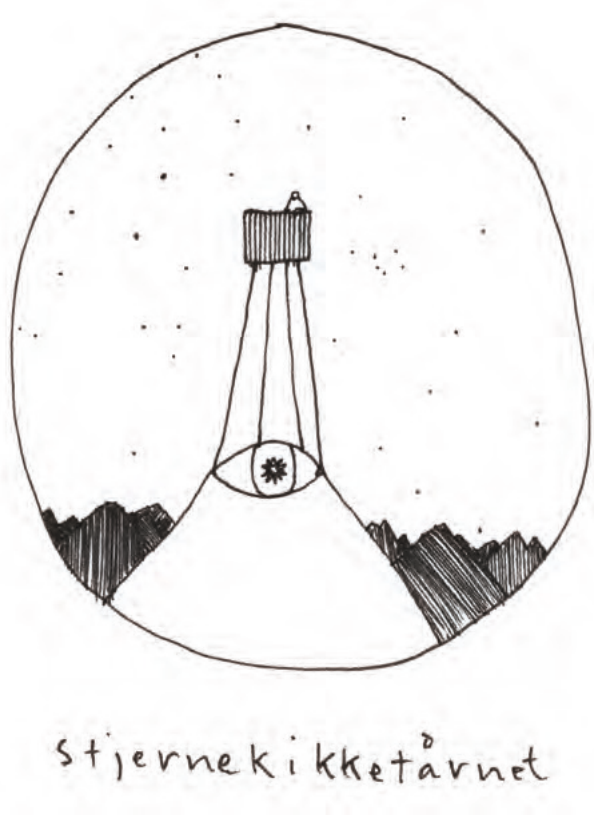

TIMBER CONSTRUCTION

STAR GAZING TOWER IN RINDAL
AAR 4565 - SPRING 2014




INTRODUCTION

The main task of professional architects is to design buildings to be built on site as physical structures. However, in architectural education, the end product usually only consists of drawings, scale models and 3D digital models. This book is a presentation of the results of two integrated courses worked out in 2014, Timberstructures A and B, using full-size models and technical drawings for timber structure details as an important educational tool.

The use of M = 1:1 full-size building workshops is a pedagogic tool that enables architecture students to test their own design and to experience the transition from representation to the actual object in a safe environment where experimentation and exploration are encouraged and valued. Thus, the students are learning by doing.

The courses this year were full-time and 15 weeks in duration. During the first week the students and teachers visited the site for the stargazing structure case study in Rindal. A meeting with the municipality, represented with the mayor, and an arrangement in school and kindergarten was set up. The students intended to collect the children's ideas of a stargazing structure as inspiration.

Over the following five weeks, the 15 students attending the course designed their own individual concept proposals as "paper on the wall projects". After a presentation, the teachers selected four of the proposals for further development by student groups. The students could not work on their own project and had to switch to another selected project. At the end of a two week period, the four concepts were presented to the client, who gave response for further development. Before the presentation, all the timber structures were designed by Focus software to decide the necessary dimensions on the components.

Two weeks were allotted for ordering components and developing details; after which, the building process of M = 1:2 and M = 1:1 details began. During the next three weeks the models and the drawings of the group projects were completed. During the two last weeks, the students produced this report, documenting the projects and the process. The report is the actual documentation delivered by the students for the examination and describes the two stages in the courses.

Full-size construction of details as a part of developing a project has a significantly higher value than a "paper on the wall project". By developing their own architectural design in detail, the students achieve increased insight into the development of architectural concepts and into the inherent properties of materials, structures, workmanship, fabrication, collaboration and communication. Such skills are important for architects who want to create innovative wooden architecture.

We wish to thank the municipality in Rindal for their participating interest and collaboration. Special thanks to the Talgø Company for their sponsorship financing both the students visit to the site and the production of this report. Also thanks to Moelven Limtre AS and Tresenteret helping us getting affordable materials for the M = 1:1 detailing. Last, but not least we wish to thank all of the students for their achievement.

Trondheim 2014
Jan Siem, Bjørn Otto Braaten and Arnstein Gilberg

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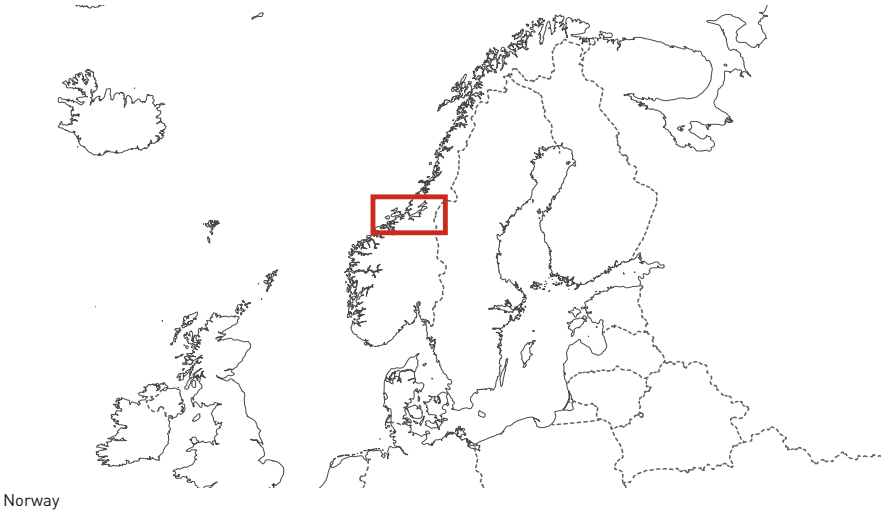
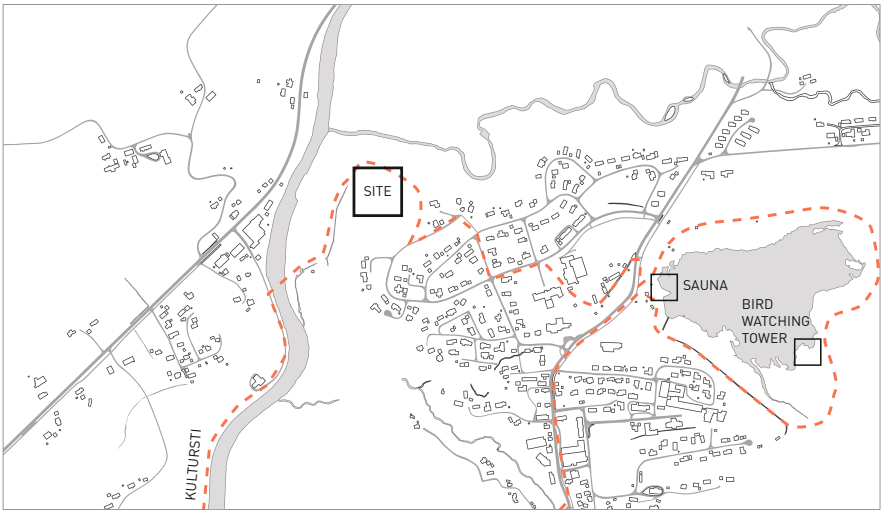
BACKGROUND



Norway

Rindal



Location site

THE COLLABORATION

In the last few years architecture students from NTNU have built two projects in the community of Rindal. These projects are part of an agreement that ensures education, research and practice for the architecture students and provides the community of Rindal with additions to their 'Kul-Tur-Sti'.

This Kul-Tur-Sti, or Cul-Ture-Path, is an initiative to create a walking path around the community of Rindal with all sorts of activities along the route. The NTNU architecture students already build a sauna and birdwatching tower, and were asked in 2014 to start designing a stargazing structure. Due to financial and planning reasons this design was spread out over two semesters. Both the spring semester of 2014 and 2015 students get the chance to work on a design that might be chosen for actual build. All students work the first period on an individual design, of which four projects are chosen to work on in groups. In the end one of these in total eight projects is chosen to build in Rindal.

KUL-TUR-STI

The community of Rindal initiated the development of this Cul-Ture-Path to create an attractive and environmentally friendly town that will attract people of all ages, especially young people that will settle and bring life to the community. The design of a walking path combined with a culture path was introduced in 2005 by the local associations of Rindal. This path would contribute to the knowledge of the community's nature, culture and history. All along the path there would be signs to display the agricultural, industrial and transport historical significance.

Also, this path would be an improvement for the children of Rindal, they could get around more easily and to school via this walking path and planned new bridge. For the children across the river Sunna, they will pass new stargazing construction on their way to school. We therefore visited the kindergarten of Rindal before starting our design. A more detailed description of this visit is explained in the next few pages.

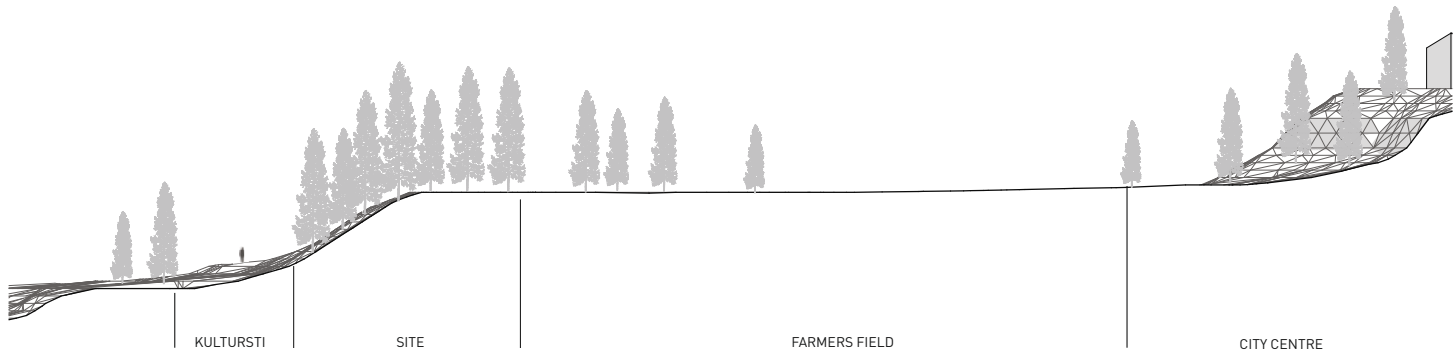
ASSIGNMENT AND SITE

As described before, the assignment from the Rindal commune was to design a stargazing structure along the Kul-Tur-Sti. The site is chosen by the municipality, its location is shown in maps on the left hand side. The municipality chose a corner of a field just outside the city. The culture path will pass close to this field. All children on the other side of the river will take this path each morning on their way to school.

The site is quite typical, there is a lot of opportunity for placemaking. It is situated as said in the corner of a field, and on the edge to quite a steep hill. There is a natural clearing in the dense woods that provides some direction to the site.

It also creates some natural sightlines and different types of access to the site. It is possible to access it via the field or, more adventurously, via the steep hill.

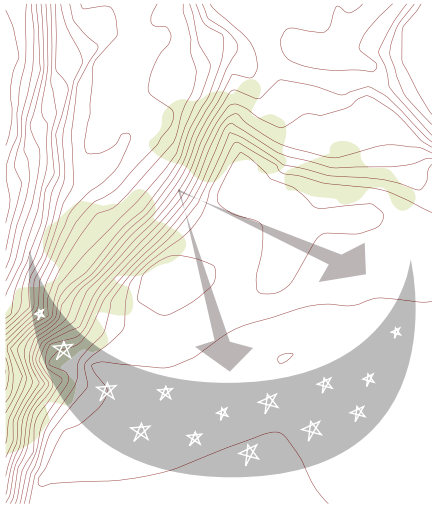
As seen below the site is not naturally ideal for stargazing. From a strictly scientific point of view there is too much light pollution and there are too many trees around so there is not a 360 ° view. Furthermore, the stargazing structure could only be used as such in wintertime, since the sky is to bright in summer months. The Rindal community expressed their wish to see it occupied also in the summer. This led to an interesting discussion about what the place could be in summertime, a playground, a place for coming together or something else.



Section site

Natural clearing and sightlines

Light polution

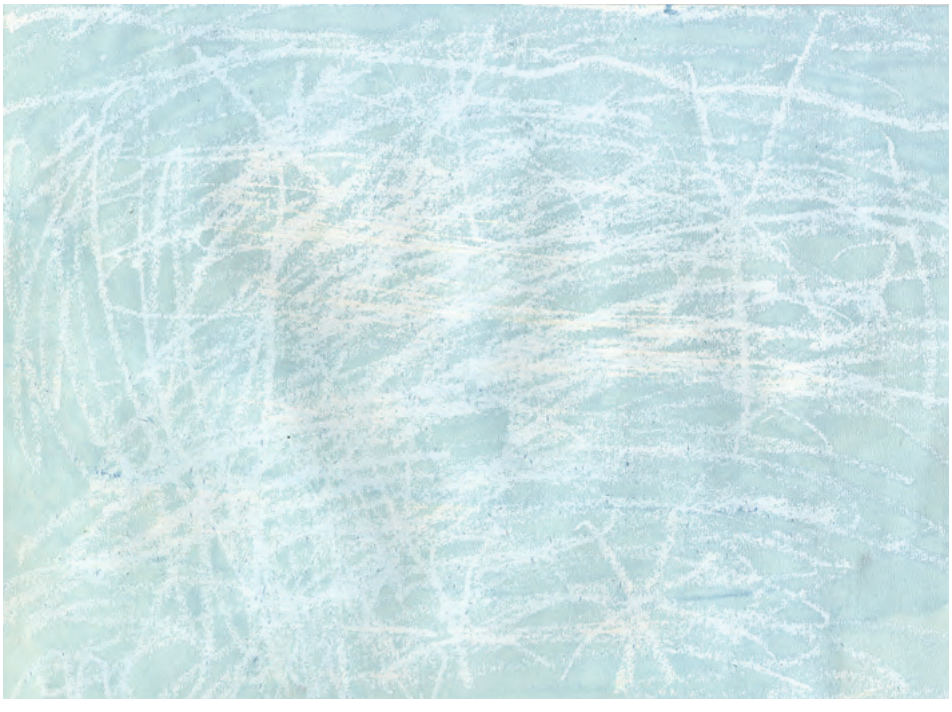

Most interesting night sky

CHILDREN'S DRAWINGS

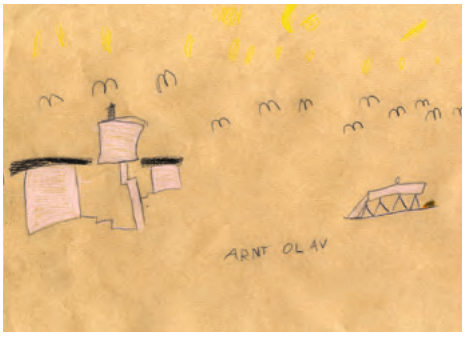
The children of Rindal are important users of the culture path. And for the town it is a goal to provide an interesting community for the children growing up. Looking for inspiration and guidance we travelled to Rindal to get to know the children.

In Rindal we worked with the children in three different age groups. When we talked with them about space and the stars they became very excited, often bombarding us with questions like what is the speed of light and if aliens exist. We provided them with answers to the best of our knowledge. One group showed a slideshow to the kids to set them in the right mood, while another group read mythical stories about the stars. The children often shared their own experiences of gazing up at the stars. One group asked the children to draw blindly with white crayons and then painted over this to reveal the image drawn.

KINDERGARTEN



FIRST GRADE



THIRD GRADE

PHASE 1 — INDIVIDUAL PROJECTS

Presented here are the individual projects of the 15 students. Four of these were selected for further development in phase 2.

After receiving input from both a professional astronomer and from the children in Rindal, we combined these with our own impressions and impressions we got from the site. The result was a visual intention program, which would inform our individual project. These are presented on the first page of each project.

All projects where developed and presented as a model in scale 1:20 - 1:10.

INSTRUMENT FOR LOOKING

ASBJØRN HAMMERVIK FLØ

CONCEPT

In working with the intention program, I found some things that appealed to me both in the childrens drawings from our trip to Rindal, but also tried to let my hand create some interesting lines without thinking to much. When looking at the result, I decided that the focus of my project would be a structure that has some qualities that children of all ages can find alien, that stokes the imagination, and that allows you to ascend to the stars.

I experimented with some different types of alien structure, before landing on a concept of a light structure that supported something heavy. Perhaps it should feel like the whole tower was some sort of instrument that aliens had left in this hill?

SITE

I had decided that I wanted a high structure, both so you could look above the treetops, but also because ascending was an important aspect. I placed the structure a little way down the steep hill, so a bridge could bring you from the top level and right into the structure. The clearing allowed some nice views to the west over the river, so it would be nice to look out the west as you where going up.

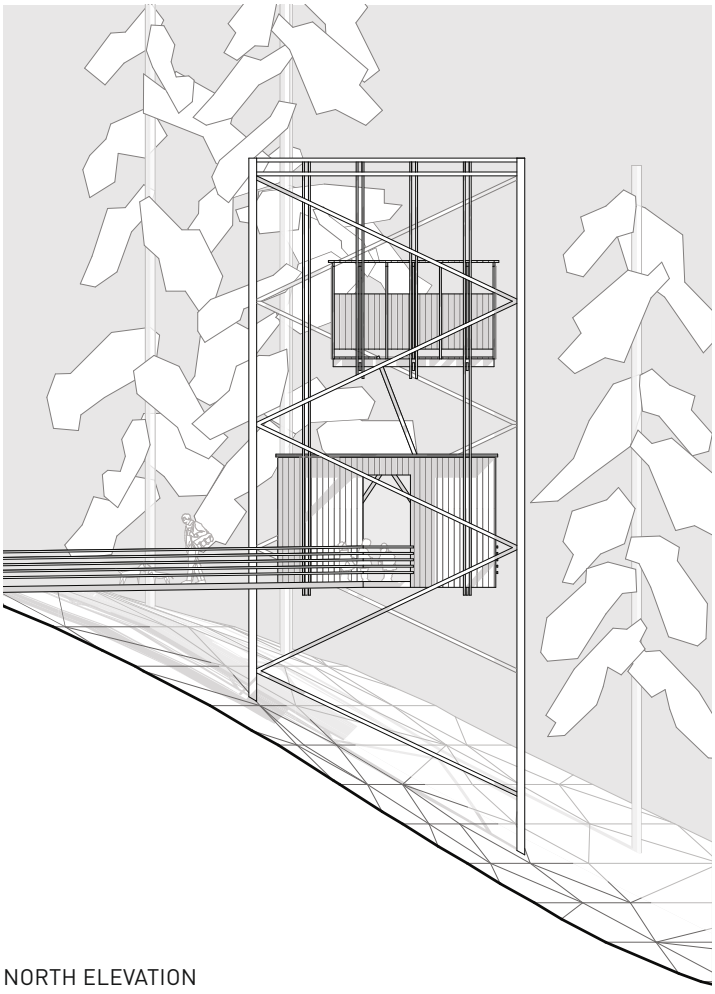
STRUCTURE

I decided to use tension as the main principle. Tension is interesting, because it allows the vertical members to be very slim.

To achieve this, a large frame was constructed, and wooden boxes where suspended from beams at the top. The frame consists of gluelam columns 8"x8" held in place by diagonal trusses 4"x4". The columns where slightly overdimensioned, to make them appear very solid in contrast to the tension members, which where two coupled 2"x2", hanging from 450mm high trussbeams.

Sketch Models

Final model in context



NORTH ELEVATION

WEST ELEVATION

ELEVATIONS M 1:200

At night

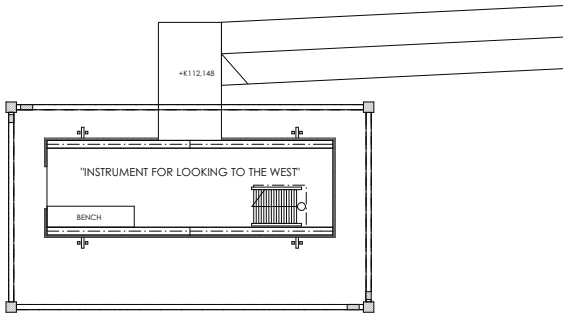
Looking up at the upper platform

END RESULT

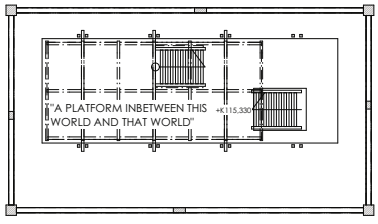
The end was a towerlike frame that held two suspended boxes hanging on slim wooden tension members. A narrow walkway takes you out over the edge of the hill, and to the tower.

In moving through the tower, you would first enter a room with a very controlled view towards the river — the instrument for looking to the west. You go through a hatch in the roof, onto the platform between two worlds, and then finally arrive at the observatory for looking at things above the treetops.

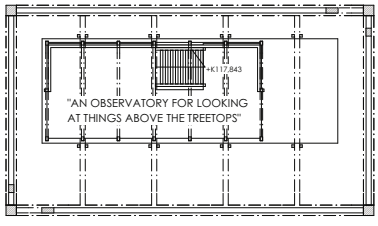
PLANS M 1:150



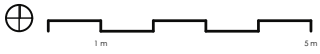
PLAN 1

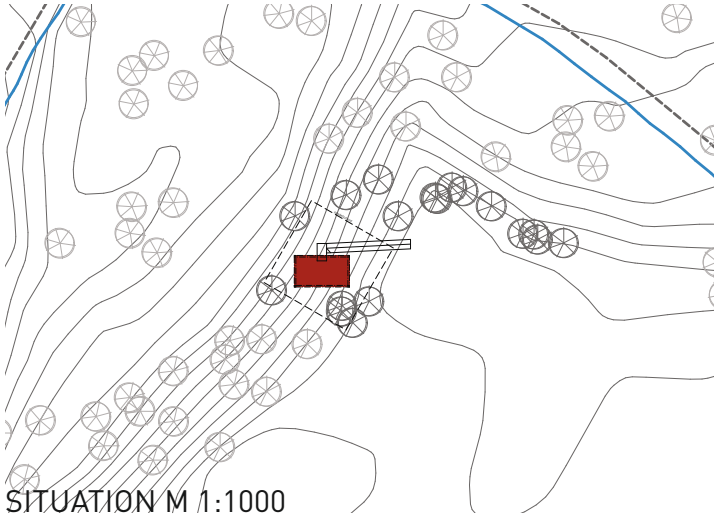


PLAN 2

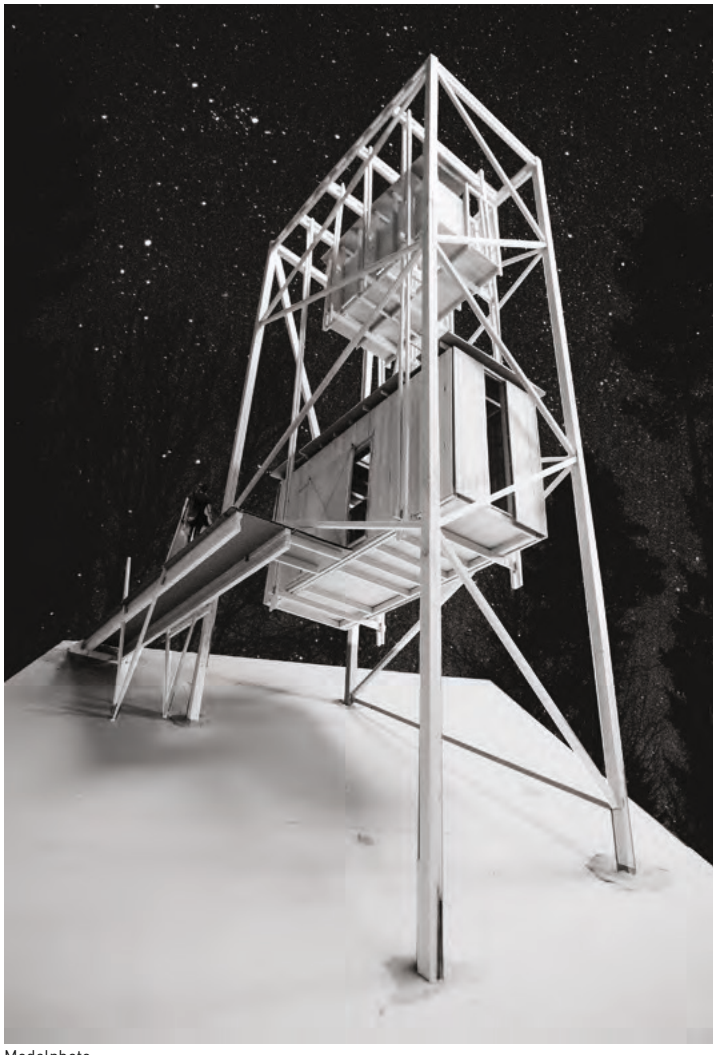


PLAN 3





SITUATION M 1:1000



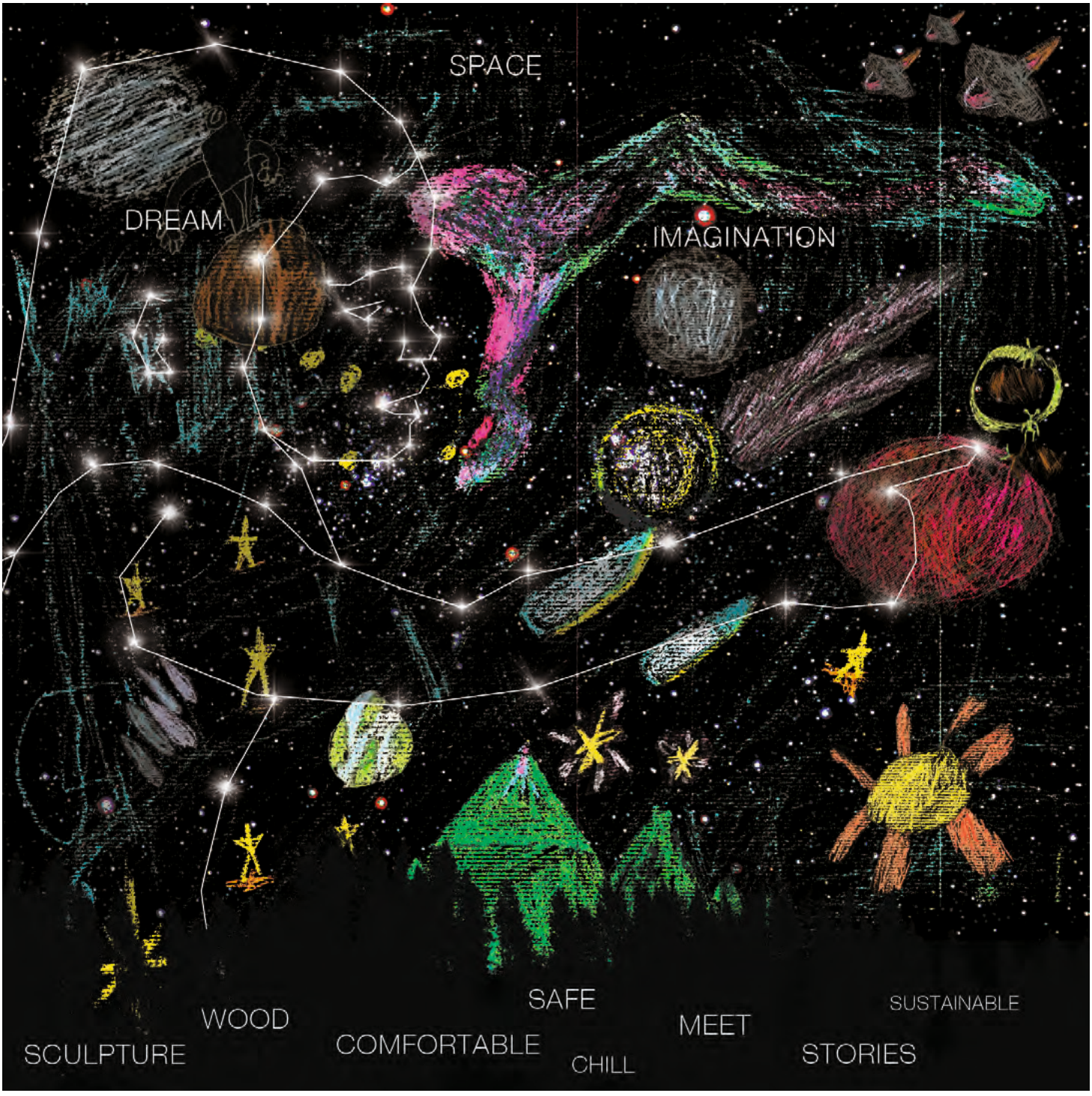
Modelphoto

A view to the west

Detail of tensionrods

DOUBLE WINGS TOWER

AXEL CORNU



STARGAZING TOWER

The “double wings” tower is a stargazing tower divided in three levels.

The first level, or the ground floor, is the meeting area where you can sit and make a fire.

The second level have a 360° view with different spots to admire the environment.

The last level is the stargazing area where you can sit or lay down and admire the stars toward south.

This tower is an educational project intend for the children of Rindal, to allow them to learn more about their sky.

Situation plan

Elevation

Axonometry

Third floor plan

Second floor plan

First floor plan

Model Pictures

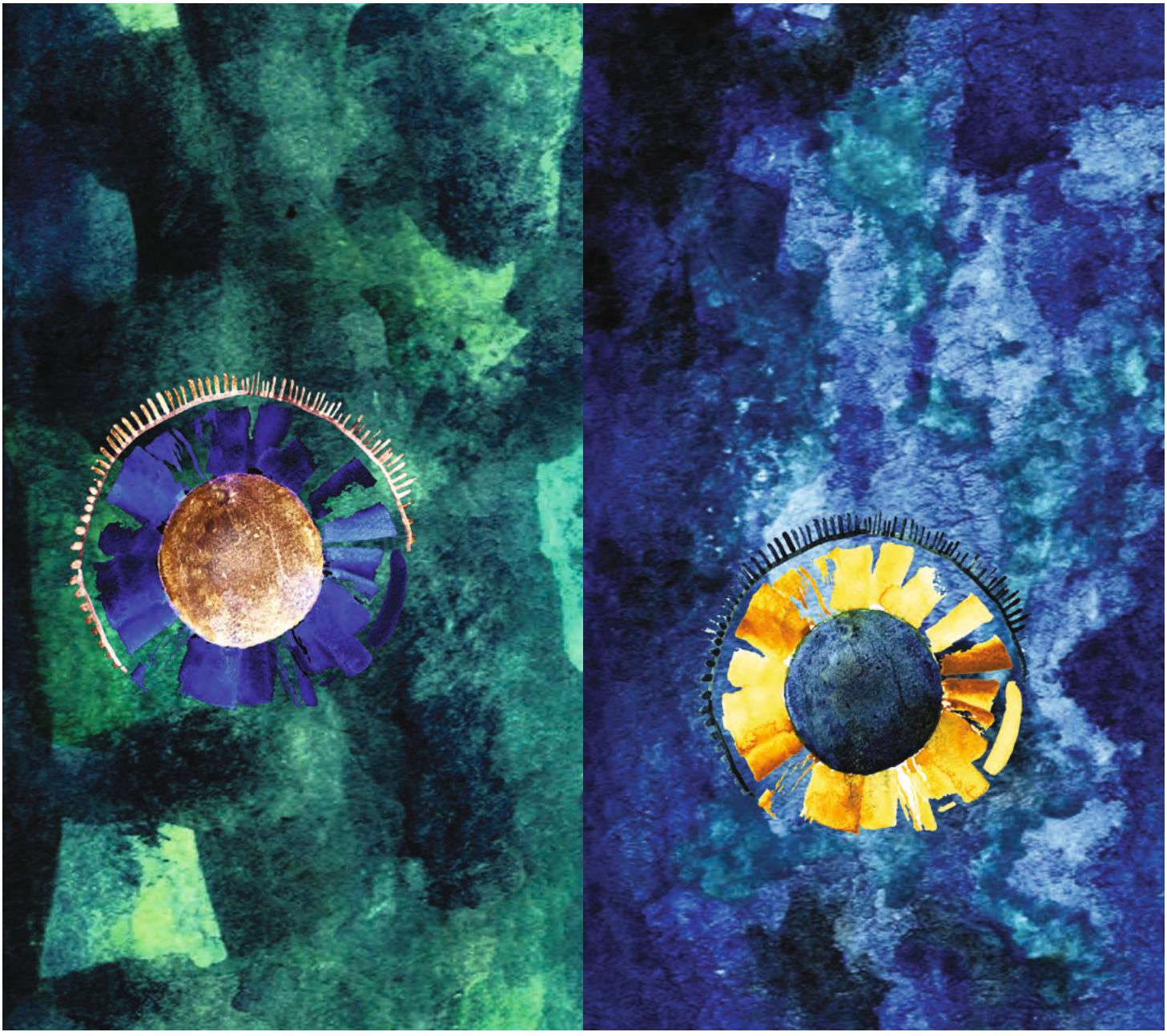
Perspective

UNDER BAKKEN OVER SKYENE

GURO WIKSTEN BRENK

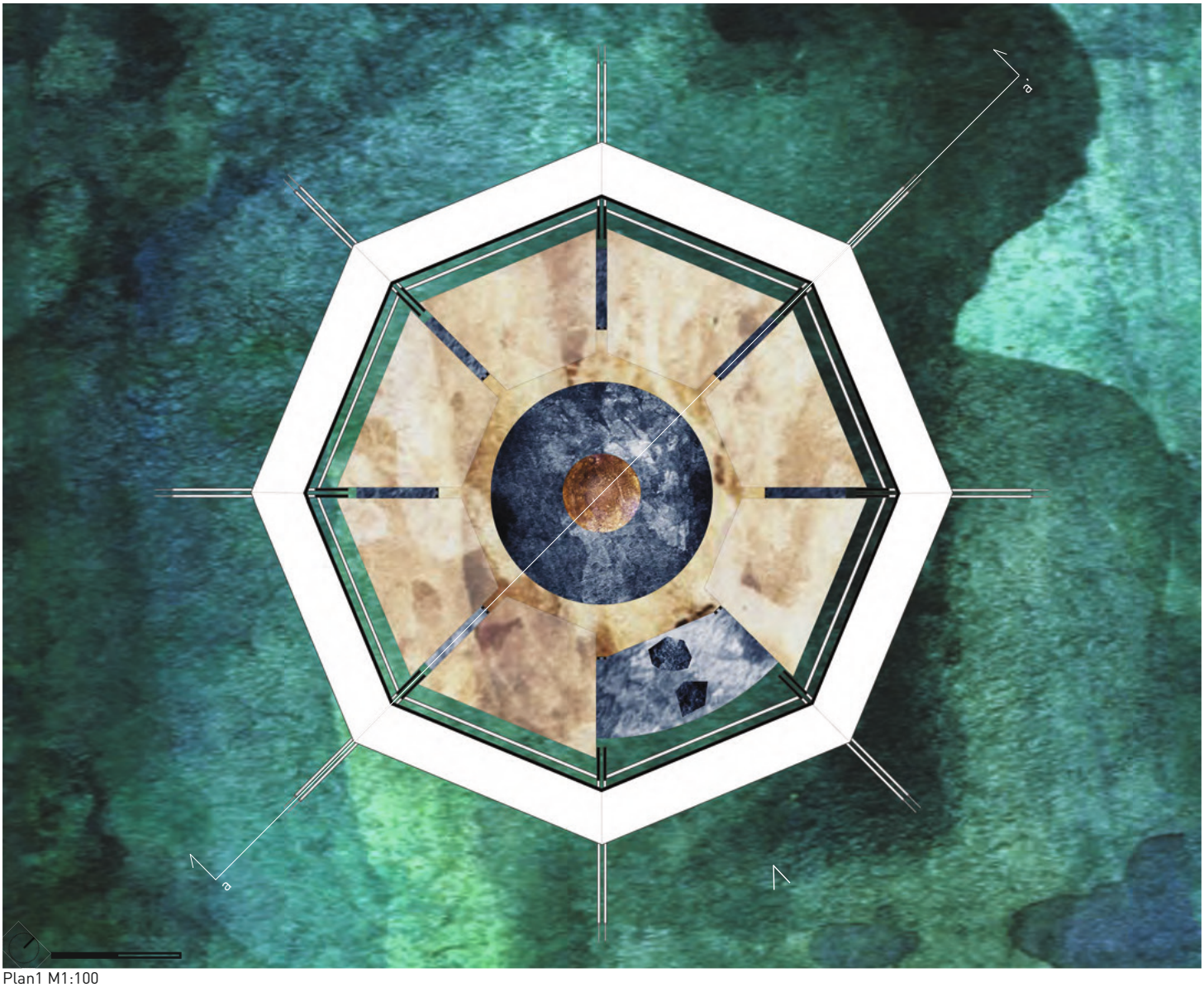
The surface underneath you feels warm, so you fall alseep for a while. High above the night is waiting. Soon it sneaks down and tickles you on your nose. It is time for you to come visit.

A room close to earth and far above the clouds. A place for wamth and stargazing. A place where you become familiar with the night and the dark.

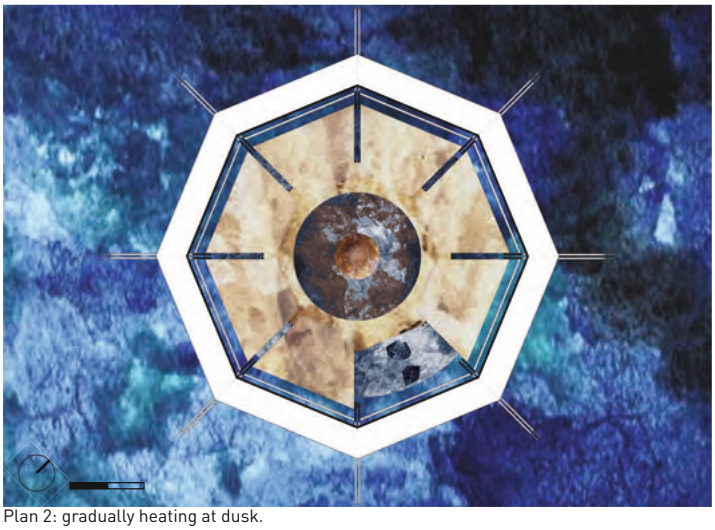


plan

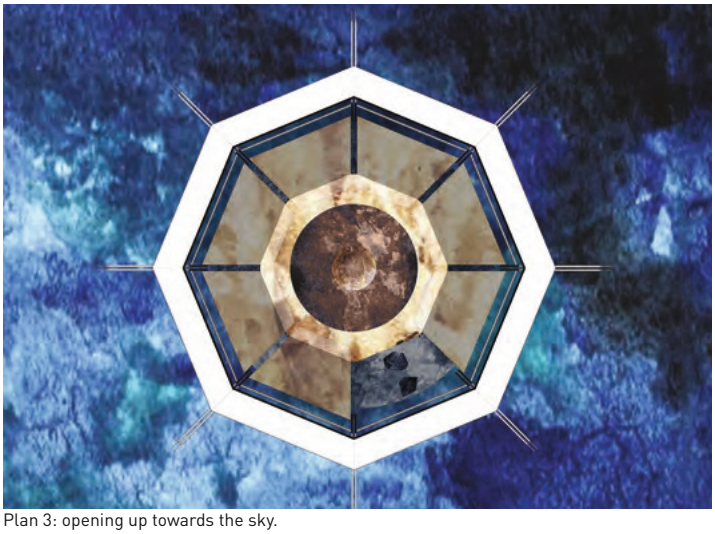
Section a-a' M1:100



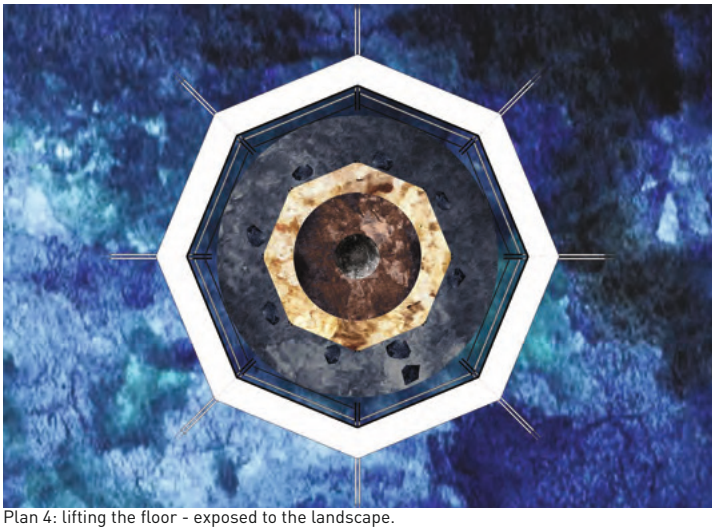
Plan1 M1:100



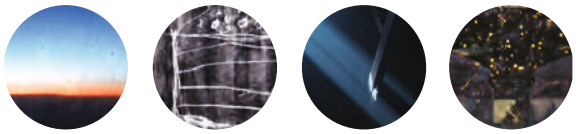
Plan 2: gradually heating at dusk.



Plan 3: opening up towards the sky.



Plan 4: lifting the floor - exposed to the landscape.



TRANSFORMATION

The municipality asks for a fireplace at the site, so the new structure can function as a meeting place for school excursions and family walks. However, the astronomer Jonas told about fire as the stargazers worst enemy; light pollution and smoke destroy the view. With this proposal I wish to unite these two voices. With firing for several hours, you prepare for a transformation of the place. When the stars turn up at night, it is time to change the space that surrounds you.

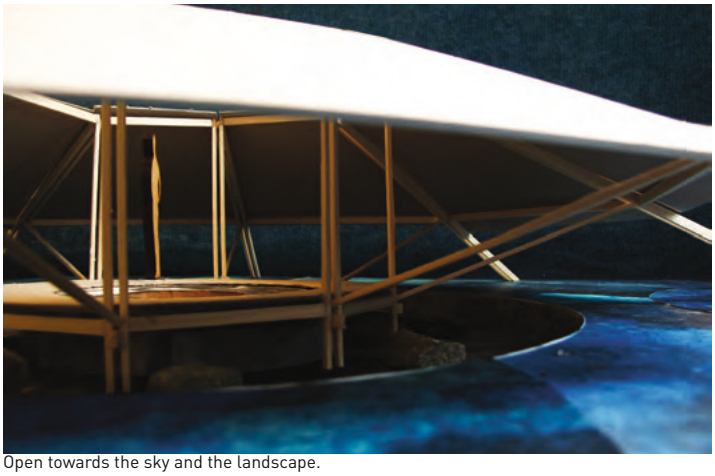
Along the culture path there is a small path continuing alongside an open field. Before you, on the edge of the forest, lies a peculiar tent. You sneak under the structure, balance over a couple of stones and find yourself in front of a fireplace, surrounded by a sloping floor, nice to sit on. Above, a canvas is rustling, filtrating some of the daylight.

During the afternoon we watch after the fire so it keeps burnig, soon the little room is nice and warm. Slowly something is happening with the stone floor in the center; is it getting warmer? (plan 2)

The dark evening wraps around you. It is time to look for the stars. We lie down in the middle of the room, the surface has become warm. The adults quad down the cancas. Now the overwhelming sky almost hit your nose. (plan 3) Finally they tilt the wooden floors up under the ceiling. Endlessly it seems, the dark landscape extends around you. (plan 4)

Situation.

Arriving to prepare for the evening.

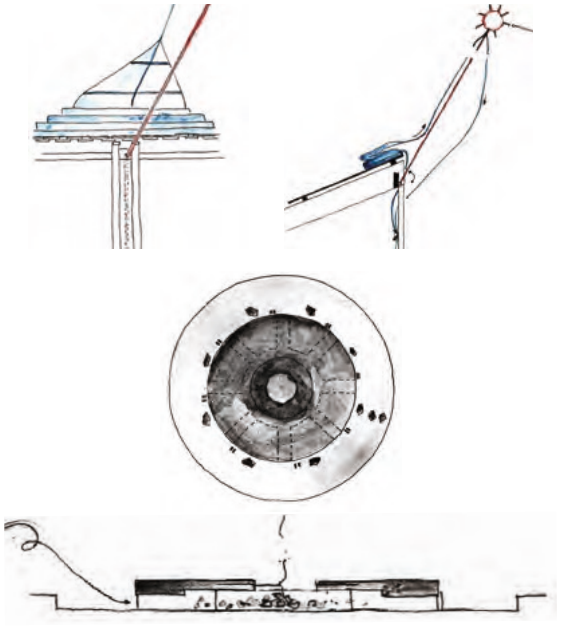


Open towards the sky and the landscape.

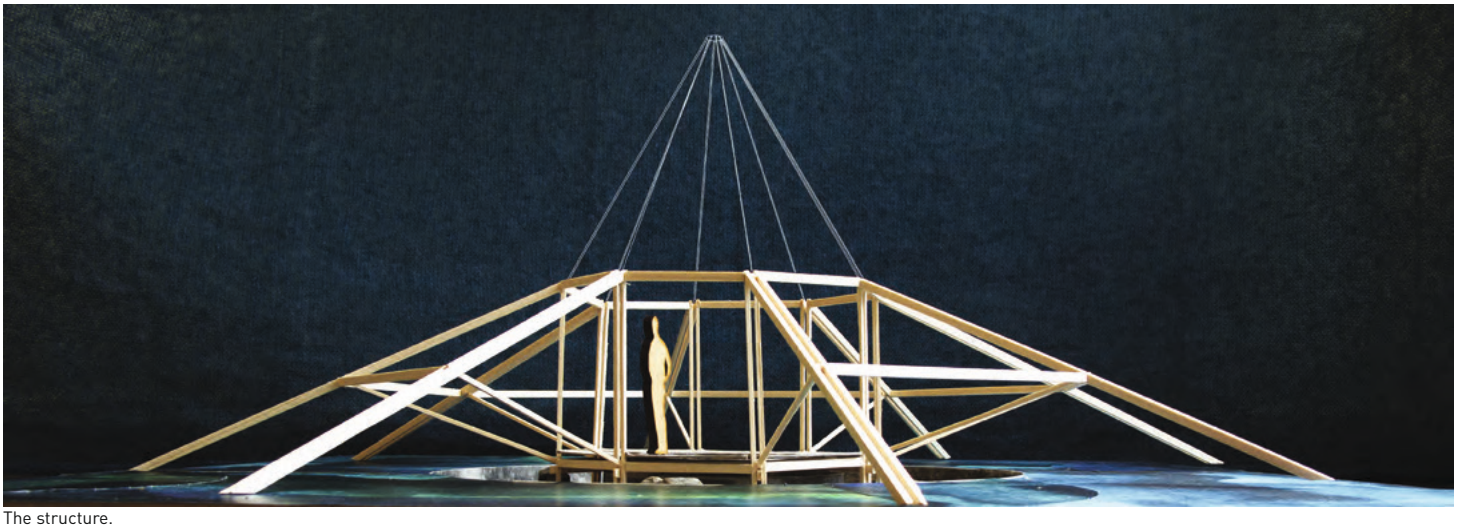
TECHNIQUES

The central floor is in principle an oven. With chambers out on the sides air can run through. Glowing coal is pushed out into the chambers, like in steam locomotives and baking ovens. The area for heat generation is wide. Between the oven and the room lies thin, thermal mass.

The movable roof resembles a tent. Along the wooden structure lies a continous canvas, attached on eight spots. From these spots the canvas can be lifted up and down, supported by telescopic poles.



On top; the tent mechanism. Just above; the chambers for the heating procedure.



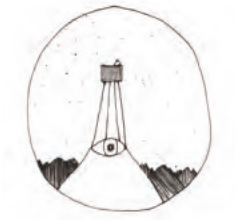
The structure.

THE STAR NEST

HELENE KJÆR BREMSETH

INTENSION
«Structures as points, lines and junctions that emphasize the potential of imagination at the place.»

«An odd place. Not necessarily ugly or pretty. First of all an alien sculpture in Rindal. The structure shall make one ask questions. What kind of place is this? That is what looking at the stars is like. Something that you fully can't comprehend or totally grasp, but still a fascination for how absurd the reality can be.»



