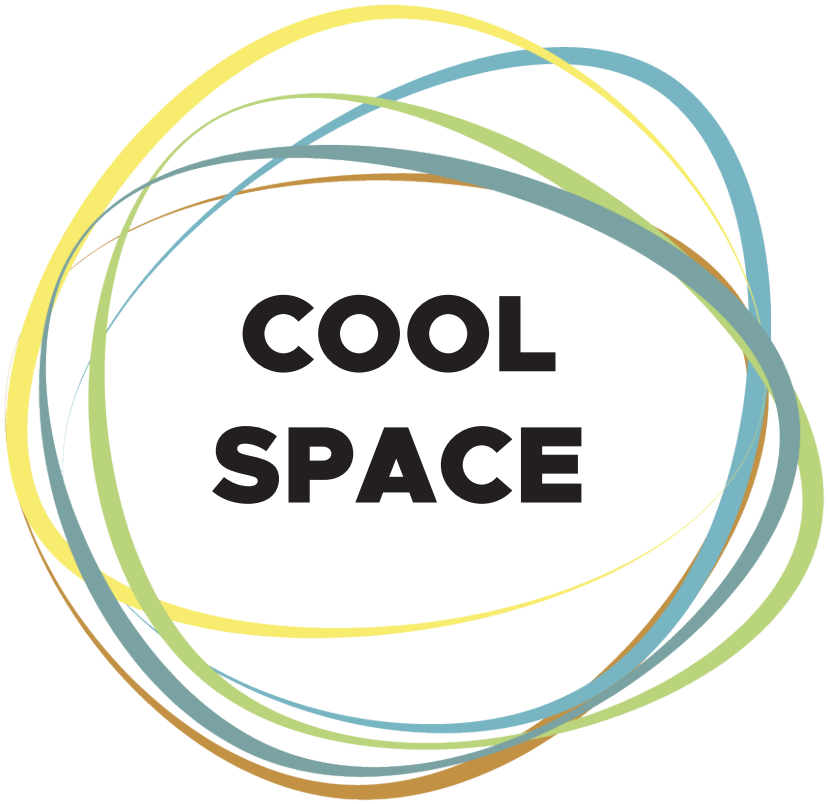


(ADAPTING) DUTCH ARCHITECTURE FOR HEAT-WAVES

WHAT ARE THE APPLICABLE DESIGN PRINCIPLES THAT WILL MAKE DUTCH NEIGHBORHOOD HEATPROOF?

YARA ALNASHAWATI

ESSAY + RESEARCH + LOGBOOK

YARA ALNASHAWATI

2019-2020

CONTENT

COOL SPACE

(ADAPTING) DUTCH ARCHITECTURE FOR HEAT WAVES

What are the applicable design principles that will make Dutch neighborhoods heatproof?

Yara Alnashawati | Essay 2020 MA|U program

Abstract

During the last heatwave that hit the Netherlands in July, the temperature reached 40 degrees, Authorities advised people to stay indoors and avoid exposure to the sun but to tell the truth,staying at home wasn't very pleasant either. Buildings in the Netherlands are not prepared to face such weather since buildings were designed with heat capture (and keeping) in mind.

climatologists have long been predicting: we are likely to be seeing more heatwaves than usual as the planet warms up.

The summer urban heat island (UHI) effect is an abnormal daytime increase in the outdoor urban air temperature
Partly caused by the replacement of trees and other vegetation with buildings, roads, and other heat-absorbing infrastructure.

The project targets the city center of the Huge, one of the most suffering cities in the Netherlands by the heat island effect. The project proposes novel environmentally friendly building materials forming a new typology with climatic and architectural values. Creating shadows over the leftover spaces, covering the existing material that has been used as city floor or creating skins that will mitigate heat islands and create pleasant gathering areas by cooling down the air around the buildings and in turn cooling down the building interior.

Keywords

Heatwave, Micro-climate, Future Dutch cities, Climate change, HumanThermal Comfort (HUC), Urban heat island (UHI),#Bio based Material,#Urban farming. Public space

Hypothesis

A method to compact the heatwave affecting the Netherlands Urban environment, by introducing climatic adaptive systems Inspired by natural strategies,to provide an architecture with optimal heat resilience in its environment by using the merits of forms and environmentally friendly materials.

Methodology

Level I Form

a novel approach to computationally discovered forms; which is harmonized with its environment and driven by material properties. The project proposes architecture as a protective skin adapted to its function and surrounding, as a natural envelope.

Level II Materialization

Employing the properties of new and experimental materials to achieve design goals.
it represents the natural envelope, the first garments, made of (animal) skins, protected humans against hostile climate.

Challenge

The KNMI* expects that when your children are old, The Hague will have a climate comparable to the one in current in Bordeaux, France. For large parts of the year, that prospect might be pleasant for some. Things are different during hot summers. For young children, the elderly, overweight people, people with medical conditions or illnesses, heat can be heavy or even downright harmful.

Heat-waves Impacts urban areas were exacerbated by an urban heat island that raised nocturnal temperatures by more than 2 degrees Celsius.

Roofs and pavements comprise over 60% of urban surfaces in some cities, On a sunny summer afternoon, these typically dark, dry surfaces get warmer in the sun and then radiate that heat into the air. The air in nearby rural areas tends to be cooler because the rural surfaces are more reflective (absorbing less sunlight) and wetter (dissipating some solar heat gain by evaporating water).

This excess in urban air temperature over rural one on a summer afternoon is called the summer urban heat island (UHI) effect. Other contributors to it include human activities that warm the outside air, such as air conditioning, industry , and transportation to name a few. This UHI can increase energy use (increasing the UHI effect in feedback loop), degrade air quality and aggravate heat-related illnesses in our cities. trending solutions nowadays revolve around bringing the forest into the city, I think we can take it even further, in an era of housing- shortage, space leakage.

Site

The Hague is applying a new building regulation in 2020, which is to have public cool spots every 300 meters around the city.

"The heat island effect in The Hague is real, Heat in a city is determined by the use of space and the main factors that cause problems are: a lot of paving, little vegetation, low albedo value (a reflection of sunlight), limited sky view, little surface water and a lot of building volume." according to the report Haagse Hitte by researchers Frank van der Hoeven and Alexander Wandl, March 2018

For reasons listed above I chose The Hague as an urgent case for intervention, closing in the warmest (300*370 m) block of Kortenbos neighborhood in the city center during a heatwave, it suffers all the factors that cause the Urban Heat Island.

The block residents are97 percent of families. The Buildings' functions are mainly residential housing, Curacao embassy, and Weinstein Hospital. Leftover Spaces are dominated by parking for hospital visitors.

The block situated at the intersection of main crossroads with four car lines, two trams, two bicycle paths, leftover spaces between buildings is used as parking lots all that leads to the aggravating of the heat island effect.

Residents and hospital workers do not have sufficient areas for social gatherings and outdoor activities. kids from the residential block told me that "There is limited space to play beside it is so hot here during summer we would rather play indoors" I asked the workers at the hospital where they spend their lunch break and whether they go for a walk after? They told me that they have lunch at the hospital cafeteria and if they want to socialize and enjoy the nice weather they go to the smoking area by the hospital entrances, hospital balconies are off-limit since it's locked duo to threat of some patients committing suicide.

I investigated the hospital performance and went through people's reviews on the matter. the majority of the complaints were over the edgy and rude behavior of the doctors and the rest of the staff. In my opinion, it is related to the isolated, over-controlled climate they are working in. they have minimum connection with nature (Light,fresh air,Vegetation….etc).

Hidden processes

"The sun is free, the light is free," Said Shelley McNamara" the architect can affect the way someone feels by manipulation of light"

light and shadow are part of our building environment, it forms our usage/ movement/ behavior of the space by seasons. People love to sit in the sun during winter, Spring, and Autumn and avoid it during summer.

As I am designing a hanging protecting structure on top of roofs and leftover spaces I think of the design that will be drawn by its shadow on the protected surfaces(Buildings, city floor, and interior spaces). Shadow is moving design, light, applicable on any surface, the shadow spot creates its own climate despite the weather around it, it is always cooler.

"Providing shaded pedestrian paths and walk-in cool water ponds will mitigate HUI effect, " Laura Kleerekoper advises.

Water reflects its surroundings in blurry and unexpected contexts similar to how our memory works, Therefore, I want to repeat the process of struggling to complete a picture of our past moments, to bring attention to an architectural moment around us by water surfaces that capture our eyes to pay attention and be curious about the historical values of buildings in the neighborhood.

Water is an effective passive element to cool down space under certain conditions. Water has to be cool, clean, and accessible people. In Kortenbos there are two ways of bringing water to leftover spaces, first water from close by channels however water channels are not protected from the sun during the heatwave so it might get hot and not be suitable for cooling down purposes .The Second is rainwater harvested in winter and stored in underground pockets since the ground beneath has a relatively lower temperature around 18 Celsius around the year, rainwater channeled into underground pockets solves flooding problems the cities are suffering from, stored water could be used to irrigate trees and vegetation on the site during summer and fill up shallow water pond around the site.

Wind during heat waves is very slow 2.5 to 5 m/s . " You cannot depend on the current wind because it is too slow to mitigate UHI, you have to accelerate/ create airflow using passive ways of ventilation" Laura Kleerekoper advises.
She performed a wind simulation comparing dark and light colored materials under heatwave circumstances, and she found out that the darker material absorbs the heat and transfer the heat to adjacent air layers, air pressure get higher accelerating micro airflow while the lighter reflected solar radiation and got cooler, adjacent air is cooler, air pressure is lower, pressure difference creates micro airflows in front of the material. She thinks this principle could work in a vertical position around urban space.

Regenerate

Bring memory back to the future and connect people to it.

I believe people have to know about the history of their neighborhood and strongly connect to it in order to motivate them to take care of and enhance their neighborhood together. Therefore the new structure I introduce to the urban spaces respects the valuable historical elements around the block whether it's a building or a tree and slows down the city's hostilities around it to create serene moments as memory would be and open up a future insight to the next generation by experiencing the past.

Create a journey

A Rout of moments to reconnect people to nature in their city.

Humanity is separated from its mother nature and brought into an intensive urban lifestyle,much faster than our body can adapt to the changes in its environment. We are using a body as a tool that fits in the slow wildlife into hectic rapid urban life.
As a result, in the 21st-century challenges such as depression, anxiety and obesity become very common. In my opinion, architecture has a big role to fulfill, since architecture shapes our daily behavior and affects our connection with our surroundings (with people, light, water, animals, material, vegetation...etc) on many levels. Therefore, the project proposes a moment of reconnecting with nature while doing our daily routine inside the city , a moment to enjoy water full in our way to work, to rest under a tree during lunch break or share book with a friend /stranger and have a cup of coffee to talk about it all in one place right on our doorstep.

To sum it up, cool space proposes architecture design that manipulates natural hidden processes to create pleasant and thermally comfortable urban space for humans.

Literature

Academic paper

01. Dr. L. Kleerekoper, R. Loeve, J. Kluck, Climate-proof retrofitting of urban areas for the same cost, Feb 2019.
Focused on how to retrofit characteristic (Dutch) typologies of urban residential areas in a climate-resilient way.

02. Arch. R. Alnashawati , Sustainable design principles of high rise building, Master thesis, 2009
the sustainable architecture principles of the Damascus house.

03. Dr. ir. J. Kluck, dr. ir. L. Klok, dr. ir. A.Solcerová, dr. ir. L. Kleerekoper, dr. L. Wilschut, dr. ir. C.Jacobs ir. R.Loeve,Mei 2020 Een koele kijk op de inrichting van de buitenruimte De hittebestendige stad.

04.Dynamic Space frame structure,M.A.P.M. (Michel) Buijsen Delft, 2011
The graduation research focuses on dynamic space frame structures, a highly innovative field of investigation. The research towards these structures is divided into the structural geometry and the design of the structural members, such as the beams, connection points and actuators.

Books

05. L. Kleerekoper , Urban Climate Design: Improving Thermal Comfort in Dutch Neighborhoods.
presents research into the possibilities for climate adaptation in Dutch urban areas. We want to know how cities can best prepare for extreme rainfall, droughts, and heat waves in future climates.

06. W. Alexander , Haagse hitt , Feb 2018.
The aim of the Haagse Hitte project is to better understand urban heat in The Hague and from there to link the characteristics of the physical space of the city and the health of the people of The Hague, resulting in recommendations for actions. These insights must make the city of The Hague and its inhabitants more aware and resilient with regard to the Hague heat island effect, also referred to here as The Hague heat.

07.J. Reiser, N.Umemoto,Atlas of Novel Tectonics,9 Mar 2006
The Physiology of Taste is one of their primary models the authors provide a cross-section of thinking and inspiration. The result is both an elucidation of the concepts that guide Reiser+Umemoto through their own design process and a series of meditations on topics that have formed their own sense as architects. Atlas of Novel Tectonics offers an entirely fresh perspective on subjects that are generally taken for granted, and does so with a welcome punch and energy.

Experts

01. Dr. Laura Kleerekoper,
Lecturer-Researcher Climate-proof City
Smart Urban Design
Urban Technology research program

02. Lydia Fraaije,
Biomimicry architect and spatial designer since 2006 focused on Ecosystems Services and Biophilia.

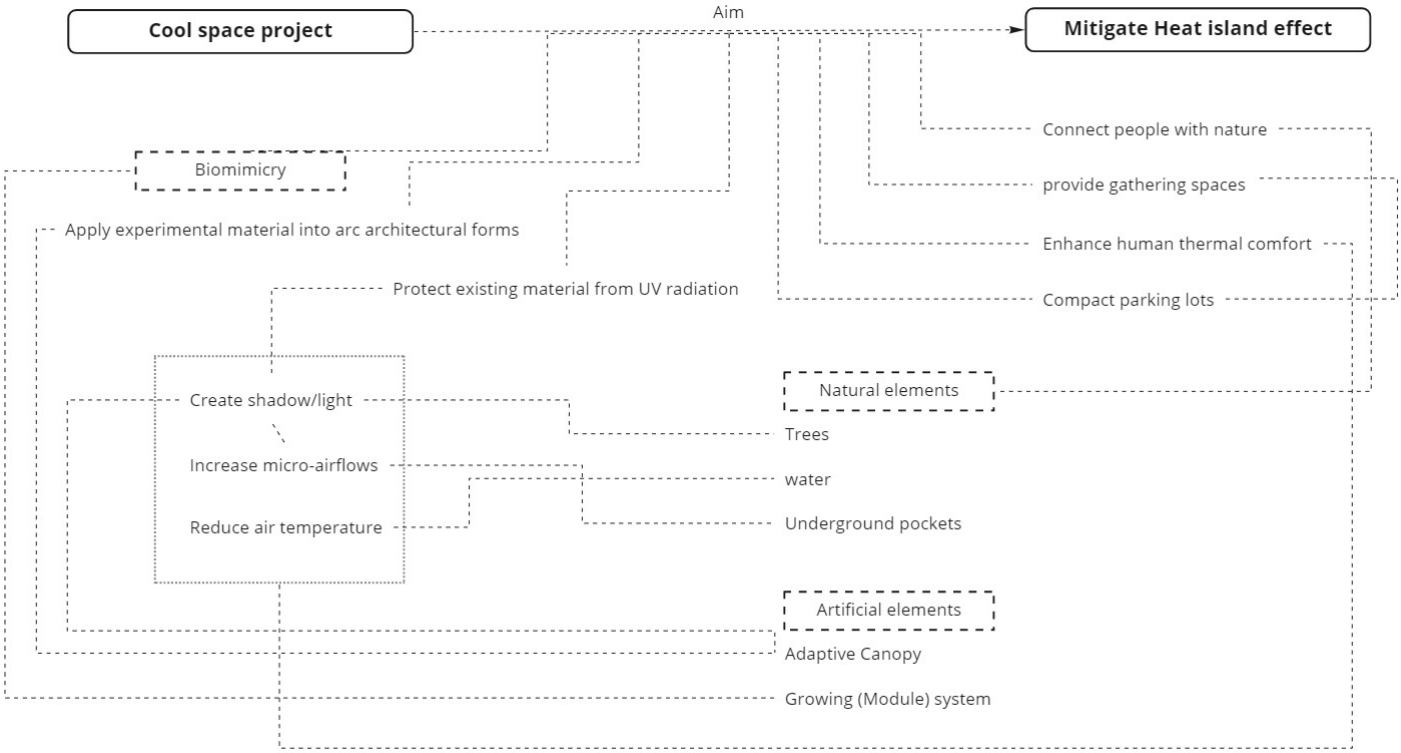
03.Anastasios Kokkos,
Computational modeling expert and Building Engineer at Platform78.

04. Shakera Jassat,
Architect , specialized Harvesting water from unexpected places at Sway studio .

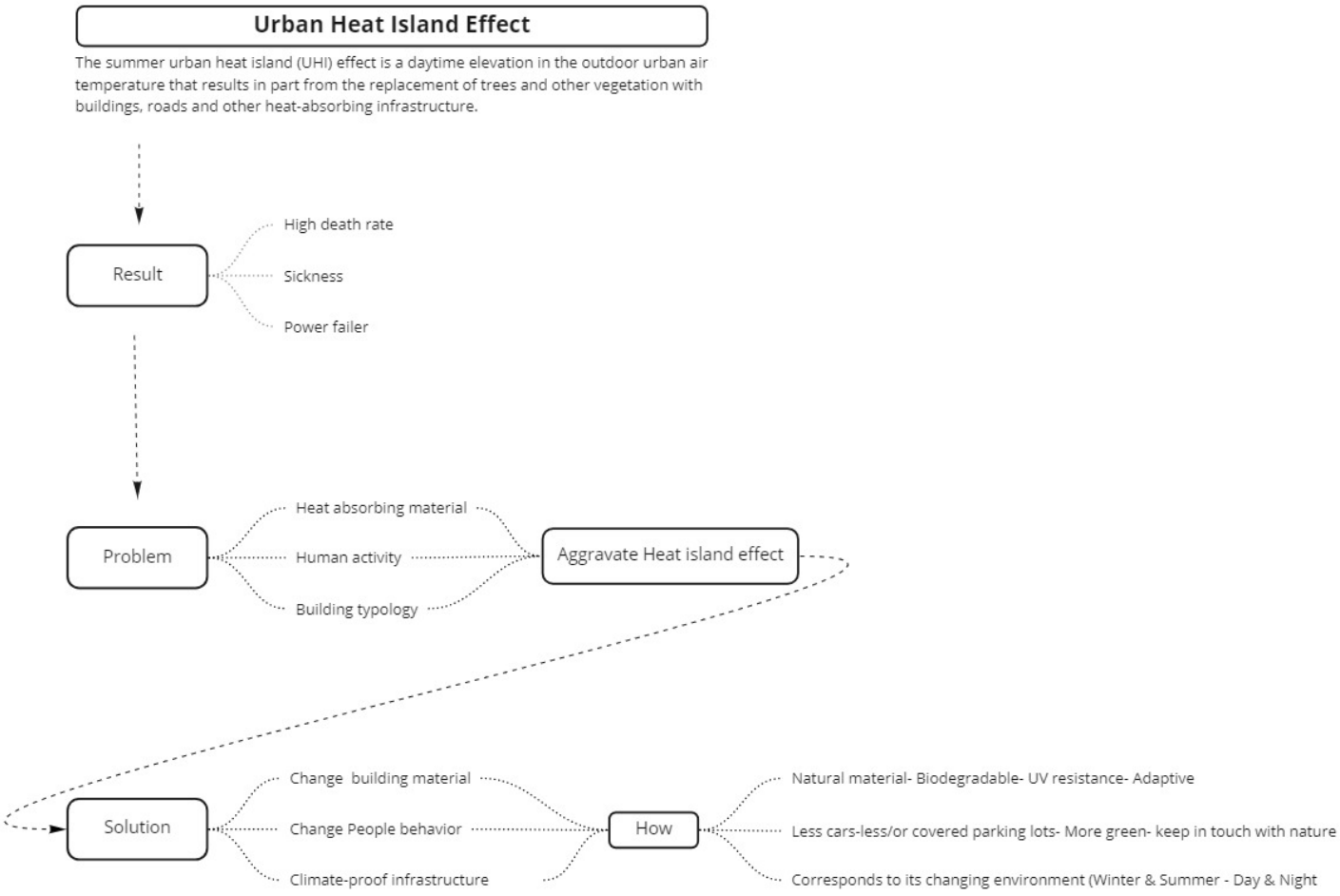
05. Sami Al Hammadeh,
Engineer, Statikwerk GmbH

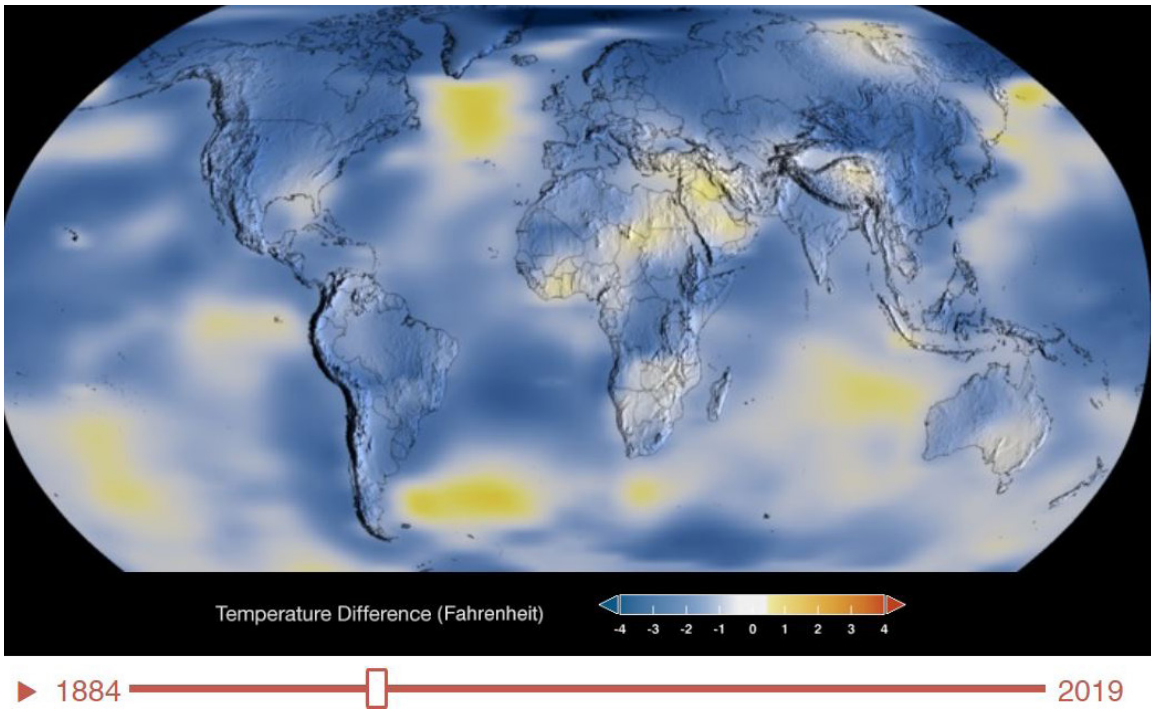
06.Sebastiaan Veldhuisen
Architect, lecturer, consultant.

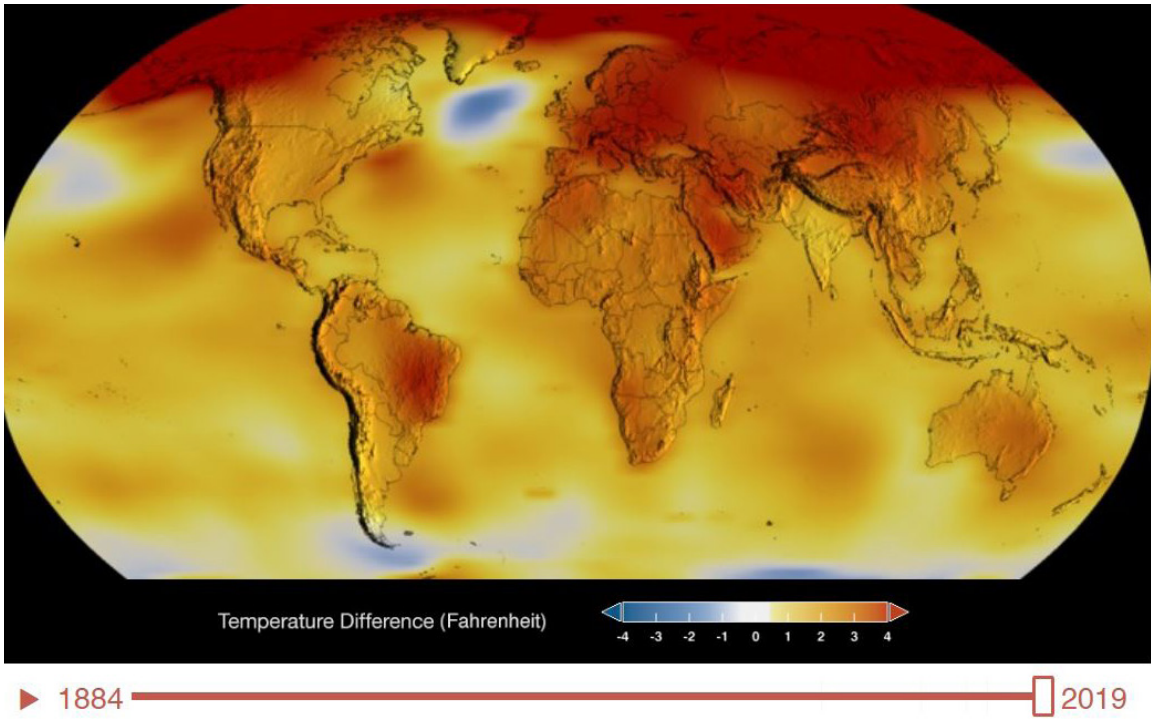
RESEARCH



PROJECT TOPICS

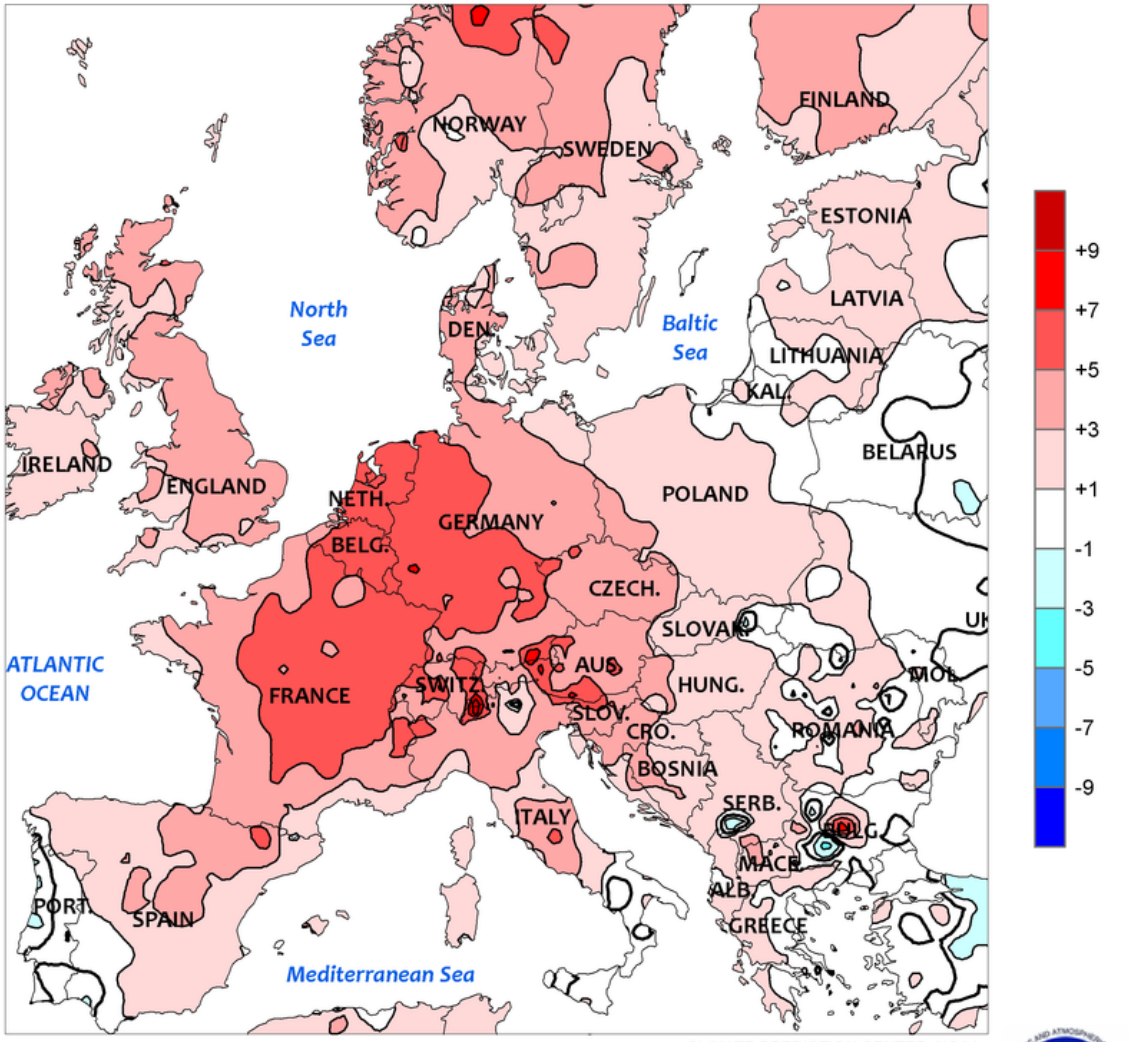

Urban Heat Island Effect
The summer urban heat island (UHI) effect is a daytime elevation in the outdoor urban air temperature that results in part from the replacement of trees and other vegetation with buildings, roads and other heat-absorbing infrastructure.
Result
High death rate
Sickness
Power failer
Problem
Heat absorbing material
Human activity
Building typology
Aggravate Heat island effect
Solution
Change building material
Change People behavior
Climate-proof infrastructure
How
Natural material- Biodegradable- UV resistance- Adaptive
Less cars-less/or covered parking lots- More green- keep in touch with nature
Corresponds to its changing environment (Winter & Summer - Day & Night



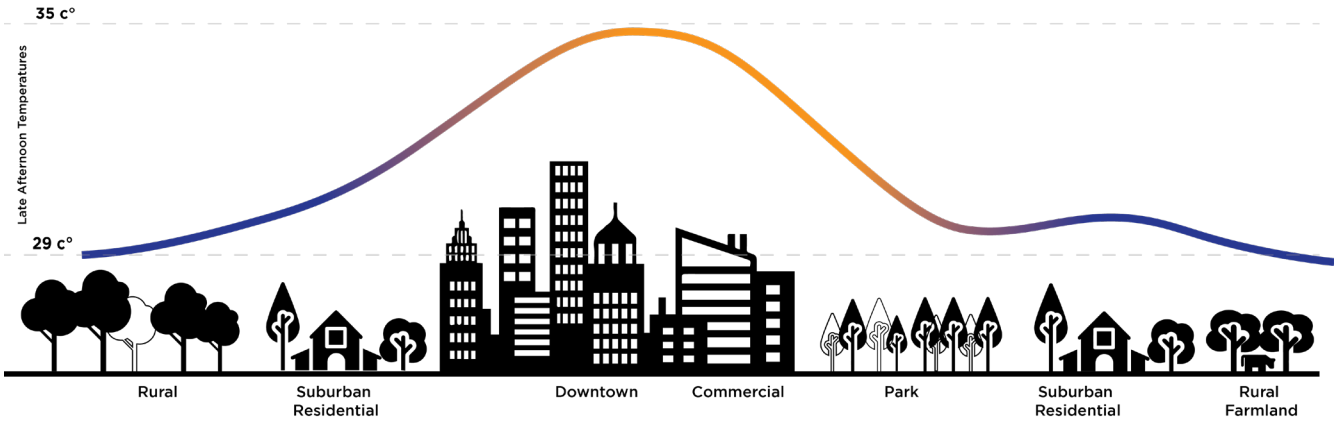


https://climate.nasa.gov/interactives/climate-time-machine

EUROPE
Temperature Anomaly (°C)
July 21 - 27, 2019



CLIMATE PREDICTION CENTER, NOAA
Computer generated contours
Based on preliminary gridded data
Normals based on 1981-2010 gridded data



Urban Heat Island

The summer urban heat island (UHI) effect is a daytime elevation in the outdoor urban air temperature that results in part from the replacement of trees and other vegetation with buildings, roads and other heat-absorbing infrastructure.

DEFINITIONS

Heatwave

A heat wave, or heatwave, is a period of excessively hot weather, which may be accompanied by high humidity, especially in oceanic climate countries. While definitions vary,a heat wave is usually measured relative to the usual weather in the area and relative to normal temperatures for the season. Temperatures that people from a hotter climate consider normal can be called a heat wave in a cooler area if they are outside the normal climate pattern for that area.

Microclimate

A microclimate is a local set of atmospheric conditions that differ from those in the surrounding areas, often with a slight difference but sometimes with a substantial one. The term may refer to areas as small as a few square meters (for example a garden bed or a cave) or as large as many square kilometers or square miles.
Microclimates exist, for example, near bodies of water which may cool the local atmosphere, or in heavy urban areas where brick, concrete, and asphalt absorb the sun's energy, heat up, and re-radiate that heat to the ambient air: the resulting urban heat island is a kind of microclimate.[2]

Urban Heat Islands

The summer urban heat island (UHI) effect is a daytime elevation in the outdoor urban air temperature that results in part from the replacement of trees and other vegetation with buildings, roads and other heat-absorbing infrastructure.[3]

Climate by spatial scale

MACROCLIMATE
The macroclimate broadly defines the climate of a region. Most of the time this describes the general climate pattern from a recording station. Its scale is from tens of miles to hundreds of miles.
MESOCLIMATE
Mesoclimate is described as the climate of a site as influenced by elevation, aspect, slope or distances from large bodies of water. Its scale extends from tens of yards to miles depending on the consistency in topography. Mesoclimate is often referred to as Topoclimate for it's the topographic influence on a site's climate.
MICROCLIMATE
Microclimate is the smallest scale of climate. Its scale is from tens of yards to millimeters.4

Adaptation

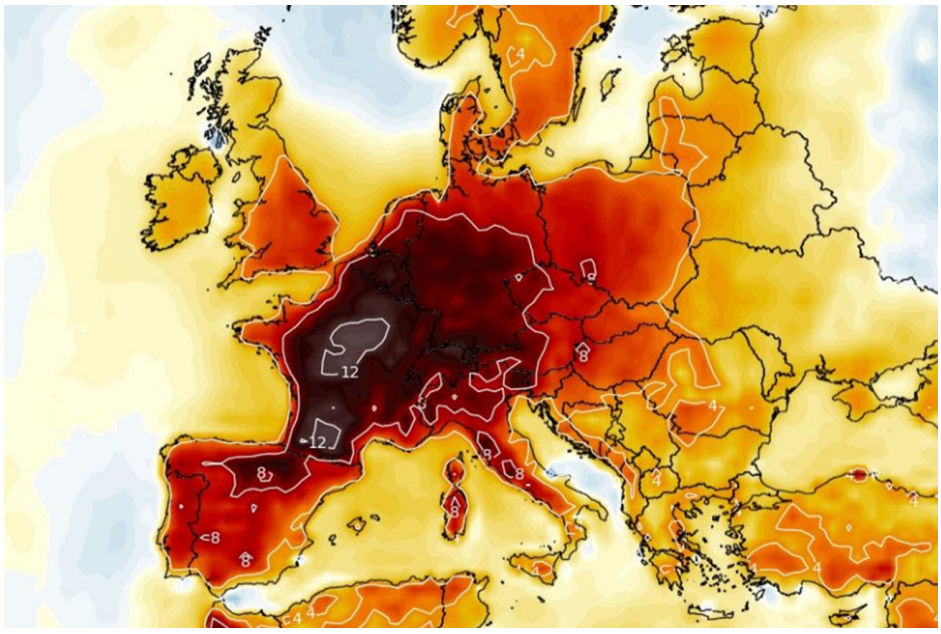
Adaptation strategies focus on secondary climate effects in order to avoid tertiary effects. For example: the increase of heavy rainfall (primary effect) can lead to a surplus of water in lower areas (secondary effect), which in turn leads to flooded roads (tertiary effect). Yet not all primary climate effects can be translated in secondary effects on specific locations because the KNMI cannot provide enough temperature data from rural areas and it is not yet possible to project the effects of heat on city scale in the Netherlands (Groot et al., 2009), pag 12). Research is ongoing about these local climate effects in the urban environment

Heat stress

Heat stress occurs when a body is not capable to regulate the body temperature due to high ambient temperatures or radiation loads. Heat stress can manifest in several medical conditions such as heat rash, heat cramps, heat exhaustion and heat stroke (Howe & Boden, 2007).

1. en.wikipedia.org
2. en.wikipedia.org/wiki/Microclimate
3. heatisland.lbl.gov
4. https://www.rexhill.com/blog/Macro--Meso-and-Microclimates

The recent heat wave hits Europe



Climate Robustness

A climate robust city is the design of urban space on which climate change has a minimal impact (Ven et al., 2009). Climate robustness is the degree in which the area is non-vulnerable in relation to a tertiary climate effect. This is explained by Groot et al. (2009) as: an increase in extreme rainfall events (primary effect) leads to an excess of water in lower areas (secondary effect), which can lead to water nuisance in urban areas (tertiary effect).

Impact levels

Climate change has an impact on many different levels. Climate adaptation measures should improve, alongside heat and water robustness; human health, energy consumption and ecological, economic and cultural aspects:

–– Human health: Heat stress, thermal comfort (psychological benefits) – the heat wave in the summer of 2003 caused 1400-2200 extra deaths (Garssen et al., 2005) and the heat wave in 2006 was rated as the world's fourth worst natural disaster in terms of actual deaths (EM-DAT);

–– Energy consumption: The worlds focus for energy is on reducing Green House Gas emissions (Kyoto and Copenhagen), important are also the depletion of resources and land use related to energy;

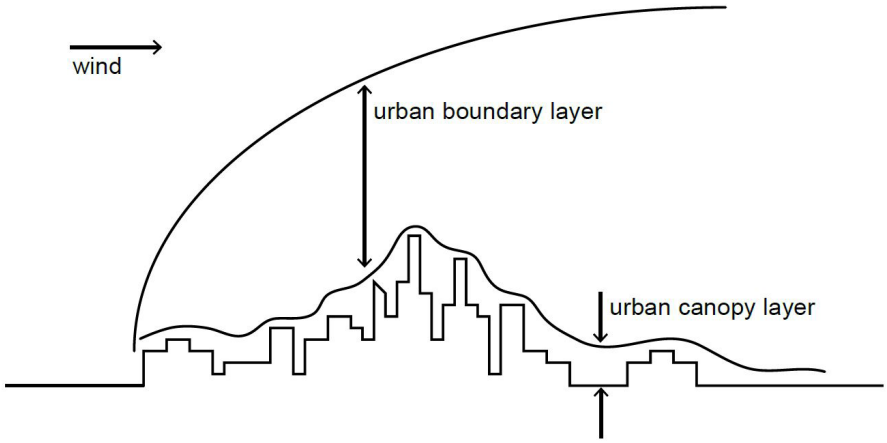
–– Ecology: "Environment is the set of conditions for life" (Jong et al., 2007), p 621), ecological development is therefore an investment in the environment instead of a cost aspect as is usual reasoned;

–– Cultural: The influence of social behaviour on the effects of heat and other climate conditions;

–– Economic: damage to buildings, infrastructure, crops and ecosystems because of climate change.

Urban scale levels

The urban microclimate is determined by two scale levels: the Urban Boundary Layer (UBL) and the Urban Canopy Layer (UCL) as illustrated in Figure 1.2 (Oke, 1982, Oke,1987). The local climate in the UCL can vary significantly within a few meters. Within close distance from buildings and objects like trees most variation occurs.



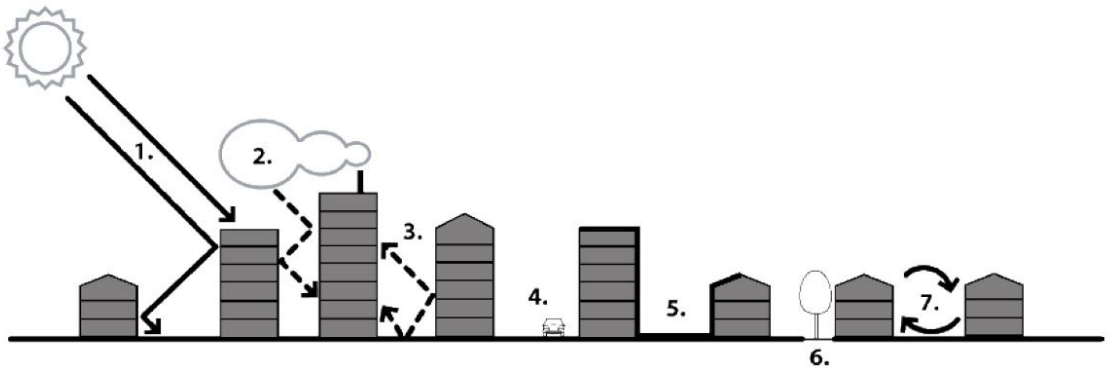
The Urban Boundary Layer (UBL) and the Urban Canopy Layer (UCL) based on (Oke, 1987).

The UBL above the buildings is a rather homogeneous layer that interacts with the cities surroundings and the urban characteristics of the city itself. Influencing the UCL on local level can have implications for the UBL as a whole. In this respect changes in one neighbourhood affect also adjacent neighbourhoods and other parts of the city. The UCL, on its turn, interacts with the UBL and indoor climates. The urban climate studied in this dissertation therefore relates to a range of scale levels: from the building scale up to the sub-regional scale as indicated in Table 1.1.(Kleerekoper, 2016)

ELEMENT	NOMINAL RADIUS (M)
Building part	1
Building segment	3
Building	10
Building complex	30
Ensemble	100
Neighbourhood	**300**
Area/Village	1000
District/Town	3000
Sub-regional	10000
Regional	30000
Sub-national	100000
National	300000

THE URBAN HEAT ISLAND EFFECT HAS THE FOLLOWING CAUSES (OKE, 1987, SANTAMOURIS & ASIMAKOPOULOS, 2001):

1. Absorption of short-wave radiation from the sun in low albedo (reflection) materials and trapping by multiple reflections between buildings and street surface.
2. Air pollution in the urban atmosphere absorbs and re-emits longwave radiation to the urban environment.
3. Obstruction of the sky by buildings results in a decreased long-wave radiative heat loss from street canyons. The
heat is intercepted by the obstructing surfaces, and absorbed or radiated back to the urban tissue.
4. Anthropogenic heat is released by combustion processes, such as traffic, space heating and industries.
5. Increased heat storage by building materials with large thermal admittance. Furthermore, cities have a larger
surface area compared to rural areas and therefore more heat can be stored.
6. The evaporation from urban areas is decreased because of 'waterproofed surfaces' – less permeable materials,
and less vegetation compared to rural areas. As a consequence, more energy is put into sensible heat and less
into latent heat.
7. The turbulent heat transport from within streets is decreased by a reduction of wind speed. (Kleerekoper, 2016)



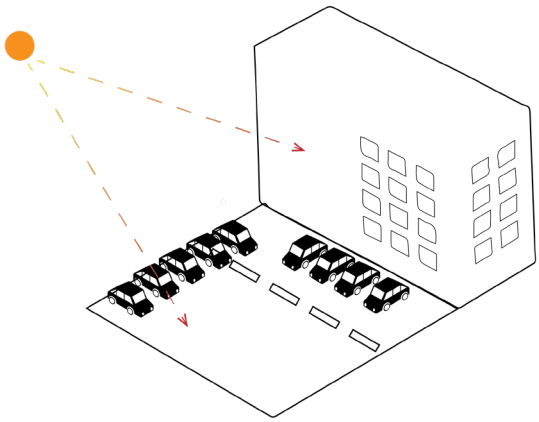
Causes for urban heat islands (Kleerekoper et al., 2012).

Some of Paris's most treasured landmarks are set to host the city's new "urban forests."

Under a plan announced last week by Mayor Anne Hidalgo, thickets of trees will soon appear in what today are pockets of concrete next to landmark locations, including the Hôtel de Ville, Paris's city hall; the Opera Garnier, Paris's main opera house; the Gare de Lyon; and along the Seine quayside.

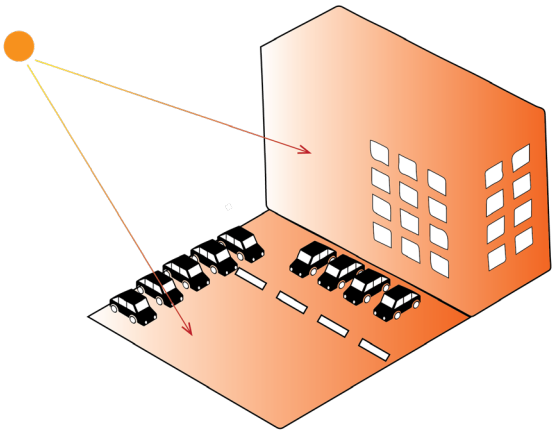
Such plans will require more than sticking saplings in the ground. Creating the new opera house cherry orchard will mean displacing a current parking lot used by tourist buses, a process that the city plans to repeat elsewhere.

