PAVILION OF RAIN

PUBLIC SHELTER IN NORDIC CLIMATE

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Public Shelter in Nordic Climate

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Gray, rainy days are ordinary sight in the Nordic climate. As a result the use of public space is limited and often reduced only to a transportation from one spot to another. To increase the value of public space the common way is to build indoor galleries and shopping street shielded with a glass roof to eliminate the exposure to the climate. This project is about the inbetween. Where you use rain as an element within the design and make it possible to experience rain without getting wet. To be able to see the rain pouring down, to smell the aromas from the wet ground and trees, to hear the raindrops falling on the surface, diffusing the noise from traffic.

The park in Brunnsparken, Gothenburg was originally intended as a recreational, calm part of the city center. Unfortunately no one is using it as such. This is a perfect place to address a new typology of public space. The design of the pavilion aims to create a relaxing contemplative atmosphere that uses water and rain as a form of design.

The project uses the technique of weaving carbon fibers to create an interesting range of transparence and porosity. By playing with the correlation between these two parameters, different ways of sheltering is created. Where the presence of nature is important and a key part of the experience. The pavilion shows how protection can be achieved in different ways. All corresponding to the intent of highlighting different aspects of rain. A celebration of the gray, rainy days.

CONTENTS

INTRODUCTION

Gray, rainy days are ordinary sight in the Nordic climate. As a result the use of public space is limited and often reduced only to a transportation from one spot to another.

To increase the value of public space the common way is to build indoor galleries and shopping street shielded with a glass roof to eliminate the exposure to the climate. This project is about the inbetween. Where you use rain as an element within the design and make it possible to experience rain without getting wet.

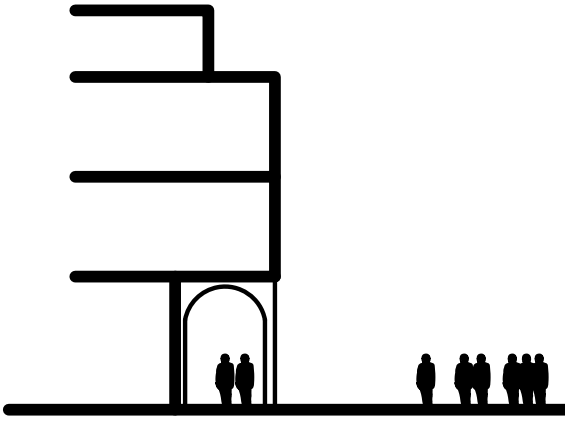
To be able to see the rain pouring down, to smell the aromas from the wet ground and trees, to hear the raindrops falling on the surface, diffusing the noise from traffic.

HISTORY OF COVERING PUBLIC SPACE

The facades and structure are becoming more and more complex, but we are not really questioning how much we cover and how much of the climate we are exposed to.

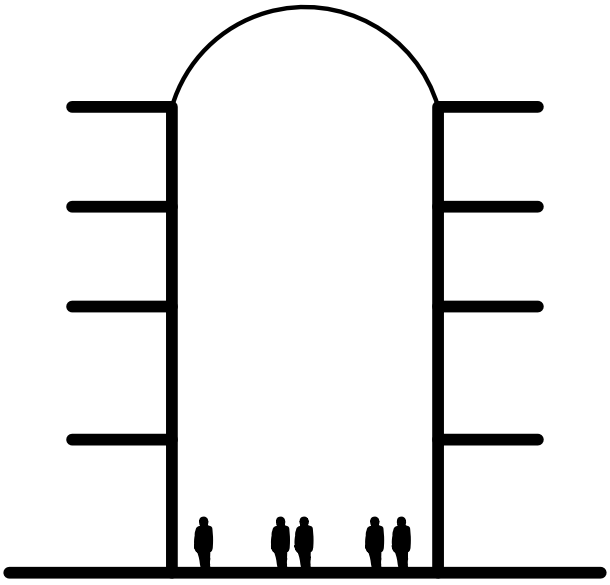
Ospedale degli Innocenti, Florence (1419–26)
by Filippo Brunelleschi

A smaller part around the big important square is protected and a popular space for making business.



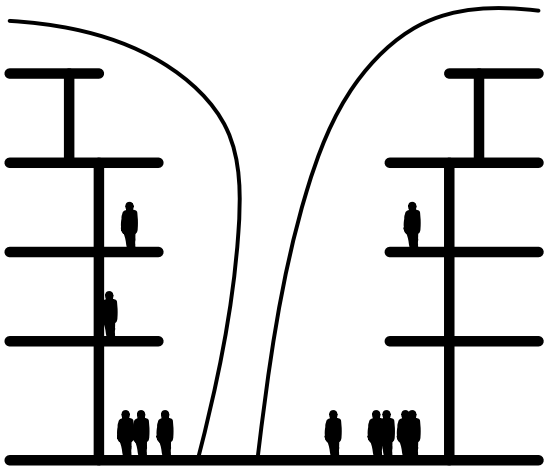
The Galleria Vittorio Emanuele II, Milan (1865-77)
by Giuseppe Mengoni

The first galleria with the streets covered by
a glass roof. This is the beginning of todays
shopping malls f ex Nordstan in Gothenburg.



Myzeil Shopping Mall, Frankfurt (2002-2009)
by Studio Fuksasv

The covers an protection layer is today highly complex and deleting the border between roof and wall. But the consept is exactely the same as in the galleries. Delete the impact of outdoor weather exept for the visual parts. Today's shopping galleries are even controling the thermoclimate and create an indoor feeling.



WHAT WE MISS

RECONNECT TO THE SENSES

By deleating the impact of wather we lose the connection of outdoor. We create a city and public life that is artificial and by that also the awareness of our environment and impact.
Often spending a small time outdoor is also making us less stressed. By focusing on somethin else.

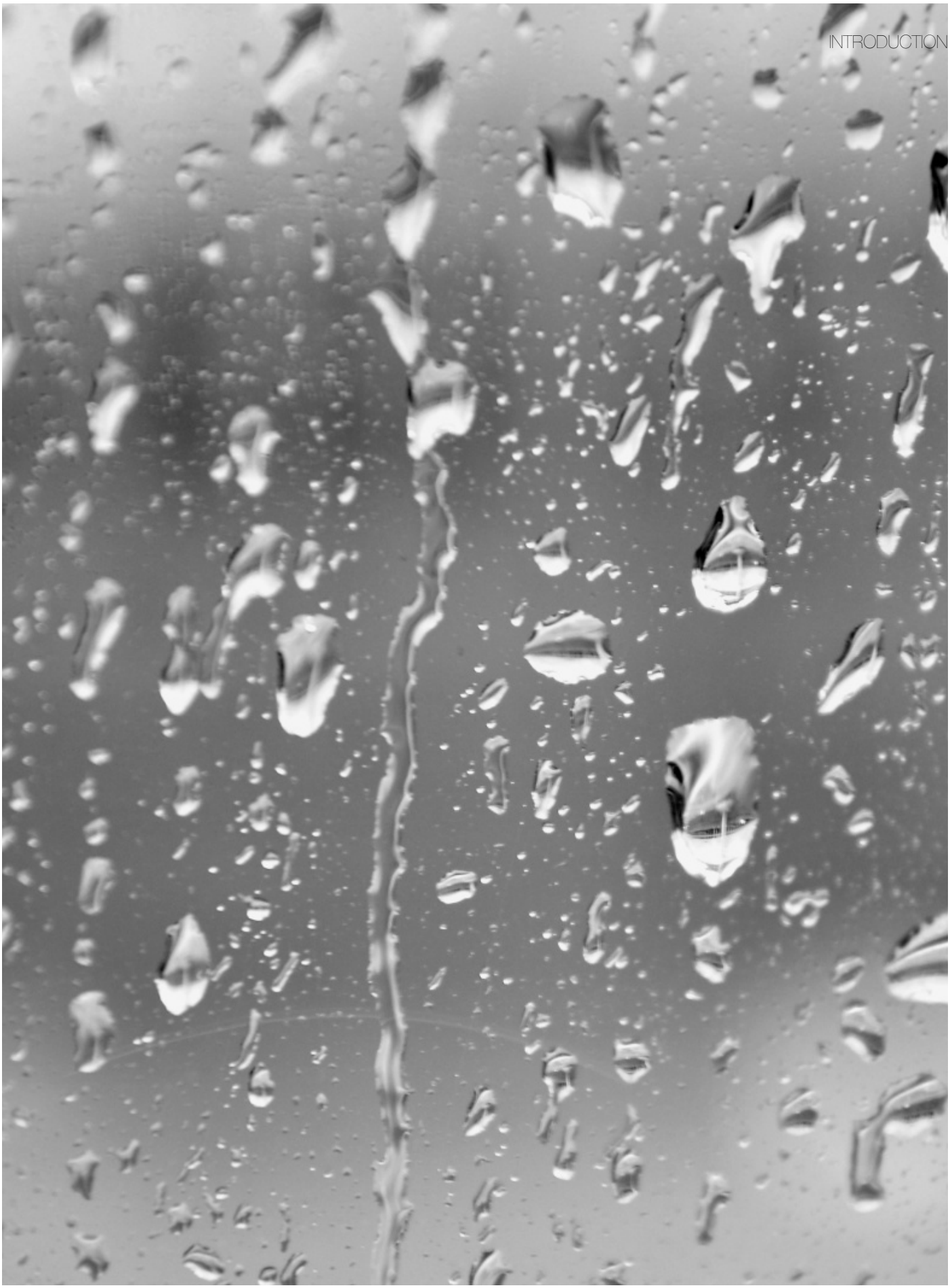
Visual impact of rain
To watch water falling down a transparent surface.

Sound of raindrops
To hear the drops falling on the surface makes realise the happenings around you. At the same time it masks the high traffic noice from the streets around.

Smell rain
To be able to smell the rain is an important part of your full understanding ofthe weather.

The touch of rain
To be able to toch the rain when you want makes a freedom. To be totally inclosed by the impact of rain and wind.

To not be wet
The idéa is to create a space that include all the impact described above but still let the person be able to walk without getting wet.



DESIGN INSTALLATIONS

Examples of a more free and artistic approach is easy to find in the design field. Next is three different projects that work with rain as an element.

“World with endless rainfall”
by Anne von Galen

"I was fascinated by the behaviour of people in the rain. How they move, react and function."

From the studies she designed accessories that address the specific behavior she observed.

Rainroom but not being wet
by MoMA

The project create and play with the feeling of walking in the rain. The important difference is that you will never get wet.
By sensors the rain is stopped just at the place where you are walking.

Splash
by Iris van Herpen

A design collaboration. Using high speed camera to capture the form when splashing water on a model. From that creating a dress by using plexi. Melting, dragging, forming.

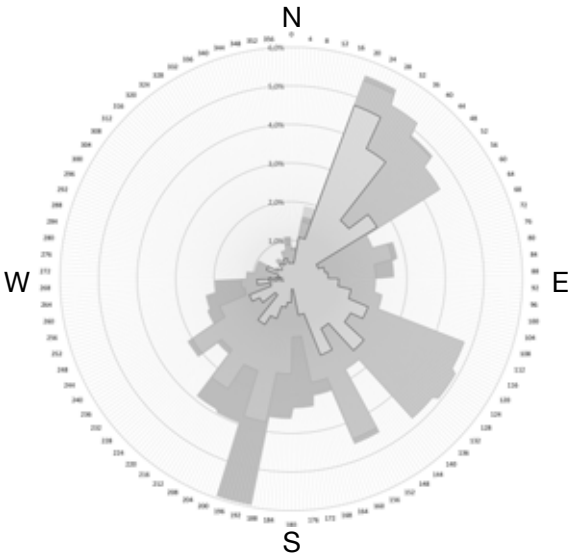
RAIN, WIND AND DIRECTIONS

DIRECTION OF WIND WHEN RAINING

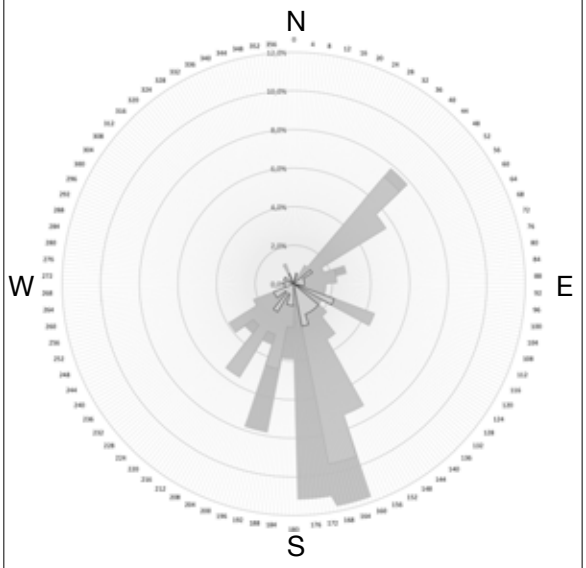
The diagrams to the right show that when it's raining the direction of the wind is close to allways from South.(In average 155°, SSE) You can also from the data see that the average wind speed is about 4-6 m/s.

A normal rain drop has the diameter of 2 mm and falling in a speed of 2-9 m/s (SMHI). That means that the angel the rain is falling to the ground approximately with the angle of 30°.

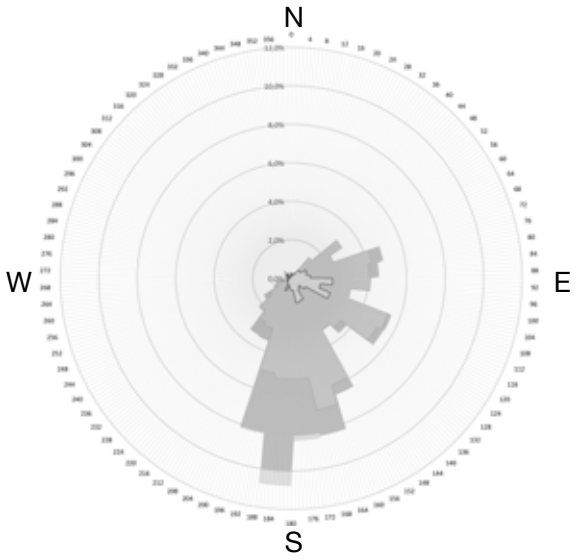
AUTUMN - ALL DAYS



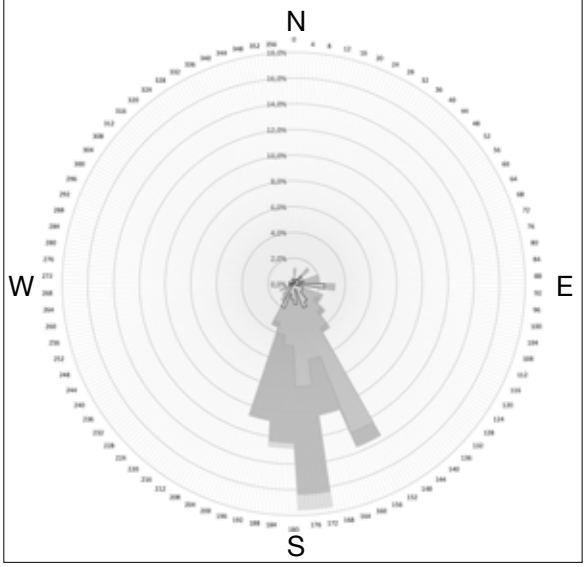
AUTUMN - RAINY DAYS

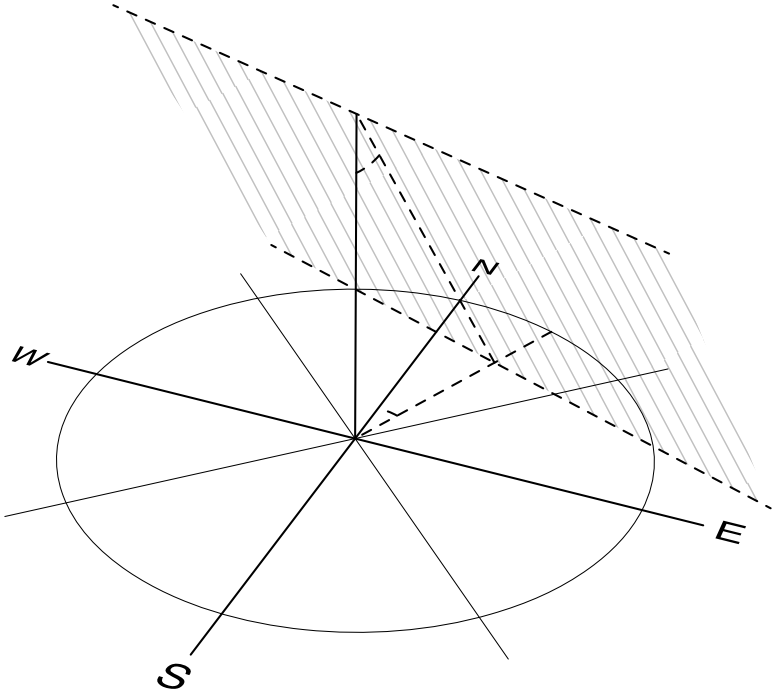


WINTER - ALL DAYS

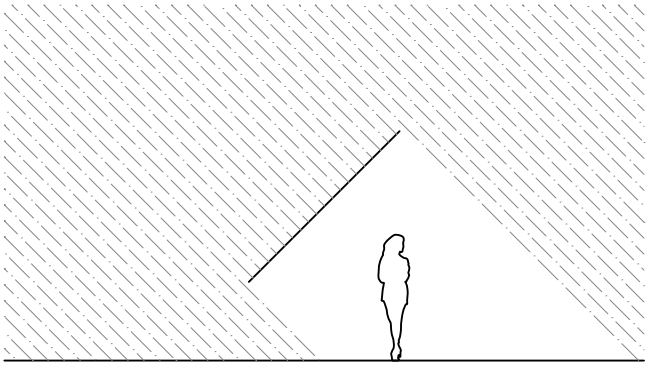


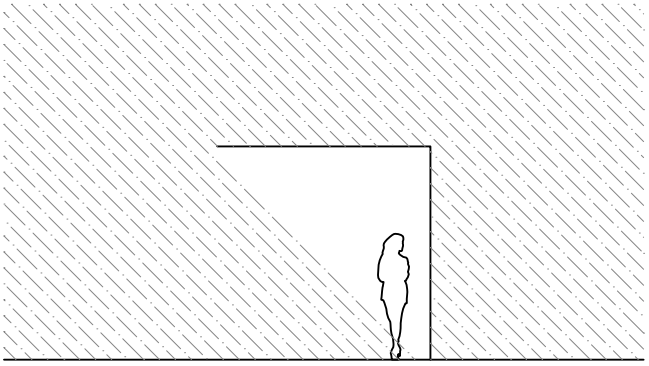
WINTER - RAINY DAYS





Average wind direction in Brunnsparken.