-formulations used during the design process

THE TRIP TO THE STAR NEST
A pointy heap of twigs stands on stilts in a steep hill surrounded by pine trees, brushwood and moss. The heap of twigs is an outsider that has found its place in the clearing. This place is a funny place if you look close. And the star nest is ready to be explored.

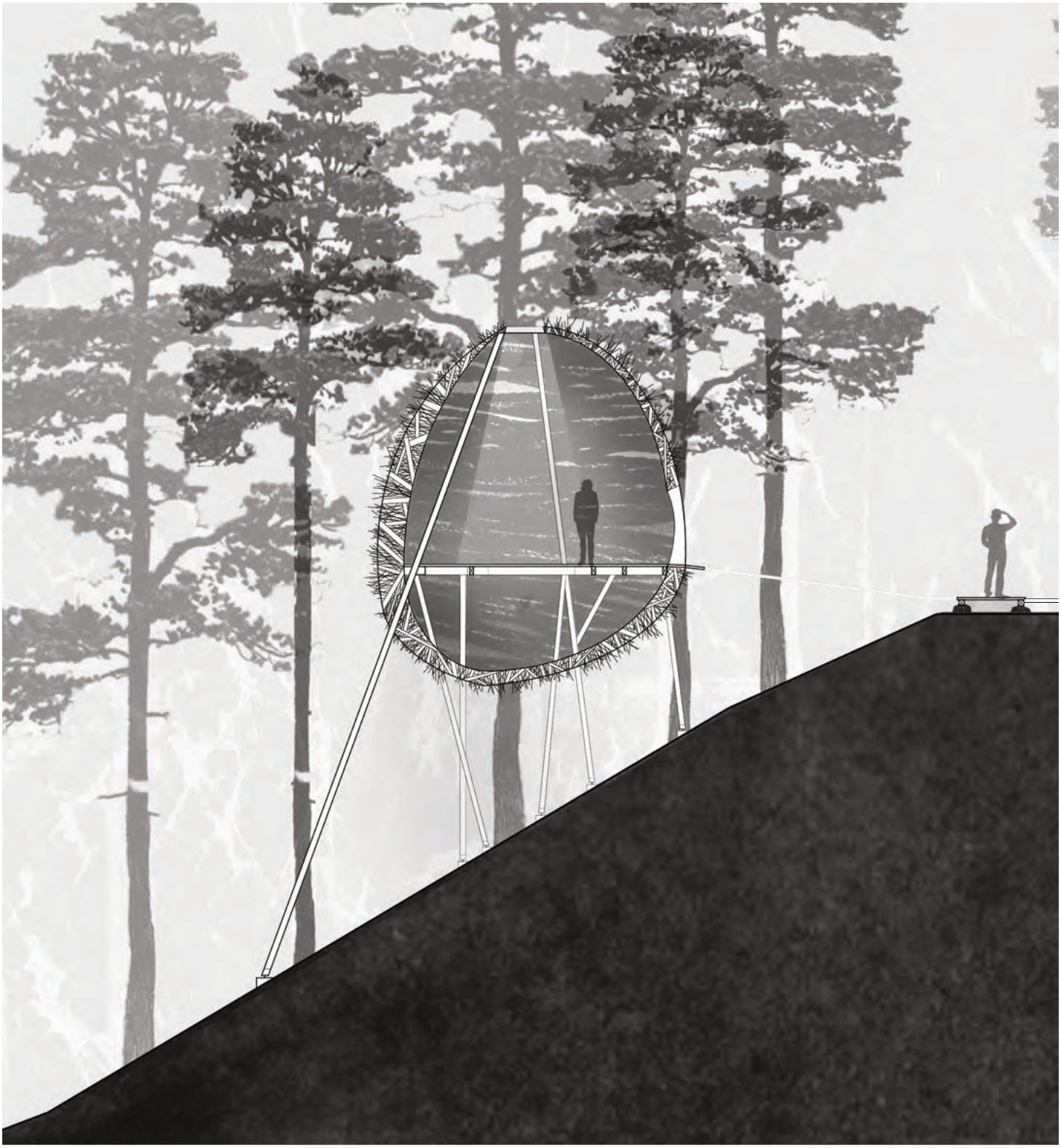
A path leads you over the wet gras, twist and turns and takes you between some trees, takes you over stones and gives you the opportunity to choose other adventures.

Before you move towards the star nest, you can take a brake where the path ends and dangle with your feet over the edge of the simple structure. Then you'll go up to the heap of brushwood and search after the hidden door in all the twisting twigs... The star nest is soft on the inside. The walls encloses you and all around you are bent twigs that curves and takes your view up towards the whole in the roof and the sky beyond.

During the day the sunlight filters through the wall of twigs, and bath you in a soft light that allows you to look at the sky above without wheying. During the night this is the darkest place and only a glimpse of the big heaven of stars above. This structure is about the fascination of looking up.

"a nest of stars"

process shown through skecthing in model



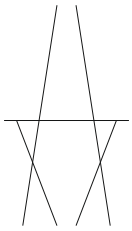
section 1:100

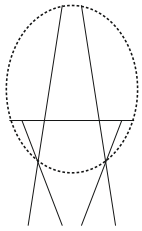
THE STRUCTURE

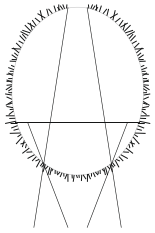
The nest is built up by a primarily construction of diagonals that support each other and creates a steady structure. The diagonals is the «legs» and the floor in the structure.

The secondary construction is a wooden skeleton of woven wood profiles. These creates a «shell» and gives the nest its spacious expression and appearance.

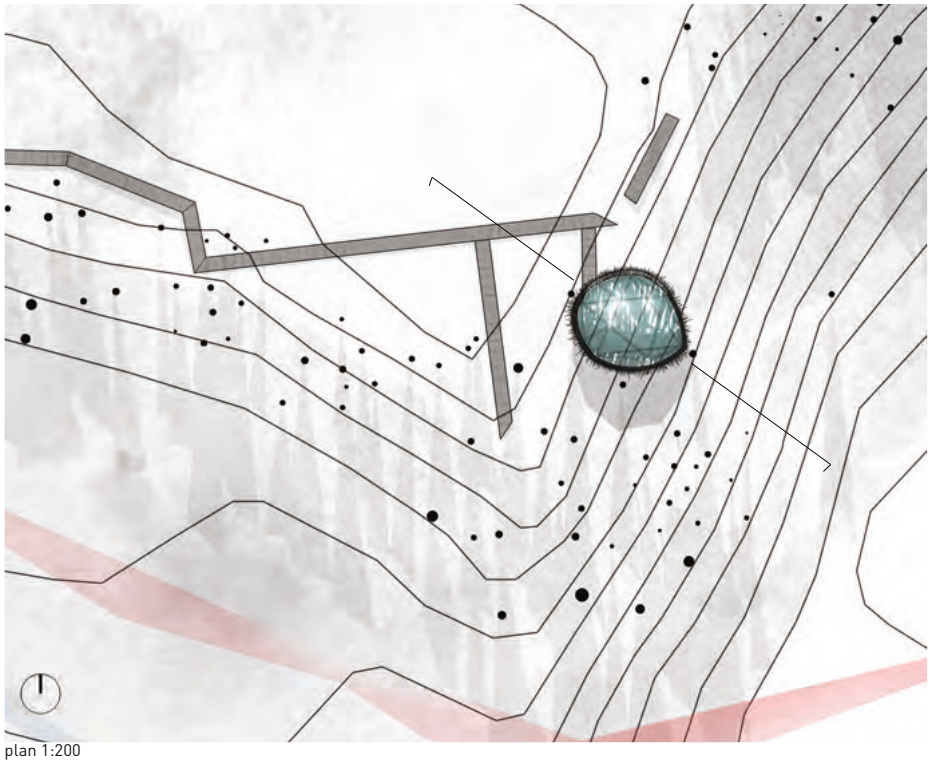
The cladding is bundles of twigs that are folded around the wooden skeleton so that the inside is made smooth and soft on its surface, and then on the outside the surface is pointy and wild. Water, wind and light filters through the cladding and makes the structure an enclosed space with changing characteristic.







structure model with bent wood sticks and thread



plan 1:200

structure model from the inside

wooden skeleton

ASCENT

JONE NORDLAND

PROGRAMME

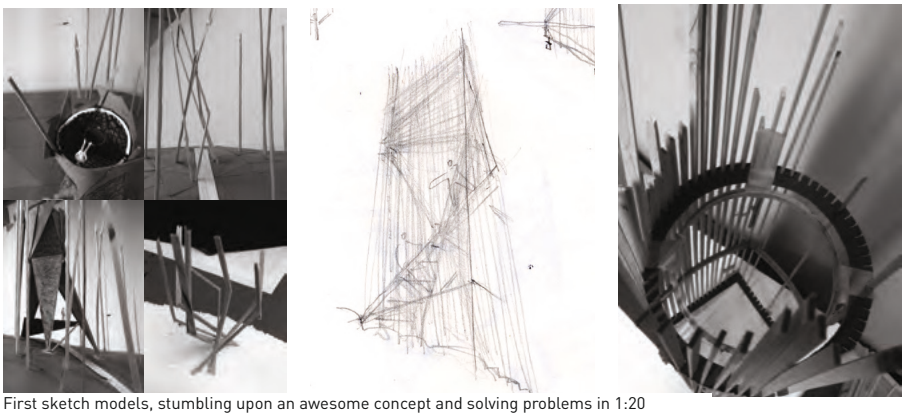
My project is dedicated to finding optimal conditions for space, time and other-dimentional travel to the perimeters of the kosmos and ones own conciousness. -i.e. that stuff that tends to happen sometimes if we look up and are in that kind of a mood.
I have wanted to make stargazing place that helps a human conciousness make the transition from a typical rational oberving and categorizing mode, to a mode of wonder, amazement and imagination.

THE TOWER

My project is a tower on the edge of the very steep slope, towards the northern side of the gap in the forrest. The top of the tower, symbolically closer to the stars, is a bed of ropes to lie on while watching the sky, with a screen around it to block out the worst light pollution. The rest of the tower is a very strange and mysterious structure, ascending through which should guide the visitors mind to a place where it is ready for the experience. Suspended from the top, in the middle of the tower, is a Foucault's pendulum, telling a story at the entrance/exit level, about our little planets behavior in the universe.

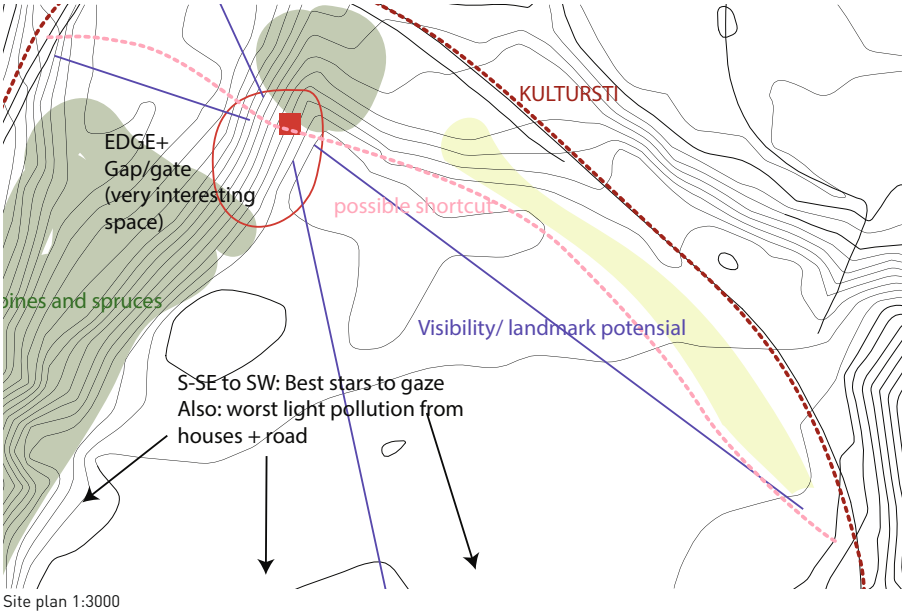
STRUCTURE

The tower is circular at the top and square at the bottom. The main structure is 64 2'x8' poles which stand tilted at different angles placed radially from the centre of the top circle. A glue-lam ring at the top, and glue-lam frames lower keep them together and hinder buckling. Bracing is taken care of with pieces of wood fitted between the poles with self tapping screws through them, forming diagonal bands that can take compression and tension.
Stairs up are carried by ropes on the inside and the poles on the outside. Ropes and poles work as space definers load bearers and safety measures. The load on the ropes is transferred to the poles via a smaller ring at the top and glue-lam arcs around the structure. The last ascent to the top is a climbing net across the centre of the tower.



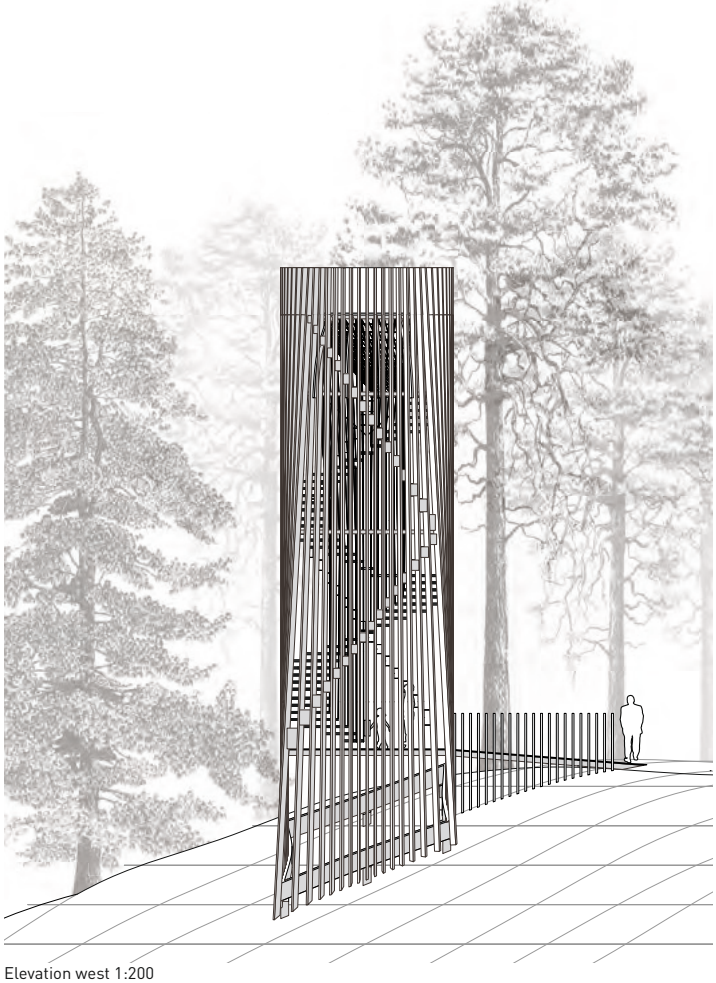
First sketch models, stumbling upon an awesome concept and solving problems in 1:20

1:20 model under trees and nights ky from the site



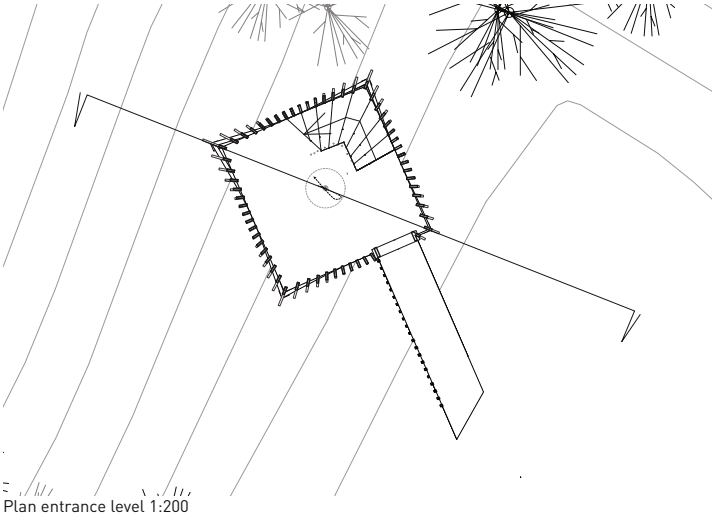
Site plan 1:3000

Section 1:200

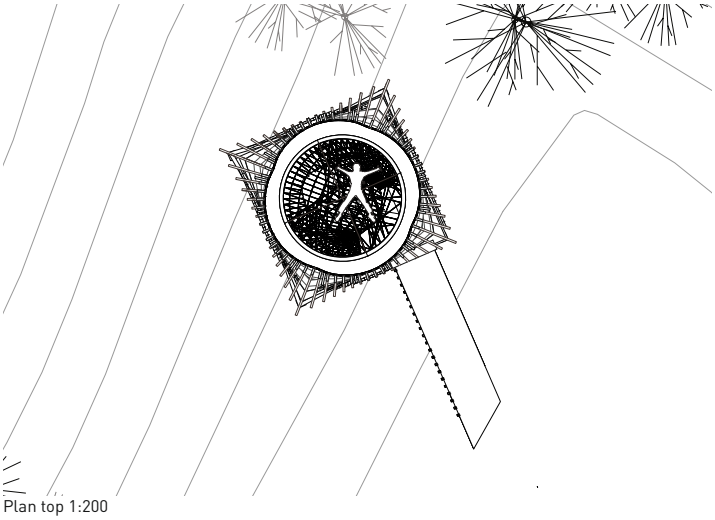


Elevation west 1:200

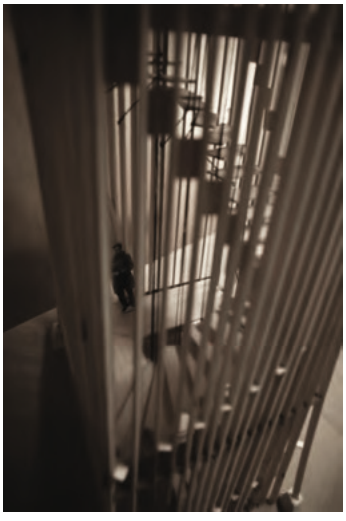
4

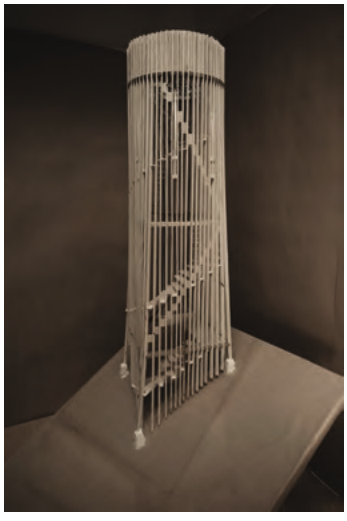


Plan entrance level 1:200



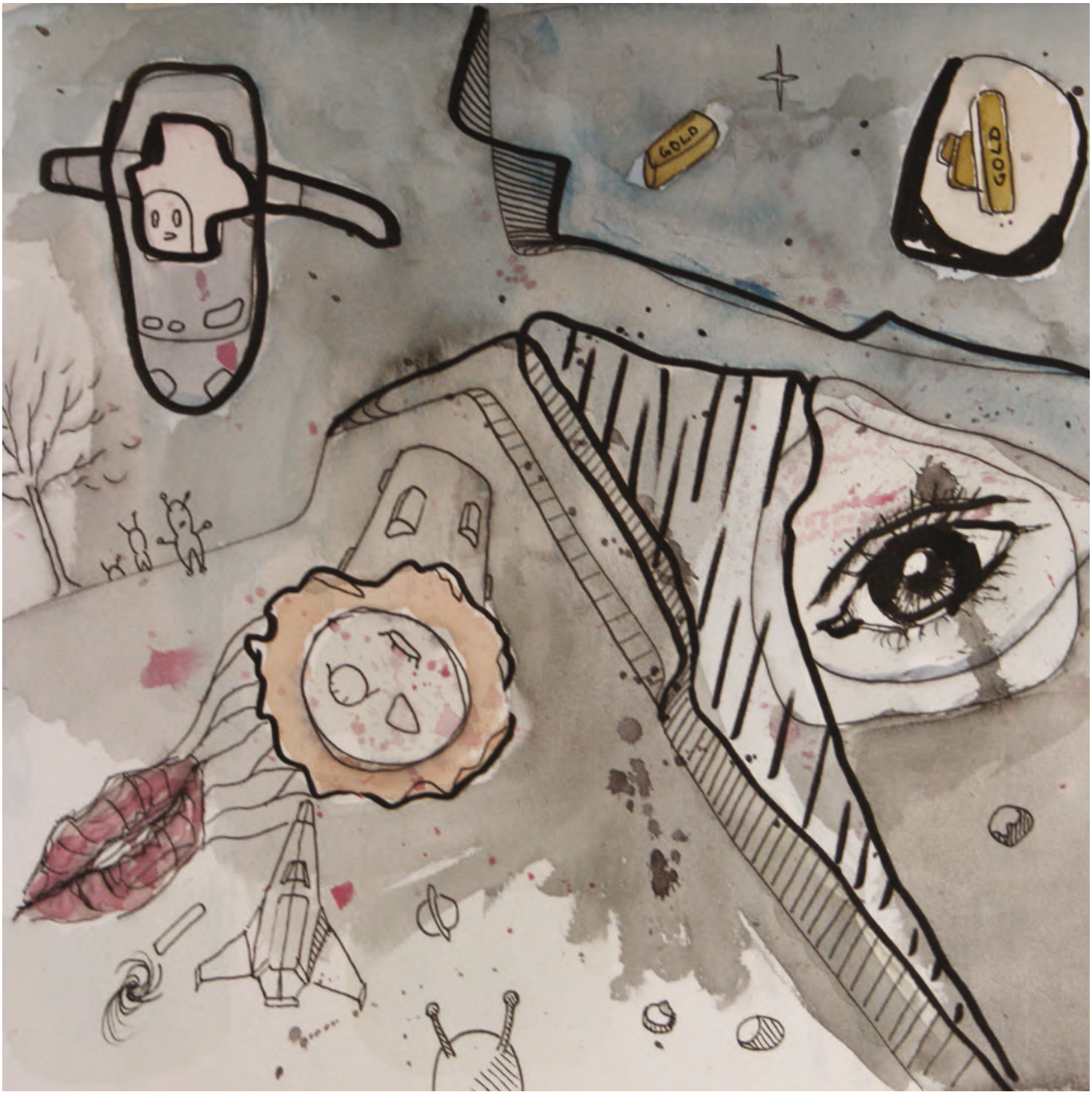
Plan top 1:200





SLEEPING UNDER THE STARS

KASPAR LUND SANDAKER



CONCEPT

Imagination is something that pushes us forward to discover new things, and something that children can be very good at. I decided i wanted to use the keywords imagination and memories to help me create the project.

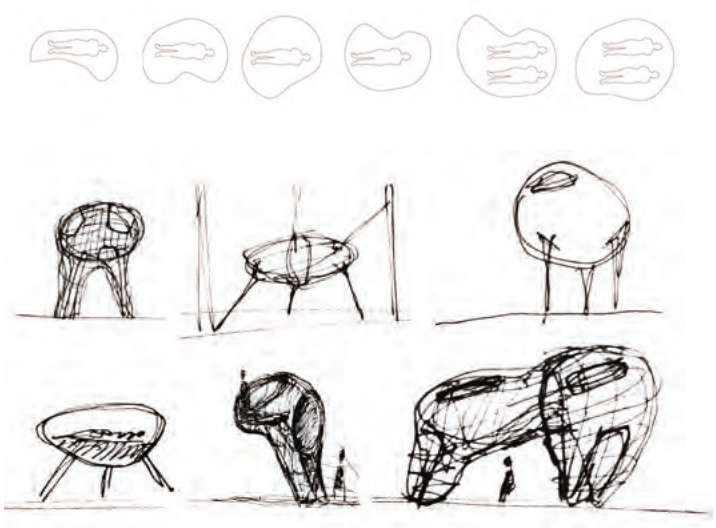
The night sky inspires us and makes us dream of distant lands and strange places. But our imagination is perhaps strongest at night and in our dreams. Therefore I wanted to connect the experience of looking at the stars with the possibility of sleeping under the stars. A place where memories can be created and imagination run wild. The stars served as maps for the seafarers for thousands of years and the pod can be seen as a vessel for exploration, a means to take us to distant worlds that our imagination dreams of.

I started the process by trying to explore the concept of imagination and memories in drawings and collages, trying to free my imagination and use it in the same way as the children in the school did when we challenged them to draw. And through this experience I landed on some irregular organic shapes.

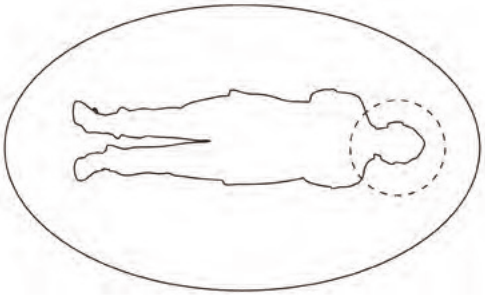
The pods shelter you from the wind and weather using your own body heat to warm up the small volume.

The structure can be made off site and then transported to the site and conected to the supports.

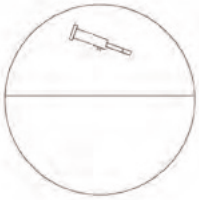
This collage was created to further explore the intention program



Concept sketches



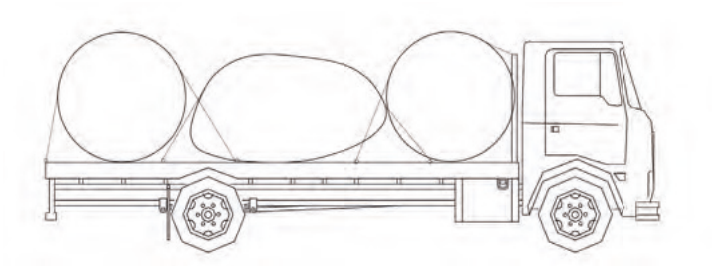
small volume



can store equipment inside

can be rented

Concept manipulations



The pod can be transported to the site

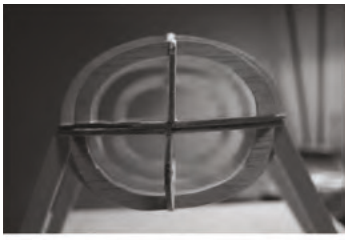
THE CONSTRUCTION

The construction uses known skills found in wooden boat construction. This makes it possible to create organic shapes but also serves as a connector to the intention program.The construction principle also gives an opportunity for learning traditional woodworking techniques.

The pods can be constructed by the students in a workshop and transported to the site. This saves costs in the construction phase since the students live at home. The pod will easily be transported by a flatbed truck and then transferred to a tractor for the final assembly at Rindal

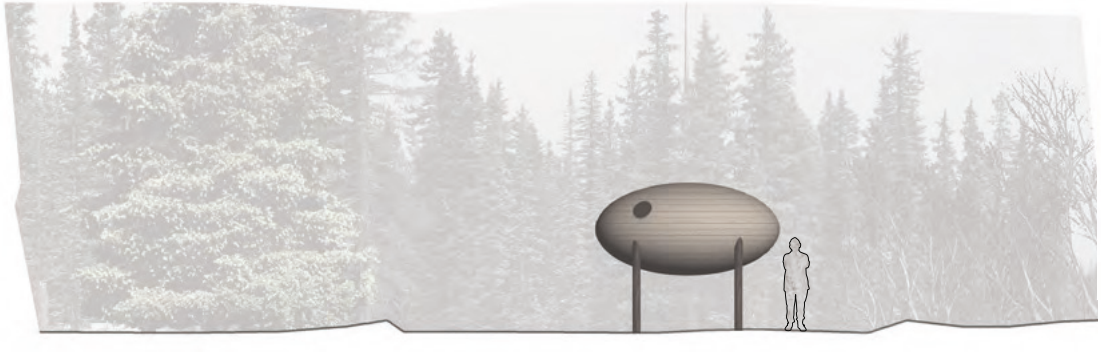
To ease the construction the upper and lower parts of the pod can be worked on separately before final assembly. This can make it easier to finish the inside of the pod, and also to work in smaller groups.The cladding uses the same principle as the planking on traditional wooden boats. With insulation and paneling on the inside the pod will be warmed up by the bodyheat of the inhabitants.

The supports are wooden poles fixed to a concrete foundation.

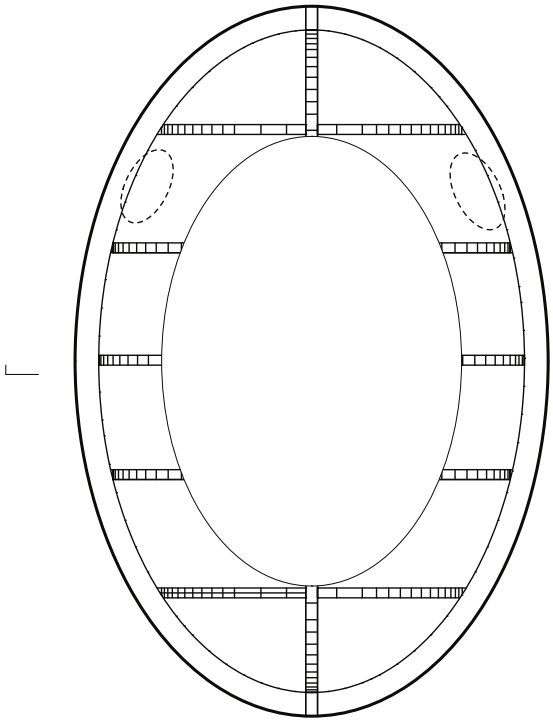


Model photos and inspiration from from boatbuilding

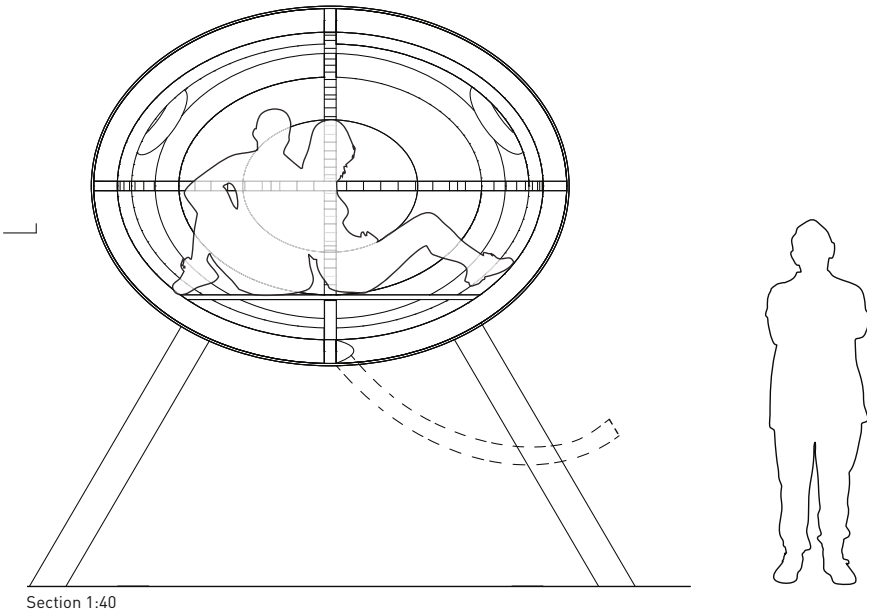
Framework



Cutaway perspective not showing insulation



Plan 1:40



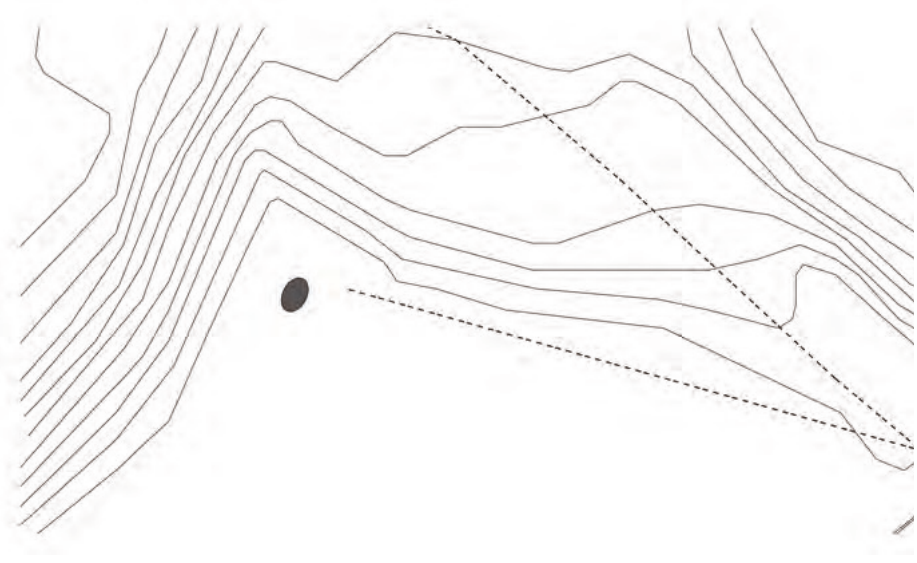
Section 1:40

THE SITE

The pod is placed in an area between the field and the slope.

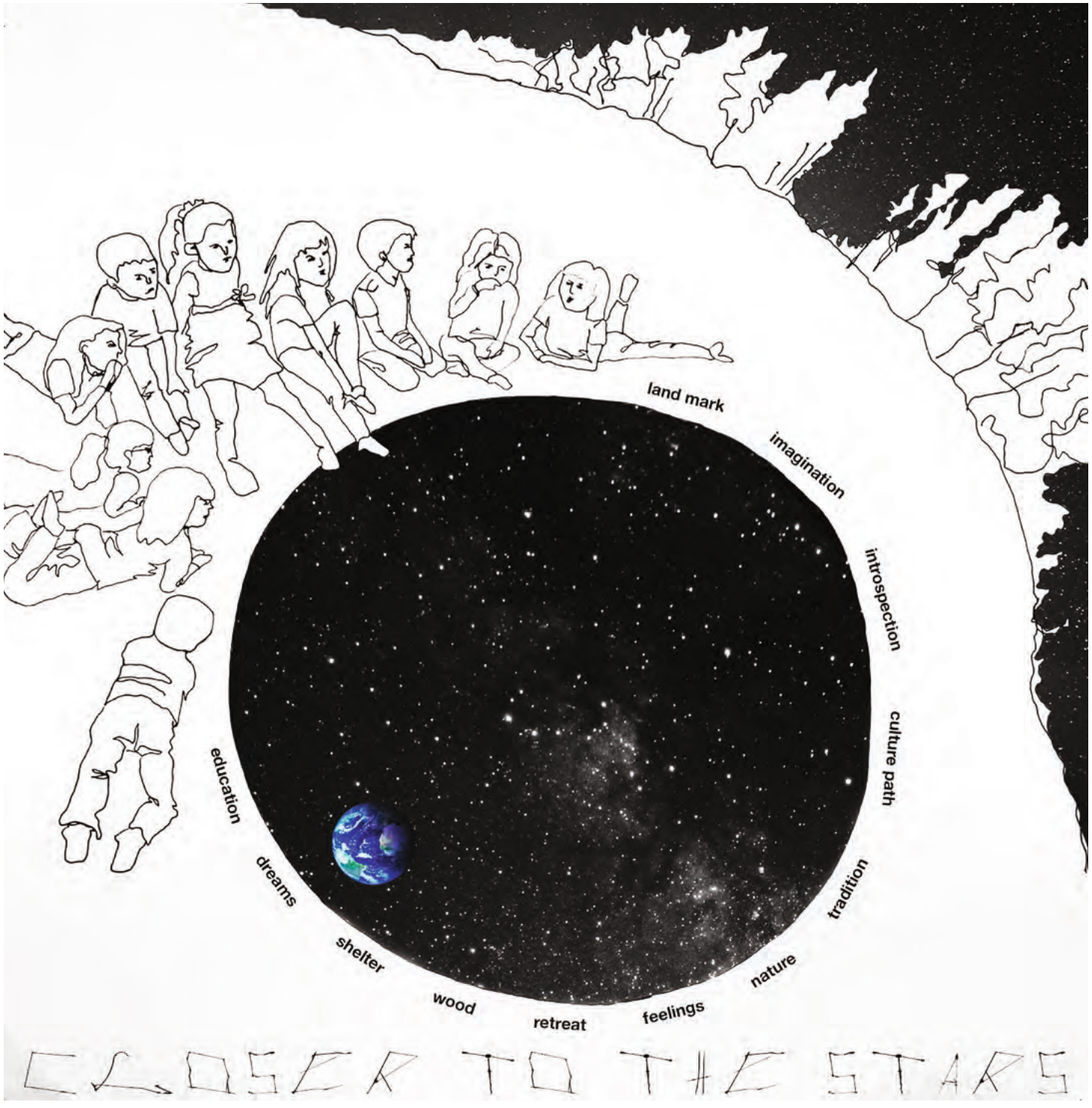
Entry to the pod is through a hatch in the side of the structure. Axcess to the pod could for instance be organiced
by a local tourism business, the local school, or the municipality

At the site the pod is reached by a small trail close to the culture path of Rindal. It is a small structure of a human scale. The pod can can give association tho animals or maybe an alien structure. It is something uncommen and can spark the imagination of visitors.



CLOSER TO THE STARS

MÓNICA PEREIRA DA SILVA



INTENTION PROGRAME

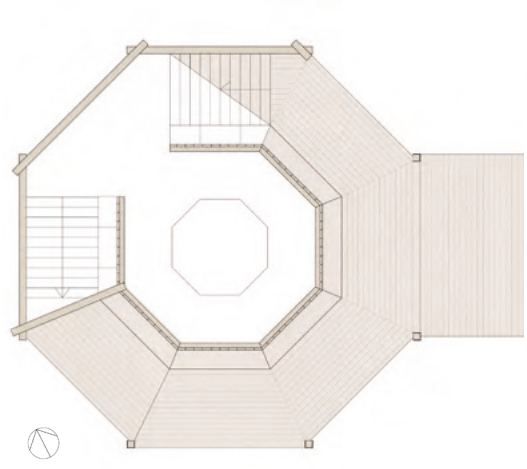
The story of a group of children that left planet earth to a new place closer to the stars. A retreat, a get away, a detatchment, of our busy daily life to a far away place where we can learn, dream and meditate.

CONCEPT

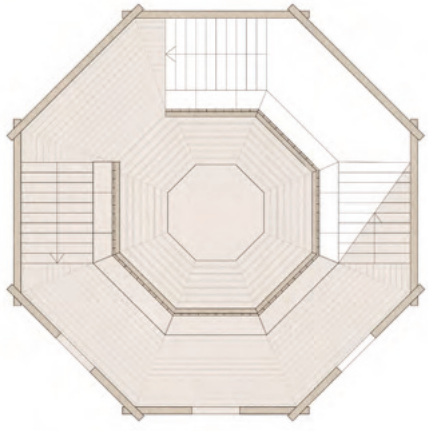
The Star Gazing Tower in this project it not only for Professional observation but also for families and children education. It's a place for shelter, introspection, imagination and contemplation.

The Project is situated near the edge with the main façade to the south and it function as an extension of the path that continues trough the building as a corridor, that through stairs

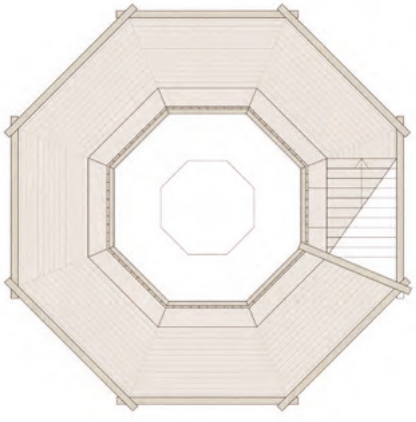
Context plan



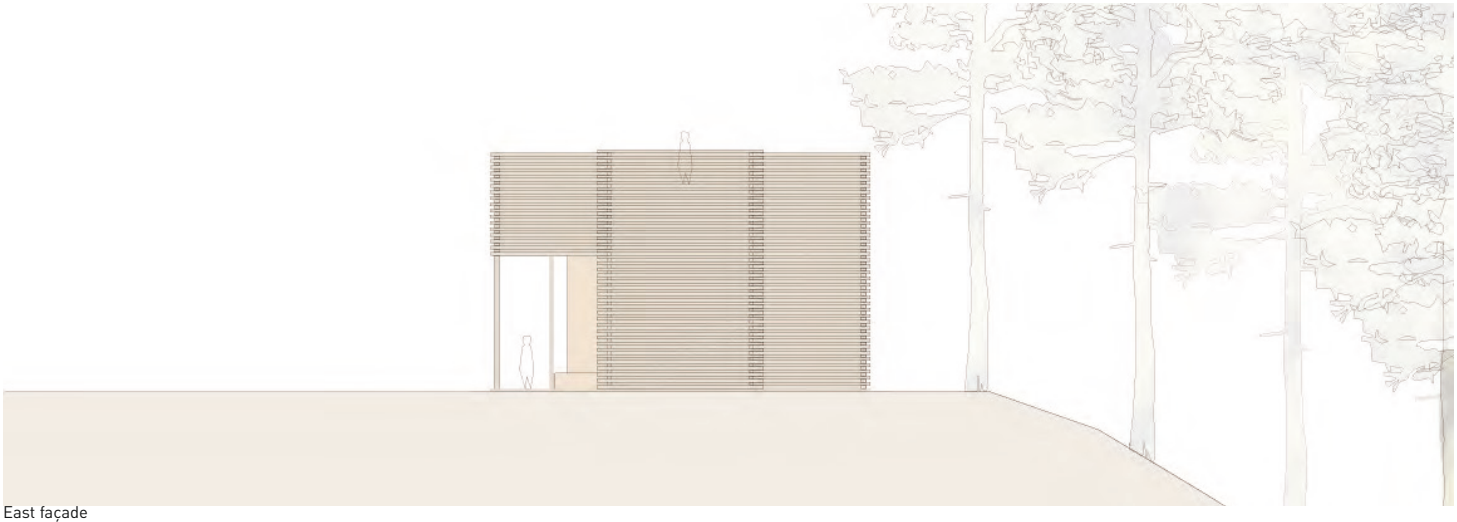
Plan floor 1



Plan floor 2



Plan floor 3



East façade

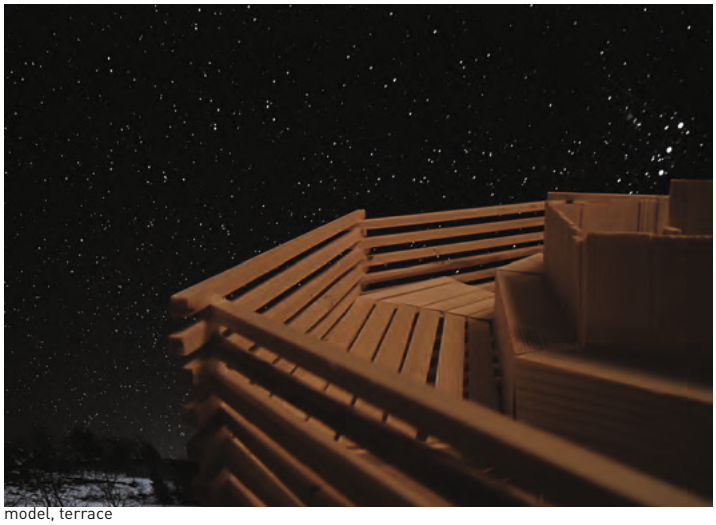
Seccion

enables us to rise to the many levels, each one of them providing us a different way of seeing the night sky and taking us closer to it.

The ground floor is protected from rain and sun, where groups of friends or family can be together.
The entrance of the building its done through stairs that lead you to the first level where you find a small, dark room, that's only open to the sky. In the midle of this room there is a wooden bed where you can lay down looking at the stars.

If you continue up the next stairs you arrive to a corridor with three windows. Each window is directed to a different view and have diferent information about the stars, galaxies, etc.
Finally when you get to the last floor, you'll be in the terrace, where you can see the sky in all directions.
All the corridors in each floor are accompanied by a bench.


model, interior corridor


model, terrace

STRUCTURE

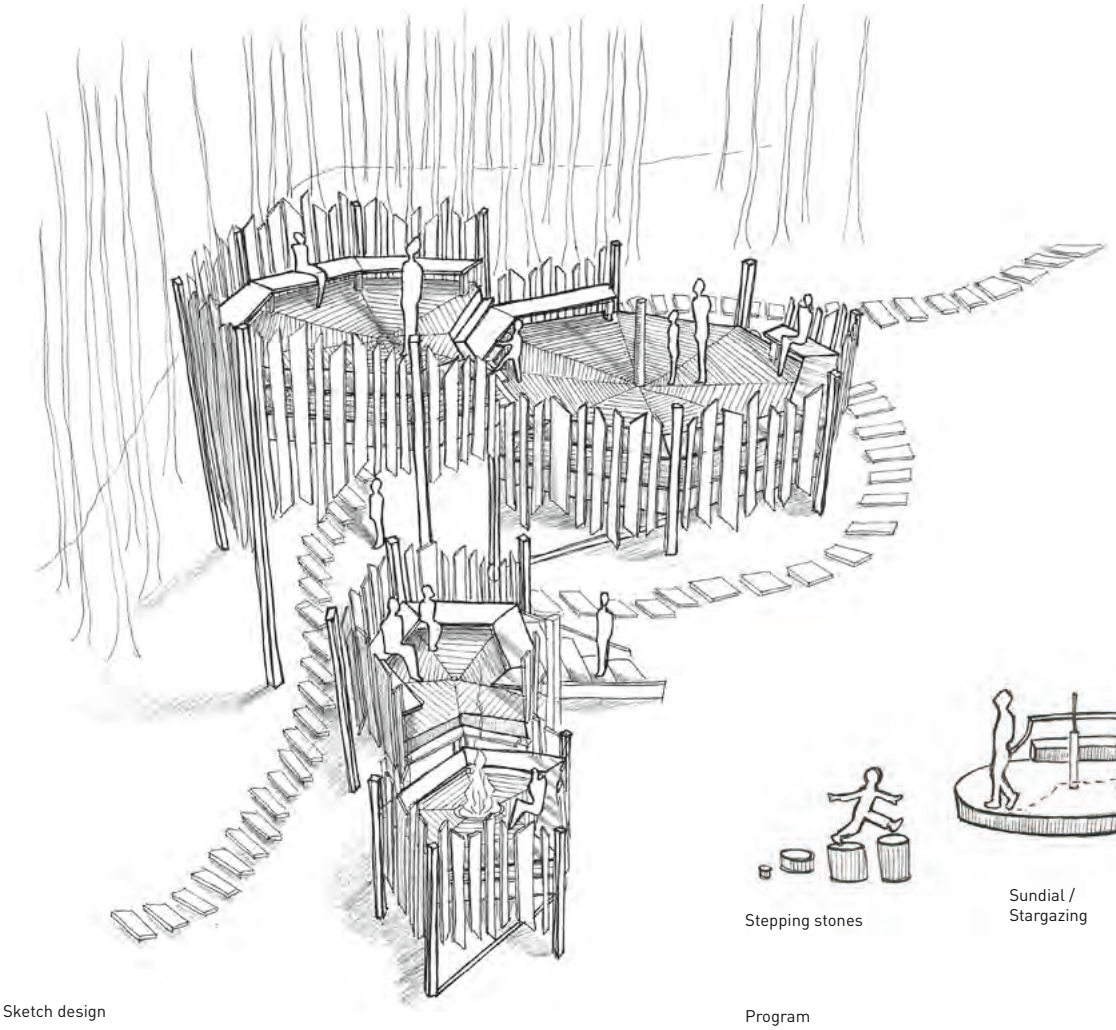
There are two diferent rings with diferent structures.
The exterior ring has a log structure, that lets light enter trough the corredors and makes the walls "transparent", beeing possible to see the view trough the openings.
The stairs are part of this ring structure and are locked between each log.