The new plantings are part of a plan to create "islands of freshness"—green spaces that moderate the city's heat island effect. It also falls into an overall drive to convert Paris's surface "from mineral to vegetal," introducing soil into architectural set-piece locations that have been kept bare historically. As a result, the plan will not just increase greenery, but may also provoke some modest rethinking of the way Paris frames its architectural heritage.



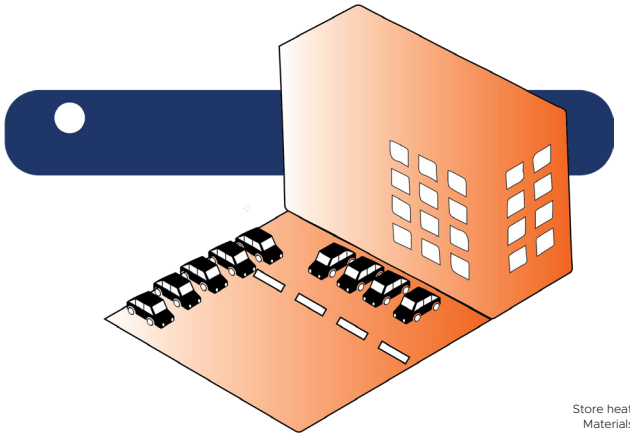
Morning

Current function-Parking



Afternoon

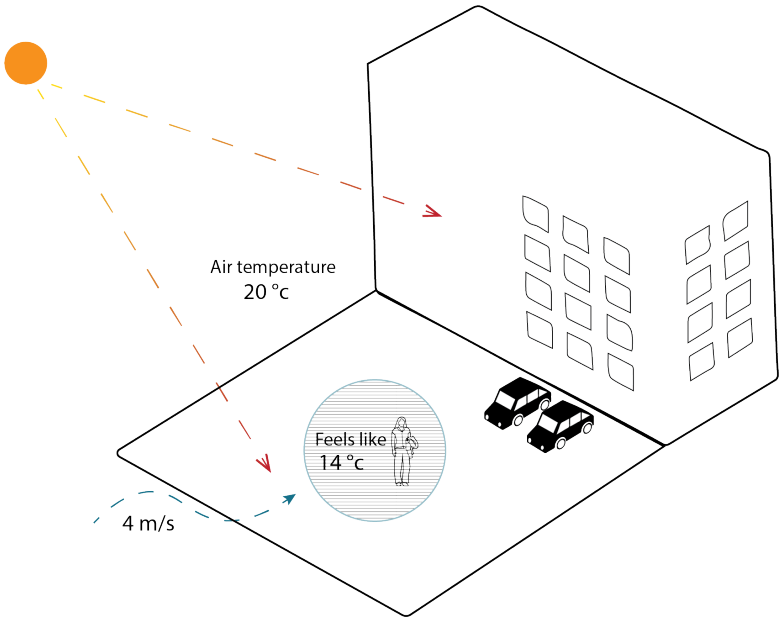
Heat-up during the day
/Absorbed material effect/



Night

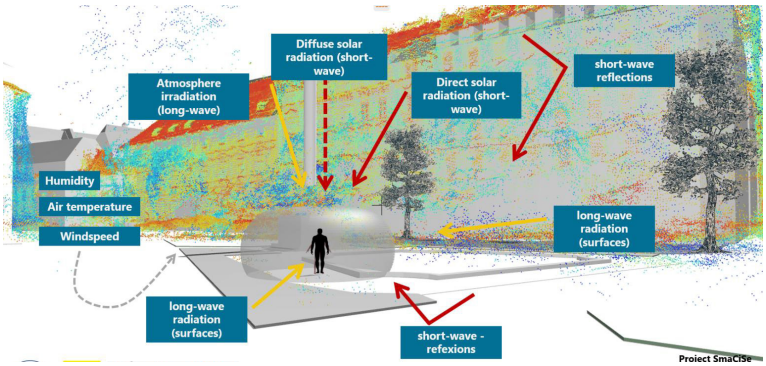
Store heat during the Night
Materials as a heat tank

HUMAN THERMAL COMFORT

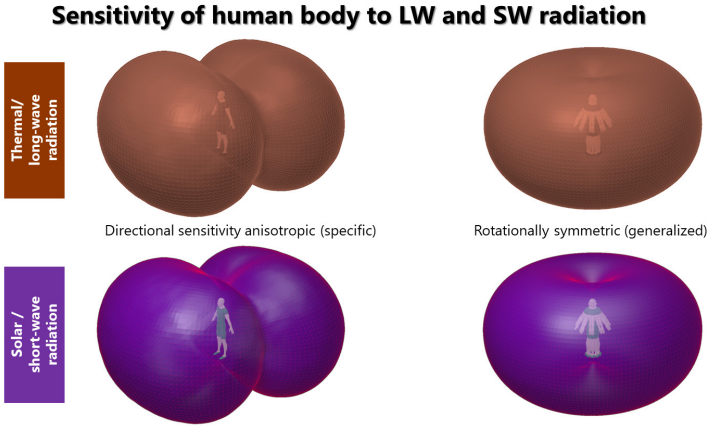


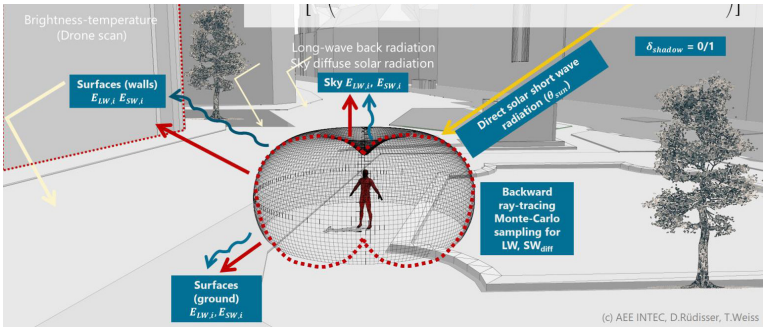
Outdoor themal comfort according to the digital simulation

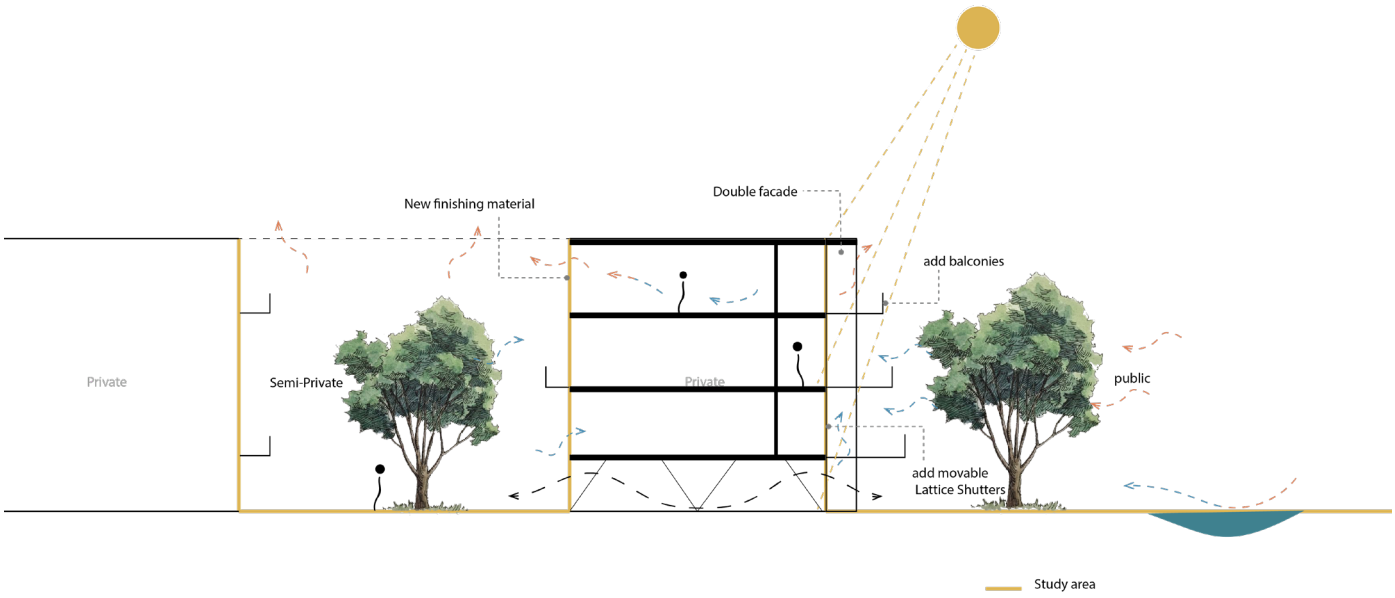
Anisotropic sensitivity of human body to long-wave and short-wave radiation



The project addresses innovations in acquisition and sensing of geo-referenced city related data with novel processing chains in city data analytics. The project proposes three dimensional microclimate and air-quality models that represents volumetric models of air- and surface-temperatures as well as of air-quality related measurements at various height levels. As innovative data acquisition platforms, dedicated detector heads to be mounted on zeppelins, drones and UAV's (Unmanned Aerial Vehicles) will be developed.
The project focuses on small-scale thermal environment analysis, especially urban heat island effects, as well as on concentration levels of major pollutants in Austria and China /Guangdong.(Rüdisser,2018)





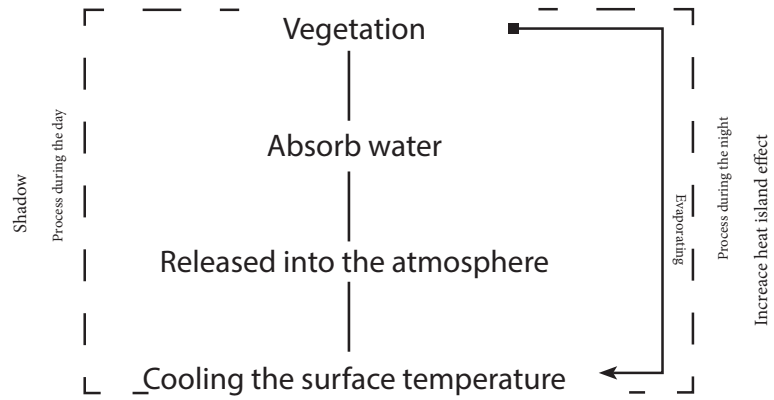

New finishing material
Double facade
add balconies
Private
Semi-Private
Private
public
add movable
Lattice Shutters
Study area

TRADITIONAL MATERIAL

SOLUTION

IS IT A TREE ?

VEGETATION WATER CYCLE



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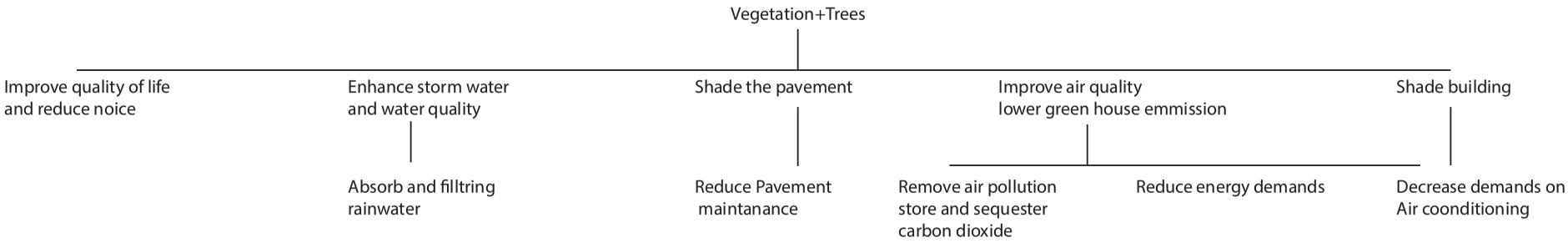
Bring forest to the city

I BELIEVE WE CAN TAKE IT FURTHER

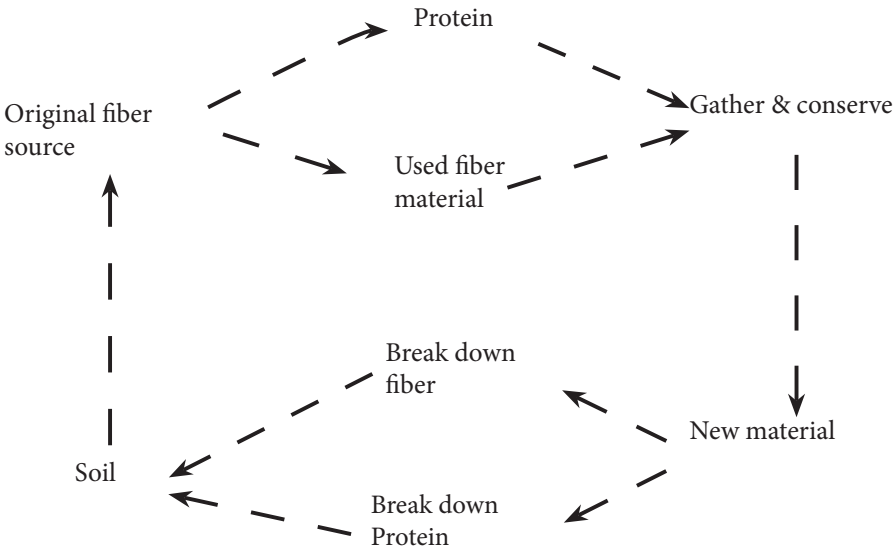
LEARNING FROM NATURE

Nature has been here for over than 3.8 billion years

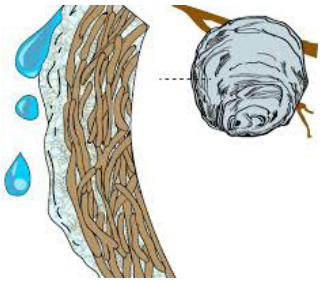
NATURAL STRATEGIES


Vegetation+Trees
Improve quality of life and reduce noice
Enhance storm water and water quality
Absorb and filltring rainwater
Shade the pavement
Reduce Pavement maintanance
Improve air quality lower green house emmission
Remove air pollution store and sequester carbon dioxide
Reduce energy demands
Shade building
Decrease demands on Air coonditioning

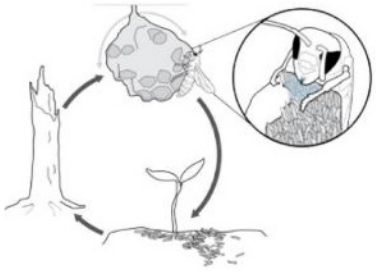
DESIGN INFLUENCED BY NATURE



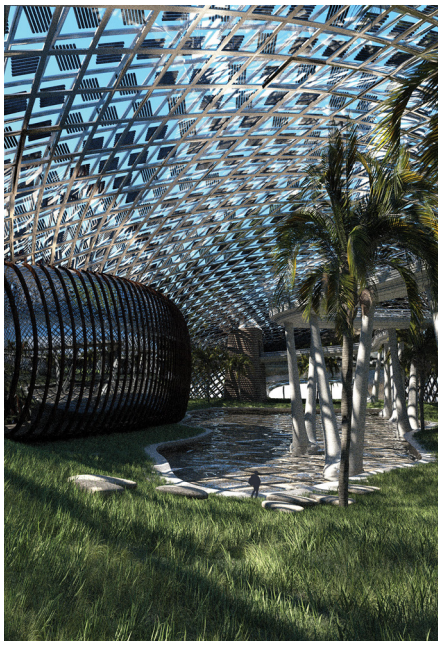
Paper wasps



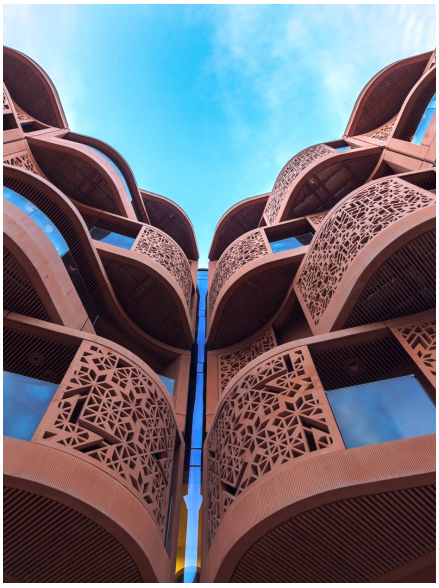
Domed shape sheds water



Effective design strategy build by available resources



Closed courtyards

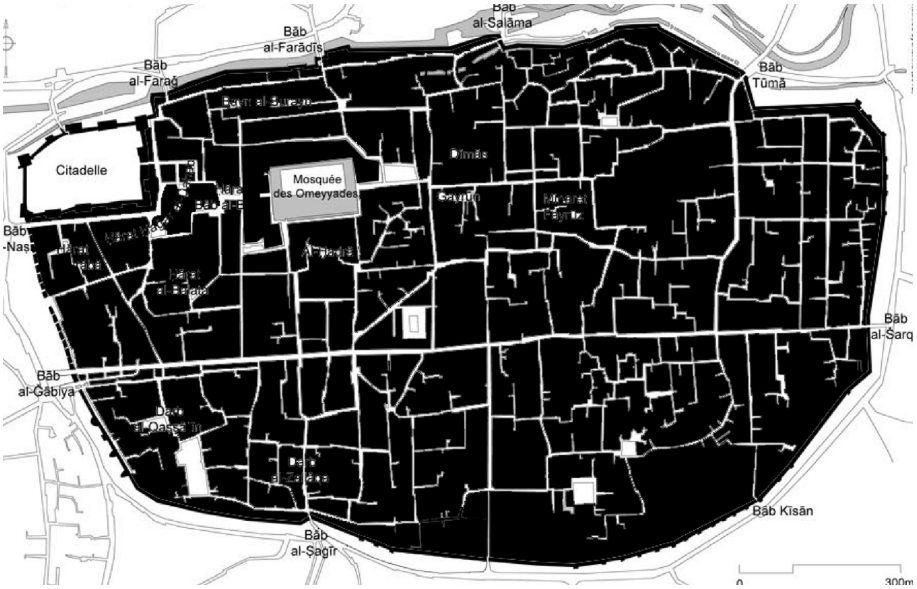


Shadow/light

Narrow shadowed streets

15 C° degrees cooler then its surrounding

LEARNING FROM OLD-DAMASCUS CITY



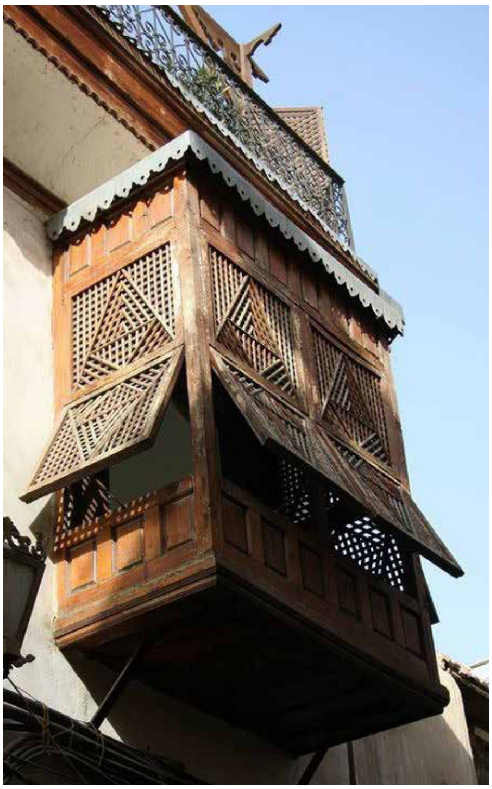
Credit: Roula Alnashawati

Height Vs Width

URBAN
Typology

Damascus old city where the average temperature is 45 C° during summer, however, in the alleys and inside houses is 10 C° cooler
Horizontal two to three stories maximum that relates to the proportion of the house hight and the road width. it provides light to the road around the year and with less direct sun in summer .
Open towards inside due to environmental and cultural reasons (see courtyard) therefore,the external walls have less importunateness than the ones facing the courtyard in term of design and material . In addition the houses stands against each other to share the same wall and reduce the thermal loss and gain through the wall.
All that factors shaped the city fabric of old Damascus. Narrow and ramified roads that lead sometimes to dead-end to create a small meeting space between four to five house's entrances.

Interior windows



Exterior windows

ARCHITECTURE
Windows

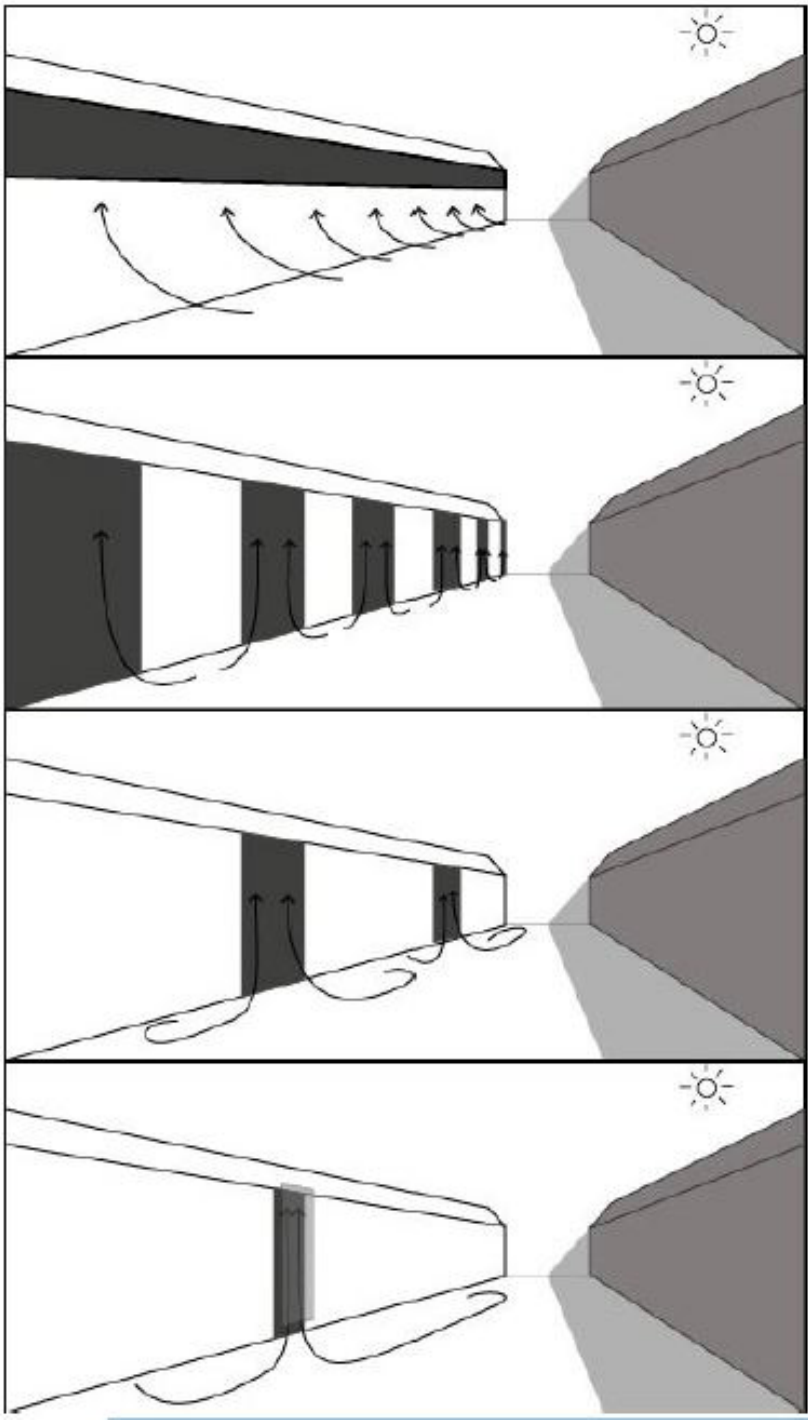
There are two types of windows
Street windows are few and protected by Mashrabia, The Mashrabiya is an archetype of ancient Arabic architecture denoting an oriel screen-wall or window made of latticework. It functions as a social barrier and an environmental filter.

Courtyard windows
It is wide relatively and transparent to increase the solar index into the bedrooms' corridors.


Credit: Roula Alnashawati

ARCHITECTURE
Courtyard

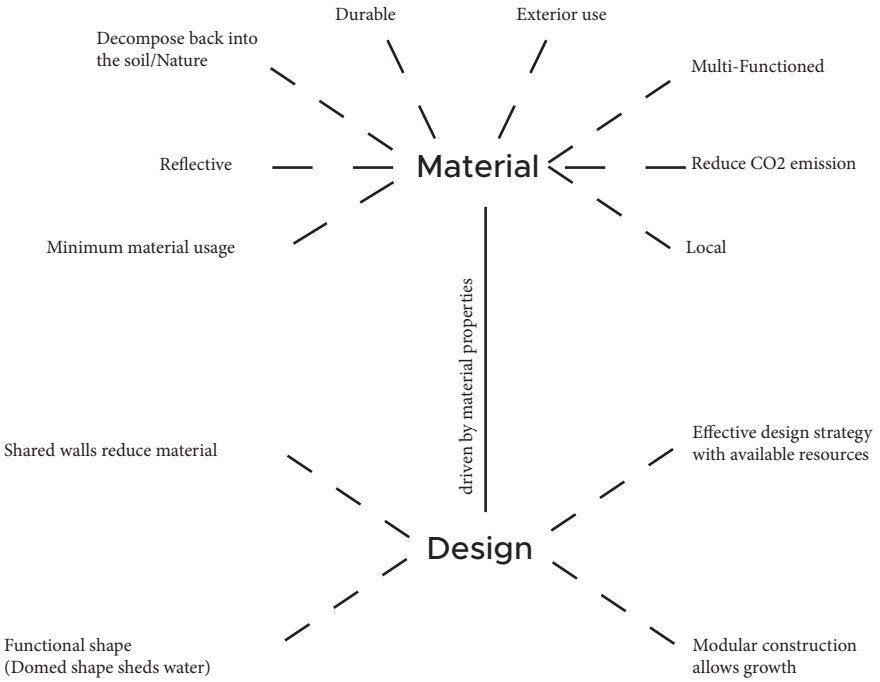
The house is open towards the inside to control the house temperature all around the year. Through multiple elements, all of them are natural and passive.
First and foremost, a WATER fountain in the middle and green elements around the courtyard which degrease the coming hot air temperature and increase its humidity in order to have a cooler atmosphere.
The cool air has a higher density than warm air stays in the low air layers and cools the walls, floors and sneak indoors to replace warmer air inside the rooms around the courtyard. Since the cool air does stay in the lower air levels the courtyard store it at night till late day hours.
The seasonal TREE next to the fountain provides shadow in summer and allow sunlight to pass through its naked branches during winter.
WALL STONES(Ablaq) colored in two or three contrast colors because white stone reflects the light and stays cool while the black stone absorbs it and gets warm which creates small airflows.



Dark Vs Bright

Painting options from top down: the upper part of the facade is painted dark, the facade of dwellings are painted dark alternately, only a few dwelling facades are painted dark and a small vertical strip is painted dark with a glass plate in front.

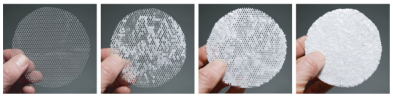
phase 01

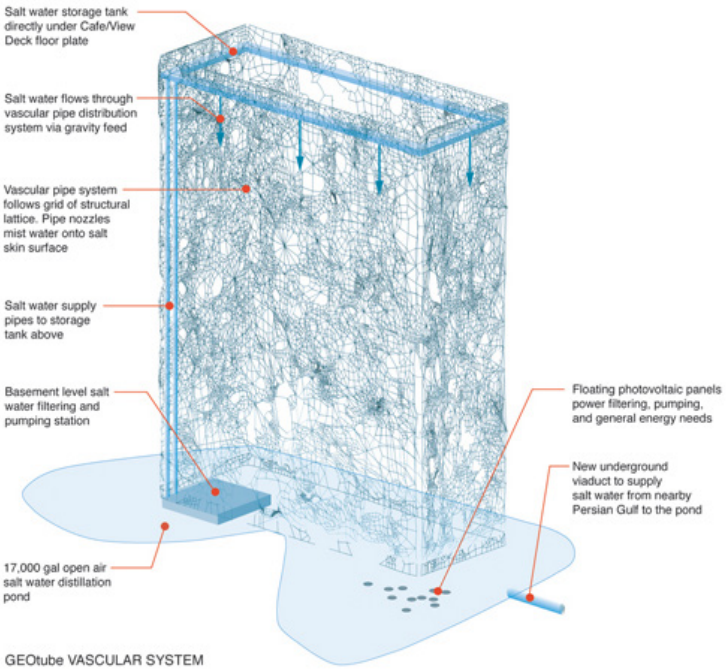


phase 02

DESIGN PHASES

ADAPTING TECHNIQUES

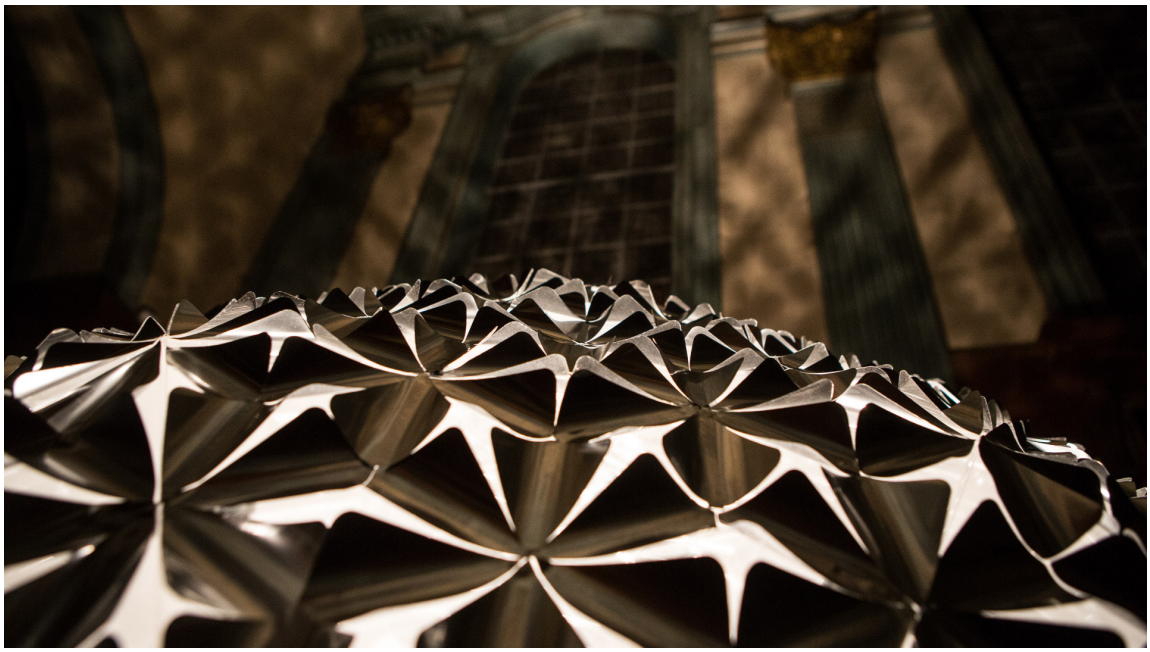




GEOTUBE

MATERIALIZED: CRYSTALLINE GROWTH
Materials: Salt crystallization over 3d printed substrate

GEOtube, a proposal from Berkeley-based Faulders Studio, uses saltwater to grow a facade. The proposed facade for a tower in Dubai is to suck up water from the Persian Gulf (the source of the world's saltiest ocean water) through a 4.62 km underground pipeline, and then spray it over its mesh facade. The building's skin is entirely cultivated rather than built; instead of being fully finished, it is in continuous development. As the water evaporates and salt deposits aggregate over time, the tower's appearance transforms from a transparent skin into a solid, highly visible white surface.



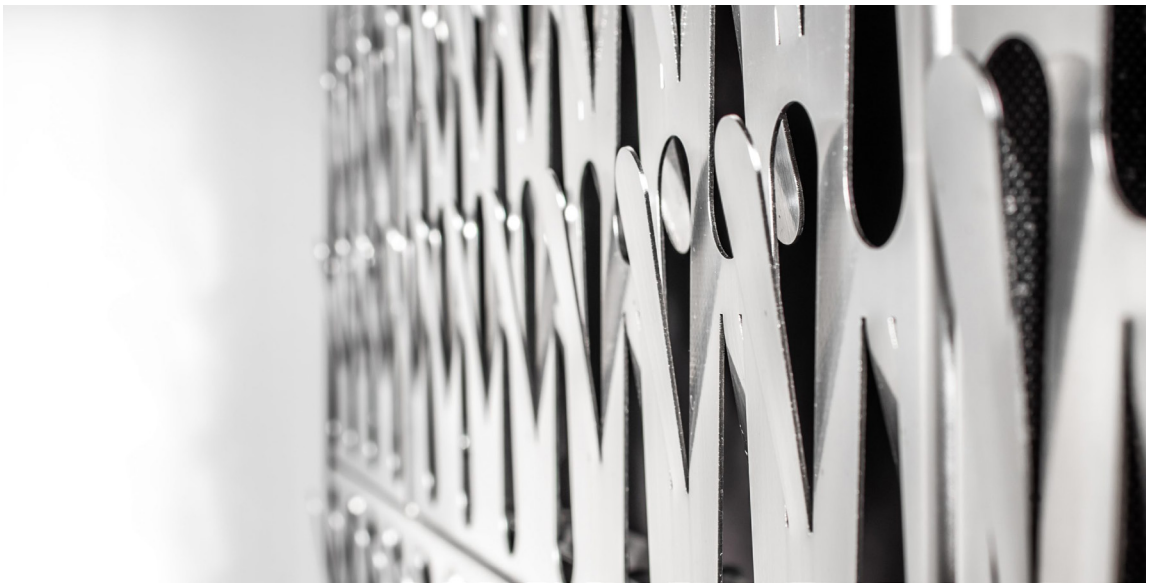
LOTUS DOME

is a living dome made out of hundreds of heat-sensitive smart flowers which fold open in response to human warmth and light, creating an interactive play of light and shadow? This dynamic relationship between people and technology is what Roosegaarde calls 'Techno-Poetry'

COOLEST WHITE

the most interesting feature of the coolest white is that it can achieve two goals:
-It can reduce the urban heat load.
-It makes the building more resilient.
“UNSProducts and UNSknowledge have developed The Coolest White with Monopol Colors. The Coolest White is an ultra-durable paint that protects buildings and urban structures from excessive solar radiation – thus slowing down the Urban Heat Island Effect. The paint is based on fluoropolymer technology. It has long-lasting and ultra-durable properties that prolong the lifecycle of the coating up to 30 years. The multilayered coating system was developed for high-quality metallic facade elements and aluminum, steel or fiberglass structures.”

Footnote:
10. unstudio.com/en/page/11721/the-coolest-white



AQUATECTURE

Shaakira Jassat

Having experience in the field of architecture has prompted Shaakira to question whether the built environment could provide sustainable alternatives to the way our cities are managed. Usually in urban areas we remain detached from the sources of our water, we open the tap and water magically appears. However, there is a complex network around how our water supply, water waste and stormwater run off is managed, which is not so immediately visible within a populated city. Aquatecture makes water conservation both visible and engaging, while the collected water may be reused within the building lavatories or stored for later use during drier periods. It also plays a role in easing the pressure off storm water drainage during heavy rainfall periods.

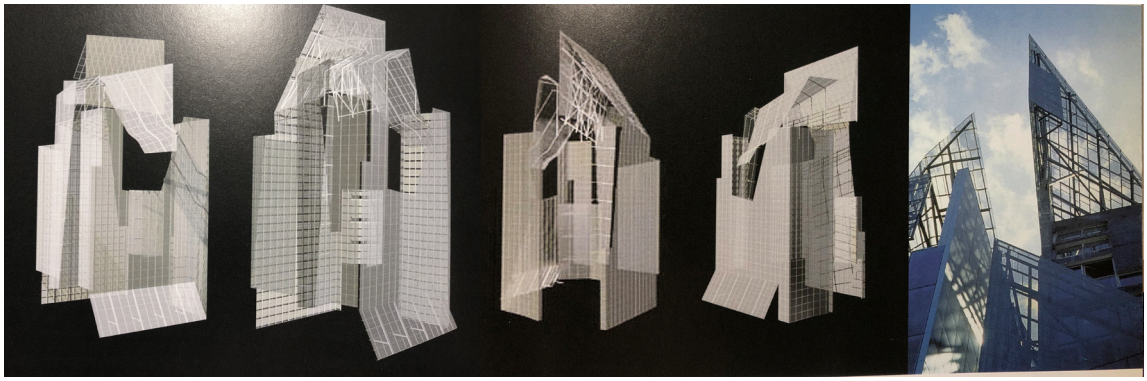
photo : Elinor Carucci

SKIN

Skin is a multilayered, multipurpose, organ that shifts from thick to thin, tight to lose, lubricated to dry, across the landscape of the body. Skin, a knowledge-gathering device, responds to heat and cold, pleasure and pain, it is both living and dead, A self-repairing, self-replacing material whose exterior is senseless and inert while its inner layers are flush with nerves, glands, and capillaries.

Contemporary designers approach the surfaces of product =s and buildings as similarly complex, ambiguous forms. Manufactured skins are richly responsive substances that modulate the meaning, function, and dimension of things.

Getto 1 ,1999
Photography: Margi Geerlinks b.1970



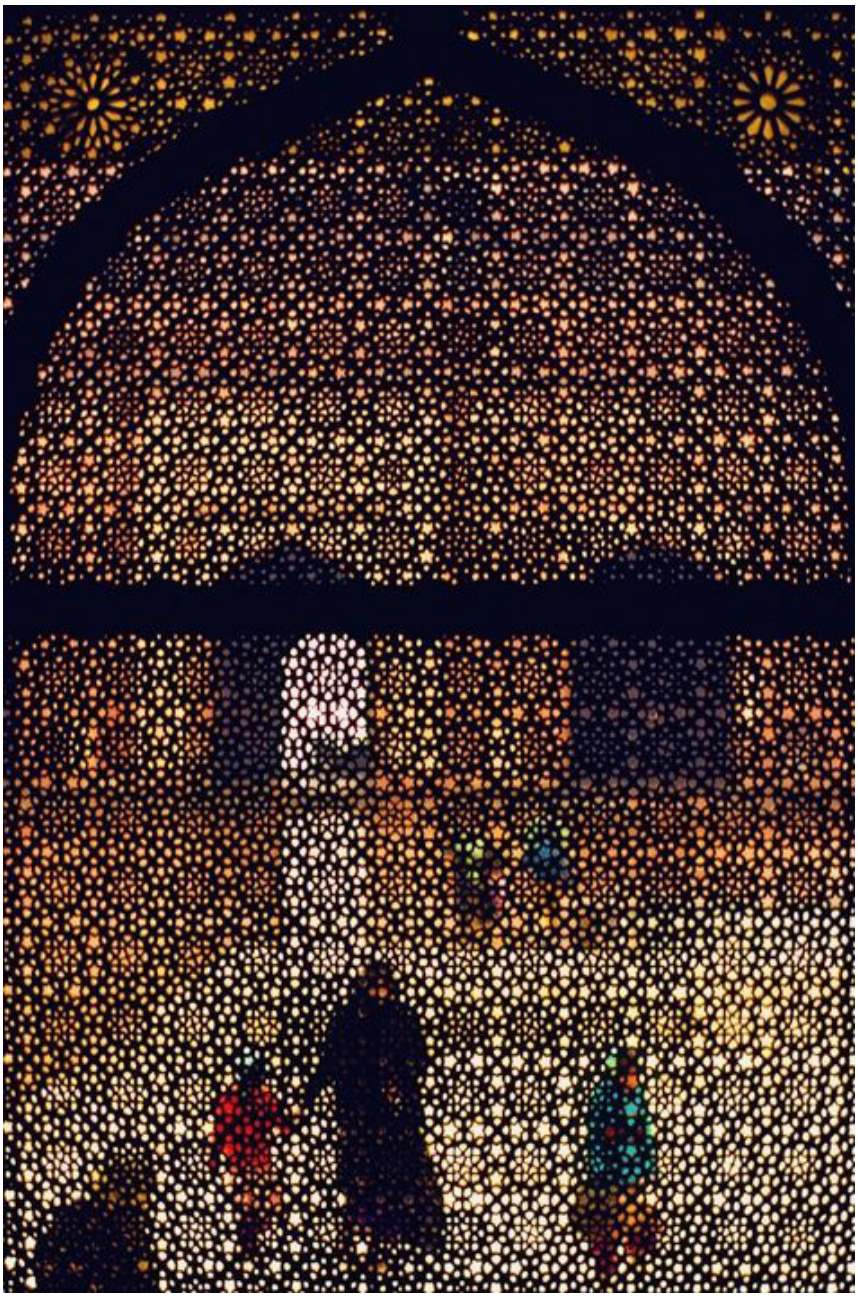
Village fashion center, Seoul,Korea, 1997

MORPHOSIS

Thom Mayn

“The space between the surface of the body and the surface of the skin __the interstitial territory bounding interior and exterior allows each face of the building to act alert as the light conditions change with the movement of the sun in the sky and of pedestrians along the street” Thom Mayne, Morphosis

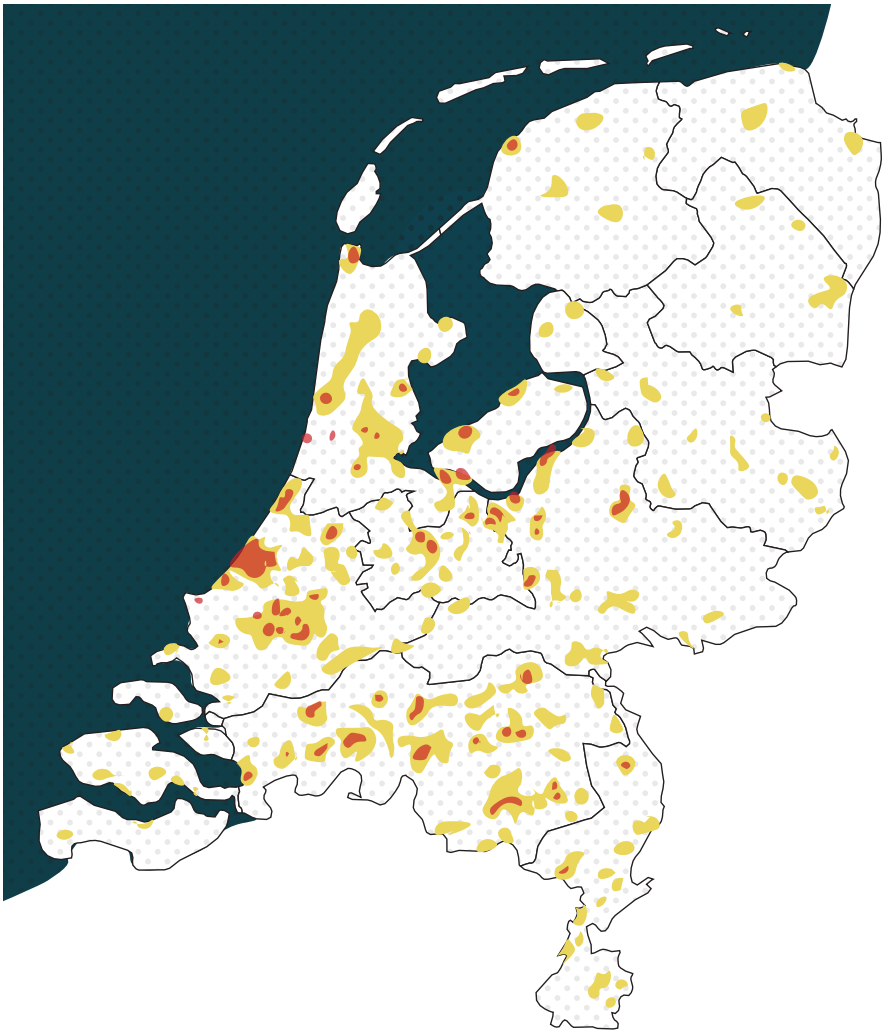
In this building for fashion school in Seoul, Morphosis designed a building clad in a dramatic garment of translucent planes. a second skin of perforated aluminum encloses the concrete column of the building. This fabric like membrane is set 20 centimeters beyond the interior body, creating a gap between inside and outside. the skin is translucent by day and transparent by night, illuminated with light from the interior.