Sheltering in different ways.

BRUNNSPARKEN

Location in Gothenburg.

Brunnsparken is situated in the center of Gothenburg.

It's one of the most used areas for both locals and tourists visiting the city.

Building mass around Brunnsparken.

The buildings surrounding Brunnsparken is 5 level blocks with a height of approximately 18 m.

The first floor of the buildings in this area are shopping. As the most important shopping are in Gothenburg it serves all the region.

On top of shopping the most common is offices. A very little part is residential housing.

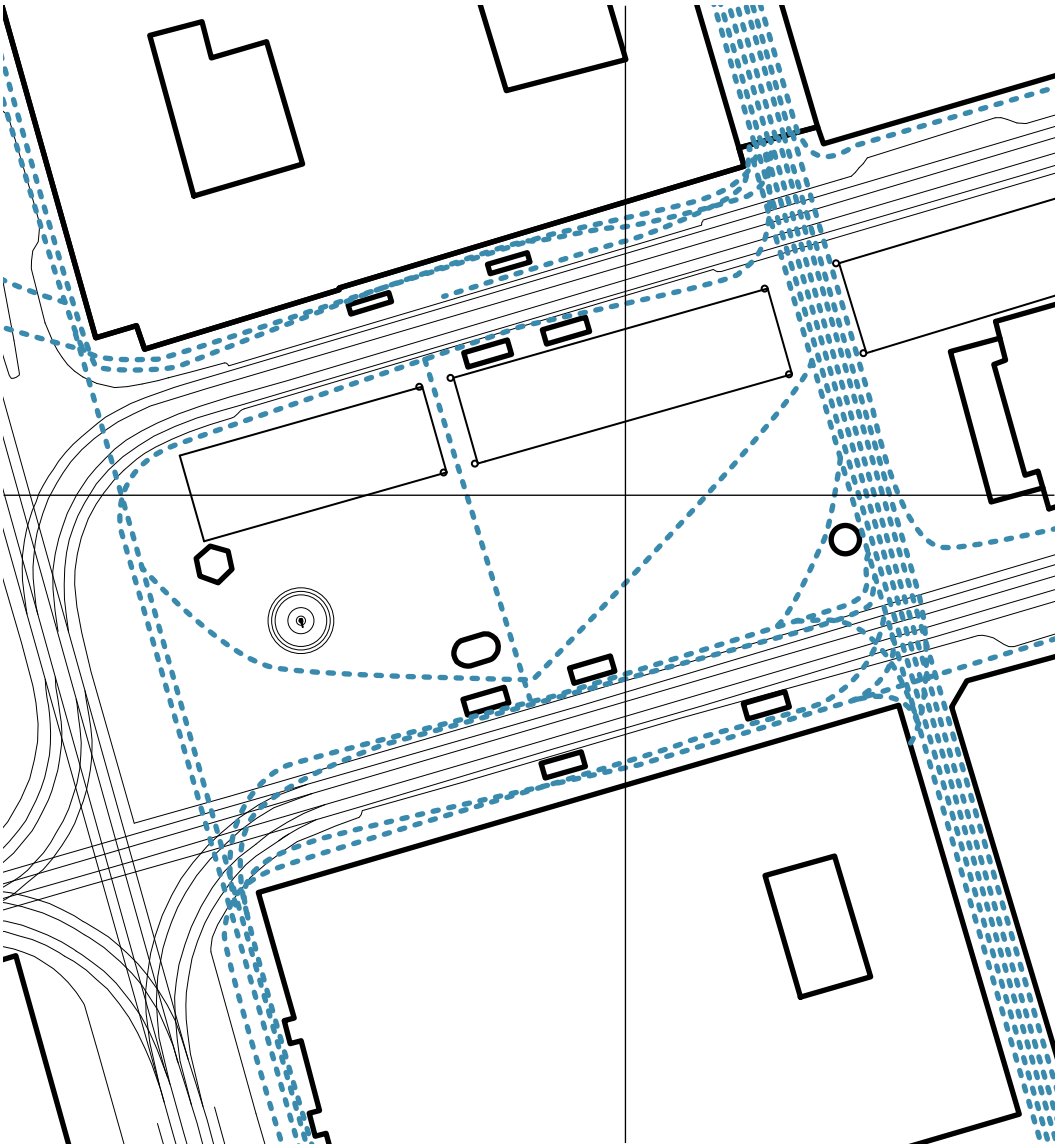
Along Brunnsparken goes the old canal used as the main harbour during 1800th century.

Brunnsparken as the nod for public transport.

Due to the central location Brunnsparken is the most important and high frequency trafficated places in Gothenburg.

It is a node for the public transports, mostly by trams and buses.

Because of Brunnsparken's importance as a node for public transport and it's high dense shopping the use people is one of the most high dense areas in Sweden.



Brunnsparken as useage by people.

Even though the streets around Brunnsparken is highly dense with people the use of the park itself is very low.

It's mainly used as a shortcut to the tram stops or the shops.

HISTORICAL RECREATION PARK

Central Gothenburg, 1815

Brunnsparken was created in the early 1900th century as a recreational area in the middle of Gothenburg.

With its park and even bath houses it was an attractive calm area in the middle of the city.

Before it became a recreational area it has been a central place in the historic Gothenburg due to it's well. The well provided water with medical effects.

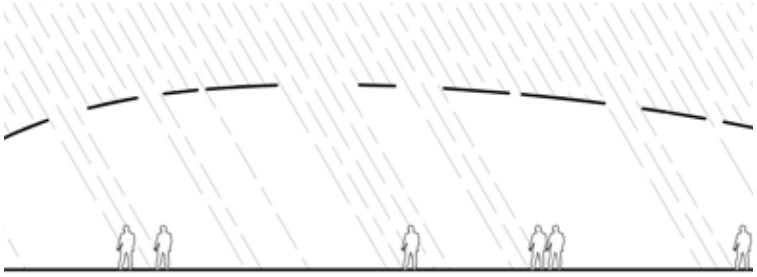
Brunnsparken with it's important well, 1900th century. Photo Unknown

CONCEPT

From the inputs, the design examples and the data for rain three different concepts was developed.

The three concepts, named Urban Umbrellas, Focusing Umbrella and Shifted Umbrella all highlight different aspects of rain together with the design.

URBAN UMBRELLAS



A large structure partly cover the space. Here you can find your dry way through the area or stop by in a dry spot you find.

The structure makes it possible to let natural vegetation exist in the space.

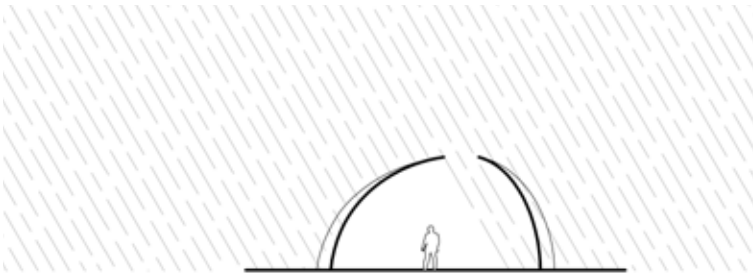
The rain draining along the transparent plastic cover down to the collectors at the support.

A sound of the rain towards the surface. Masking the high traffic noice.

The ground and trees releases the wet, fresh, forest-smell

The ground shows where to walk without getting wet.

FOCUSING UMBRELLA



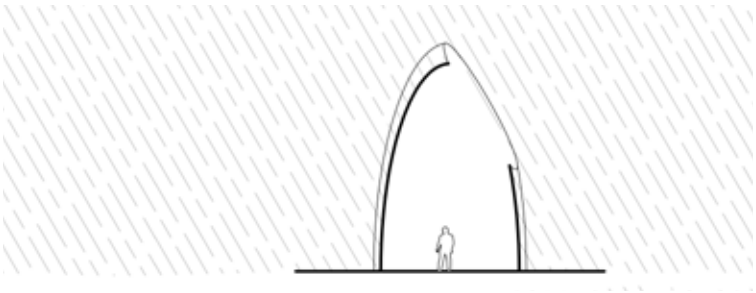
The smaller space is totally covered except from one opening in the top. Here the rain lets pouring into the space and collects on the ground.

By the small opening in the roof a focused rain part is allowed.

Inclosing the space and shielding from outer noice. The clatter on the surface will be th mainly sound.

The rain that allows through the opening in the roof is falling into the water collector.

SHIFTED UMBRELLA



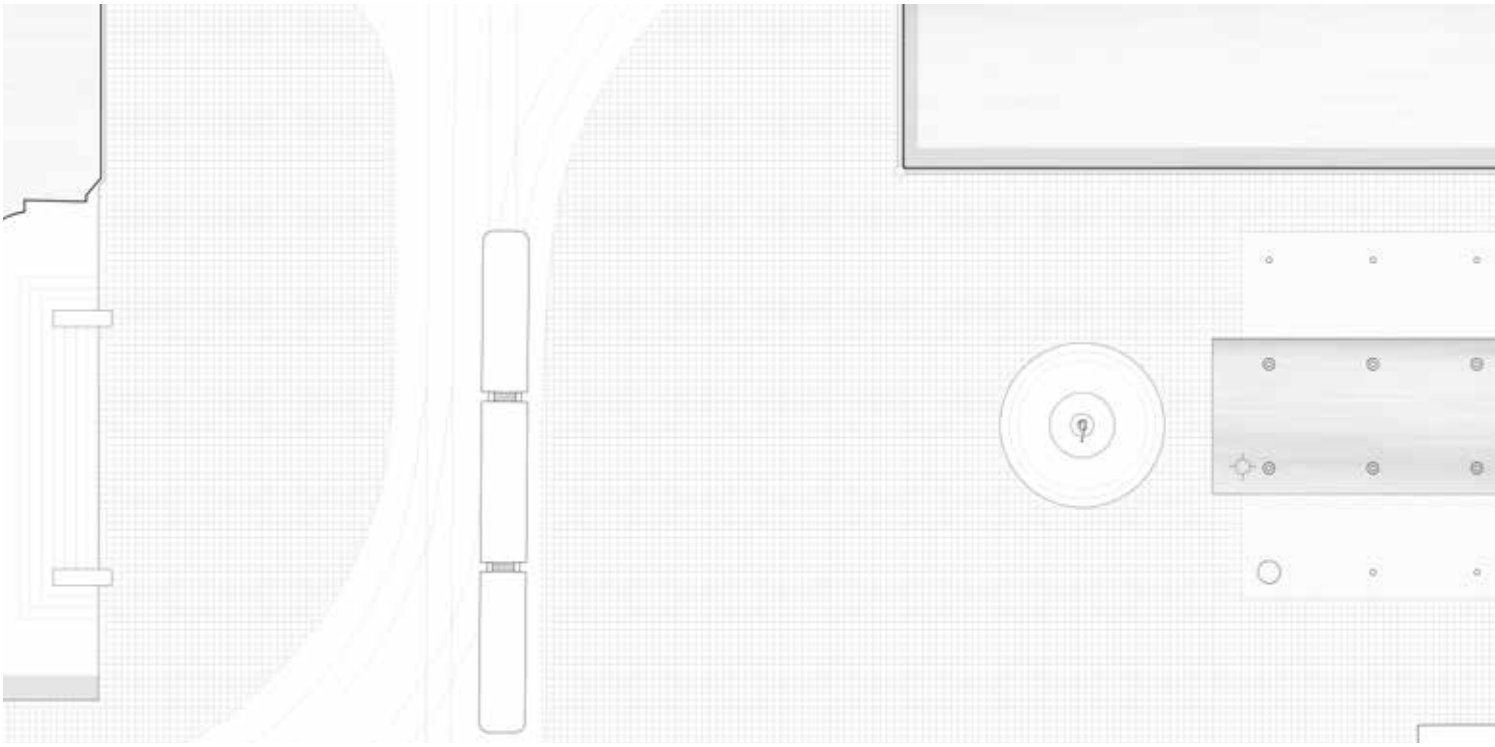
The space provide maximal opening towards the sky without making the inside affected by the rain.

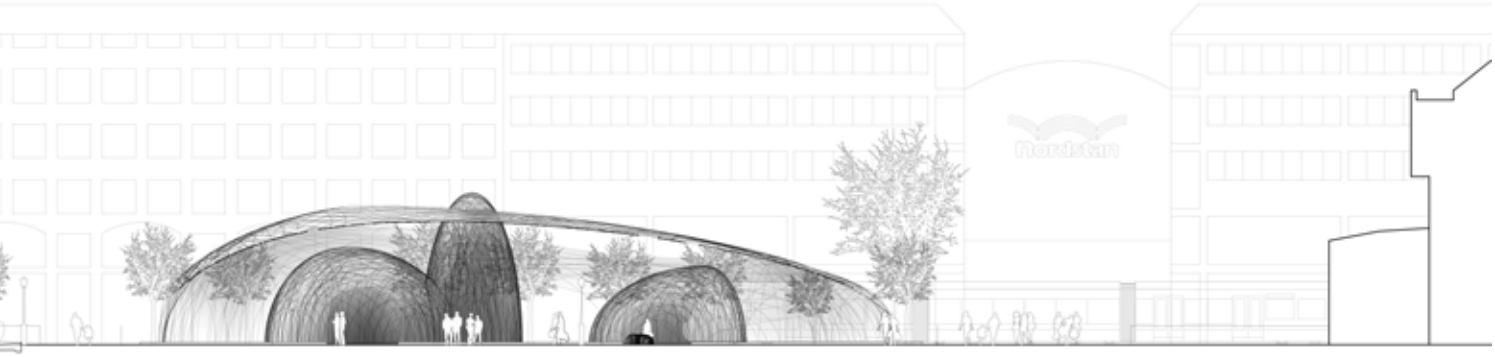
A big opening is made. You will have the visual impact of being in the rain.

Inclosing the space and shielding from outer noice. The clatter on the surface will be th mainly sound.

The cut in the roof is made withan angle that makes most of the rain not fall into the space.