The interior ring is totally closed with wooden boards, keeping light from enter, defining, in this way, the central room. A dark and introspective place, completly enclosured by tall walls, keeping your attention only to the sky.
The corredors of the diferent levels, aswell as the bench, always function around this interior ring and are part of its structure.

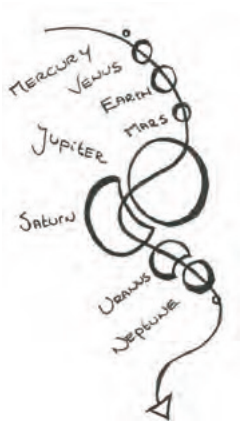

model photos

LINK

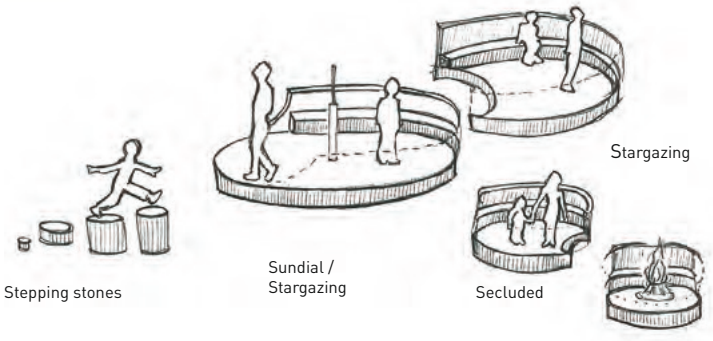
NADIA REMMERSWAAL



Sketch design



Concept



Program

CONCEPT

Stargazing can be approached from many perspectives, one can look in a very theoretical way to the sky to study the constellations and its positions. There is more to stargazing however than just this perspective, the sky offers wonders and has the power to trigger the imagination. The children of the community of Rindal showed us how much wonders the sky can hold to an individual. Their imagination was easily triggered by just giving simple facts about the sky.

This inspired me to base my design on our solar system and use the planets relative size to create platforms on which stargazing can be experienced in different ways. The first four planets can be used to step into the structure. The large size of both Jupiter and Saturn make them perfect for common stargazing areas, while our last two planets Uranus and Neptune are designed so the stargazing can be experienced in a different, more secluded way. The stargazing tower is therefore designed in a way that it links the above with below.

THE SITE

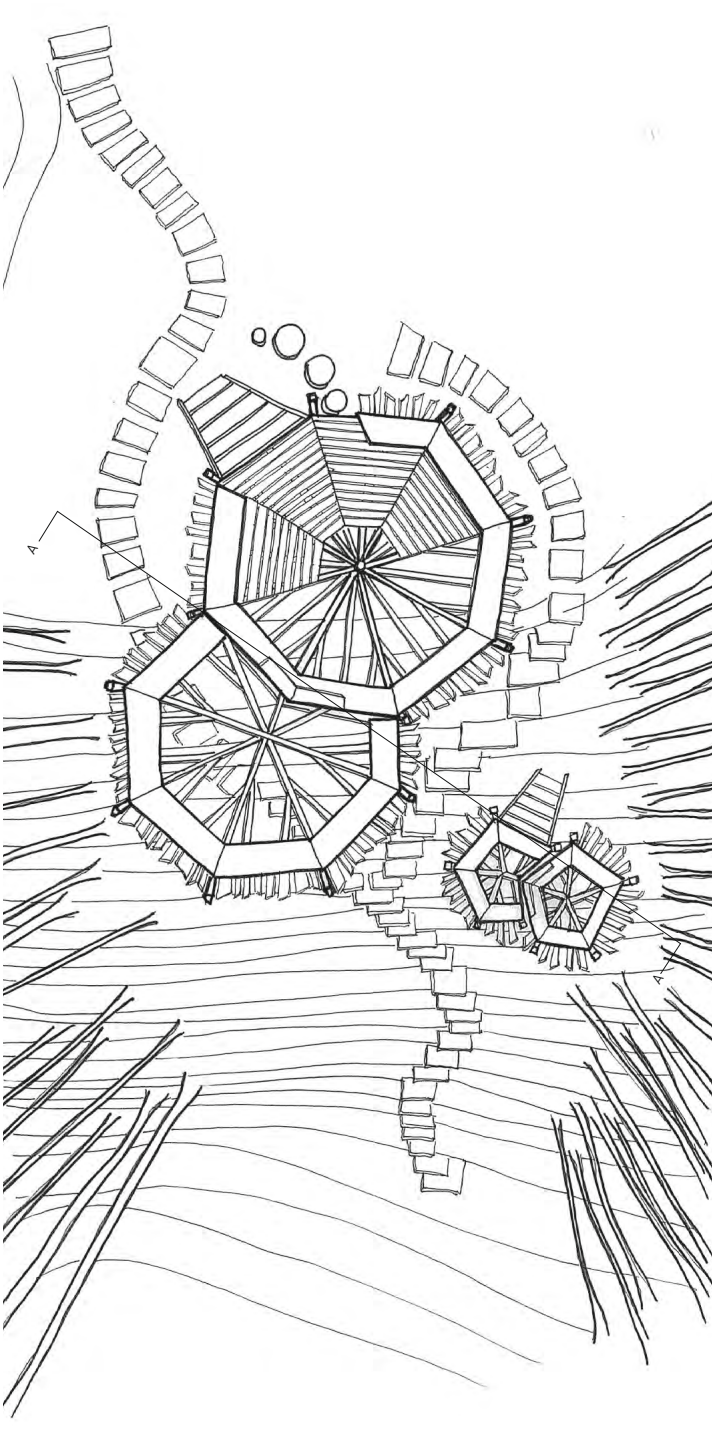
The site has some unique characteristics, such as the steep edge and the place where the trees thin out and provide a view of the lands below. I chose this place to further enhance the feeling of being far above the ground and closer to the stars.

The structure can be both reached from the field, or more adventurously, from below to travel through the structure to reach one of the entrance points. It is possible to chose the bigger platforms for stargazing, or search for the smaller platforms.

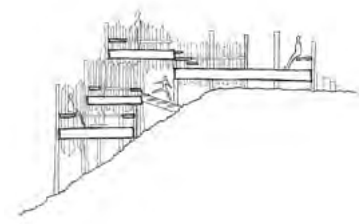
CONSTRUCTION

The structure is made out of platforms that are constructed from columns and one centre beam on which the other beams rest. Since it is a circular structure I chose a cartwheel construction with extra bracing all in the direction of the centre of each platform. To give the impression of the platforms 'floating' in the air I chose to set the columns on a distance to the actual platforms. On top of the structure the floorboards are constructed transverse to the direction of the beams.

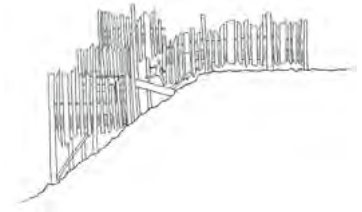
Because circular structures are sensitive to torque and therefore have a tendency to rotate, I decided on making the platforms stable two by two. Both the bigger platforms and the two smaller platforms are seen as one structure and both have their own crossbracing in three directions.



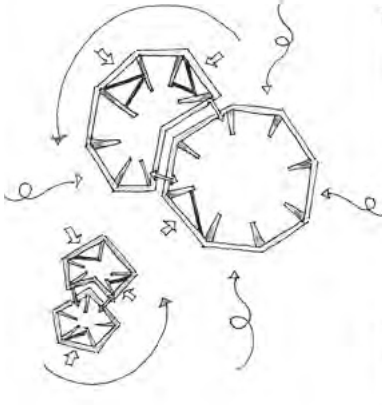
Plan 1:200



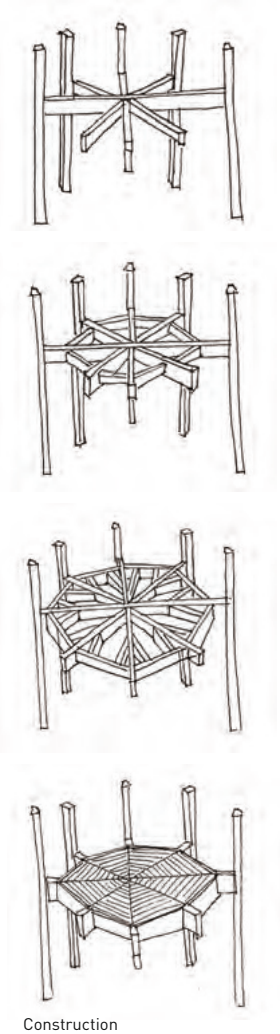
Section A-A 1:400



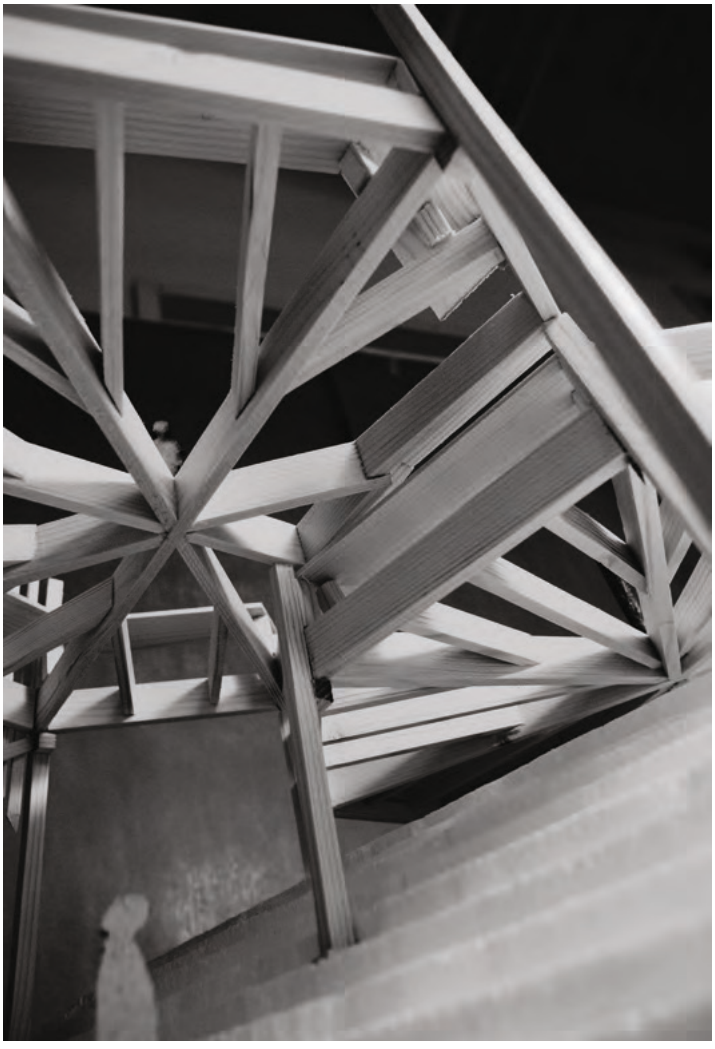
Facade 1:400



Crossbracing

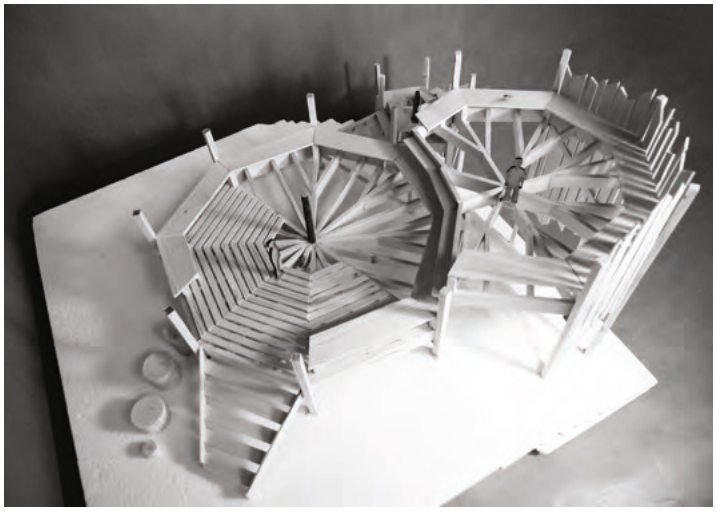


Construction

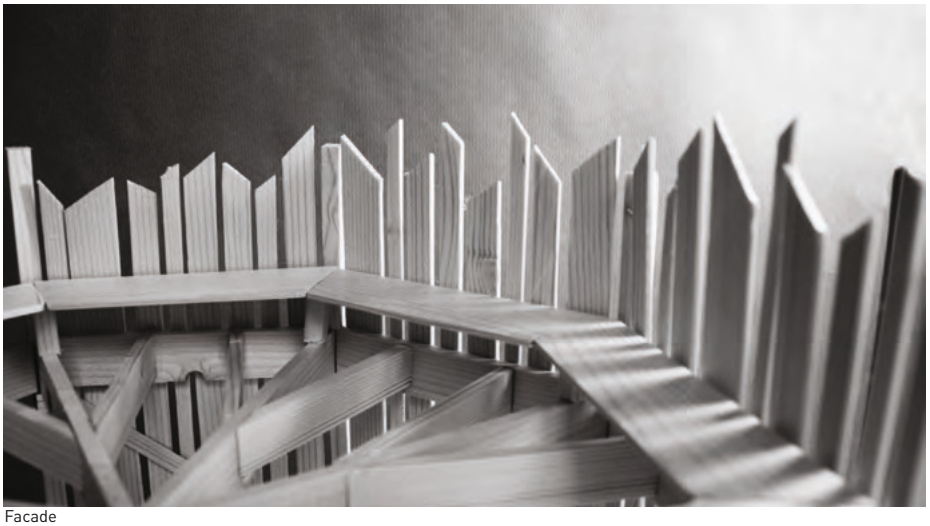


Underneath

Entrance



Overall

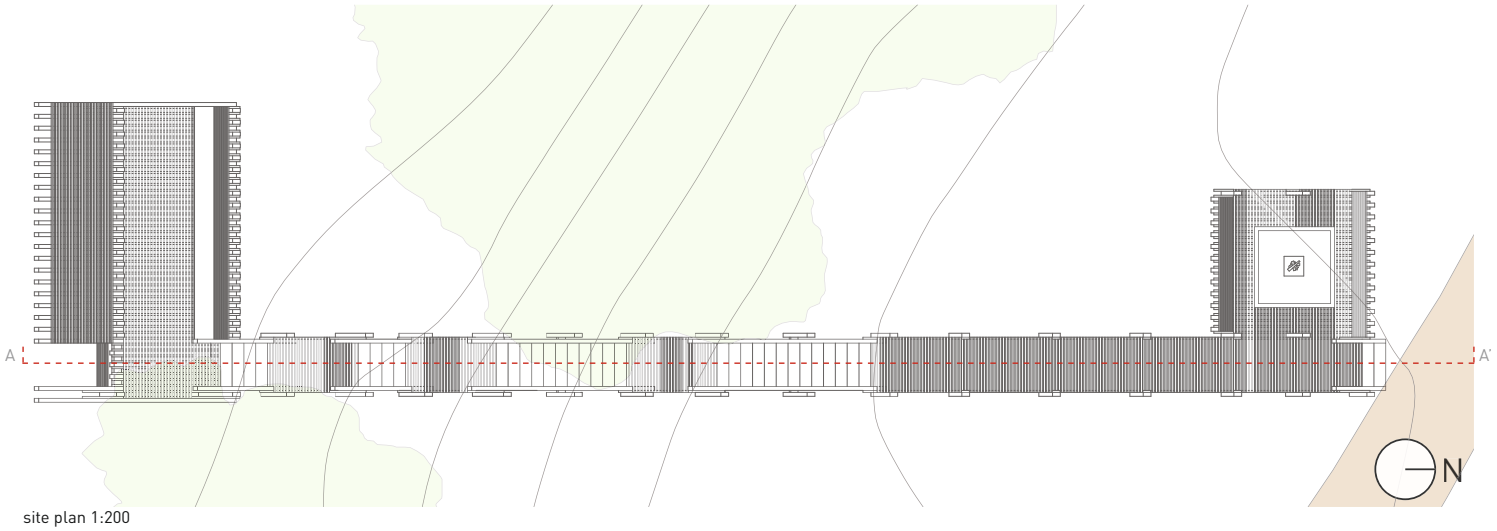


Facade

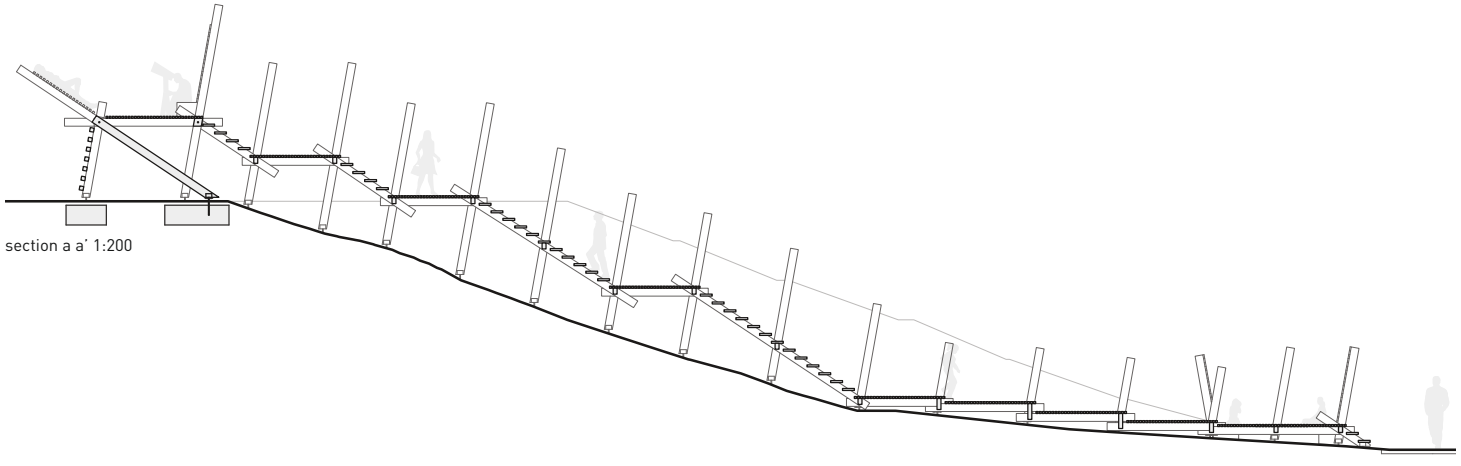
Flooring

STARGAZING PLATFORM IN RINDAL

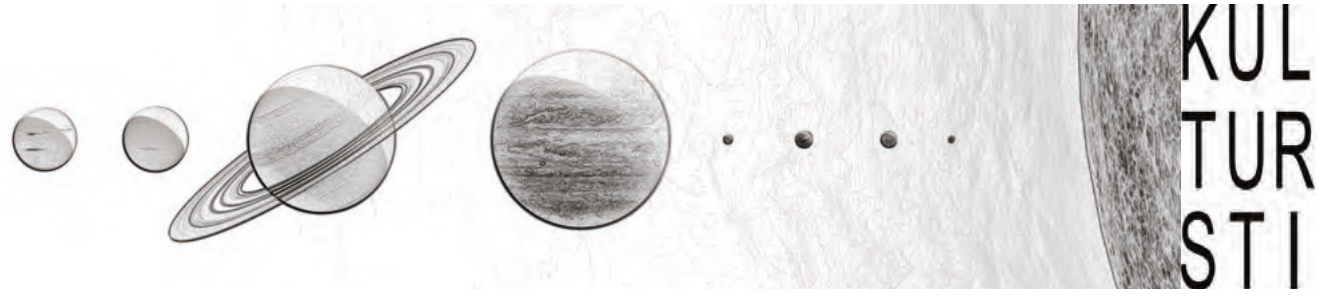
NELSON M S SILVA



site plan 1:200



section a a' 1:200



DIAGRAM

My initial diagram had some ideas based on the various feedback that we got from the small kids in Rindal's kindergarten, the *Rindal kommune* people, the astronomer and our visit to the site.

I wanted an elevated platform, facing south, a "playground" in the slope to teach something to who visits the building, a place to lay down and watch the sky and a fireplace to be warm. The building wound be a way from the *KULTURSTI* to the stars and would be sheltered from the weather.

SITE

The site is in the edge of an open field with a slope, in Rindal *kommune*. The field is open to south and closed to north with trees located in the slope. I used this slope to make the learning "playground" with the planet sizes.

During the winter this place has a lot of snow so i opted for an elevated platform to also convey the idea that you are closer to the stars.

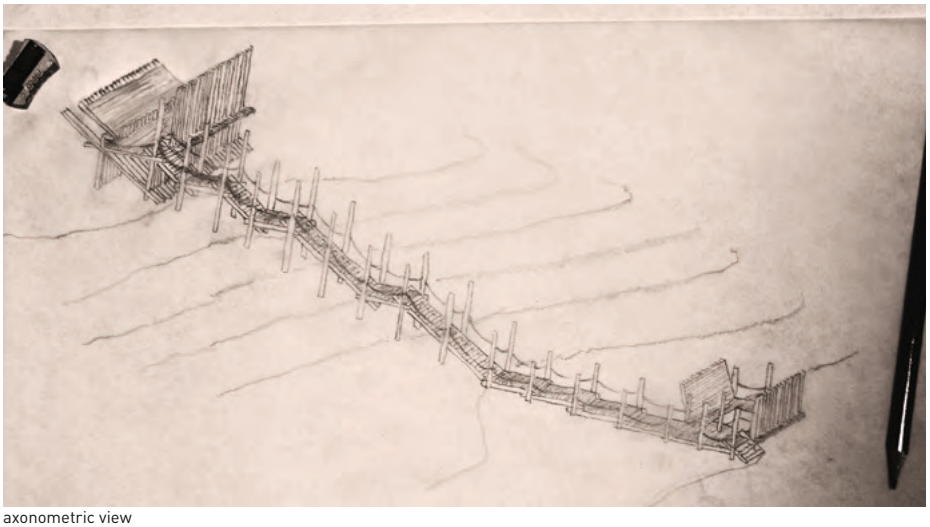
The fireplace is close to the *KULTURSTI* to claim people's atention when walking home or school.

PROJECT

The building was therefore directed to south, the main entrance was from the fireplace, the connection with the KULTURSTI. From that fireplace (sun) to the platform where you can see the stars you pass through the learning "playground", where you can understand, by how much you climb, how big are the planets in the solar system.

If you arrive from above, you have another entrance, a ledge climbing from south of the platform. Both the platform and the fireplace are sheltered from the uncomfortable winds.

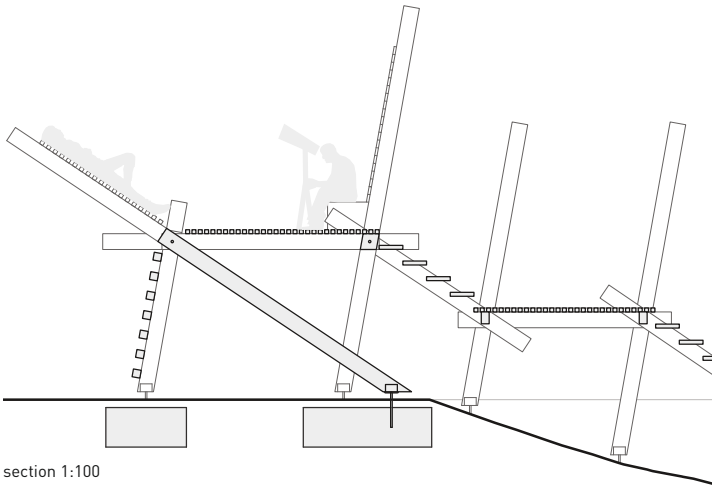
The platform has two ways of gazing at the stars: the first one is a bench where you can sit with your binoculars or telescopes facing south (where most of the stars are located), the second one is a tilted platform where you can lie down an relax while you see the big starry sky above you.



axonometric view

gazing platform

south entrance



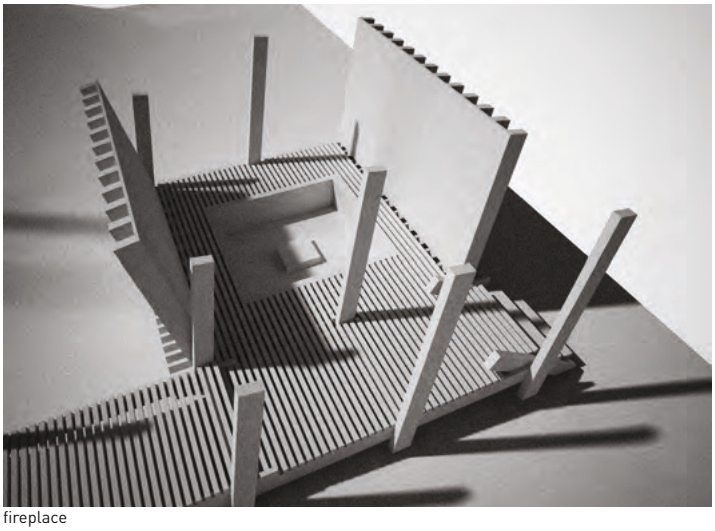
section 1:100

CONSTRUCTION

The structure is based on 100x200mm wood pieces in different angles that support the platform, tensioned in two places with steel wires to stabilize the horizontal plane. That is also done by the two wall foundations that connect to the wood with steel pieces.

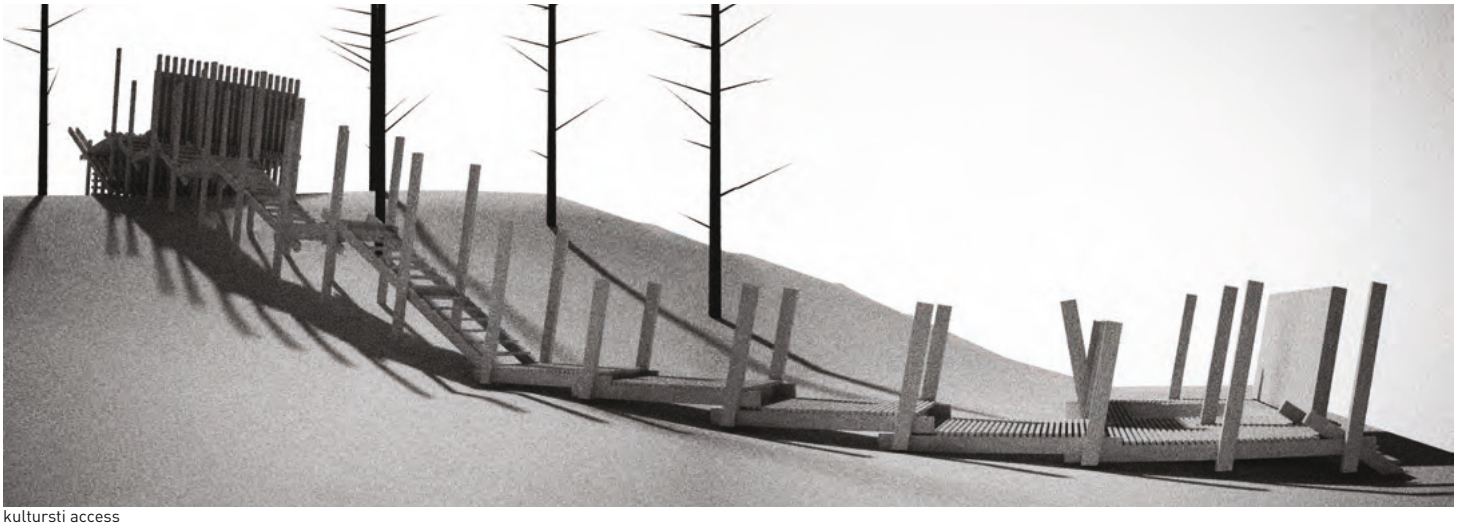
The railing would be in rope, going through the columns in the stairs. The cladding has two different styles, if it is a floor and you need the snow to go through, the cladding is 50x50mm wood pieces, with the spacing being between 30mm and 50mm.

If the cladding is a shelter wall and you need it to be closed to stop the wind, the cladding is 100x25mm wood planks, put together with the minimum spacing so it doesn't bend.



fireplace

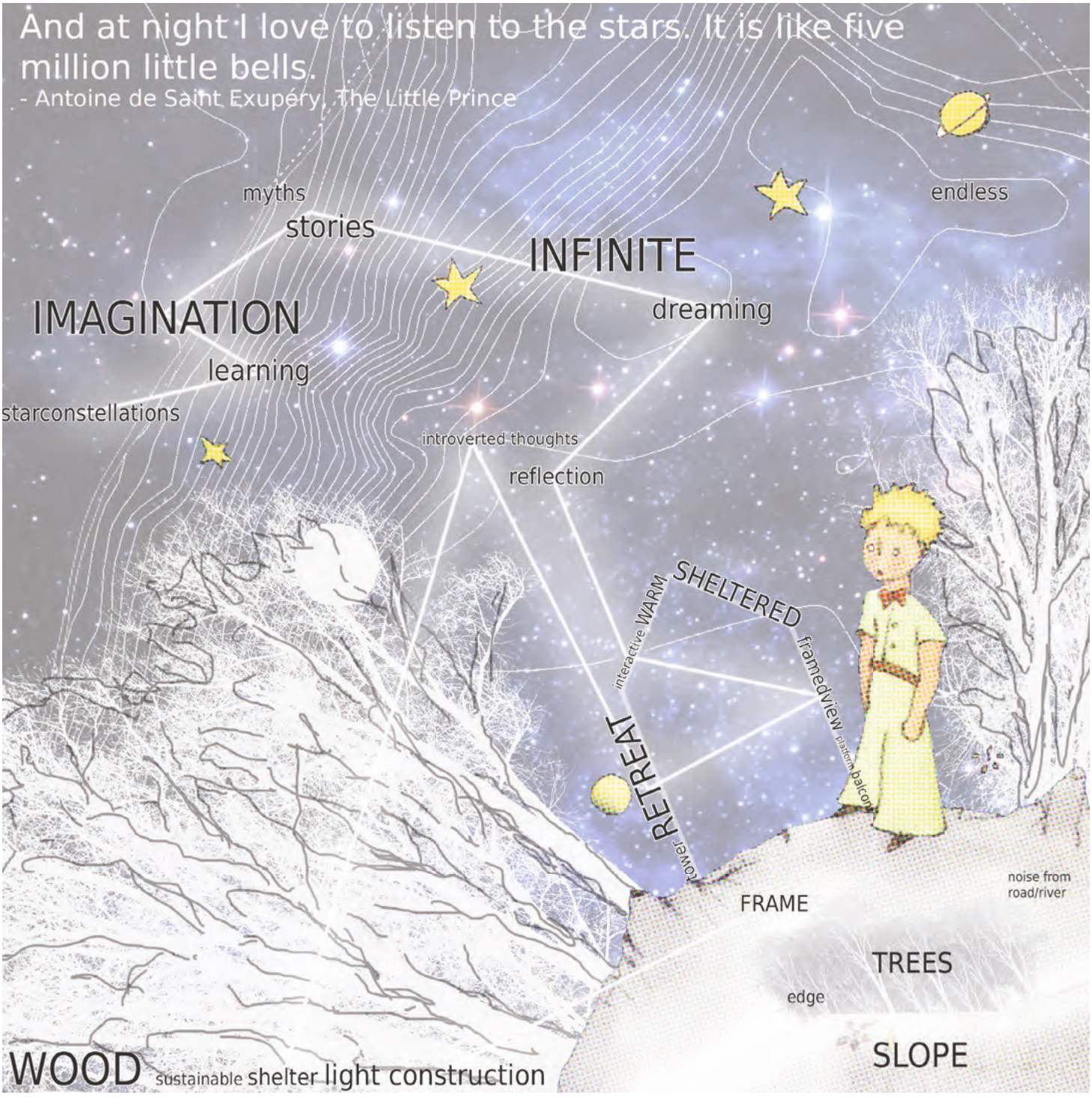
field access



kultursti access

FOREST WALK

JAN NIKLAS KOCH



exterior perspective

INTENTION

When we were first introduced to the task of designing a star-gazing-tower and got the feedback from the children of the kinder garden/school I was impressed by how fast these kids were able to get lost in their imagination of the sky, the universe and the things that might, or might not, be out there in the space. I realized that this ability of setting our minds free is getting lost when we were growing up and is swallowed up by our daily life, our responsibilities and worries.

With this design of a star-gazing-tower my goal was to give the opportunity to discover the capability of childish imagination again. Since the site is not really suited for a star-gazing tower that fits the needs of professional star-mongers it was clear for me that I wanted to design a space where everybody could enjoy a little bit of stargazing but also find a retreat, or a place to go to and relax and rediscover the child in themselves.

For me, one of the easiest and most efficient ways of getting away from the daily life and its restrictions is a simple walk in the forest or some quiet place where nothing disturbs your thoughts and one has the time to calm down and set his mind free of daily problems and impressions. It is impossible to shut off all these thoughts that prevent yourself from relaxing in an instant - you need a certain time to calm down and be able to enjoy the moment and force your brain to go to 'stand-by'. The time a normal walk in the outside takes is seldom enough, but it is at least a start of this process.

My design adapts this image of walking through the forest and setting your mind free by giving the real walk following the 'Kultursti' a destination to physicly relax and rest and during the night, of course, watch the stars above rindal.

light falling through 'trees'

siteplan 1.1000

STRUCTURE
The main structure of this project is supposed to adapt the simple image of the afternoon sun falling through the gaps between the trees of a forest, lighting the path in an interesting play of light and shadow.

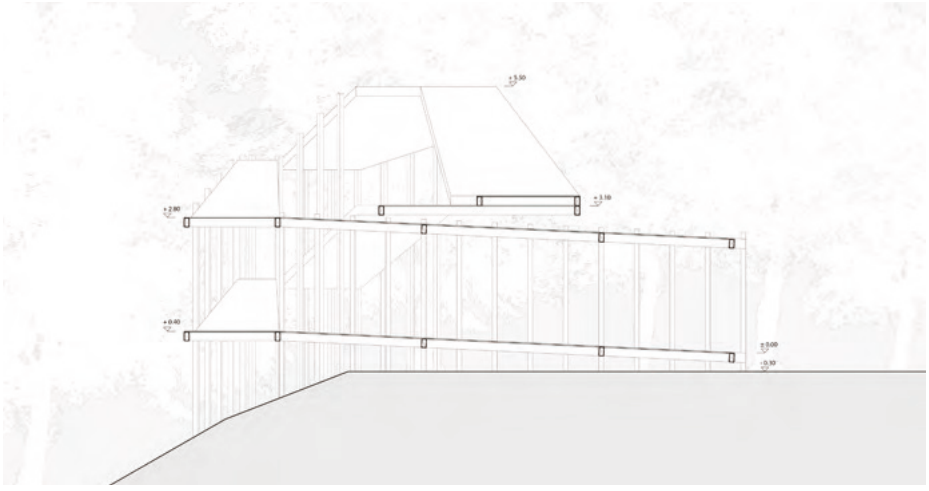
The structure consists of solid-wood-columns and beams, stiffened by metal bracings.

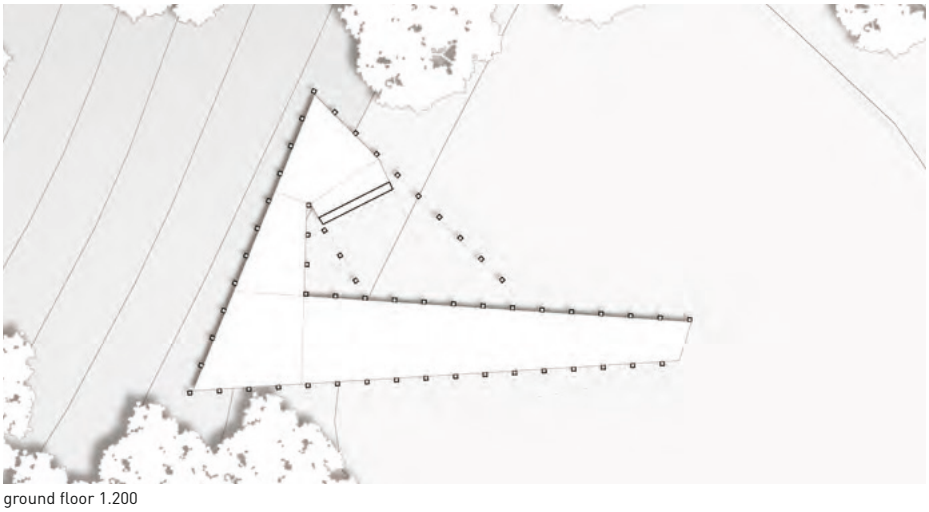
Due to the different angles of the 'pathway', which winds through the building, you experience several densities of the wooden columns in every direction - just as you would experience the irregularity of the forest surrounding the star-gazing-tower.

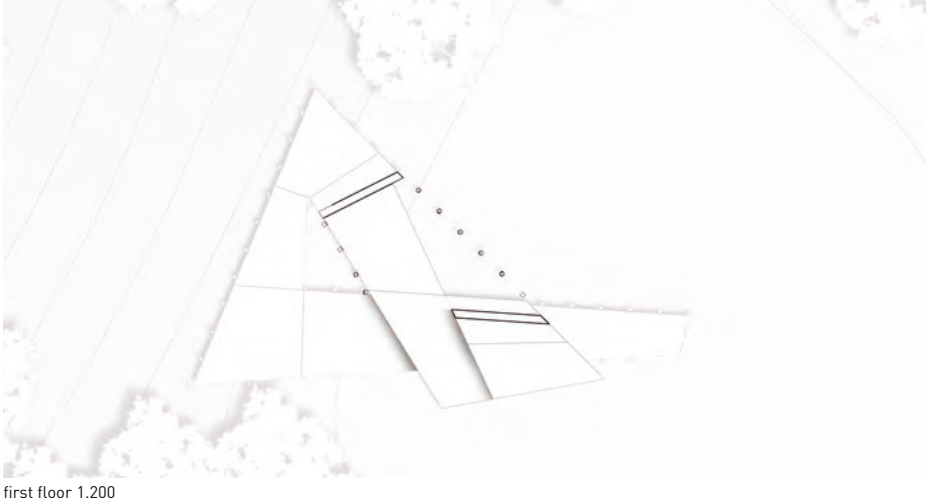
ORGANISATION
You enter the building at the east side, at the end of the field before it starts to slope down. The first part of the 'path' inside the building is slightly sloped upwards and widens towards the first corner with its platform. This first platform is facing towards west and you have a good view over the landscape. The width of this first part invites to stroll slowly towards the first corner. It even gives the possibility to install some kind of furniture to have a rest on the way onwards.

After turning right a steeper ascent leads to the second platform facing north. This platform is orientated towards the dense area of trees and gives a more closed impression than the first one.

From this platform another ramp guides the visitor to the final platform of the star-gazing-tower where the roof extends down and gives the opportunity to lay down and watch the stars in the southern sky.


section 1.200


ground floor 1.200


first floor 1.200

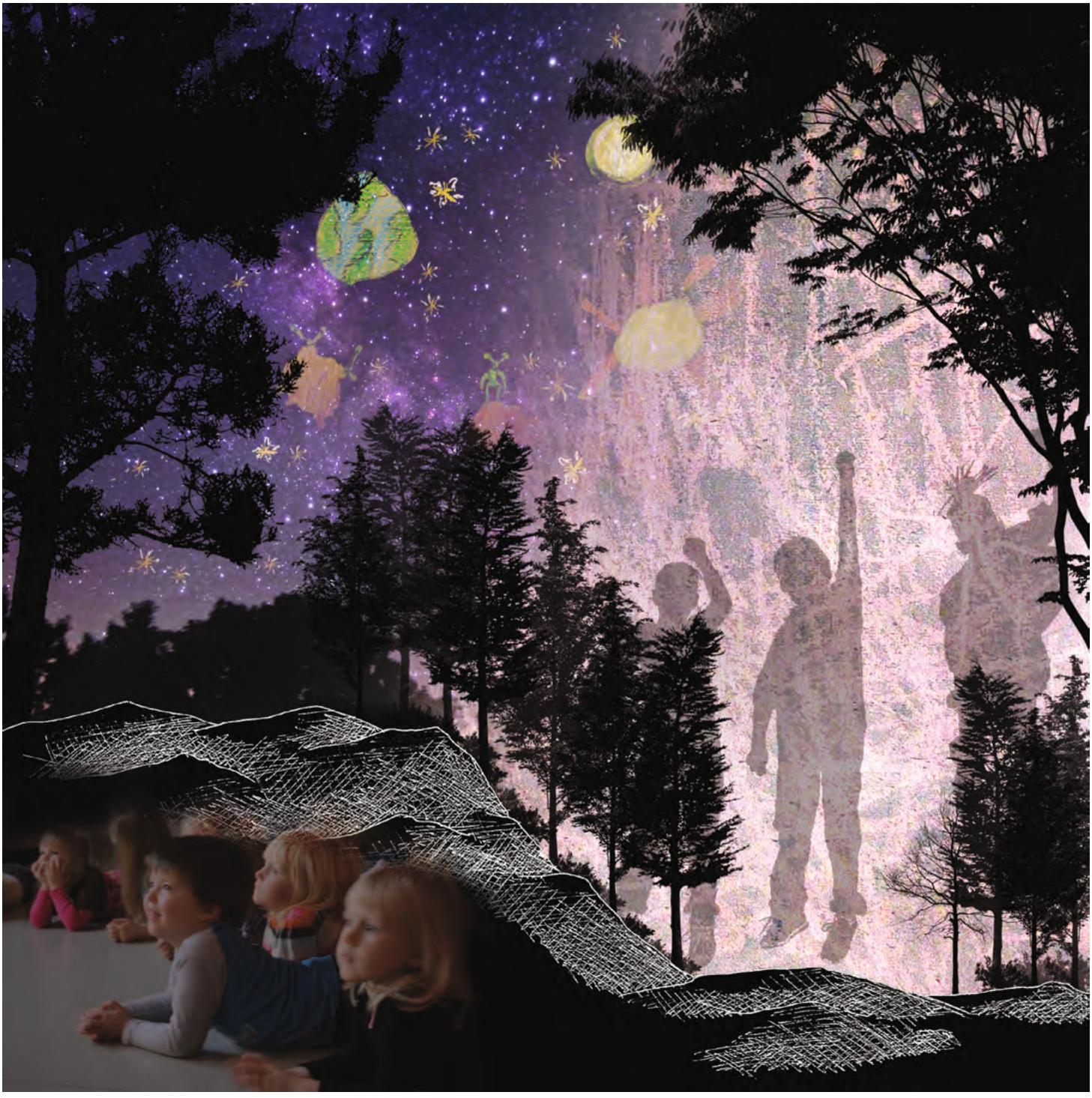
scale model 1.20

scale model 1.20

scale model 1.20

LOGS

PIERRE-ALAIN BOUCHETARD



CONCEPT

The idea is to work with a stack of wooden logs, slide and cut them to create different spaces. It is based on a study of Sou Fujimoto's project and the concept of digging into the material to create volumes. The logs are kept in the same direction in reference to the traditional way of building barns in Norway.

The whole stack of logs then hosts all the functions through different spaces but whithin a continuous mass of material

FUNCTIONS

Stargazing

Looking at stars

Story-telling place

Playground

Education tool

Meeting place for families

Part of the cultural path

Gate for the city

Fireplace

DIMENSIONS

SITE

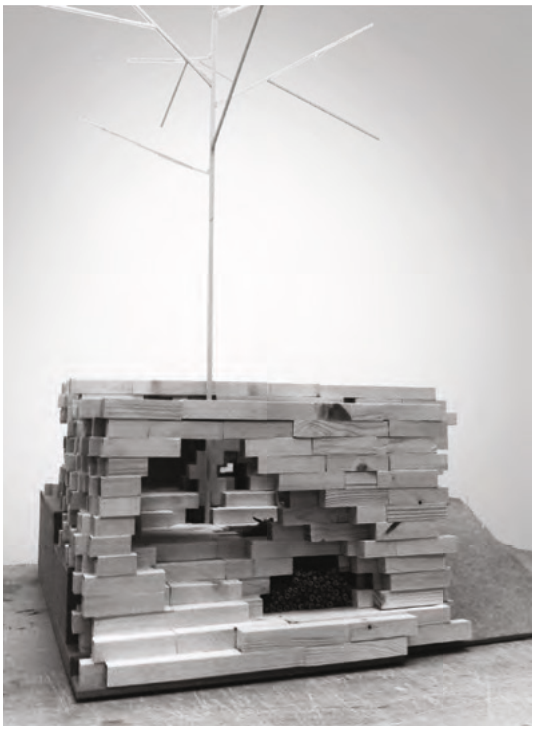
The project is set up along the culture path in Rindal going down to the river. It is on the edge of the field, half on the flat part half in the slope. The culture path goes through the stargazing place so that you can walk on the path while seeing the inside of the project.

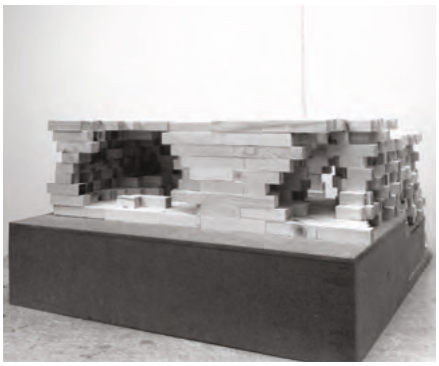
PROJECT

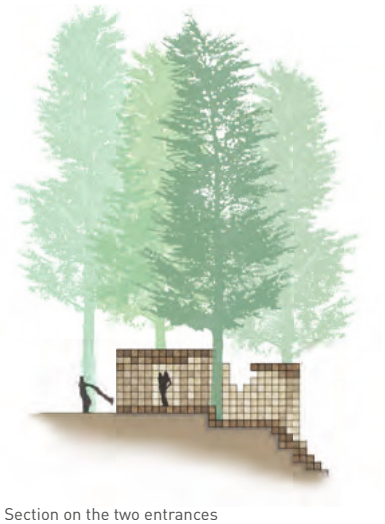
Digging into the material by sliding and cutting logs allows to create differents spaces. The project features :

- two entrance spaces to walk on the culture path while going through the project
- a fireplace for people to gather during the day or at night
- a place for stacking chopped wood for the fireplace
- a palce with tiny holes for kids to snake in and out
- a room for sitting and looking at the southern part of the sky
- a place to lie down along with one other person to look at the stars above

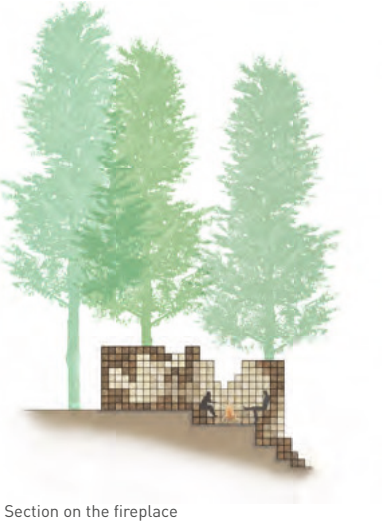
The fireplace is in the slope facing north, with the wood storrage space underneath. The stargazing place is on the flat part of the field and facing south to look at the most interesting part of the sky. The two places are seperated by a more massive part of the project - the space kids can play and people can lie down - so that the smoke and the light from the fire doesn't interfere in watching the stars.