Poetry in Stone Carved Screens from Mughal India

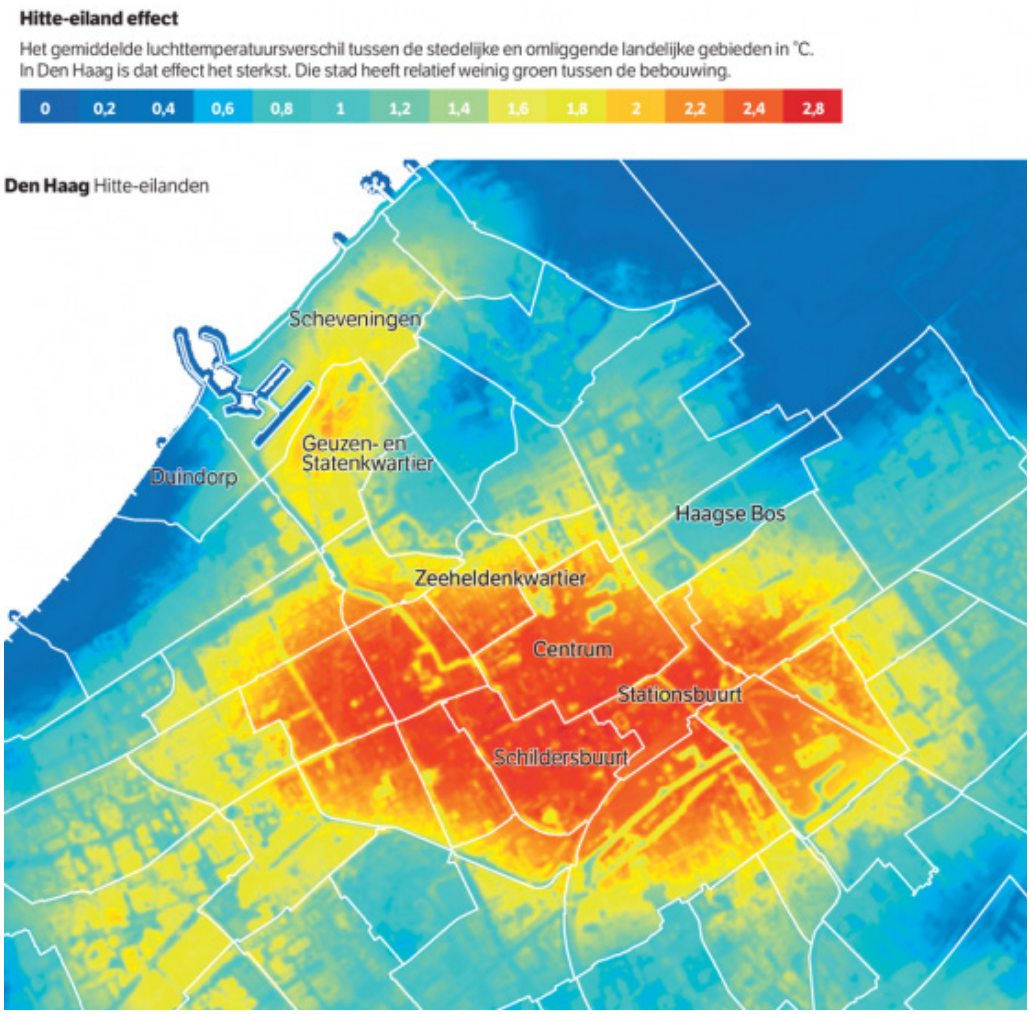
CONTEXT RESEARCH

LOCATION



HEAT MAP OF THE NETHERLANDS

KNMI published new scenarios in 2014 for the development of the future climate in the Netherlands. These scenarios provide forecasts for the 2050s and 2085s. Based on four scenarios, the KNMI predicts that the number of warm summer days will increase, as will the chance of heat waves. The air quality deteriorates during hot summers and long dry periods. Temperature rise leads to more mortality in the summer. A hot summer like that of 2006 will be the rule rather than the exception.



THE HAGUE

The KNMI expects that when your children are old, The Hague has a climate that is comparable to the current climate in Bordeaux, France. For large parts of the year, that prospect is quite pleasant. Things are different during hot summers. For young children, the elderly, overweight people, medical conditions or illnesses, heat can be heavy or even downright harmful.

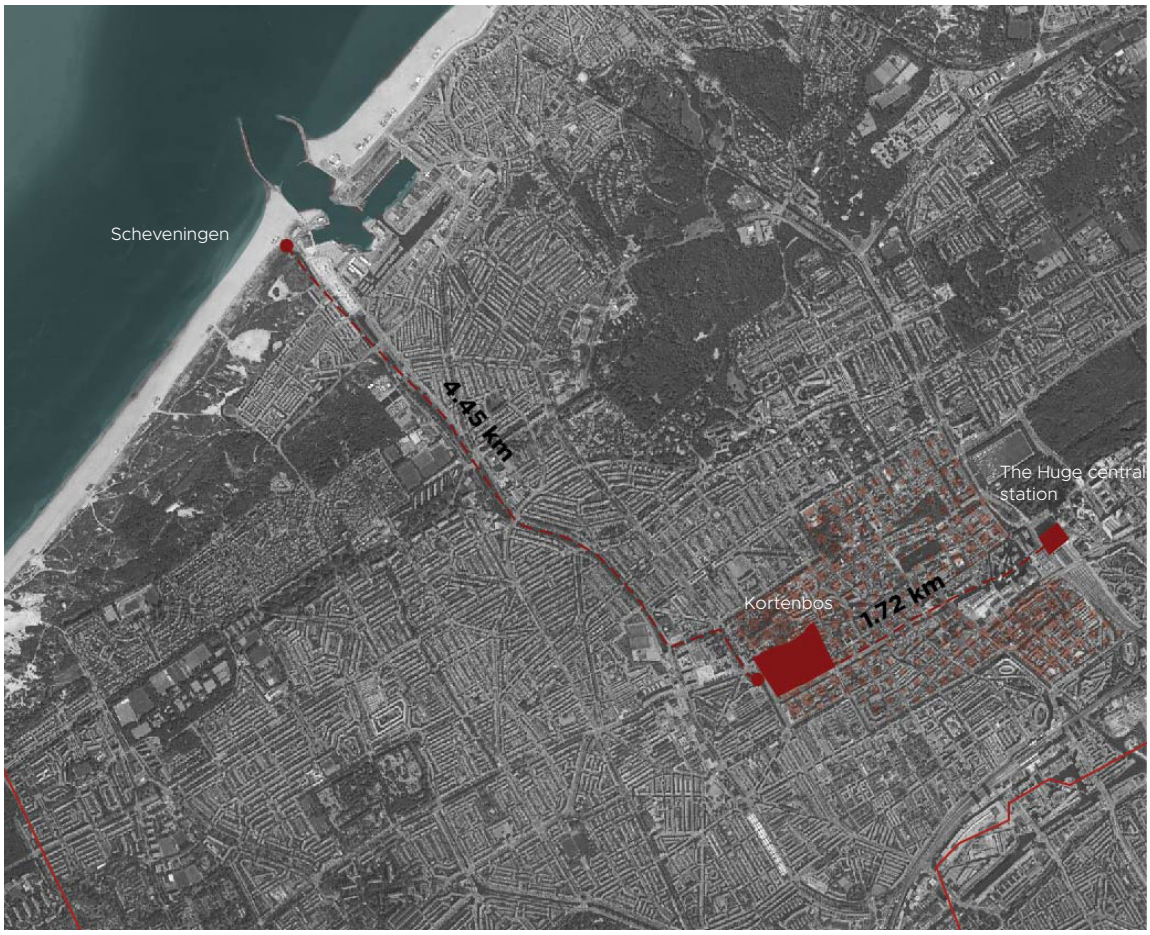
Climate map of The Hague with an indication of heat islands in dark red (Slabbers et al., 2010).

THE HAGUE COOL SPOTS

Cool spot at Every 300m

Cool spots is non-obligee regulation the Netherlands put it in action on 2020, the new building has to have as part of its program a cool spot open for public and kept cool during the heatwave. the cool spots available every 300m to be accessible by elderly, overweighted and children.

The Hague sever urban heat island effect zone



The Hague worst urban heat island effect zone location

Warm

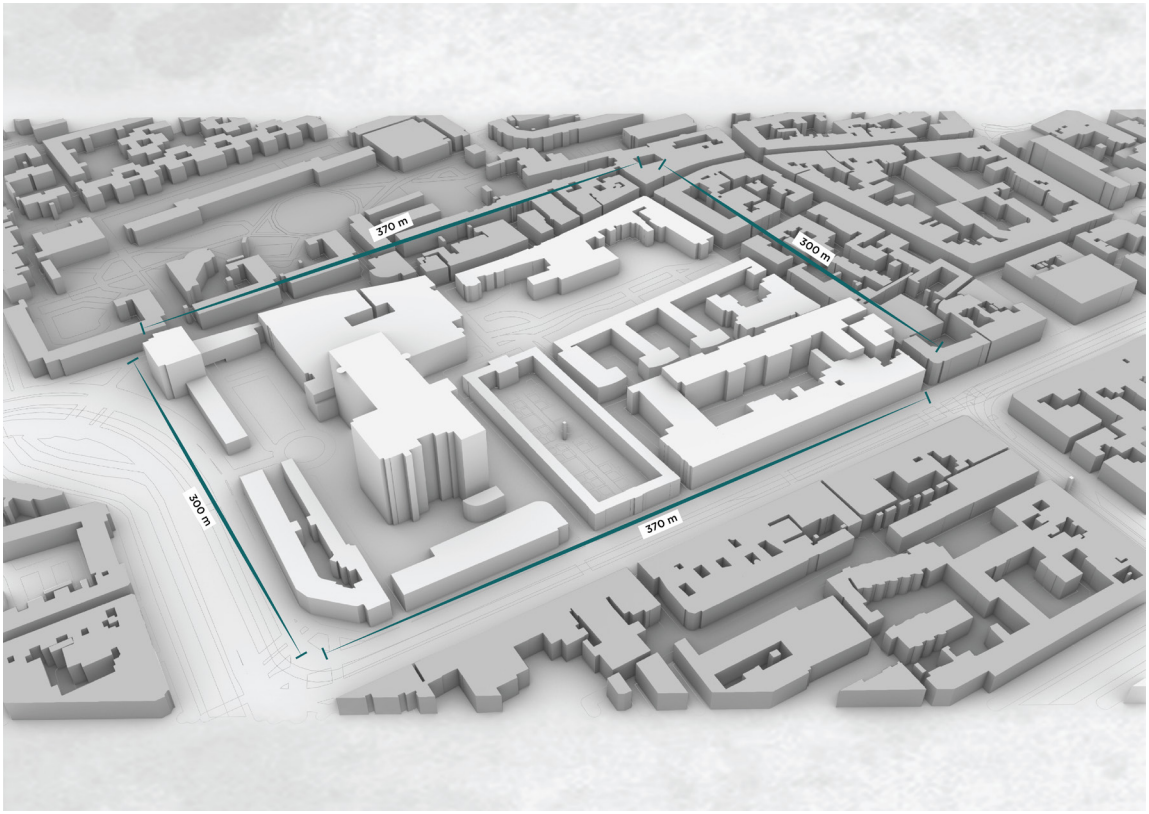
2 C° Warmer

Hot zones have less green area ,wide busy streets, many uncovered parkings' surfaces

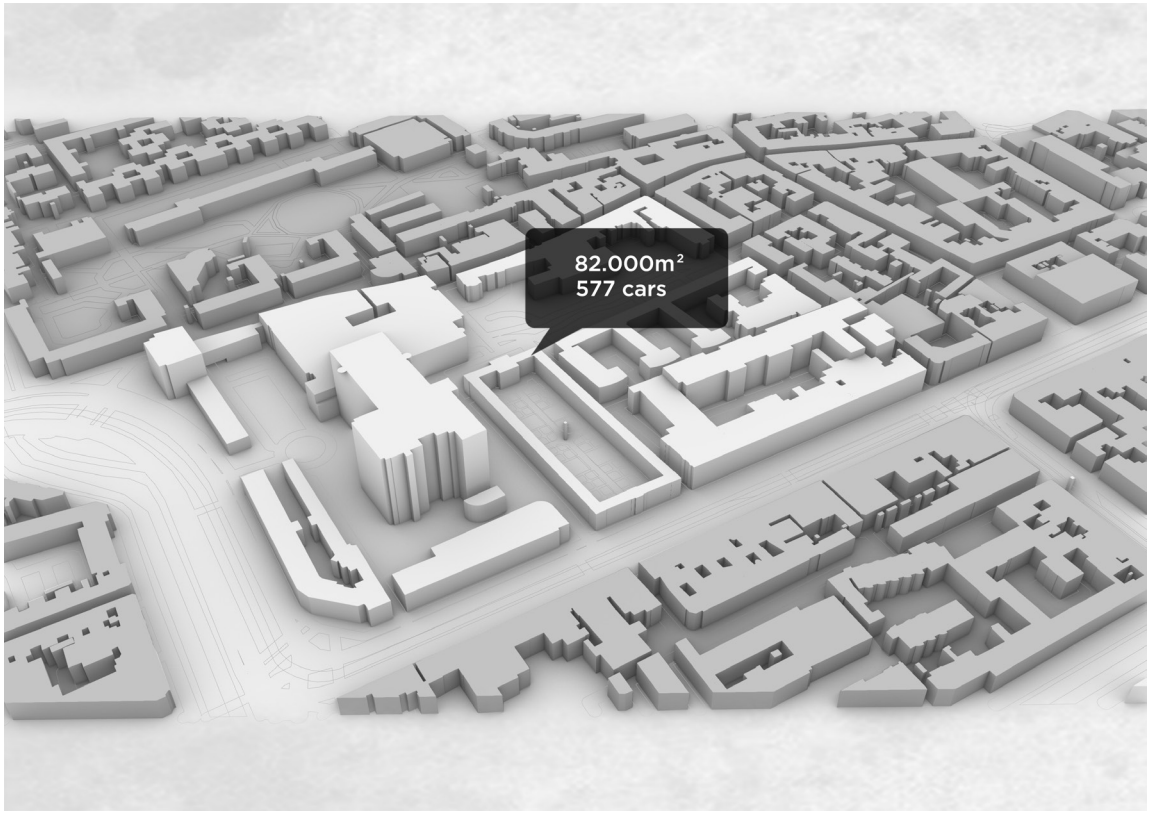
Cool

Cool zones have more green area ,narrow streets, Less uncovered parkings' surfaces

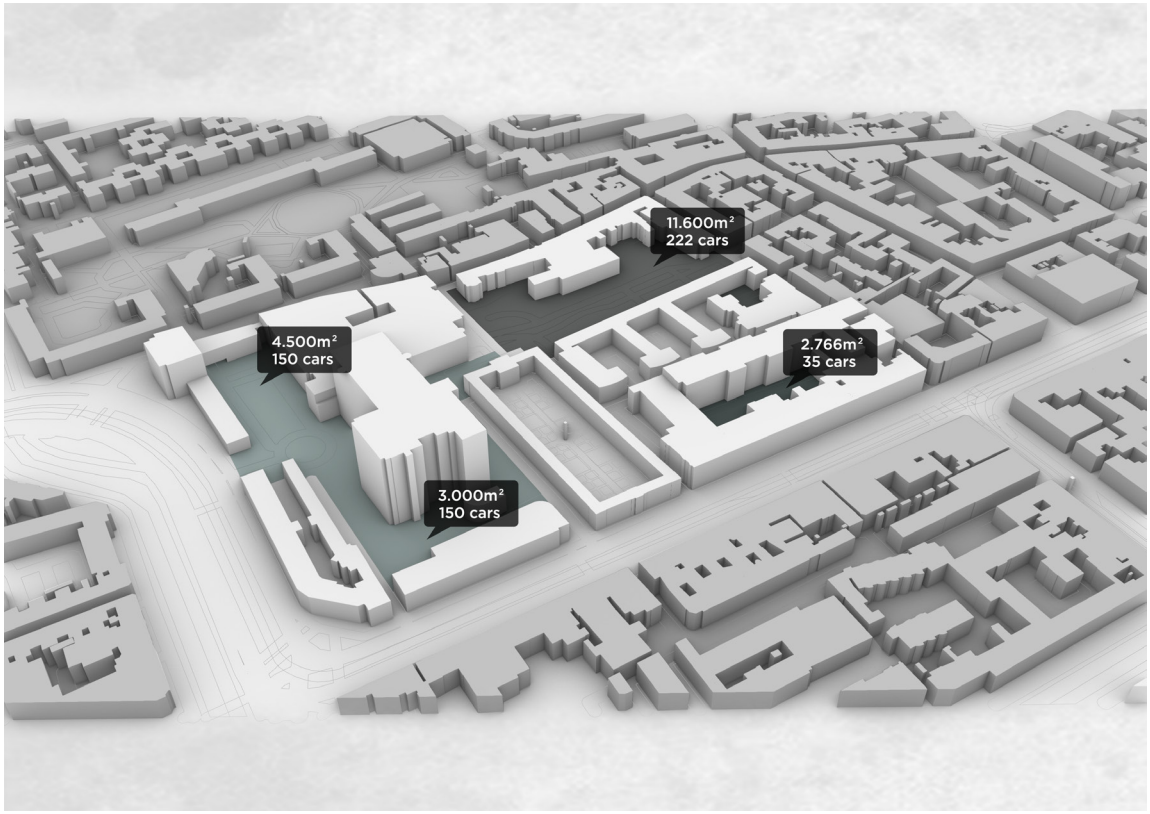
Urban typologies makes it possible to integrate the micro-climate in the design without needing urban micro-climate expertise. By analyzing specific neighborhood
Typologies applying a variety of micro-climate indicators three simple distinctive
Parameters emerge:
1 balance between pavement and natural surfaces;
2 building height;
3 built form.



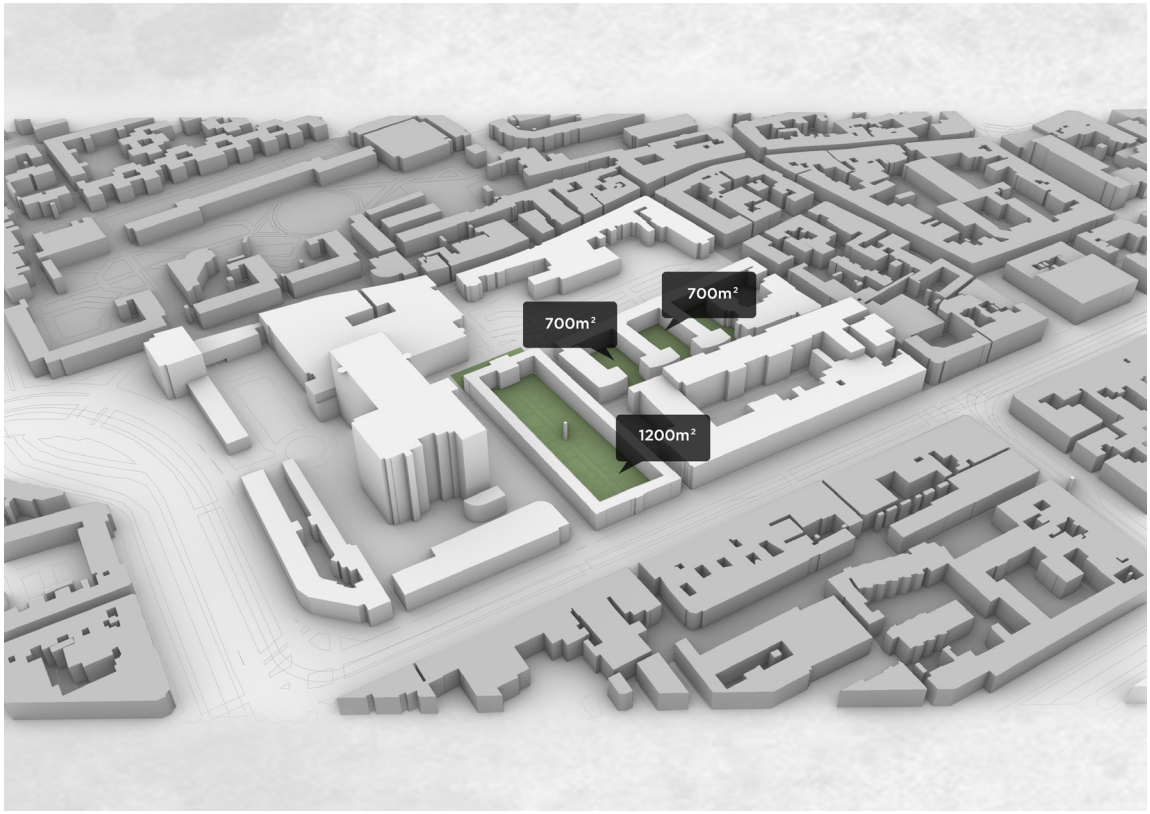
Block of 300m



General area and cars amount



Parking areas and cars amount



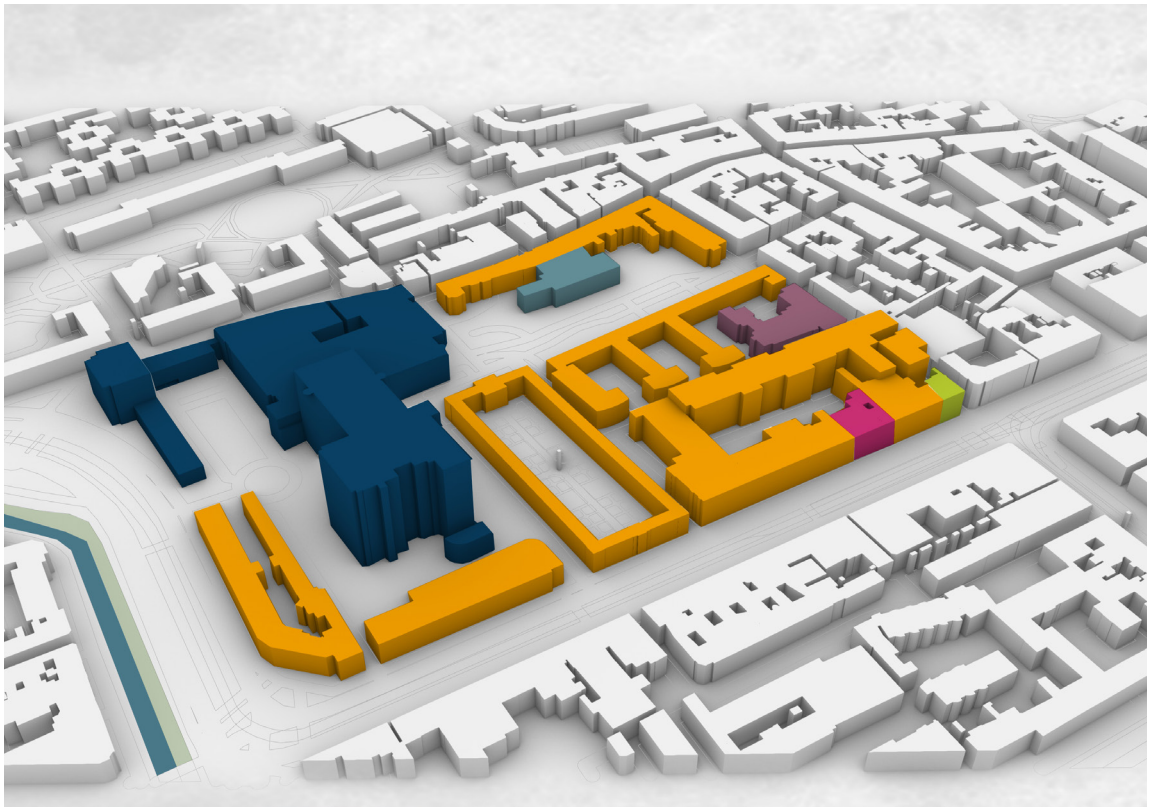
Garden areas and cars amount

Parking Vs Garden Vs cars

Trees Vs Cars

Single Vs Family

EXISTING FUNCTIONS



Hospital

Houses

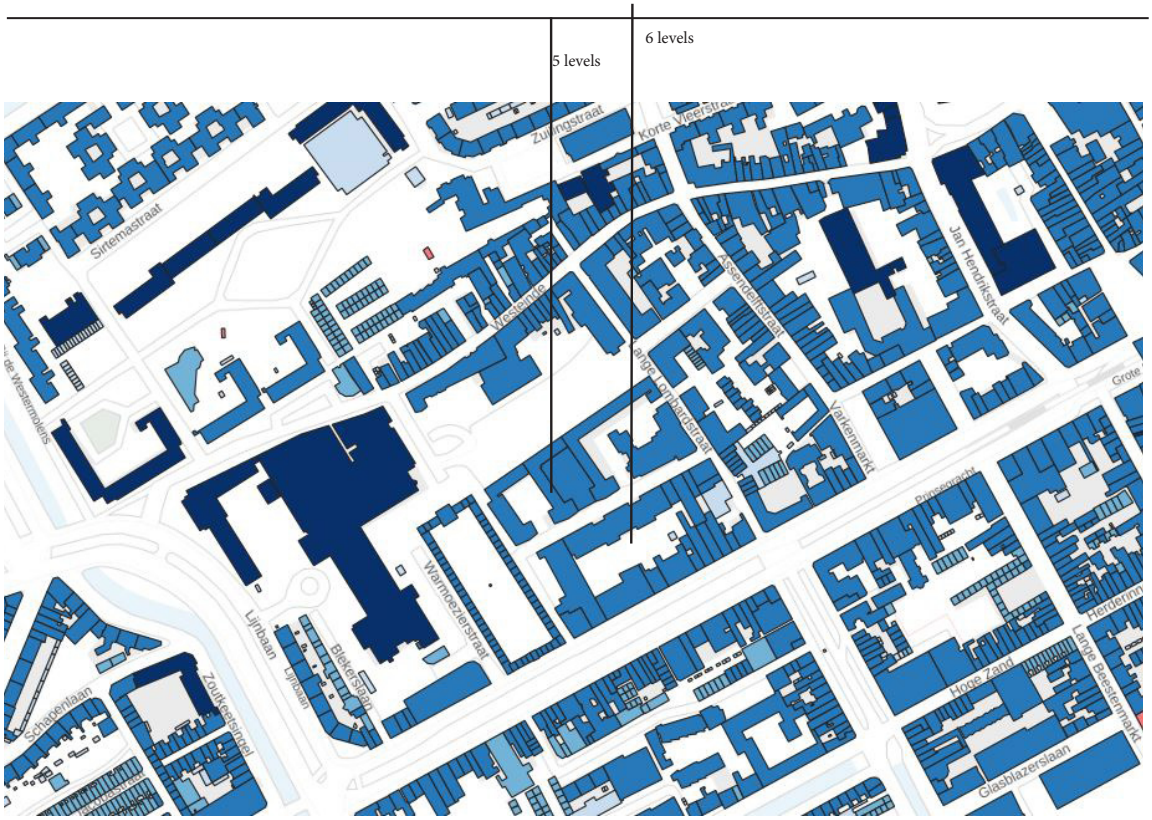
Vaccination center

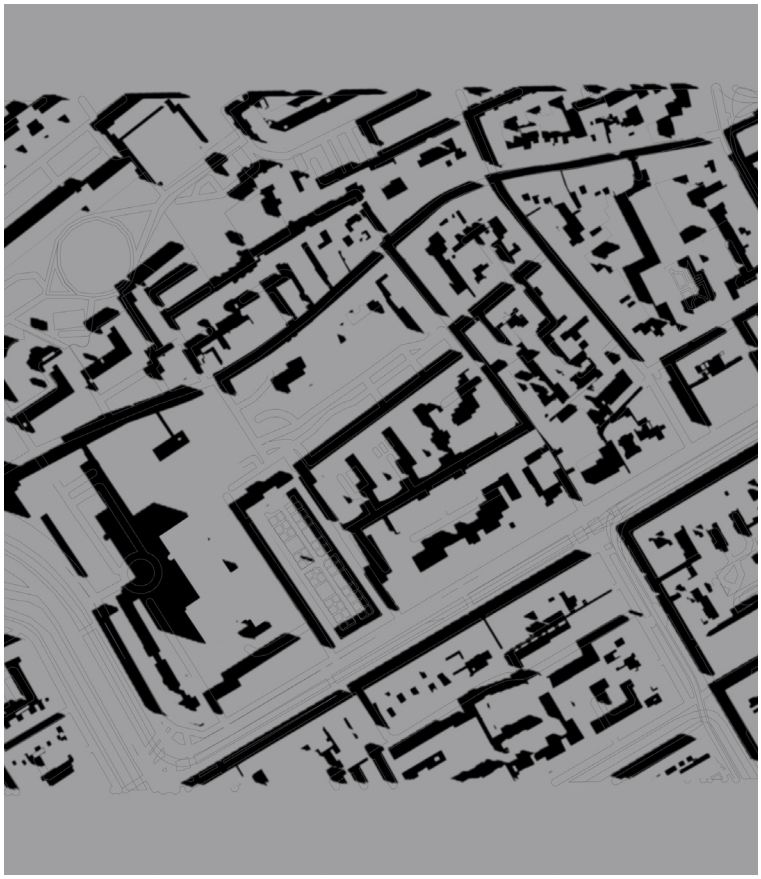
Embassy

Hostel

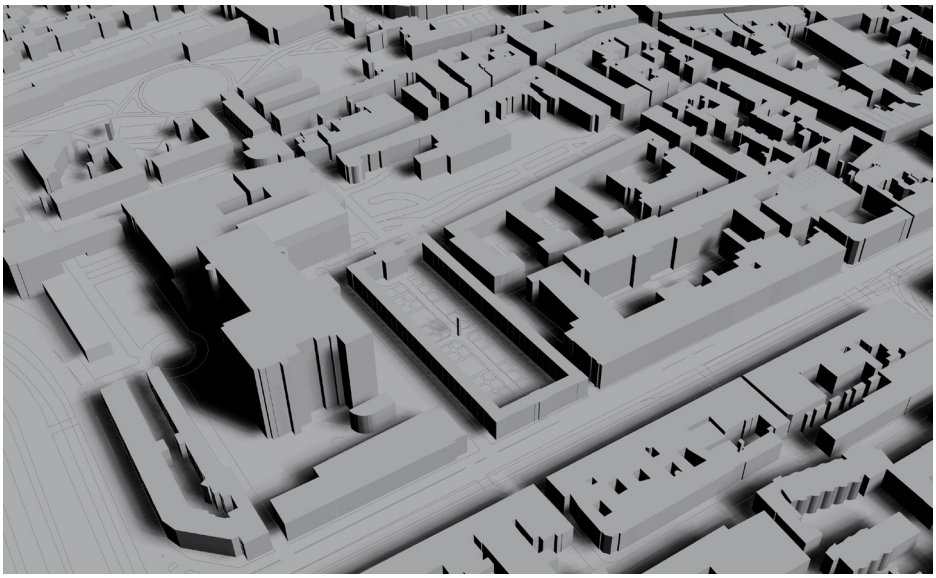
Church

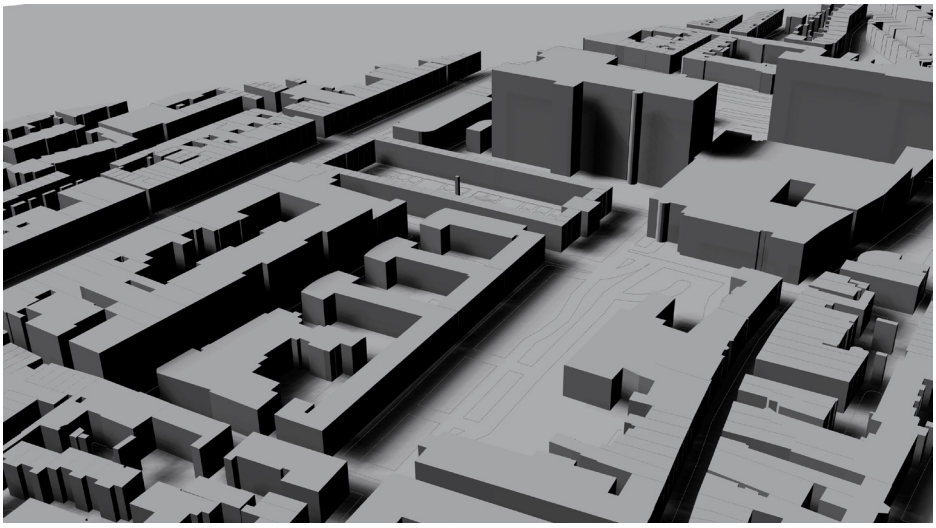
CONTEXT HEIGHTS





SOLAR STUDY





Solar movement During previous heatwave in July 2019 from two different prescriptive

https://drive.google.com/open?id=1Q4kXB9nYcn56r7NIKCeA92L4b2Le6PVC

https://drive.google.com/open?id=1yAb9ll7Kms-0nb6inNC5N4OmOWC1882G

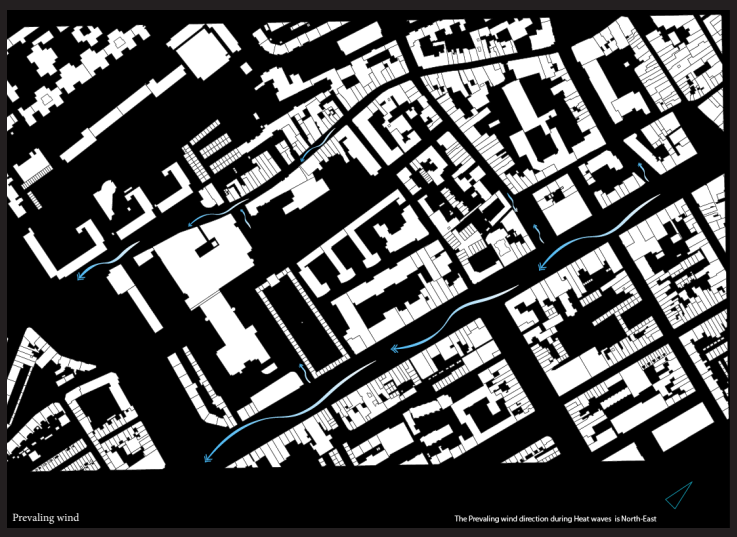
BUILDING DENSITY

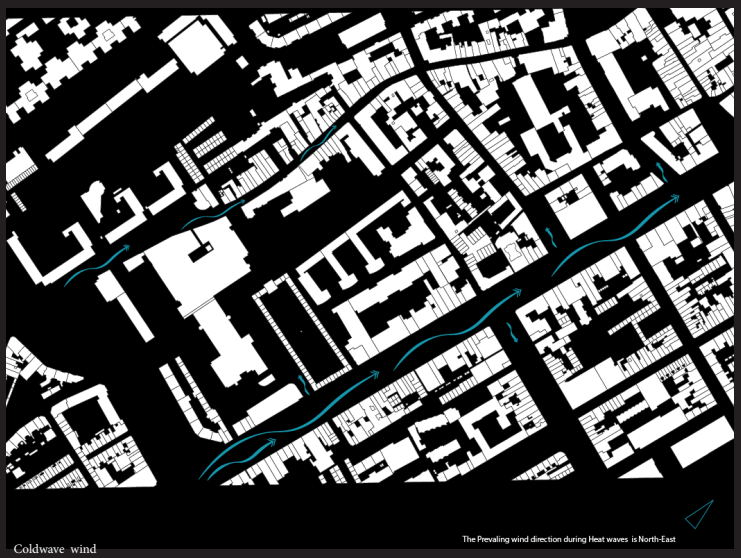
Solid

void

WIND STUDY


Heatwave wind - 0.5-2.5m/s
The Prevaling wind direction during Heat waves is North-East

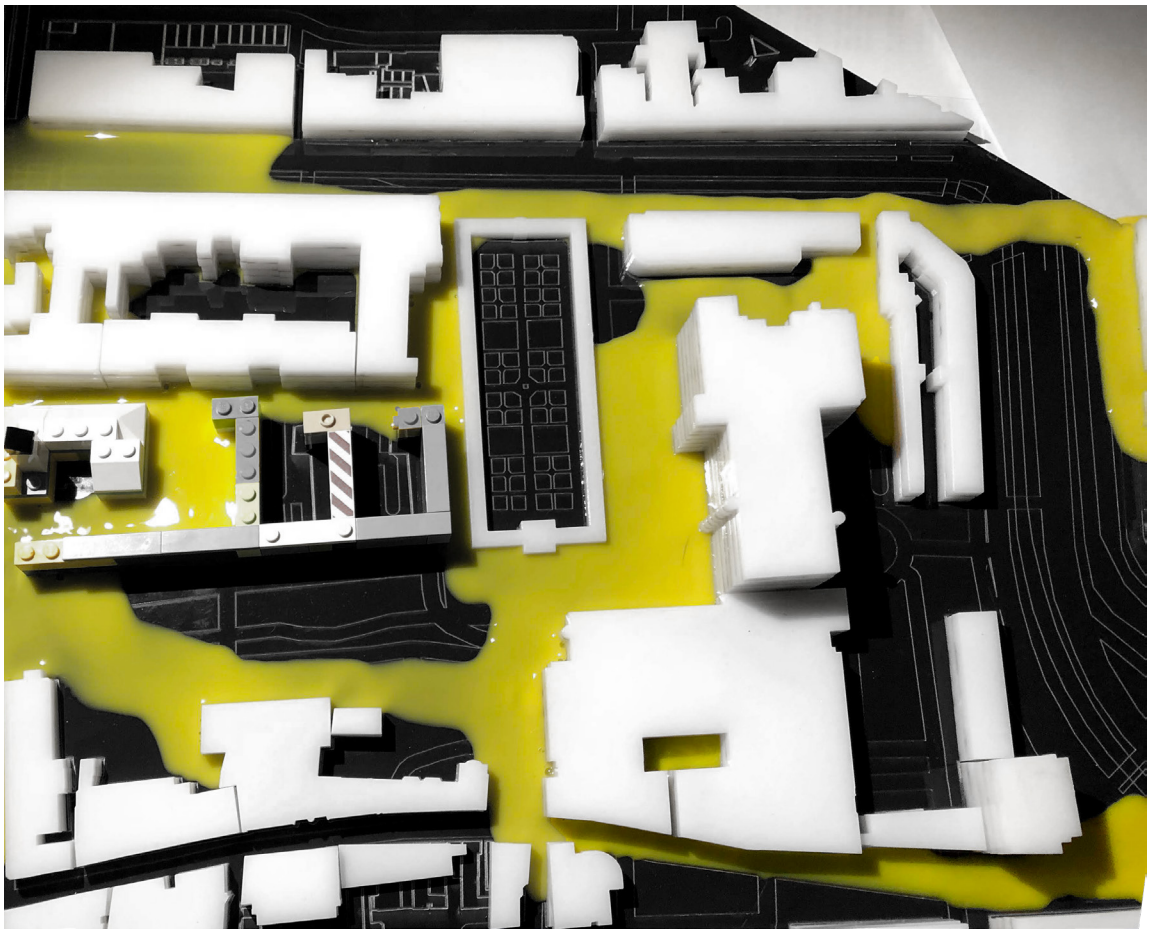

Prevaling wind
The Prevaling wind direction during Heat waves is North-East


Coldwave wind
The Prevaling wind direction during Heat waves is North-East

"For the Netherlands the prevailing wind direction during the heat waves is North-East. Unfortunately this is also the prevailing wind direction during cold waves,and moreover, the strongest year-round prevailing wind direction is exactly opposite: the South-west. therefore, streets oriented from N-E to S-W will be less comfortable in especially winter and during stormy weather. In addition, the measure will not be that effective because wind speed is usually very low during heat waves ,around 0.5-2.5m/s(KNML,2011).

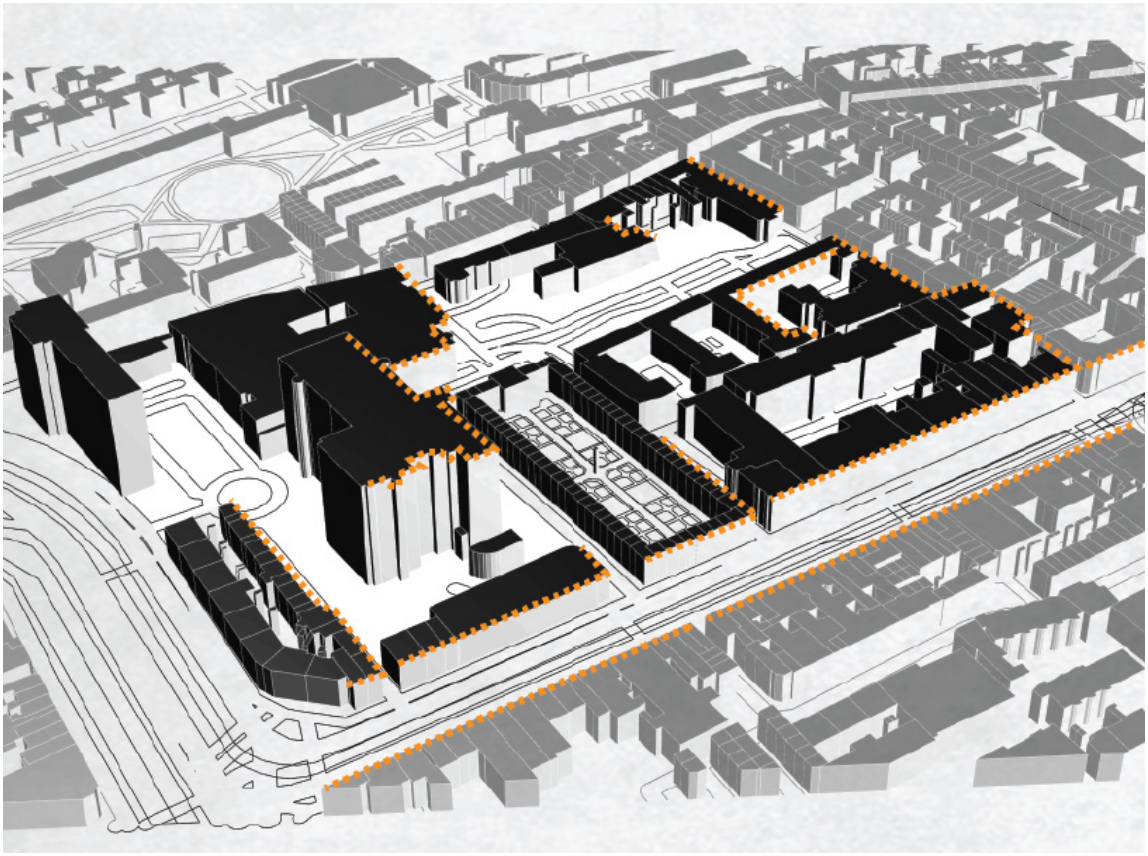
Another way to bring cool air in the street canyon during sunny weather could the to accelerate the process of thermal stratification. On a large scale this process is known from situations where cool airflow is generated from a park to a hot urban area adjacent to this park(Eliasson & Upmanis,2000). On the smaller scale of a street the use of temperature difference could be used to accelerate airflow"

L .Kleerekoper, Urban climate design, improving thermal comfort in Dutch neighborhoods , 2016



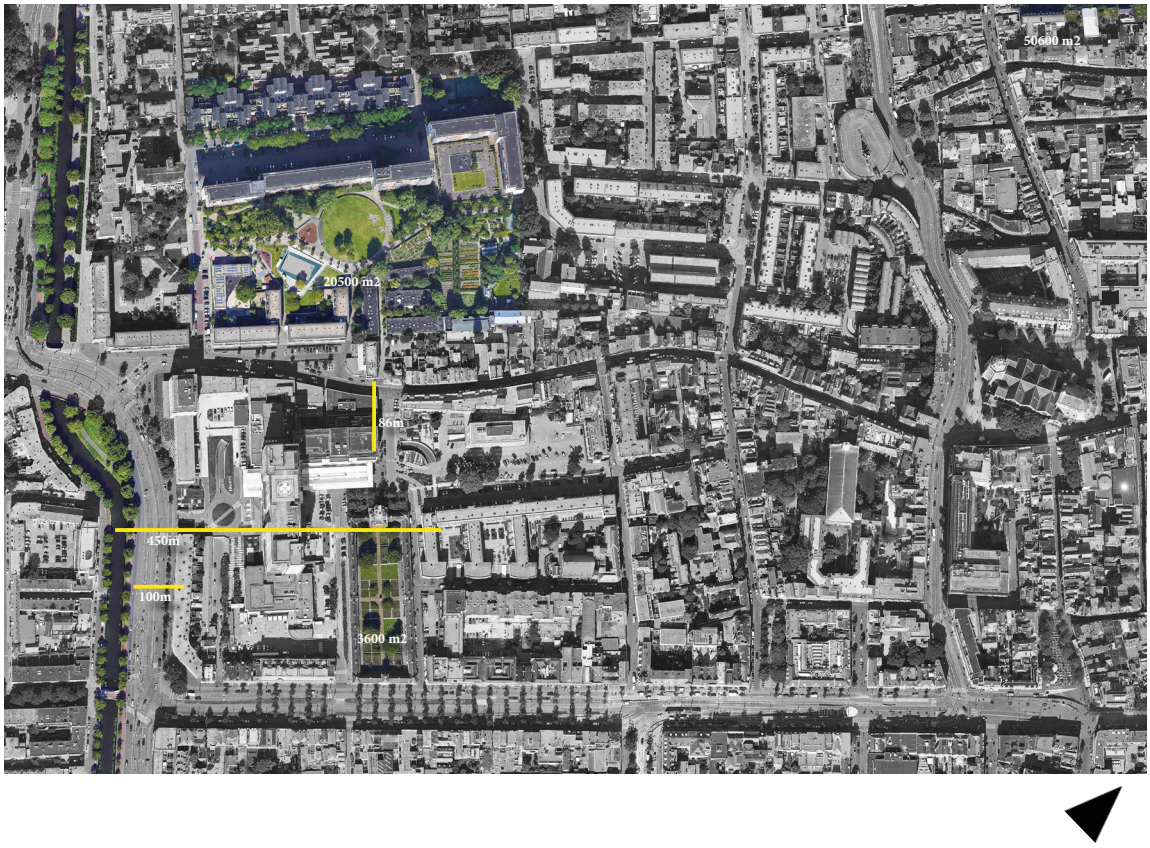
WIND SIMULATION

Airflow direction study demonstrates the surfaces facing the warm airflow during heat/cold waves.