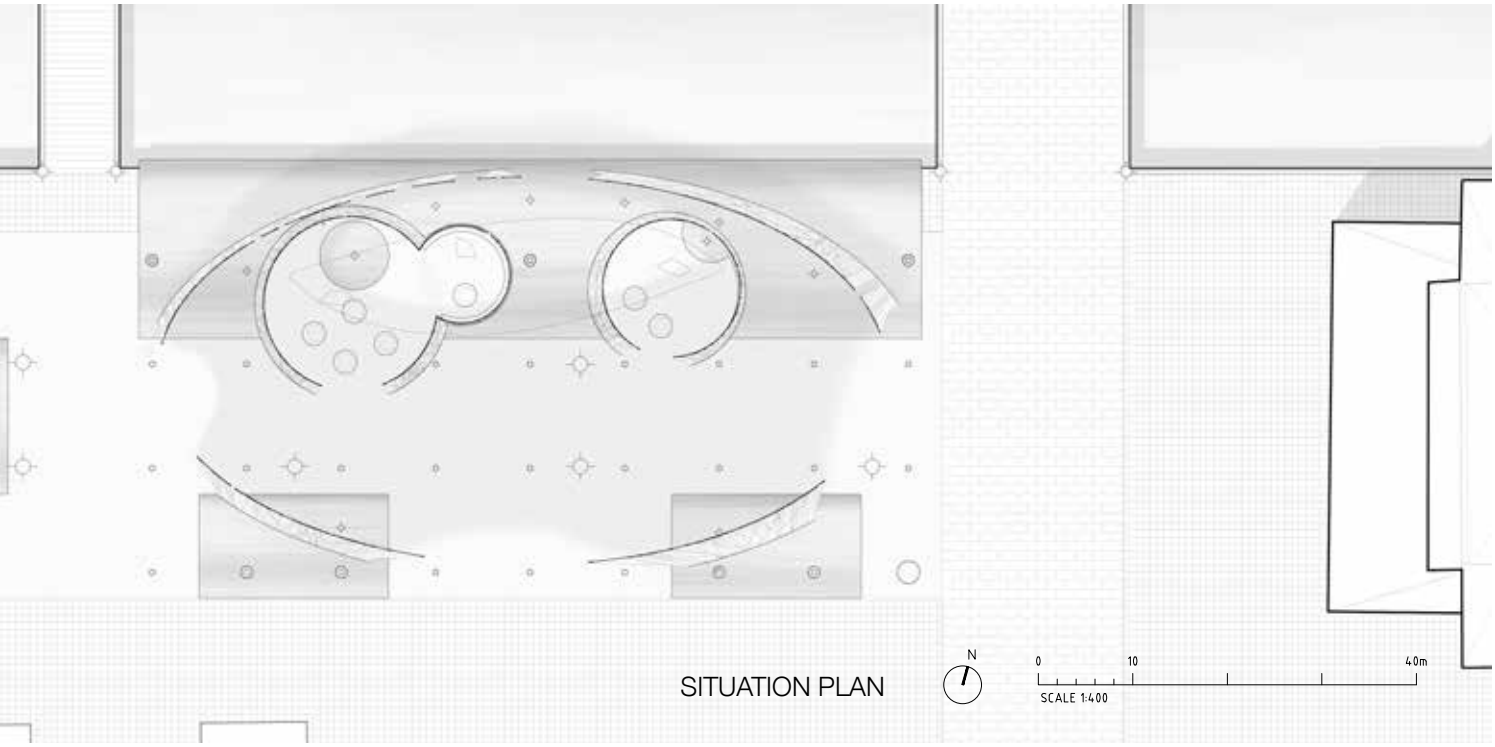
DRAWINGS





SECTION A-A

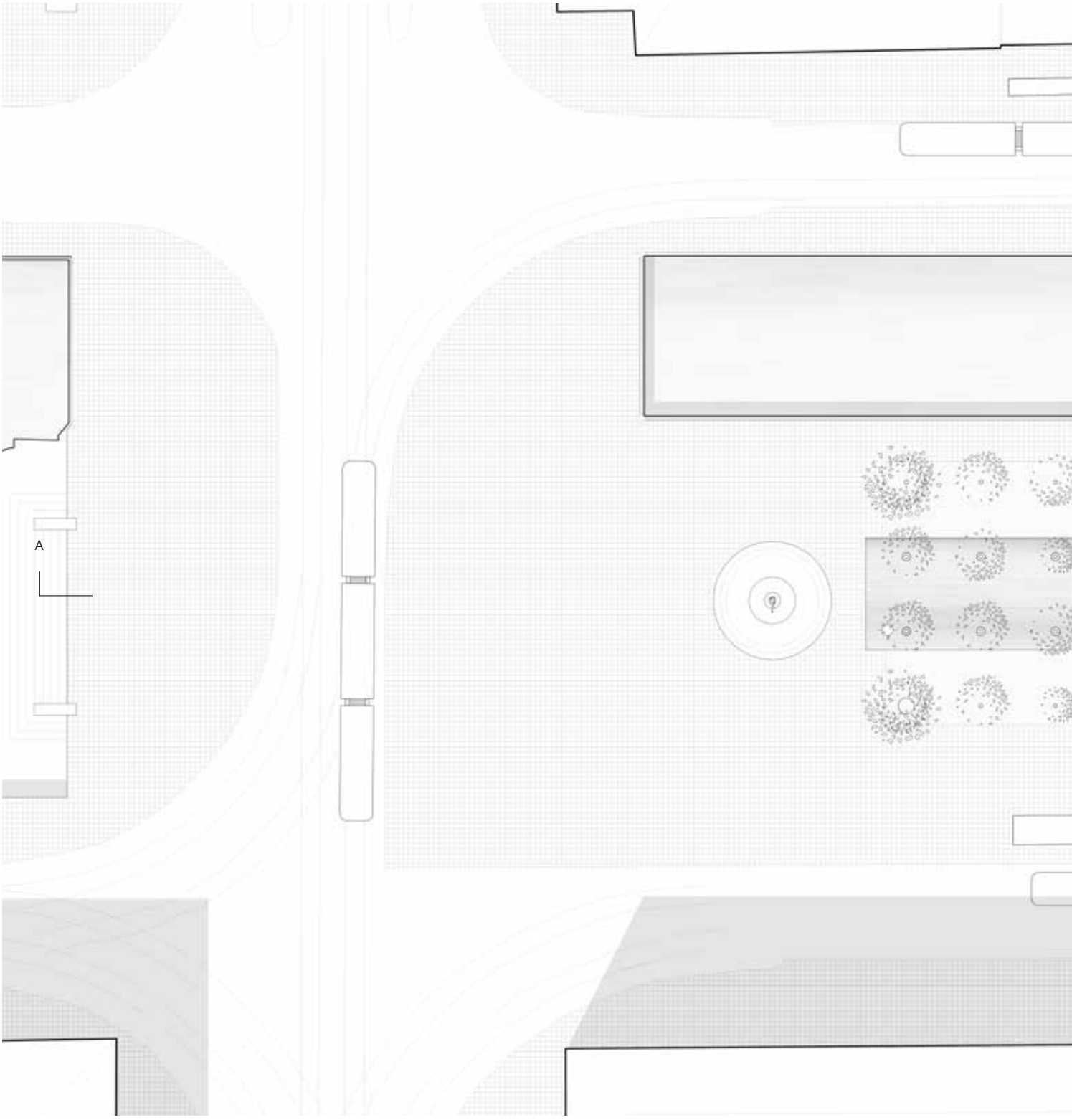
0 10 40m
SCALE 1:400



SITUATION PLAN

N

0 10 40m
SCALE 1:400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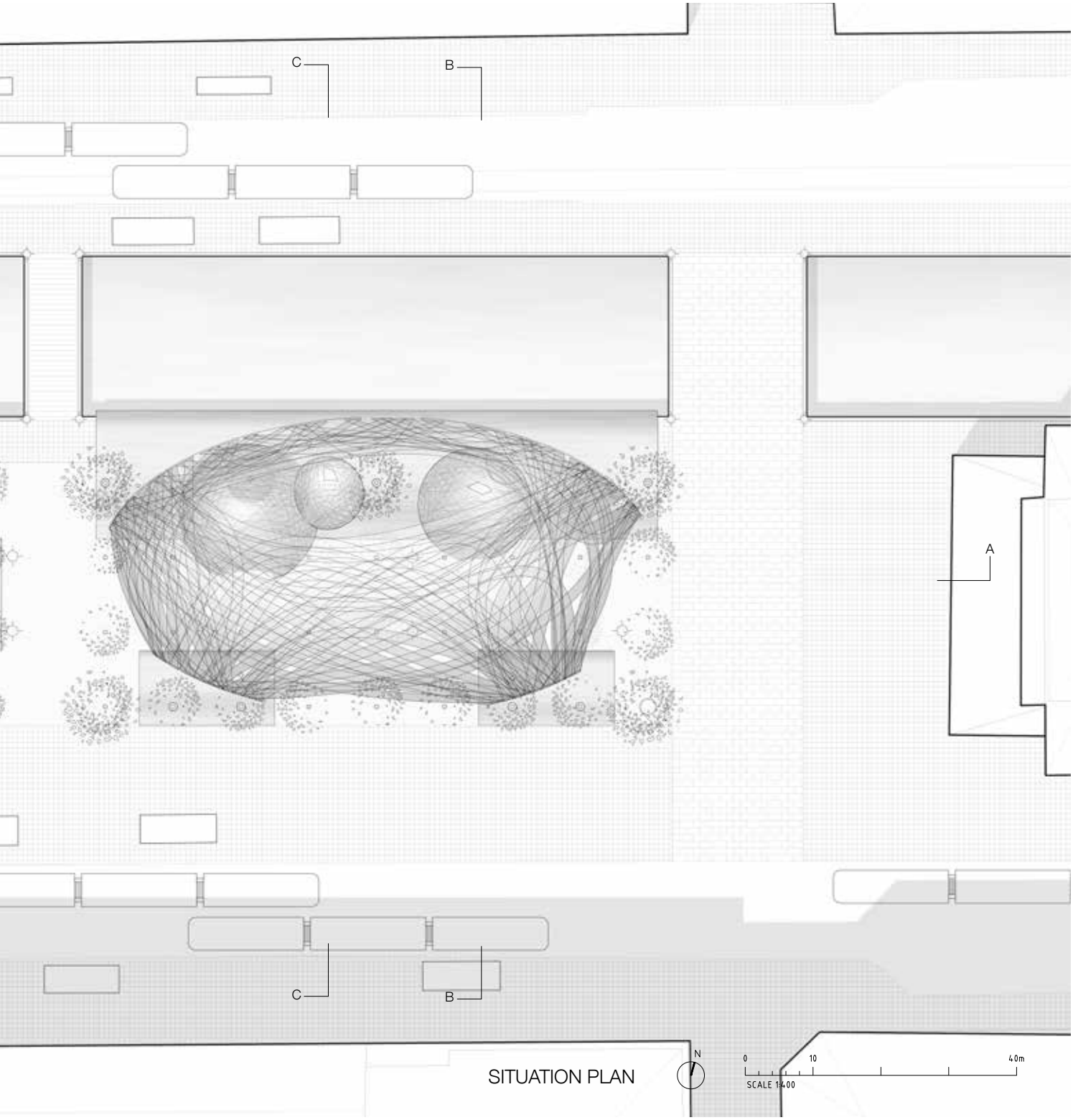
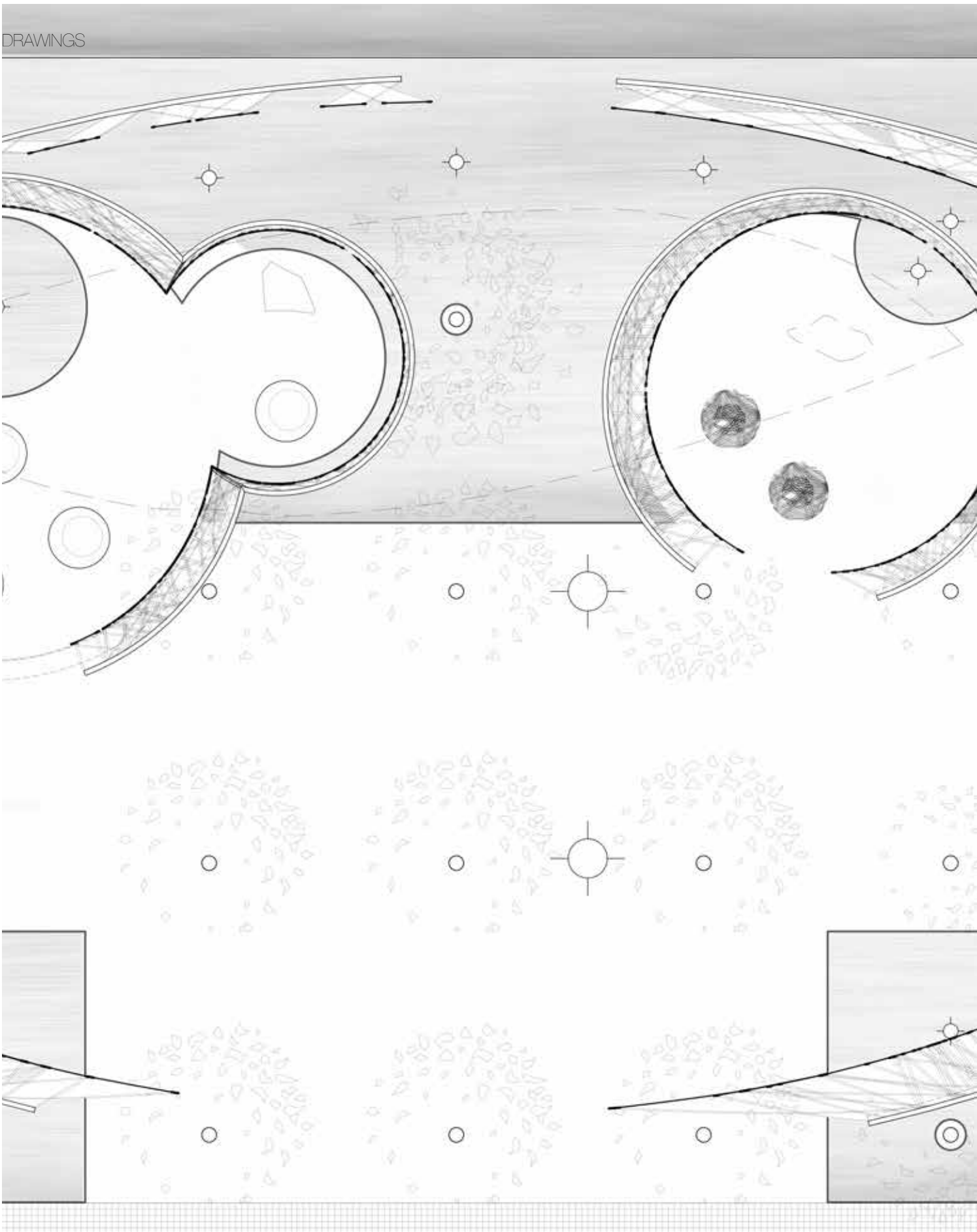
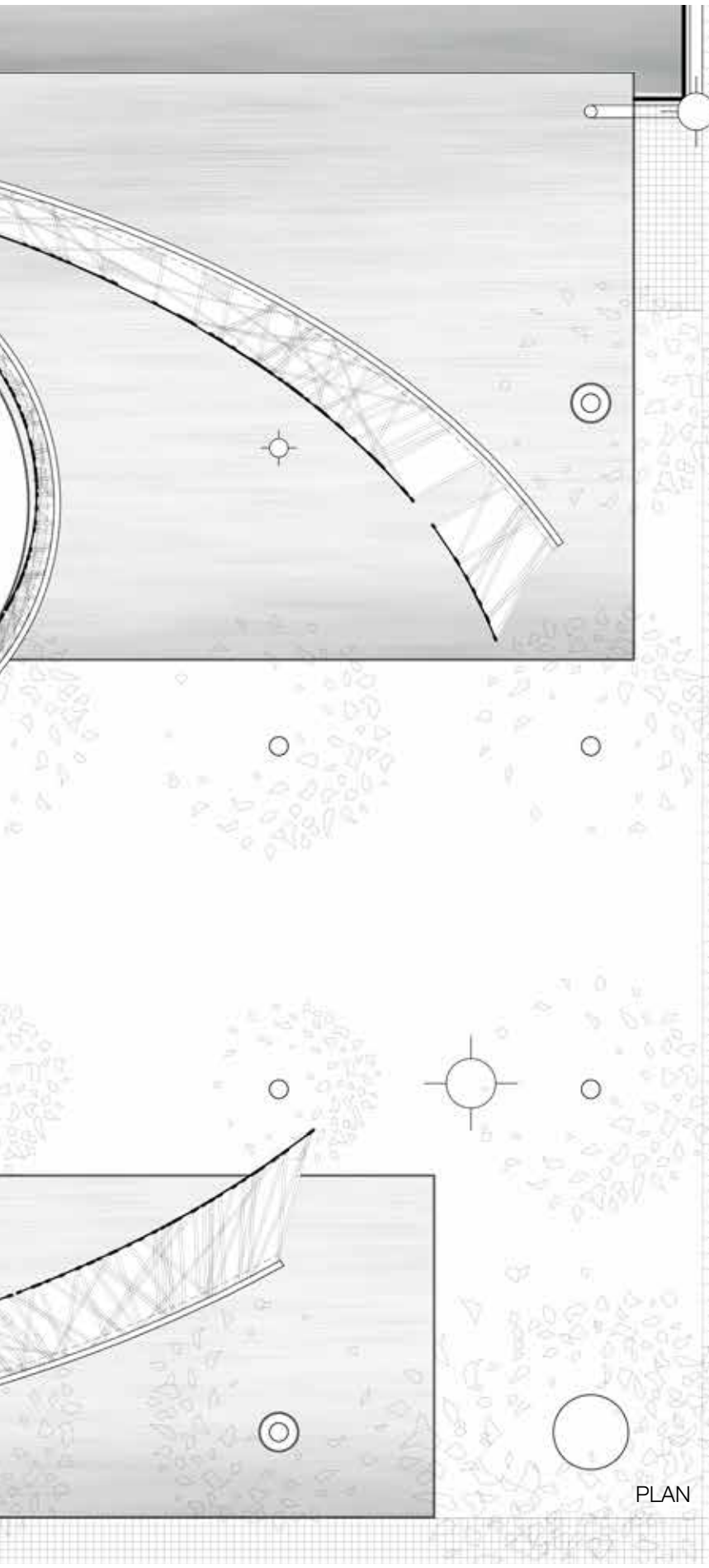
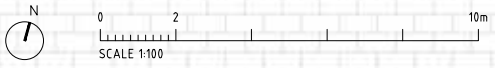