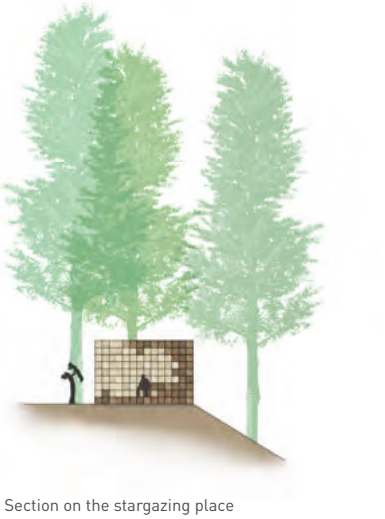




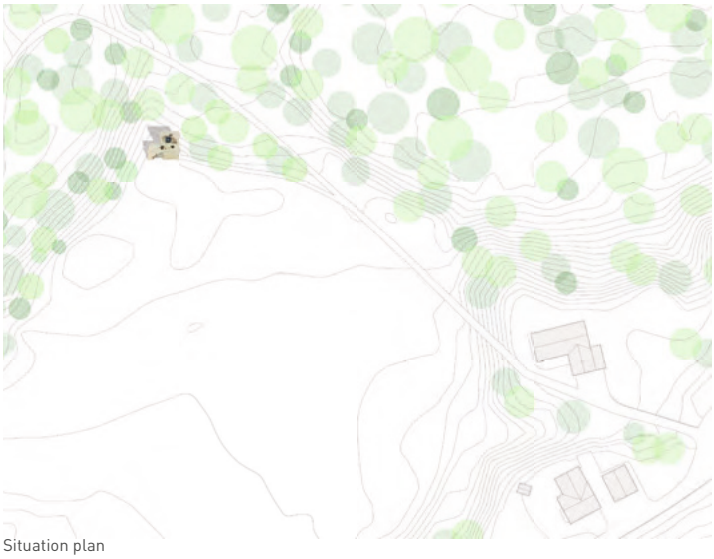
Section on the two entrances



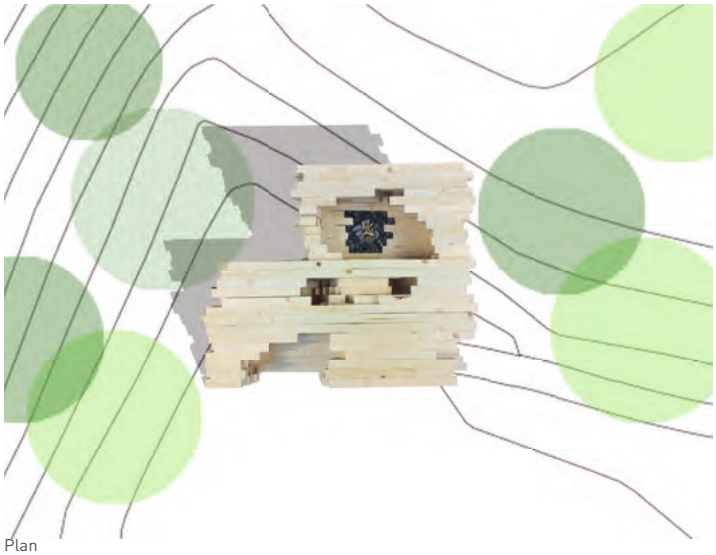
Section on the fireplace



Section on the stargazing place



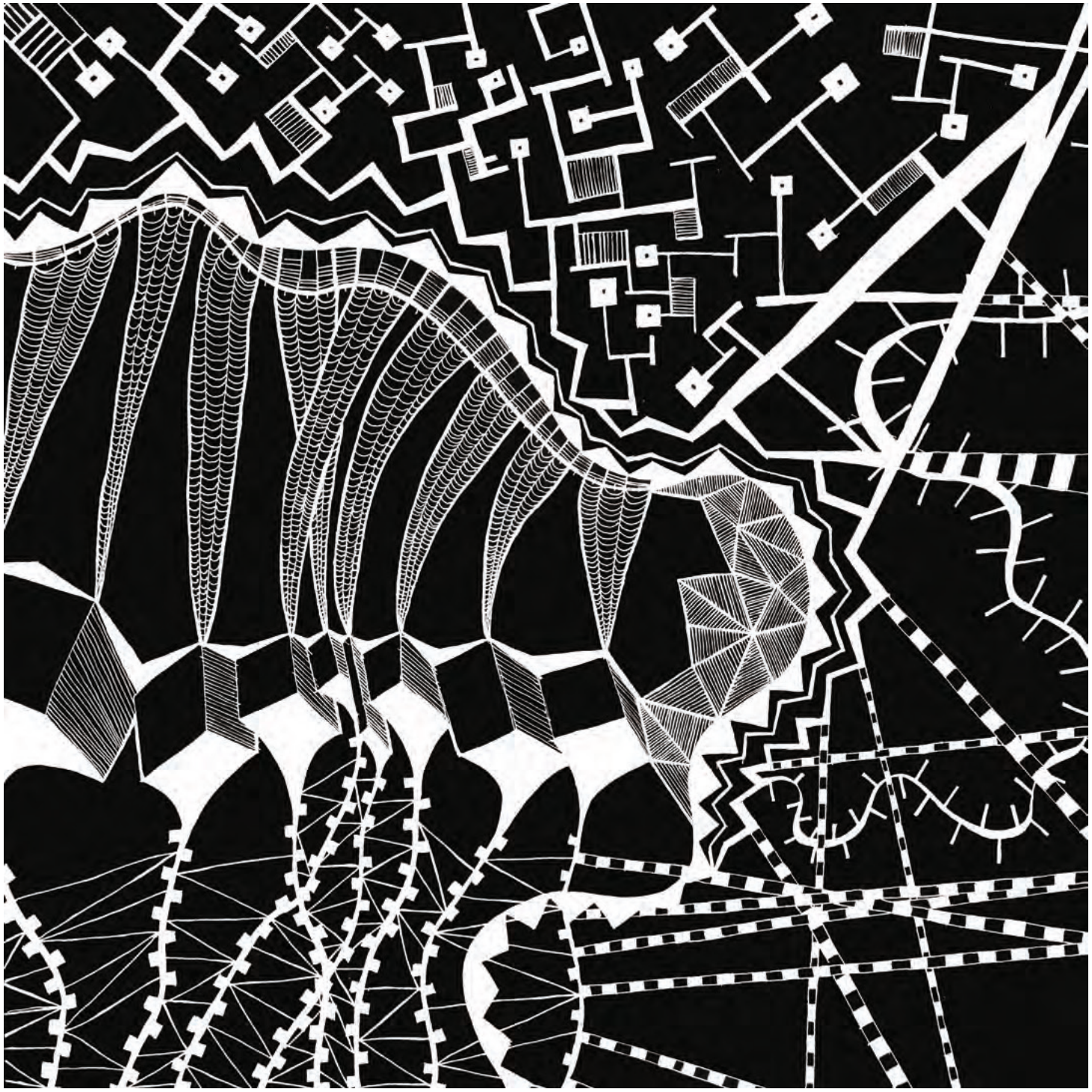
Situation plan

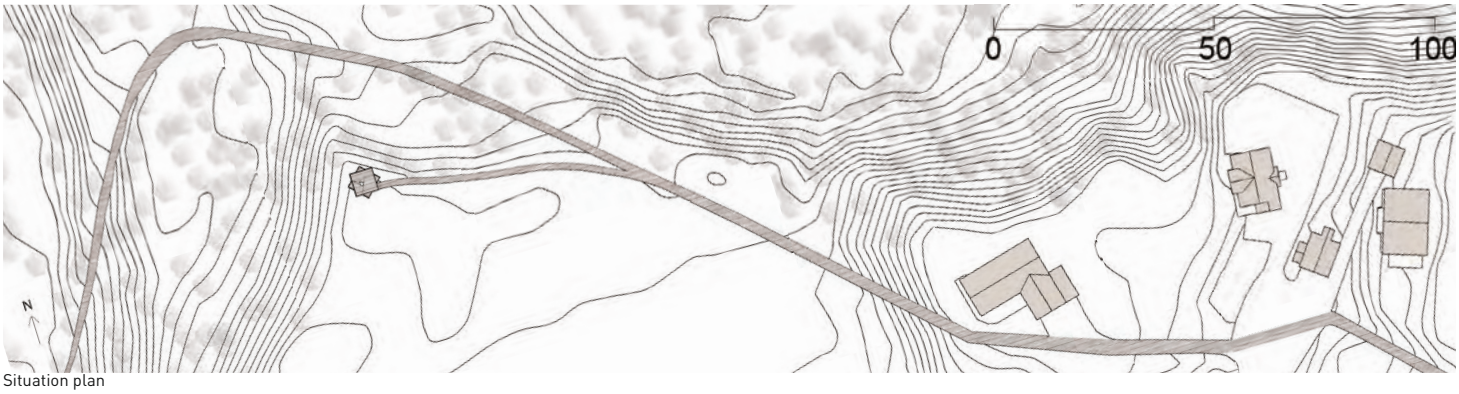


Plan

KALEIDOSCOPE

TERESA RODRÍGUEZ PARDO





Situation plan

INTENTION PROGRAM

The drawing represents the division of the architecture in three worlds.

The first one is the traditional world. It represents the roots and the DNA of the inhabitants, their culture and customs. The second one is the physical world. It is what surround the architecture and was there before it: the forest, the river, the weather, and the boundaries. The third one is the sensitive world, It is the one that affects in the mind of the users. It is represented by the sky because it is the mistery, the dreams and the imagination.

Architecture has to be a transition between theses three worlds.

THE FORM

My project wants to be these transition . The tower is designed to be an ascension from the ground to the sky. It is divided in three steps or cubes that represents the progression between the three worlds.

The first cube is related to the inhabitants. It is the meeting point where the open walls work as a welcome signal for the users. The second cube is linked with the surroundings. It is orientated and in the same level as the trees and it walls are less open to make the users feel that they are inside the forest and be part of the vegetation. The third cube is the stargazzing point. The roof is completely open, while the walls are closed, to frame the view in the sky.

THE PLACE

The situation of the tower works also as a transition between boundaries in the area. The culture path extension to get to the tower link three parts: the housing area, the forest and the cultive fields. The tower is in the limit between the forest and the open field, the limit between the flat land and the steep land and the limit between the wild nature and the controlled ground.

THE STRUCTURE

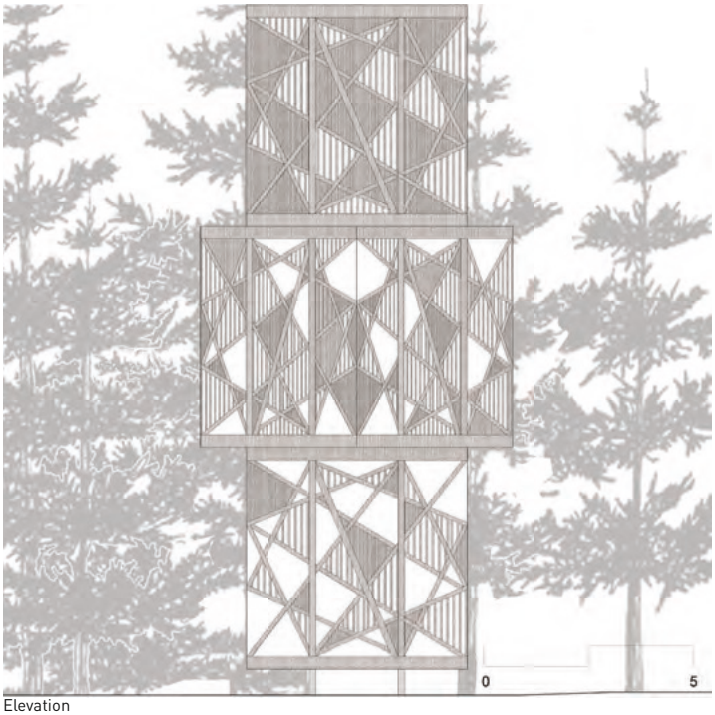
The cubes dimensions are 5x5x5 meters. They have a simple structure based on eight wooden pillars and beams that leaves the cortners of the squares empty. This estructure is twisted in the change between cubes because of its use.

The conection between the cubes is made by big opennings in the floor structure, the stairway and the open roof cortners of the cubes that allows a partial view of the sky which shows the users advances of the final line.

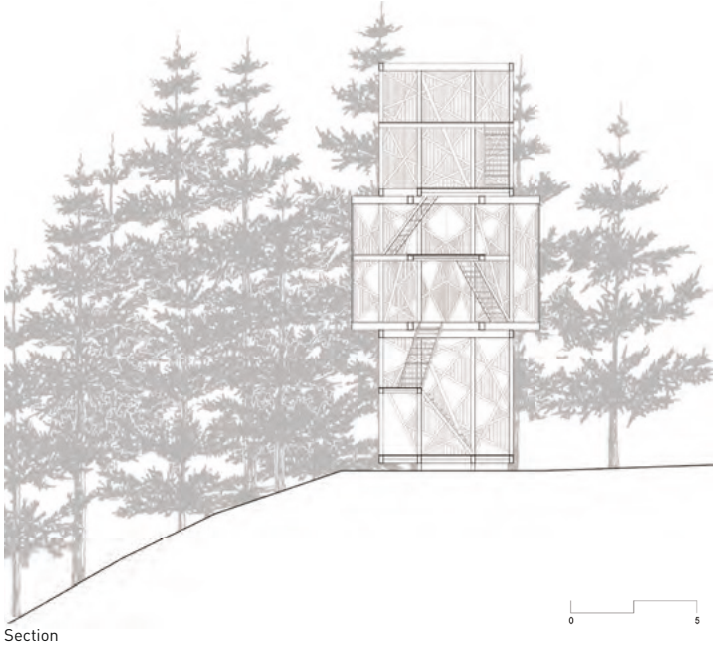
THE CLADDING

The design of the cladding is made by wood sticks panels. It has an open pattern that adapts the permeability necesities of each cube. The same panel is repeated in each wall of the three cubes but it permits to be more covered when is required depending of the cube.

Plan

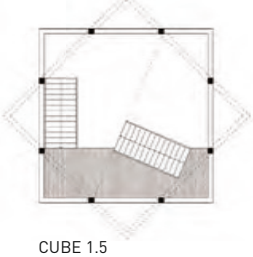


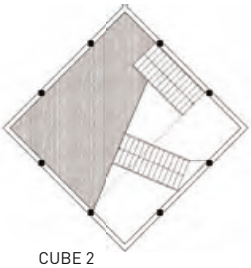
Elevation

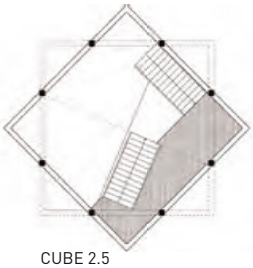


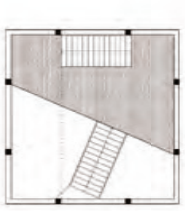
Section

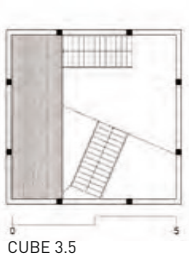

CUBE 1


CUBE 1.5

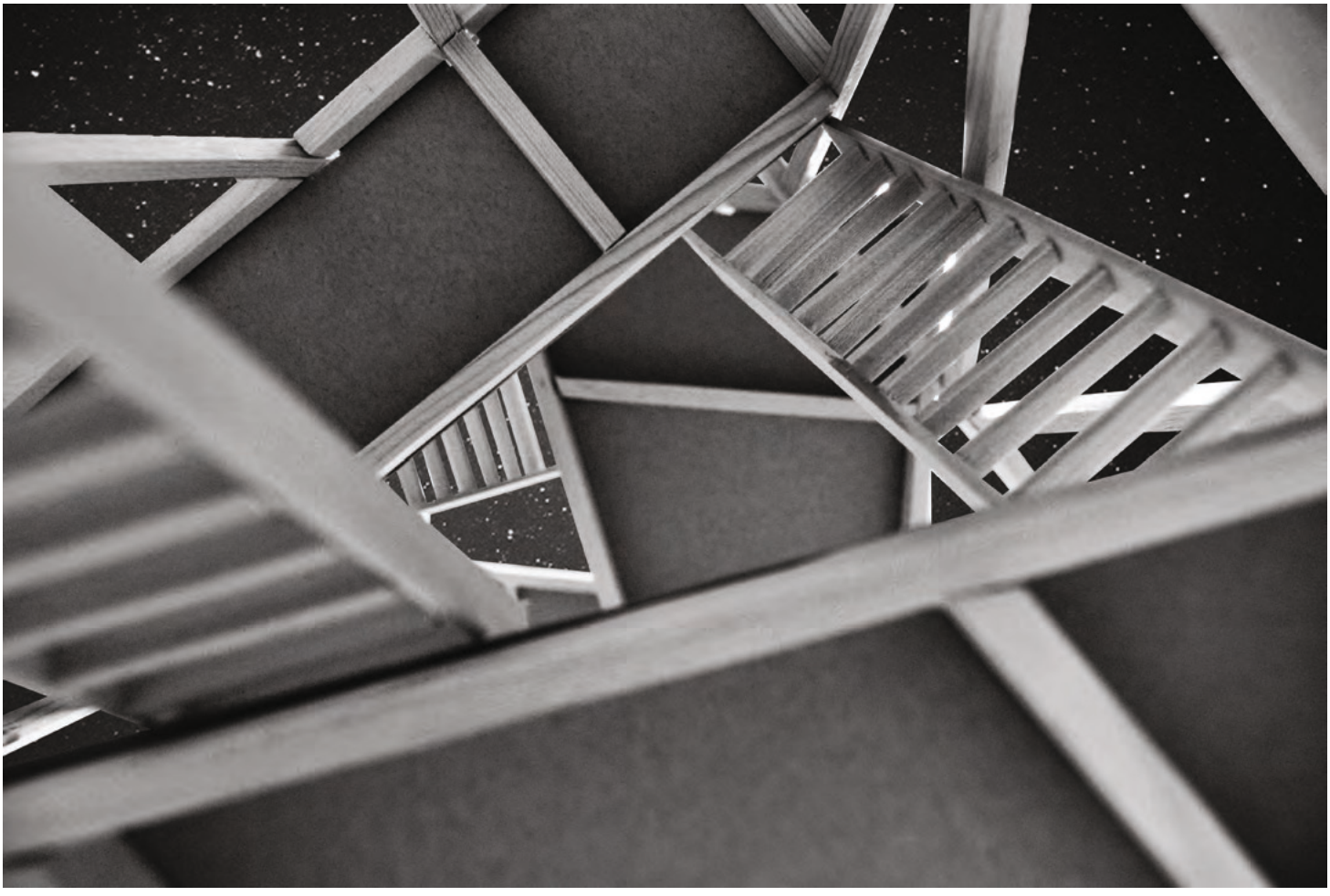

CUBE 2

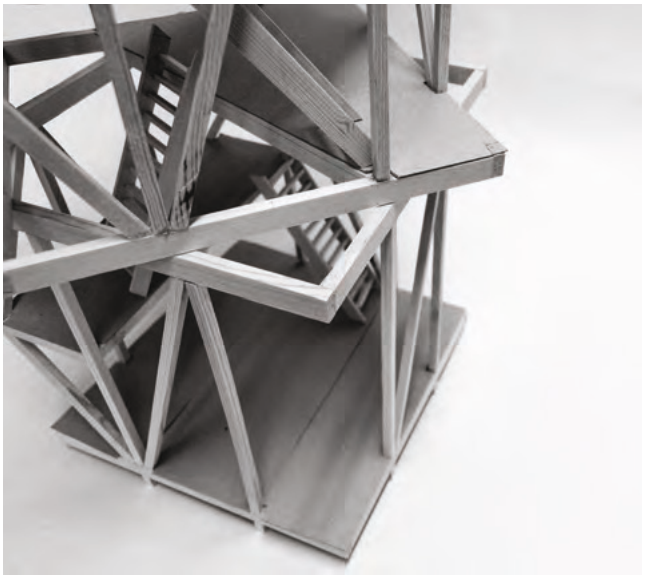

CUBE 2.5


CUBE 3



CUBE 3.5





STARGAZING TOWER IN RINDAL

THEA HOUGSRUD ANDREASSEN

INTRODUCTION

After working with the intentional program, I wanted to create a place for dreaming and a place to lie down and watch the stars. The structure should be a visible landmark along the cultural path, and give the people of Rindal a place to meet. I also wanted to work with repeating modules, and see if the structure itself could be used not only to carry loads, but also be functional.

SITE

The structure is placed in the natural opening between the trees on the periphery of the field. It is located on the edge to utilize the height difference on the site.

THE STRUCTURE

The goal was to create a structure, which emphasized the different qualities on the site, and give different spaces and experiences to the users. The structure is based on a grid, with a repeating frame. The diagonals connect the tower, the bridge and the fireplace platform, and hold them together. The diagonal braces are also used as benches, railings, and as stairs inside the tower.

CONCEPT

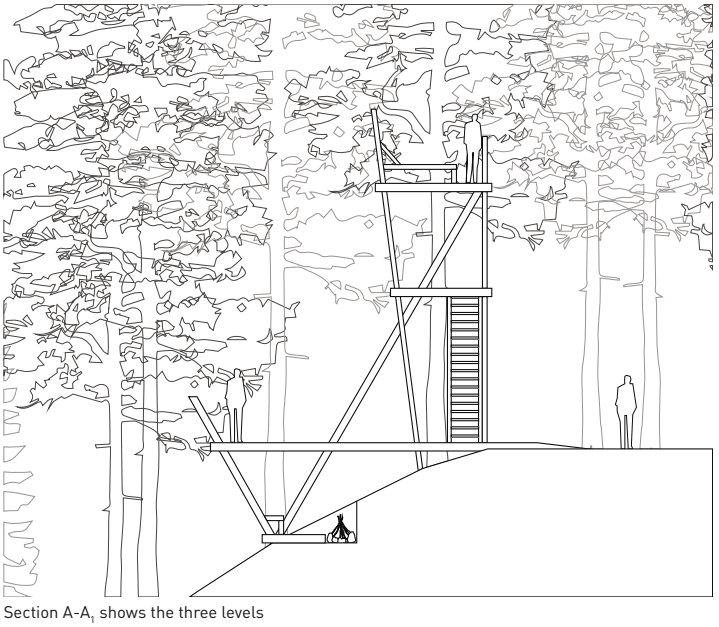
There are three different spaces I wanted to enhance: a place to look up at the stars, a place to experience the trees, and a place for socializing.

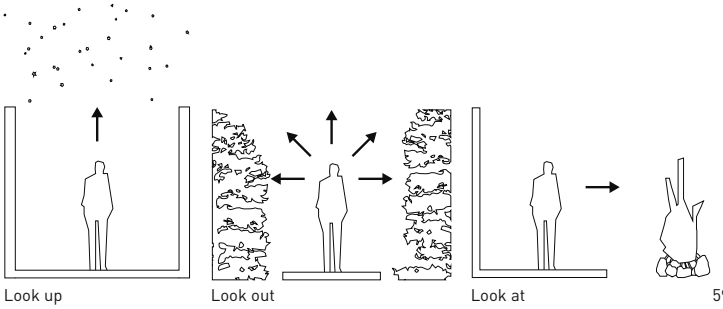
The tower is focused upwards with high walls, and has a lower wall facing the southern sky where you can rest your binoculars. There is only room for 2-3 people, and there is also a place to lie down. By ascending the tower, you are not physically closer to the stars, but the ritual of going up can bring you closer in a psychological sense.

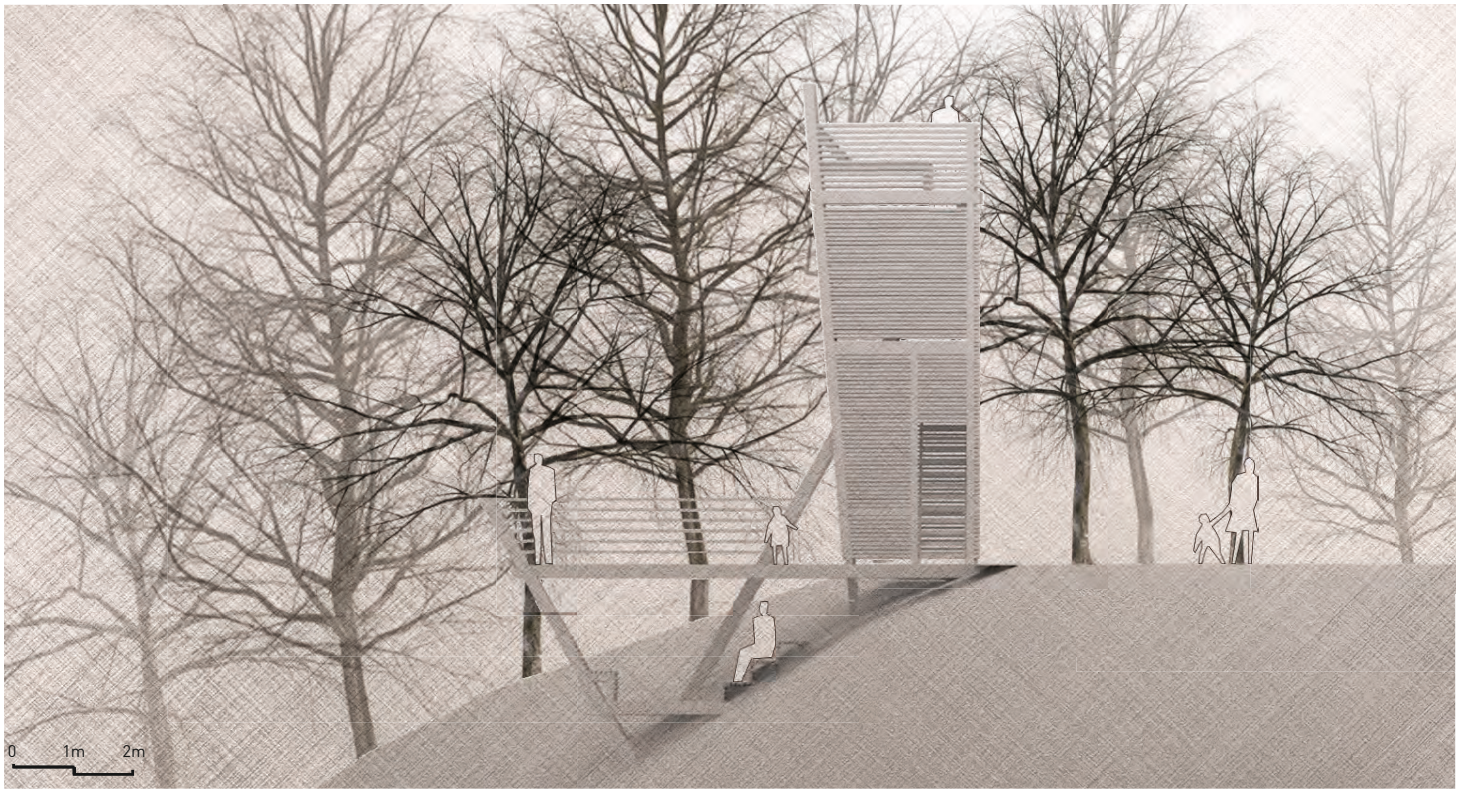
The bridge is a welcoming threshold, which takes you from the flat, open field, over the steep edge and into the treetops. There are no walls, only railings.

The third place is located on the ground, and this is a social space for a group of people. The focus and the benches are faced towards the fire. The fireplace is partially dug down in the ground. The stairs down from the field to the fireplace can also be used as benches, and the platform above can give shelter if it rains.

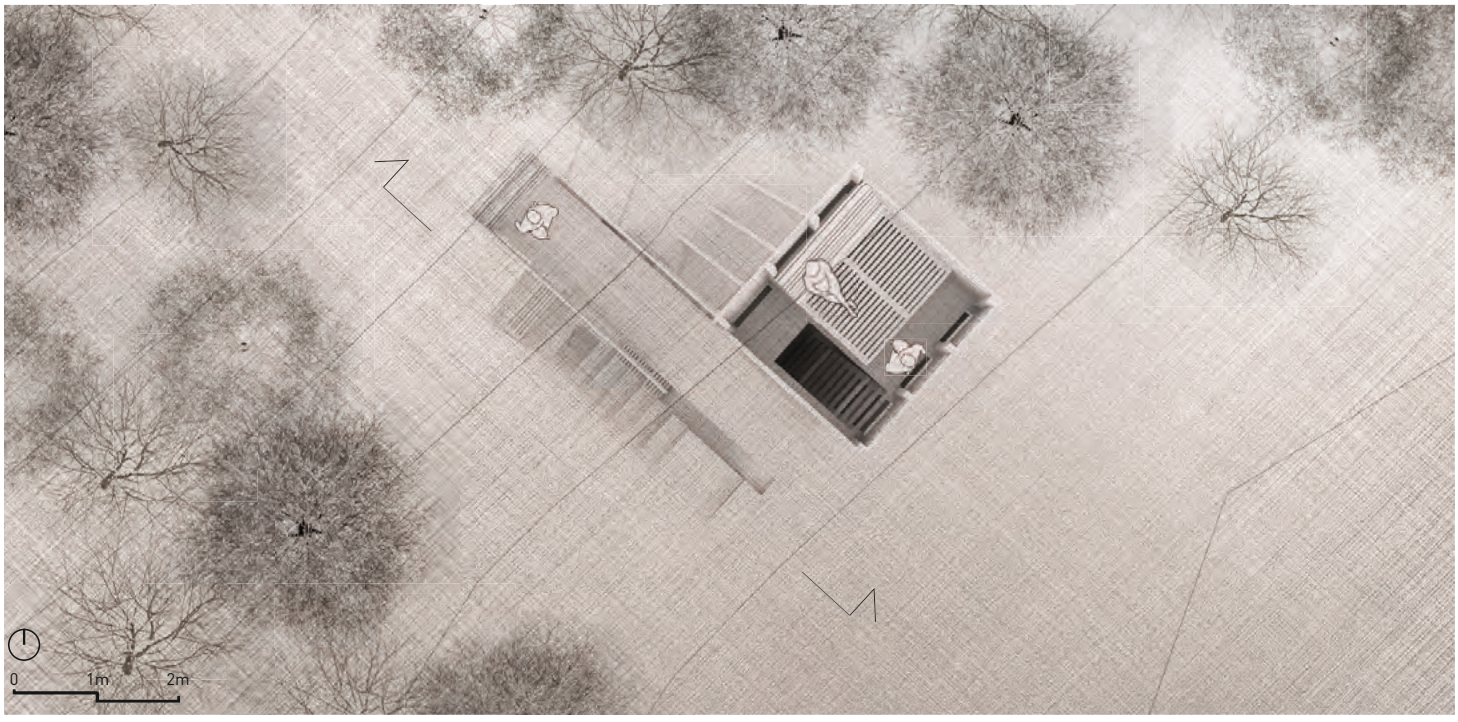
Site plan


Section A-A_1 shows the three levels

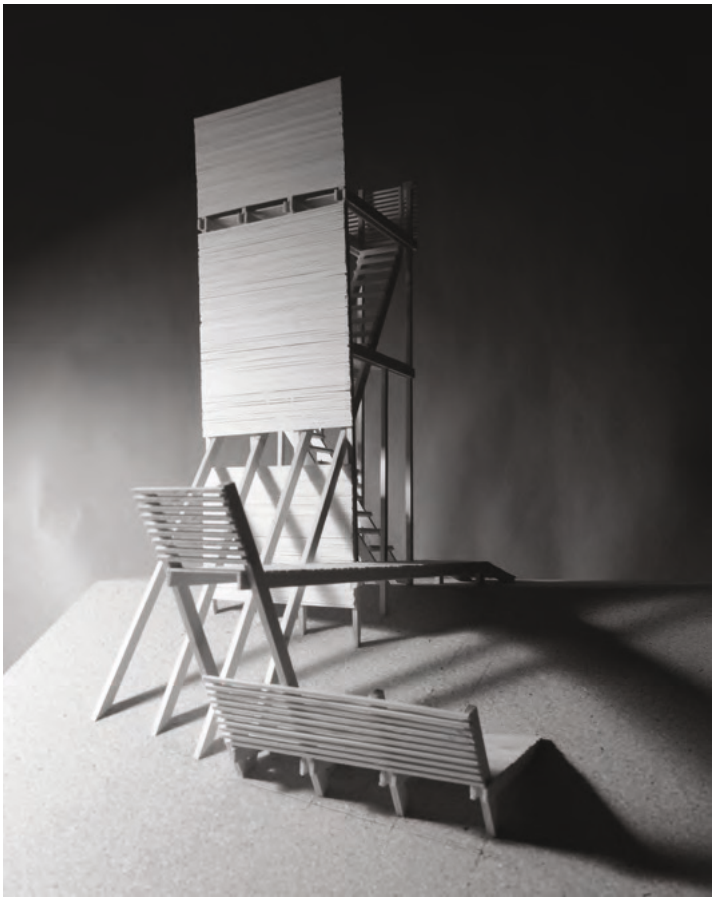




Elevation



Plan



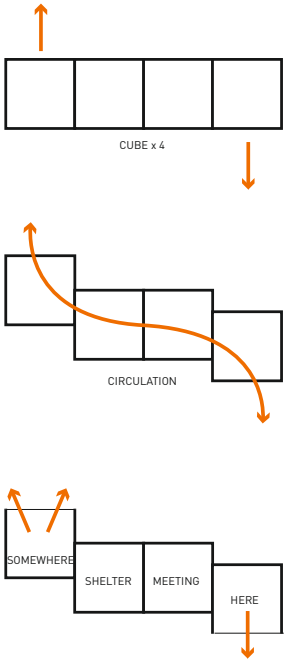
Model photo 1:20

Model photo 1:20

Arriving from the field

BALANCE

TONJE SKAGA



Arriving from east

CONCEPT

Stargazing makes me think about the vastness of space, which reinforces the feeling of being a small part of something big. The tower is a place for both the big and the small and it is a place that balances on the edge between a "here" and a "somewhere".

The tower consists of four cubes that frame the view or the experience of the surroundings in four different ways.

"Here" is the hanging cube in the structure. This cave like volume has no floor, so your attention is drawn to the ground. You enter the cube from a hanging stairs.

"Meeting" is the social spot in the structure. The fireplace and the surrounding trees are in focus.

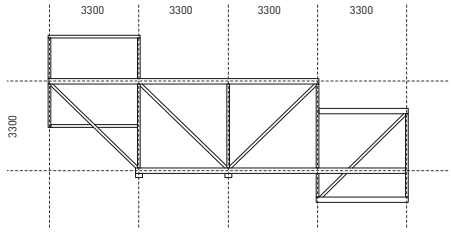
"Shelter" is the place where you are protected from the rain, and where you can climbe up to the stargazing level.

"Somewhere" is the place where you can lay down on a soft web of ropes, and gaze at stars all year round.

Site plan

SITE

The tower has an east-west orientation and it is situated on the edge of the steep slope on the site. Seen from the east, the tower is placed in the clearing in the woods. The tower is visually connected to the KULTURSTI on both the east and the west side. For those who want a physical challenge the structure can be entered from the slope, but entering from the field is also an option. On both sides the visitor enters the tower from beneath cantilever cubes.



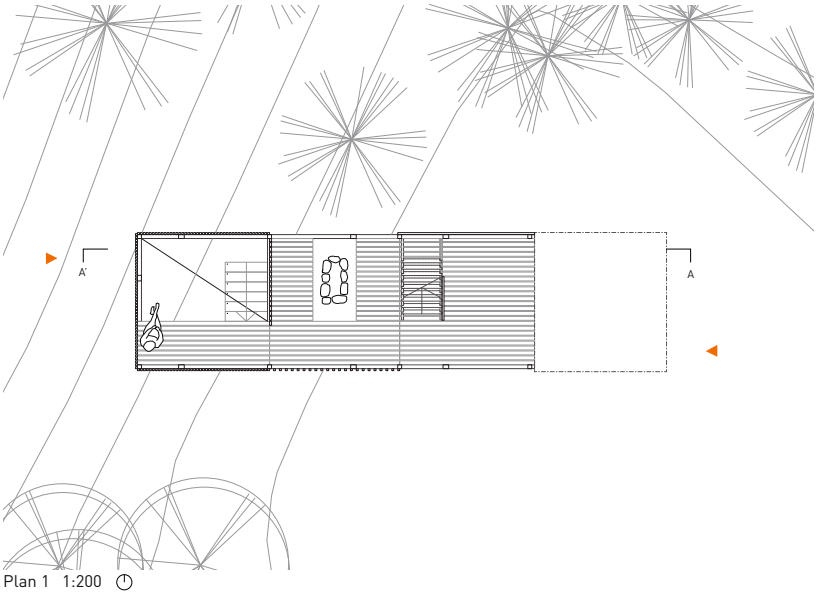
The grid

CONSTRUCTION

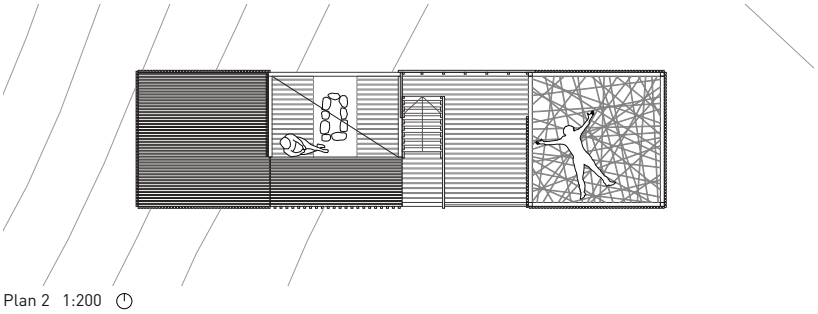
The main construction of the tower consists of two large cantilever trusses. The columns have dimensions 100x100 mm and the beams are 100x200mm. Concrete fundaments support the tower and anchor it to the ground.

The tower is designed based on a grid of 3300 mm in three directions (x,y,z). Thus it is possible to use standard lengths of sawn timber. The construction and the joints take mainly compression, and all constructive elements are aligned in the vertical plane.

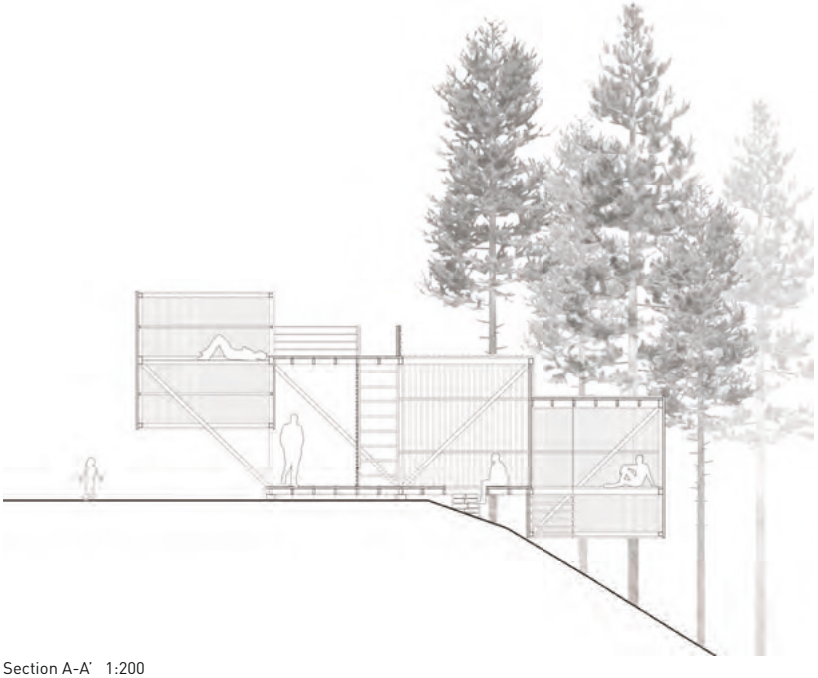
In addition to wood, rope is an essential part of the constructive elements. The rope web enables stargazers to lay down and observe the stars without getting wet and cold, despite heavy snowfall. Rope also carries the hanging stairs, and thus prevent it from touching the ground. This supports the concept og the balancing structure.



Plan 1 1:200



Plan 2 1:200

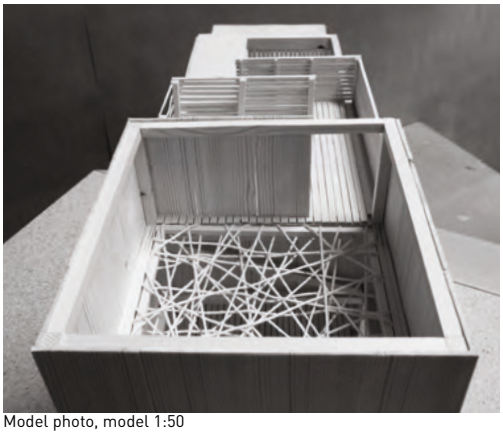


Section A-A' 1:200

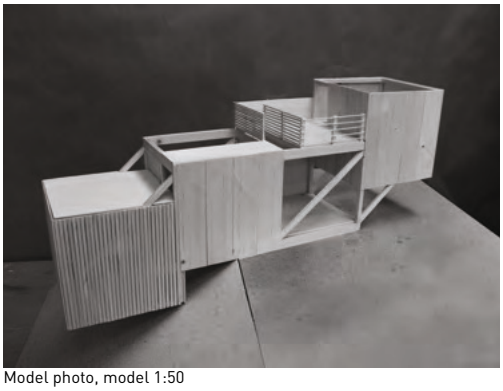
Model photo, by the fire place

Model photo, entering the structure from beneath the web

Model photo, arriving from the slope



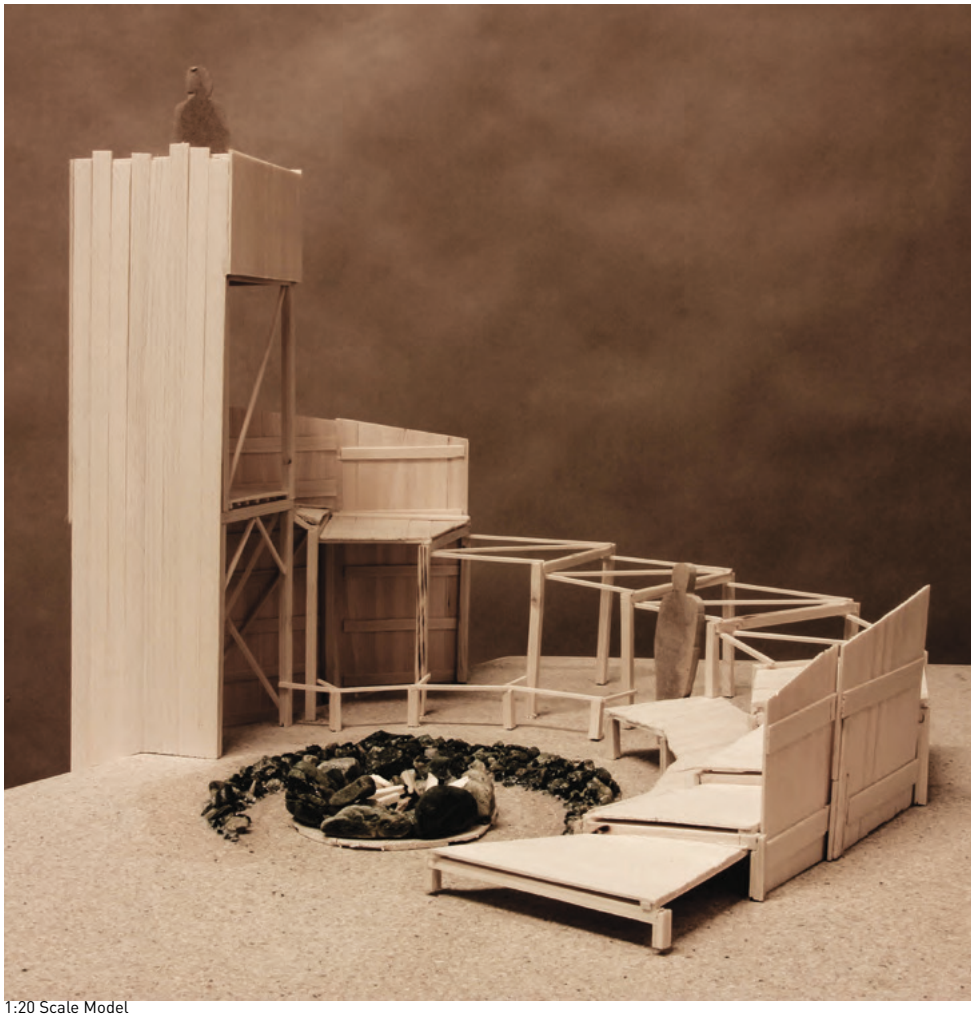
Model photo, model 1:50



Model photo, model 1:50

MOON DIAL

WILLIAM J. SPRATT-MURPHY



1:20 Scale Model

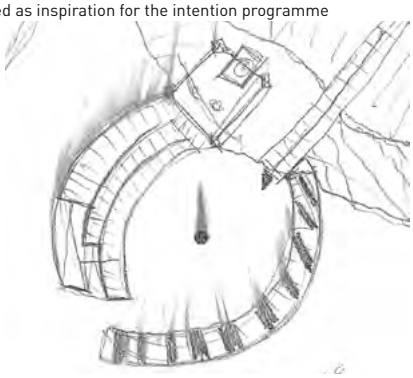
LOOKING FOR THE STARS

The concept of 'Star Gazing' comes to me in two ways. An individual experience of the stars and within a group looking and discussing what we see. The approach I took to designing a space for 'gazing' was as such. The individual's experience and a group experience. Both need something different for their experience.

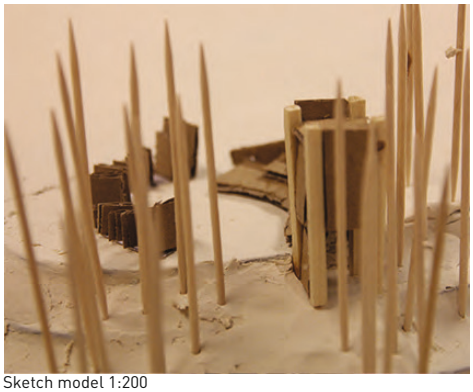
The contrast between these two experiences can also be echoed in a difference between the Sun and the Moon. The Sun in this project, I feel, is just as important as looking to the heavenly night sky. The period of star gazing in Norway is winter time, 7 months of the year. The other 5 months are filled with long bright nights and I hope in my project to address both night and day.
Taking lead from this approach to the night and day elements of this project I decided to contrast the individual and group experiences physically different. The individual experience is in the form of a tower elevating you above the site and hence closer to the stars. There is only space for two people atop this timber tower.