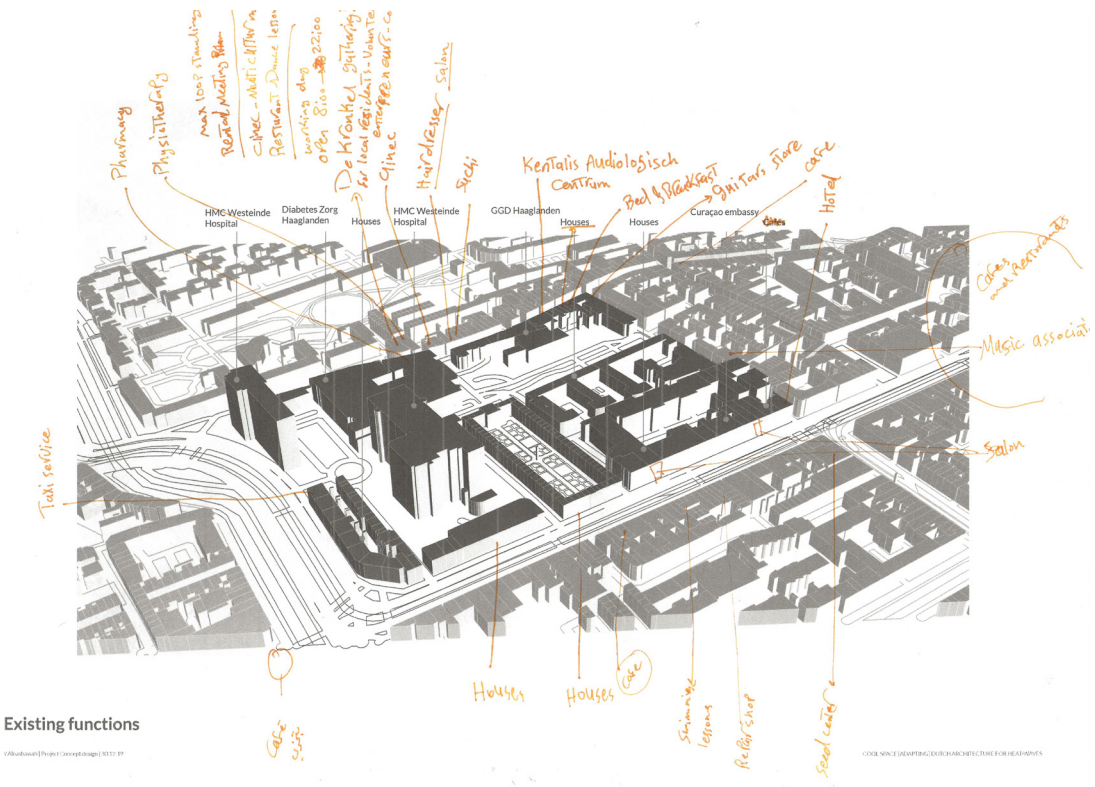
SURFACES FACING HOT-WIND

Diagram demonstrates the surfaces facing the warm airflow during heat/cold waves.

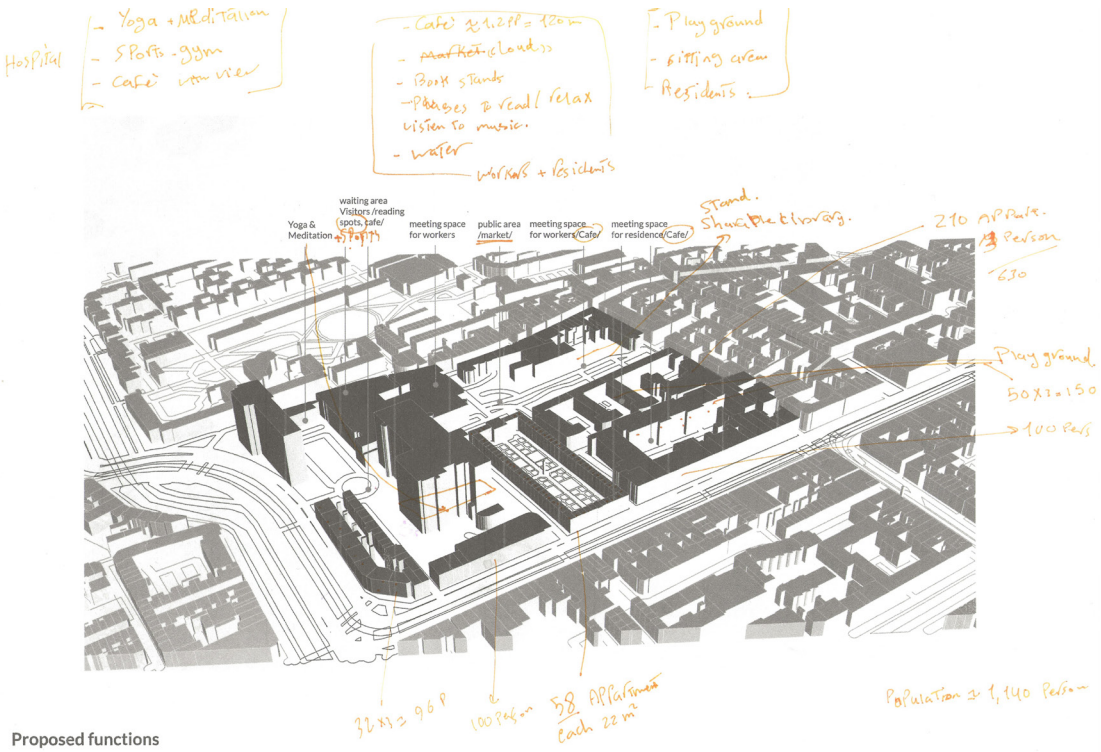


Existing natural elements the area of/ distance to each park in the neighborhood and the distance to the adjacent water channel.

EXISTING FUNCTIONS

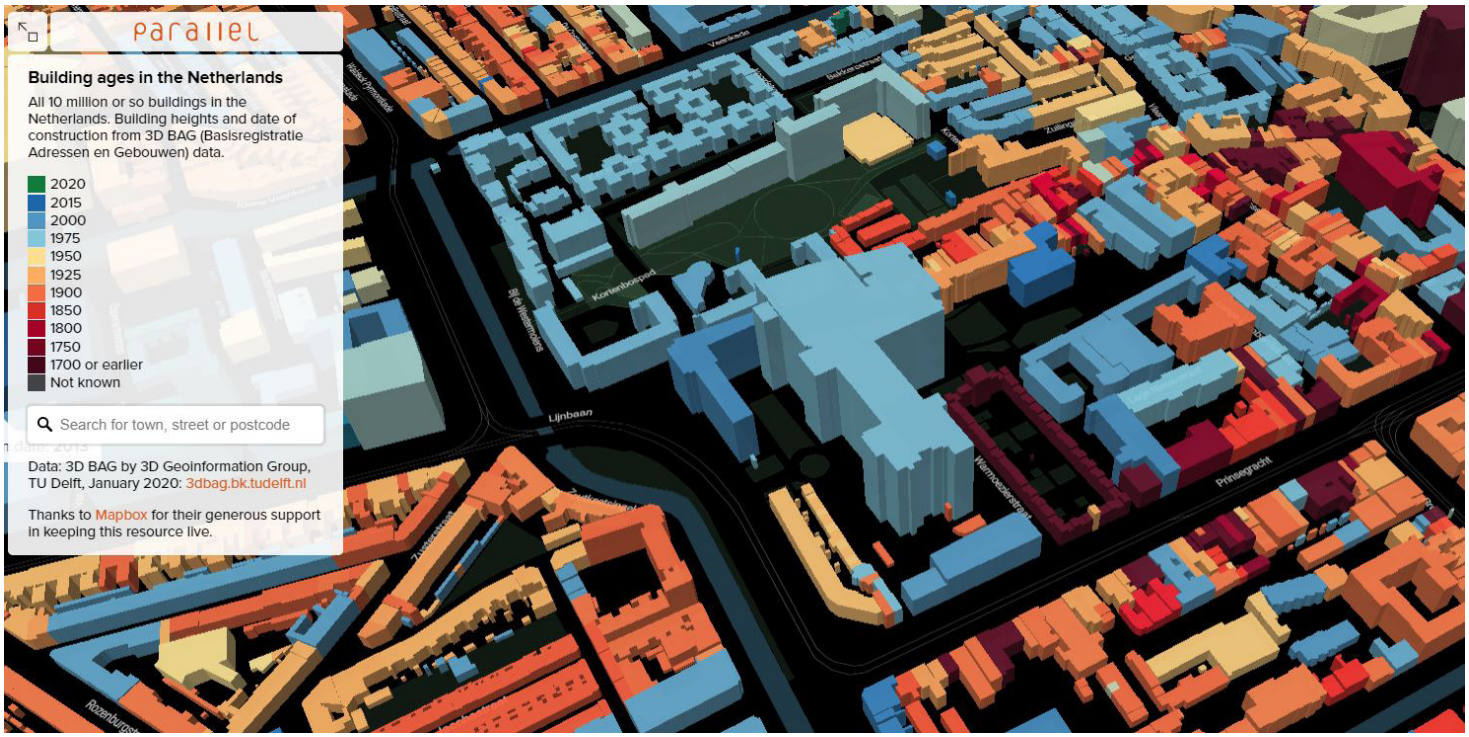


PROPOSED FUNCTIONS



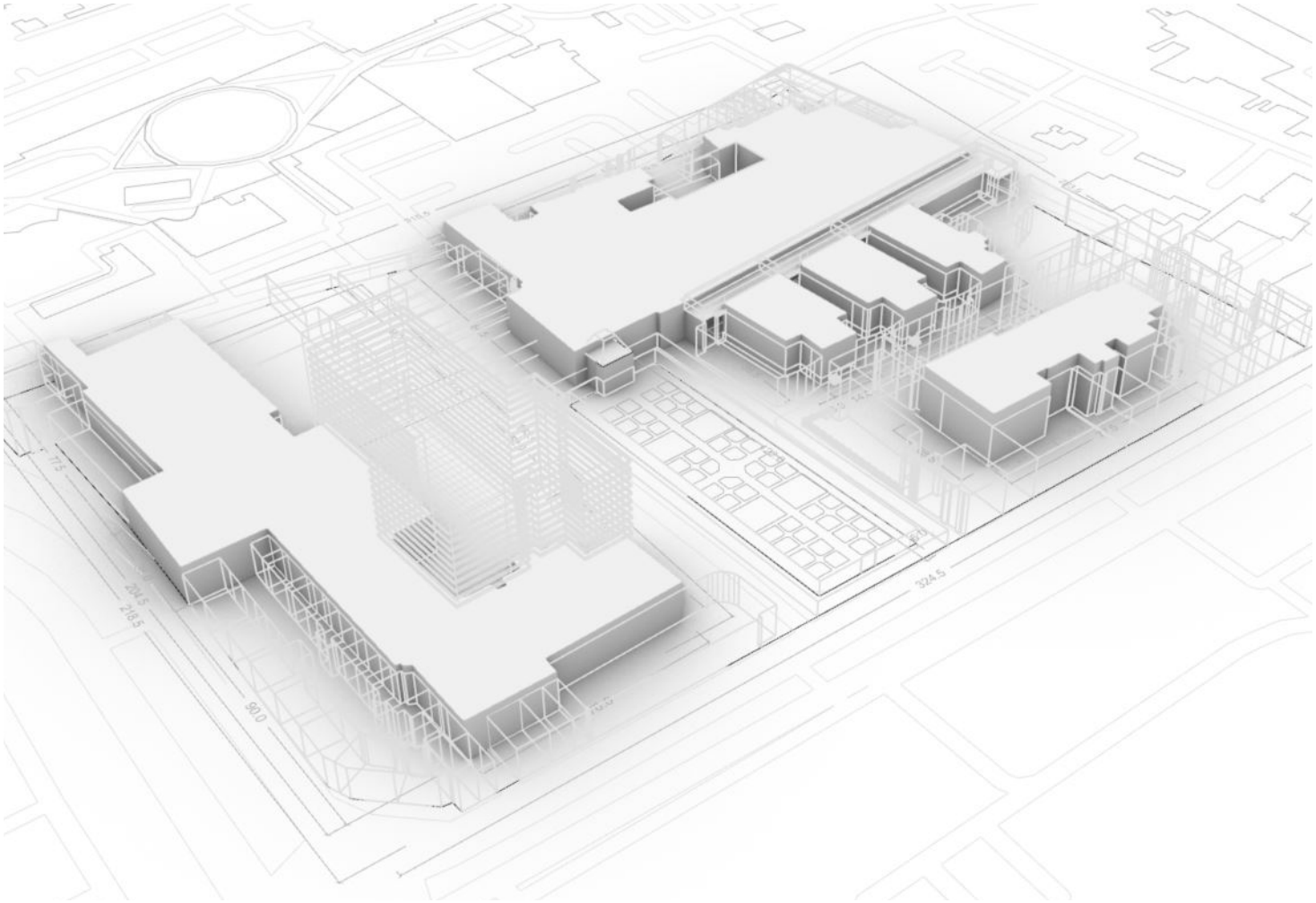
Proposed functions

BUILDINGS AGE



Hofje van Nieuwkoop-1661

built in Johan de Bruijn van Buijtewech, Lord of Nieuwkoop gardens on Warmoesstraat for poor or needy widows, The main entrance is on the Prinsegracht, but at the back of the Hofje is an entrance that is now used daily. In 1970 The Hofje turned into houses there are 62 houses in a rectangle around the garden.


324.5
90.0


315.5
150.0
36.5
70.0
29.5
50.0
12.5
77.5
38.5
59.0
84.5
63.0
43.0
13.5
173.0
83.5
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24.0
8.5
24.0
8.5
59.5
38.0
204.5
218.5
52.0
193.0
36.5
44.0
4.5
14.0
8.5
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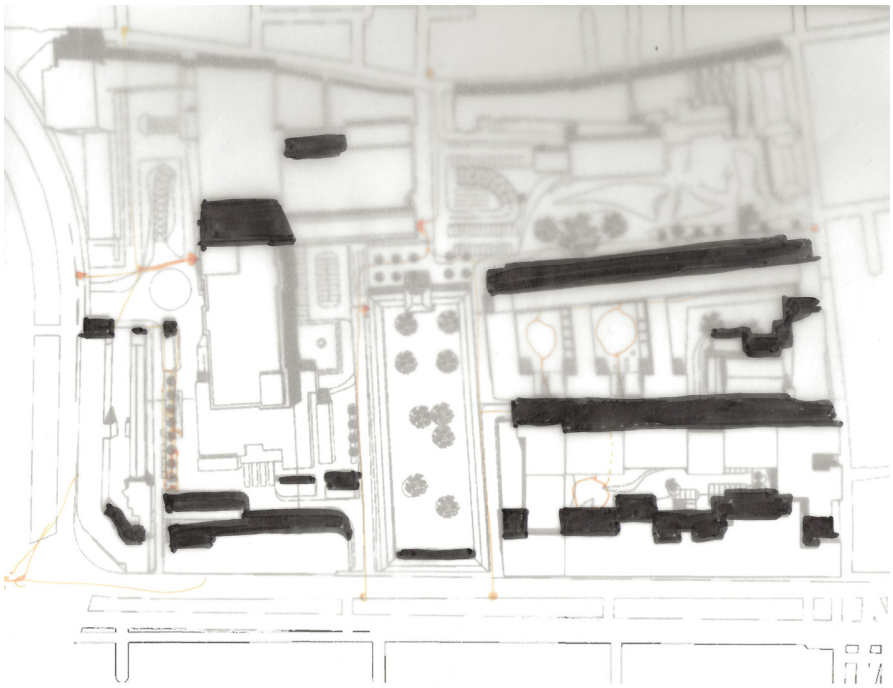
324.5

CITY FLOOR COOL SPACES



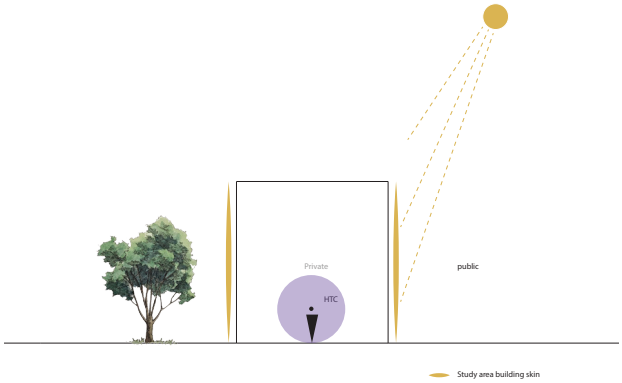
July 12:00

July 18:00

SOLAR STUDY

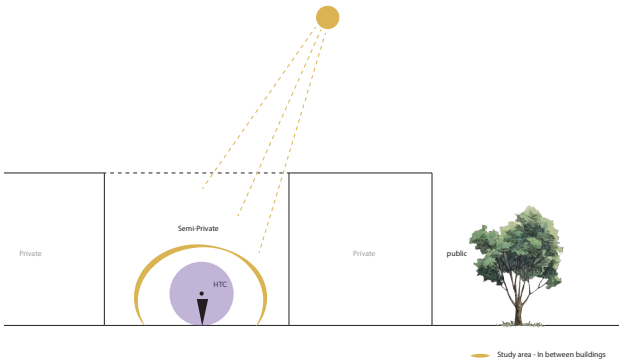
Solar study for the current typology during the last heatwave in July 2019. the study has been done at 12:00 around lunchtime when workers go for lunch and a short walk. At 18:00 when residents come back from work and would like to spend some leisure time out. Overlap the result to spot the unprotected areas might need an intervention to be more pleasant during a heatwave.

DESIGN SCENARIOS



a.Design building skin

The skin is attched to an existing construction
Pros- Cons
-Protect the envelop of existing buildings..
-enhance the interior thermal comfort.
-applicable almost in any case.
-correspond to cities imperatives.
-Impact on the adjacent surrounding microclimate.



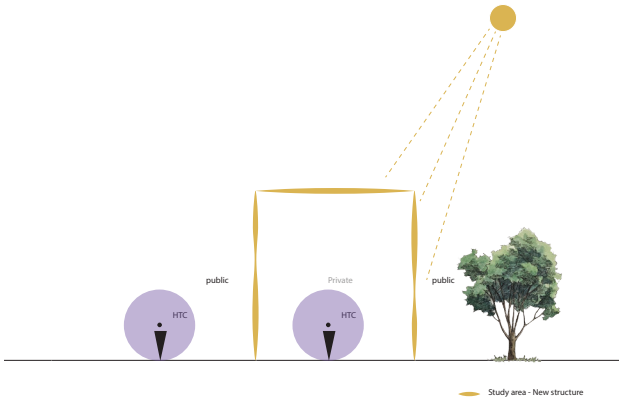
b.Design between buildings

The skin links building envelops and create new volume .

Pros- Cons
-Partly Protect the envelop of existing buildings.
-Enhance the interior/exterior thermal comfort.
-Applicable almost in any case considering space typology .
-Correspond to cities imperatives.
-Impact on the adjacent surrounding micro-climate on wider rang.
-Adaptation on neighborhood scale.
-Provide space for social activities.

Cool spots

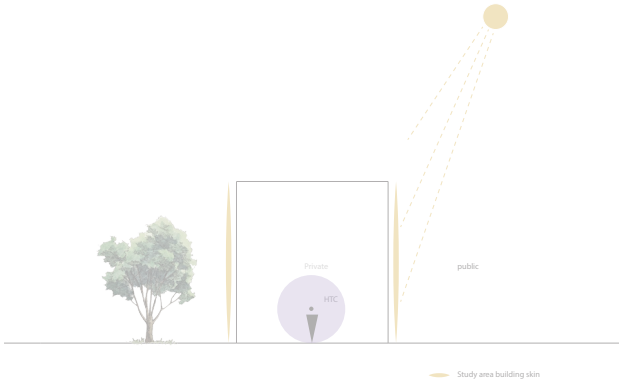
is a new building regulation in the Netherlands, where it is obliged to have a semi-private /public spots around the city with in 300m radius.
it is in practice in Den Haag, the rest municipalities will follow in January 2020.



c.Design new Structure

The skin links building envelops and create new volume .

Pros- Cons
-Enhance the interior thermal comfort.
-Applicable almost in any vacant plots considering space typology
.
-Correspond to cities imperatives.
-Impact on the adjacent surrounding microclimate on wider rang.
-Provide space for social activities.



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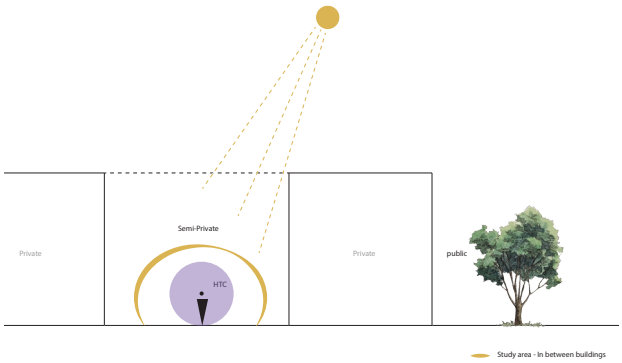

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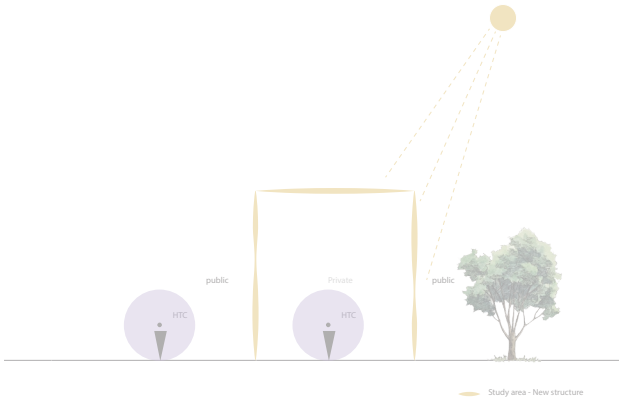

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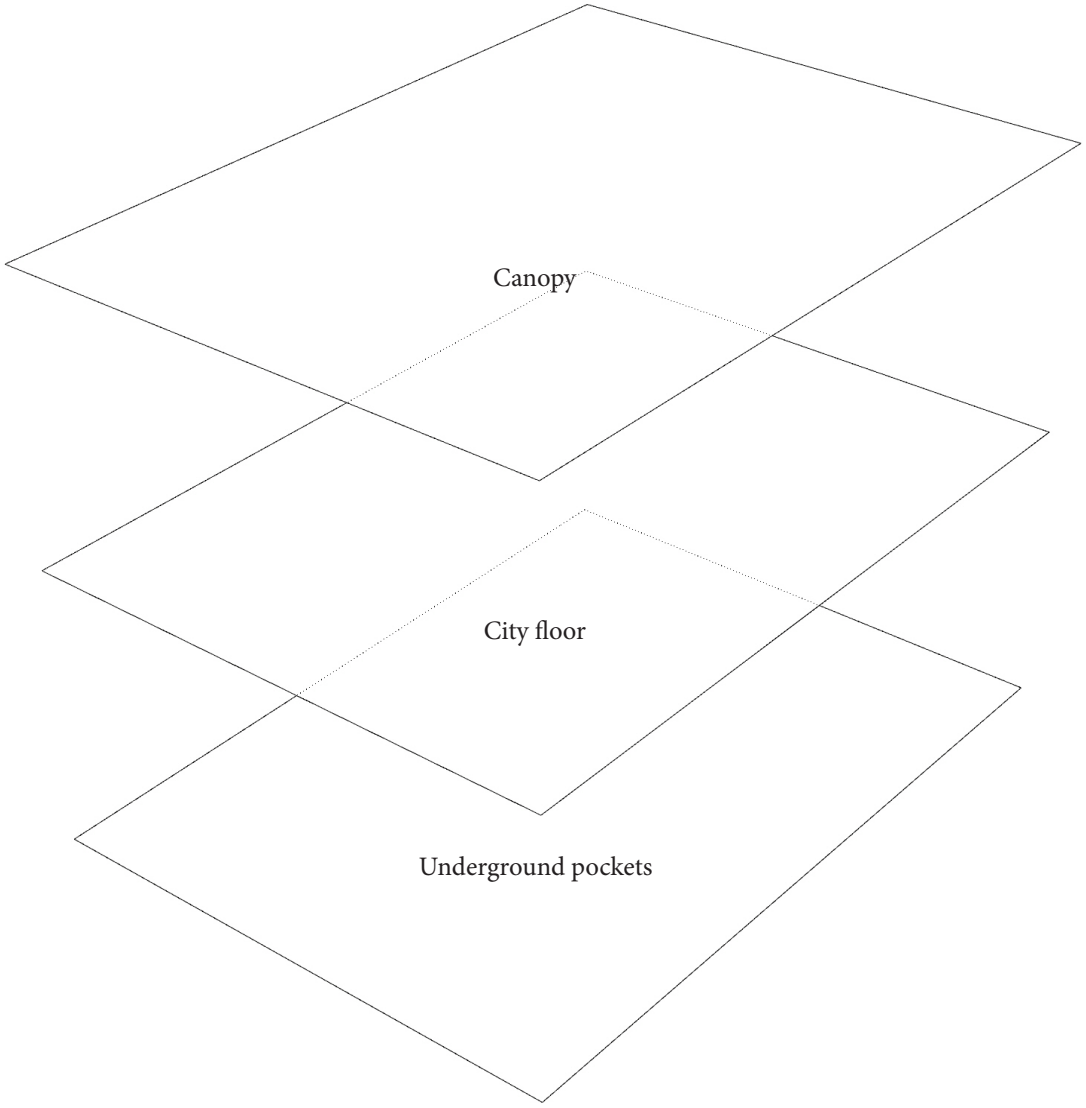
COOL SPACE ASPECTS

DARK & BRIGHT MATERIALS

SHADOW & LIGHT

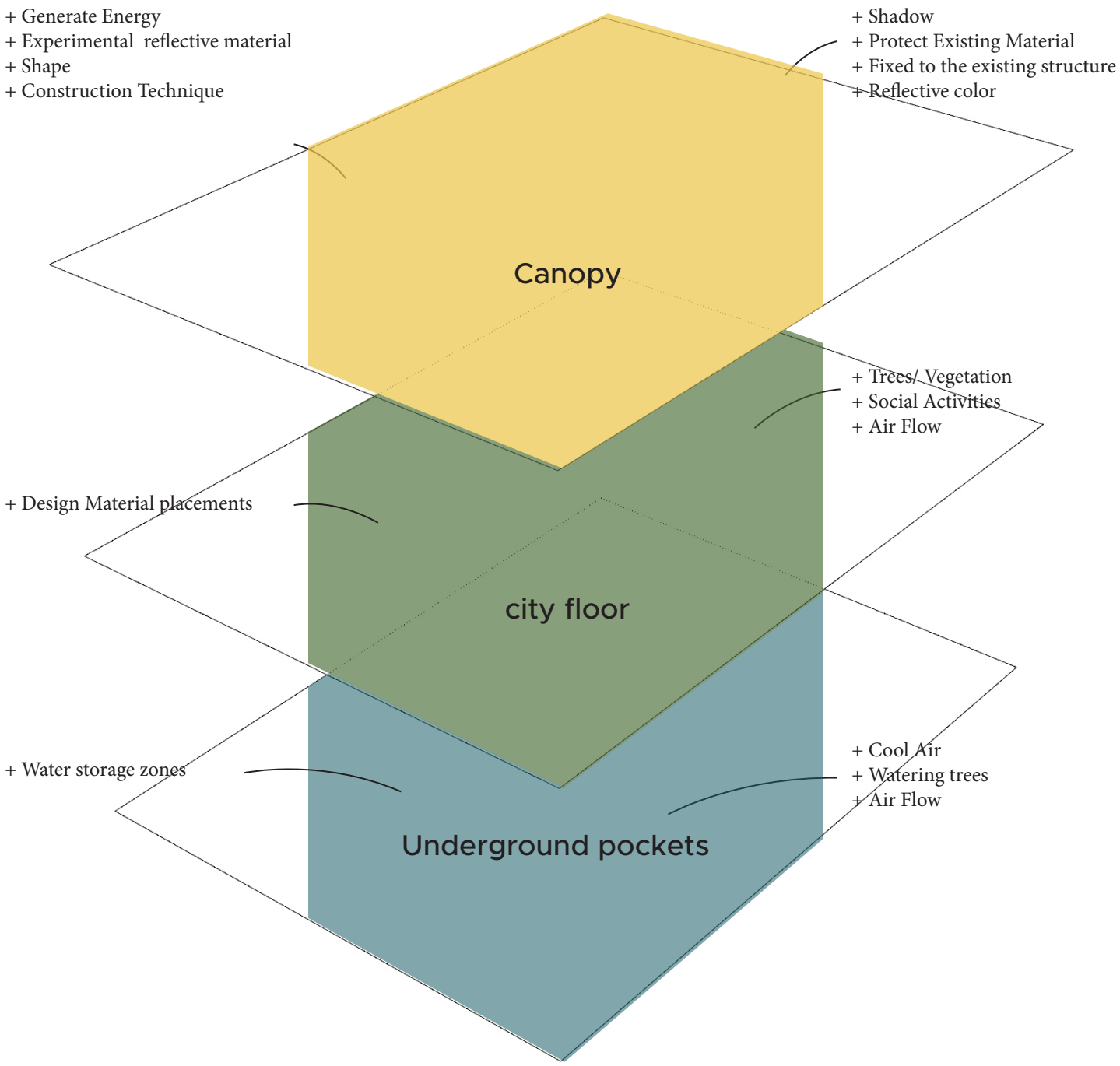
SOLID & VOID



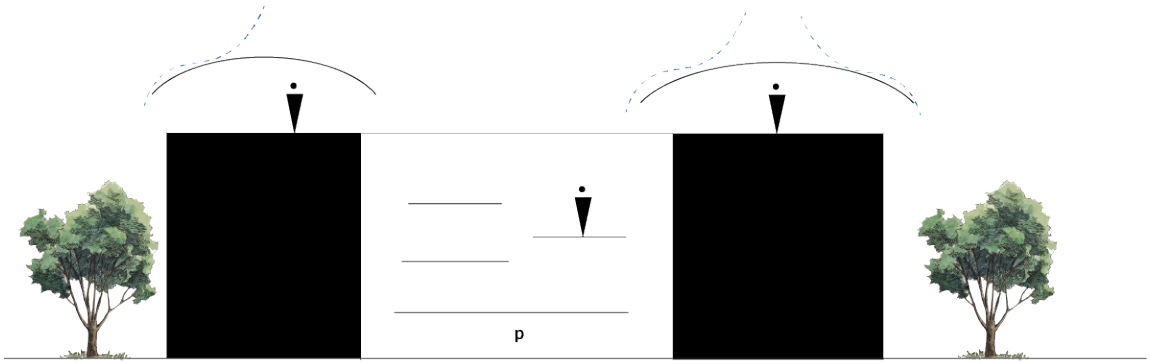
DESIGN INTERVENTION LEVELS

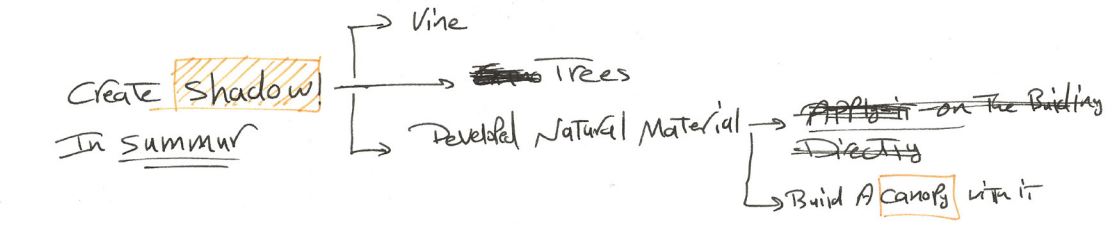
COMPUTATIONAL

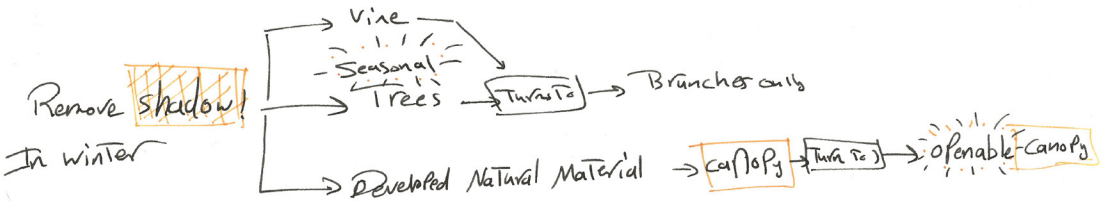
TRADITIONAL

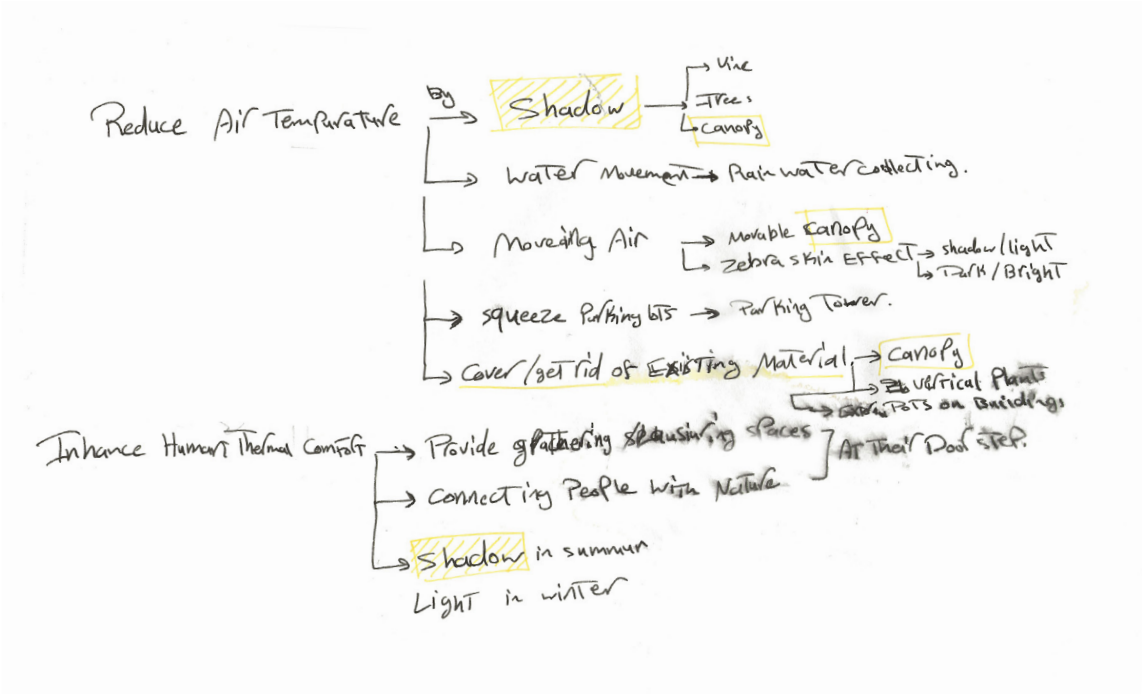


CANOPY

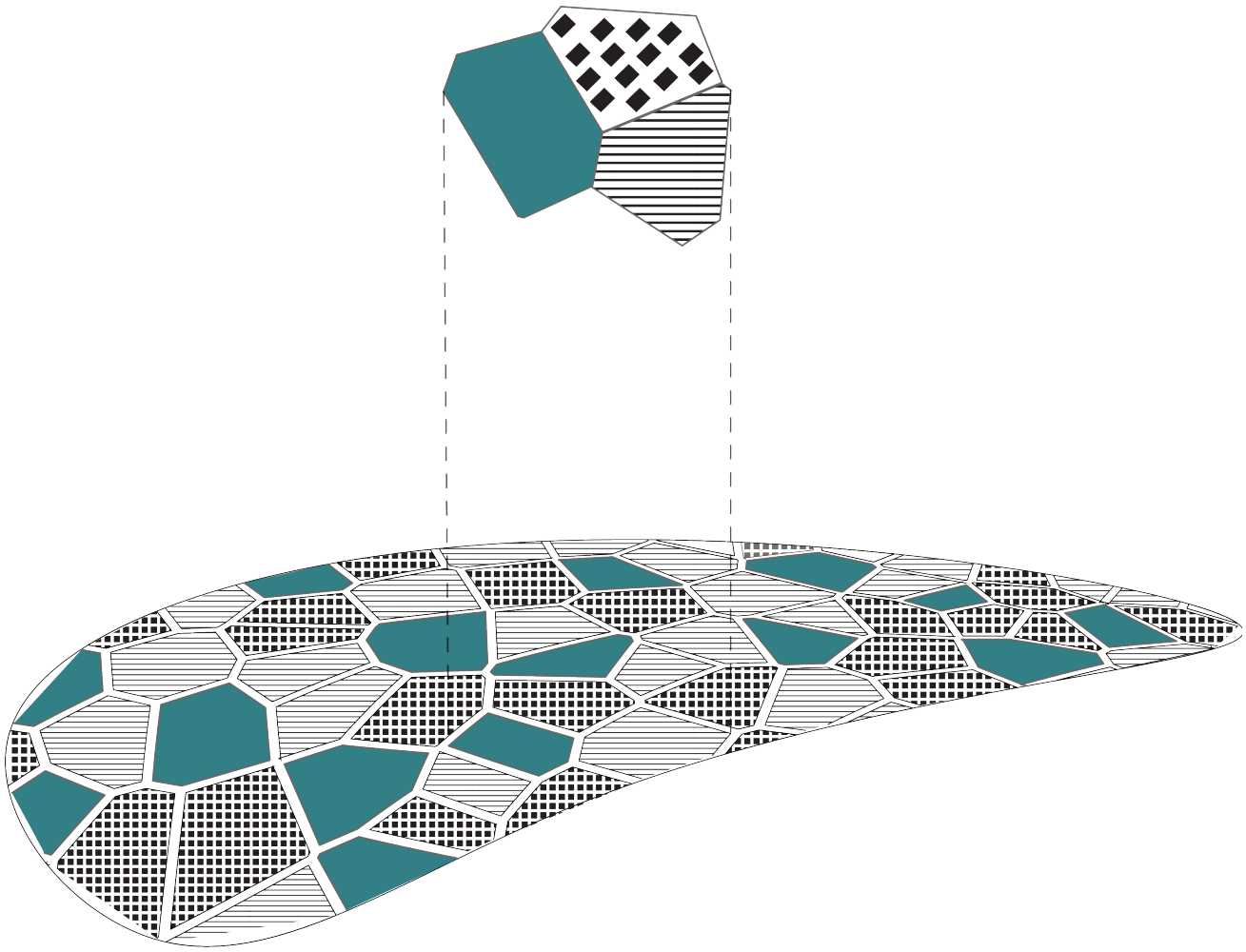

p


Create Shadow
In summur
Vine
Trees
Developed Natural Material
Directly
Build A Canopy with it


Remove Shadow
In winter
Vine
Seasonal
Trees
Turn To
Brunches only
Developed Natural Material
canopy
Turn To
openable canopy

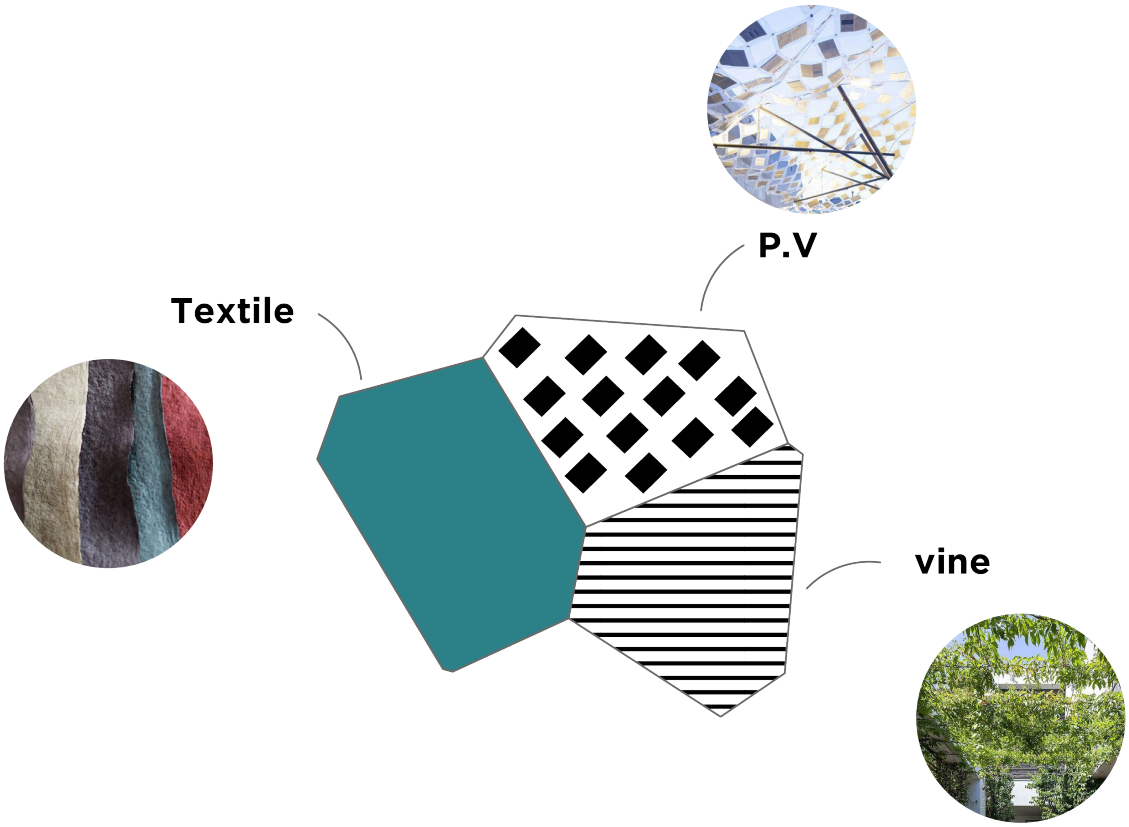

Reduce Air Temperature
By
Shadow
Vine
Trees
canopy
water Movement
Rain water collecting.
Moveing Air
Movable canopy
zebra skin Effect
shadow/light
Dark/Bright
squeeze Parking lots
Parking Tower.
Cover/get rid of Existing Material
canopy
Vertical Plants
Pots on Buildings
Inhance Human Thermal Comfort
Provide gathering spaces
At Their Door Step.
connecting People with Nature
Shadow in summur
Light in winter

CANOPY STRUCTURE

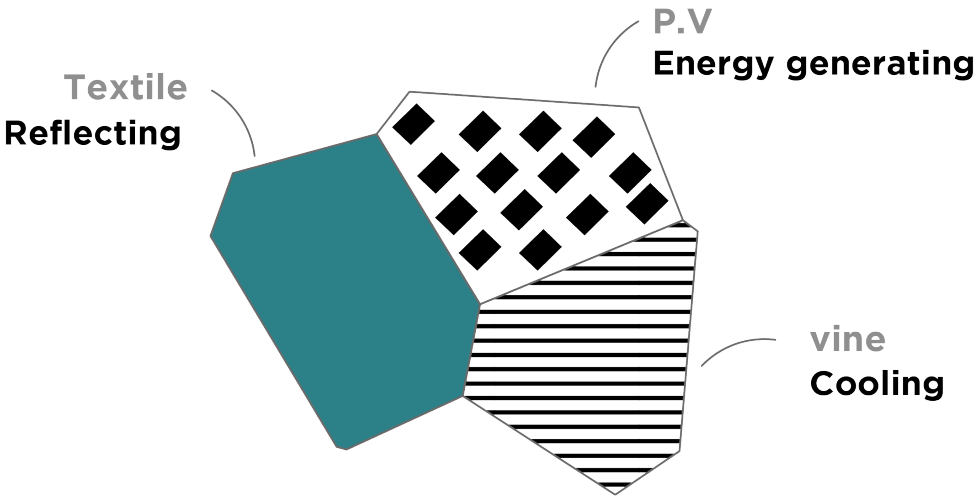


Structure made up of 3D-printed in a mixture of polylactic acid (PLA) – a fully compostable bioplastic that is made using renewable resources – and wood fibers.