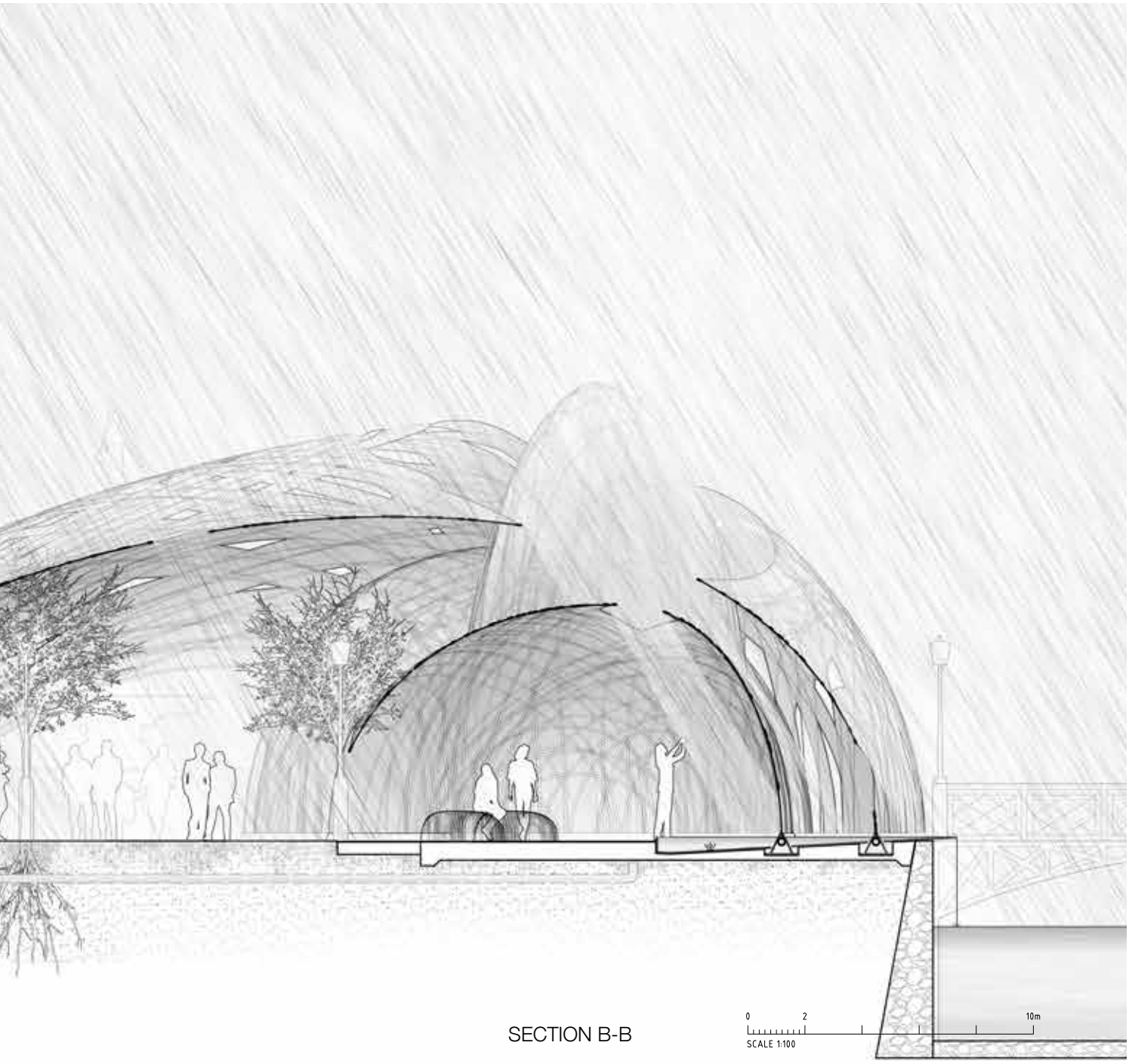
SITUATION PLAN





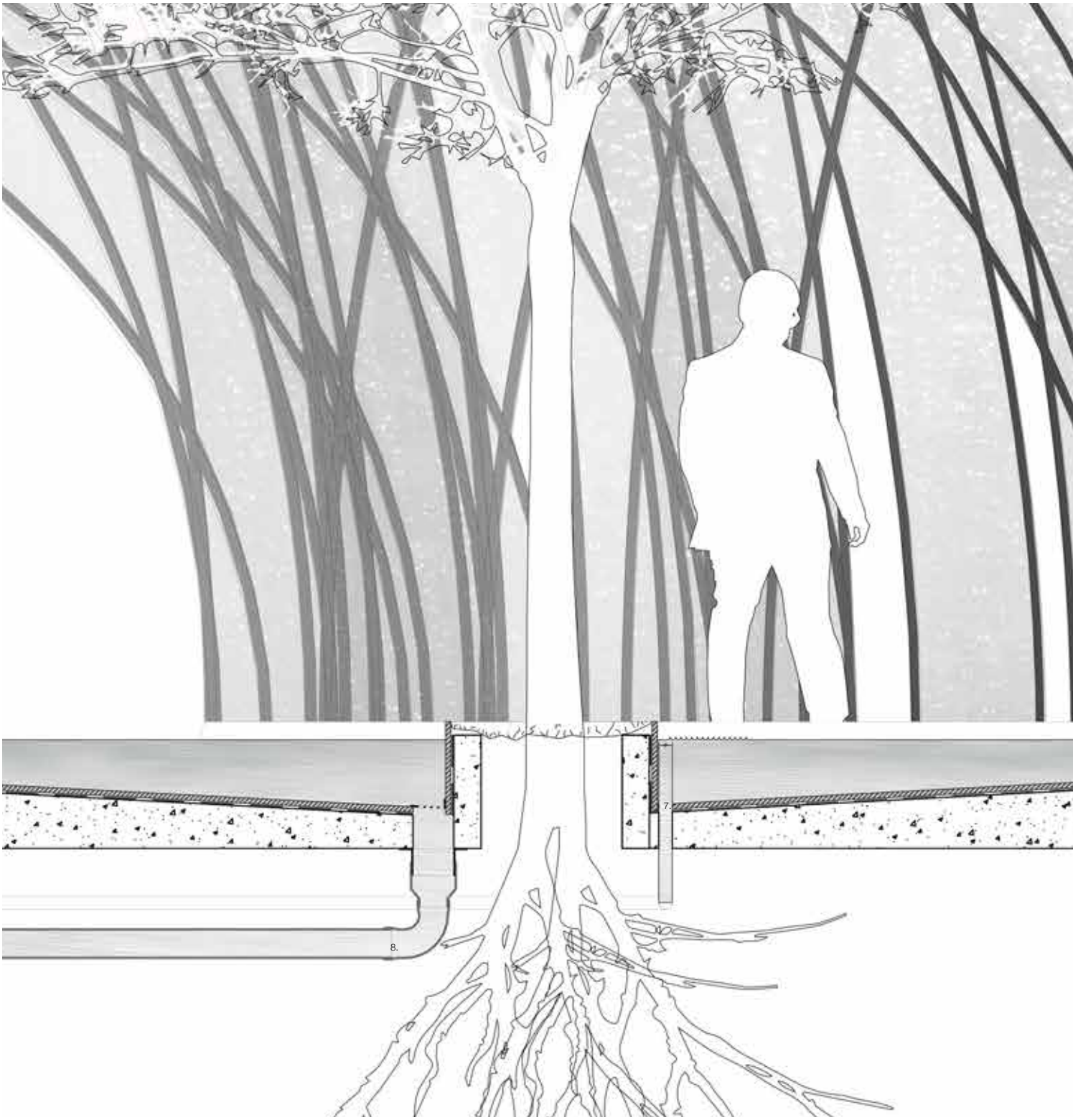
PLAN

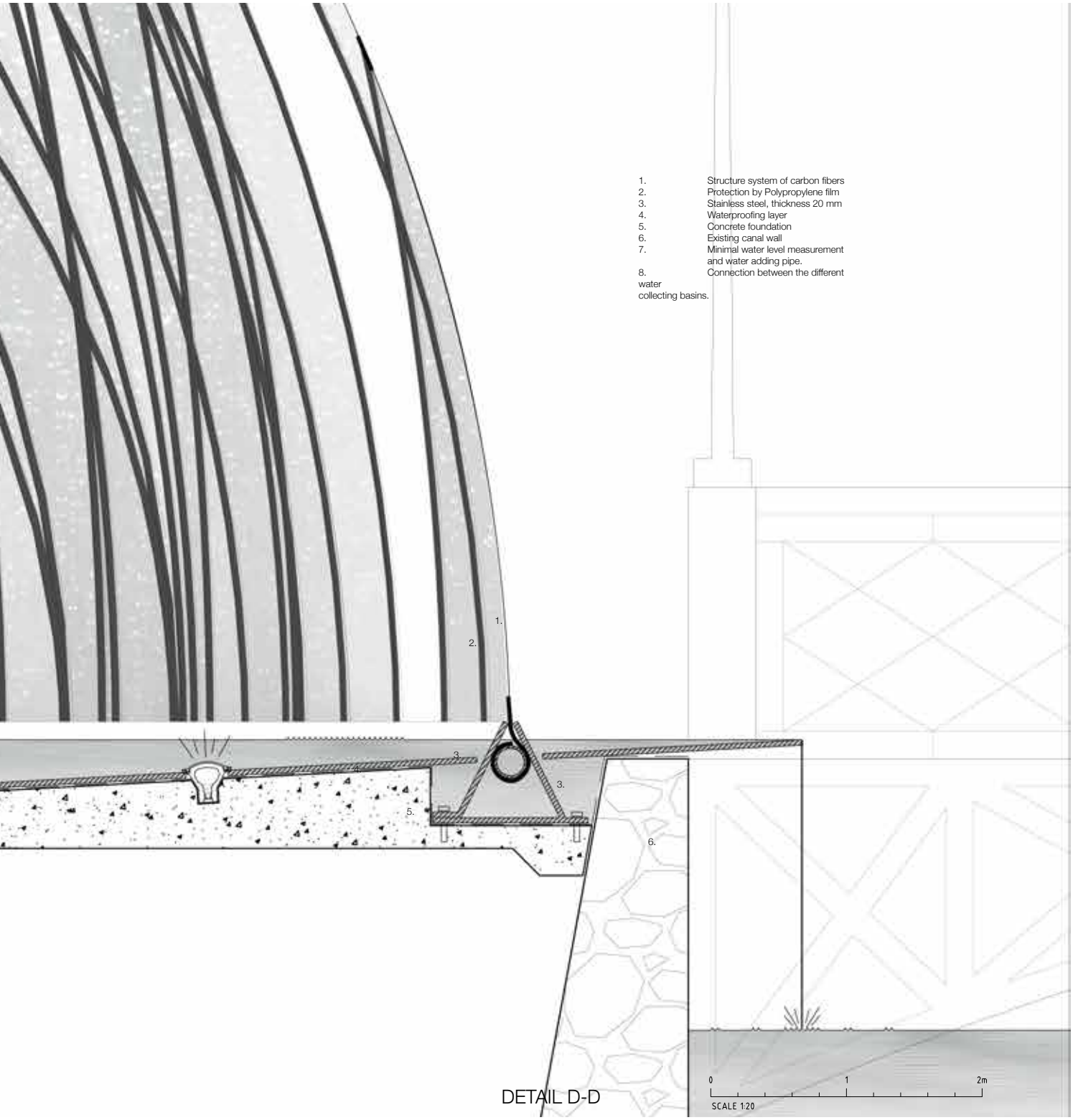




SECTION B-B

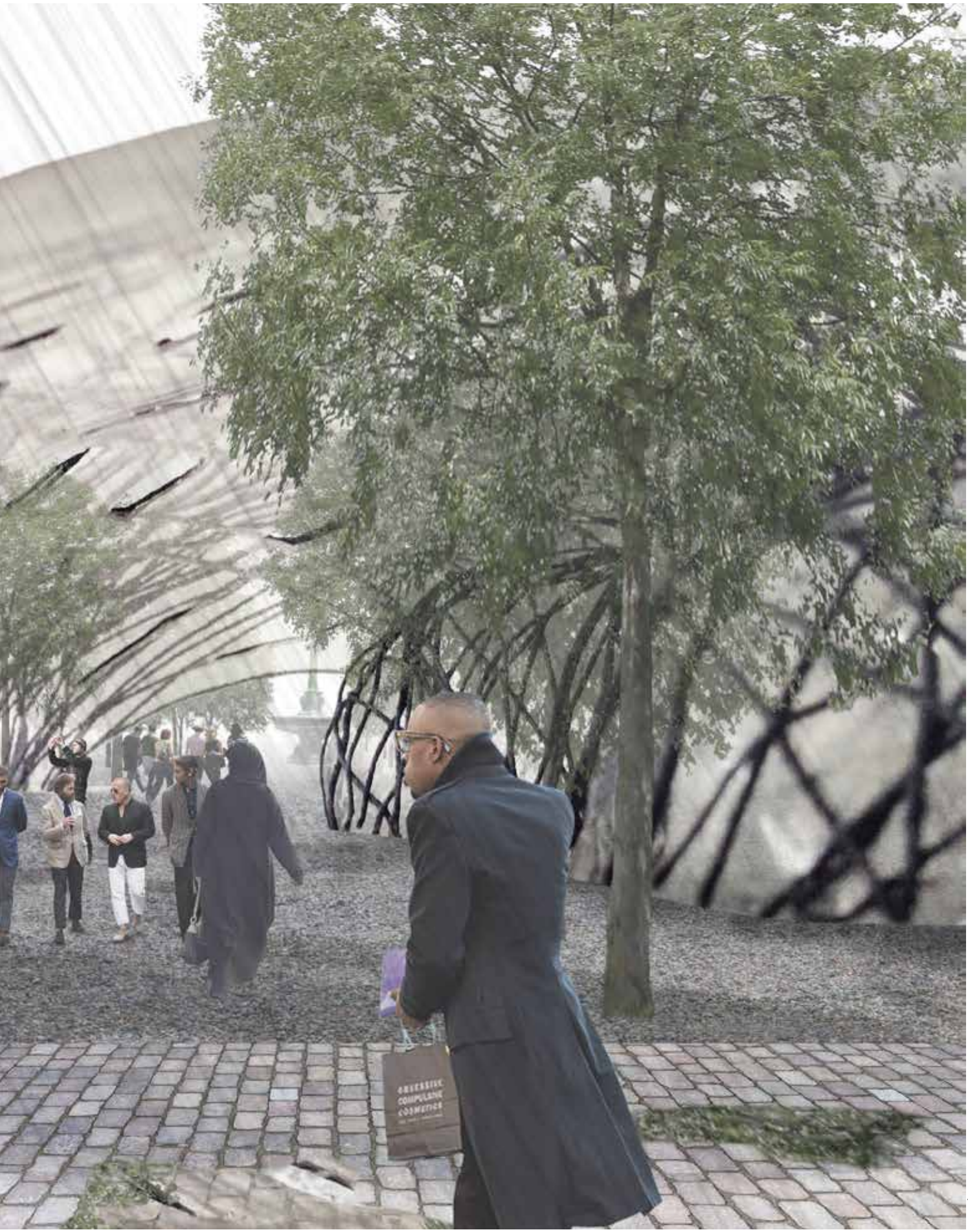
SECTION C-C


7.
8.



1. Structure system of carbon fibers
2. Protection by Polypropylene film
3. Stainless steel, thickness 20 mm
4. Waterproofing layer
5. Concrete foundation
6. Existing canal wall
7. Minimal water level measurement and water adding pipe.
8. Connection between the different water collecting basins.

DETAIL D-D




ARKADEN

PRODUCTION

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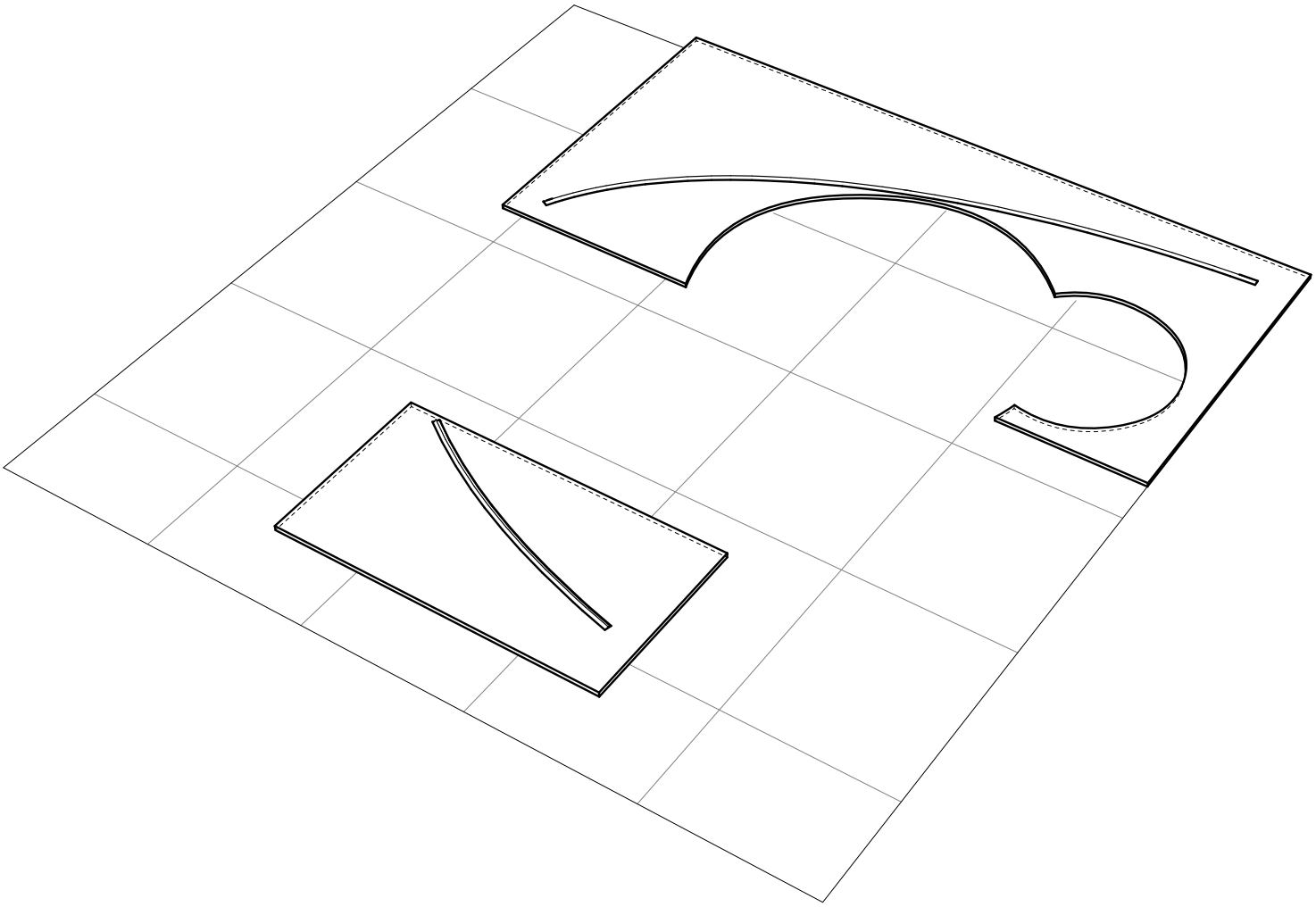
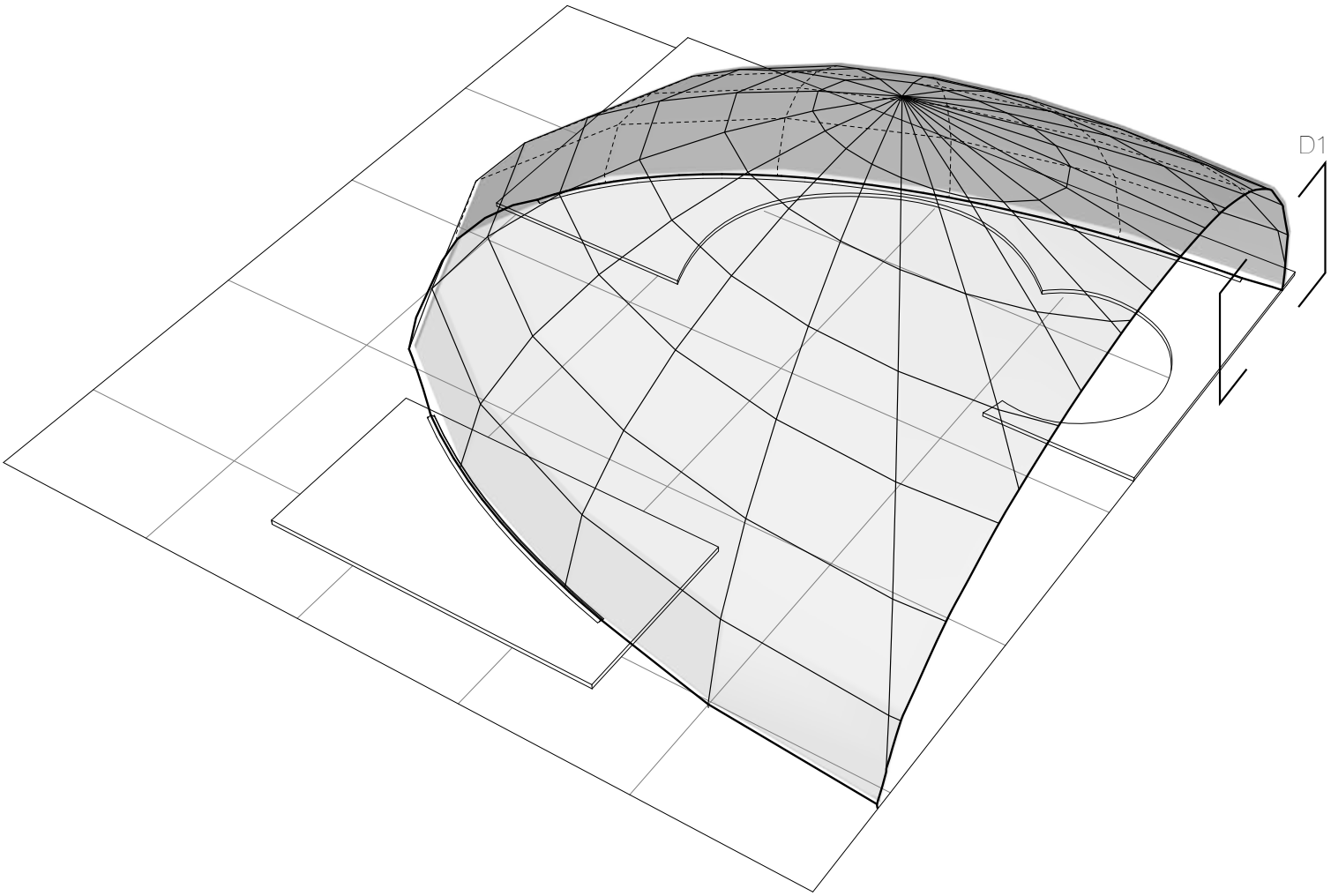