The group aspect of the is represented physically as the Moon Dial. A spiral helix which is divided equally through a centre point. The spiral is based on a sun dial with the fire place at it's centre, this also acts as a primal experience through the

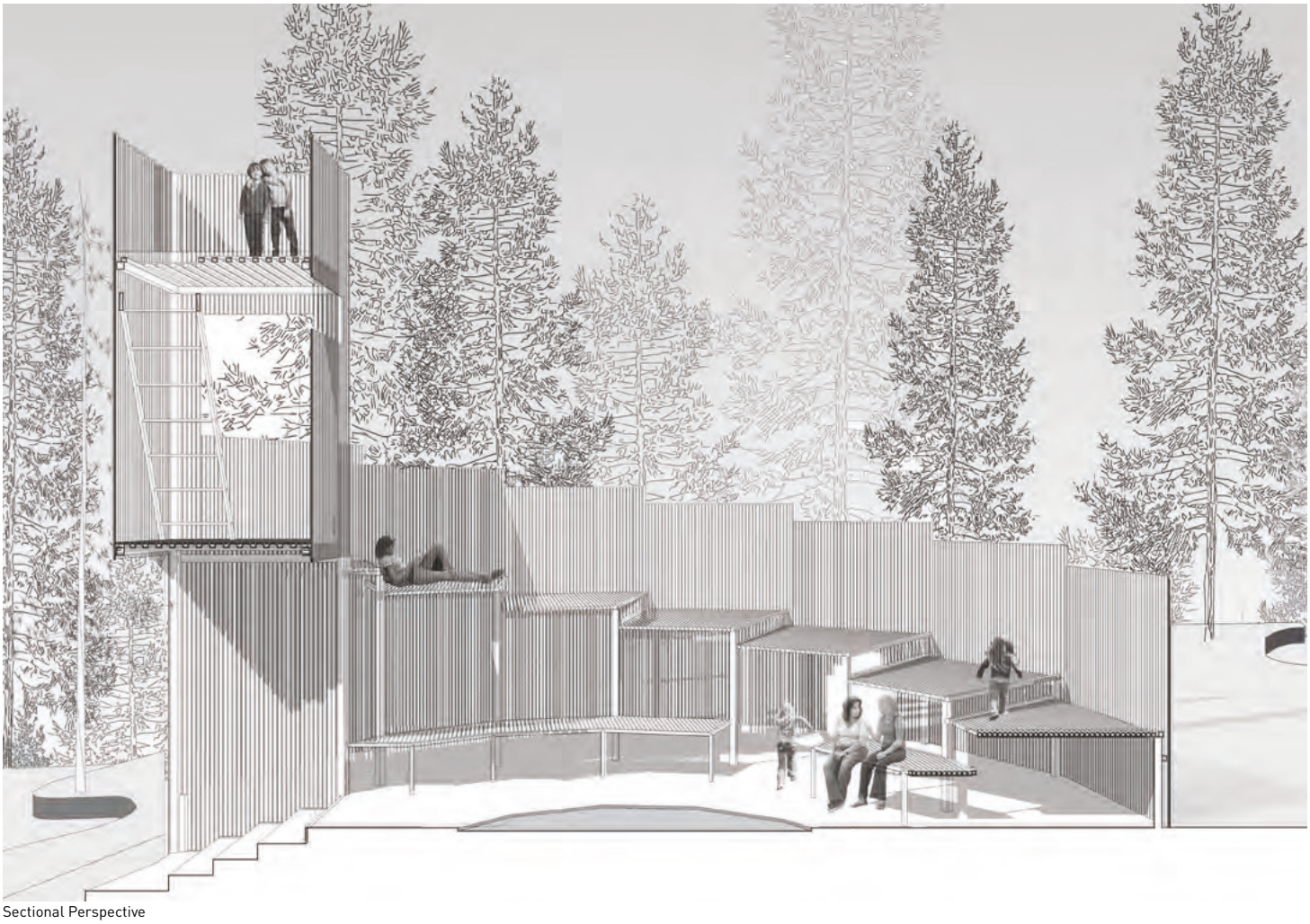
Children's drawing -
Used as inspiration for the intention programme



Development sketches



Sketch model 1:200



Sectional Perspective

act of story telling around a fire. As there are many entrances the etched marking in the ground is used a threshold to give a sense of place to the area. It is also a shadow of the spiral and tracks the movement of the Norwegian sun during the year.

The area underneath the platforms of the spiral can provide reasonable shelter and is another area for kids to play in.

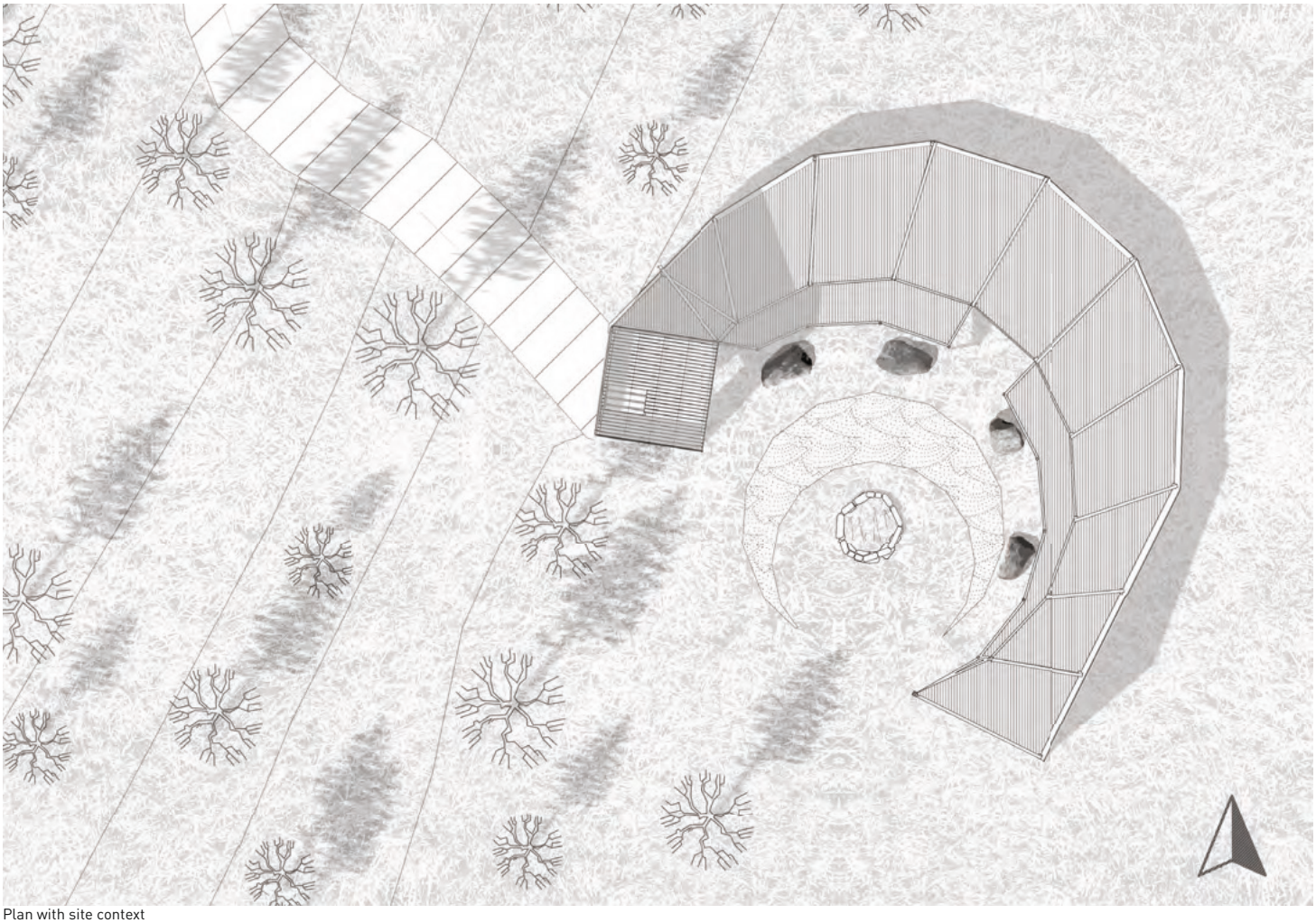
THE SITE

The wooded sloping site plays a role in the form and positioning of the structure. The main entrance is from the foot of the hill. This path is winding and gives multiple views the tower through the trees and a sense of space that lies behind the high timber walls. The issue of snow in Rindal is a pressing one and can't be ignored. The Moon Dial Rises 2.5m above ground level which is more than enough to cope with heavy snow fall in the winter.

THE STRUCTURE

The primary element here is timber. The structure of the tower consists of four glue-laminated columns. These act as an anchor for the spiral. The structure is curved adding extra strength. The construction is simple post and beam skeleton structure. This is then clad

View from the Kul-Tur-Sti



Plan with site context

in pine 2x1's. This gives the feel of a solid fort from the approach but reveals spacious platforms upon arrival

FOR RINDAL

The main goal for this project is to actively engage the people and particularly the children of Rindal in Star Gazing. The space also needed to act as a meeting point. The site will become a landmark along the kul-tur-sti and will entice people to investigate the space for themselves. Creating a space for children that are travelling to and from school to socialise with each other.

The Moon Dial will guide the people of Rindal to the stars.

1:20 Scale Model

Storytelling on a summers night

PHASE 2 — DETAILING

Four projects where selected for further development. Using the individual projects of Tonje, Kaspar, Guro and Teresa as a basis, they where developed by a group of four students in a way that they could conceivably be build.

In this fase the projects were first rediscussed by the groups to prepare them for further development. The next step was to develop the structure, detailling and cladding in physical models 1:20, 1:5, 1:2 and 1:1.

BALANCE

NELSON SILVA, MONICA SILVA & THEA HOUGSRUD ANDREASSEN

INTRODUCTION

In the further development of Tonjes project the main focus was to figure out a way to build the structure with pure wooden joints, and to make a more clear definition of the different spaces. We wanted to keep the main idea: a structure balancing on the edge, with two cantilever trusses and four boxes as the main concept.

We wanted to explore old wooden joints, and see if we could use this in a modern structure. The goal was to see if the main concept and structure could look the same and not need to undergo major changes at the expense of the wooden joints.

SITE

The structure has an east west orientation, and is placed in the natural opening between the trees on the periphery of the field. It is located on the edge to utilize the height difference on the site. It can be entered from the eastern side from the Kultursti, or, for the more adventurous, from the steep slope and up through the hanging cube.

Site plan

CONCEPT - HERE SOMEWHERE

The structure balances on the edge between “here” and “somewhere”.

The idea of a journey that starts “here” close to the ground, continues through the building, and has its end “somewhere” closer to the stars.

This building is not only for stargazing, but it is also a place to meet friends and family, learn, dream and give shelter from the changing weather in Rindal.

THE FOUR BOXES

The project has four boxes with four different functions. There is one box open towards the ground where kids can play and enter the building in a more challenging way. The next box has a fireplace, and it is open towards the forest. One box has a roof and gives shelter from the rain and the sun. This box also has a ladder taking you up to the second floor where there is a platform for stargazing and where you can access the fourth box. The last box is open to the sky, has high walls and a net where you can lay down and look up at the stars. Due to the net, snow will not accumulate, so it is possible to lay down all year round.

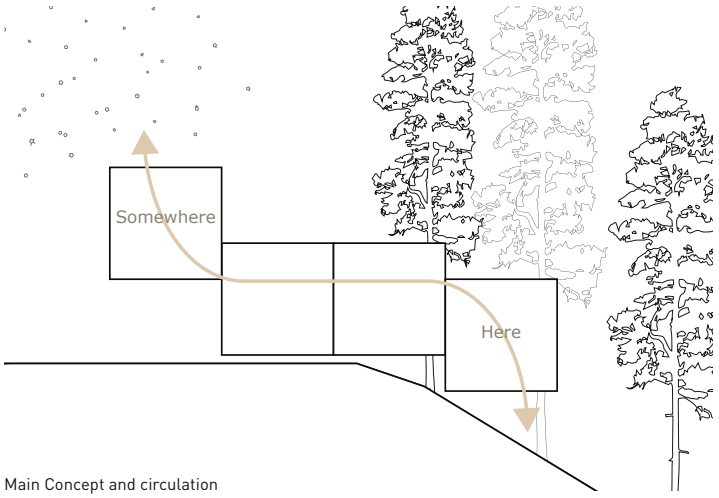
SIGHTLINES

As mentioned above, the four boxes have different identities and functions, but also different focus on the surroundings. The playground box is related to the ground; the fireplace box is open towards the trees on the north side; the shelter box is open towards the east and south creating the main entrance; and the stargazing box is focused upwards to the sky.

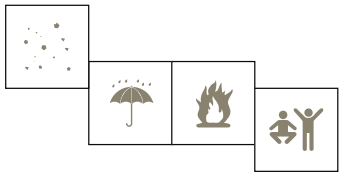
STRUCTURE

The main structure is a counterbalance system and works with trusses, columns and beams. It has two large cantilever trusses, which hold the boxes together. The boxes are divided in a grid of 3300mm c/c in three directions (x,y,z). Only one of the boxes touch the ground, and it rests on its four corners. It is anchored to the ground by two steel rods in two corners, and it rests on the concrete slabs in the other two.

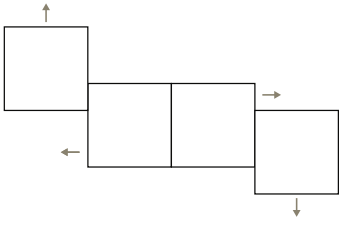
Most of the construction takes compression, unless when it takes tension from the box that hangs of the structure. By running the model through a structure calculation program, we found that the original dimensions of the wood had to be increased. The grid and all the constructive elements stayed the same but the large beams became 160x200mm, the columns and diagonals 160x160mm and the columns taking the tension from the hanging box increased to 240x160mm.



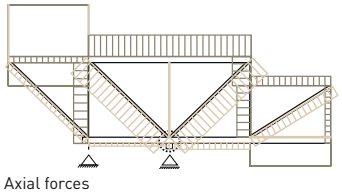
Main Concept and circulation



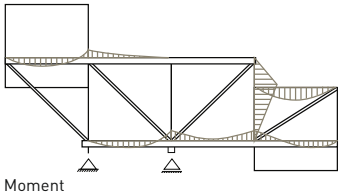
The four boxes have different programs



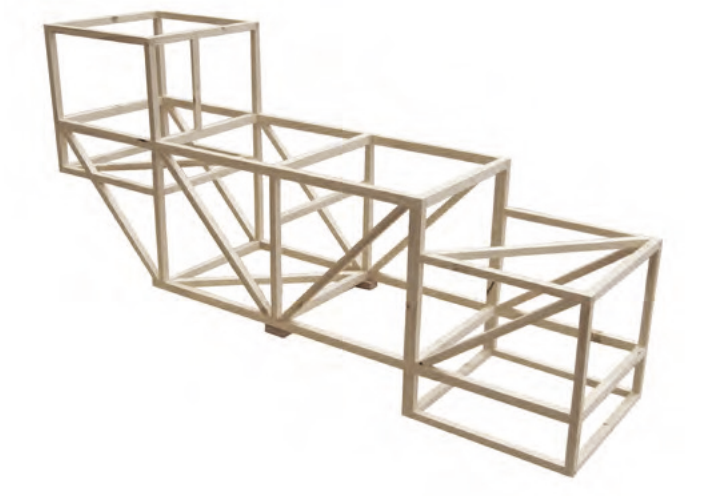
The four boxes foucus on different views



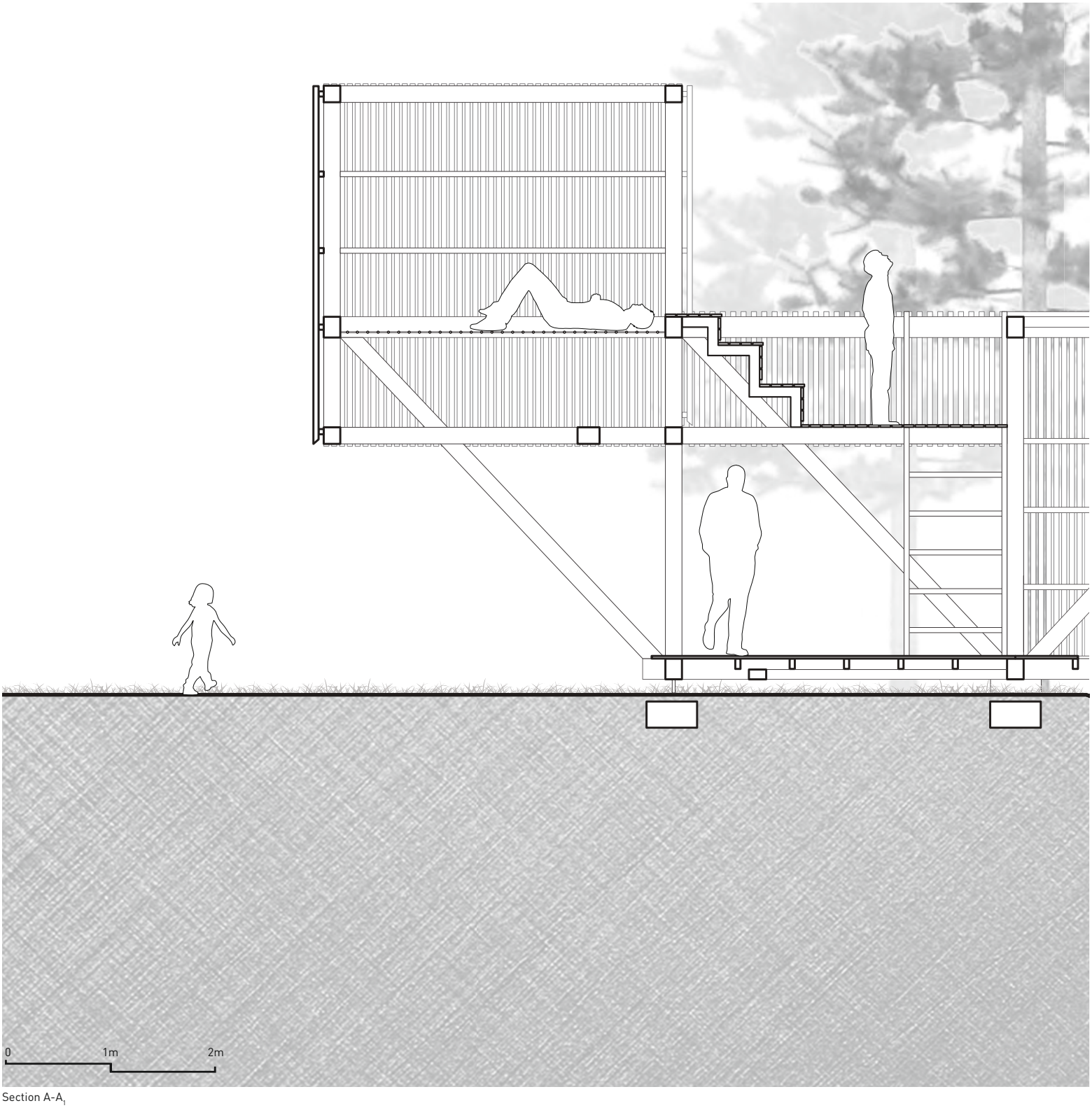
Axial forces

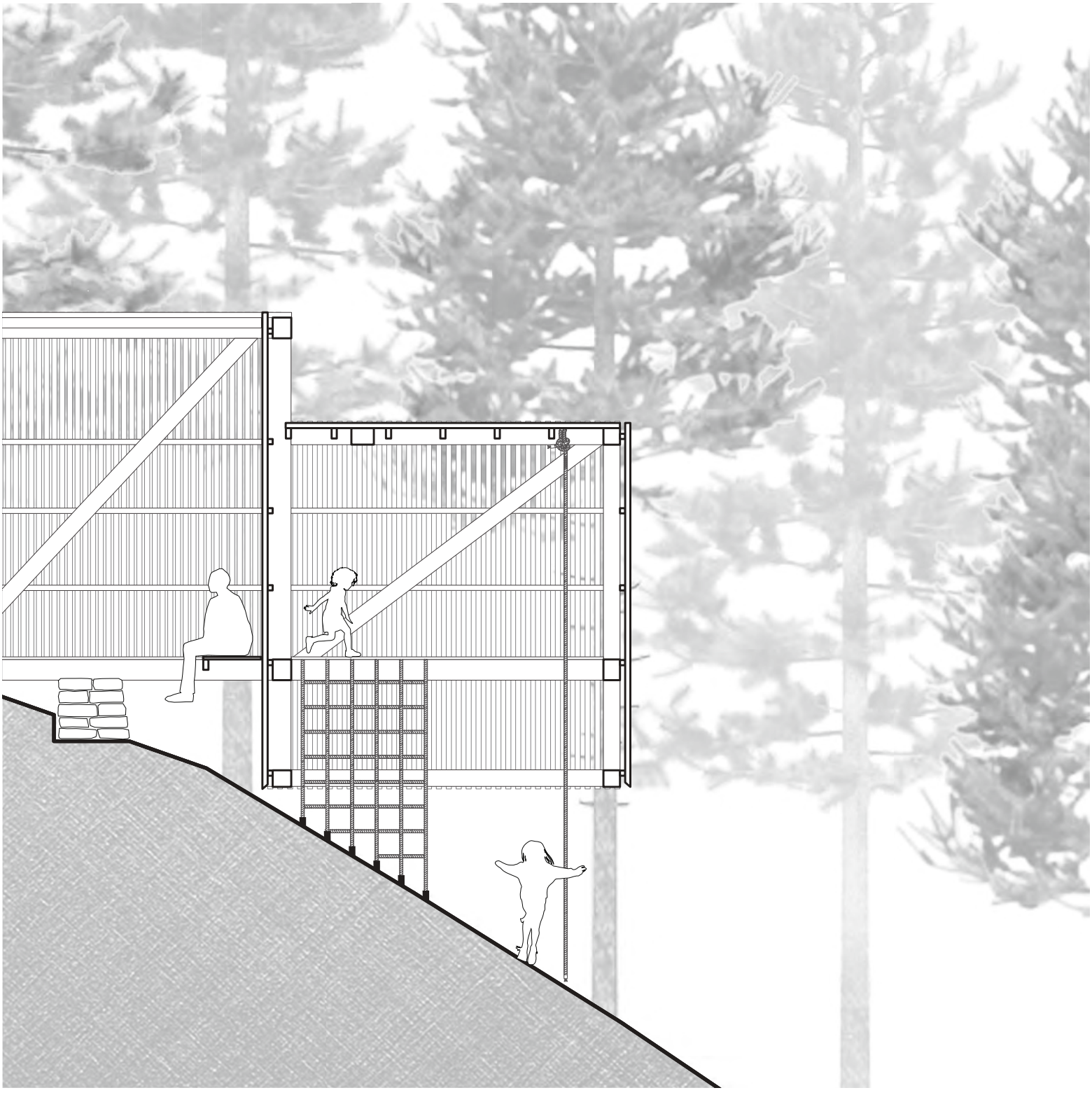


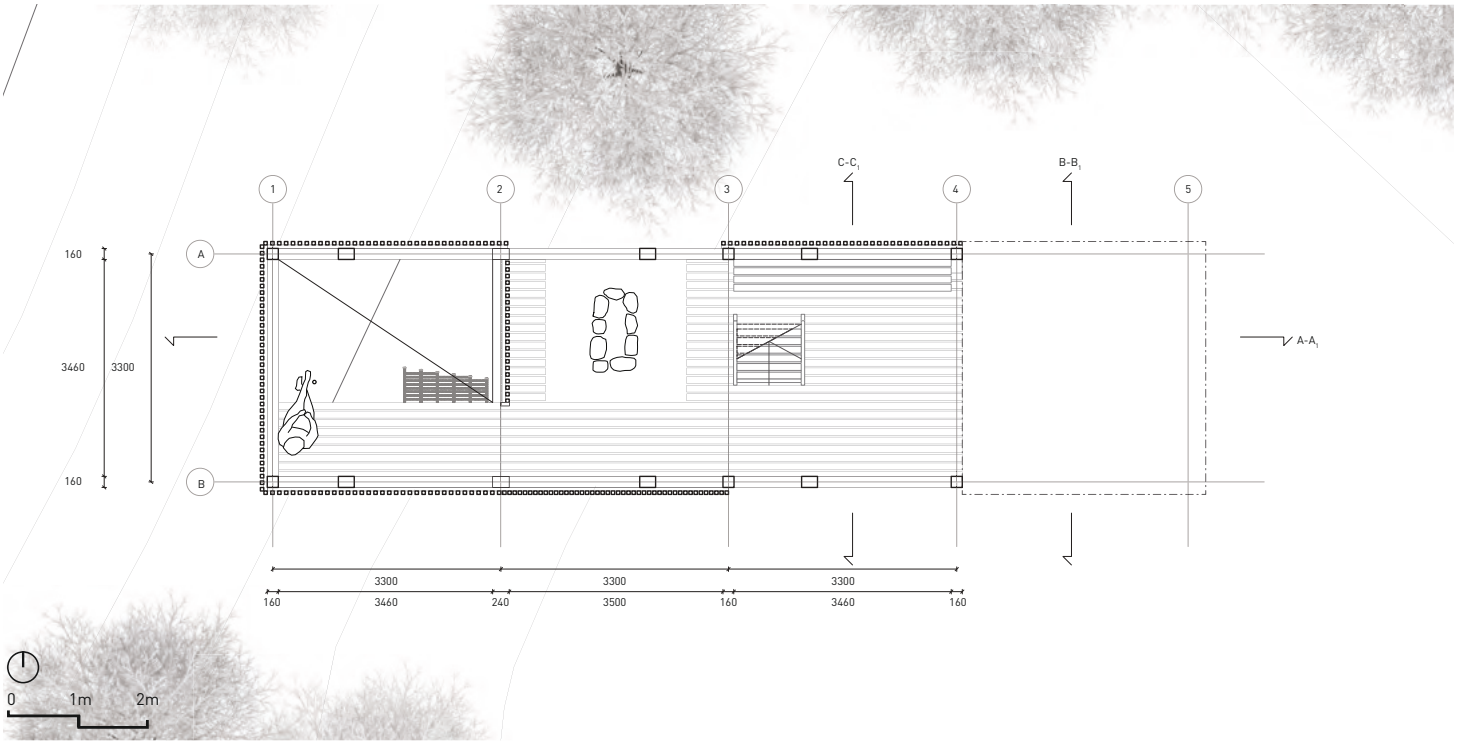
Moment



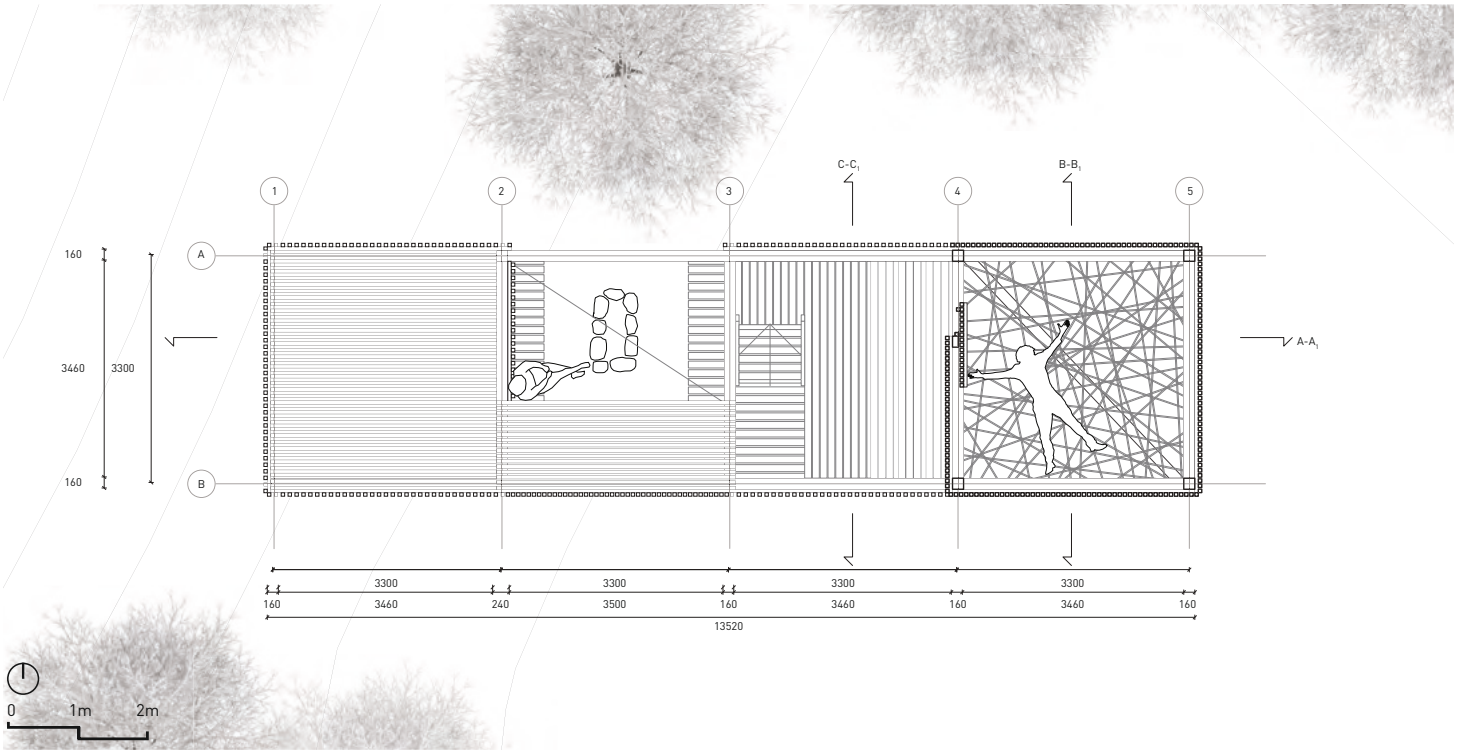
Model 1:20 structure


0
1m
2m

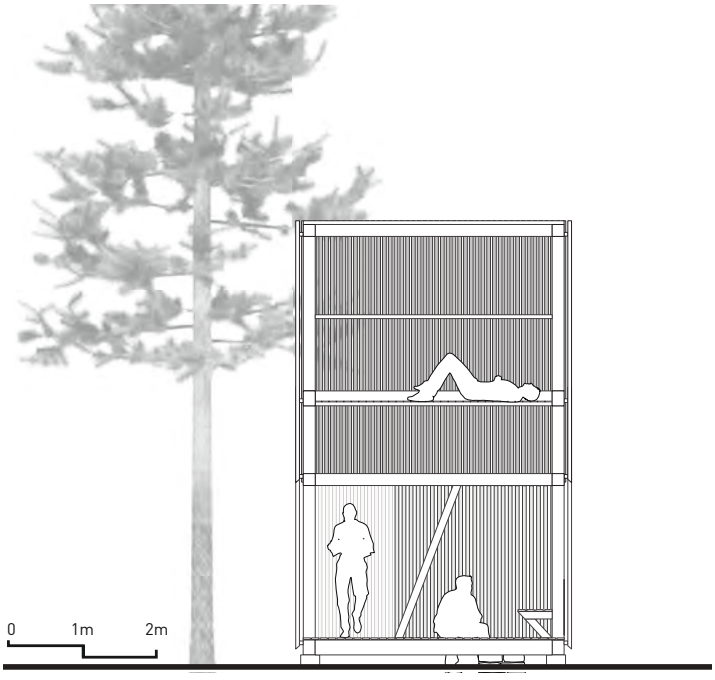




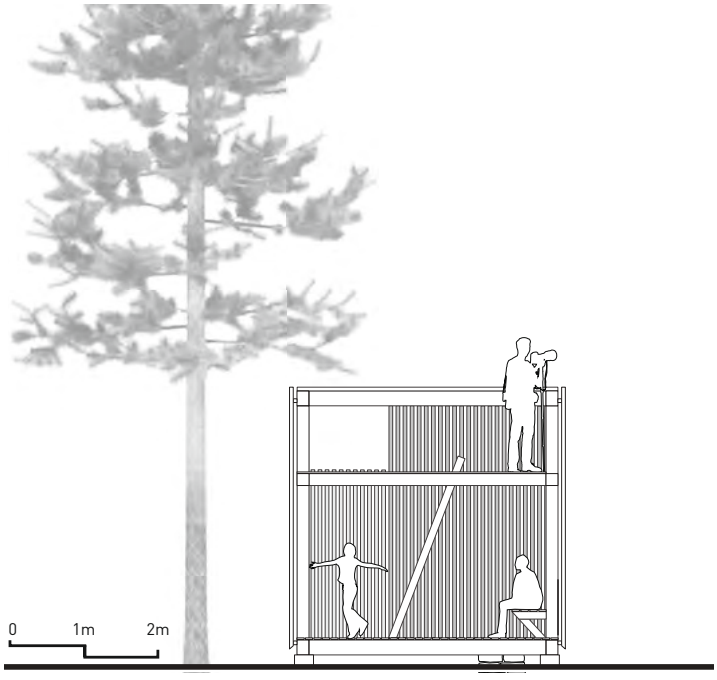
Plan 1st. floor



Plan 2nd. floor



Section B-B_1



Section C-C_1

PLAN

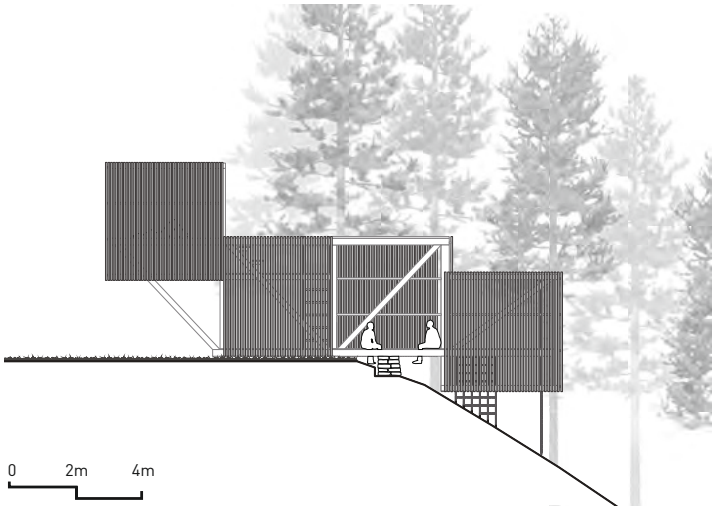
The structure is divided in a grid, where the distance is 3300mm between the centre of the columns in each cube and in every direction. There are many openings in the structure to the outside area, and there is a given movement through the building. The thought was to cross the four boxes from one extremity to the other with no walls blocking the path.

SECTION

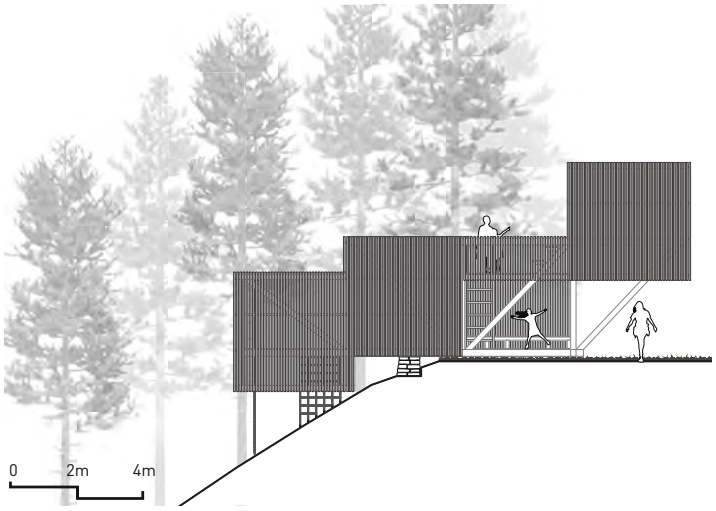
Section A-A_1 shows the whole structure and the identity of the four boxes. Section B-B_1 shows the stargazing box and the shelter box underneath it. In section C-C_1 one can see the second floor platform. The first floor is 2000mm tall, and the upstairs railing is 1100mm making it possible to rest when using binoculars or telescope to gaze at the stars.

An alternativ way to enter the building

The eastern entrance



North Elevation



South Elevation

FACADE AND CLADDING

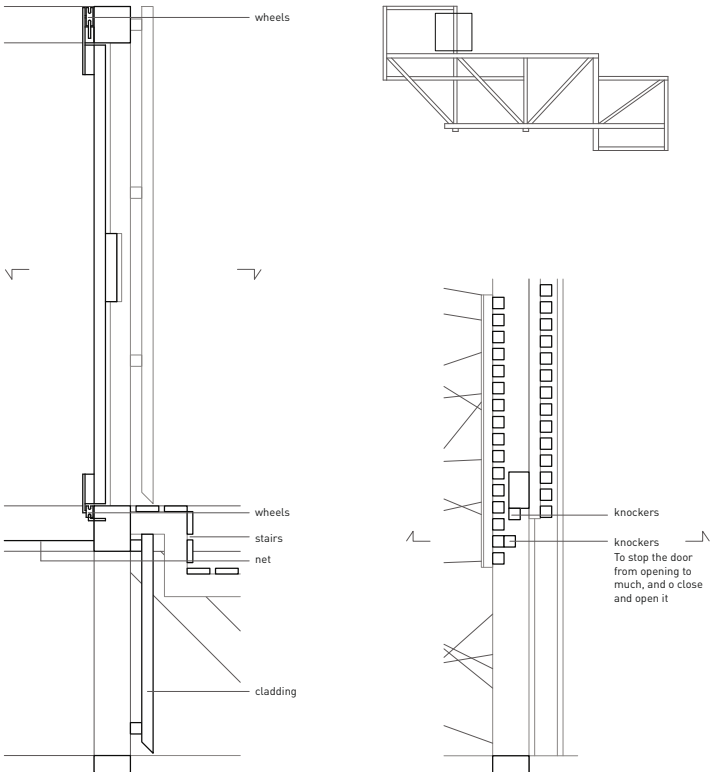
The four boxes are covered with 2" by 2", with different spaces between them depending on the type of box and its use. The stargazing box is very closed to stop any light pollution from the surrounding houses and the fireplace. The shelter and the playground boxes are more open, where the distance between the 2" by 2" are a 2" (5cm), and the distance in the fireplace box is 1" (2.5cm).

The cladding covers almost all of the walls with exception of the places where the structure opens up to the outside. These frames different views, entrance points, and lets the smoke out by the fireplace. The cladding is separated from the main structure by a secondary smaller beam that makes drainage and air flow easier. Also, at the lower end of each 2" by 2" pieces have a diagonal cut (a drip nose) to prevent water from ruining the wood.

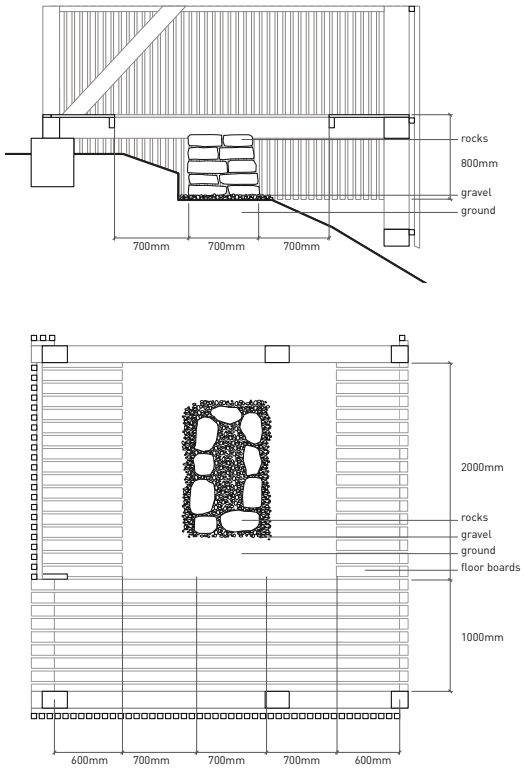
Despite the cladding being independent of the main structure it takes some of the compression and tension and helps holding the structure together.


The Fireplace


The second story



Detail of door. Left: Section Right:Plan



Detail of fireplace. Top: Section Bottom: Plan

Model in scale 1:5 of the fireplace box

FIREPLACE

This project is not supposed to be used only for stargazing, but also to give the people of Rindal a place to meet. One of the first concerns was how to solve the issues regarding the temperature, and how a fireplace could be inserted in the building in a way that would not ruin the stargazing with smoke. The actual fireplace is set in the ground, and it is independent of the wood structure. It has a secure distance from the building, and space for someone to sit on the edge of the floor and stay warm.

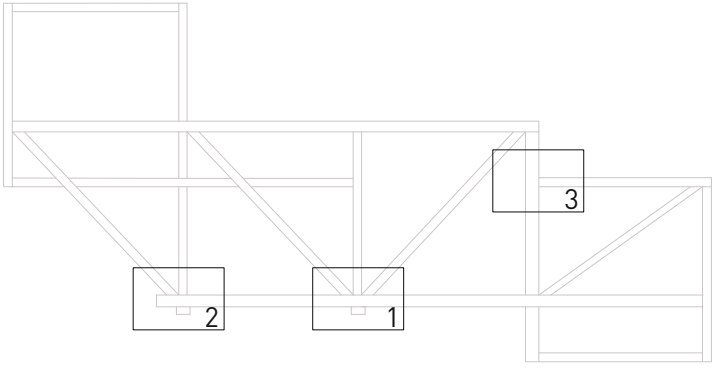
DOOR

On the second floor one enters the stargazing box by using the bench that also works as stairs. To enter the box there is an opening in the cladding. Due to the fact that we did not want any kind of distraction or light inside this box, there is a sliding door, covered with the same type of cladding as the building. In this way, when the door is closed you can not distinguish where it is, and the inside of the room is totally protected from the surroundings.

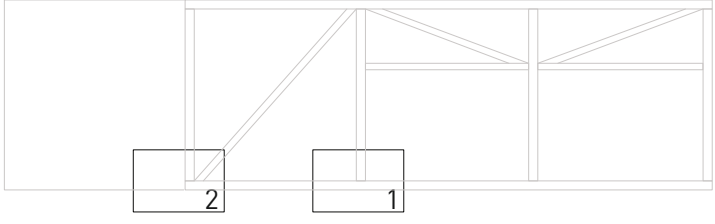
DETAILS

We worked with three of the more important and complicated wooden joints, in order to find out if the structure we calculated could be built. Therefore, after calculating the compression and tension of the joints, we drew two details, always aware of the fibre directions in the wood pieces. Later we built the two wood joints in scale 1:2, and one of them in 1:1 in glued laminated wood (glulam). We concluded that if this structure was to be built we had to: either enlarge the dimensions of the beams and columns, meaning a more expensive construction; or use steel in the joints instead of the pure wooden joints. This would allow the structure to be lighter and slimmer. Another solution is to increase the number of trusses, decreasing the compression and tension, but this will change the appearance of the structure.

Despite discovering this problem, our group decided to continue to work with wooden joints and to try to find the best possible details for this structure to work.