CANOPY CELLS



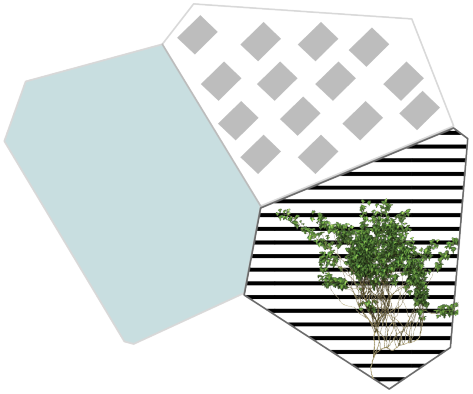
CANOPY CELLS MATERIAL



Sun Protection

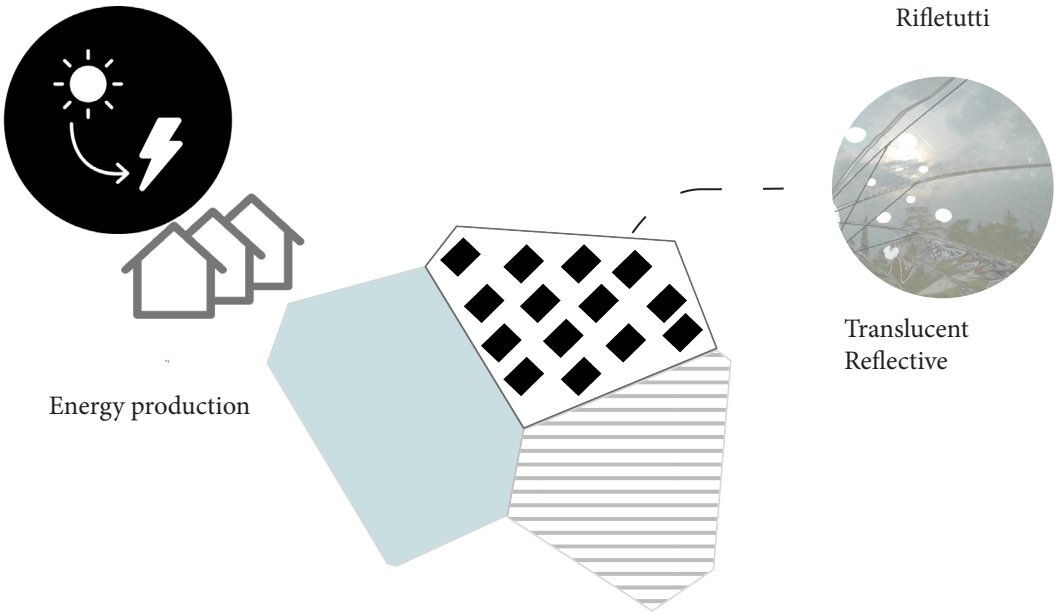
Shadows

Increase solar panels performance

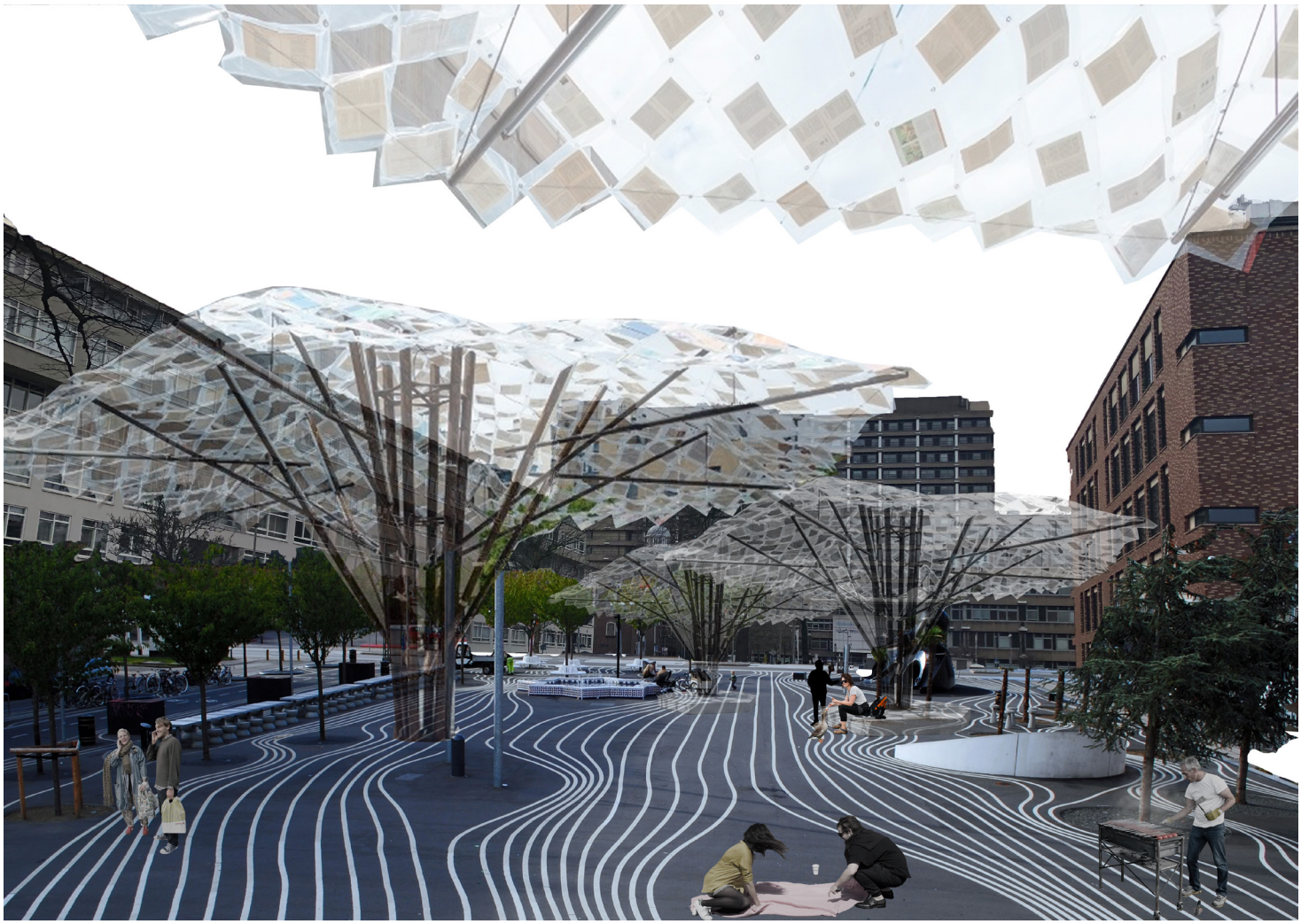


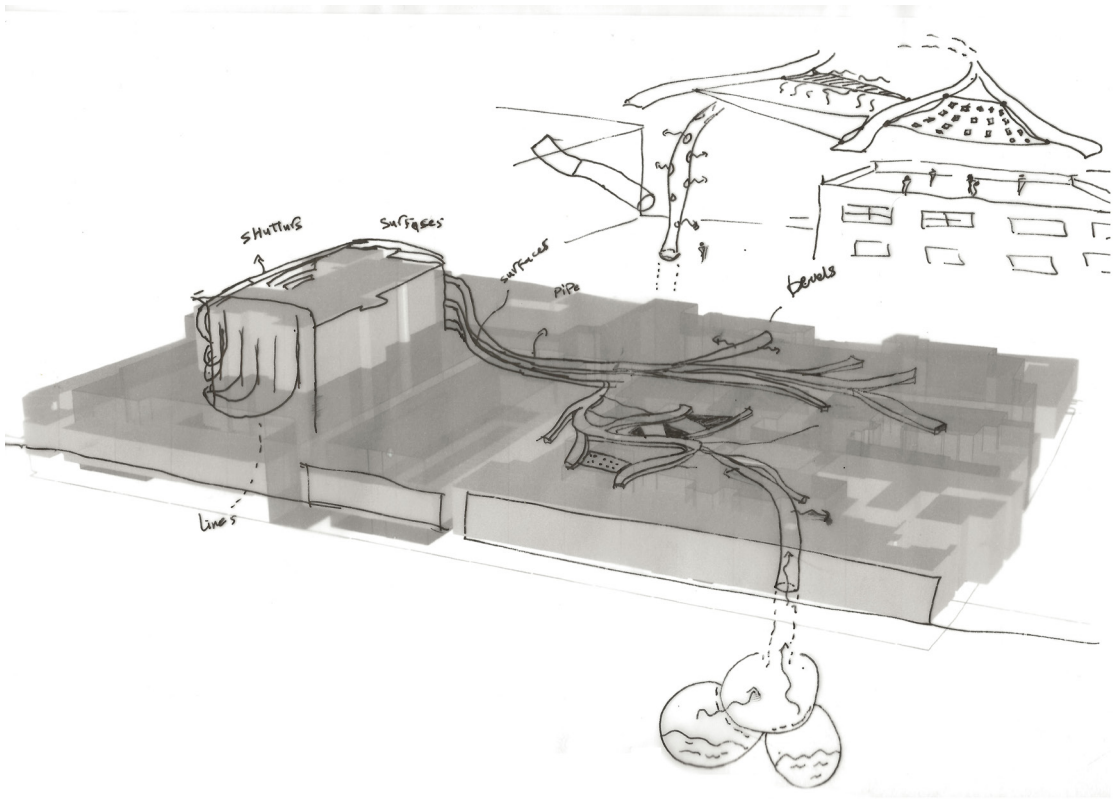
Biodiversity

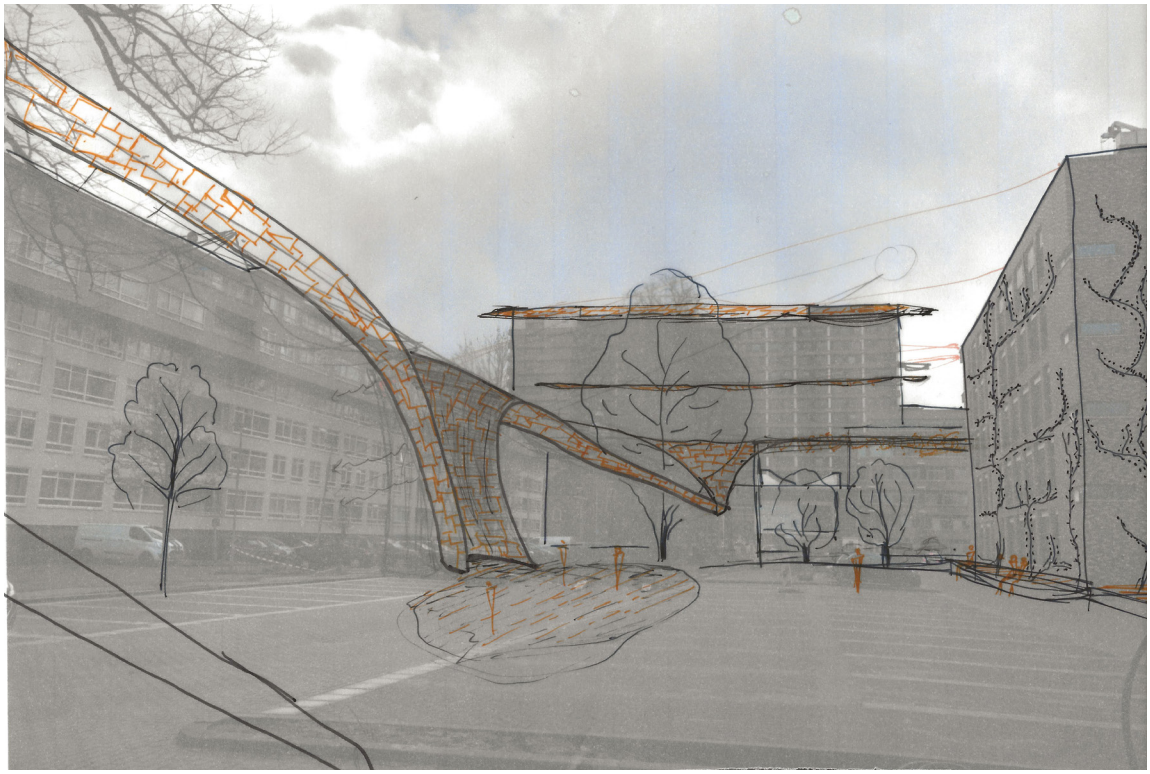
PERGOLA
Cooling

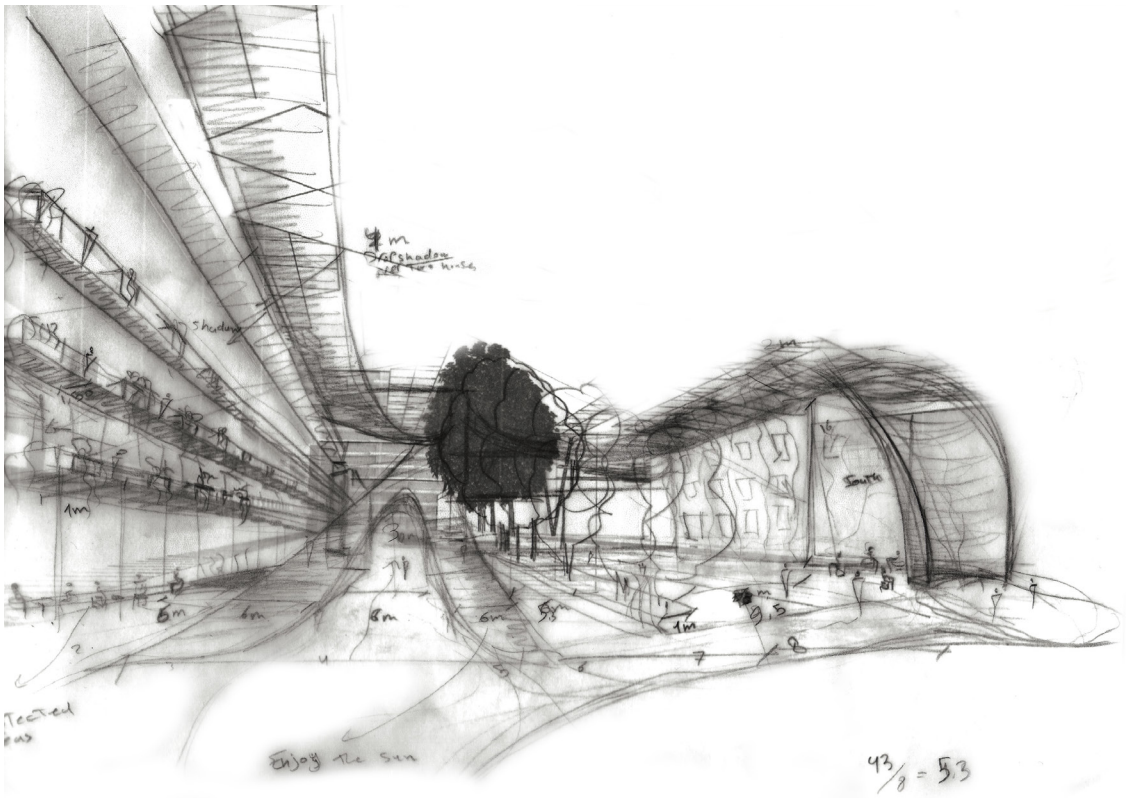


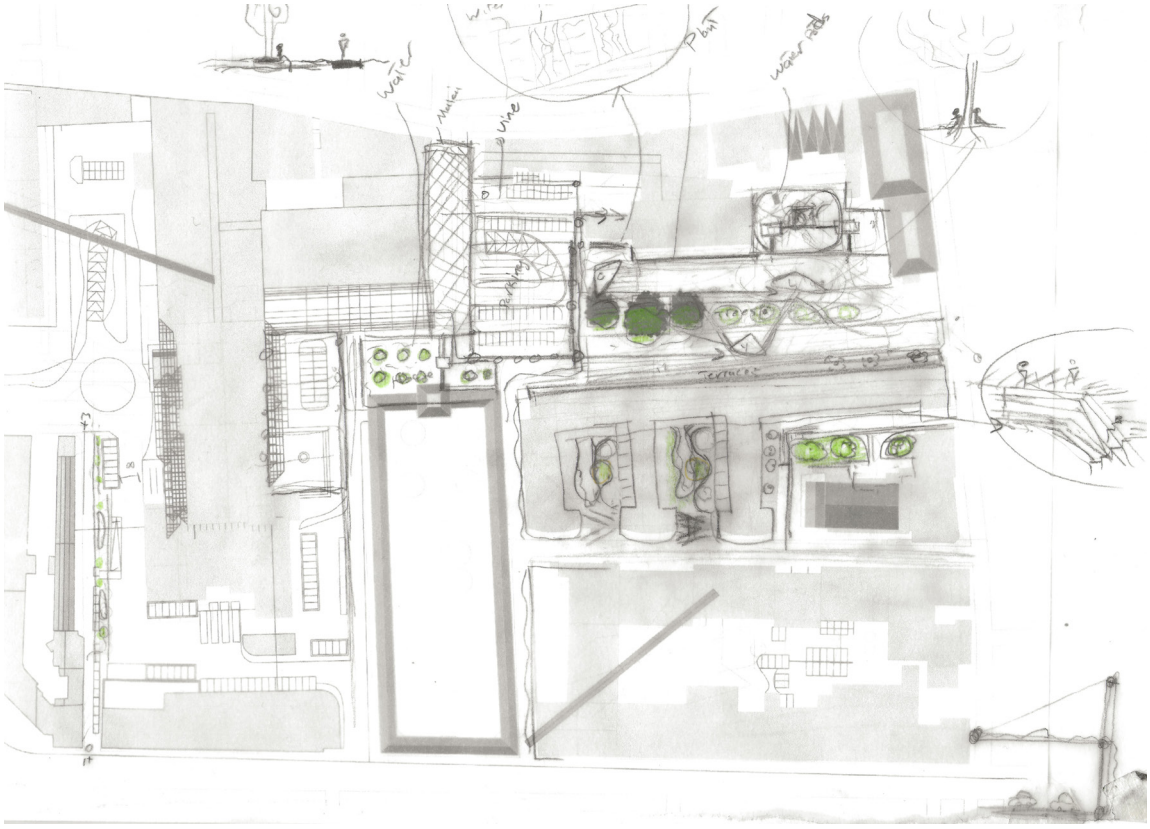
SOLAR PANELS
Energy production

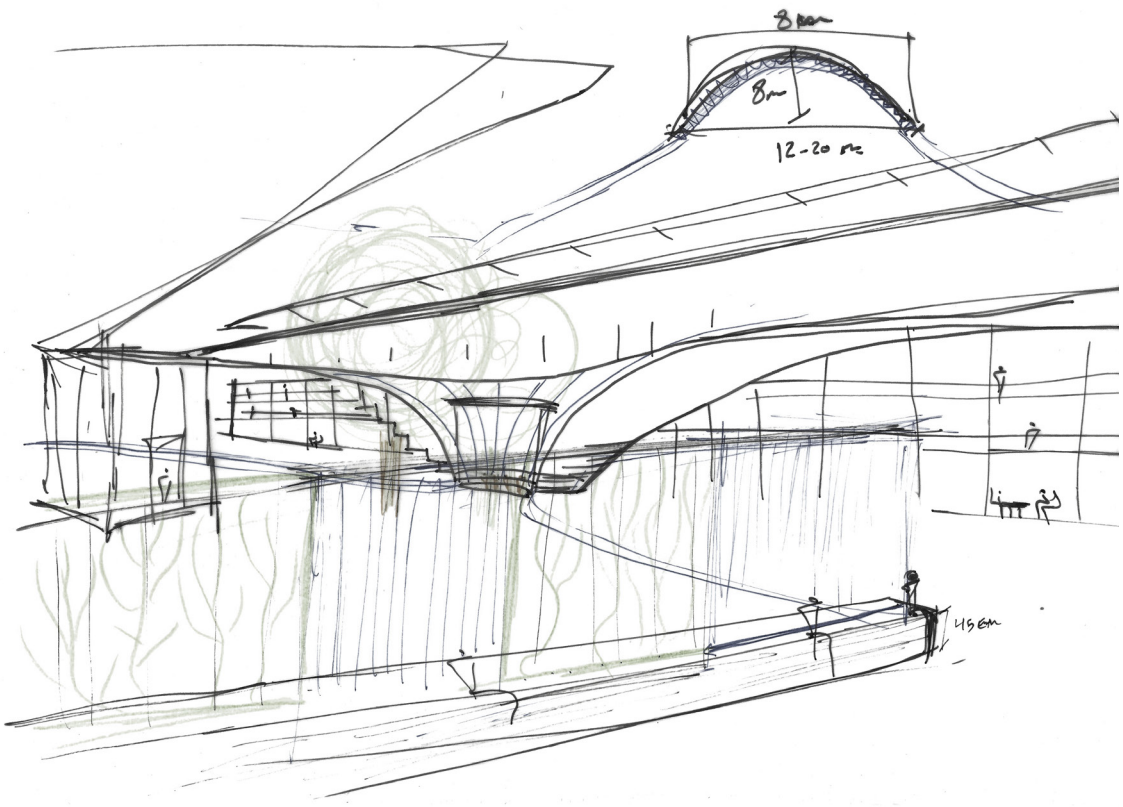


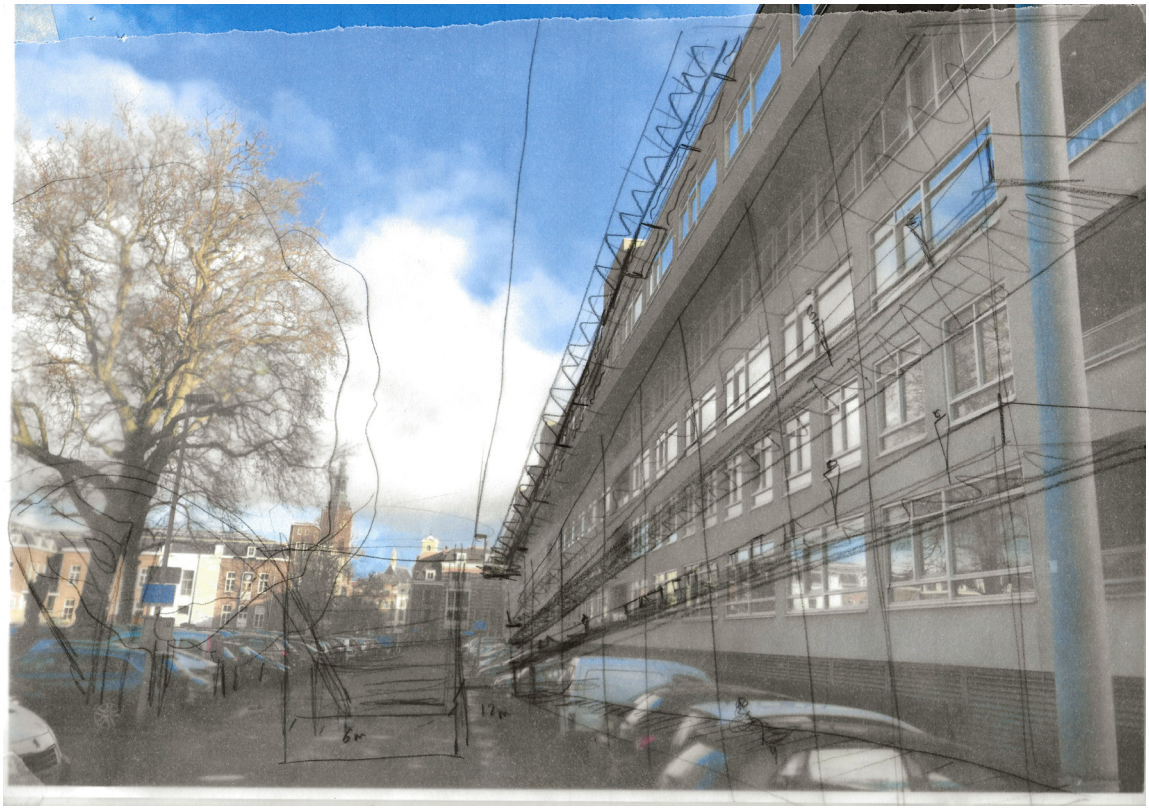

shuttings
surfaces
surfaces
pipe
levels
lines



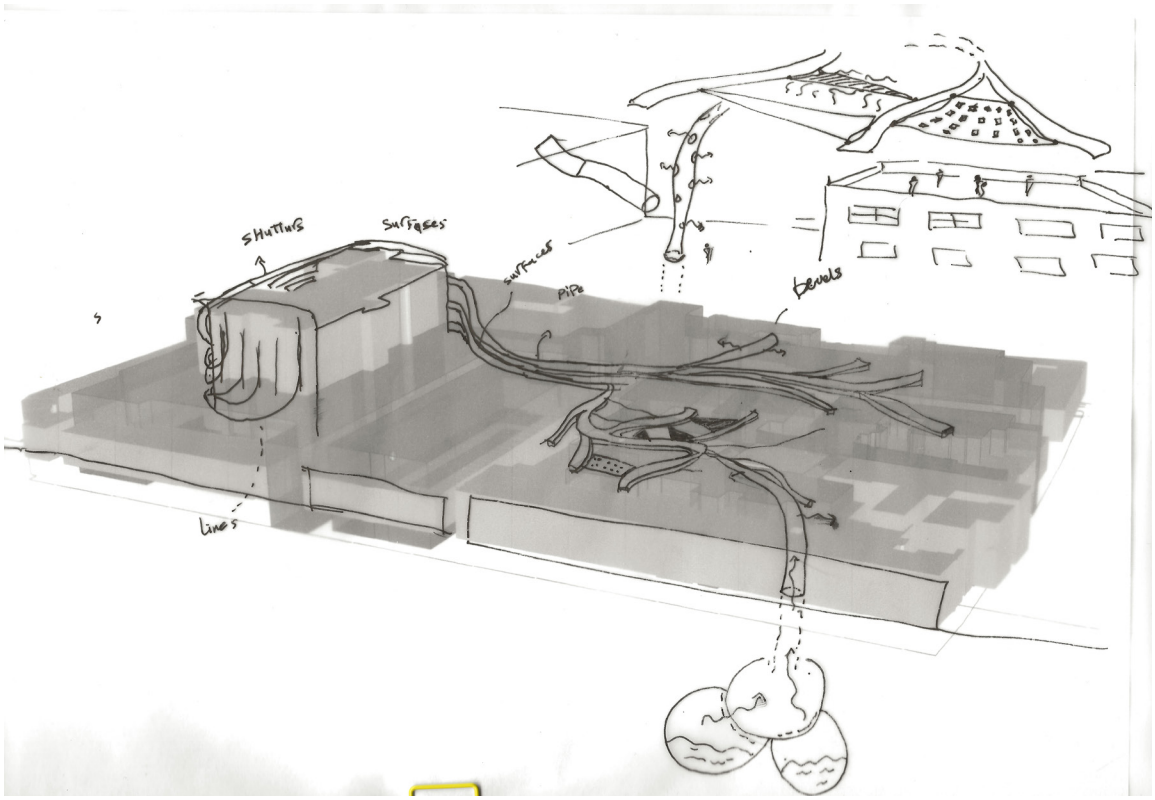

Enjoy The Sun

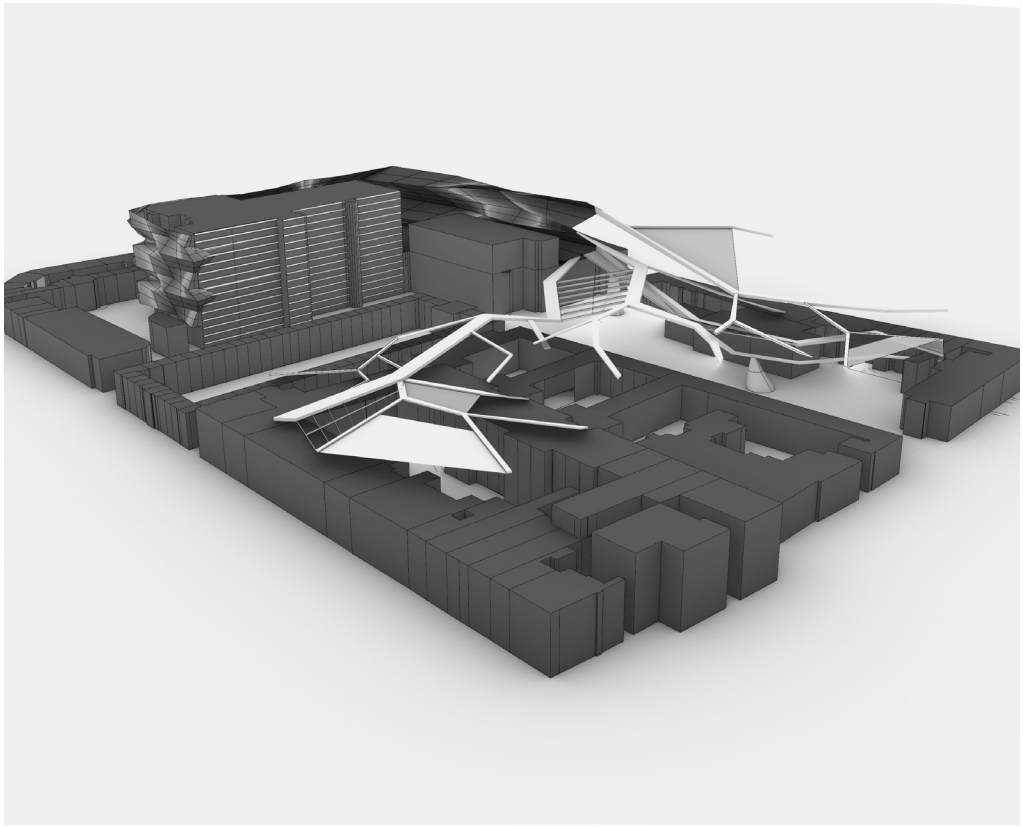

Plant
Water
Texture

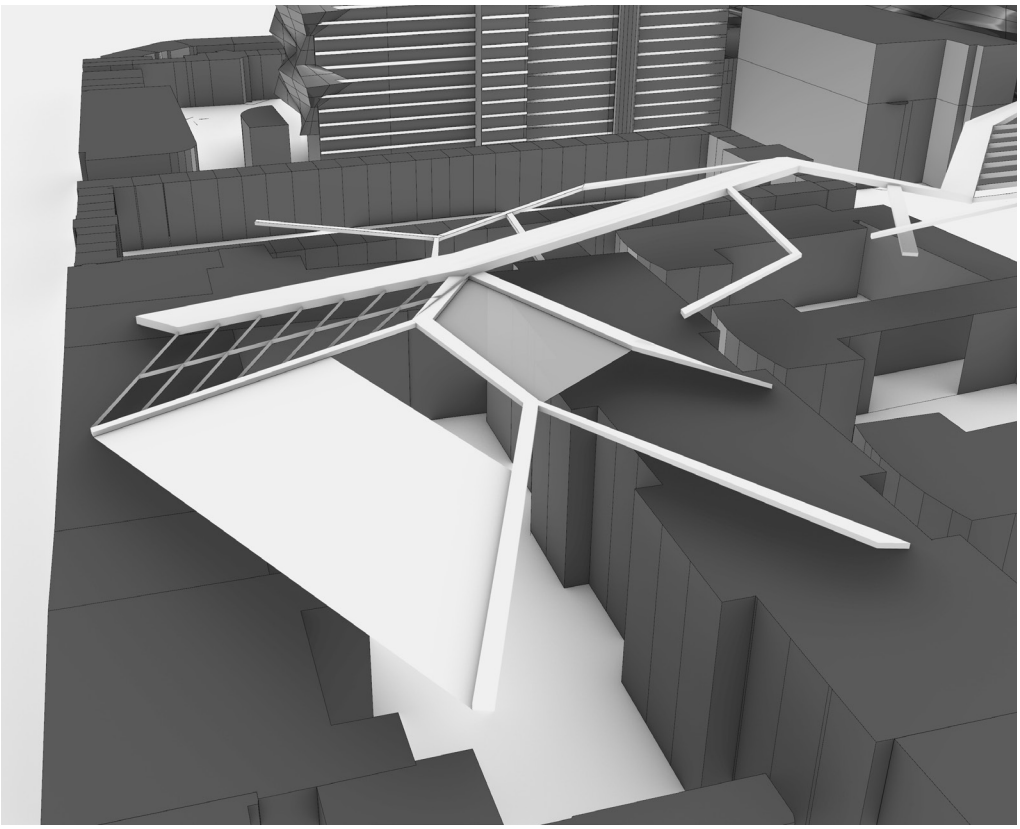

8m
8m
12-20 m
4.5m

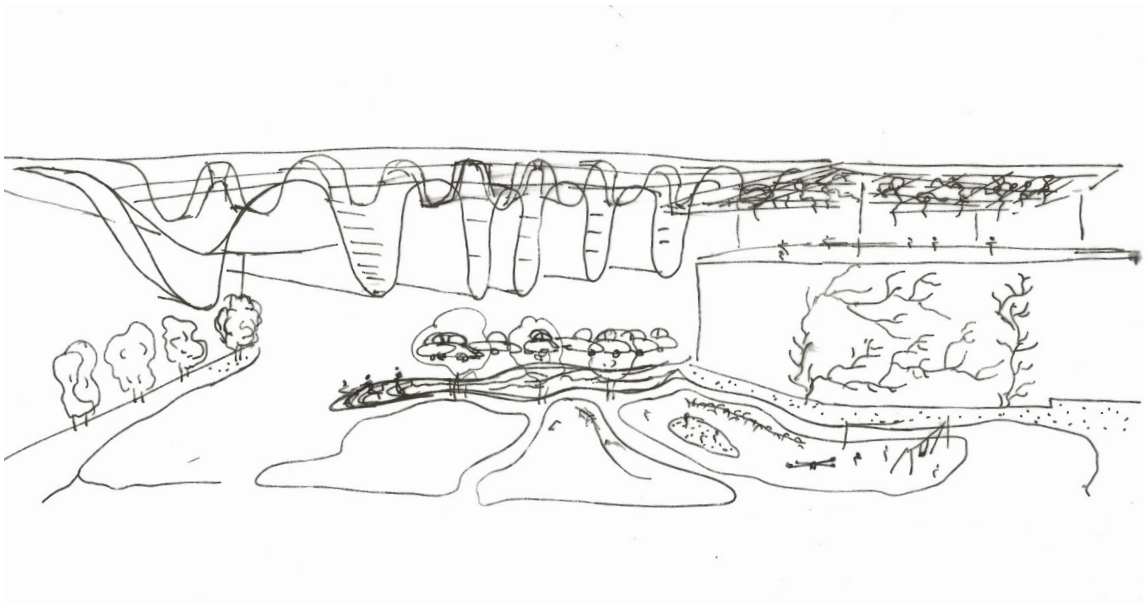


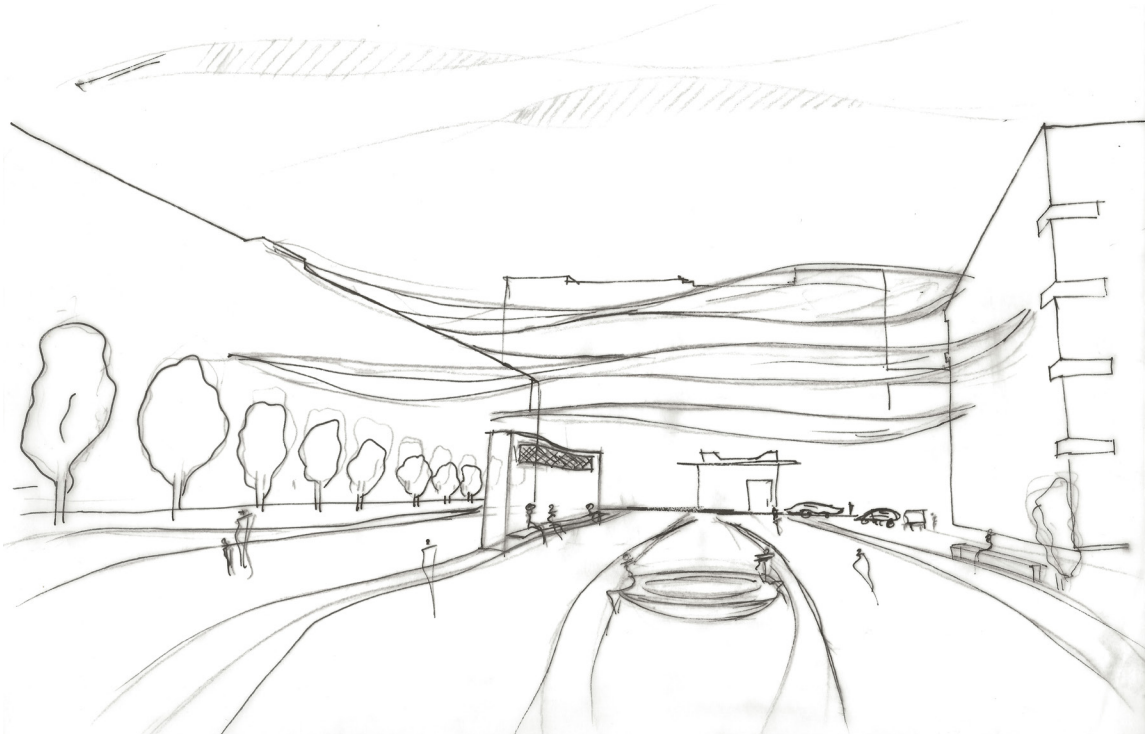
FIRST DESIGN CONCEPT

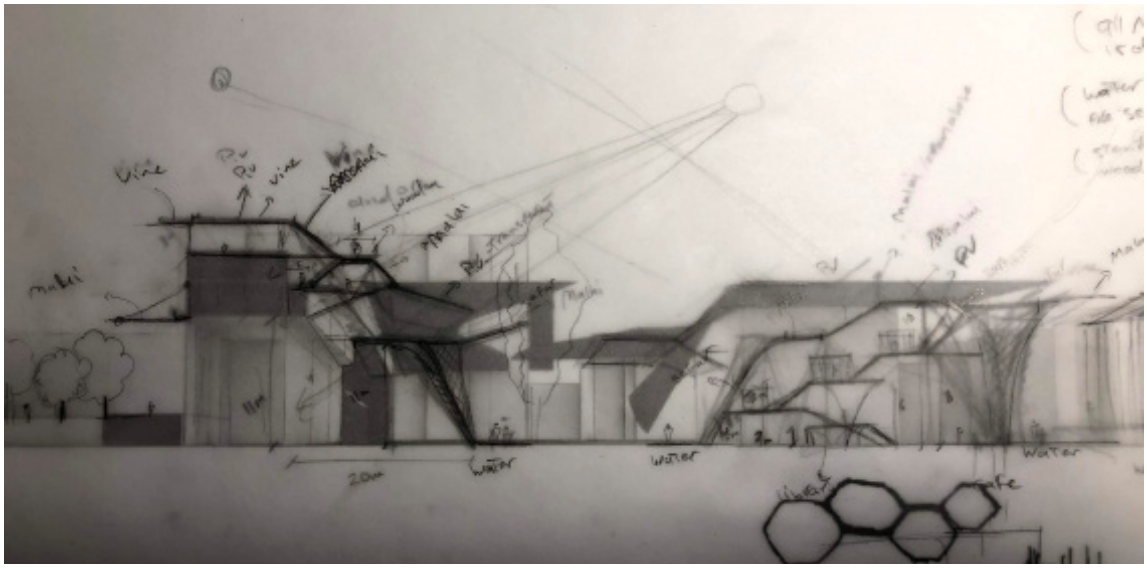


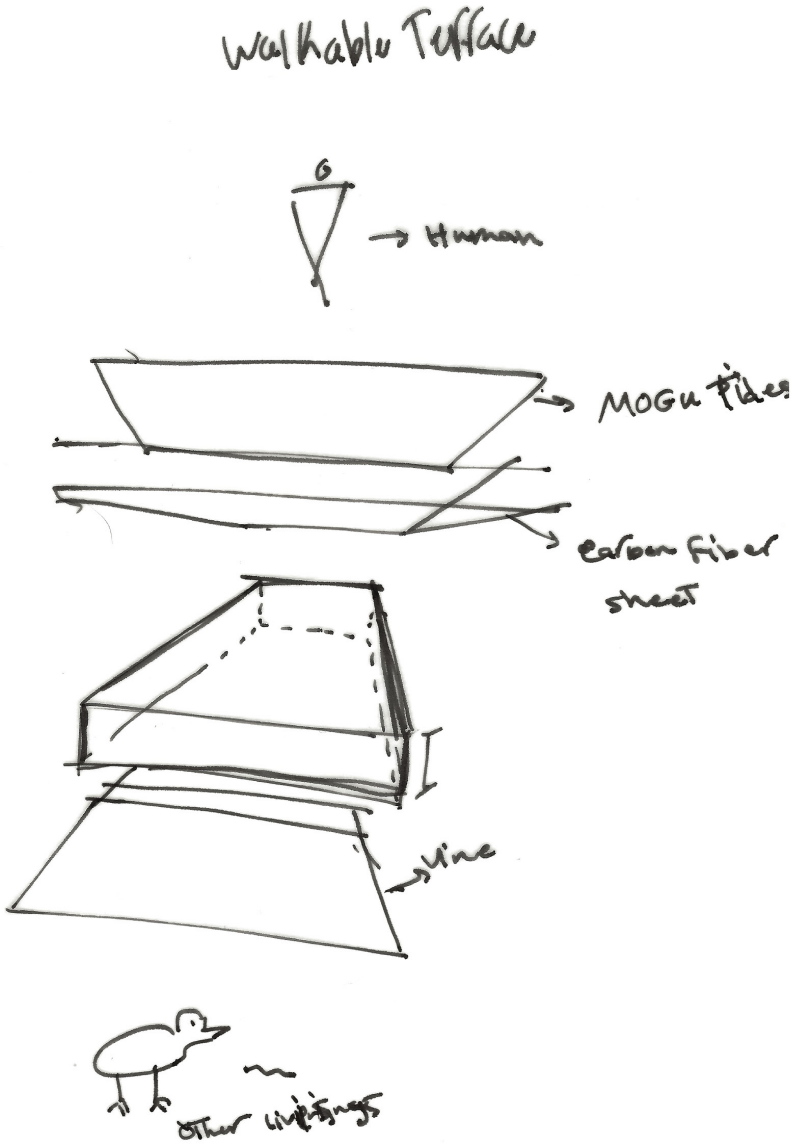




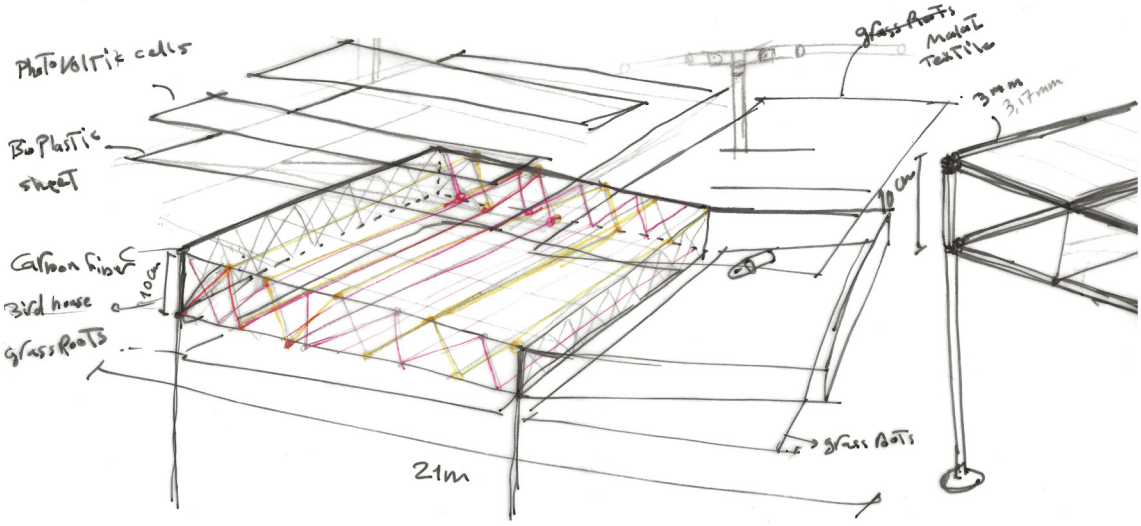




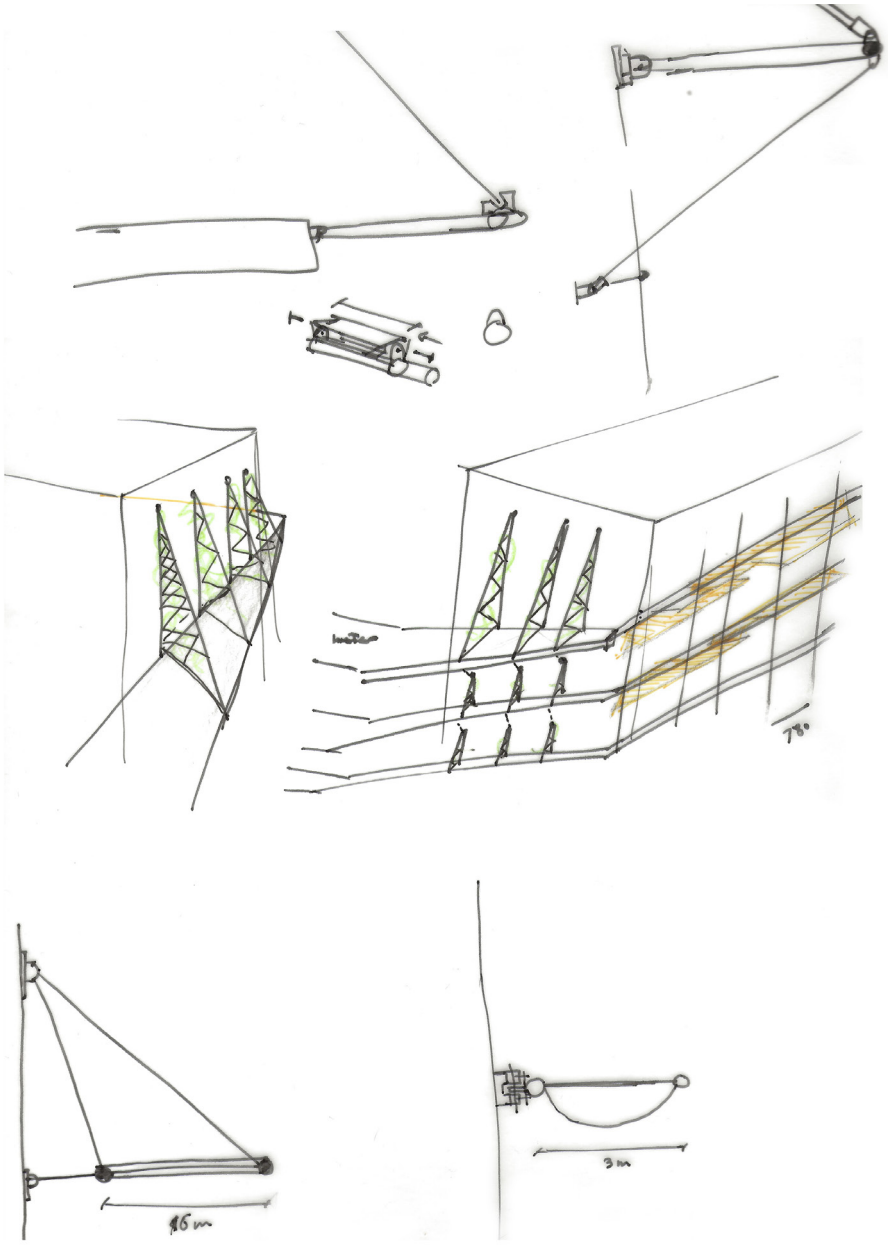

vine
water
water
water
20m

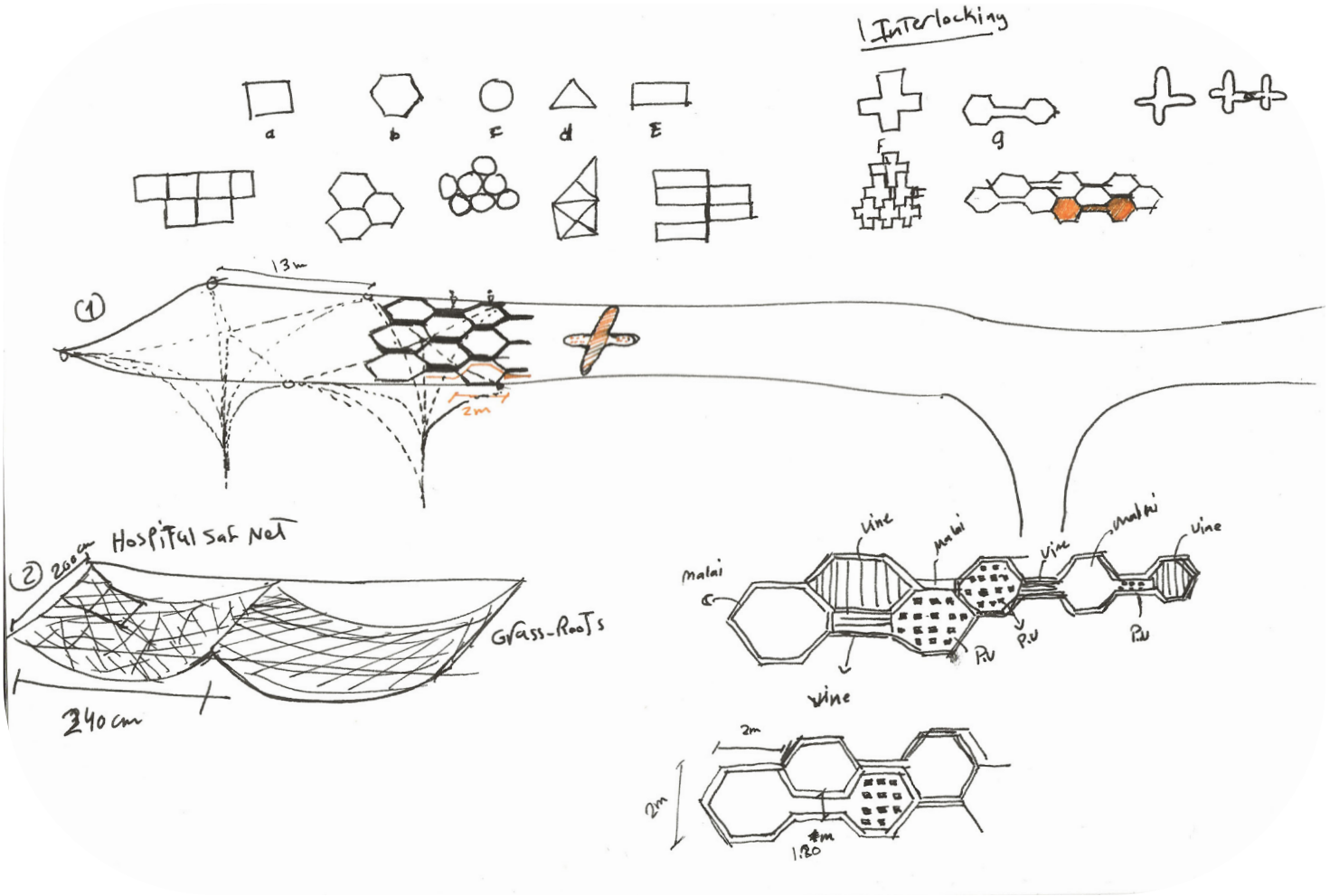


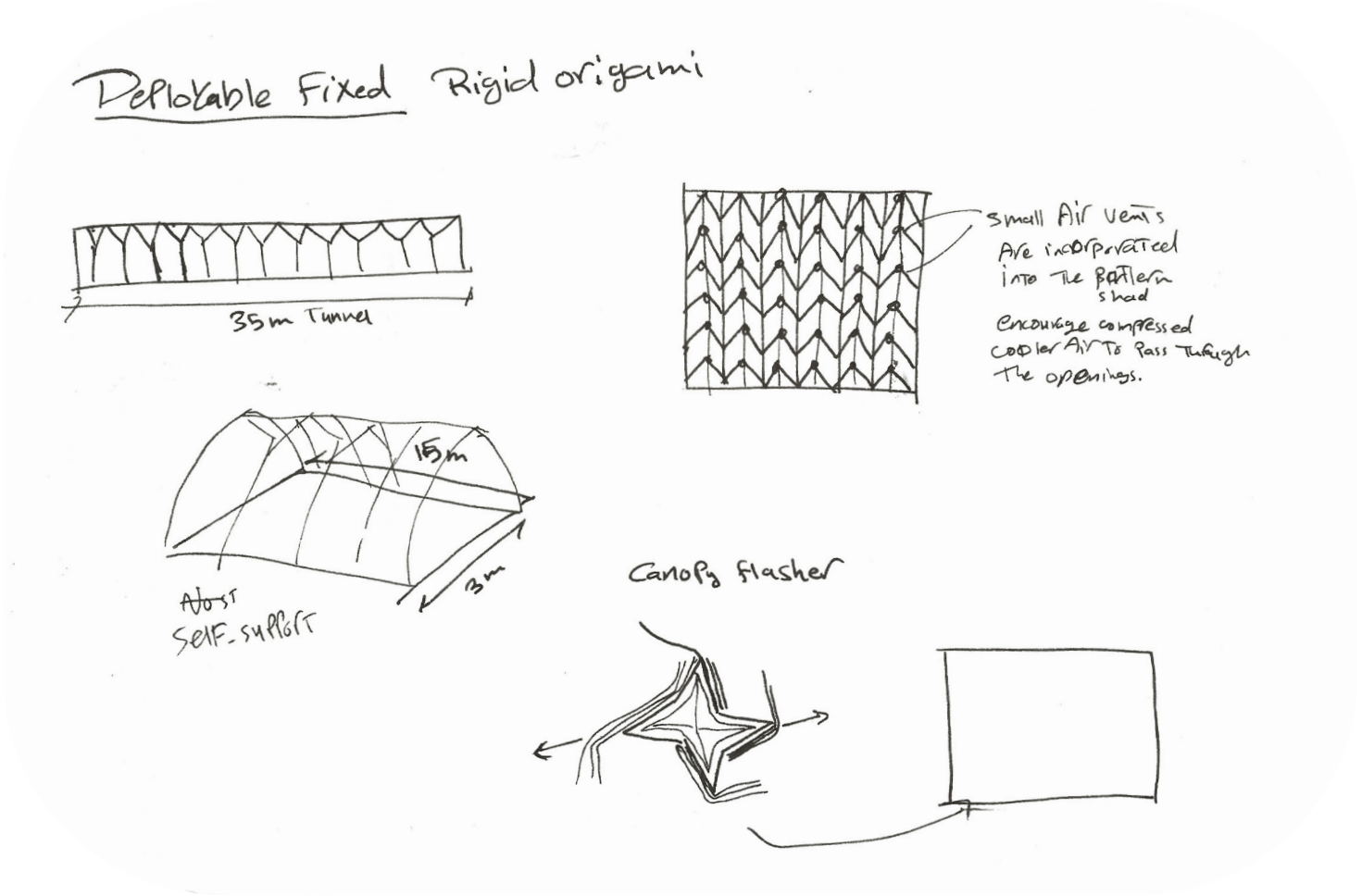
WALKABLE TERRACE


Photovoltaic cells
Bio Plastic sheet
Carbon fiber
10cm
Bird house
grass Roots
21m
grass Roots
Metal Textile
3 mm
3,17mm
70 cm

CANOPY CELL

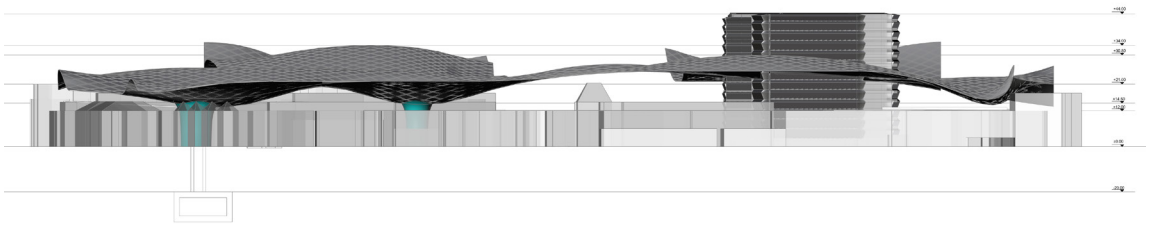

16 m
3 m

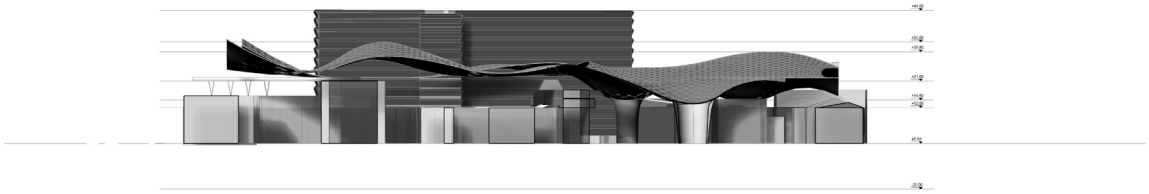

Interlocking
a
b
c
d
e
f
g
1
13m
2m
2
200cm
Hospital Safe Net
Grass-Roots
340 cm
malai
vine
P.V
2m
1.80

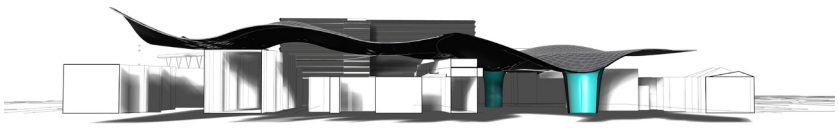


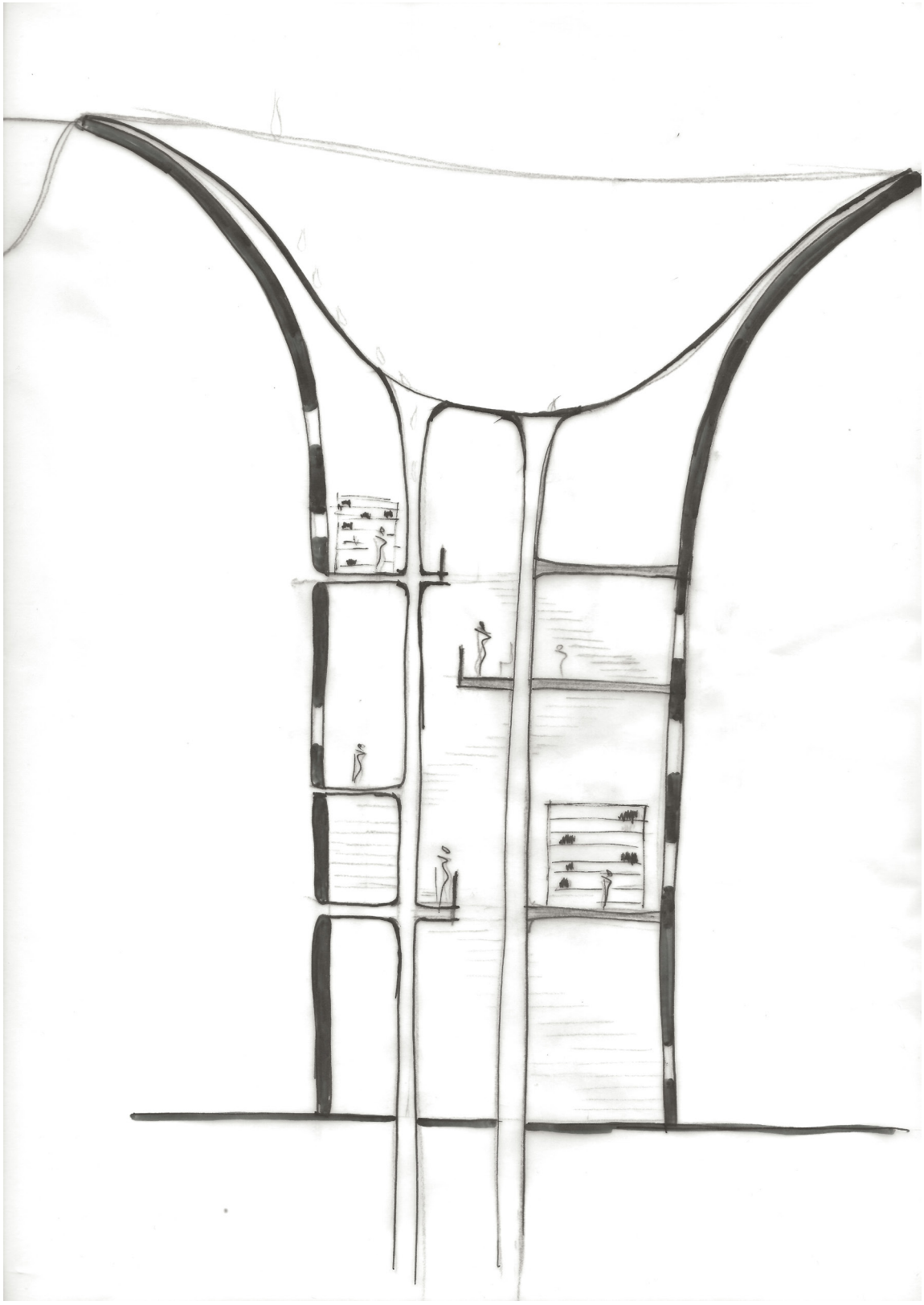
ORIGAMI

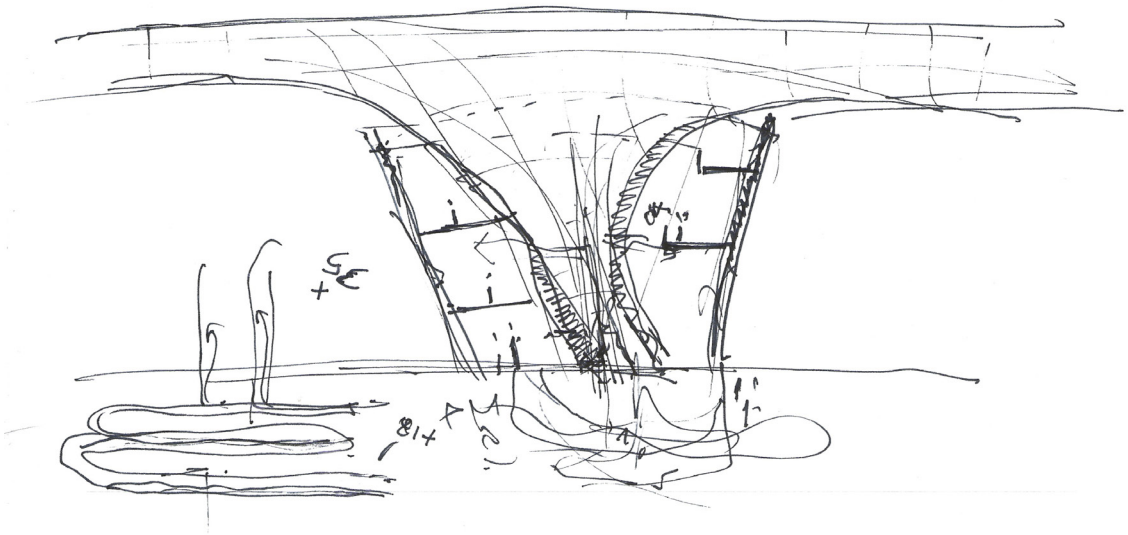
The Deployable Fixed Rigid Origami structures take advantage of the self-supporting capabilities of Rigid Origami surfaces and of their ability to be folded into a flat, compressed object. These surfaces can be easily assembled and disassembled without the need for additional supporting substructures and, when flattened, are easily transported and stored.