1. SUPPOR IN CONCRETE

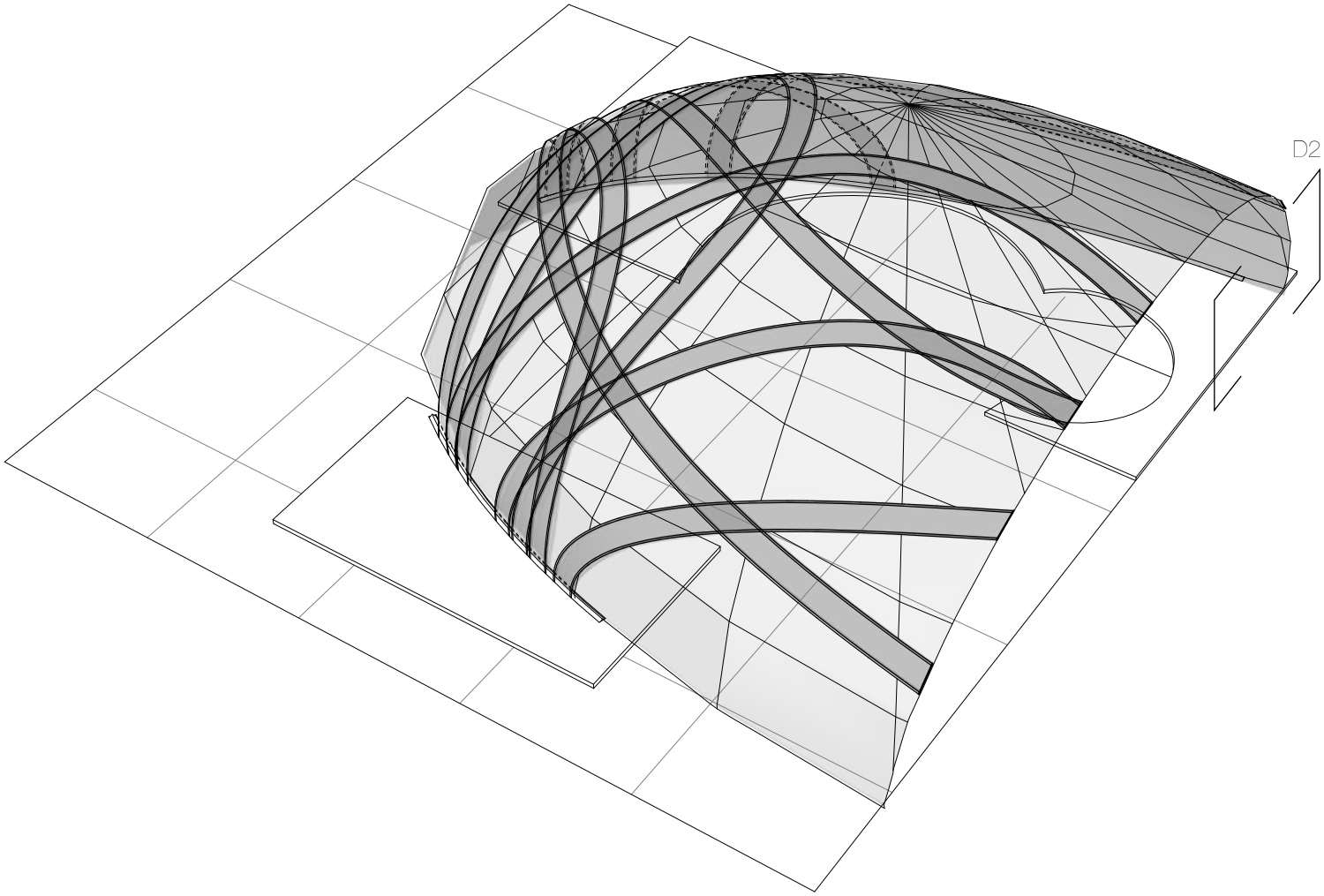
A fundation made of concrete is built on place. (1.)

In the prepered line the first part of support steel structure placed. (2.)



2. FORM FOR PRODUCTION

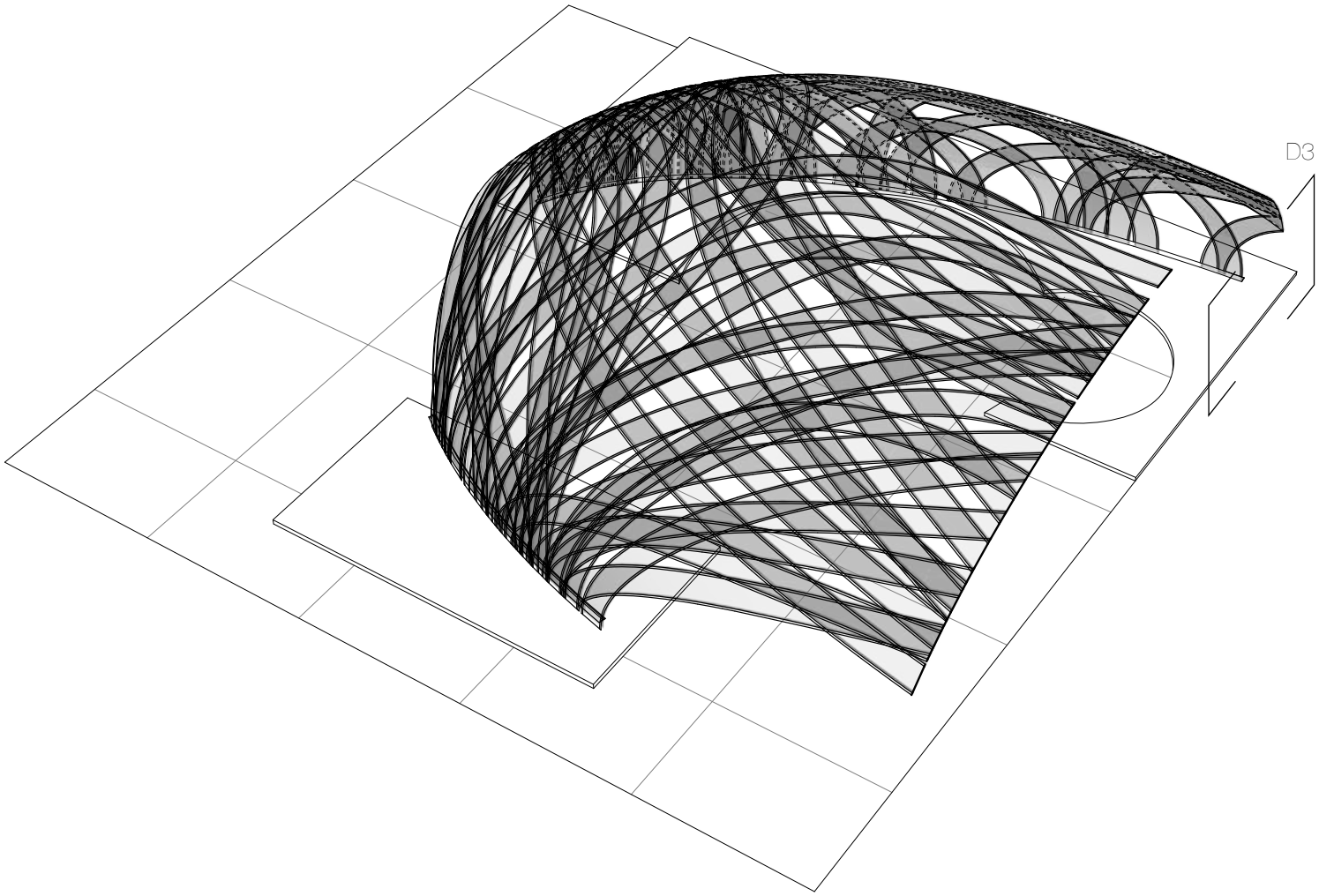
A plastic form of ETFE (3.) is filled with air. This makes the form for the structure.



3. ADDING STRUCTURE OF CARBON FIBRE

On top of the ETFE-form strings of carbon fibre and polysterene (4.) is attached. The strings is following a pattern to cross the privios string with as big angle as possible.

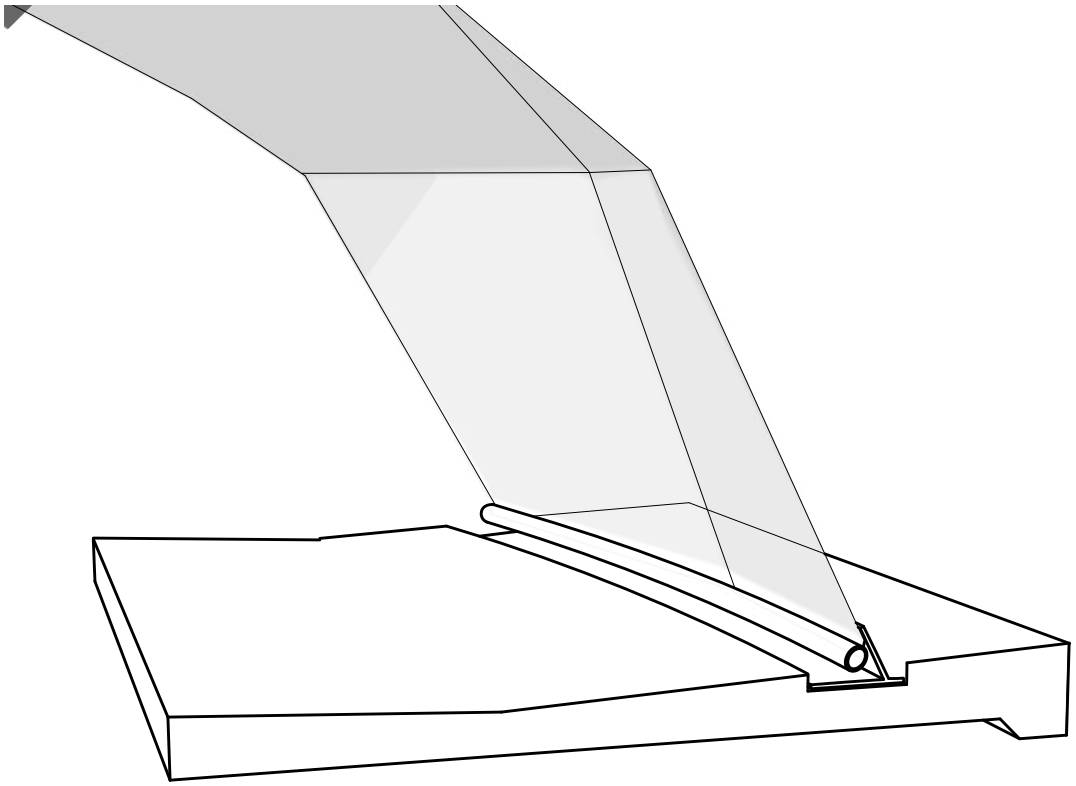
The strings is attached by a robot head possible to move over the current site.



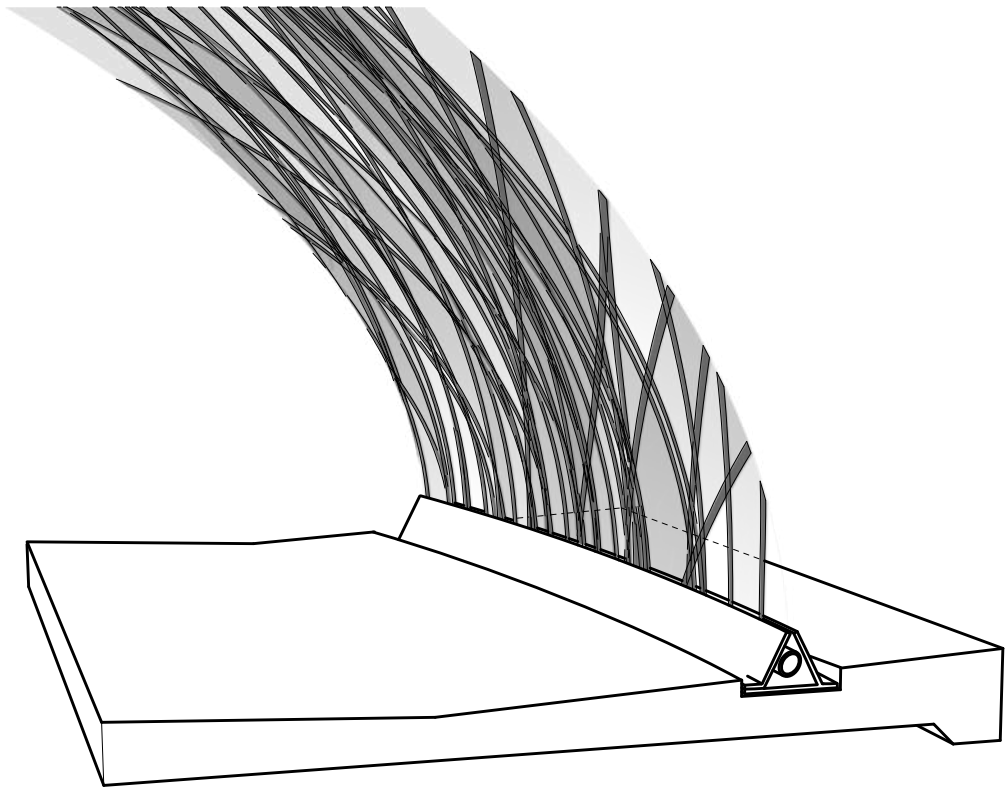
4. REMOVE FORM

The inner part of the support steel structure is fixed to the concrete fundation.

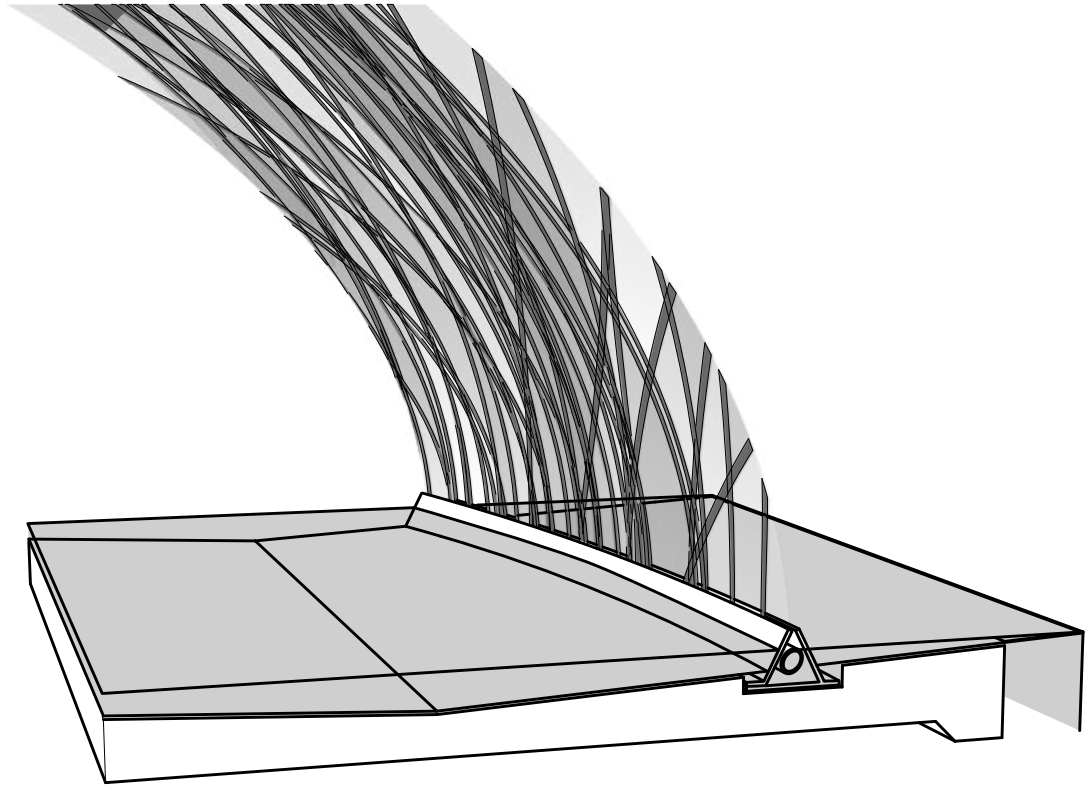
At the same time the form of ETFE is possible to remove.



D1.Support detail with form



D2. Support detail when finished



D3. Warer is filled up in the collectors

MATERIALITY

STRUCTURE MATERIAL

CARBON FIBER

Carbon atoms spun into filament yarns by chemical and mechanical process.

Align atoms in a way to enhance physical properties.

CARBON FIBER-REINFORCED POLYMER

Carbon fibers are used as reinforcement togehter with a composite material, a resin.

The resin is usually epoxy witch is curing by heat.

Extremely strong and light. often used in aerospace and automotive.

PROTECTION MATERIAL

THERMOPLASTIC

To be able to follow the double curved surface the protection material has to be strechable.

Polypropylene film is a thermoplastic material with good optical properties.

MERGING OVERLAPING

The stripes are overlaping that makes it important to prevent the appering pockets where dirt can fix.

The plasic stripes are heated to the right melt temperature so they attache to each other and creating one merged surface.

GROUND MATERIAL

GNEISS GRAVEL

To connect to the rocks in the Gothenburg area the gravel on the site is made of gneiss.

The stone has a well defined differens in colours when it's wet compered to when it's dry.