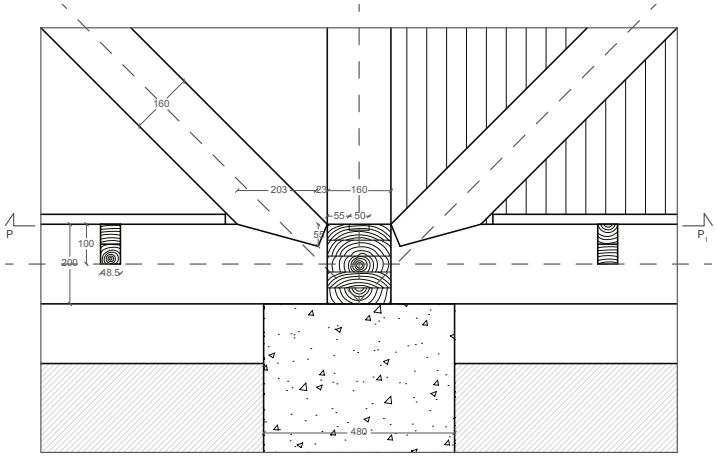


Selected details in section

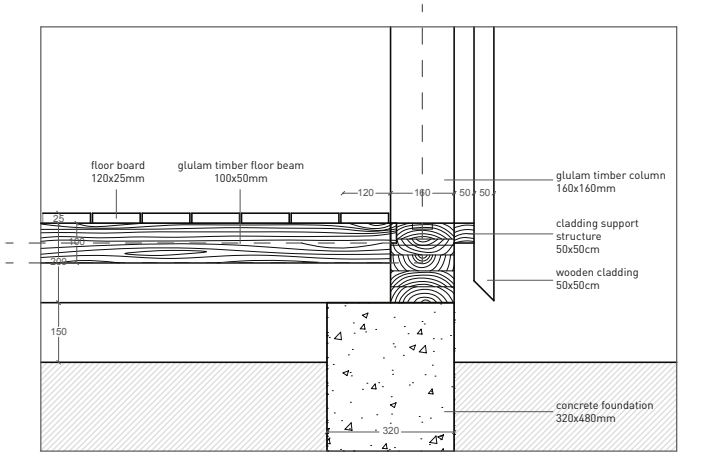


Selected details in plan

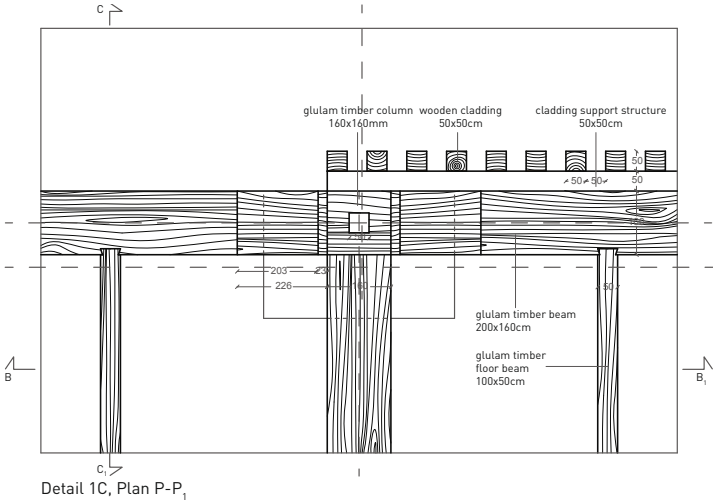
DETAIL 1



Detail 1A, Section B-B_1

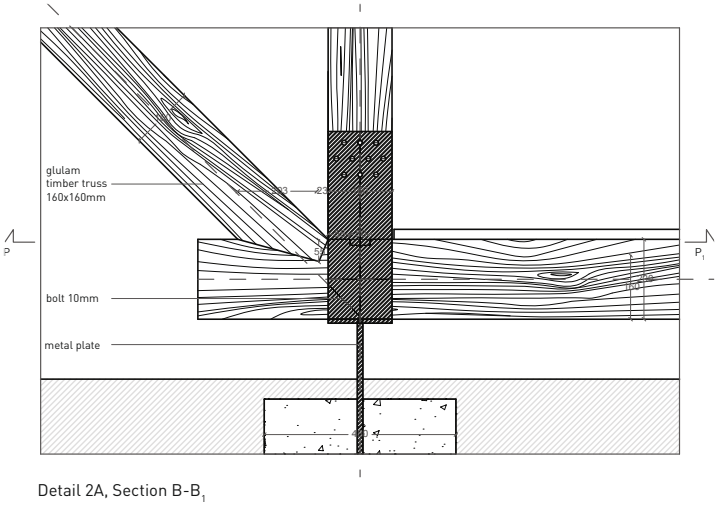


Detail 1B, Section C-C_1

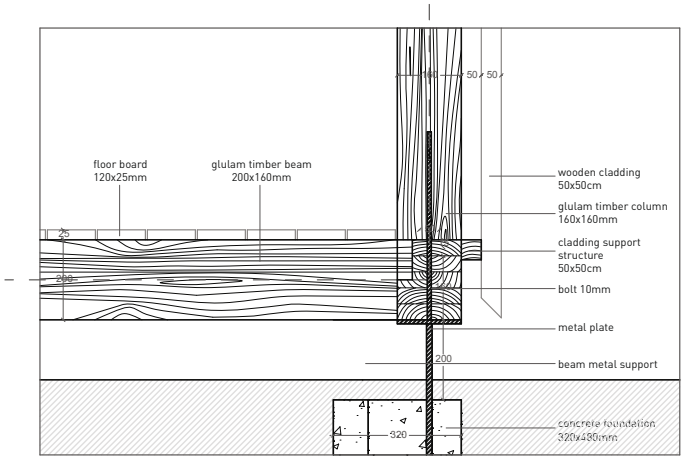


Detail 1C, Plan P-P_1

DETAIL 2



Detail 2A, Section B-B_1



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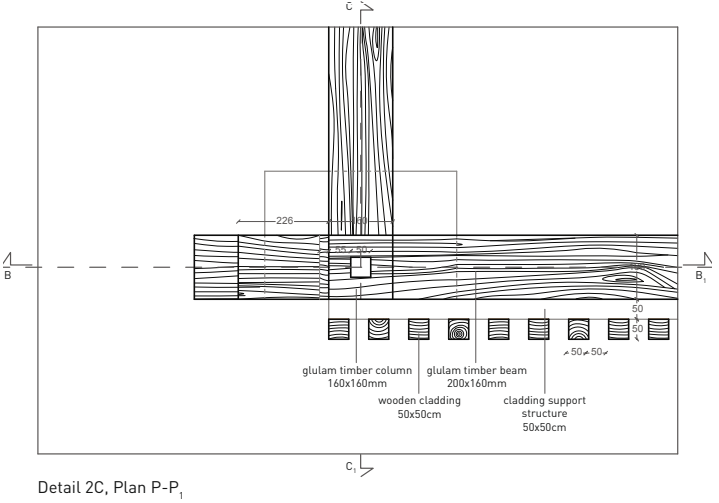
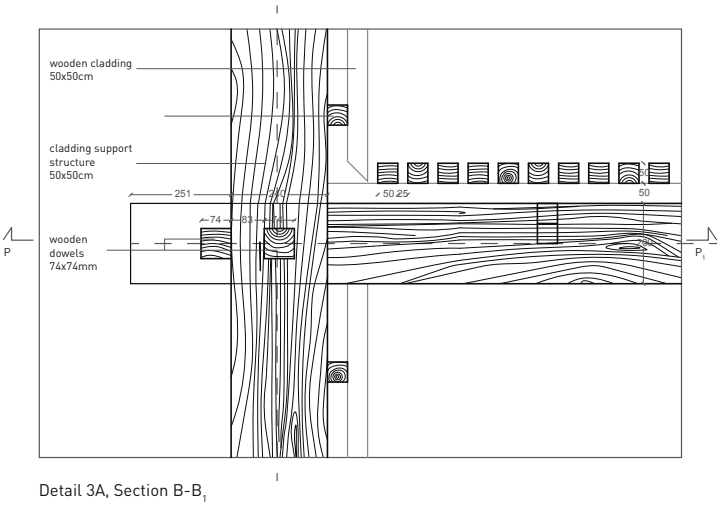
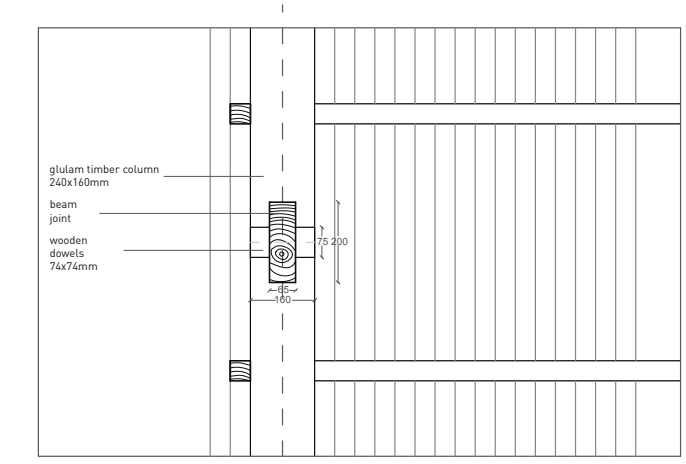


Detail 2C, Plan P-P_1

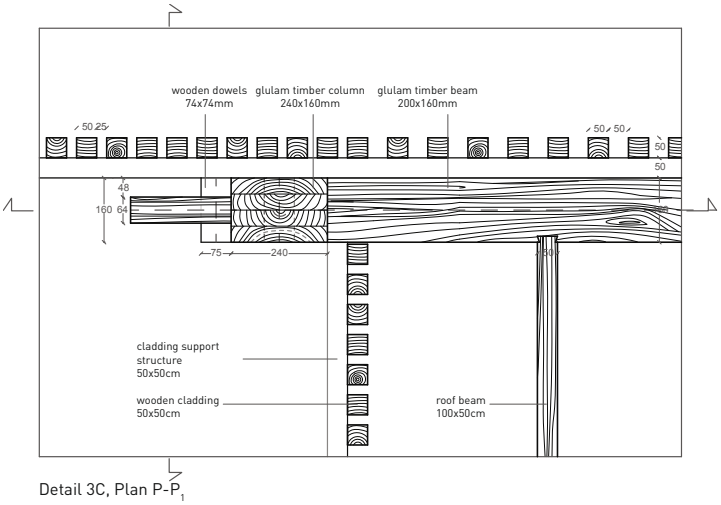
DETAIL 3



Detail 3A, Section B-B_1



Detail 3B, Section C-C_1



Detail 3C, Plan P-P_1

BUILT DETAILS

Detail 1 built in scale 1:2, testing the joint with most compression

Detail 1 built in scale 1:1, improved version of compression joint

Detail 3 built in scale 1:2, testing the tension joint

Detail 1 built in scale 1:1, pieces taken apart

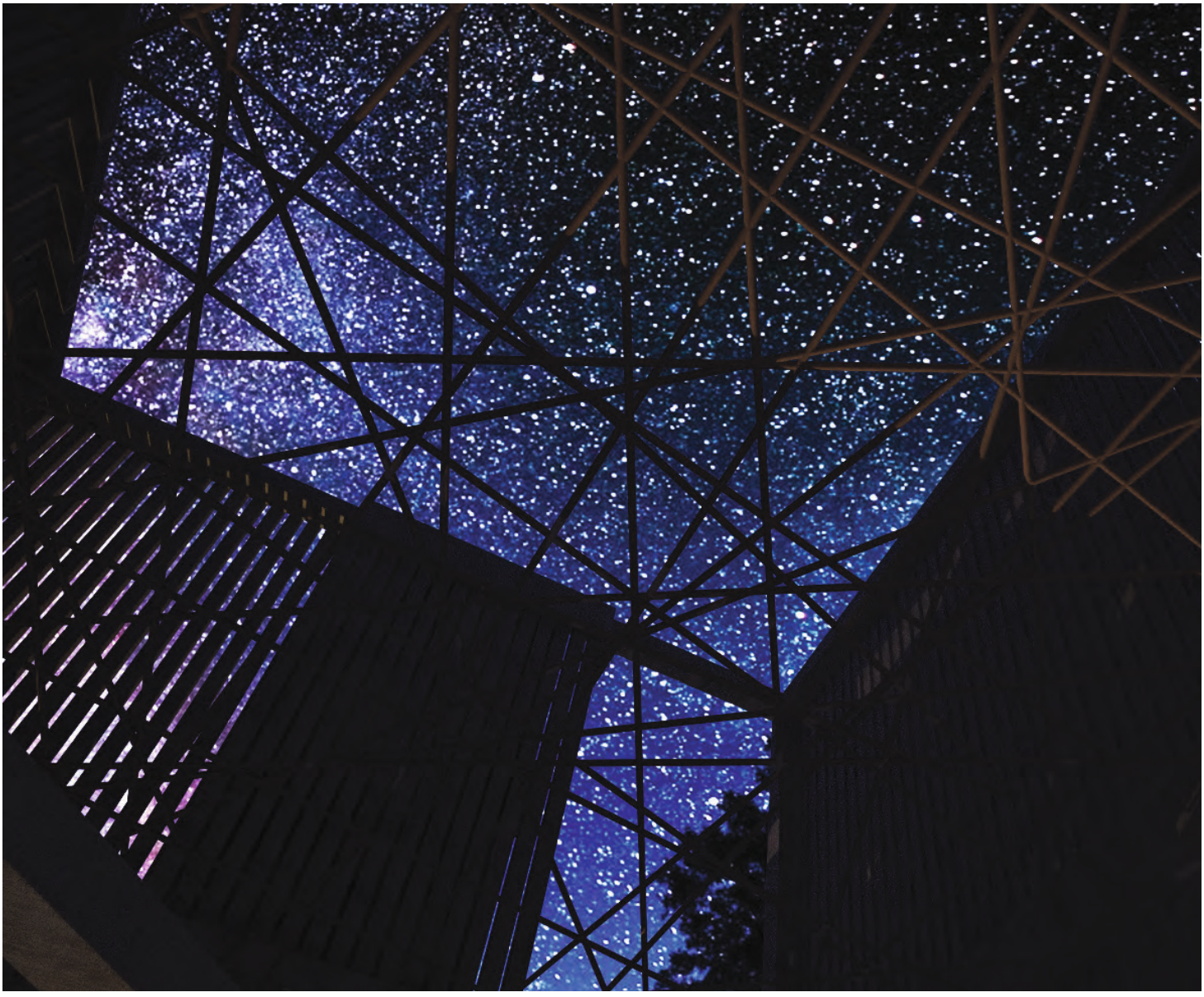
CONCLUSION

Our goal during this process was to figure out how to build the structure based on pure wooden joints.
The structure is possible to build based on our calculations, but the dimensions and proportions one gets from just using wooden joints are very big. This also interferes with the idea of the structure; something light balancing on the edge.

Also, by using pure wooden joints, the structure will not have a clean frame. Again, this is not a problem, but it will change the appearance of the structure.

To build this construction, one then has to choose what is most important: a clean light structure with hidden steel joints, which is not a pure tectonic construction, or a fully tectonic structure only built in wood, but with large dimensions and an appearance based on the woods permissions.

During the projects process we gave wings to our imagination, returned to our childhood, discovered the universe and learned the capacities of wooden structures and how to transform an idea into reality.



SLEEPING UNDER THE STARS

ASBJØRN FLØ, GURO BRENK, JONE NORDLAND, TERESA RODRÍGUEZ

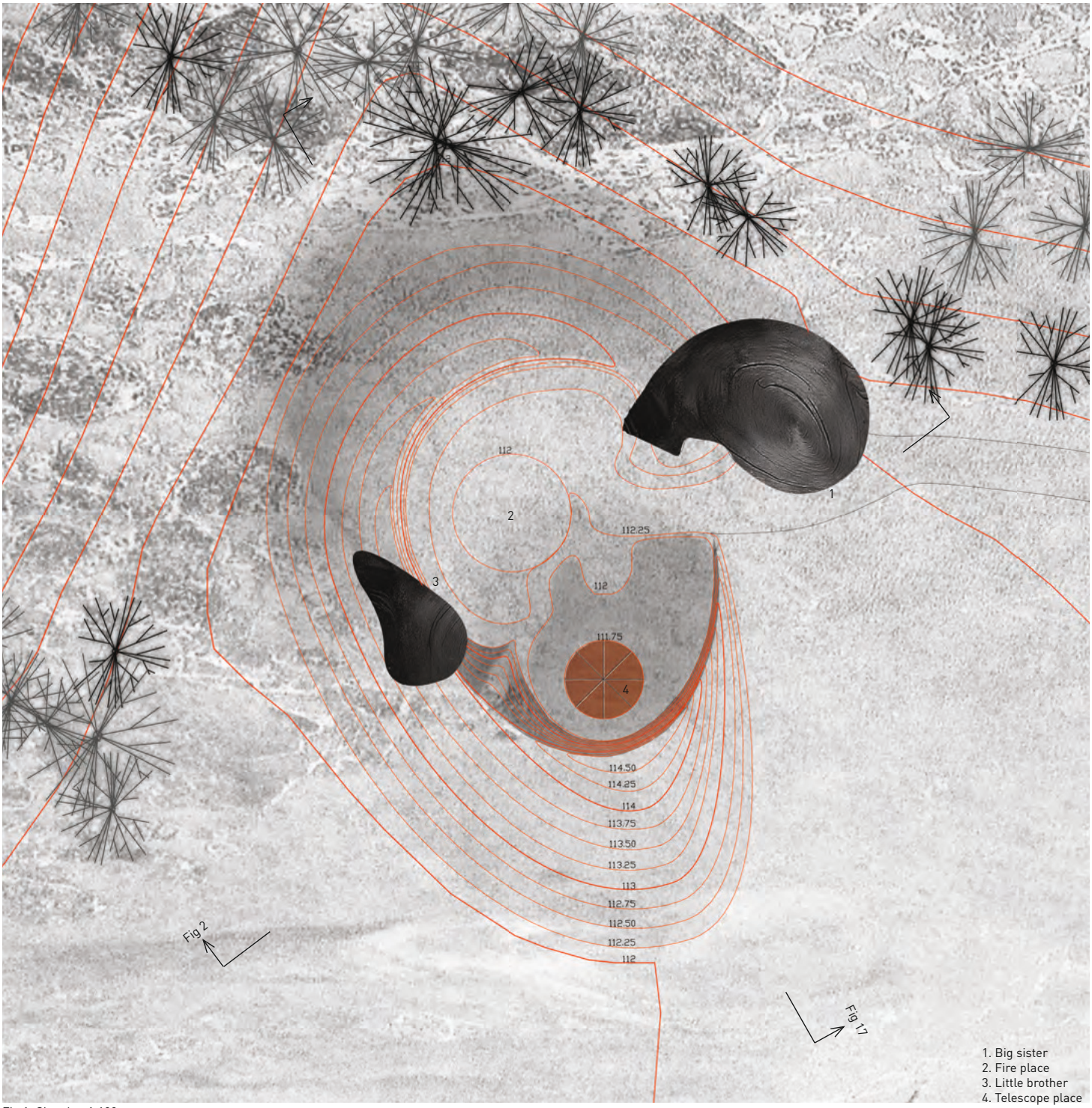


Fig 1: Site plan 1:100

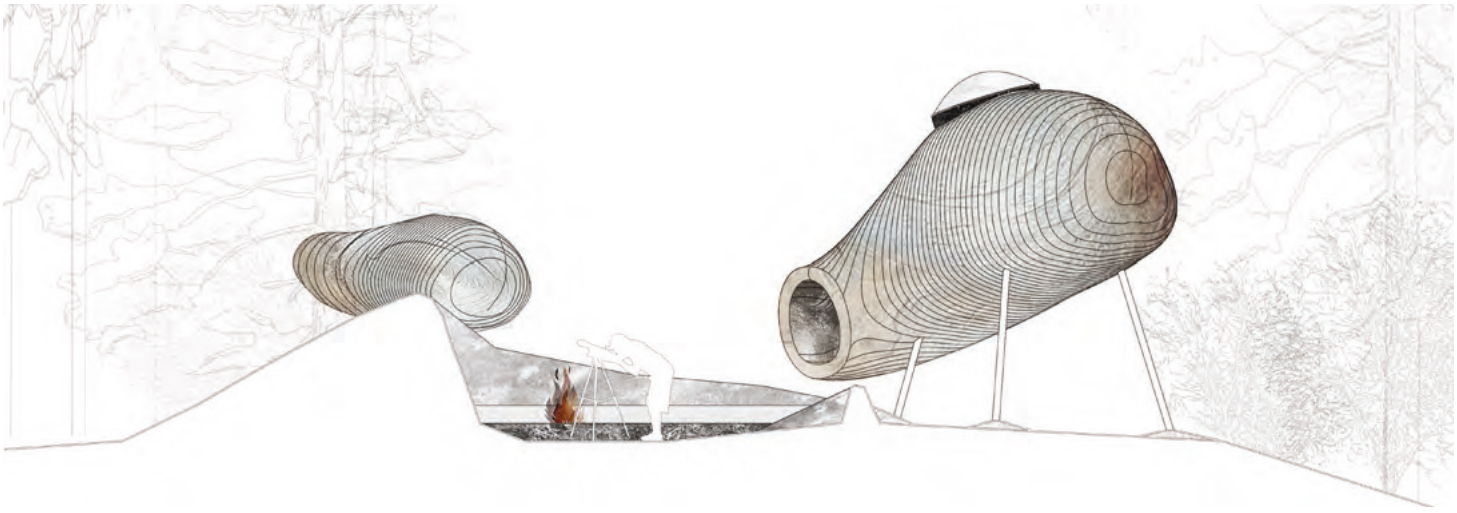


Fig 2: Site section 1:100.

FROM A GALAXY FAR, FAR AWAY.

During this semester we have come to recognize three fundamentally different ways of looking at the stars and the universe. You could bring a telescope and dive into the science of astronomy. Or you could leave your telescope and knowledge at home and just go out for a late evening walk. Sometimes, it can be nice to leave houses and lights behind you, be alone with the overwhelming starry sky, and feel just how small you are in the bigger whole. A third way to look at the stars we find around the fireplace on a cold, dark evening with your family and friends, telling stories of galaxies far, far away, watching the smoke from the fire rise towards the stars. When the municipality of Rindal asks for a stargazing tower, we believe all these ways of meeting the universe should be part of such a place.

Our starting point was Kaspars project; peculiar objects standing on the edge of the hillside. The interior is a confined space with a continuos surface surrounding you. The only connection with the outside is through an upward facing window framing the sky and the stars. Alone, or with just a few others you leave the well-known world behind you and enter a space where your body is moving and feeling differently and the night sky is incredibly close.

With a little comic book we wanted to tell a story to the children of Rindal, as a way to connect the alien objects with their imagination. The peculiar structures became small alien children from a distant galaxy, which accidentally crashed-landed in Rindal and made a huge crater. This story is not only important to make a connection with the children, we also consider it as an important part of the architectural discussion. The crater spatially and conceptually defines a meeting-point in the municipality where the children can visit the friendly aliens, read stories around the fireplace and see the night sky through an installed telescope. Moreover, the wooden structures which is our main study, is unquestionable of both an animal and alien character. It has been important for us to take this analogy serious and continually discuss how the architectonic structure and details are able to spark the imagination and create meaning beyond mere structural and pragmatic reason.

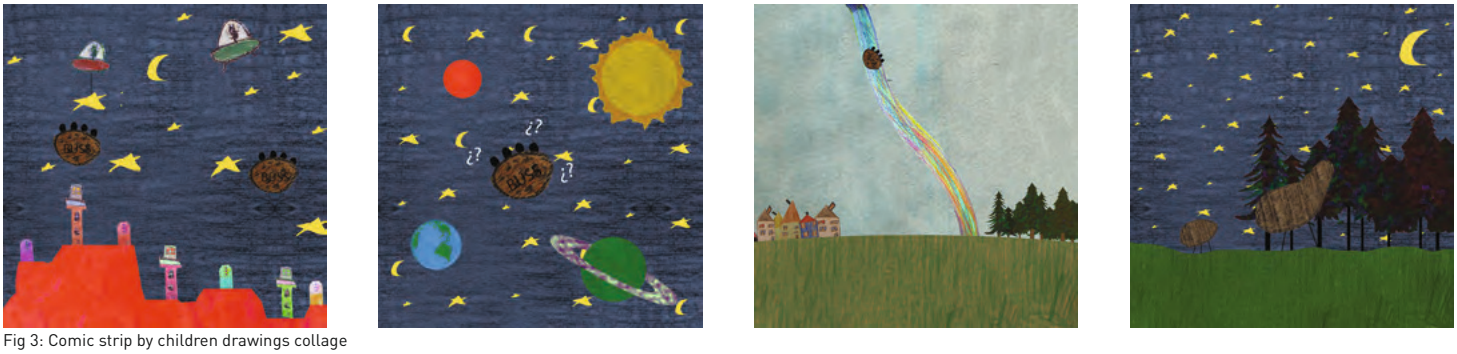


Fig 3: Comic strip by children drawings collage

THE BIG SISTER AND THE LITTLE BROTHER

The two alien structures are standing on each side of the crater. The "big sister" you meet at first, emphasizing the entrance to the crater. The "little brother" lead your eyes all the way to the other side of the valley, by leaping over the edge on the site. Their construction principles are basically the same, but their spacial expression is considerably different from each other. "The big sister" is based on the igloo-principle, with entrance positioned at a lower level than the primary space inside. This ensures both ventilation and a comfortable temperature inside, as well as the possibility to keep the room open and therefore accessible to anybody at any time. For sleep-over this space would have room for three adults. "The little brother" is a lot smaller, a confined space heated by your own body temperature, almost like a sleeping bag. With room for only one adult, this space invites to an experience of the universe in solitude, while the "big sister" has more of a social program. Similar for the both of them is the connection with the outside; the upward facing window. With a sharp edge as a frame and a possibility to open the window entirely, the starry sky nearly touches your nose.

CONSTRUCTION PRINCIPLE

The two siblings are rooted in a fairly new building tradition, one that emerges from digital 3D-modeling. Just like an MRI-section of the human brain, a section through an organic building structure will give information about itself only - not so much about other parts of the object. In an essay by Børre Skodvin on Lanternen pavilion in Sandnes, an important aspect of unorthogonal shapes is pointed out: the traditional drawings of the architect have become insufficient for the building process and are replaced by two products only: site plan and digital 3D-model (Skodvin 2012: 17). The Lanternen building drawings were all generated from one 3D-model; all the different producers made production details based on it.

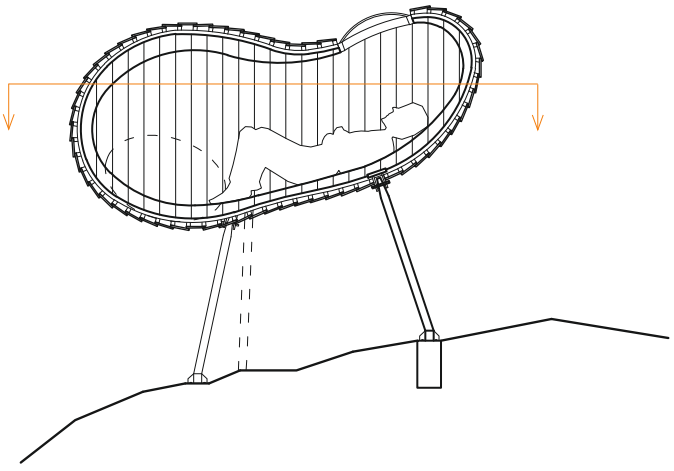


Fig 4: Little brother section 1:50

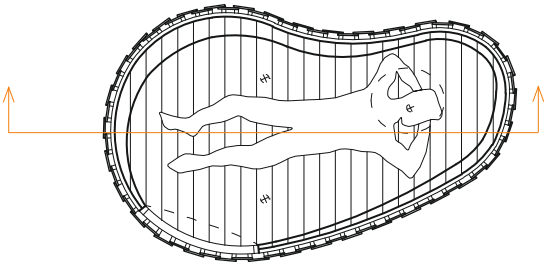


Fig 5: Little brother plan 1:50

Source: Skodvin, Børre. m. fl. 2012. *As built 8 Lanternen.* Pax Forlag.

Fig 6: Little brother interior photo model 1:10

Fig 7: Little brother exterior photo model 1:10

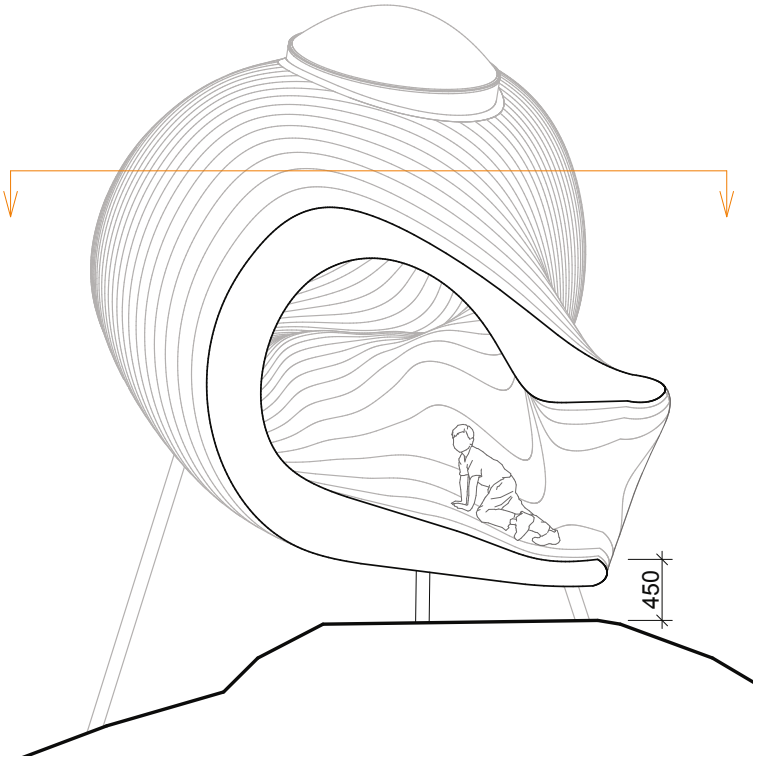


Fig 8: Big sister plan 1:50

Fig 11: Big sister exterior photo model 1:10

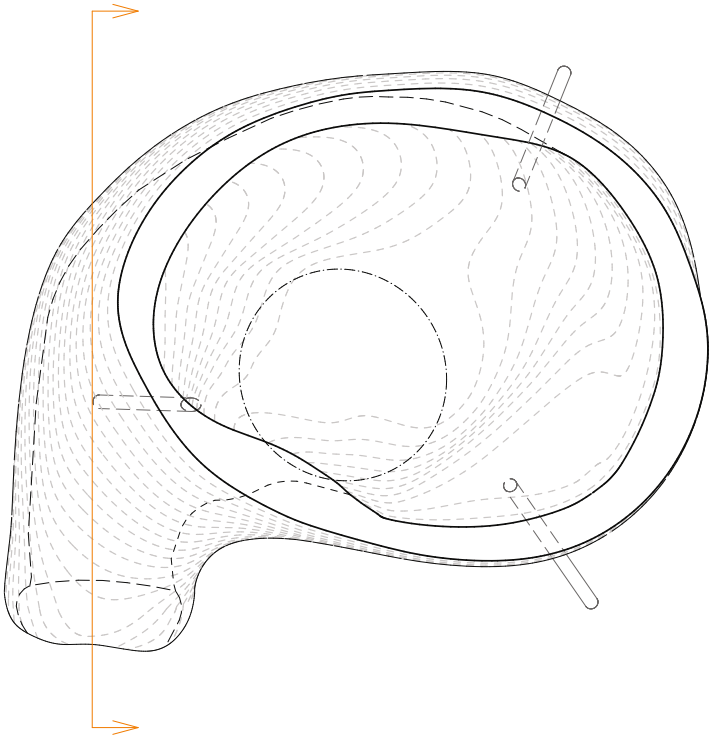


Fig 9: Big sister section 1:50

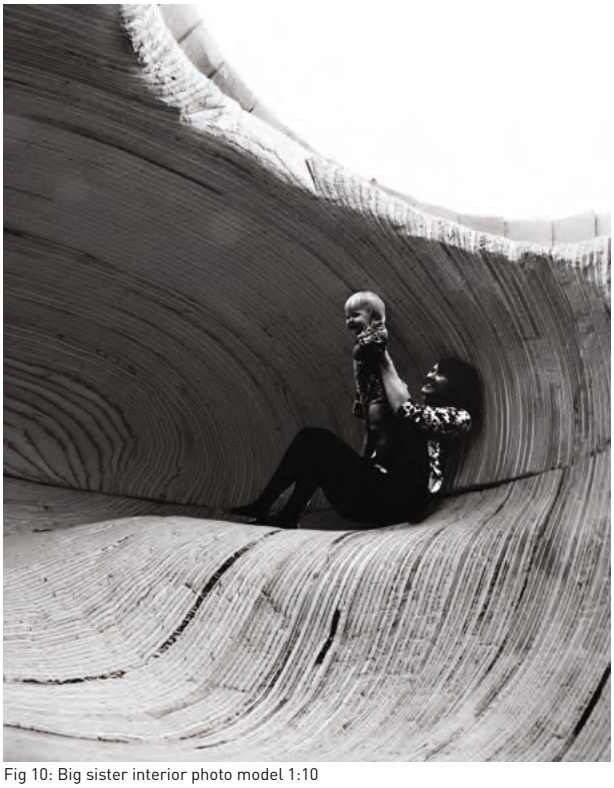
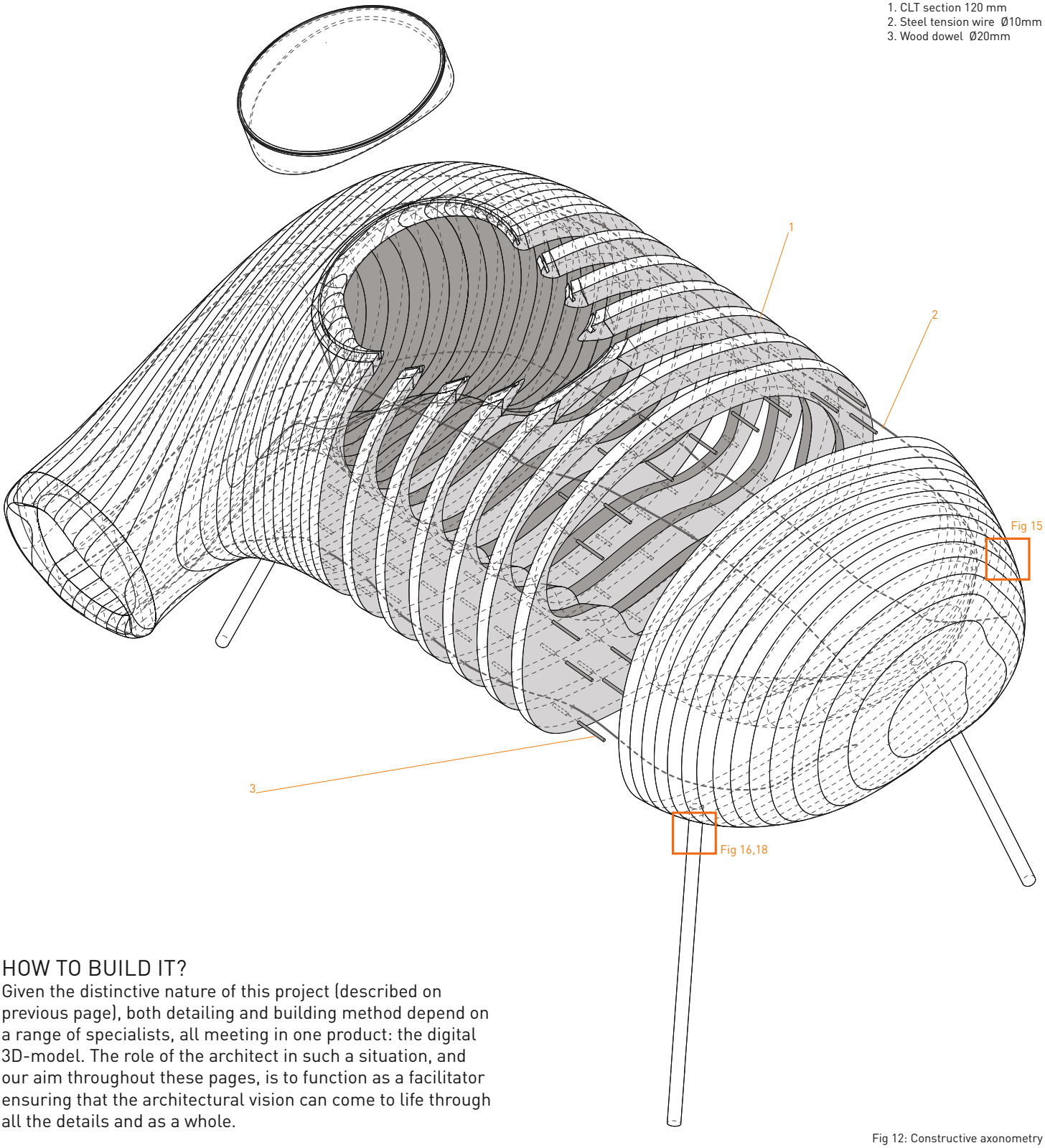


Fig 10: Big sister interior photo model 1:10



HOW TO BUILD IT?

Given the distinctive nature of this project (described on previous page), both detailing and building method depend on a range of specialists, all meeting in one product: the digital 3D-model. The role of the architect in such a situation, and our aim throughout these pages, is to function as a facilitator ensuring that the architectural vision can come to life through all the details and as a whole.

Fig 12: Constructive axonometry

WOOD WORKS

The primary structure is a double curved piece of carved wood. With an uneven shape standing on columns placed quite far underneath the "body", the structure is behaving like a cantilevered beam (fig. 14). This challenges the wood, which should take up the forces only in its fibre direction. Our solution is CLT (cross laminated timber) in vertical sections, connected together with wood dowels (fig. 12.3). The tension forces across the sections in the upper area, underneath, and on the sides overhanging the columns, are taken up by steel wires (fig. 12.2).

The production of the primary structure starts with the 3D-model of the complete form. The form is divided in vertical sections, ending up with 43 unique sections constituting the whole (fig.12.1). The width are based on a CLT standard; 120mm with 5 layers. To exploit the blocks of CLT, each section should consist of two parts, connected later with wooden dowels. To prevent this split to weaken the structure, it should be located on different spots on the different sections. The following process is a job for the specialist; to generate data for a CNC machine to cut the exact double curved form. Amongst others, the workshop Snekkeriet in Verdal has this expertise.

An important aspect of CLT is its fragility towards water. Its exposed fibers absorb water, causing quick damage when untreated. On the outside the protection will be in the cladding details, but on the inside it is important to keep the wood exposed. A solution is to wax the surface (normal technique at Snekkeriet) to prevent both water and dirt from destroying the wood.

ASSEMBLY

The assembly should be done at the workshop, leaving a fixed form ready to be transported (fig. 13). The crucial measures are that of the Big sister: height 3,2m and width 4m. Maximum height an width on the road to Rindal is 4,5m and 4,2m. The width are accepted for transport of house modules, escorted by the police.

At site the two objects are placed on the columns which have already been attached to the foundation (see columns detail). Foundations and columns will be placed according to UTM coordinates from an exact site survey.

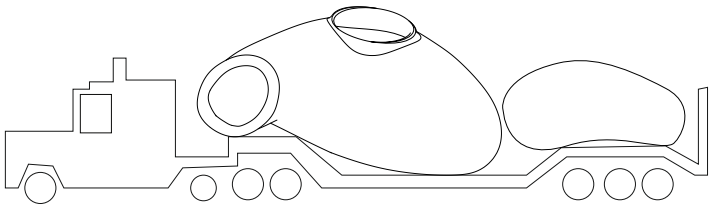


Fig 13: Truck scheme

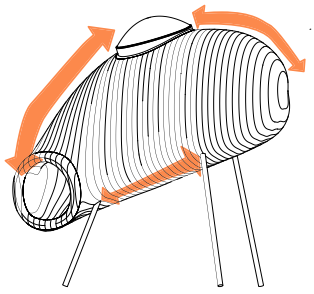


Fig 14: Tension forces scheme

1.Plastic cover
2.Steel corrugated duct
Ø10mm 7Ø3mm
3.Trumpet
4.Steel plate 50x50x5mm
5.Wedge plate 50x50x13mm
6.Wedge Ø6mm
7.Grout cap
8.Wood cover

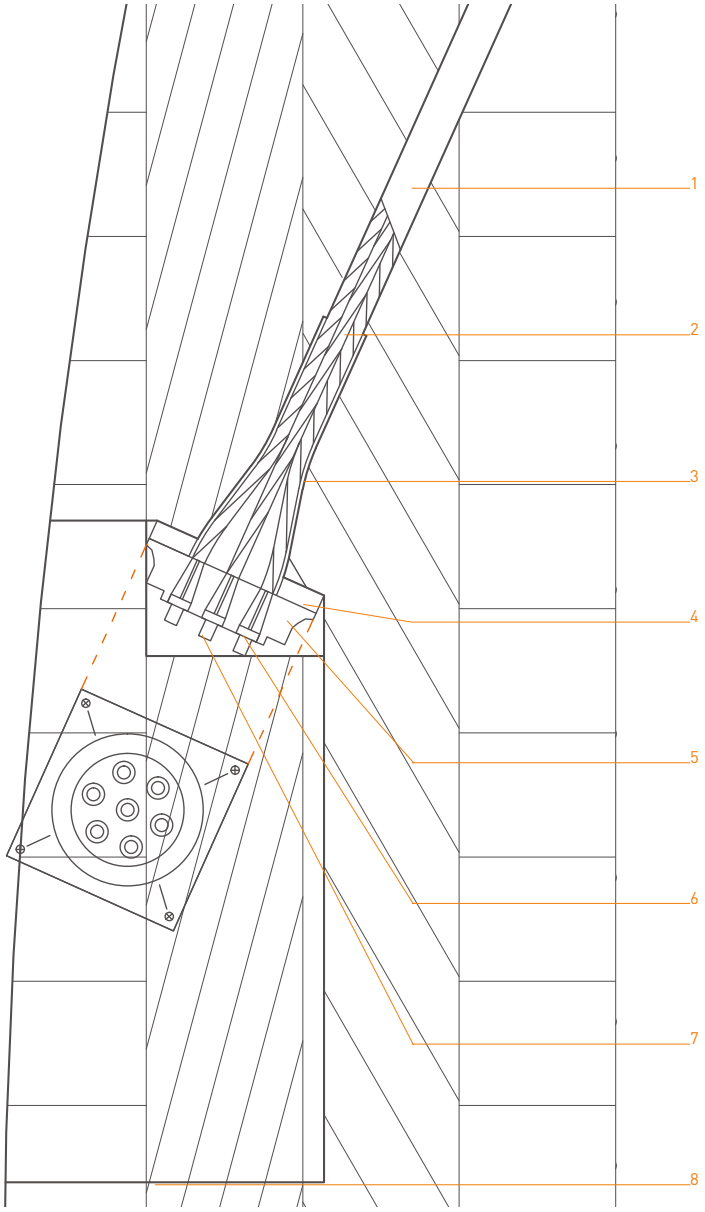
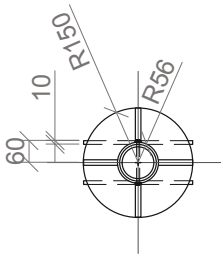


Fig 15: Ending steel wire detail 1:2

THE COLUMNS

The columns are an important aspect of the project in so far that they give an animal like character to the wood structure; giving them legs. But there is one big difference between legs and columns: the legs are supposed to walk, while the columns stand fixed. In many aspects our choice has been to visually and structurally keep them as columns. In fixed position the best balancing number is 3, they can be straight without any "knee" joints and steel columns allows for equally slim structures, even though more weight lies on some of the columns. Another important difference is that the columns should be fixed in the ground.

On the other hand, there are several structural solutions that emphasize the resemblance with animal legs. Even though a column should be fixed, it constructively wears "shoes" to attach them to a foundation, and in our case we found it important to accentuate this detail (fig. 18). Since the columns only need to be fixed in the object, not in the foundation, the joint detail on the ground is unfixed, making a dynamic expression. However, in the transition from column to wood, the joint is fixed by preparing a compartment of steel placed in between the CLT sections (fig. 18). This detail is done at the workshop before the assembly of the CLT sections. At site then, the columns are attached to these compartments.



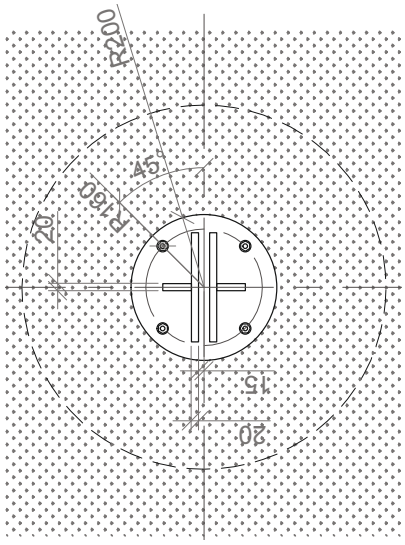


Fig 16: Columns horizontal section

THE GROUND

The creation of an extra-terrestrial space is needed to host our guests. Based on a crater morphology, the new area is built using superficial ground movements in which the compensation between excavations and slopes avoid waste soil.
As a delimitation for the functions and areas we use different materials: sand, gravel, vegetation and stone. These materials create an intinerary for the visitors as well as permit the evacuation of rainwater, which would be absorbed by the undisturbed soil.

GROUND
1.Undisturbed soil
2.Permeable slope soil
3.Reinforce fill with plantable fill
4.Native vegetation cover
5.Compacted agregate 15cm
6.Gravel 5cm
7.Sand 5cm
8.Gravel 10cm
9.Slate unit paver 5cm
10.Geogrid 8x8mm Ø2mm
11.Turf reinforcement mat
12.Concrete blocks 50x85x50cm
13.Concrete blocks 25x50x50cm
14.Concrete blocks 10x10x10cm
15.Air gaps 5x10cm
16.Concrete blocks 10x30x10cm

COLUMNS
1.Fixing in the wood: welded steel plates and tube Ø112mm, thickness 6mm. Bolts Ø8mm
2.Column: steel tube Ø100mm, thickness 6mm
3.Welded steel plates base, pin connection, bolt Ø12mm
4.Anchor bolts 12 mm
5.Steel reinforced concrete foundation
6.XPS insulation
7.Gravel

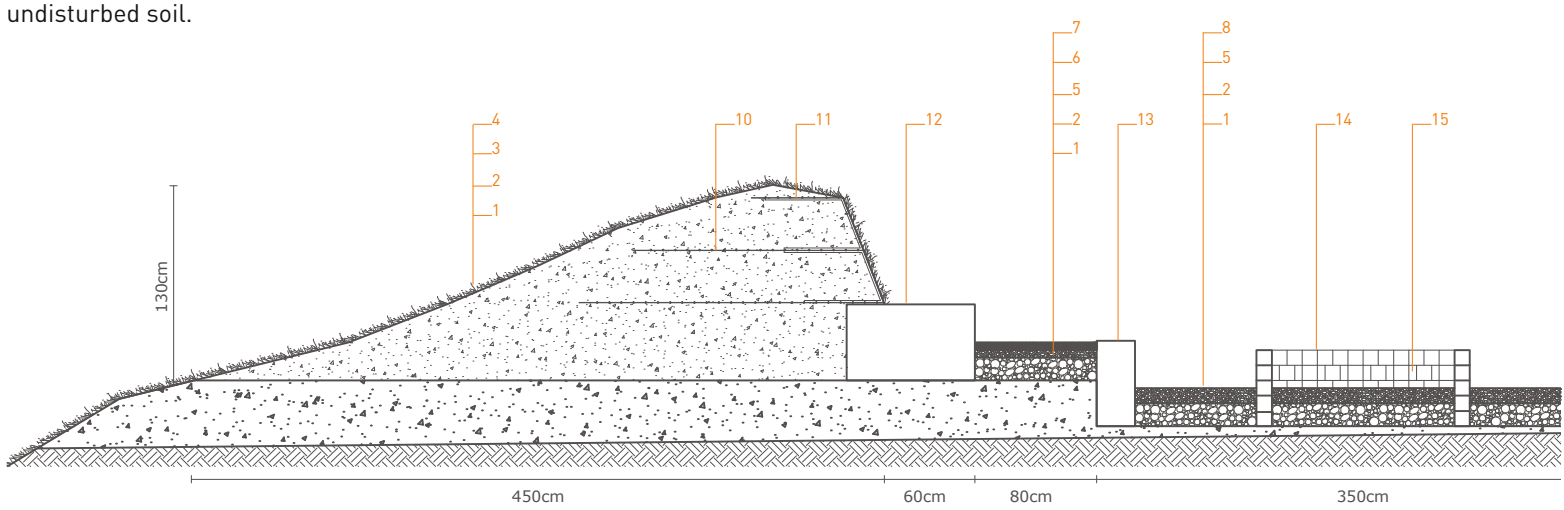
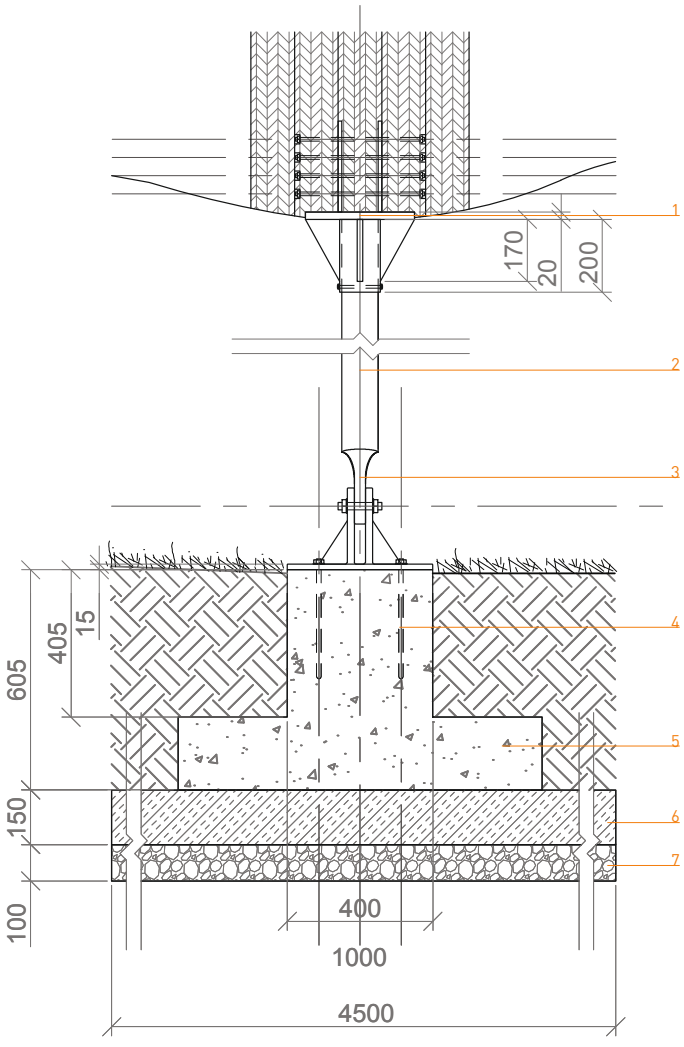


Fig 17: Ground section 1:50



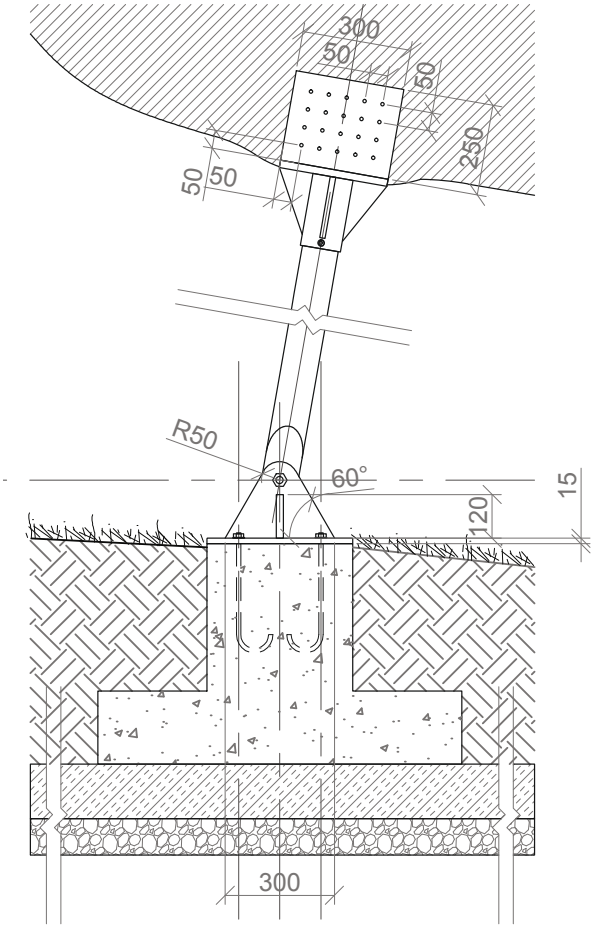
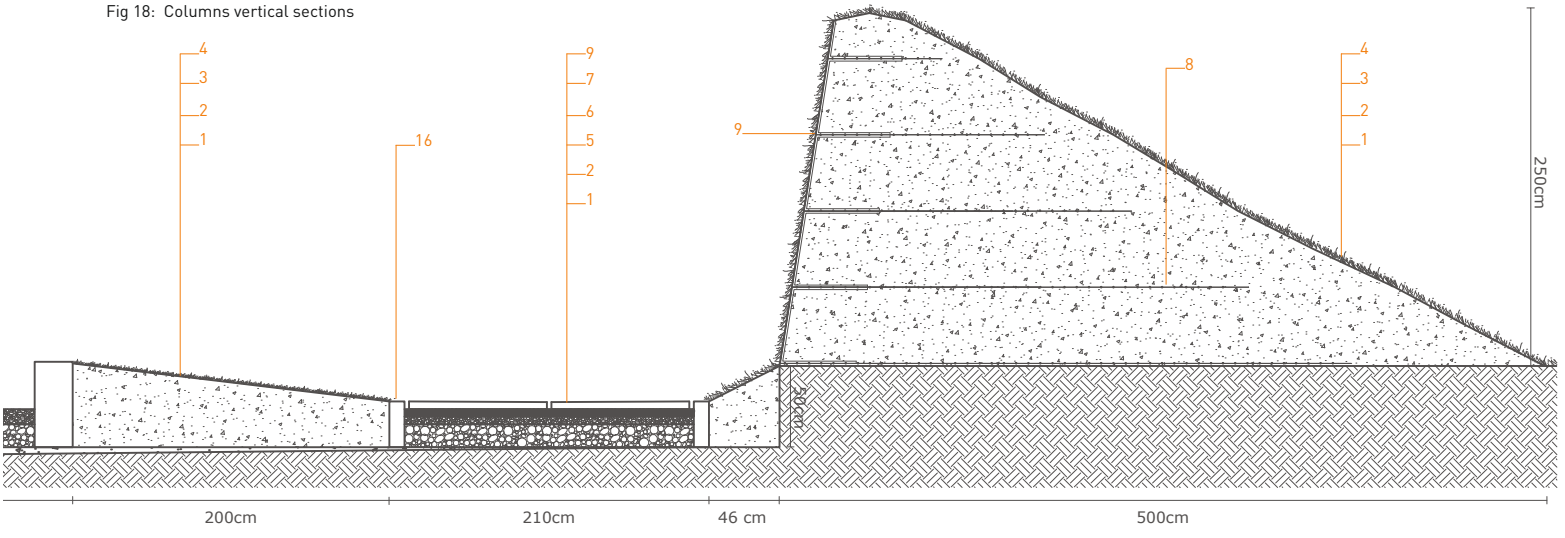


Fig 18: Columns vertical sections



CLADDING

For covering an organic shape with a number of complex forms on the surface, there are mainly two principles to follow: either lots of small entities following each other or one piece of material with the potential to be formed just like the wood surface. To keep computers and big machines to a minimum, as well as keeping the animal discussion in mind, our solution fell on the first. Our starting point was wood shingles, but even though it is a flexible principle on the organic shape, we found several challenges. First and foremost, the battens are problematic in meeting the form. An alternative we have suggested is spacers; elements between the shingles and the primary structure attached to the screws, which keep every shingle lifted from the primary structure (fig, 19 and 20). The crucial point in this system is to keep every shingle in balance. This is partly why we came up with plastic shingles; they allow for three screw holes without cracking and are soft enough to form itself by each others.