More recently, in 2014, the students of the University of Southern California made a pavilion in polycarbonate that occupies an area of 15m x 3m and is 3m high. All these examples can support themselves without the addition of alternative structural systems due to the rigidity of the main material and the chosen Origami geometry.

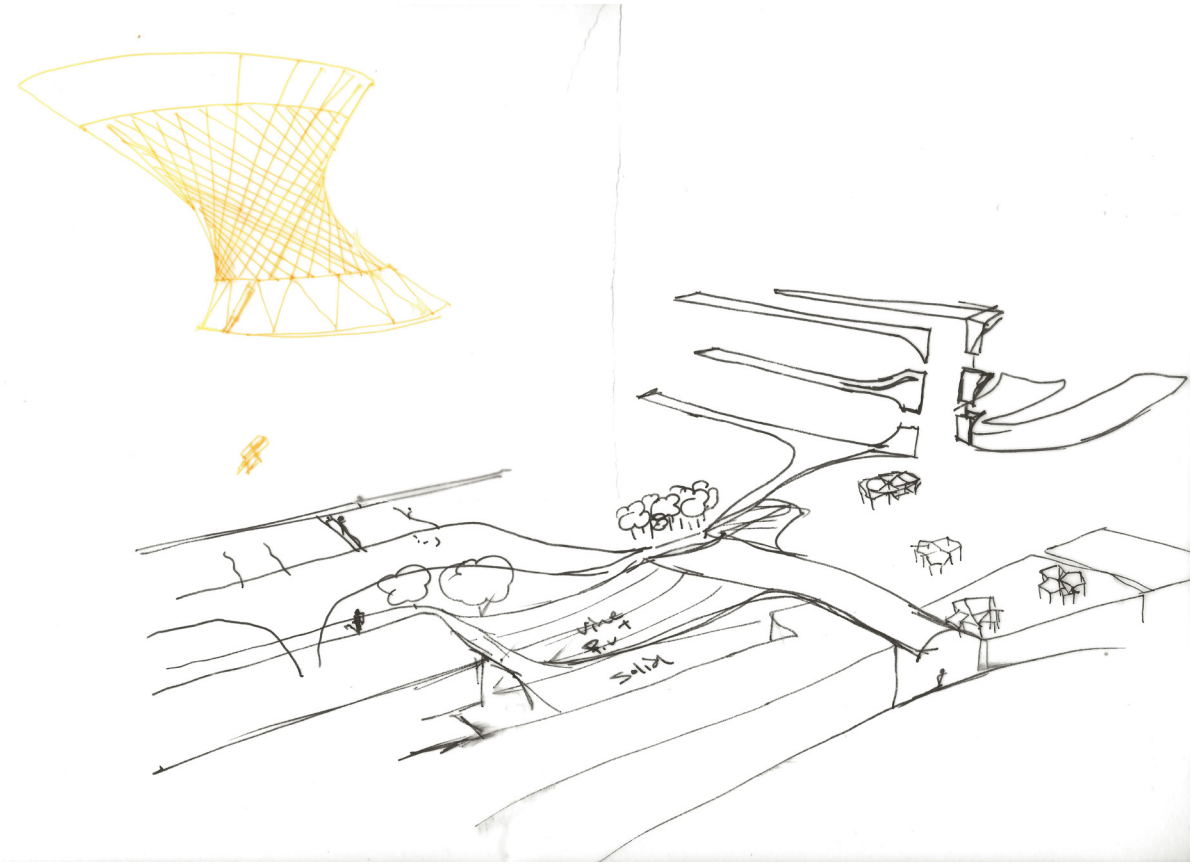


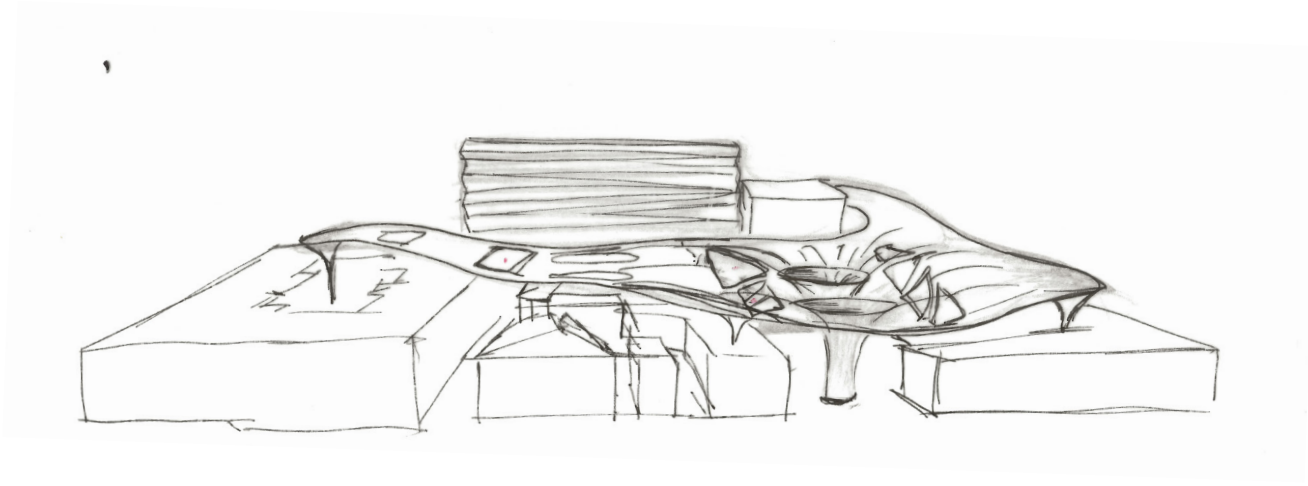


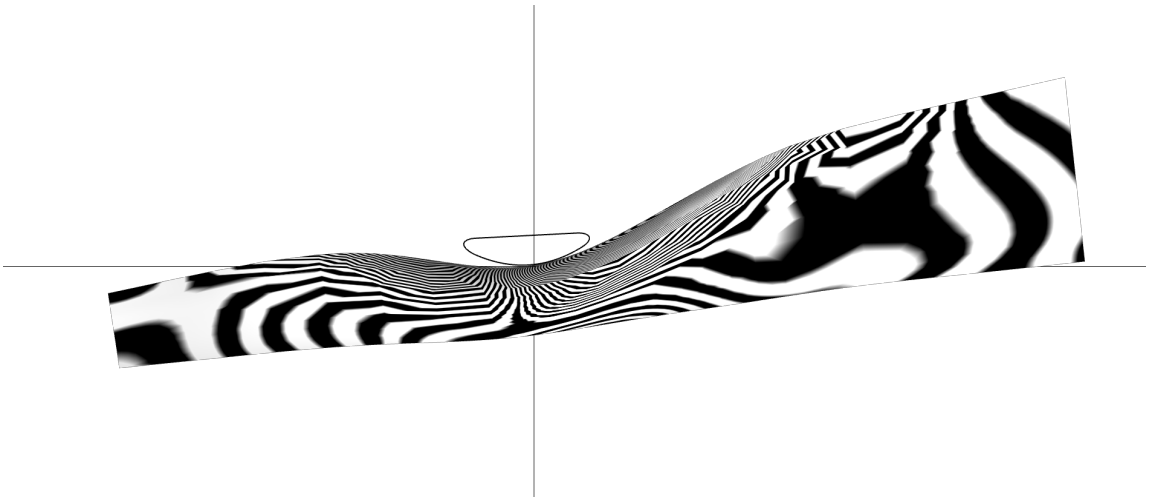




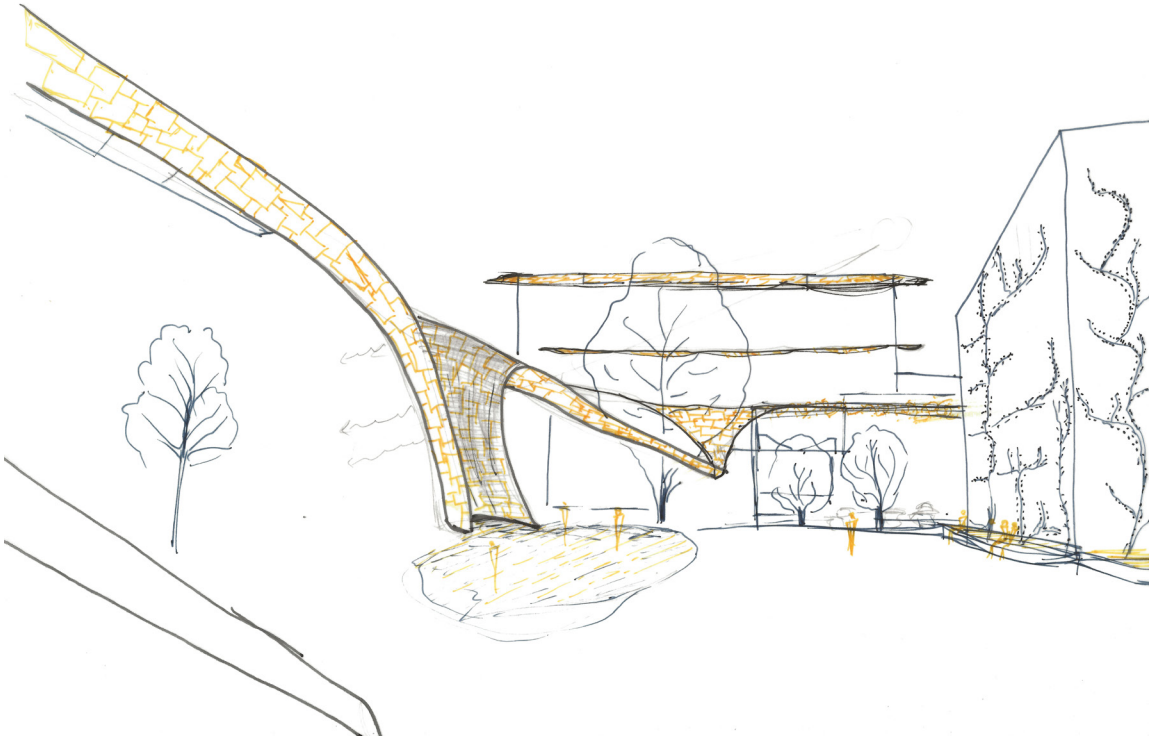


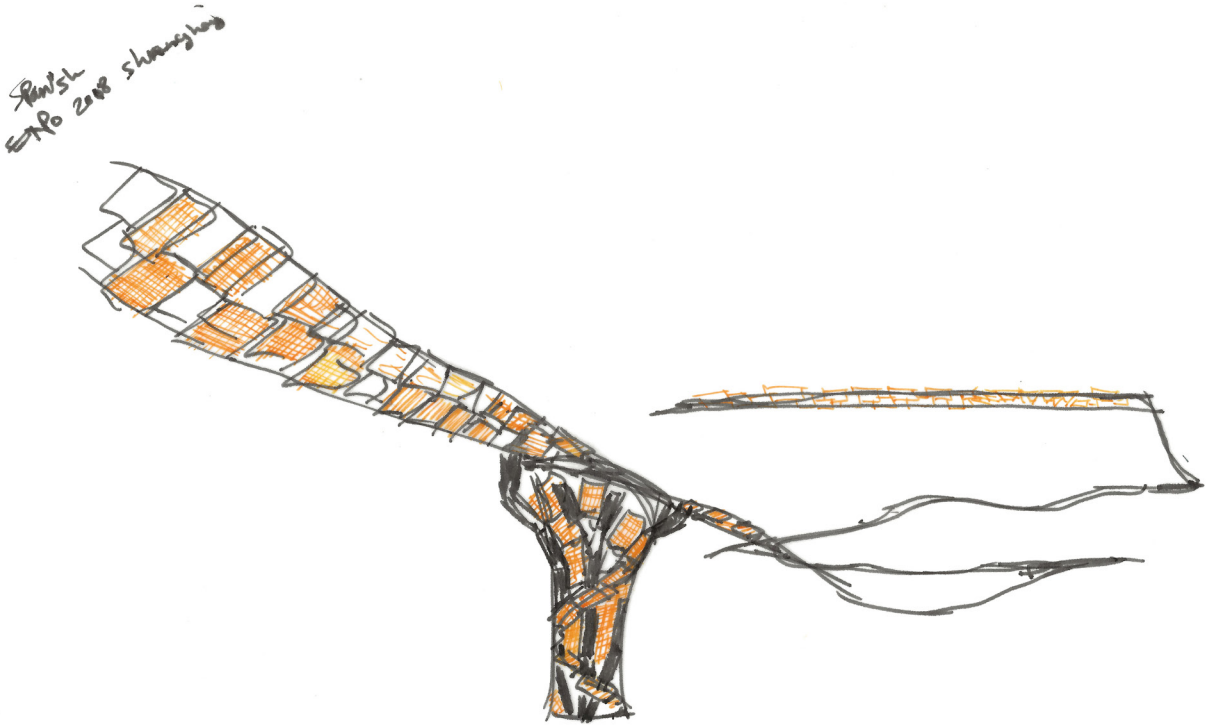


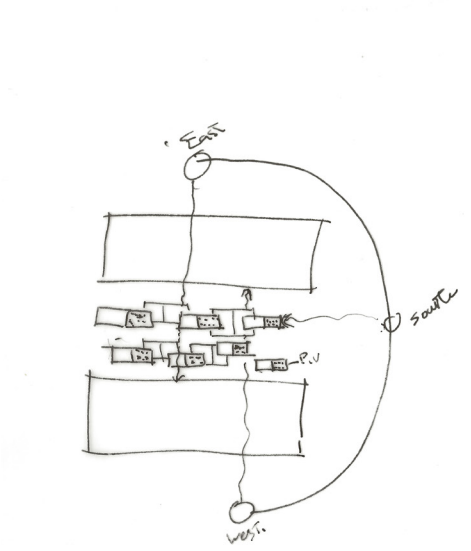




SURFACE CURVATURE COLORED MAP





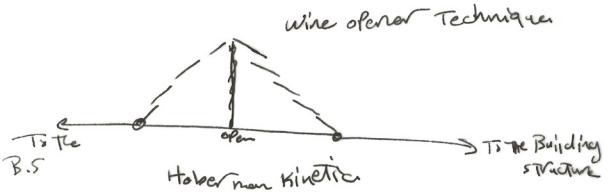


How deep could you bring light into a space?!

"Taking the Light Through a solid from south wall
To the North wall"

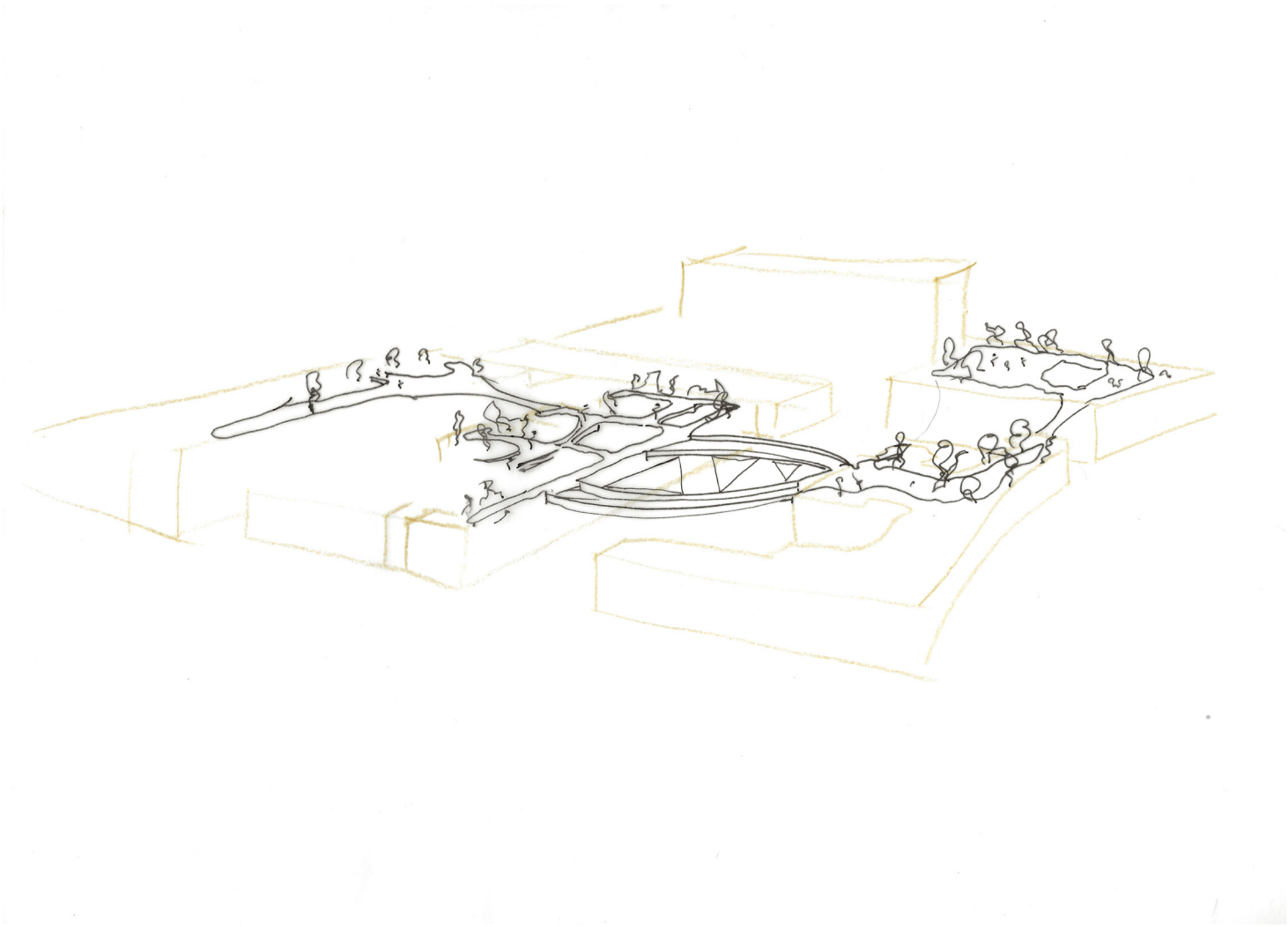
"The sun is free, Light is free"
the Architect can effect the way somebody feels
By Manipulation of Light"

"The challang nowadays in Term How we use resources."
That would might chaang the waykinds of building that we Maki

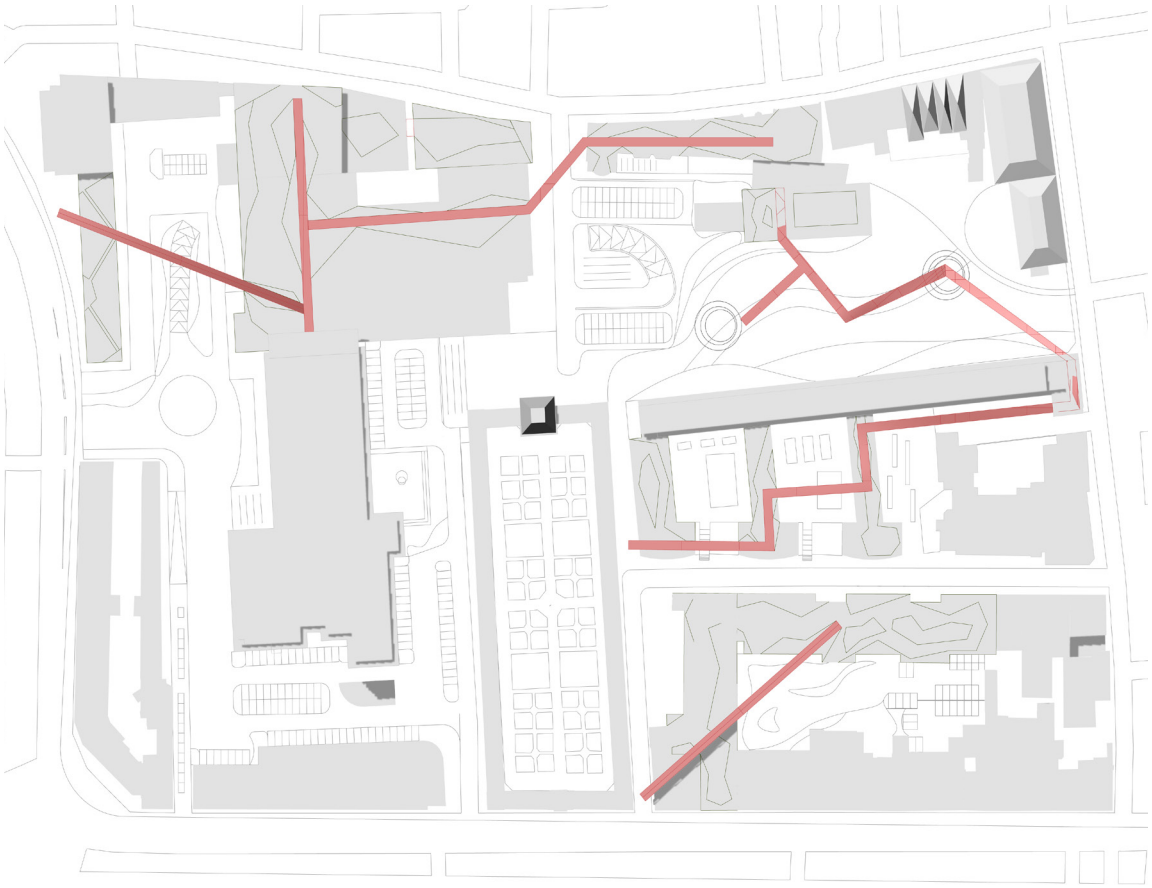


$$\frac{A}{B} = \frac{B}{A+B}$$

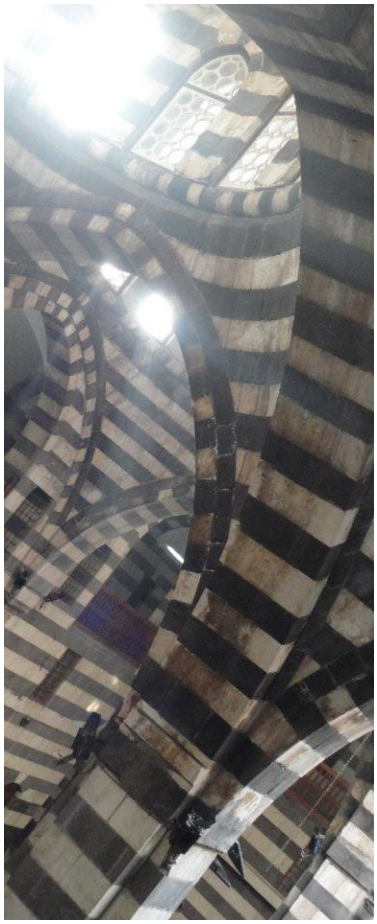
ROOF PARK



Kortenbos residences are mainly families and in this particulate block of the neighborhood there are other category added which is hospital worker. who both do not have a space around their house/work to have a walk ,run ,walk the dog or meet their peers . Therefore cool space proposes adding another layer and bring park like feeling closer to the neighborhood inhabitant, a roof park designed to connect different buildings together to create a continuance path with interesting visual watch points.