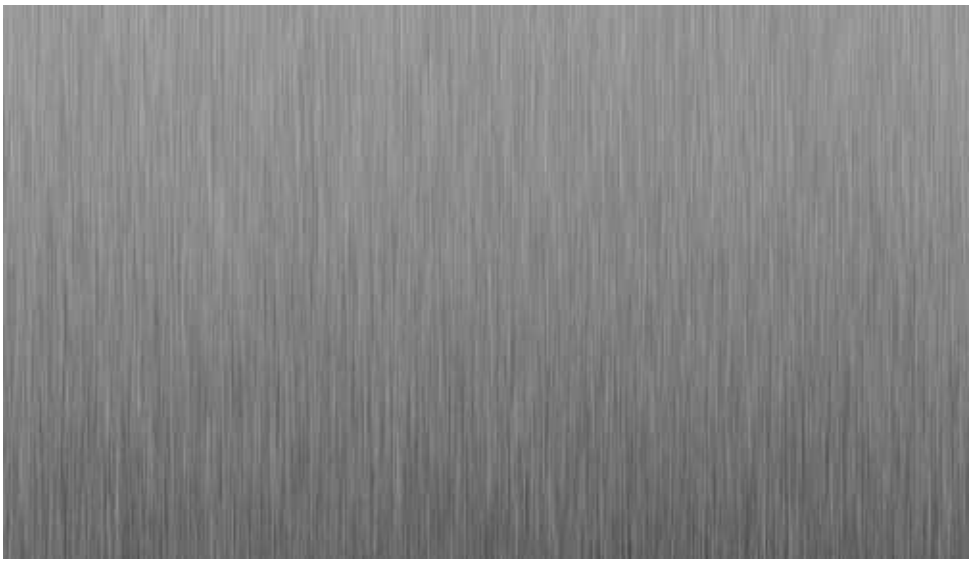
The size should not be too small to make it easy for the rain water to pass throug.

WATER COLLECTORS

STAINLESS STEEL

The structure and surfaces to the water collectors as well as the supporting steel-frame to the structures are made out of stainless steel.

It gives the base for the structure an industrial carachter and harmonize with the gravel.



STUDIE VISIT IN STUTTGART

ICD/ITKE RESEARCH PAVILION 2014-15

ICD Institute for Computational Design – Prof. Achim Menges
ITKE Institute of Building Structures and Structural Design –
Prof. Dr.-Ing. Jan Knippers

STRUCTURE

A EFTE-plastic half bouble is filled with air. From the inside the robot is attaching strings of carbon fibers.

PRODUCTION

To attache the carbon fibers from the inside a six-axis robot is used. The robot controlle the deformation of the plastic bouble and recalculate the path for the current string.

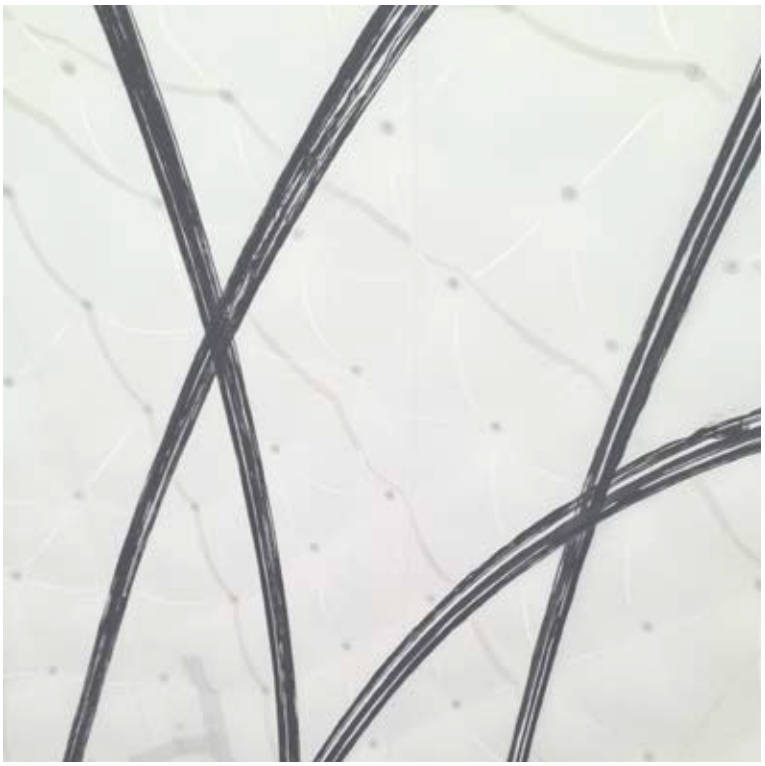
The robot head is unrolling spoles prepared with carbon fiber filament and resin. A glue is sprayed to the plastic surface to make the fibers attach to the surface. When the resin is heated up (outdoor climate) the fiber strings are after four hours hard and working as a structural element.

REPETITION

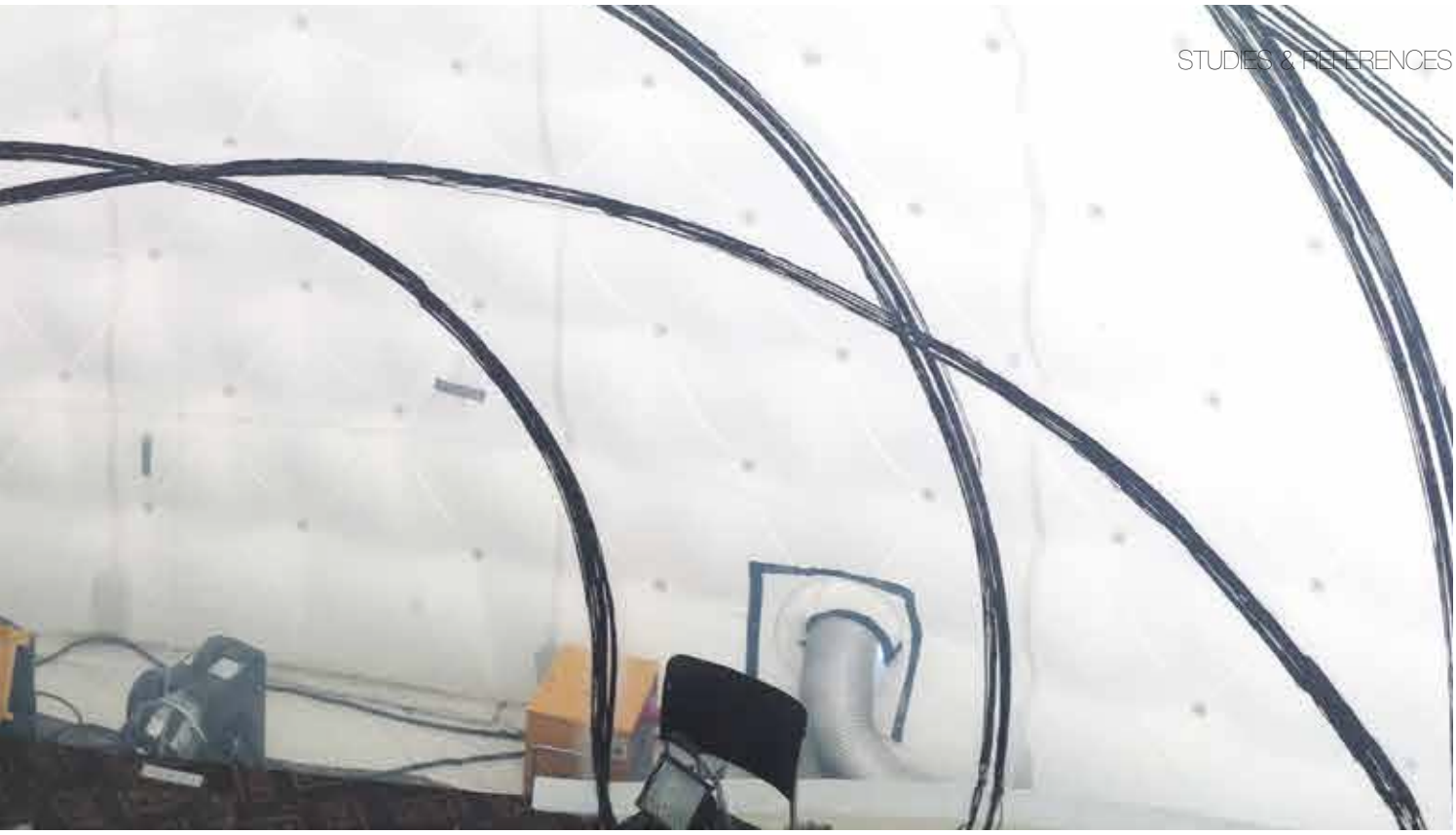
With a small offset distance the robot make several strings that finally build up the loadbearing archs attached to each others.

Inspiration from the Water Spider.

Production of pavilion

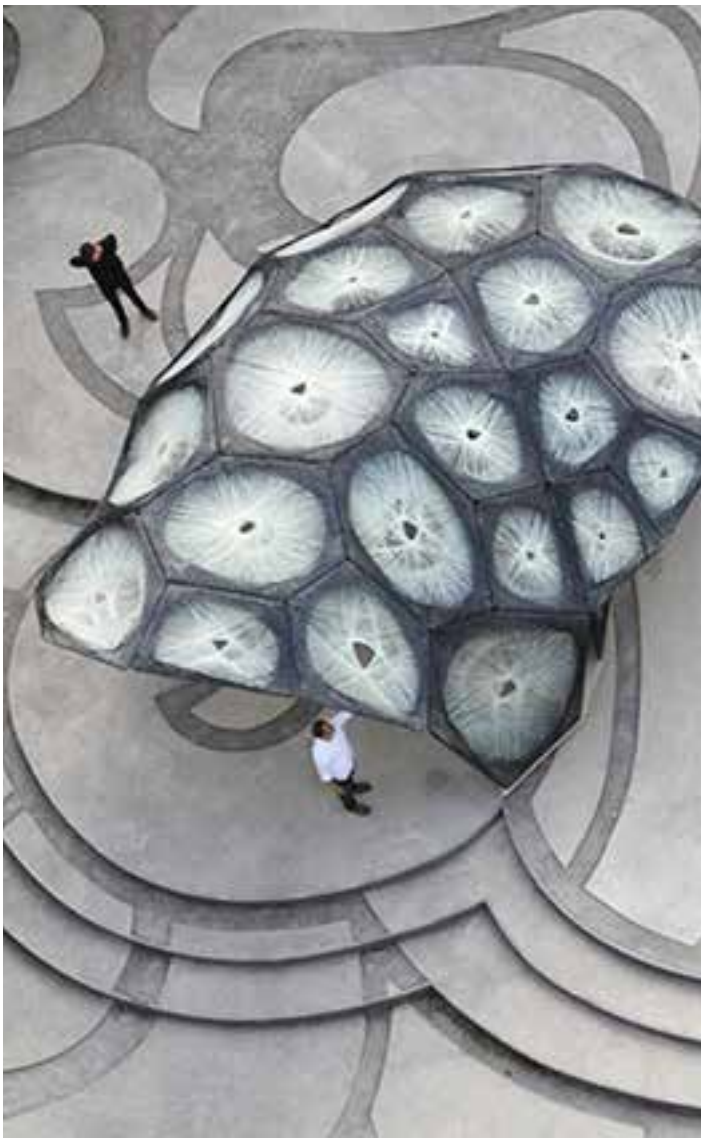


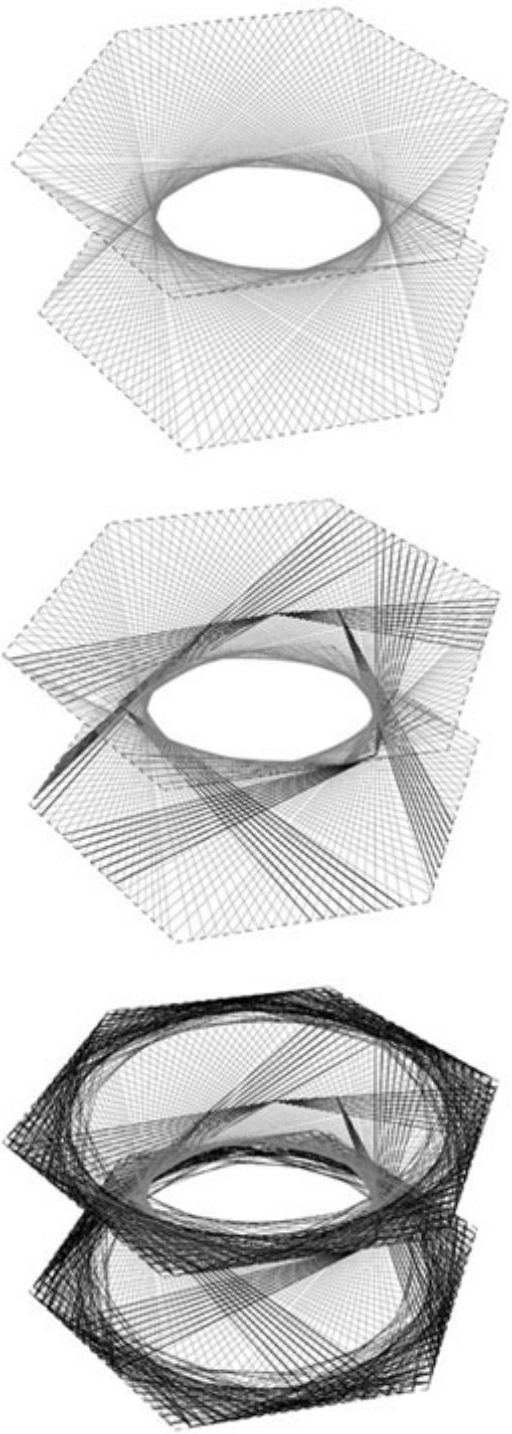
Carbon fiber strings.



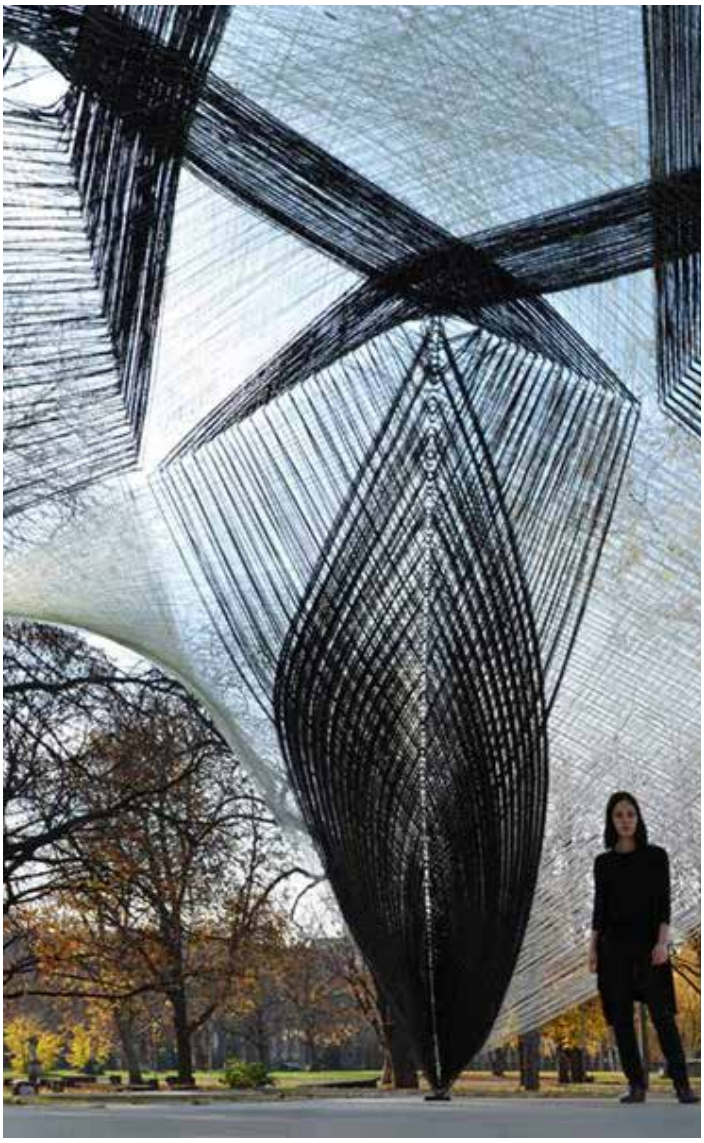
Robot head with glue spray and carbon fiber attacher.