The shingles are placed over each other in a 1/3-pattern, while the screws are offset 1 cm from this pattern. (fig 21) This enables each shingle to stand disconnected from the others. The three fixing points balance the shingle. The distances keep the shingle soft enough to bend without cracking where they are overlapping each other.

The material is polycarbonate, a pliable plastic. This is a material which is easy to find as cheap left-overs. The final expression is therefore dependent on colors available. We see the potential of sorting out the colors and use them for characteristic movements in the "fur" of the animal. (photo to right)

Fig 19: Inteiror detail model photo 1:1

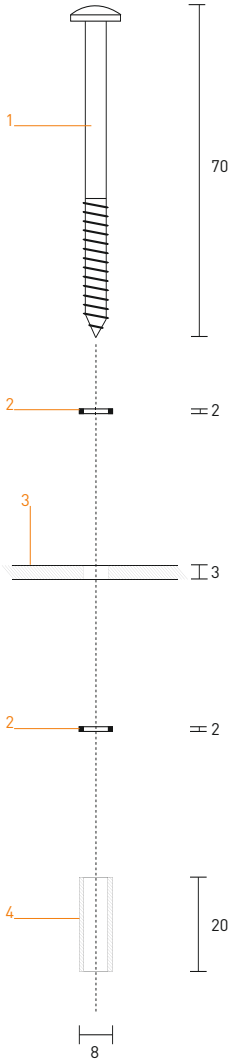


Fig 20: Fixing detail

1. Screw with a flat surface towards the shingle
2. Gasket
3. Shingle with pre-drilled holes
4. Spacer

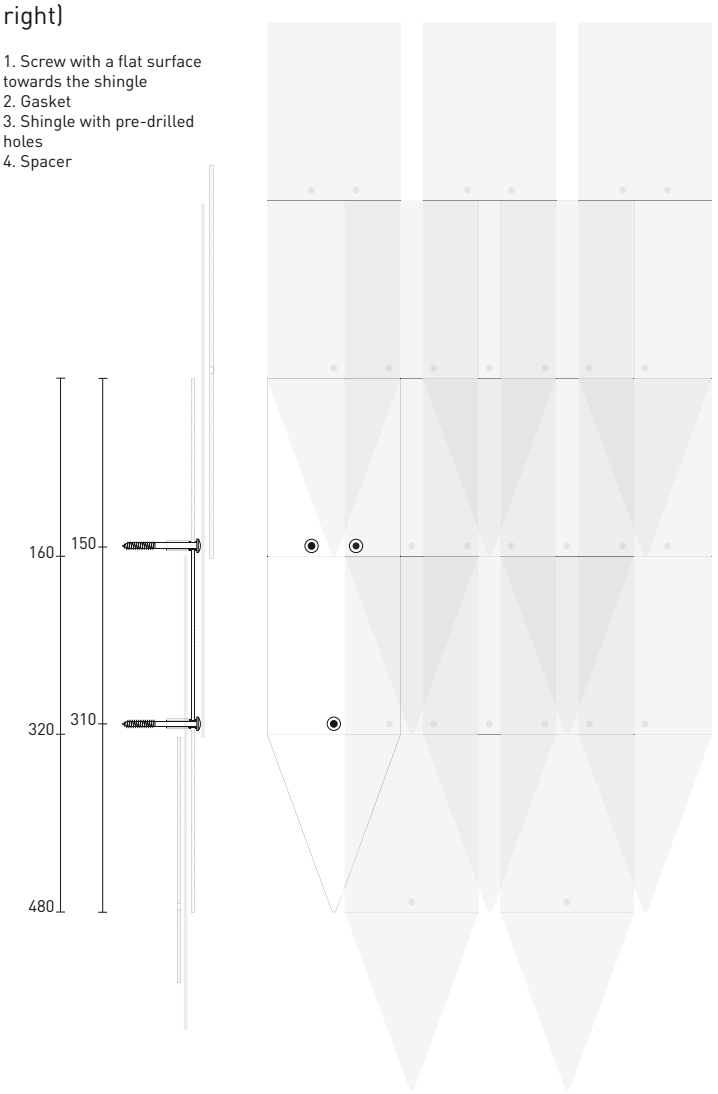
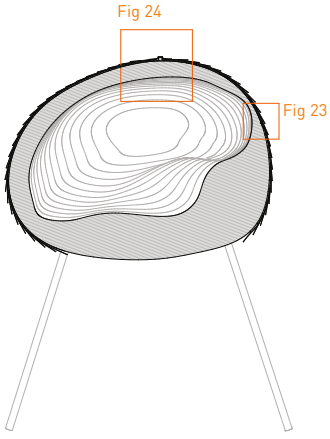


Fig 21: Shingle fixing principle

Fig 22: Cladding detail model photo 1:1

Finally, there are some points on the structure that are more fragile. Over the back of the structure there is an extra protecting layer of tar paper (fig.23.2). Along the "spine" on the back where the shingles are changing direction (fig. 24), around the window (fig. 25), flashing must be added for final protection.

Underneath the form is not in danger of being wet, and the wood can remain exposed, as a hint of what is hiding inside.



1.Cladding: Cross laminated lumber-CLT
Tar paper
Spacer 20mm
Polycarbonate shingles 3mm
2.Tar paper drawn across flashing
3.Zinc flashing
4.Wood ridgebeam 48x48mm
5.Zinc ridge flashing

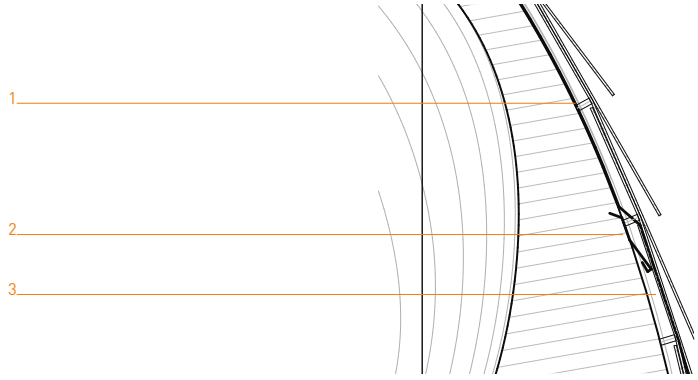


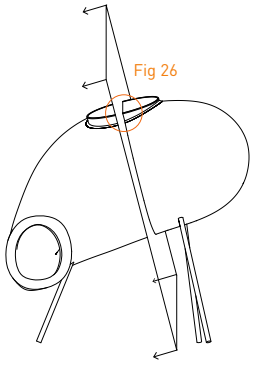
Fig 23: Cladding ending detail E 1:10

Fig 24: Ridege cladding detail E 1:5

WINDOW

The physical experience of the night sky is an essential aspect inside the wooden structure. We find it of high importance that the window can be open fully, as well as this procedure should be easy to do. Our solution is a two-parted plastic dome, a light structure easily maneuverable. You push it open and get it back to place by pulling connected ropes. (fig. 25)

Another aspect is the window frame, that visually should be as sharp and clean as possible to make the perception effect of the sky lying close to the window (fig. 25.3)



1.Polycarbonate formpressed dome 3mm
2.Galvanized steel 6mm, flanged, inner Ø1550mm
3.Galvanized steel 6mm, outer Ø1550mm, inner Ø1450mm, chamfered edge down to 3mm
4.Hinge for dome
5. Cladding: Cross laminated lumber-CLT
Tar paper
Spacer 20mm
Polycarbonate shingles 3mm

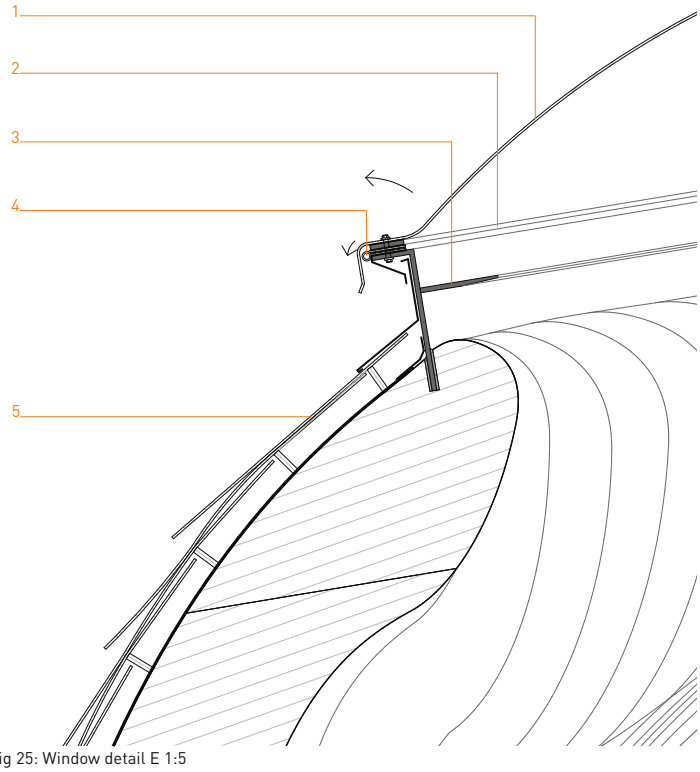


Fig 25: Window detail E 1:5

Fig 26: Exterior render photo

Fig 27: Interior model photo 1:10

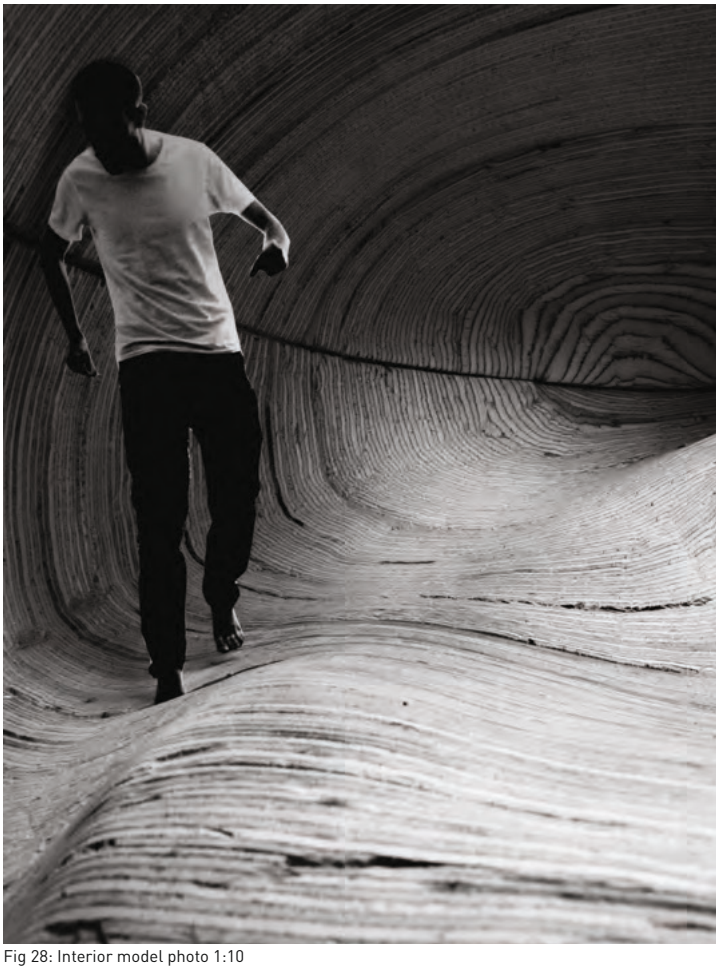


Fig 28: Interior model photo 1:10

T(H)REE CUBES

PIERRE-ALAIN BOUCHETARD, AXEL CORNU, JAN NIKLAS KOCH, KASPAR LUND SANDAKER

exterior perspective

THE SITE

The project is set up along the KulturSti in Rindal. It is on the edge between the open field and the slope in the forest. A small wooden deck coming from the culture path leads to the entrance on the southern side of the tower.

THE PROJECT

The tower consists of three main volumes, with the middle one twisted 45 degrees. Within each volume there are two levels, giving the tower six levels in total. The top level is open to the sky with a net suspended between the structure. This invites you to lie down and take in the sky from a horizontal position. It also makes it possible to have a visual connection between the floors and to the sky. You enter the tower in the corner facing the field and the path. The winding way up takes you along the perforated façade and gives the visitor different views on the way up.

The cube volumes are 4 by 4 meter in outer dimensions. The total height is 12 meters. This is slightly shorter than the surrounding trees, making the tower blend in rather than towering over the treetops.

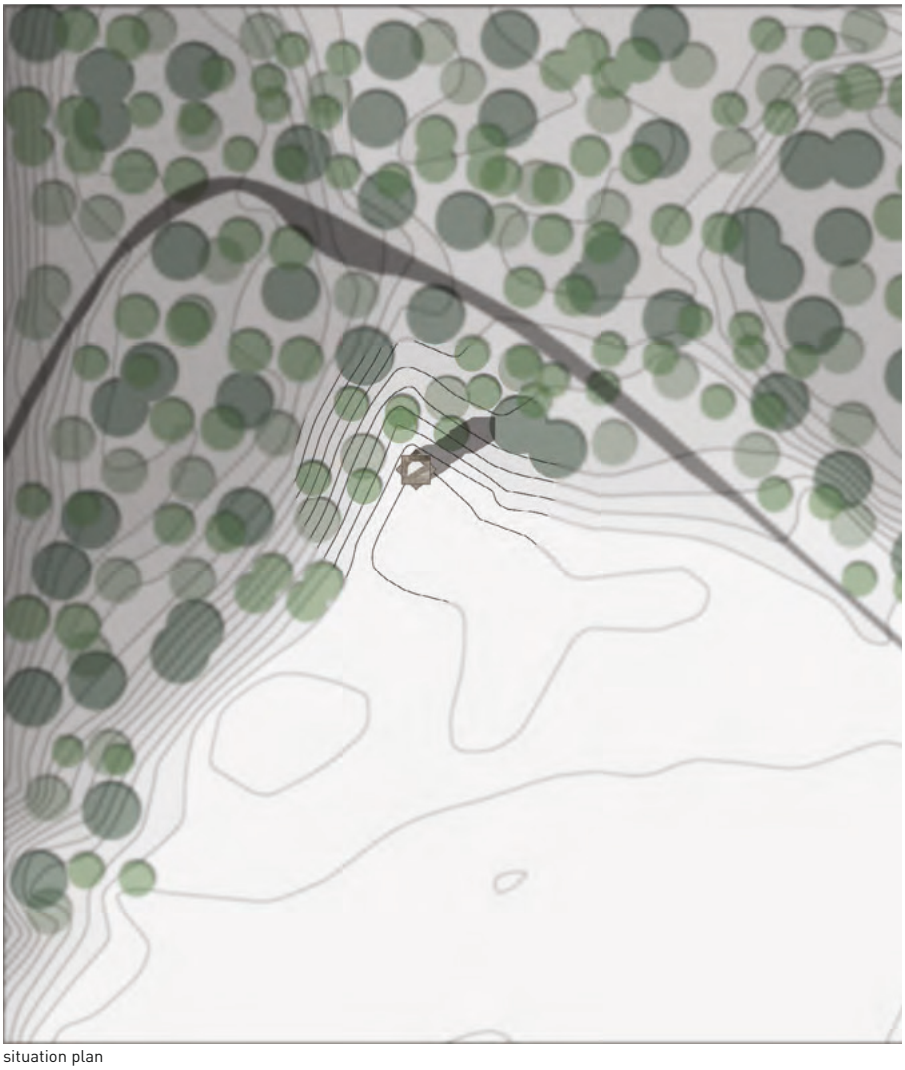
THE FACADE

The façade takes up the graphical theme of the intention program. With its varying degrees of space and openings it provides a filter between the forest and the visitor. When ascending the tower the degree of filtration changes with the levels and views. This gives a special quality to the different levels. There is also a visual connection through the tower, and from level to level. From the top floor you can see through the middle and down to the ground floor, enhancing the feeling of height. In the same way, the sky is revealed in steps and only fully visible on the top floor.

CLIMBING

The fact that you can climb the tower gives a physical dimension to the stargazing. You go from the ground, through the trees, and towards the sky. Although the distance gained is dwarfed by the vastness of space, the act of climbing towards the sky prepares you, and makes you reflect over the distance to our stars.

scale model 1.20



situation plan

ground floor 1.100

1st floor 1.100

FIRST CUBE

The ground floor is the meeting place.
The entrance is in the corner facing the field and the culture path going up to the city. Fastened to the stairs reaching the next floor is a bench for people to sit and under the upper floor landing is an alcove where one or two people can lie for cumfortably to watch outside, read a book or let their imagination run wild.
On the second floor the footbridge leads to the stairs to the next cube. It also makes the entrance lower so that visitors get this impression of compression before getting into the big volume inside the cube.

2nd floor 1.100

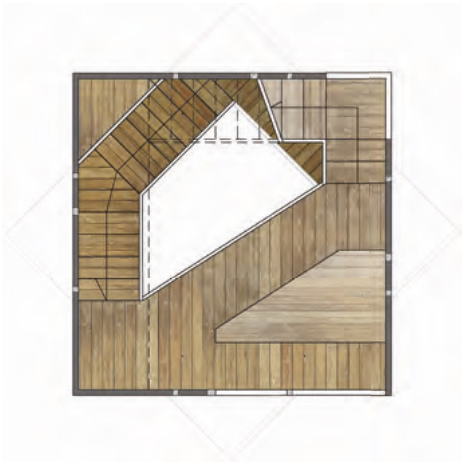
3rd floor 1.100

SECOND CUBE

The middle cube is the space connected to the forest.

On the first floor is a big bench with a triangular shape where people can sit or lie and look at the nature.

As people climb up the stairs to the last cube, they will find several type of openings in the cladding giving them different views of the nature - one in the corner to see the open field towards the south, one to watch the hill between the trees and finally one in the northern corner to grab a view of the moutains in the background through the forest.

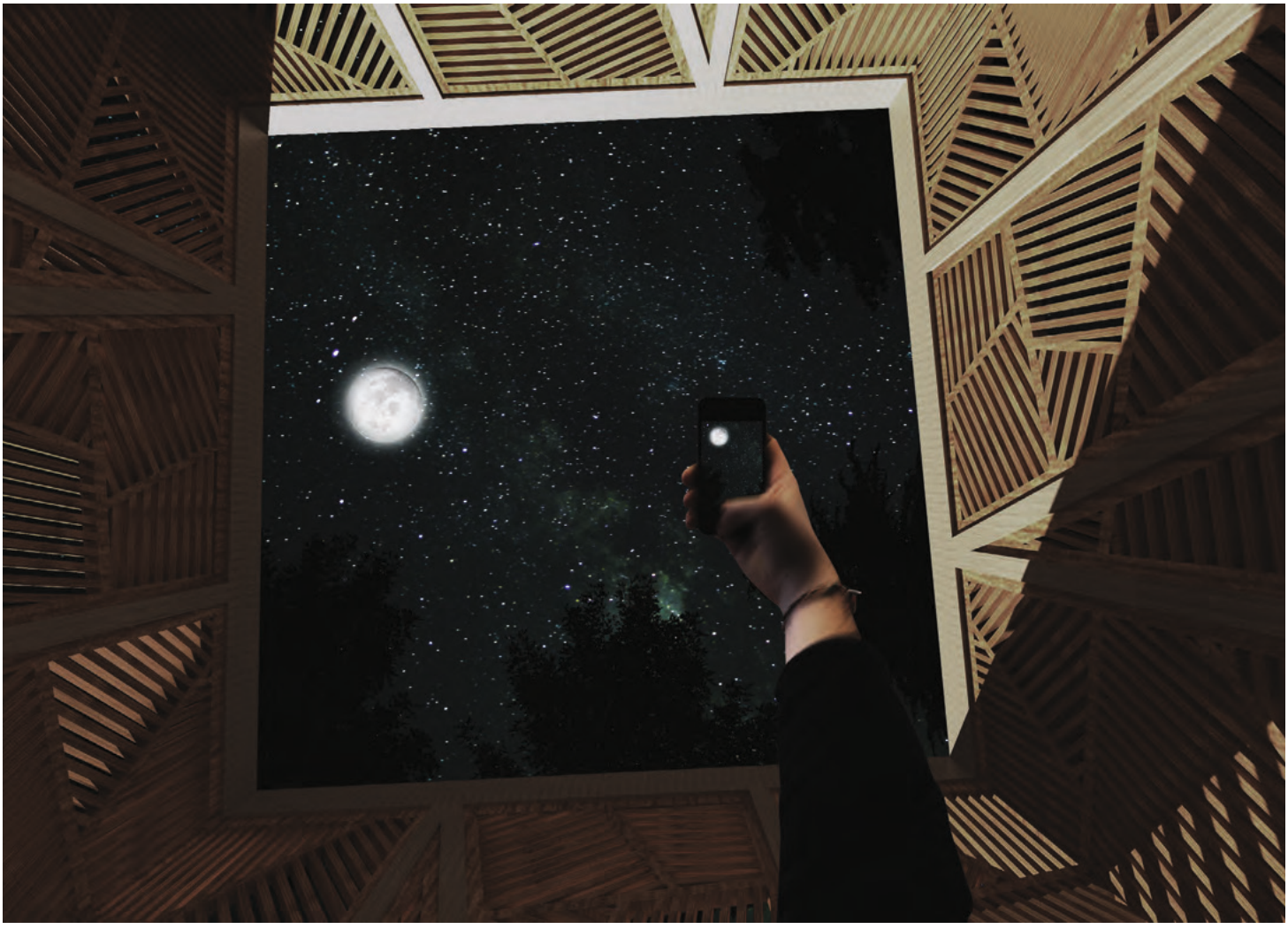


4th floor 1.100

5th floor 1.100

THIRD CUBE

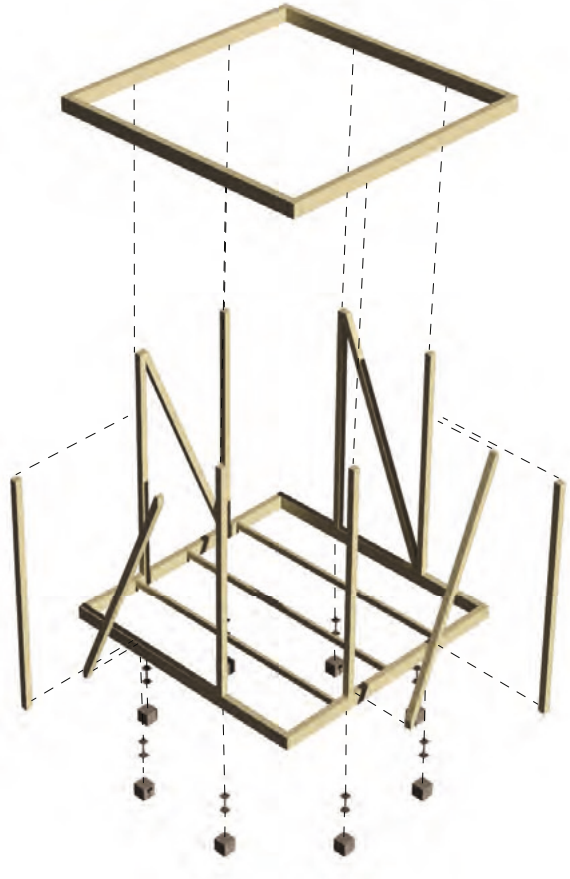
On top is the cube dedicated to stargazing. It starts with a large landing on the first floor and a long chair to sit and look at the stars. It faces south where the most interesting part of the sky is.
The last flight of stairs brings you to a large net where you can lie and watch the stars above. The cladding here is much denser so that you don't see anything but the sky above framed by the structure of the cube.

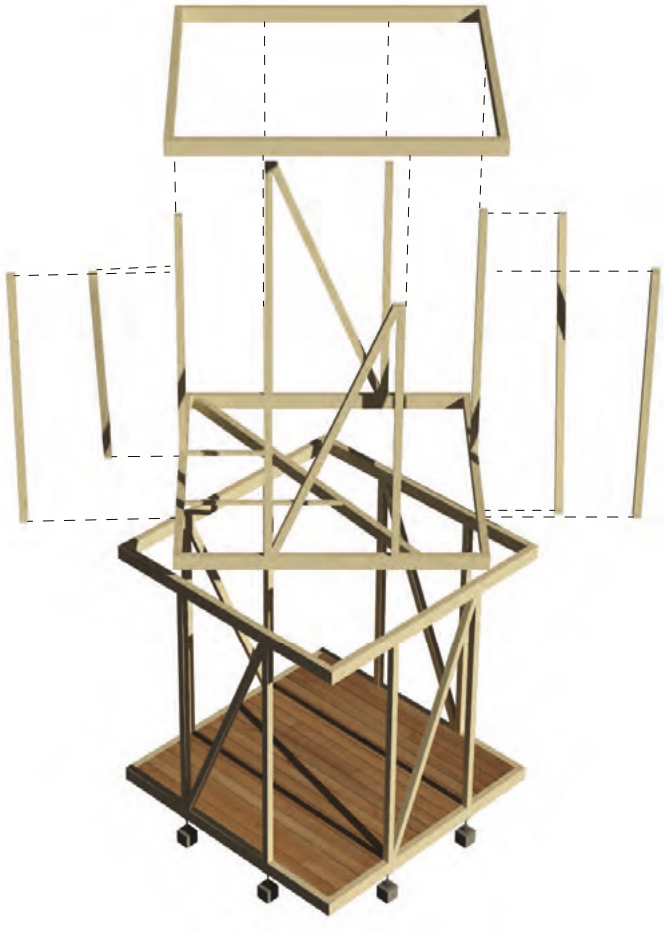


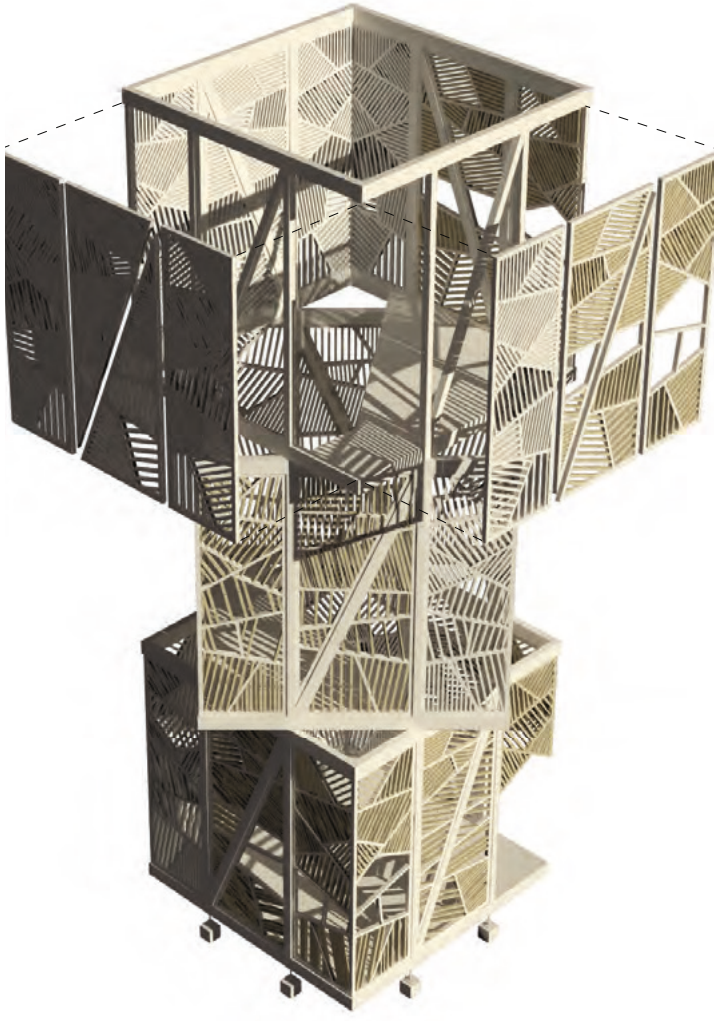
elevation 1.100

section 1.100

CUBE 1 — — — — — — — — CUBE 2 — — — — — —



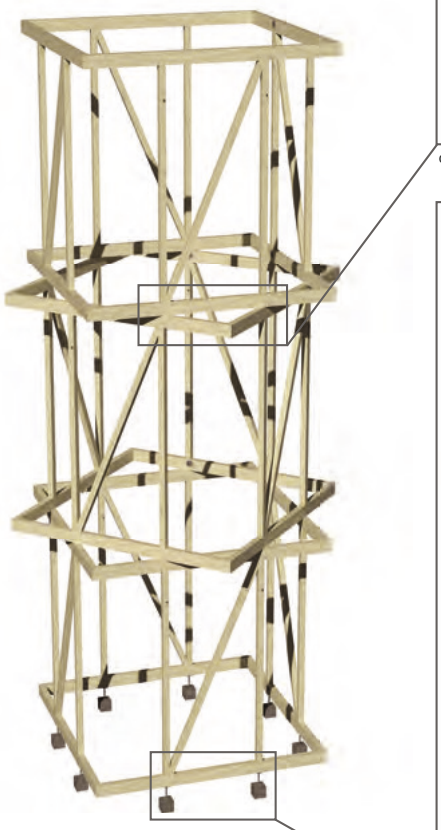


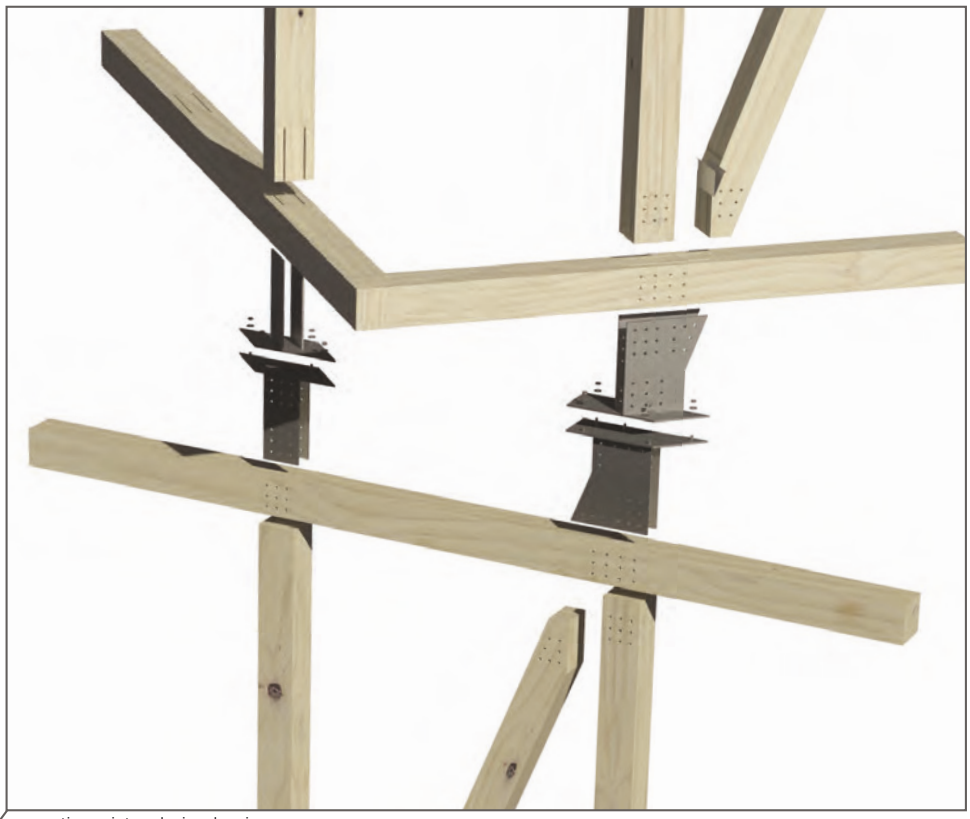


THE MAIN STRUCTURE

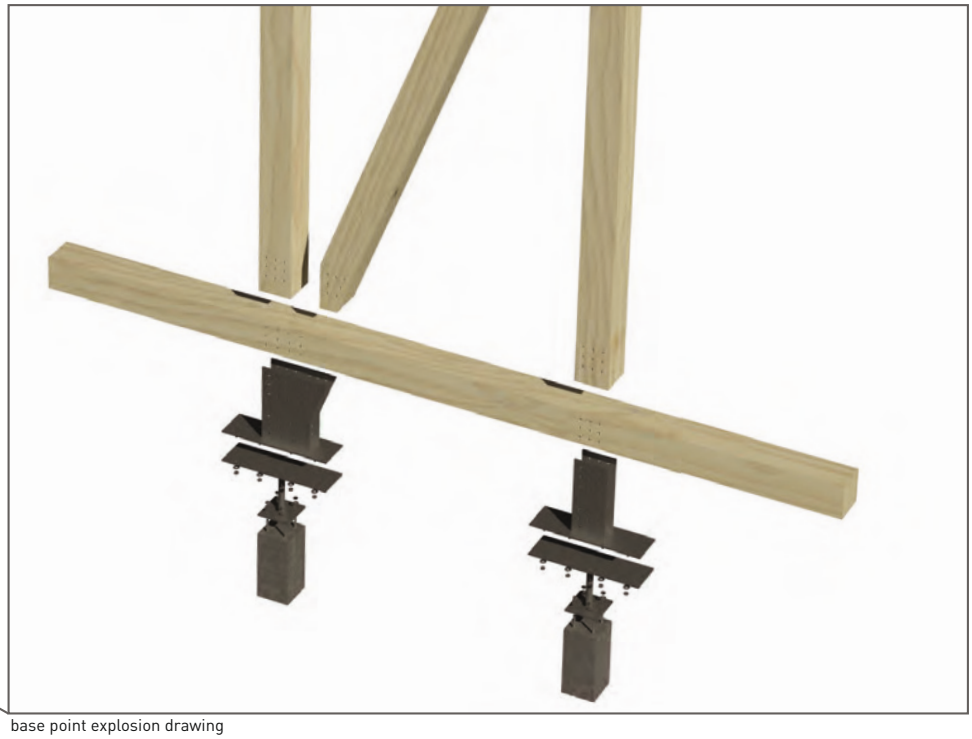
The tower is is composed of 165x165mm glue-laminated beams and columns. The joints between the cubes are made with 8 mm thick steel plates designed for this particular structure. The use of steel was a requirement from the calculation of shear forces due to the wind forces on the tower. Each steel element is holding the column, the beam and the bracing together and the two elements are then screwed to one another to keep the two cubes attached. The steel plates are placed into narrow slits in the wood and then fixed with 12 mm dowels so that the presence of steel is minimized.

The steel elements are also used at the base point to maintain the structure on the concrete point foundations.





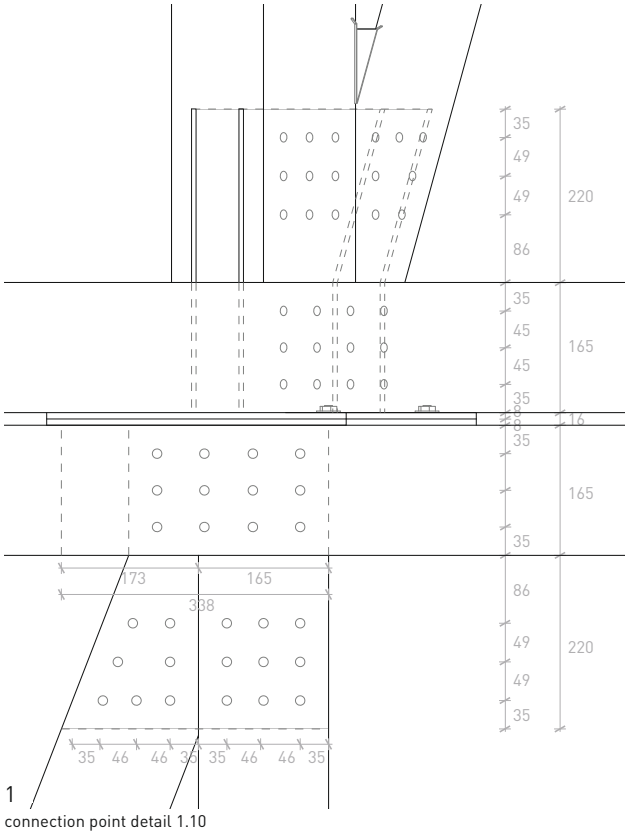
connection point explosion drawing



base point explosion drawing

1

connection point axonometry

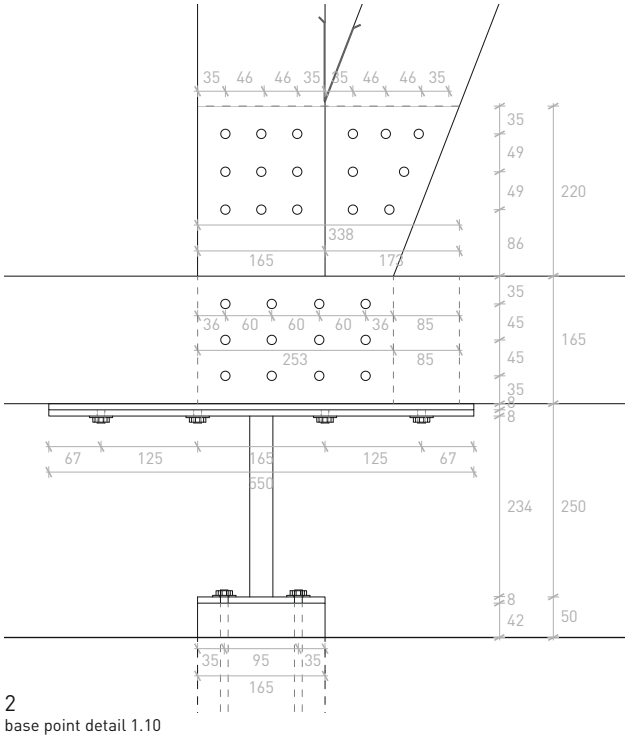


1

connection point detail 1.10

2

base point axonometry



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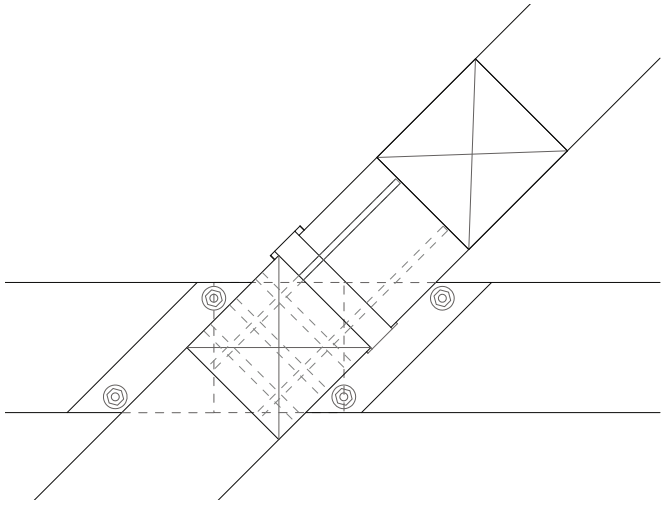
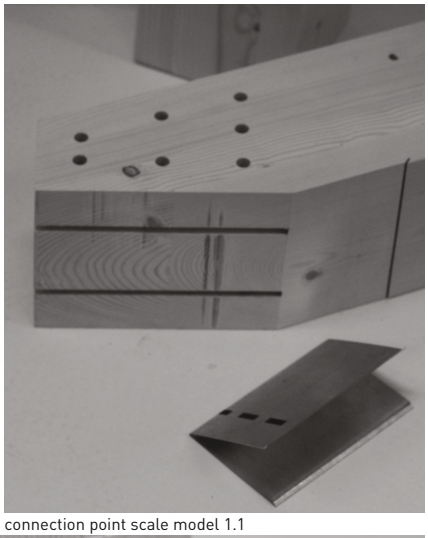
base point detail 1.10



1

connection point detail 1.10

connection point scale model 1.1



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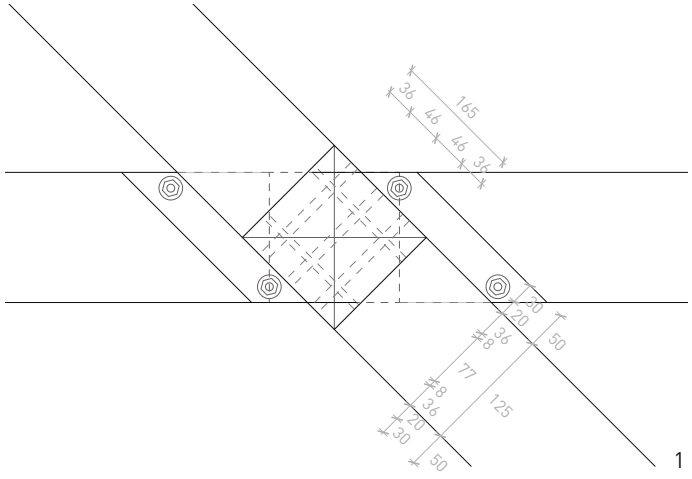

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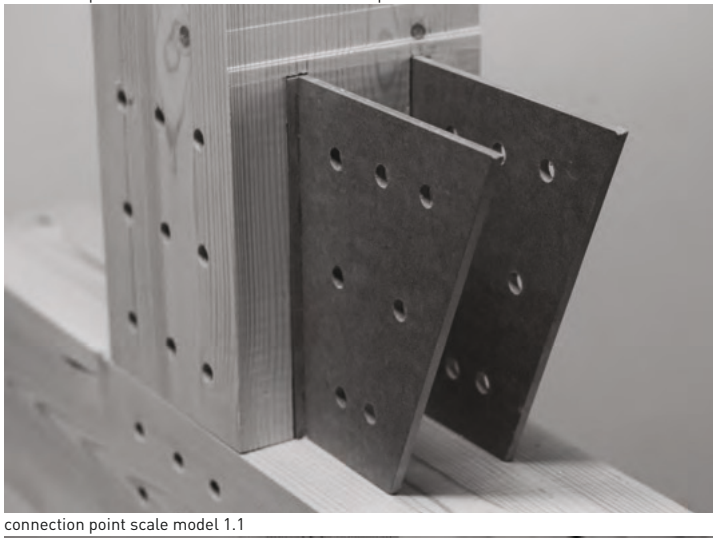
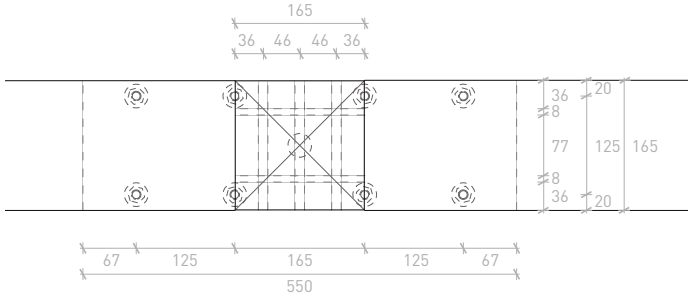
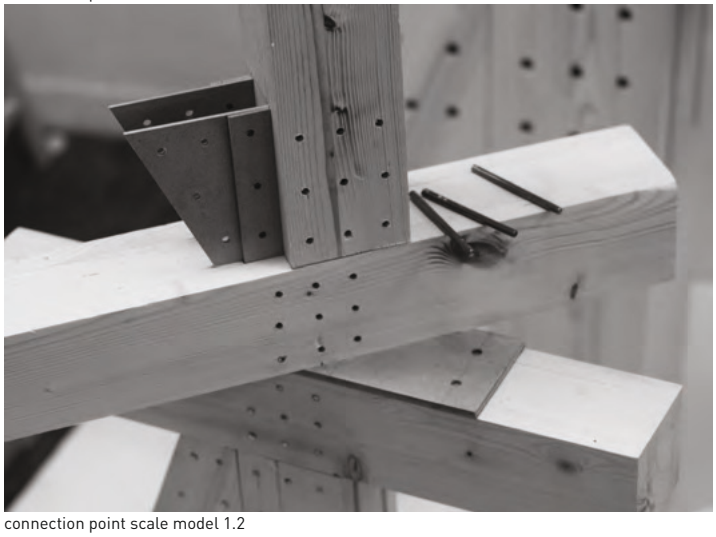
connection point detail 1.10



connection point scale model 1.1



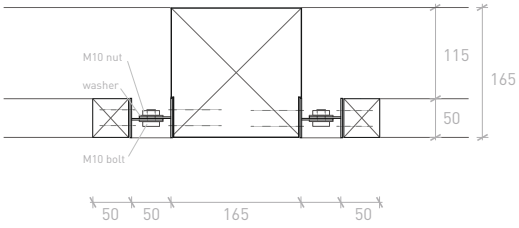
2



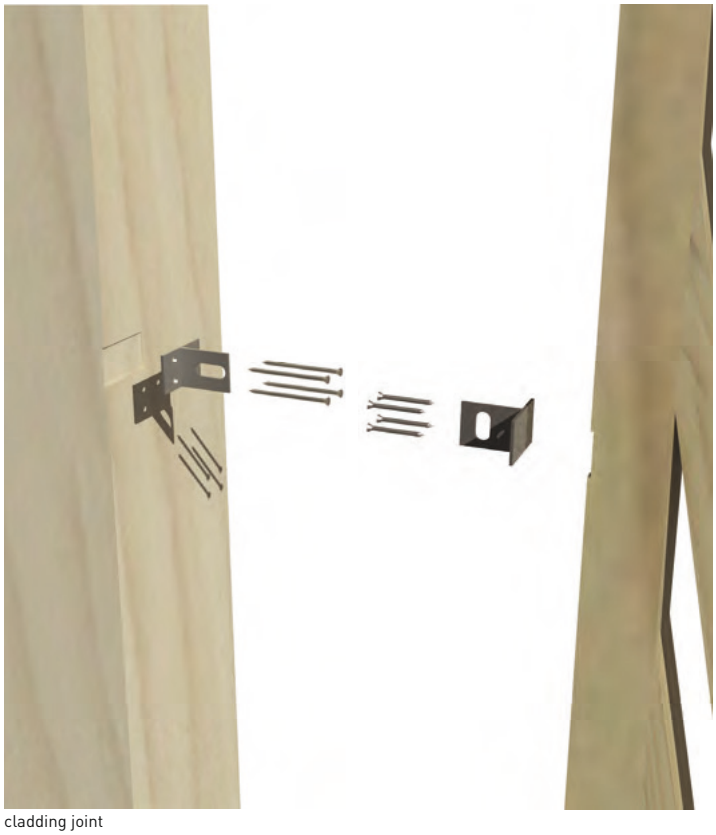
connection point scale model 1.2

THE CLADDING

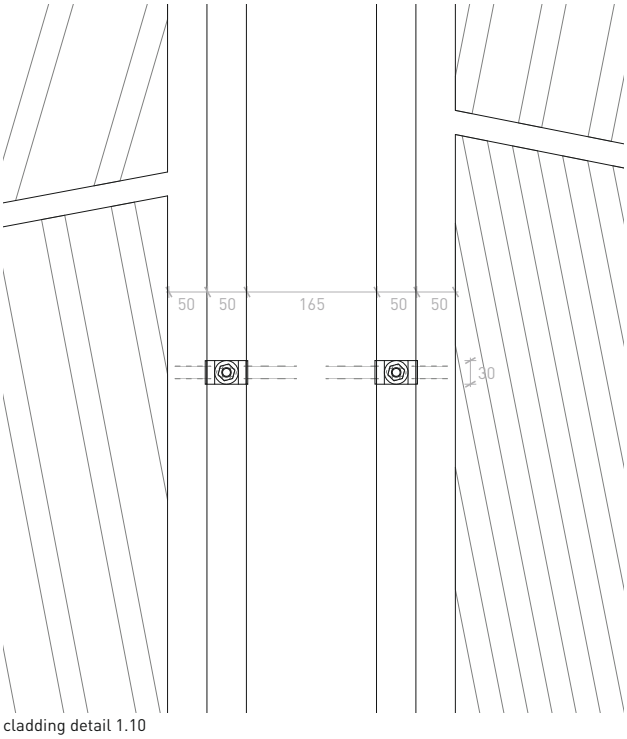
The cladding is a composition of different patterns giving the tower an very singular look reminding of the intention program of the project. The panels are prefabricated with 50x50mm wooden sticks following the different patterns according to their place in each cube. Each panel is then put on the main structure on site. Their are attached to it by small steel ties bolted together. Here again the size of the steel pieces are minimized as much as possible to keep the wooden appearence of the project. The panels are placed in between the structural elements so that the structure stays visible from the outside as well as from the inside.



cladding detail 1.10



cladding joint



cladding detail 1.10

cladding joint

THE UFO

HELENE KJÆR BREMSETH, NADIA REMMERSWAAL, TONJE SKAGA, WILLIAM SPRATT-MURPHY

Arriving from east

INTRODUCTION

The Kultursti takes you down into the woods where you can hear the birds and the nearby river. Suddenly something catches your attention. There is something up on the hill, at the edge of the field, something unfamiliar, something that you haven't seen before. It reminds you of an UFO. This needs to be explored! But first you have to find your way up the hill.