ARCHITECTURAL SKIN



Zebra technique has been used in one of an old Damascus, Syria houses

Natural Zebra pattern

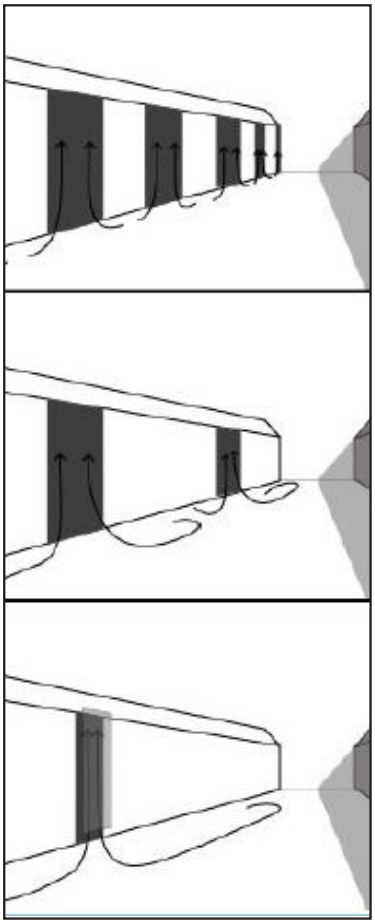
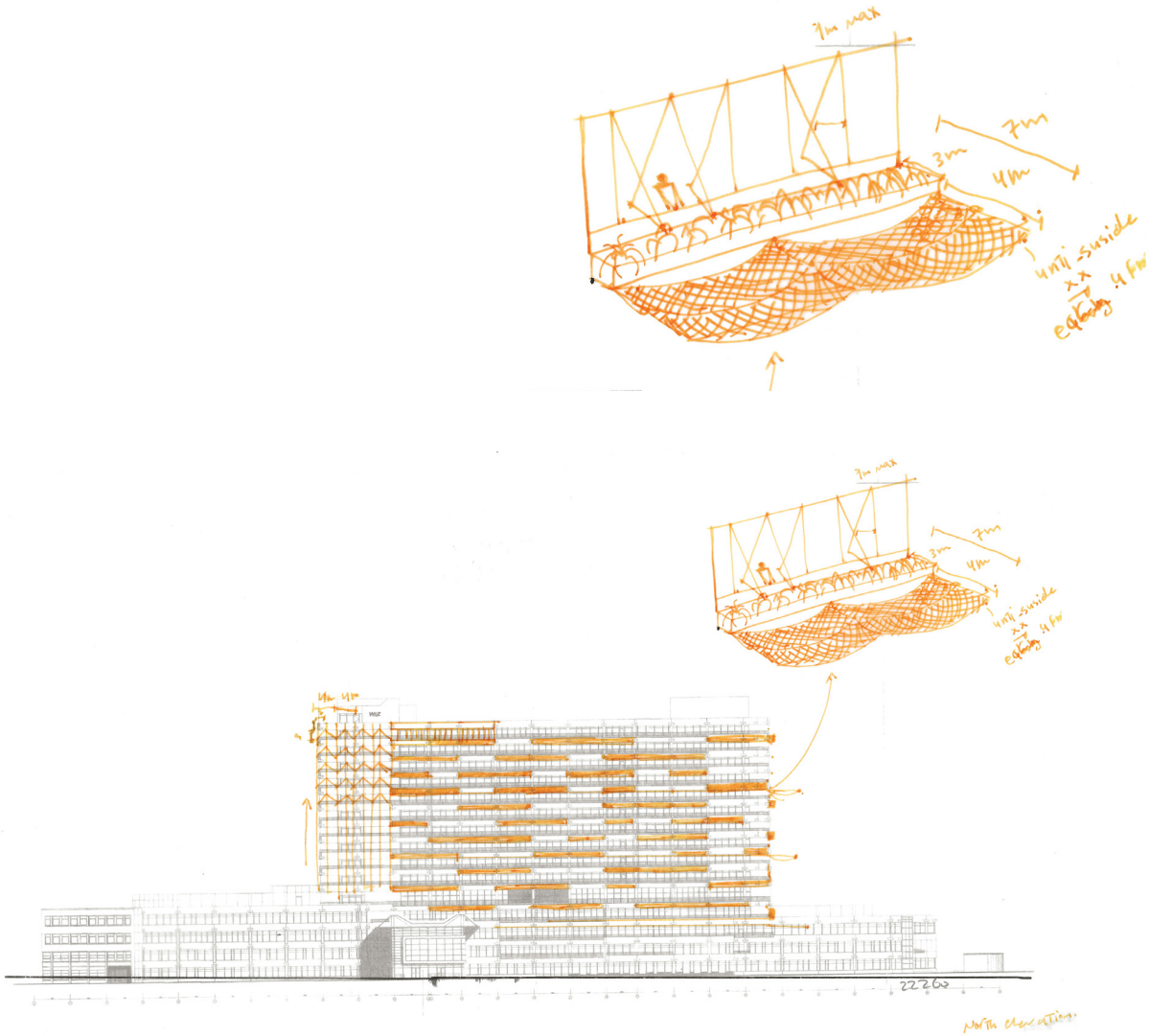
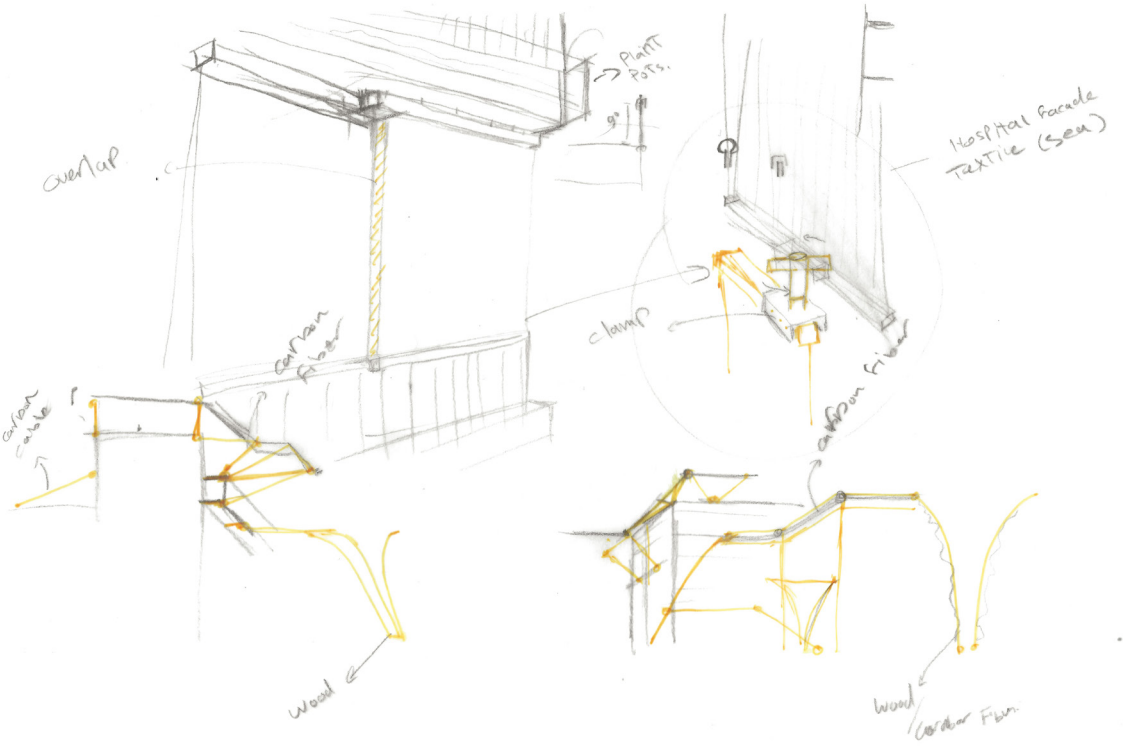
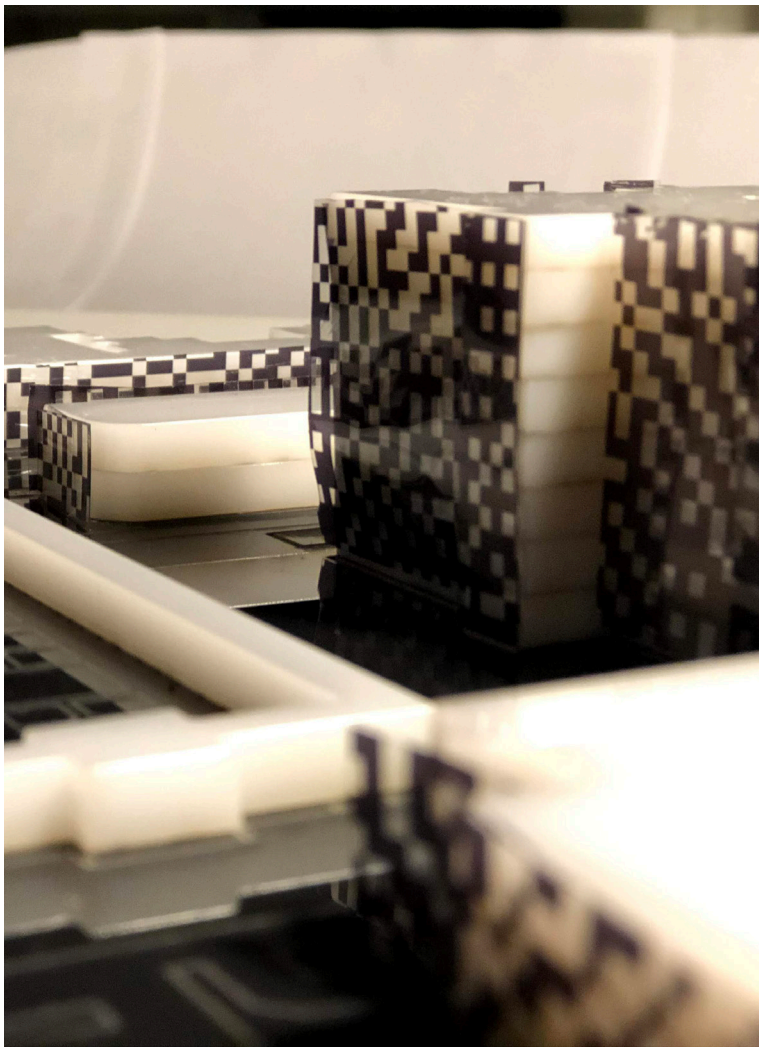


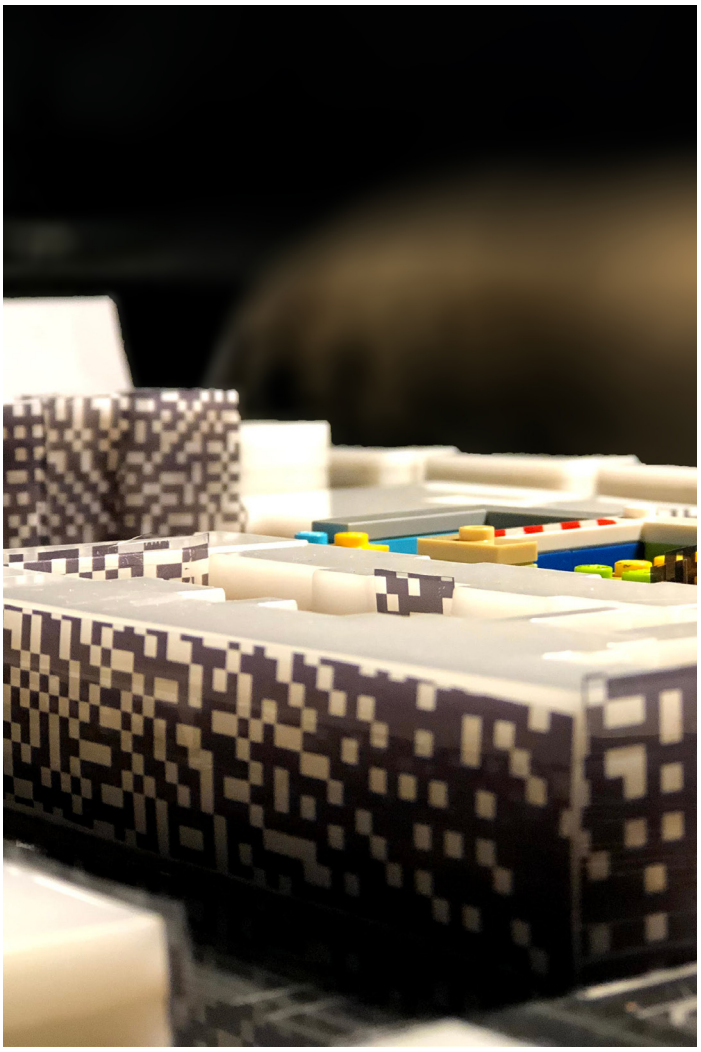
Diagram demonstrates the airflow along the colored facade


7m max
7m
3m
4m
4m
7m max
7m
3m
4m
22263

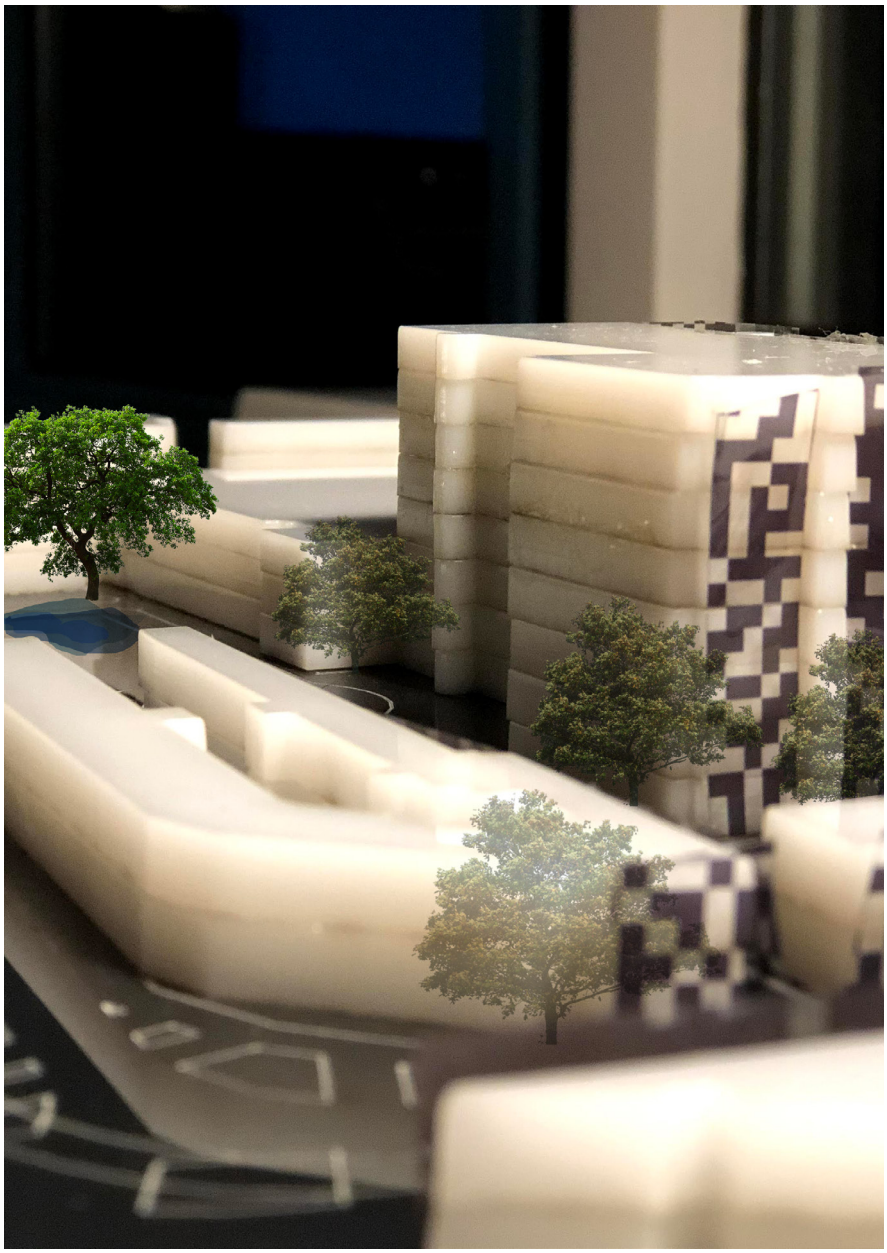

Plant Pots.
9°
overlap
Hospital Facade
Textile (seen)
clamp
carbon fiber
carbon cable
carbon fiber
wood
wood
Carbon Fiber

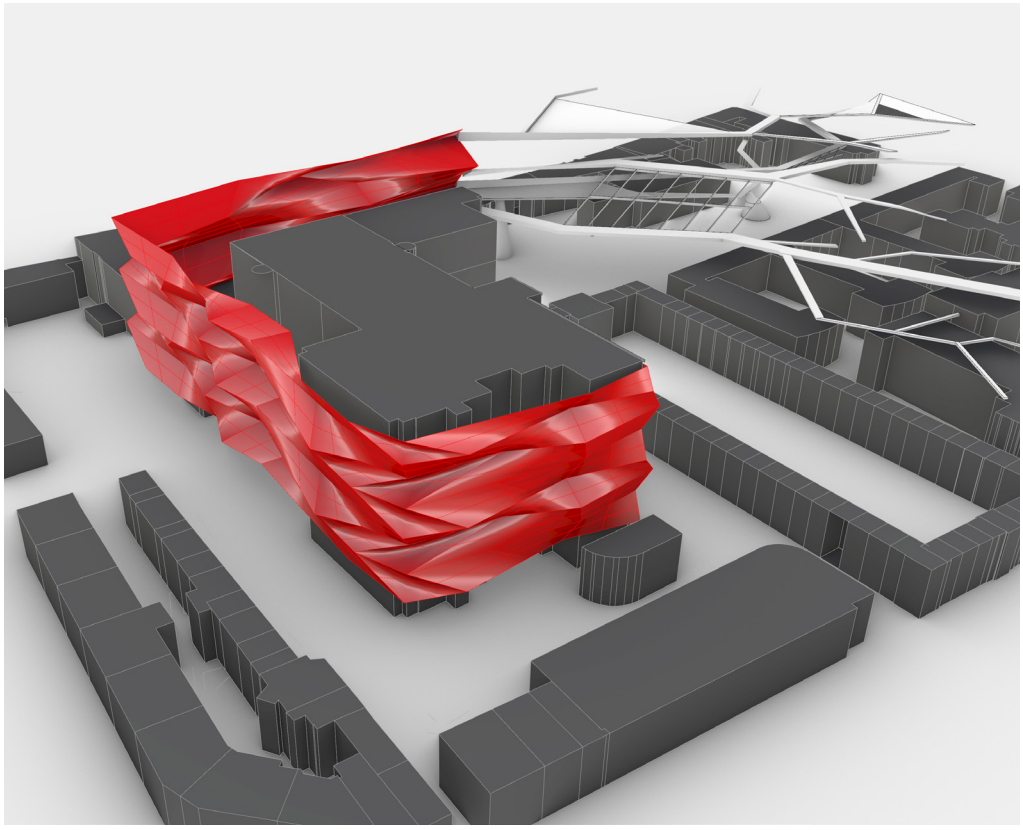
ZEBRA SKIN APPLICATION



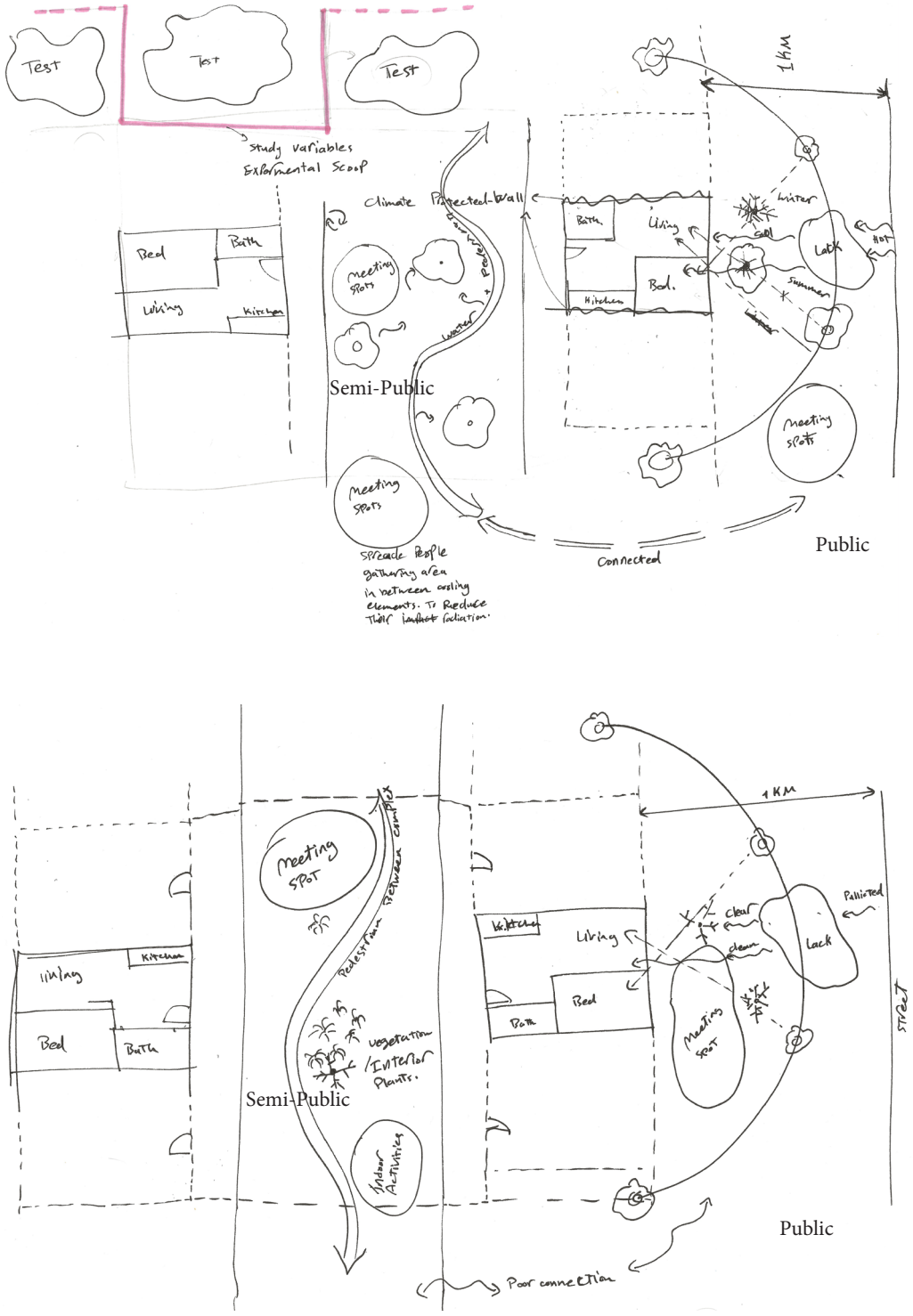


proposes to apply zebra skin effect on wind frontier surfaces to accelerate the airflow around the neighborhood, which lead to less heat stress around/at the courtyards.



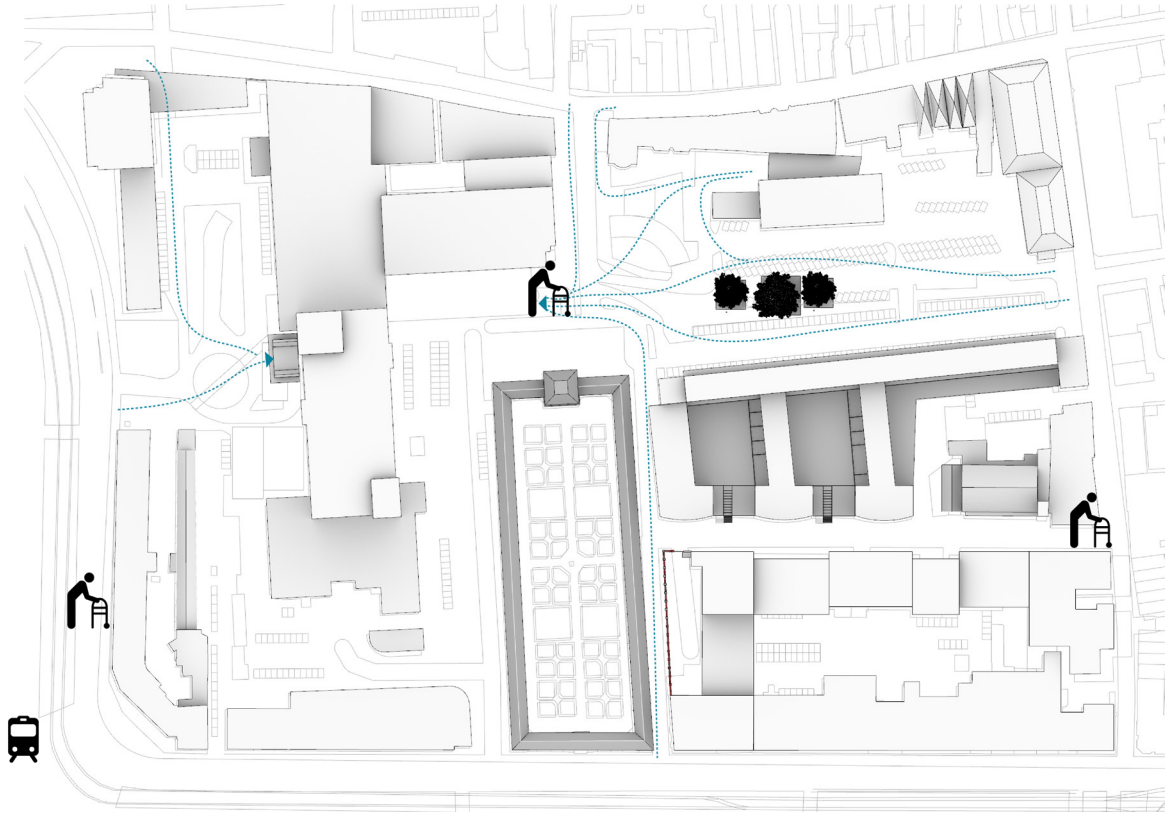


CITY FLOOR

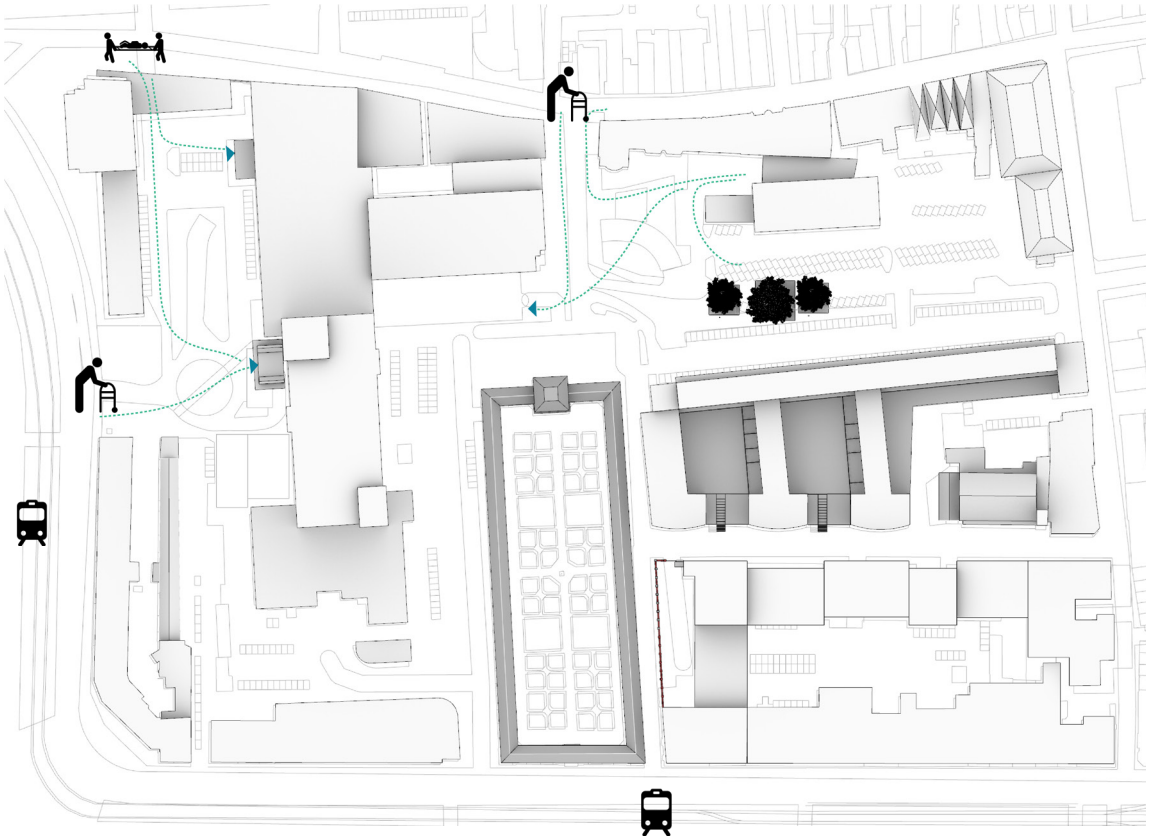


STUDY AREA / INTERVENTIONS

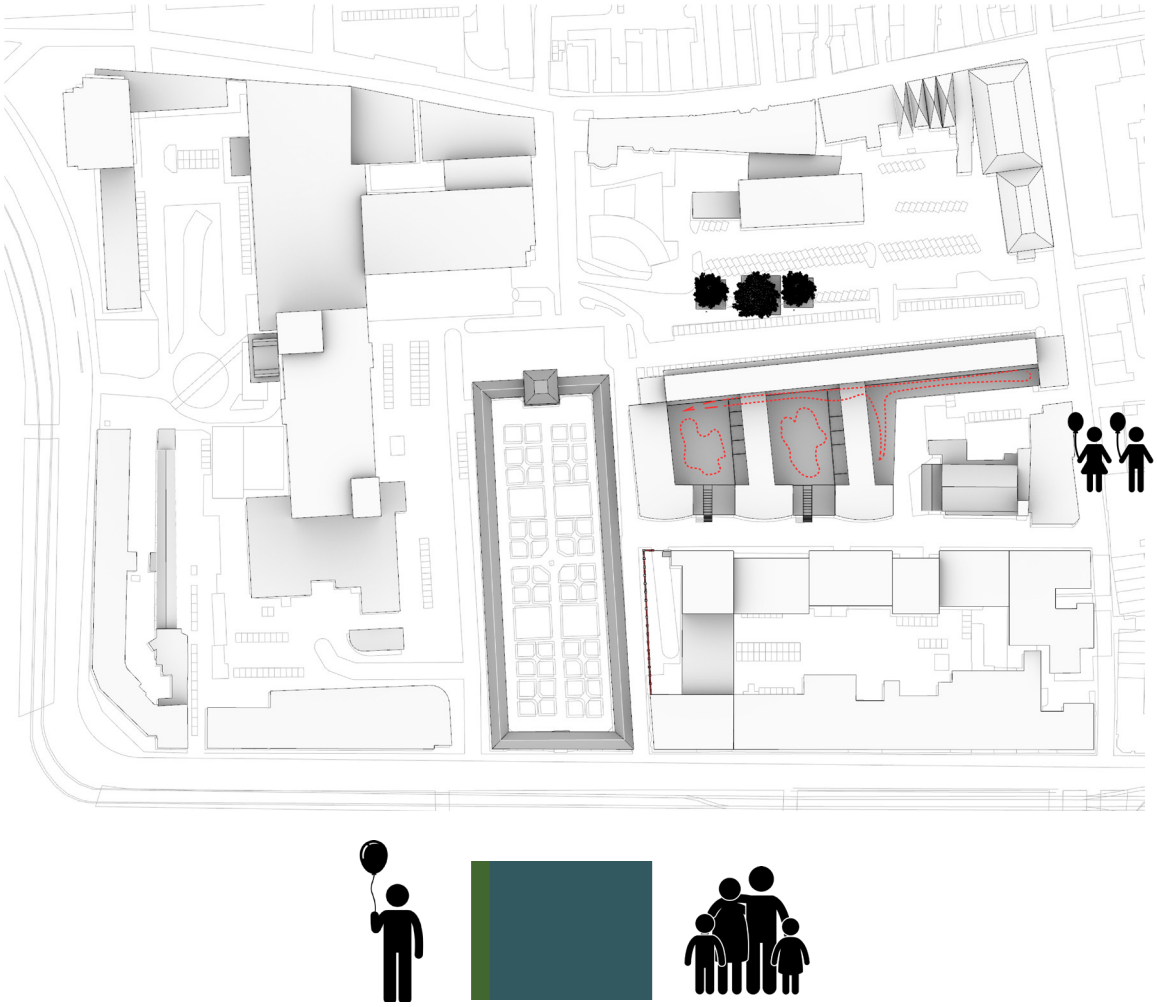
Site plans of the vision where and how the changes will take place, public/private/semi-private during two seasons summer and winter.



Elderly movement diagram

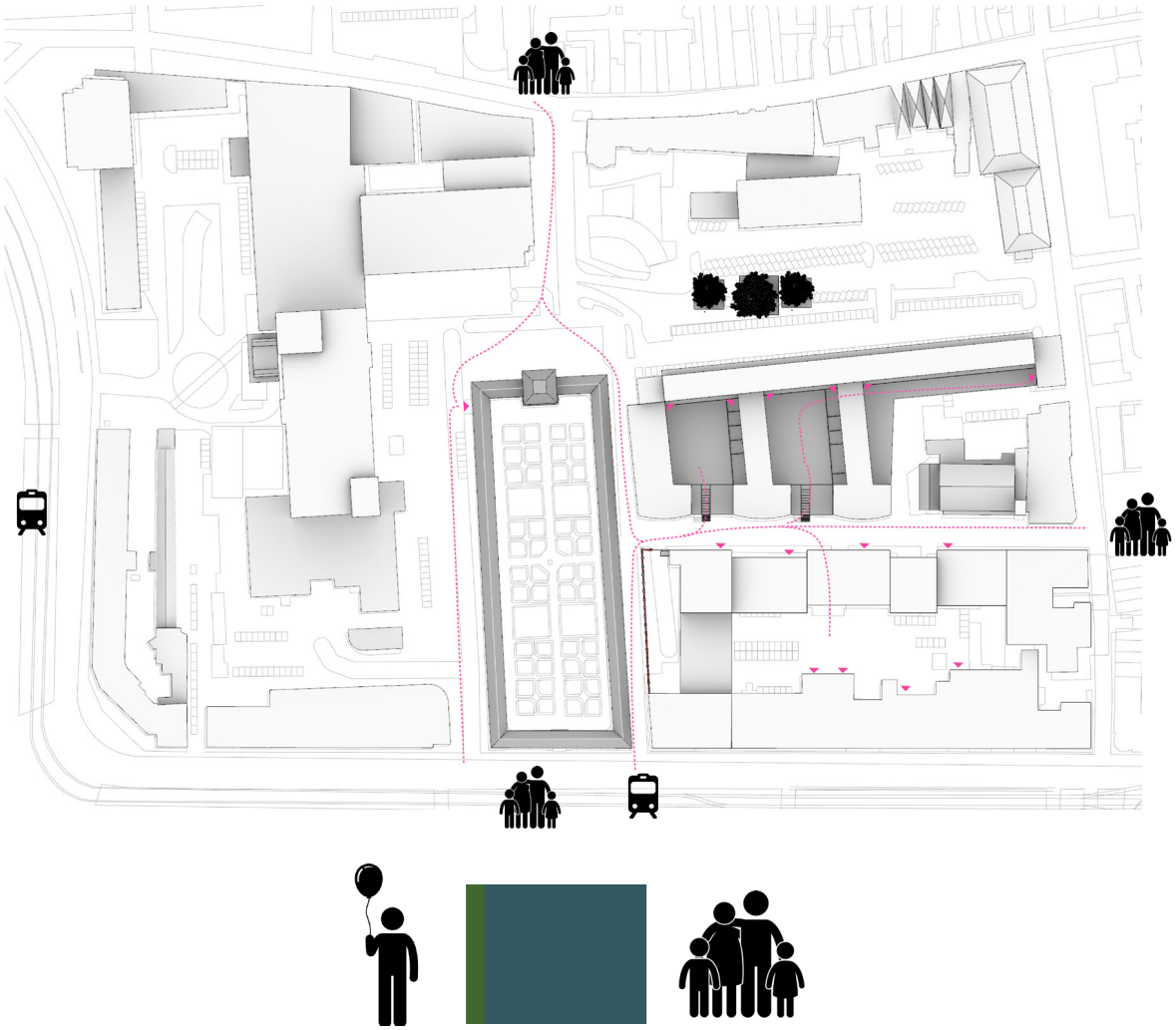


Sick people movement diagram



Single vs Family

Children movement diagram



Single vs Family

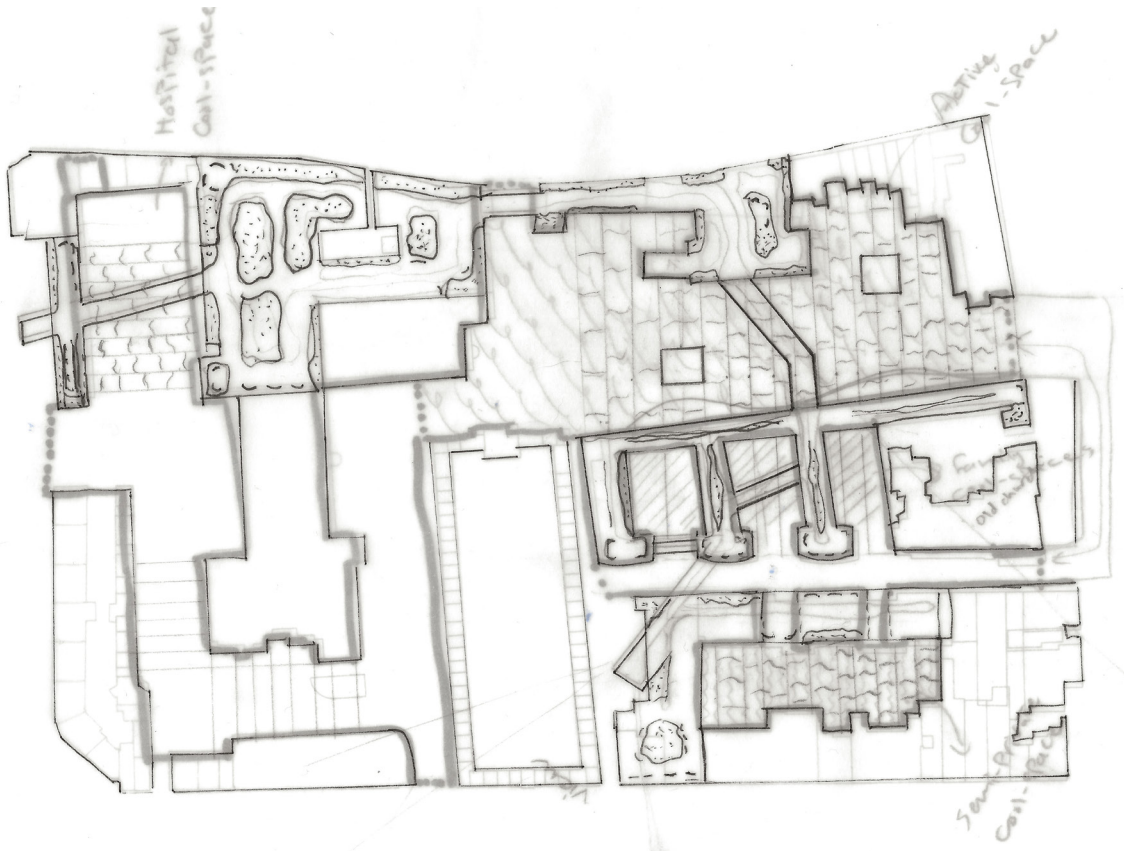
Families movement diagram

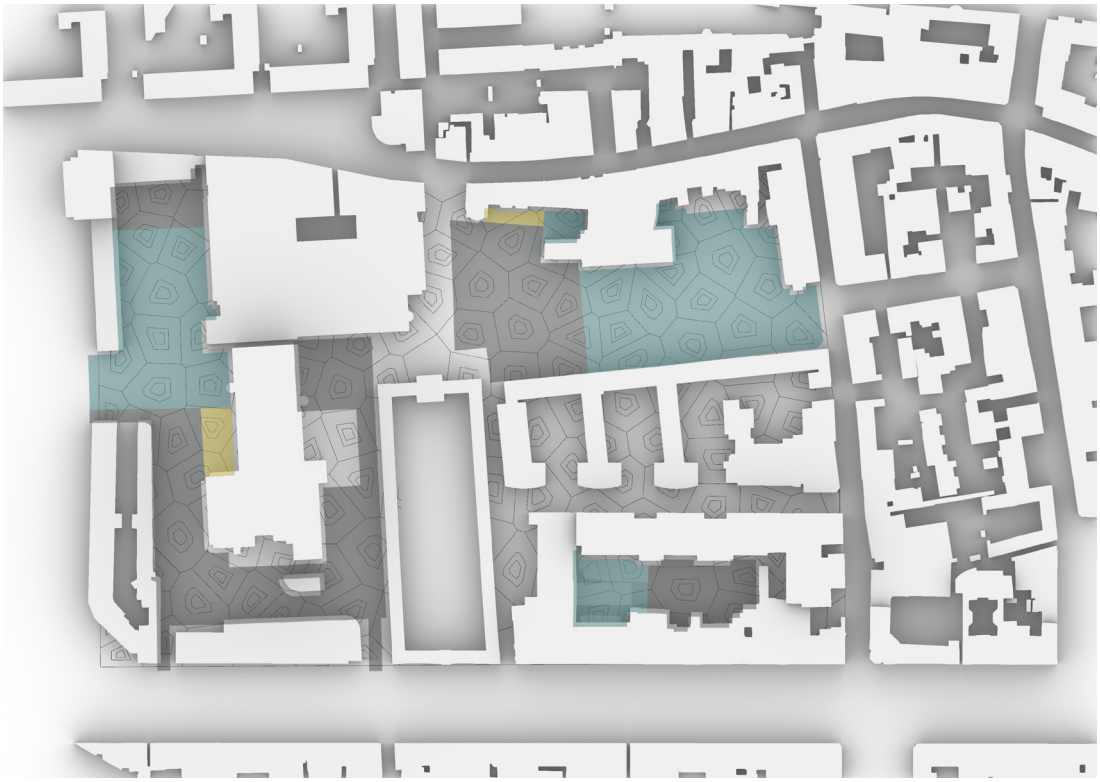
Regenerate

Bring memory back to the future and connect people to it

Create a Journey

A rout of moments to re-connect to nature into our cities



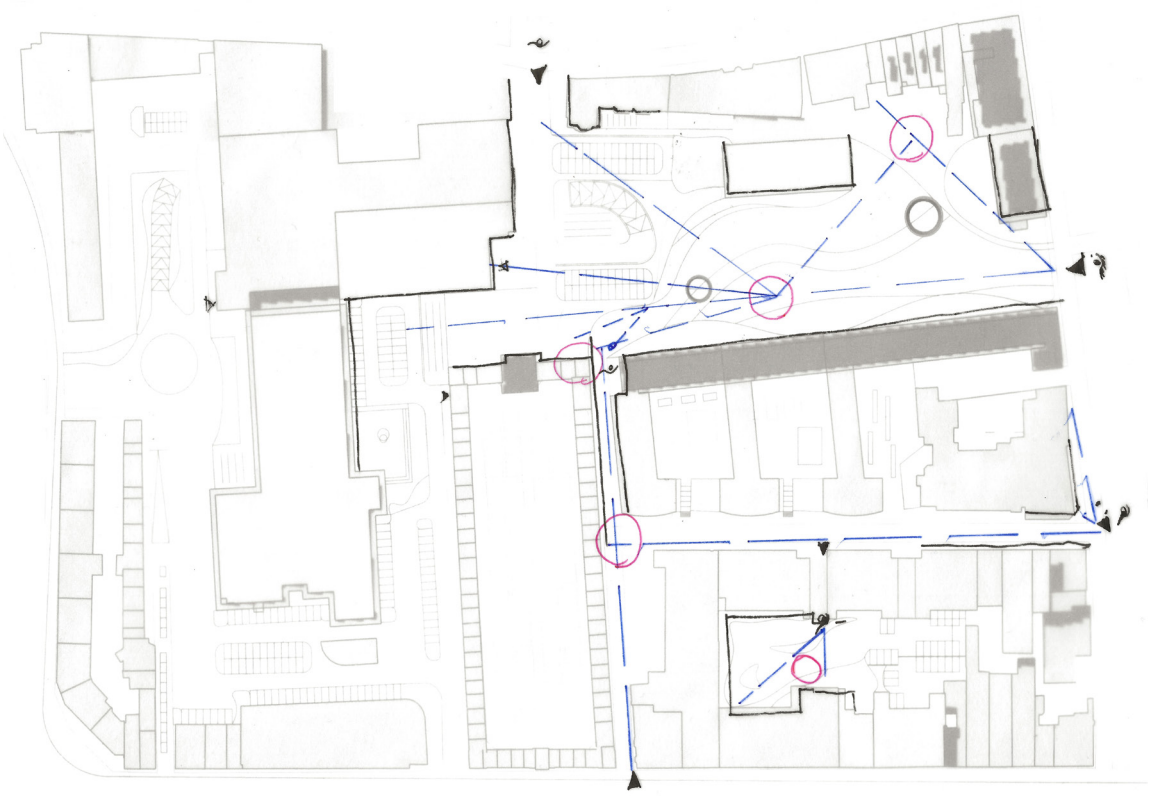


Gathering area

Car Parking

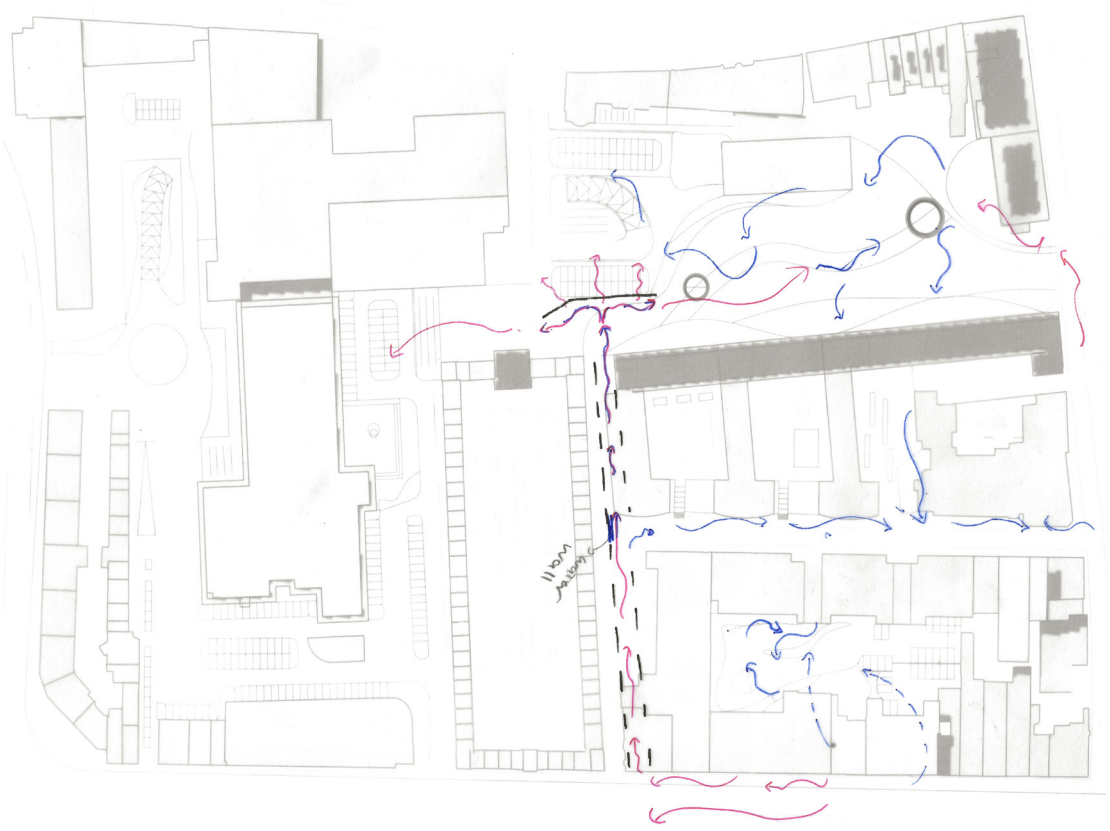
Bikes Parking


Privacy
Sound barrier
Dark & Bright facade
Shadow and light
water
Dark & Bright material



City floor Visual axis

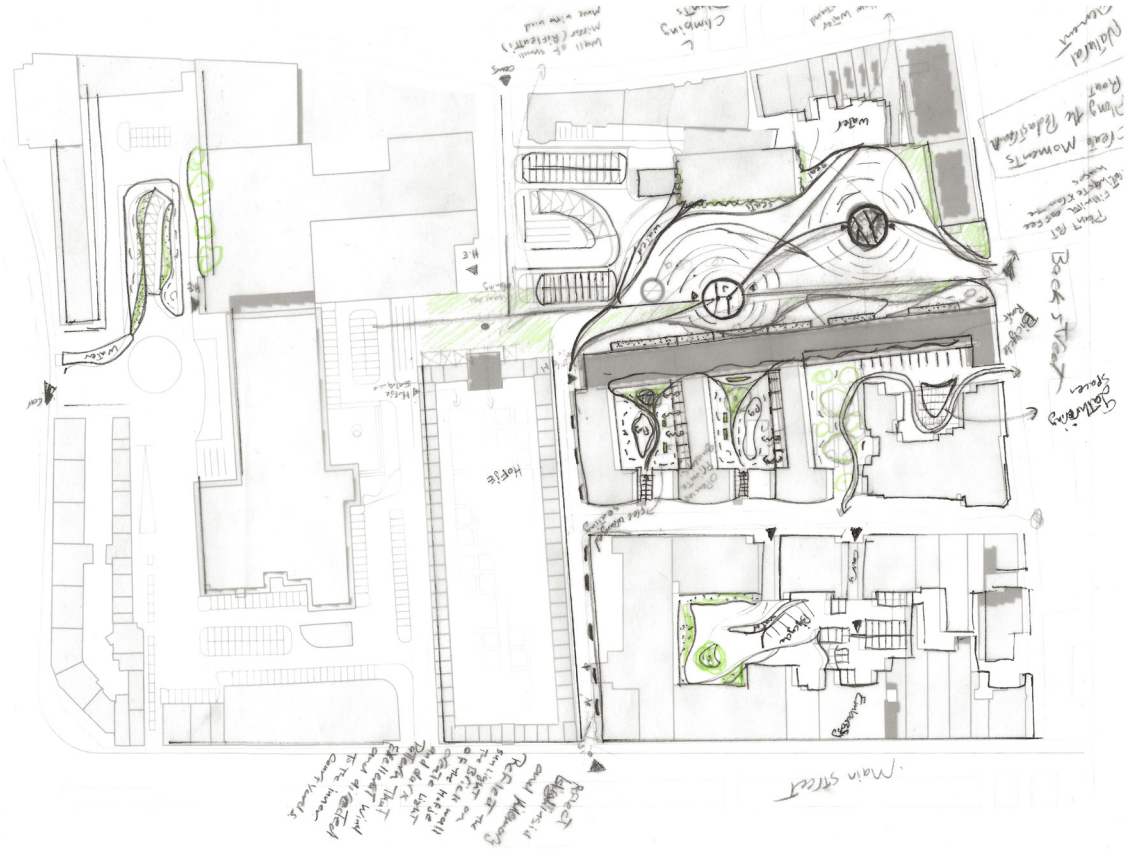
Dividing the block entrances into cars and pedestrians entrances ,and define the visual path of users depending from where they are receiving the space. It give the guild line to the design of the canopy and the city floor since it has the direct influence on users experience.