ICD/ITKE RESEARCH PAVILION 2013-14

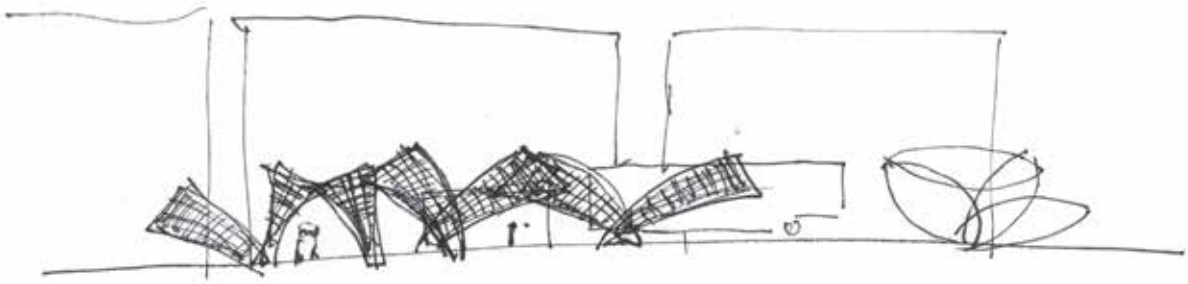


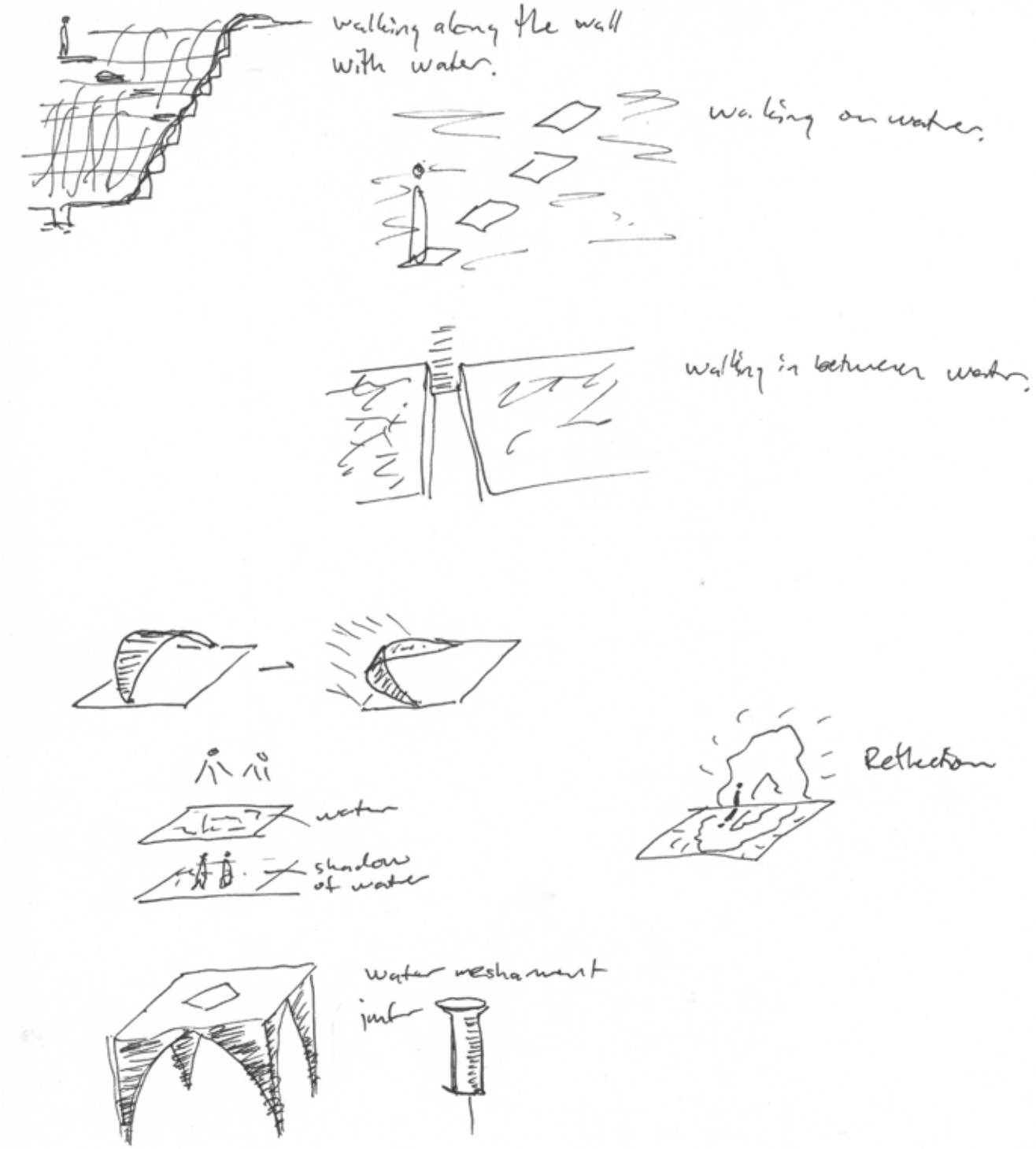


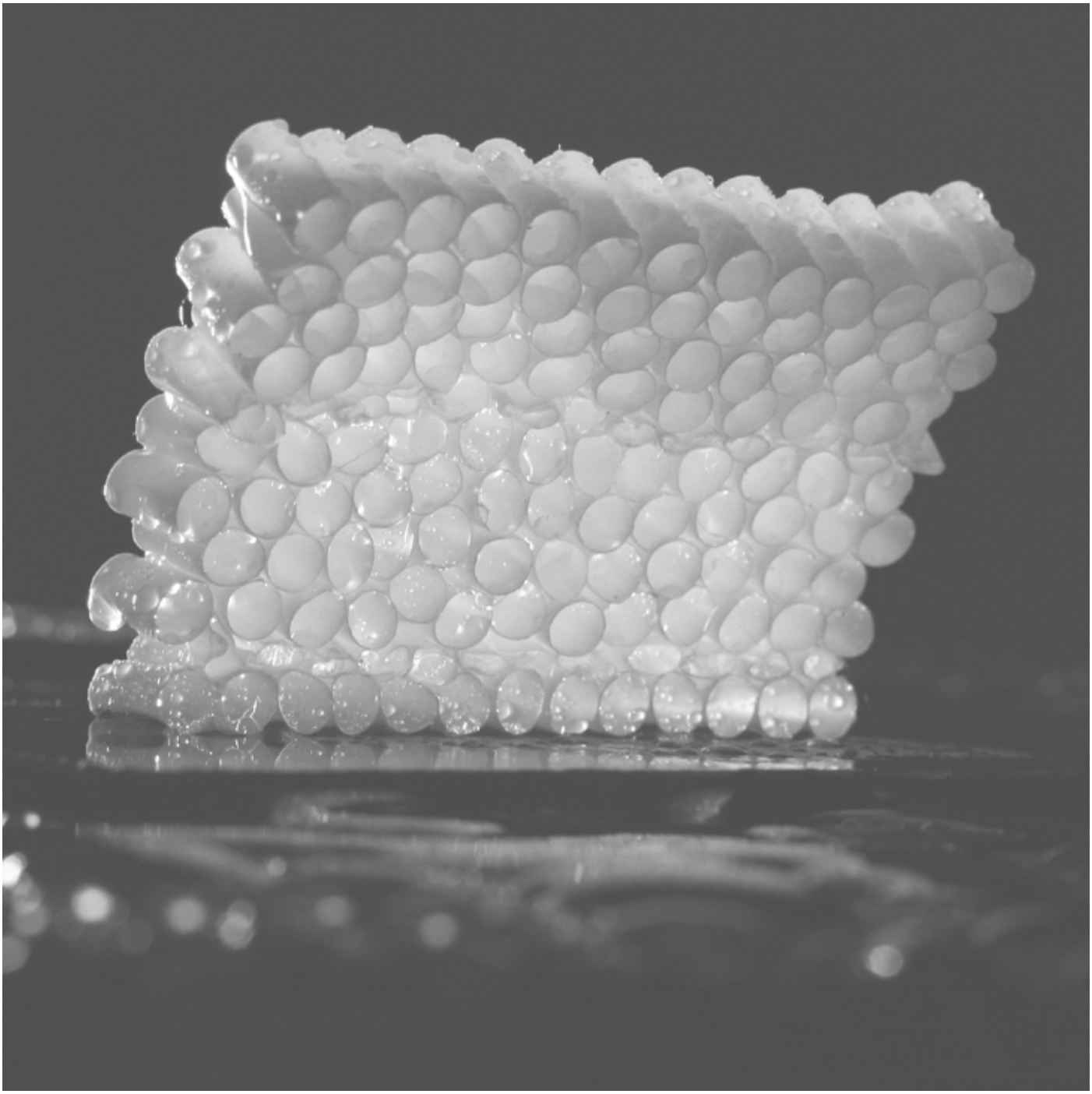
ICD/ITKE RESEARCH PAVILION 2012

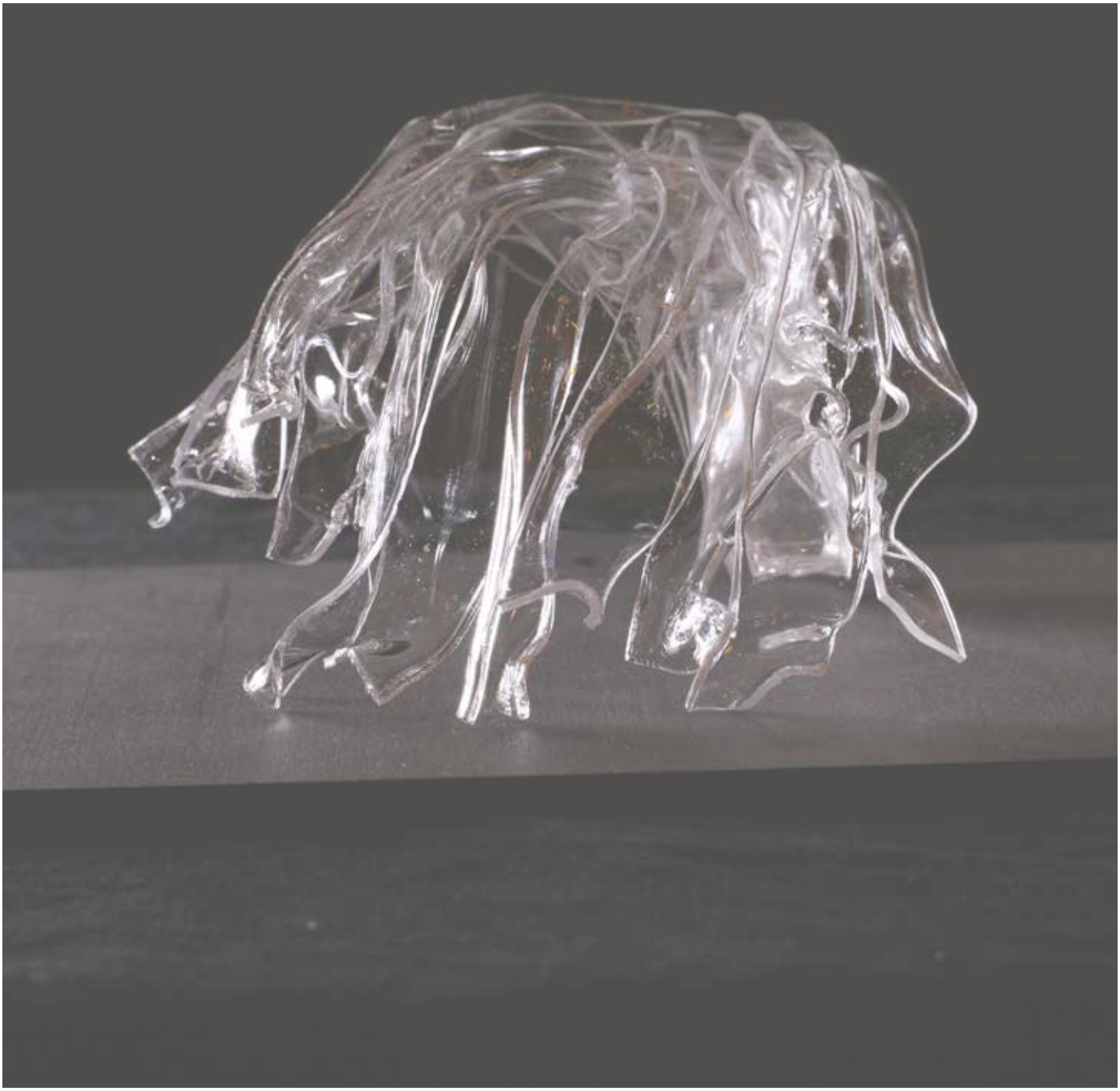


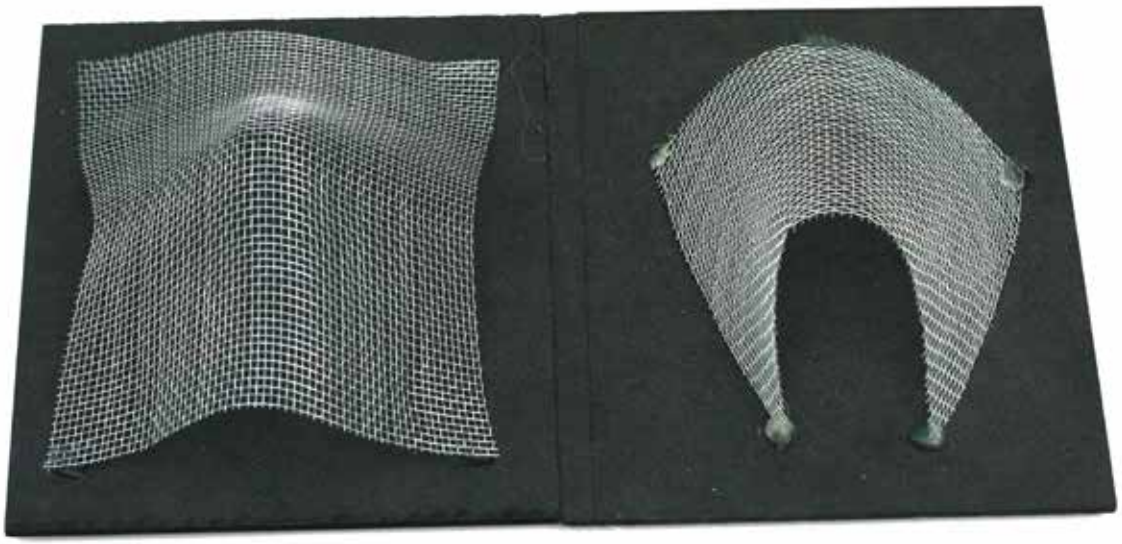
SKETCHES AND PROCES MODELS

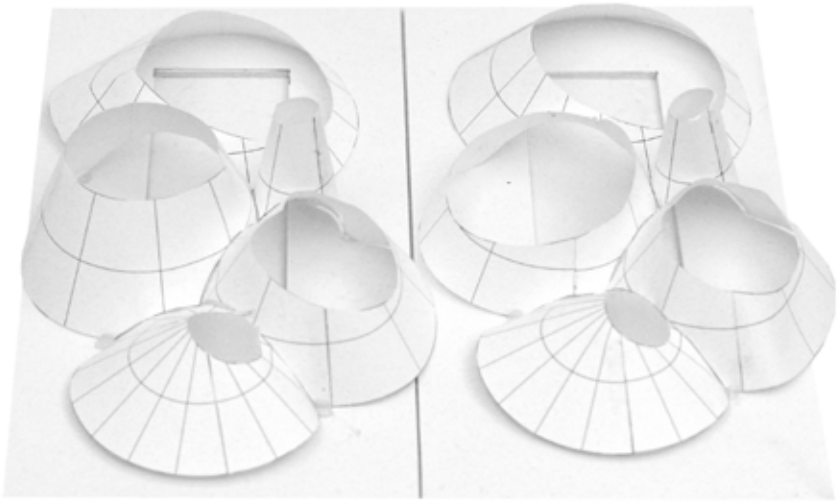


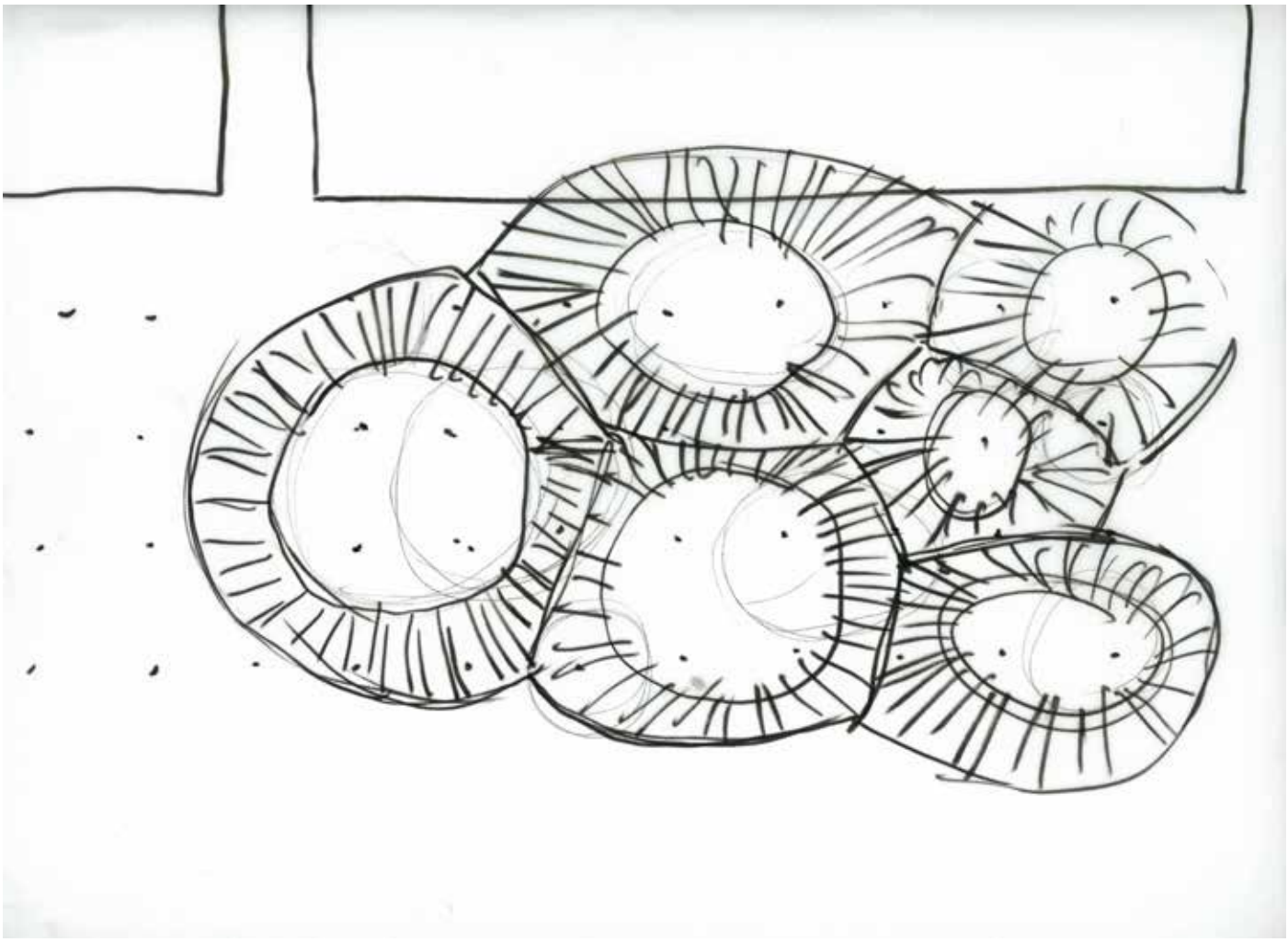

walking along the wall
with water.
walking on water.
walking in between water.
water
shadow
of water
Reflection
water mechanism
inlet