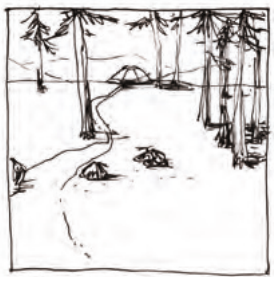
You realise that there is a way of entering the UFO. There is a clear opening where it is easy to go under the structure. Inside you find that it is not as dark as you thought it would be. Then you look down and see that the forest floor has disappeared and now you stand before a precise circle cut out of the earth and filled with rough stones.

A few footsteps more takes you under the structure and into a room where you are inside a wooden structure. You are inside the UFO! There is a fire place in the center and a view of the sky above. Here the fire would be lit and while you wait for the warmth you lay down on the inviting wood, listen to the sounds of the forest, watch the shadows from the trees and see the light change on the surfaces of the room.

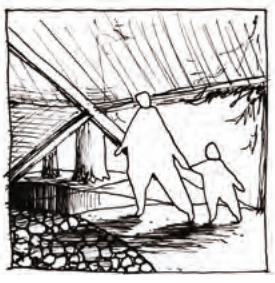
While the fire burns, the world outside gets darker and darker. The UFO turns into a glowing cave amongst the high trees. Soon, the night will be here.

When the fire dies, the stars keep popping up, until the night sky is full of the constellations. The hole in the roof is no longer big enough! Now you discover the handles on the columns. Slowly you make the roof open up to the night sky and you can lie down again, look out into the universe and wonder how far away the stars actually are.

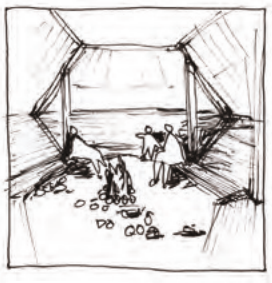
THE RITUAL



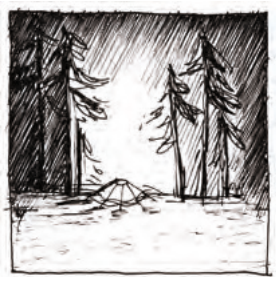
Discovering



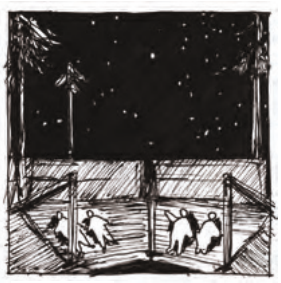
Entering



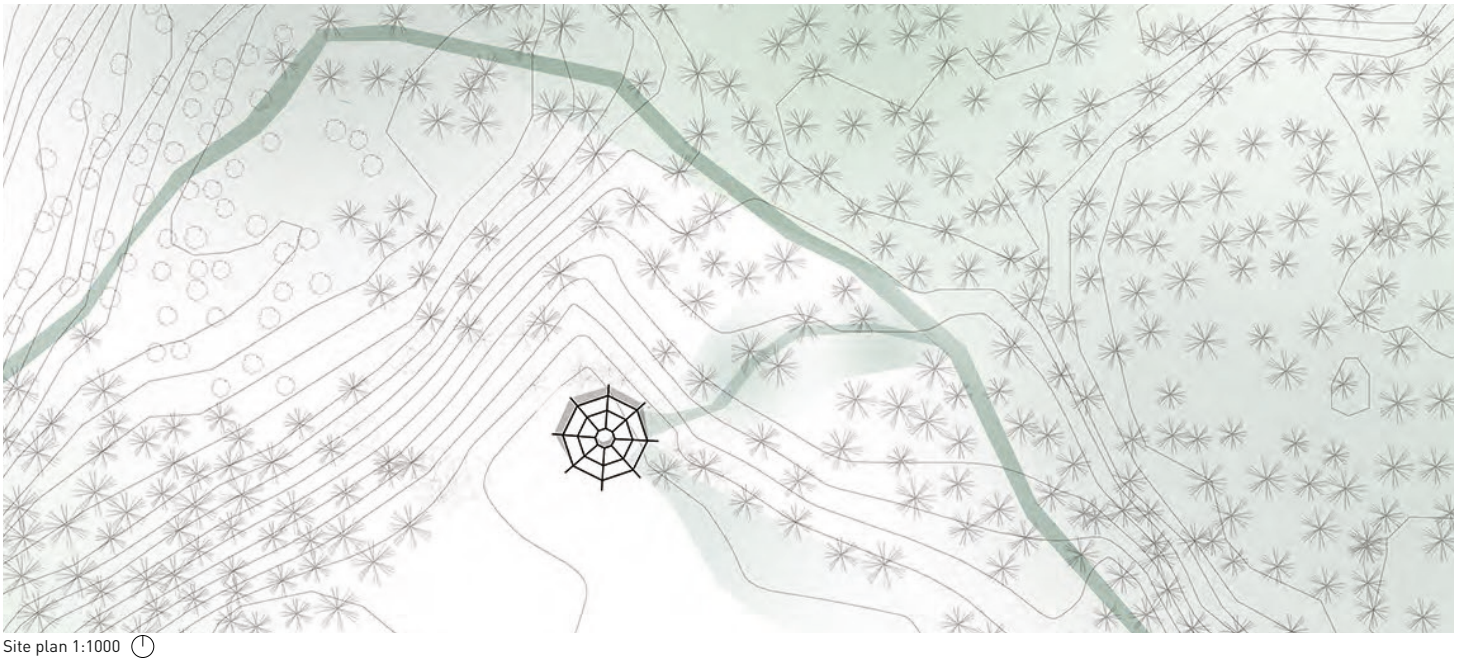
The fire



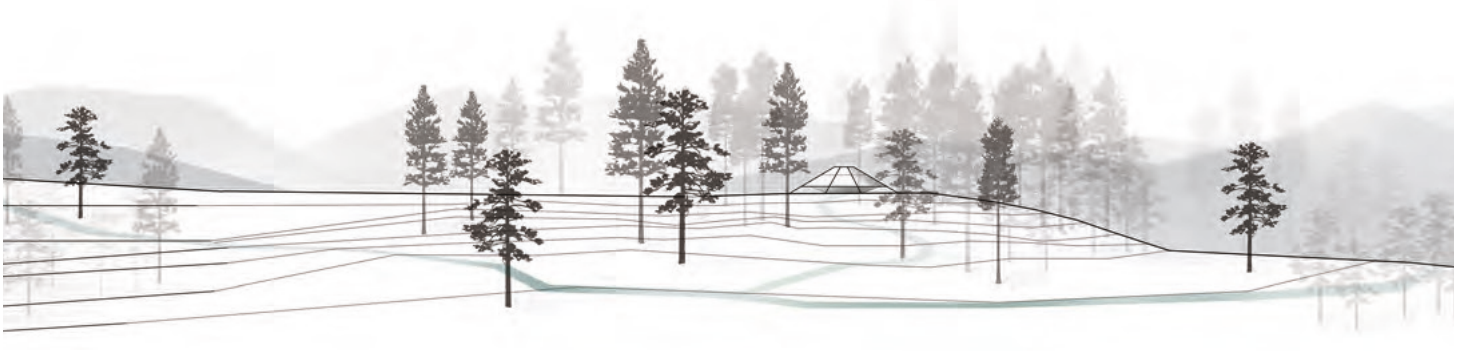
Getting dark



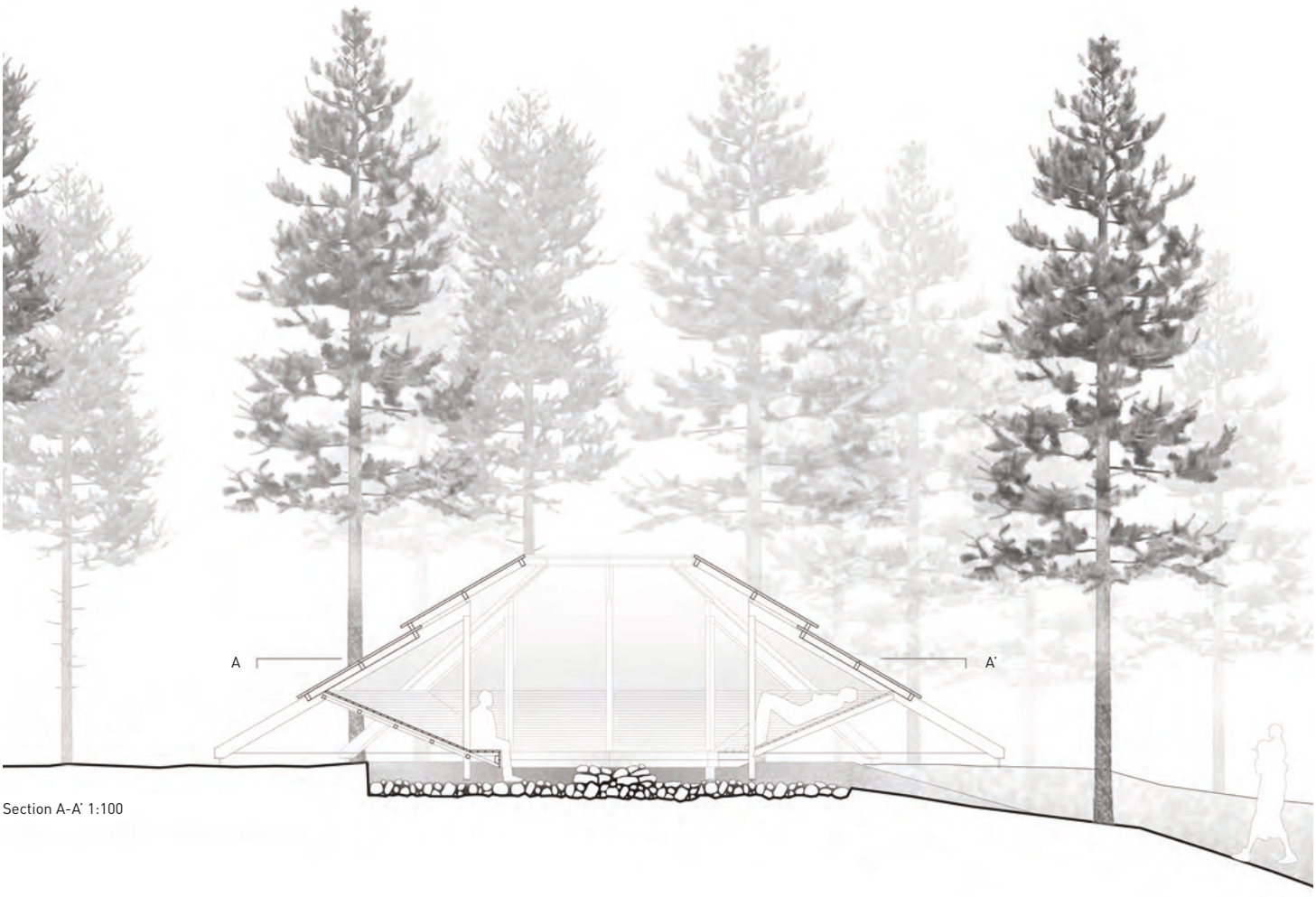
Stargazing



Site plan 1:1000



Site section 1:1000



Section A-A' 1:100

CONCEPT

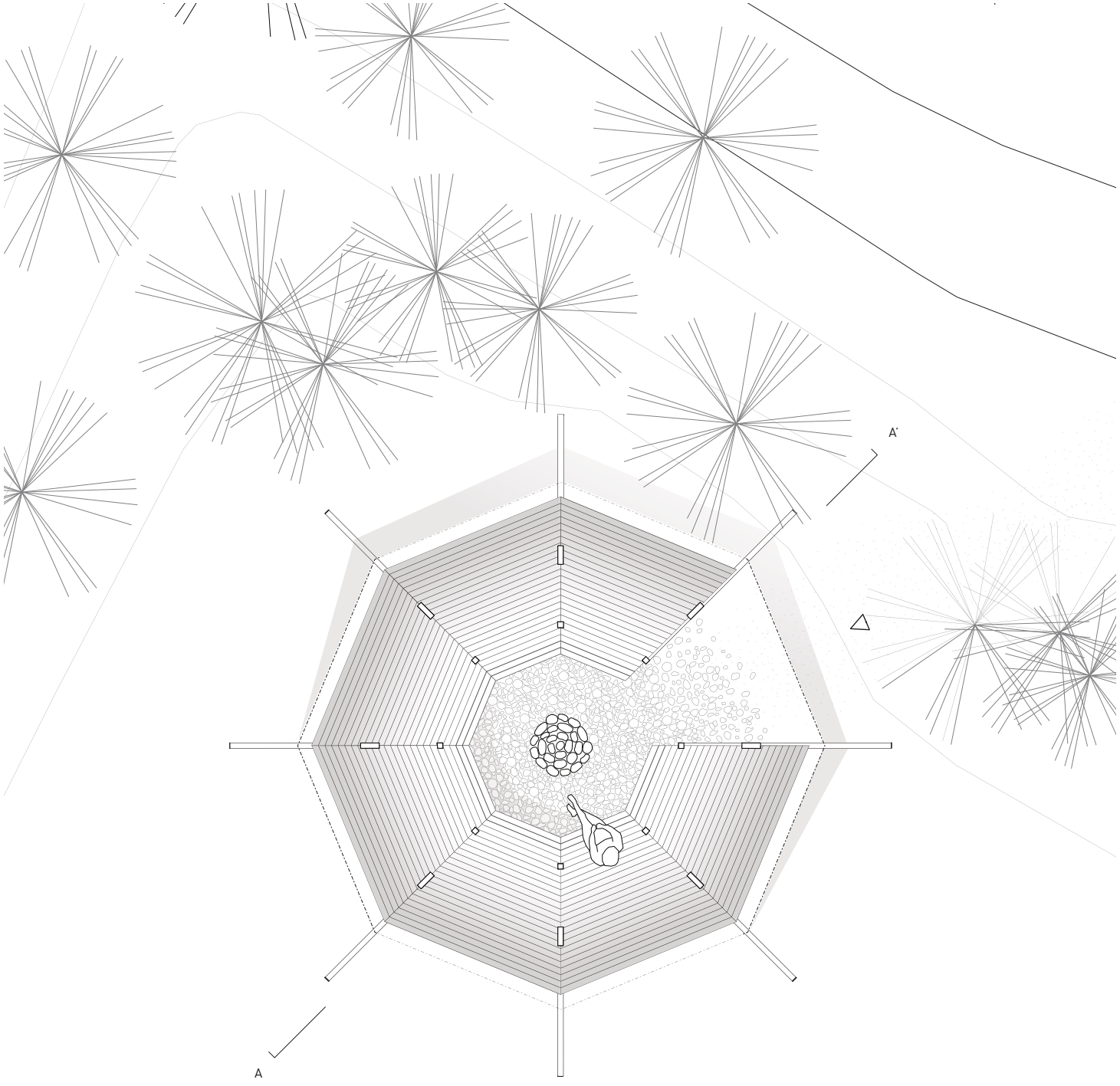
The ritual of this project was a strong element which drew our groups attention to develop it further. The original ritual was something we wanted to stay close to while also expanding the concept for the structure. The building itself was something that needed further development in terms of scale, dimension, structure and construction method.

Our process of designing was primarily based on the overall improvement of each element. The further development and investigation of how someone or a group of people would use the space for star gazing.

The issues that arose were the comfort of the gazer(s), be it warmth or shelter, they would be a priority. Other issues related to the structure such as the angles involved in the roof and how they correspond to the internal spaces, and the in-between spaces around the structure and also for the comfort of the gazer.

The angle of the roof is set at 30 degrees. This gives optimal performance of the material to clear snow from the roof avoiding excess loading. It also benefits the internal space by creating a sheltered opening and also gives a comfortable angle which to lie down under while not obstructing the view of the stars. The angle of the main structure is what defines the project as a sort of primitive form of UFO.

The foot print of the structure is kept to a conservative area with a consideration of its placement on the site tucked between a natural opening in the trees and teetering on the edge of the slope enticing closer inspection from the public travelling on the kultursti.



Plan 1:100

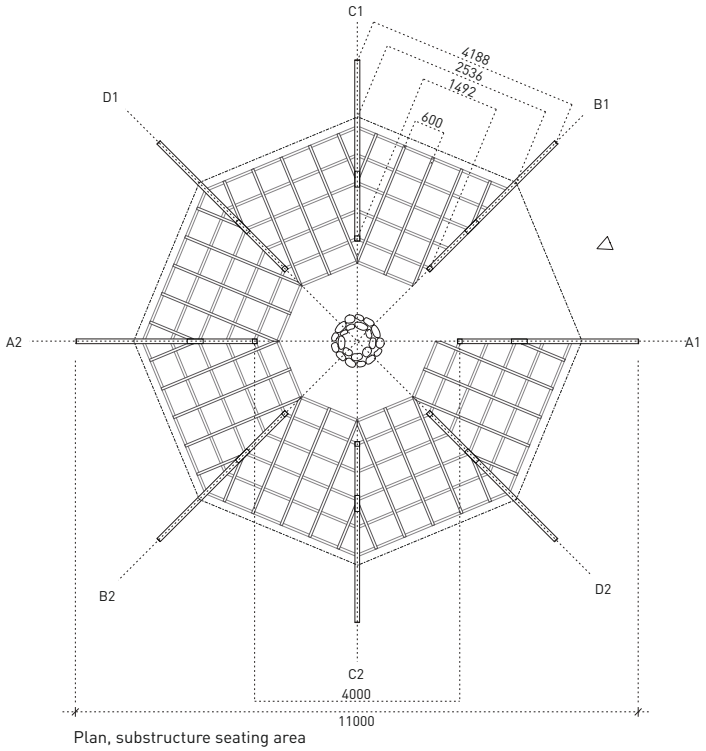
CLADDING

When designing for cladding of the structure it was important to keep in mind the snow loads that occur on the location. The cladding not only had to be strong, but it would be an advantage if the snow would slide of easily, therefore a 'smooth' surface was preferred. After research into different reference projects we chose 'Kanalplast' as cladding material. This material is very lightweight, can span large distances and is very stiff and smooth. The most important feature however is its translucency, it would therefore provide us with an extra dimension to our architecture. The fire from within, or the sunlight from outside would influence how the design would look like during day or night.

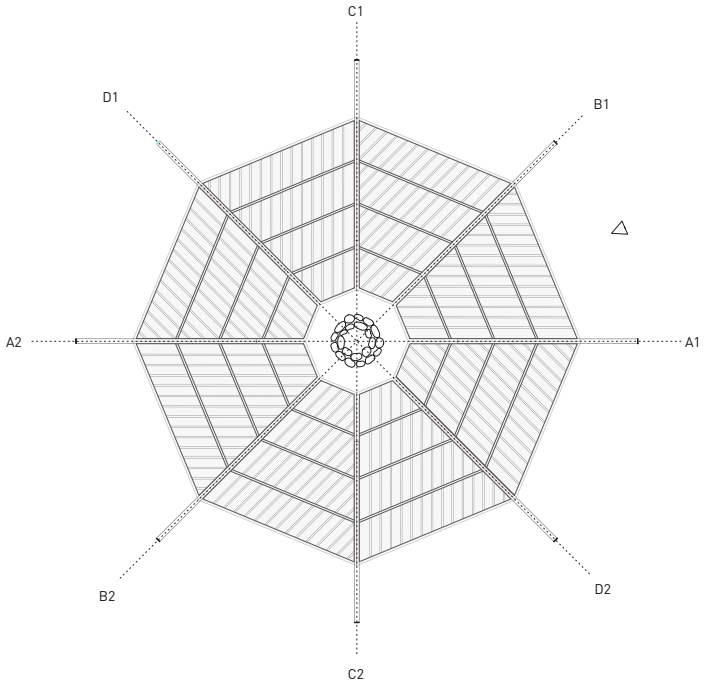
We chose a standard of one meter width to horizontally clad our structure, using four 'plates' for each segment in between the trusses. This top layer of Kanalplast is secured to a decorative wooden substructure that is ordered in a fan pattern that creates an overall 'swirl' effect. The Kanalplast is being directly supported by wooden frames that are connected in between the trusses, these frame help stiffening the structure as a whole.

Because we designed our structure to flip open, it was important that the cladding was light and very strong. The Kanalplast has the advantage of being very light and stiff so for us this was a good choice.

Model photo, cladding outside

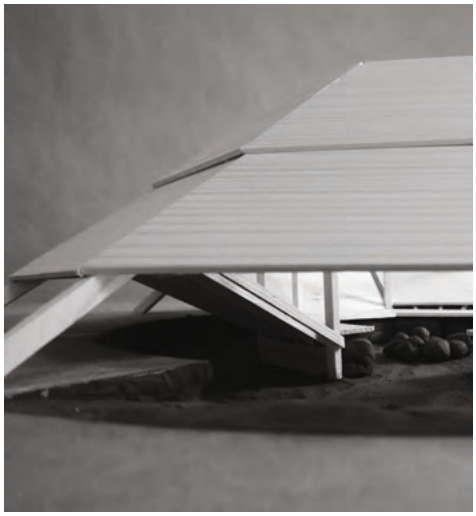


Plan, substructure seating area



Plan top view, cladding

Model photo, process



Model photo, process

Model photo, process

Model 1:5

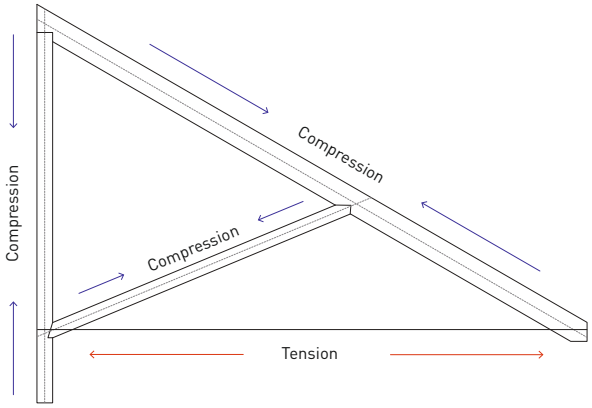
Model 1:5

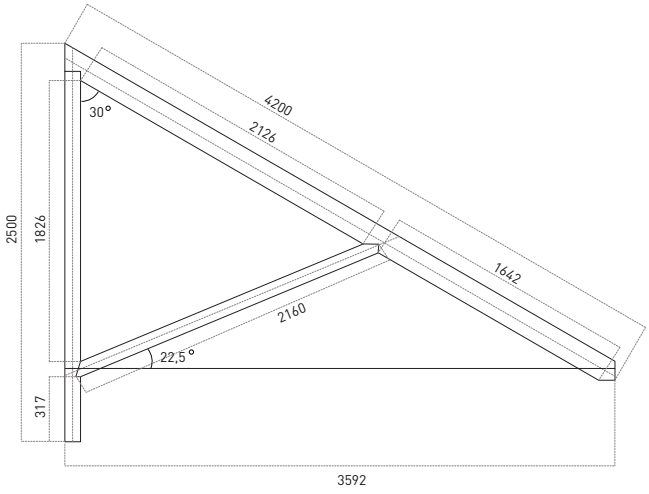
Visualisation, daytime

CONSTRUCTION

Our construction starting point was that we wanted to make our truss joints completely out of wood if possible. Necessary for this was a construction based on compression. Therefore we used one tension wire to achieve compression in all three important joints. This also insured we could work with a relatively 'light' construction in wood.

The angles of our construction are based on research we did for optimal stargazing and lying down. Furthermore the height, width and length of our constructions followed from these angles. For the main trusses we use pine beams, 90x90 for the column and compression beam, and 180x90 for the main diagonal beam. The steel tension rod is 12 mm.



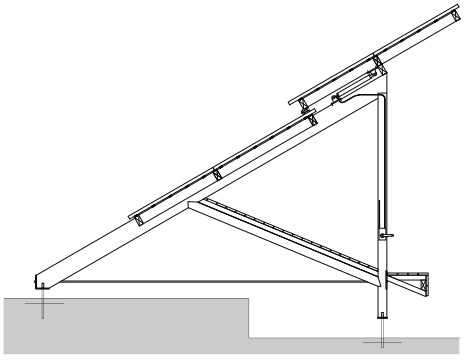


Closed roof

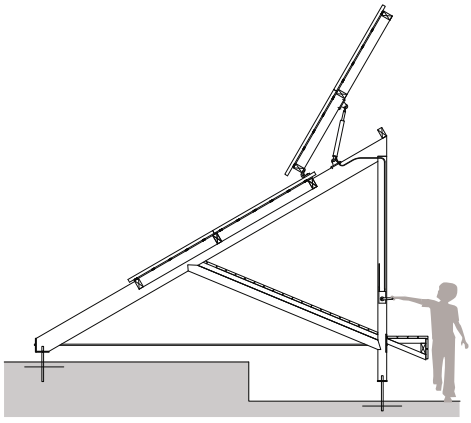
Open roof

MOVABLE ARCHITECTURE

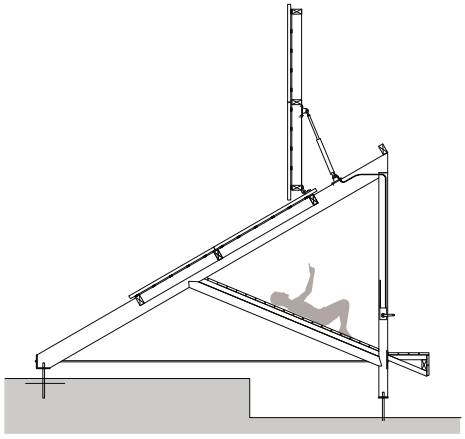
The structure can be open via a hand winch that is connected to a hydraulic cylinder. The hand winch has a built in delay that lowers the forces conveyed through the hydraulic cylinder. One of the eight roof parts only needs one hydraulic cylinder on one side, the other side is powered by a pressure pump that helps lifting the structure by compressed air, but can not go up by itself. The roof is lifted by turning the hand winch, the roof therefore can be partly opened or completely if wished. Because of the smooth roof surface the snow can easily slide down when the structure is being opened. Heavy duty hinges on both sides of the construction transfer the forces directly on the main beams of the construction.



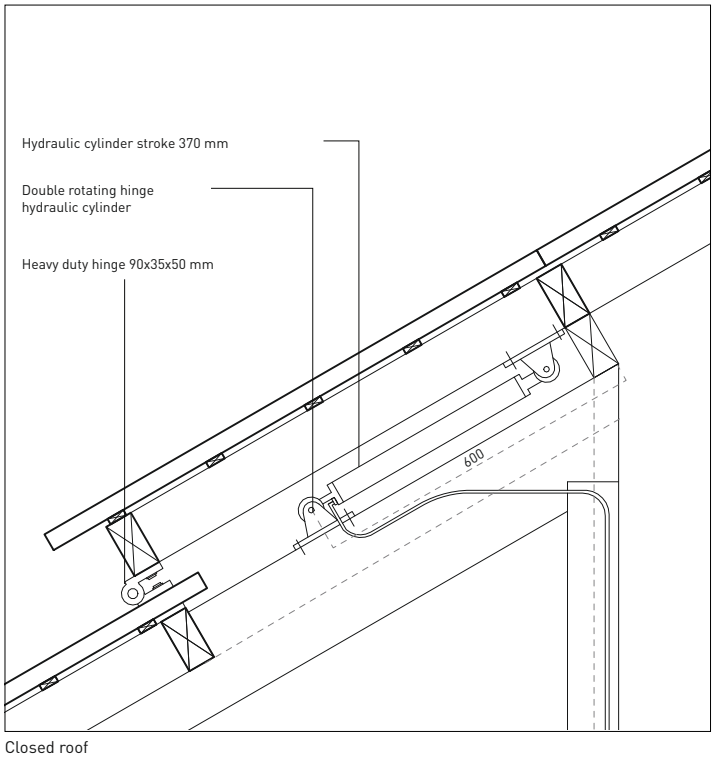
Closed structure



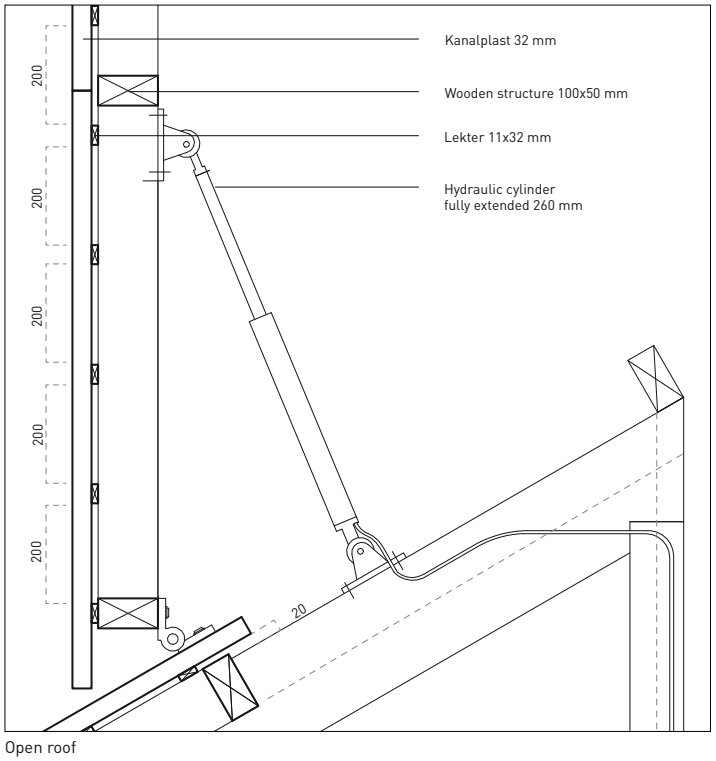
Openable by hydraulics



Openable by hydraulics



Closed roof



Open roof

DETAILING TRUSS

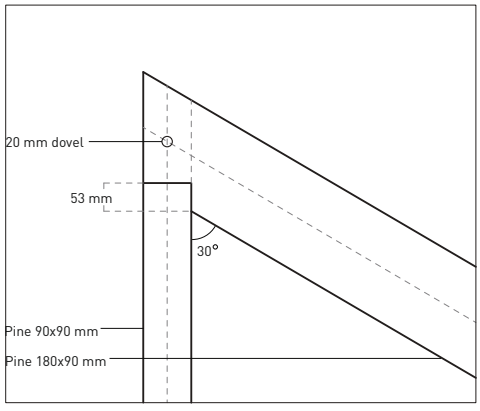
We chose to focus on four details within our main truss. These details are calculated and optimally dimensioned for their task. We make only use of only dry wooden joints and pegs, steel plates or bolts are not used in the joinery except for taking the pressure of the steel tension rod.

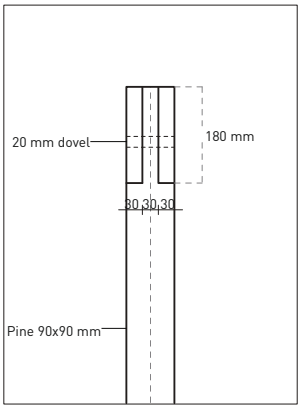
The joints are designed in such a way that they can easily be made by hand or machined. The erection of each frame is a relatively straightforward process. The joints all fit together to form the basis of the frame. The dowel in joint 1 tightens the joints making it easier for the tension cable to be secured. This creates a stable frame which can be moved into place.

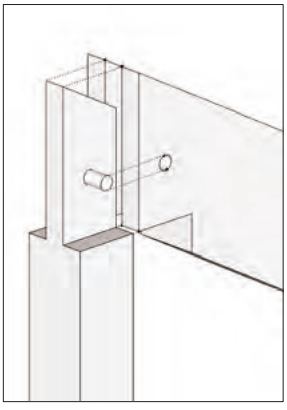
1 This detail takes both compression and tension. The tension is because of wind forces that can lift the roof when the wind comes in via the entrance. The compression comes from the facade and the main diagonal beams own weight. The tenon is made to go all the way through the top beam so there is more material that can take the tension to the dowel. The size to strength ratio is strongest in this one third construction.

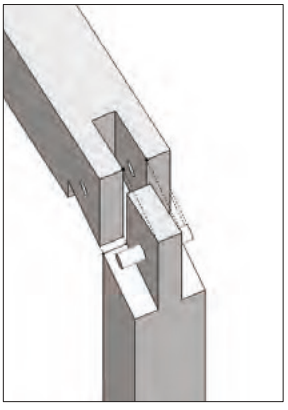
2 In this joint the tension rod is joined within the detail. Most important was that the rod is going through the centre of the joint to be able to properly put tension on the structure. A bolt with a diameter of 21 mm through a steel plate embedded into the 90x90 column ensures the tensioned structure.

1



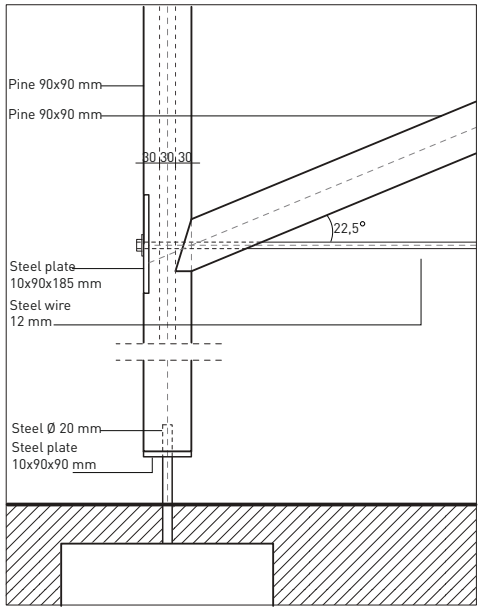


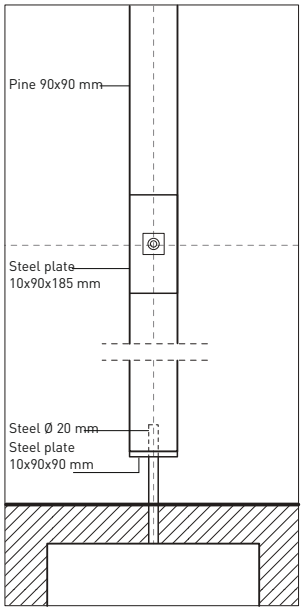


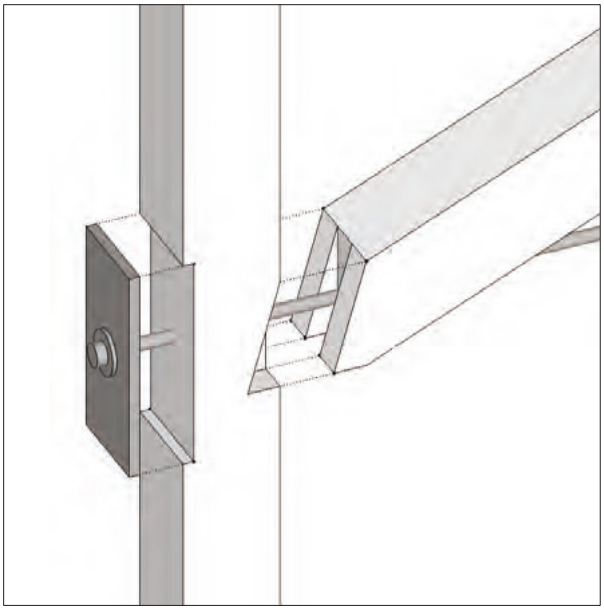


Mortice and tenon joint

2

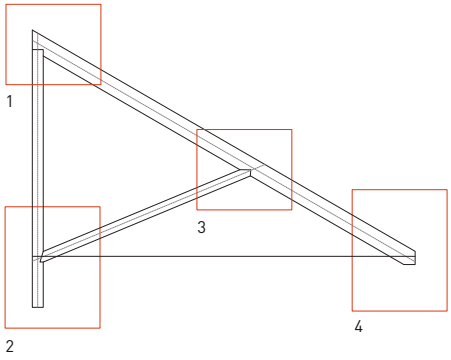






3 Different angles make this a complicated detail to construct. The down part of the compression beam has to take all the forces from the diagonal bigger beam in a relatively small surface. It can not protrude further into the main beam, less it becomes too weak at this point and buckles out. Therefore the angles at this point are carefully chosen. There is no need for dowels since there is only compression in this joint.

4 The horizontal forces of this diagonal beam are taken by the horizontal tension rod. Left in this joint is the downward forces, these are being taken by the horizontal steel plate that carries the forces to the concrete foundation through a steel rod with a diameter of 20 mm.



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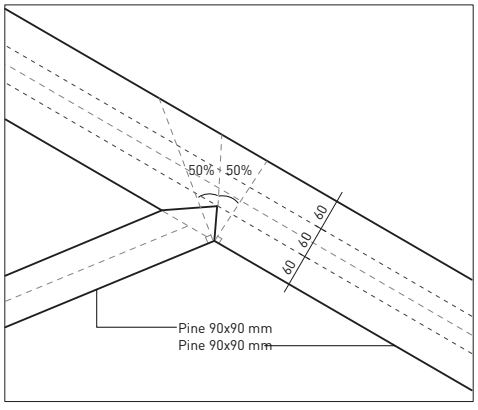
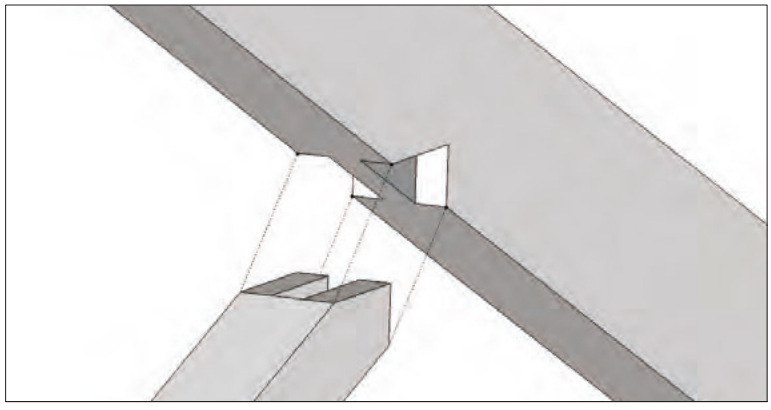
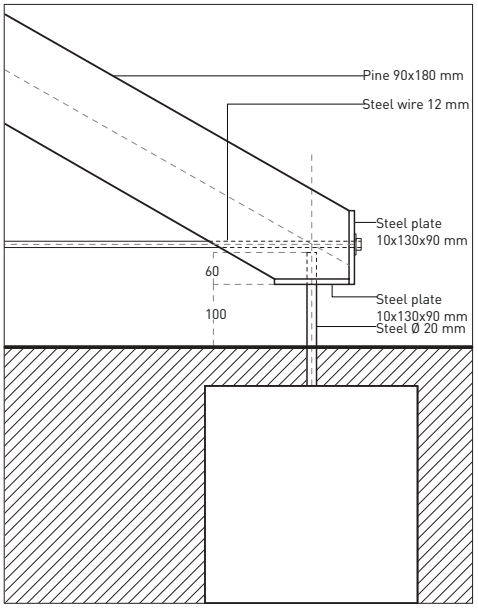
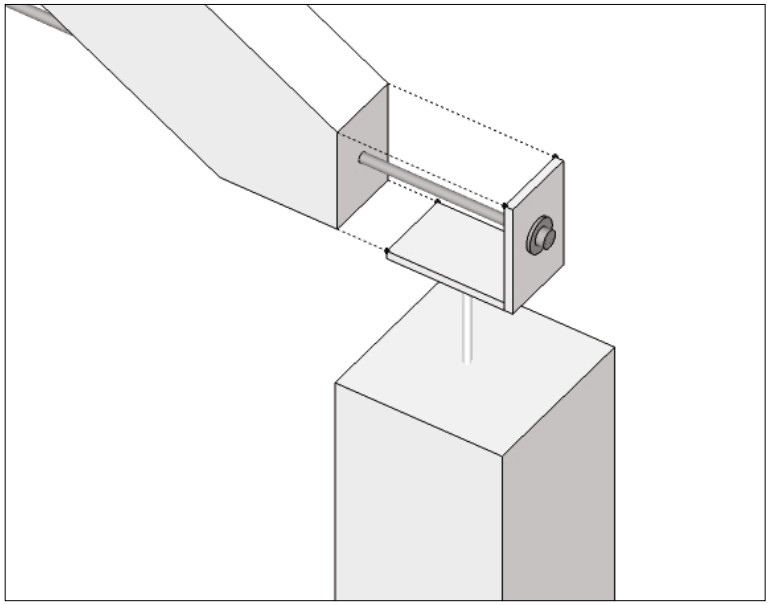




Bridle joint

4





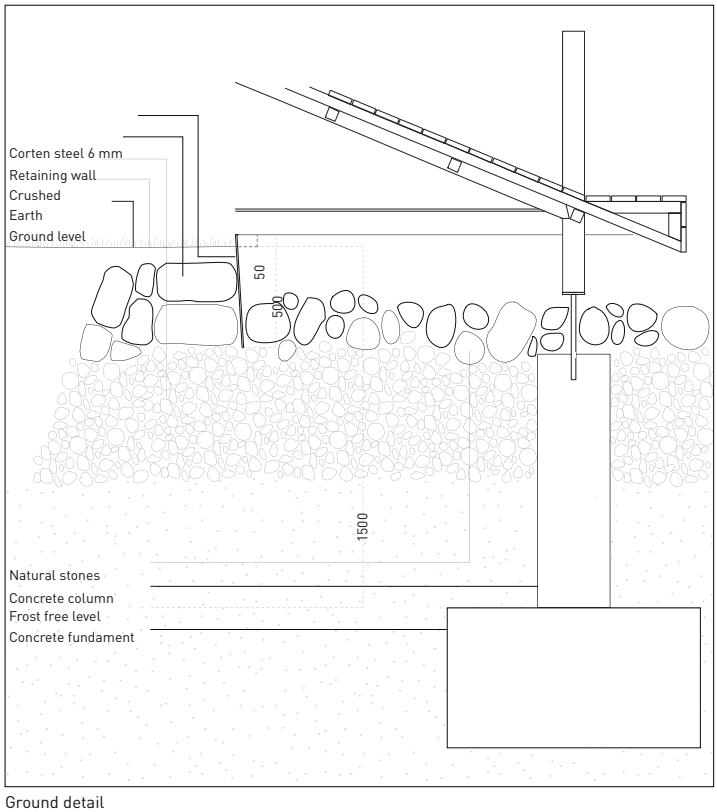
Foundation detail

DETAILING 1:1

In the process of developing the structure, we chose to build one of the trusses of our structure. With this we could investigate both the scale and dimensions in the project, as the joints are in 1:1. From the drawing table to the physical 1:1 model, there were a lot of practical decisions made. Being in the workshop we found which machines could be used to actually build this structure.

Full scale truss

1:1 model, bridle joint



Ground detail

1:1 model, bridle joint

SPONSORS

Special thanks to the Talgø Company for their sponsorship financing both the students visit to the site and the production of this report. Also thanks to Moelven Limtre AS and Tresenteret helping us getting affordable materials for the 1:1 detailing.

The use of M = 1:1 full-size building workshops is an important educational tool at the Faculty of Architecture and Fine Art, NTNU in Trondheim. By developing their own architectural design in detail, the students achieve increased insight into the development of architectural concepts and into the inherent properties of materials, structures, workmanship, fabrication, collaboration and communication. Such skills are important for architects who want to create innovative wooden architecture.

This booklet documents such a process. During the spring of 2014, in cooperation with the local authorities, the 4th and 5th year architect-students developed a stargazing structure at a site in the community centre of Rindal.

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