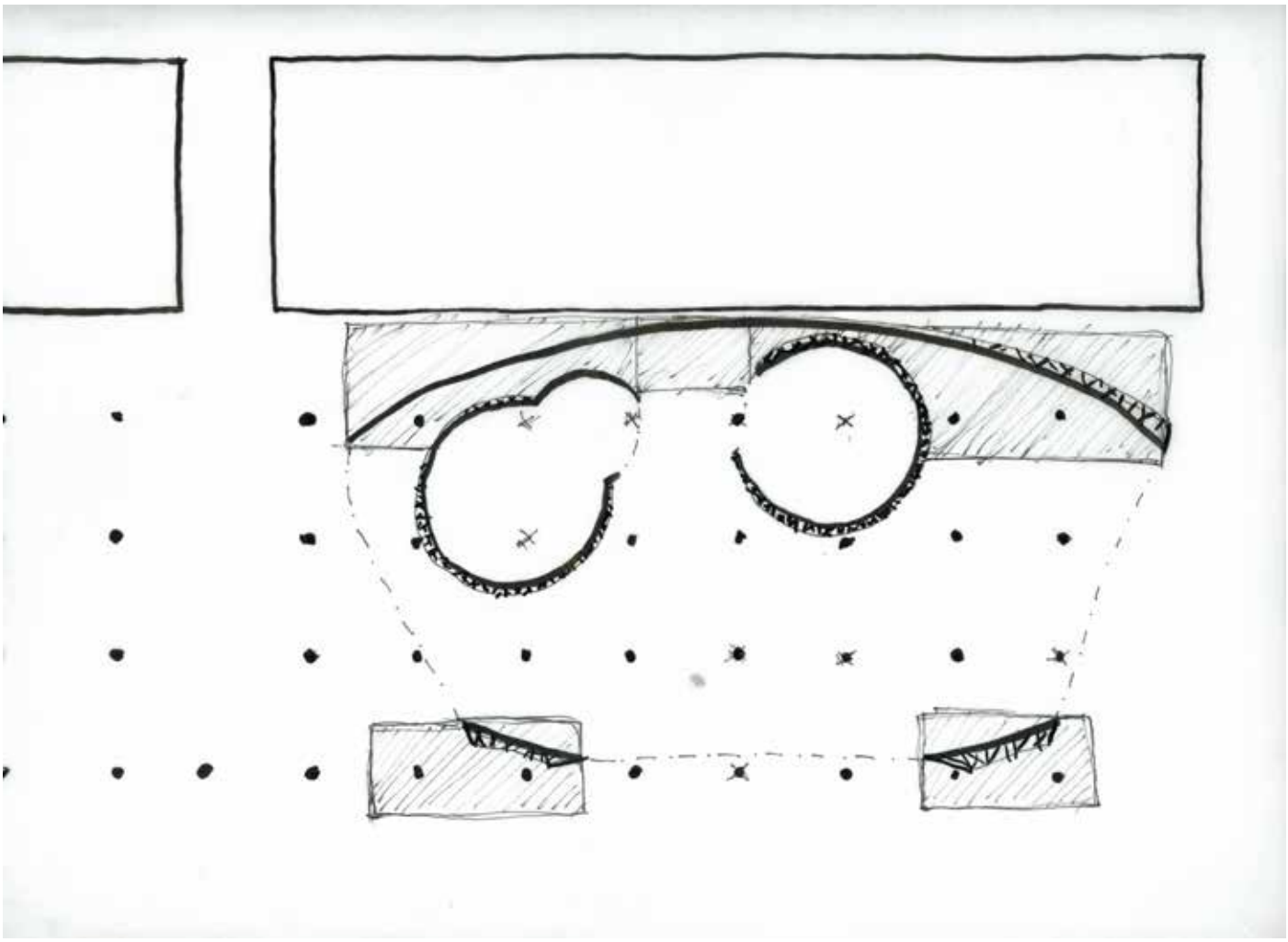


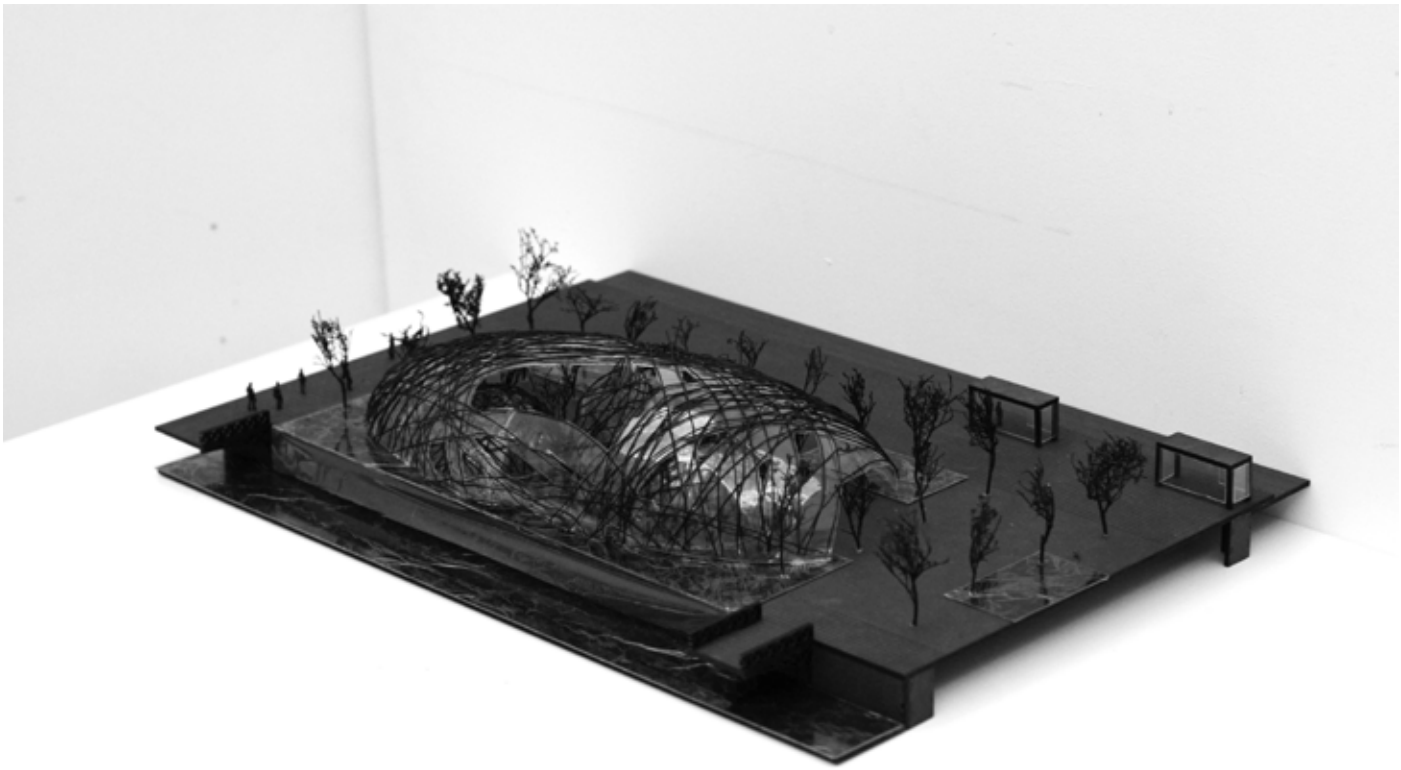


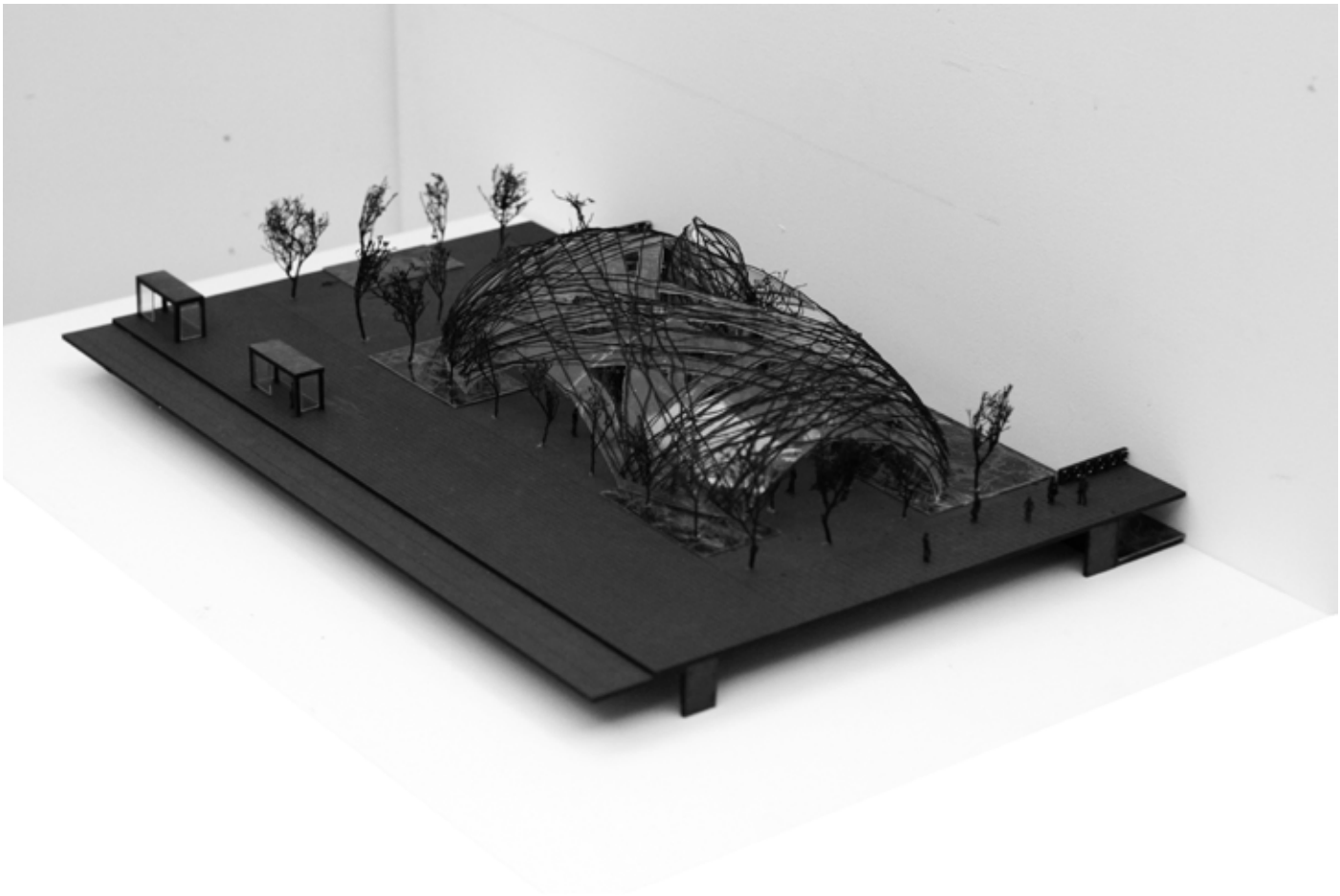


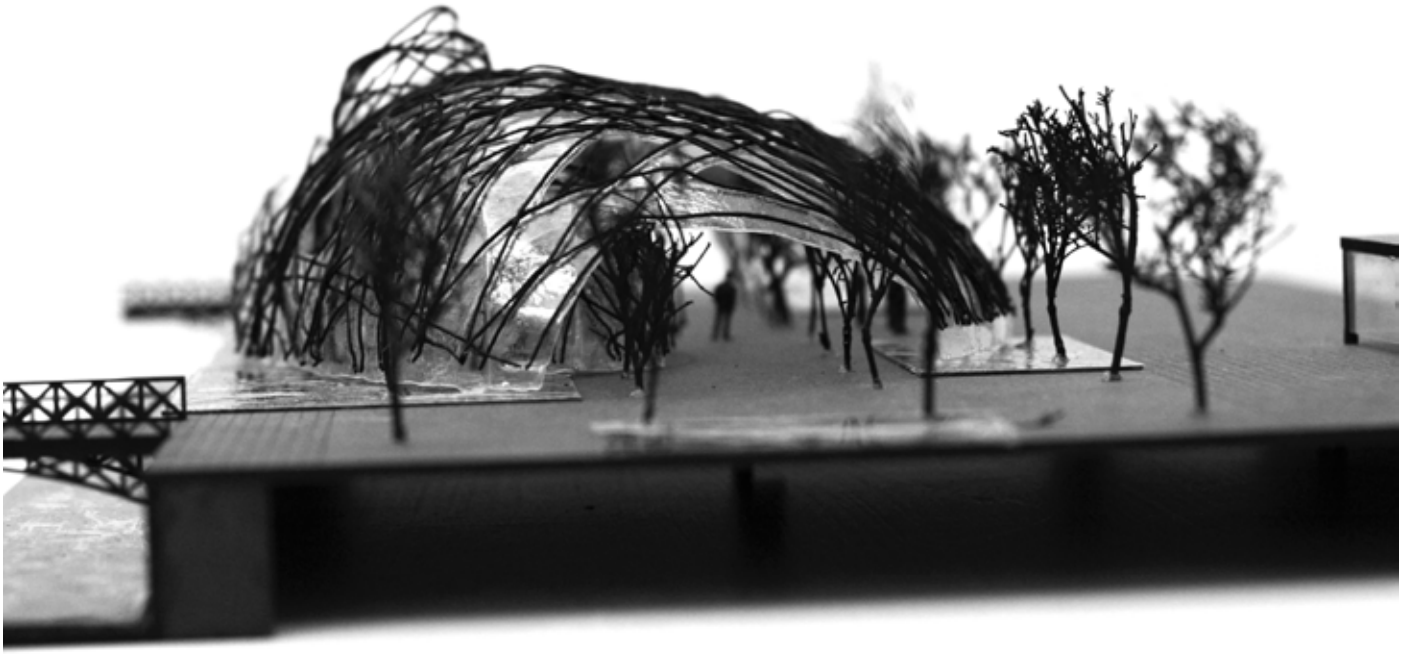


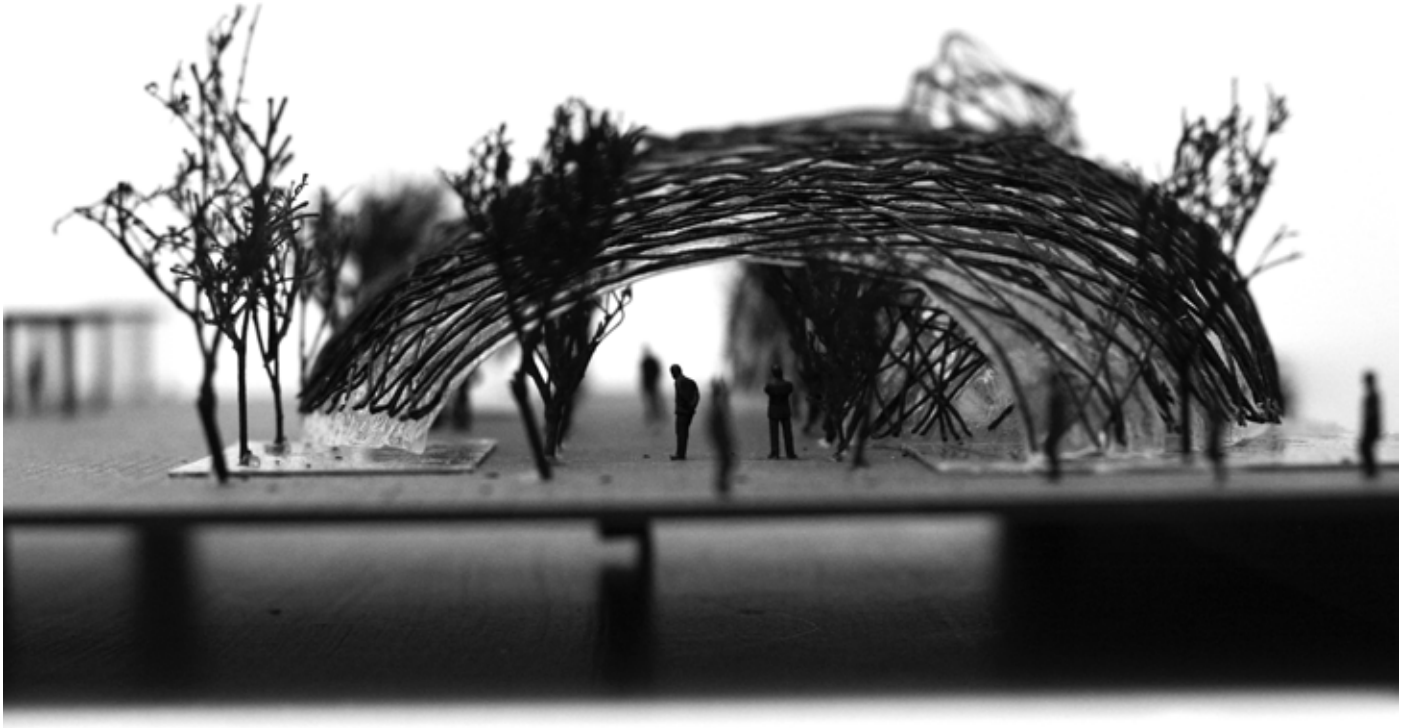












DISCUSSION

The rainy days we have in northern Europe is a challenge to the public space. To create a pleasant outdoor atmosphere challenge the way we design public space. This project highlight that rain could be used as design element.

By choosing a site that originally was designed as a recreational place in the center of Gothenburg but today isn't used the project show the possible transformation. At the site four different structures are placed to create a variety of characteristic spaces. The project is carefully created to emphasize the existing paths crossing the site, the existing park structure as well as the urban context. The addition is giving space where you want to spend a little longer time even though the weather is unpleasant.

The project is developed with the intention to create different characters of space. Space where you just stop for a few minutes and space where you want to spend half an hour. A larger structure provide the temporary stay and a collection of smaller structures provide space for the longer stay.

By study visits and model sketching the materiality and structure was developed. The way of constructing with carbon fiber and plastic isn't that developed within architecture that makes it hard to tell if the assumptions are correct or not. This is also the case of how the materials would work together. For control it hundred percent a full scale model would be the only solution. A full scale model takes a lot of time to develop and that wasn't possible within the timelimit.

In the context of today's architecture that tends to inclose more and more this project highlight a different approach. Complex roof structures and automatic production makes it possible to build large structures and cover, climatise and control the environment we spend our time in. This project is instead a proposal to include what we often don't like, turn it around and create a celebration of the environment we live in.

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CONCEPT

Umbrellas from top.
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Man with umbrella in falling water.
https://www.pinterest.com/pin/295126581808269851/ (2015-05-20)

Man holding umbrella over dog.
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