City floor Wind movement

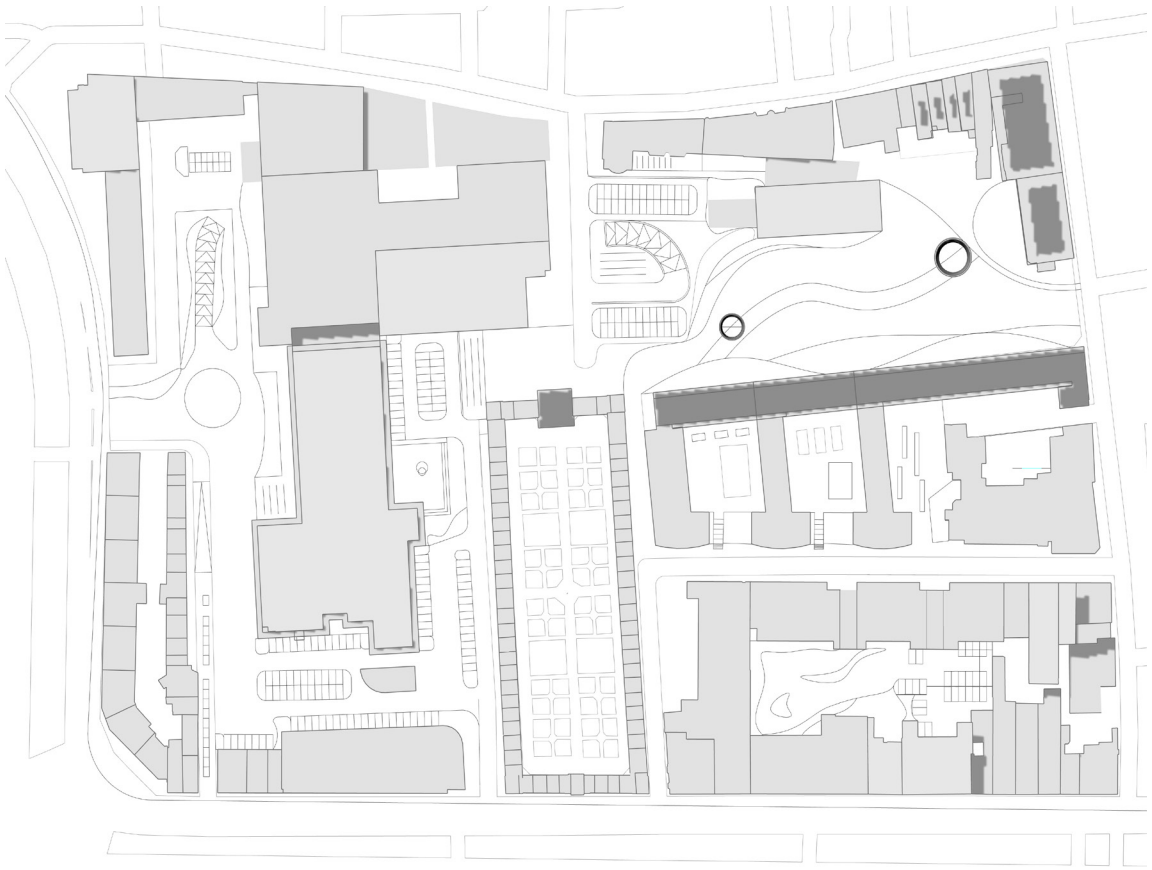
Starting from wind tunnels of the city the main street on the side of the neighborhood and has perpendicular connection with the inner initiated cools paces, from the point where people take off the tram and enter the block Placing small mirrors reflecting the Hofije create the dark and light pattern along the ally,because of the Zebra skin effect increase the micro-flow velocity and drive the air into the leftovers paces where it hits the water surfaces that cools it down and the space around.

To prof this proposal I need to run an wind simulation before and after the intervention, therefore, I have asked experts to help me out as Laura Kleerekoper,Anastasios Kokkos and Bert Blocken who advice to do it as a separate project since it requires labrotory equipments and time .

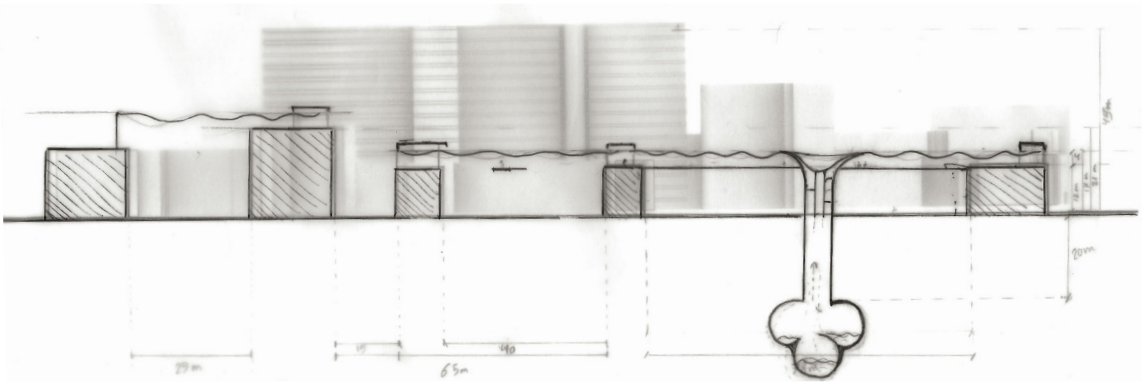


City floor landscape design

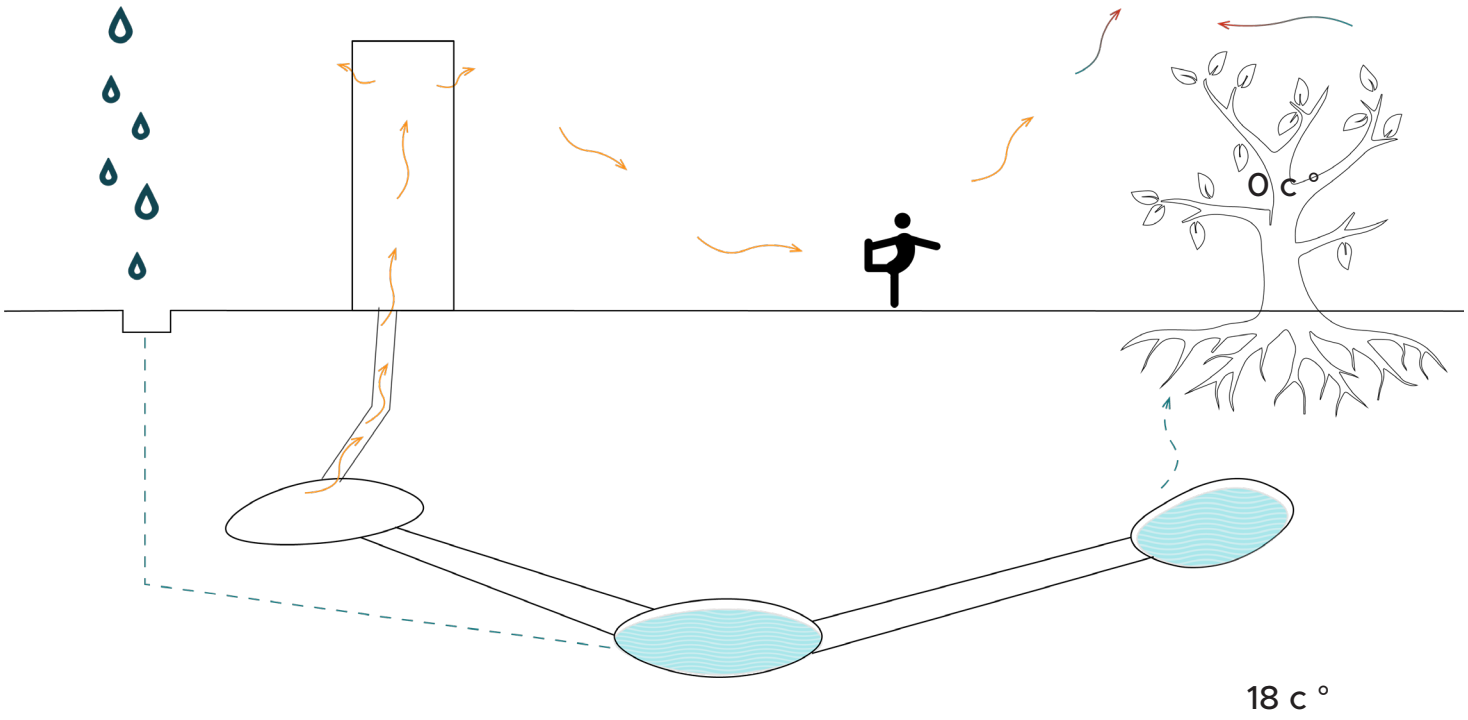
According to visual axis study and wind assumption the landscape design formed. Each cool space landscape designed in correspond to end users needs as it is categorized into four spaces the family cool space, the activities cool space -the hospital cool space and the semi-private cool space.



UNDERGROUND POCKETS

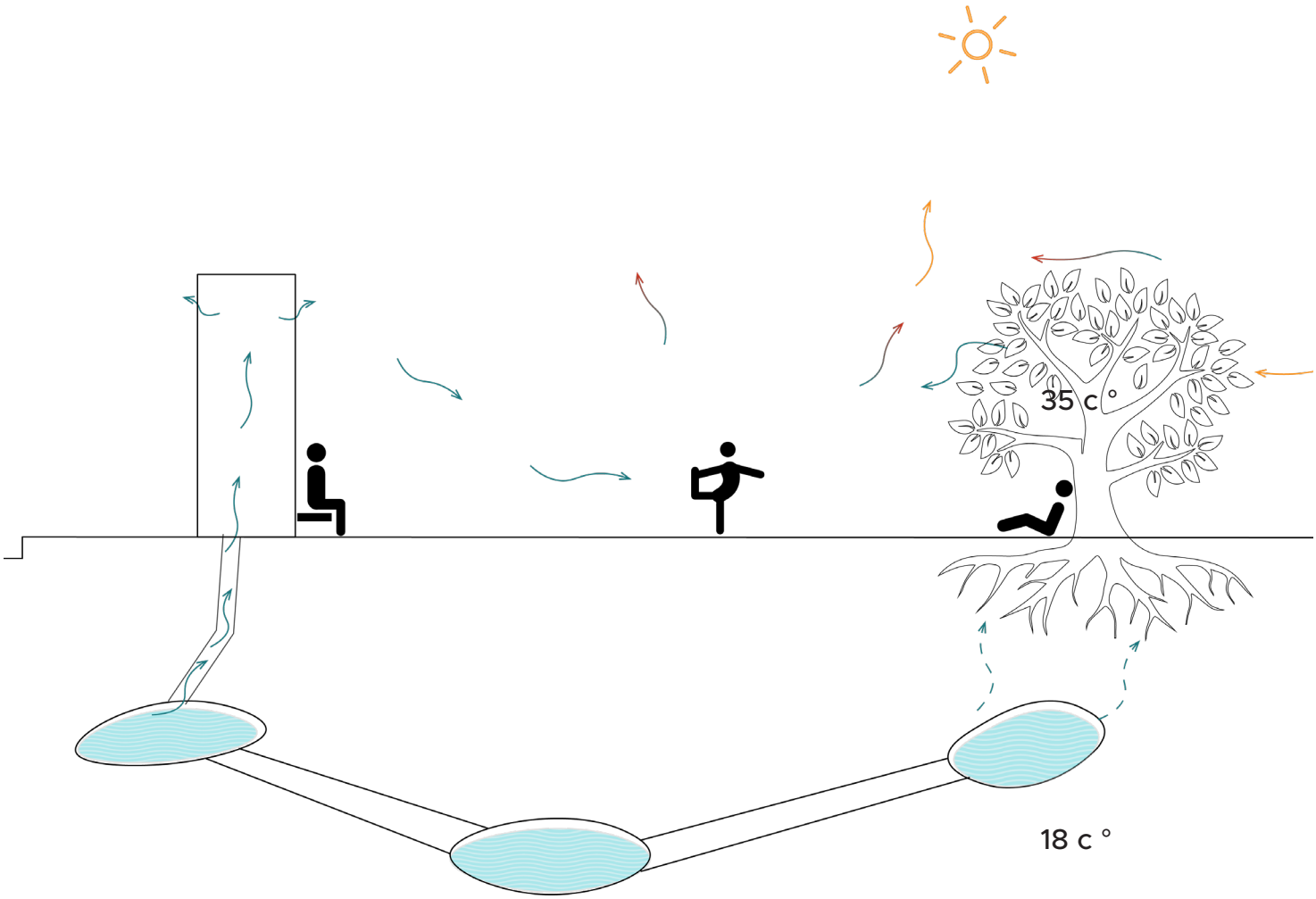


WATER MOVEMENT



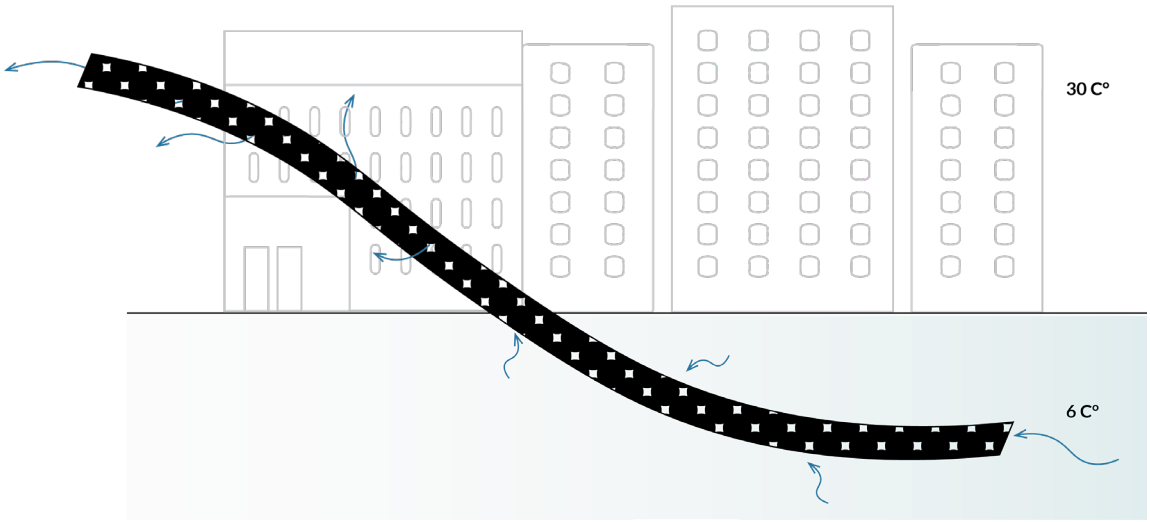
WINTER
Abstract diagram

WATER MOVEMENT



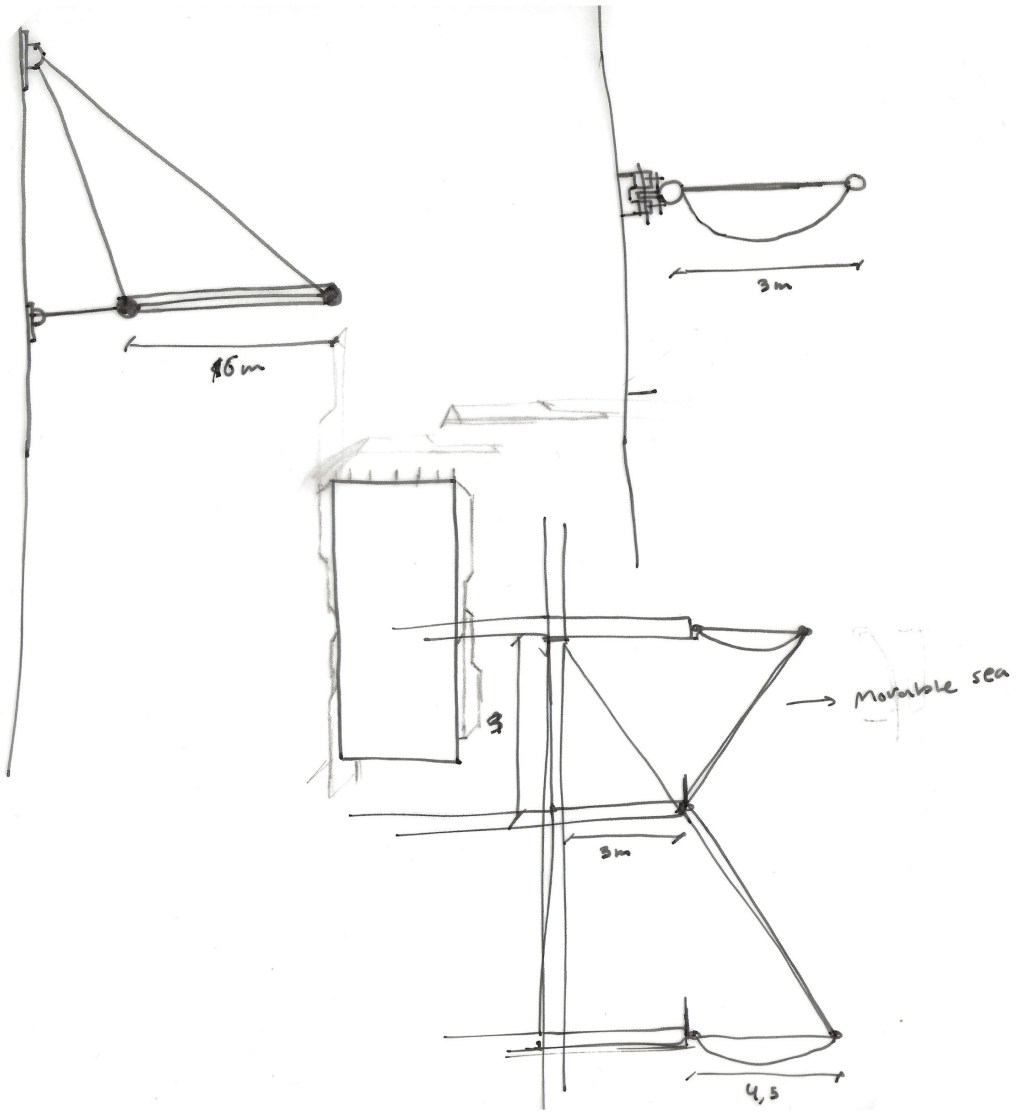
SUMMER
Abstract diagram

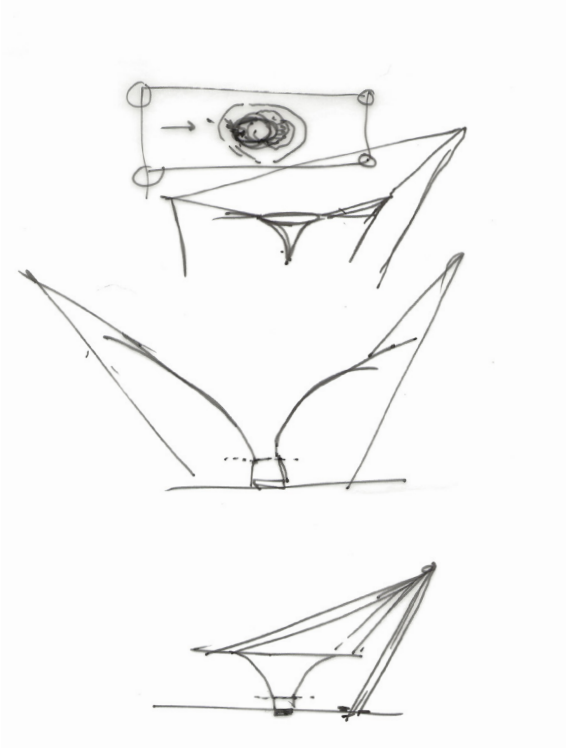
VENTILATION SYSTEM

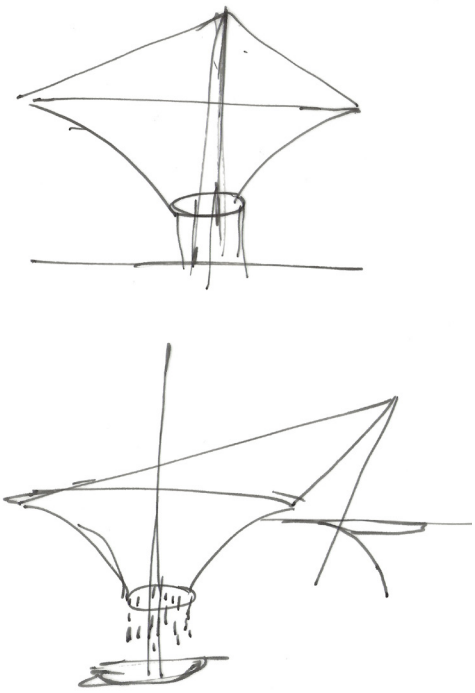


Hollow pipes contentious from underground up transfer cool air.

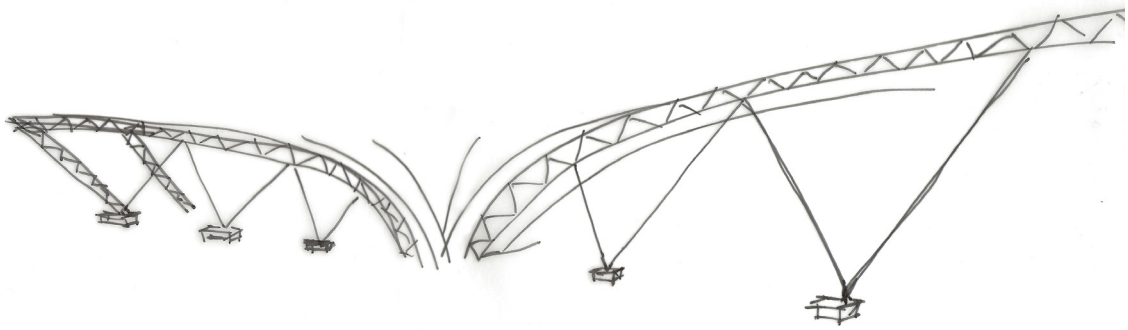
STRUCTURE

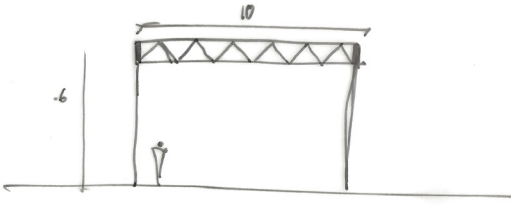

1,6 m
3 m
9
Movable sea
3 m
4,5



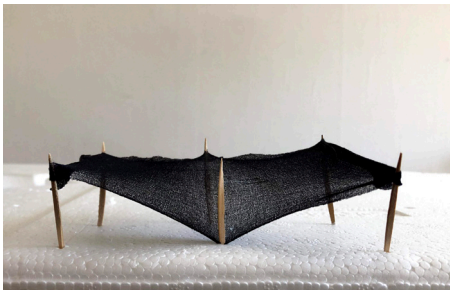


STRUCTURE SKETCHES

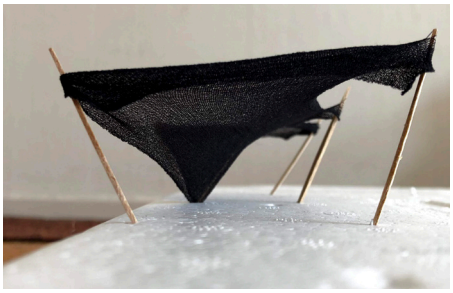
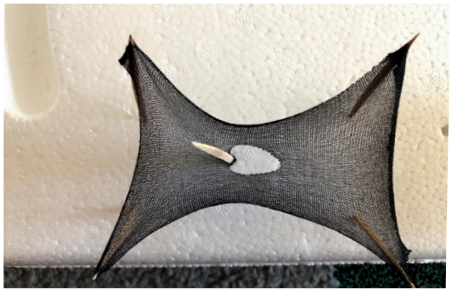



10
6

CANOPY MODELS EXPERIMENTS



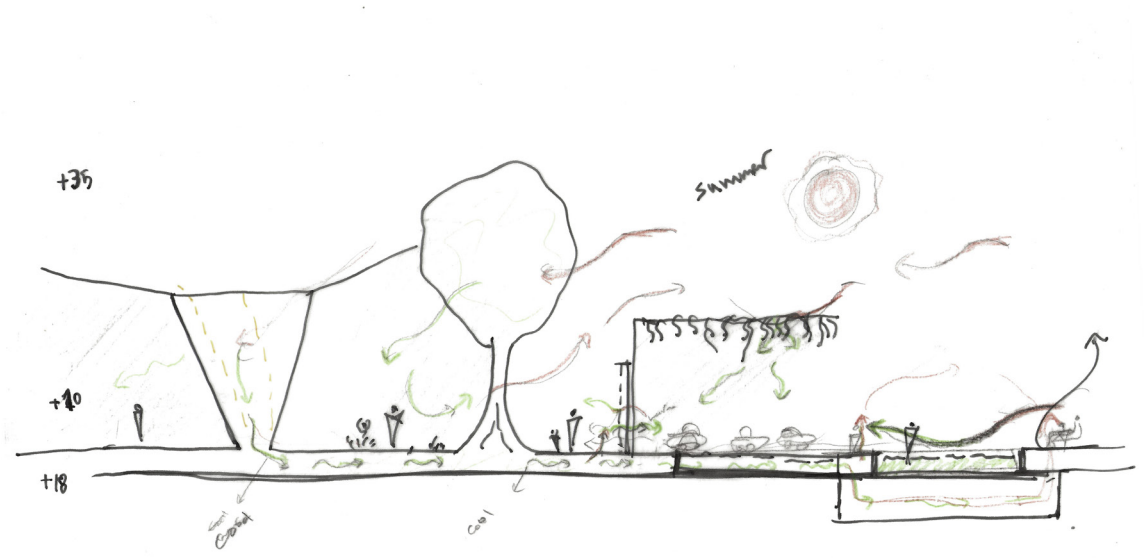




Inspired by Frei Otto soap bubble experiment

Cover the maximum area with less structure

ENVIRONMENTAL DIAGRAMS

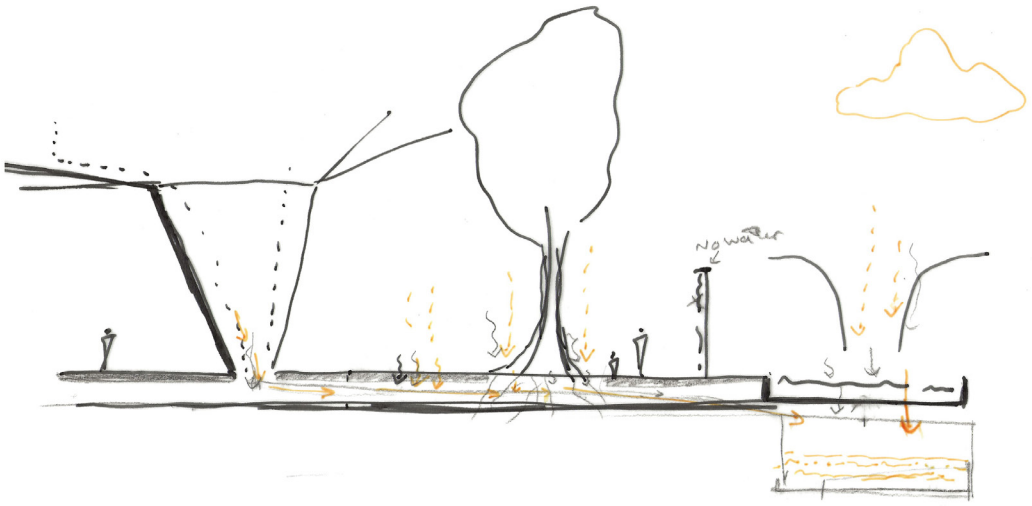
Winter wind



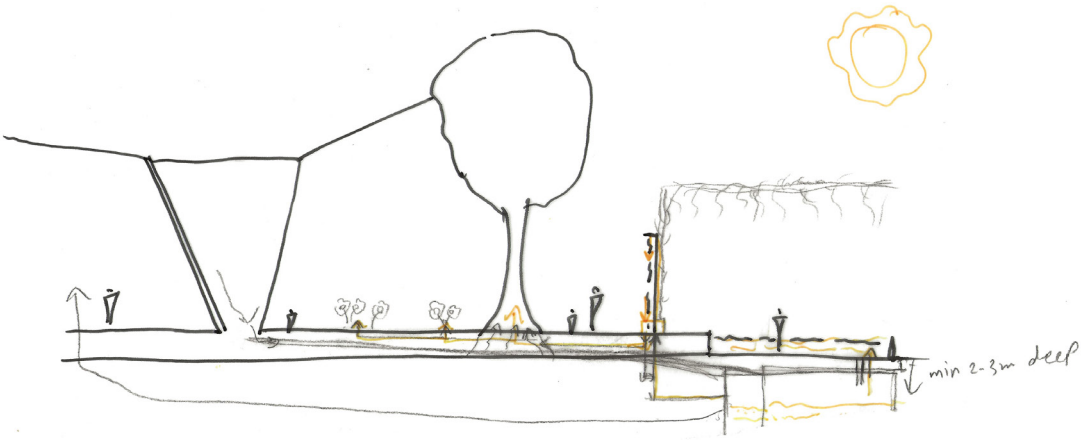
Summer wind

WIND ABSTRACT DIAGRAM

the study demonstrates the design elements and is effect on the adjacent air temperature during seasons .



Winter water



Summer water

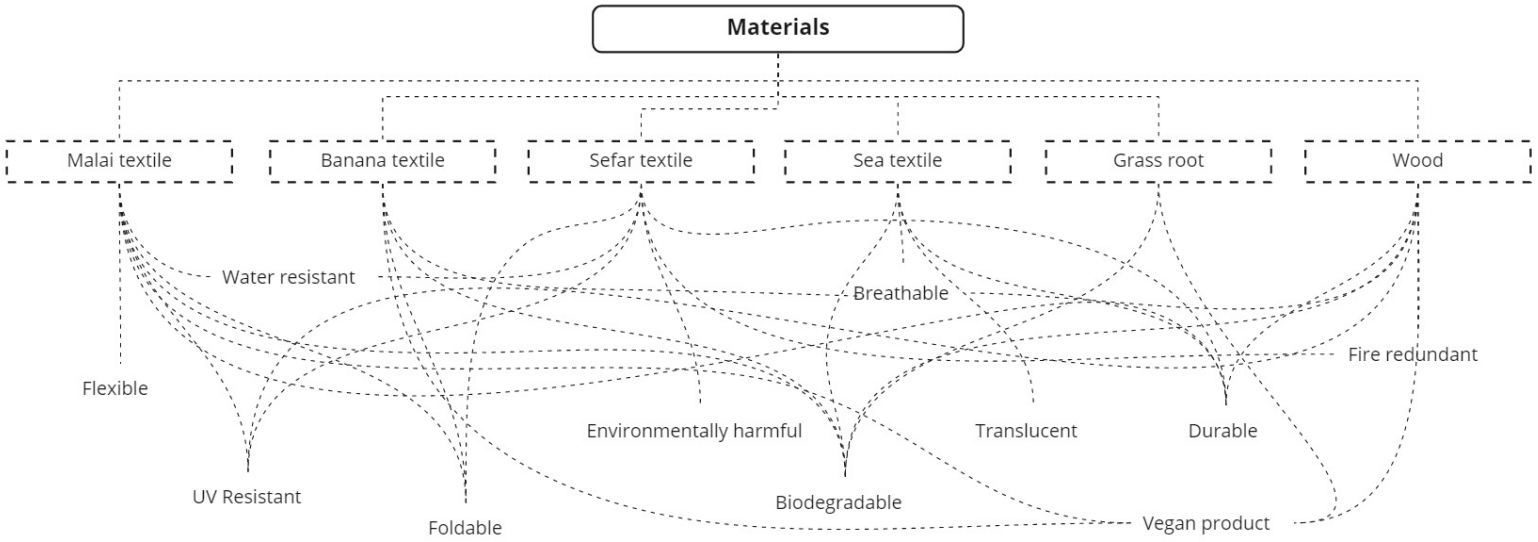
WATER ABSTRACT DIAGRAM

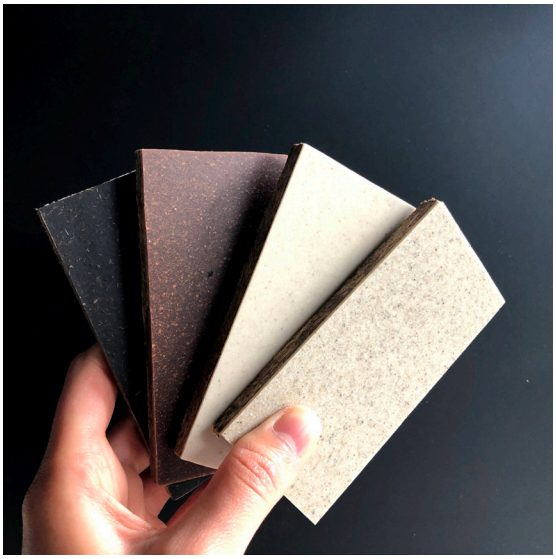
the study demonstrates the design elements and is effect on the water flow during seasons .

MATERIALS

"The race to find the next sustainable technology or material that will greatly reduce our ecological footprint as well as improve our environment is causing countless new materials to develop which hold the possibility of helping to achieve this generation's sustainability goals. This 100 percent organic material has been gradually developed across multiple disciplines, with the architectural and construction industry recently taking interest in its possible implications" certifiedenergy

Material research portfolio


Materials
Malai textile
Banana textile
Sefar textile
Sea textile
Grass root
Wood
Water resistant
Breathable
Fire redundant
Flexible
Environmentally harmful
Translucent
Durable
UV Resistant
Biodegradable
Foldable
Vegan product



MOGU

Floor Panel

Material specs

+Biobased
+ Durable
+ Water Proliferation
+ Weatherproof
+ Multi colored

MOGU

Acoustic Panel

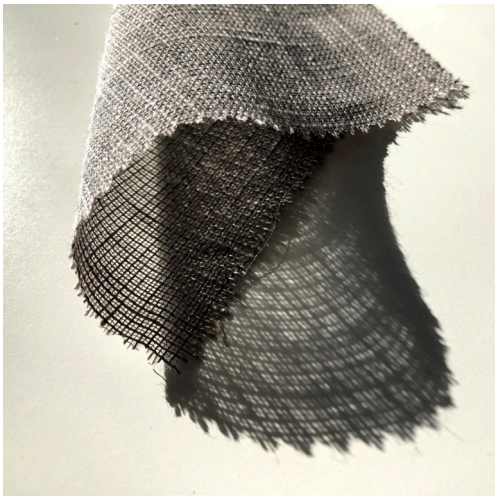
Material specs

+ Noise reduction
+ Durable
+ Waterproof
+ Weatherproof
+Bio based

SEFAR

Material specs

+ Permanently UV-resistant
+ Durable
+ Highly translucent,
+ Waterproof
+ Weatherproof
+ Colorfast



SEA TEXTILE

Material specs

+ Made from Shoreline plastic
+ Flame retardant
+ Transparent
+ Suitable for Roman Blinds

Bacterial cellulose +

+

MALAI TEXTILE

Material specs

+ Flexible
+ Durable
+ Composite material
+ With a feel comparable to leather or paper
+ Water resistant
+ Vegan product
+ Produced in sheets (with a range of thicknesses)
+ Can create seamless three-dimensional objects using a molding technique
+ Colored by mordant-free natural dyes

RECENSIE **'HYPER RHIZOME'**

Wandkleden van wortels tonen onvermoede schoonheid

Beeldende kunst

Hyper Rhizome van Diana Scherer, Droog, A'dam. T/m 24/2 Inl: Droog.com
●●●●○

Waar zit 'm nou de kunst van de kunstenaar in? In het bedenken en het maken van iets, of in het bedenken en het dan laten ontstaan van iets? Bij Diana Scherer is het dat laatste. Zij werkt op het snijvlak van kunst, design en wetenschap. Haar materiaal bestaat uit plantenwortels, die ze haast als garen behandelt. Levend textiel.

De wortels zijn puur natuur, maar dan wél onderworpen aan de vormen en patronen die de kunstenaar als een ware flora-dompteur aan ze oplegt. Zo kwetsbaar als de wortelweefsels van Scherer zijn, zo vlijmscherp verbeelden ze onze dubbelzinnige houding ten opzichte van de natuur. We zeggen die te koesteren, maar tegelijkertijd manipuleren we haar dat het een aard heeft. De manipulatie levert bij Scherer objecten op die teer en taai tegelijk zijn, en tot nadenken stemmen.

Scherer begon hiermee in 2010, met het maken van 'vazen' van wortelkluiten. Nu heeft ze een tentoonstelling *Hyper Rhizome* bij Droog in Amsterdam, van een aantal 'wandkleden', vaak geweven van meerdere lagen wortelmateriaal in verschillende kleuren. Nooit geweten dat de wortels van gras wit zijn en op zijde lijken, terwijl die van de margriet gelige strengen zijn die iets weg hebben van wol. Die wandkleden 'groeien' op de natuurlijke manier waarop wortels groeien - maar dan volgens de ondergrondse sjablonen die de kunstenaar heeft bedacht. De wortels zijn echt, maar het weefsel is kunstmatig.

Voor de tentoonstelling *Fashioned from Nature* in het V&A Museum in Londen vorig jaar kweekte ze zelfs een jurk van wortels, genaamd *Rooted #2*. In 2017 won zij de New Material Award, een tweejaarlijkse prijs van samenwerking van het Nieuwe Instituut, Fonds Kwadraat en Stichting Doen.

Deze werkwijze heeft ze ontwikkeld in samenwerking met biologen en ingenieurs van het Materials Experience Lab aan de TU Delft en van de Radboud Universiteit Nijmegen. Darwin beschouwde al de wortelpunten als het brein van de plant, en ontdekte dat wortels navigeren, zwaartekracht waarnemen, kortom dat ze een bepaalde intelligentie bezitten. Ze zijn altijd op zoek naar water en voedsel. Die dynamiek is Diana Scherer vanaf 2016 gaan toepassen om deze verborgen processen zichtbaar te maken. Door de natuur naar haar hand te zetten laat ze zien wat de natuur vermag, en welke onvermoede schoonheid erin verscholen zit.

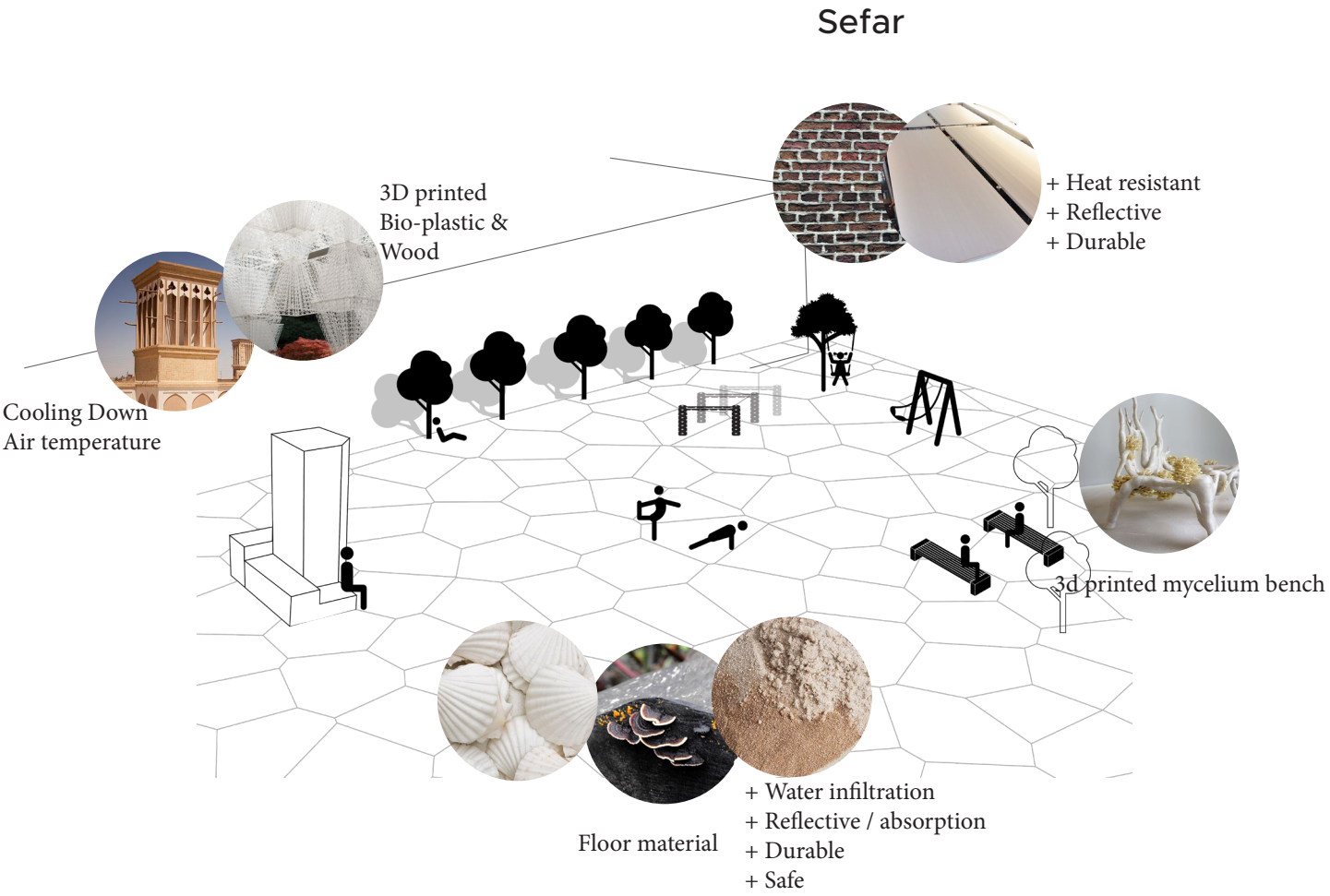
FOTO DROOG

Hyper Rhizome #7, Diana Scherer.

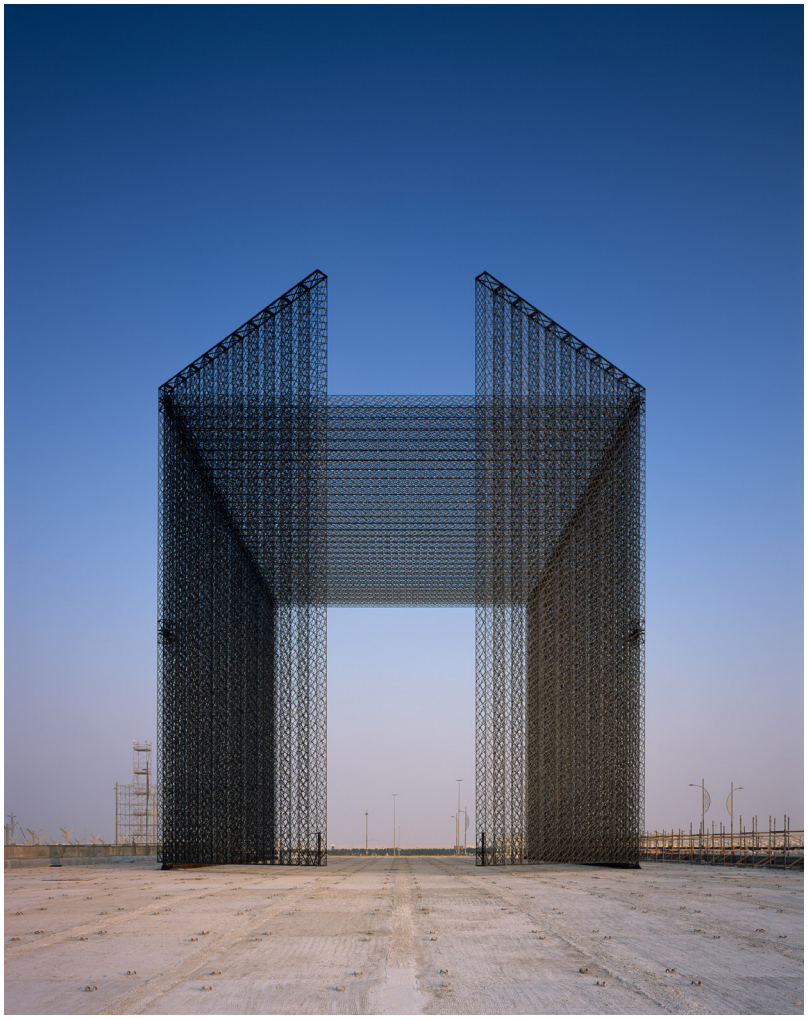
Tracy Metz

Werk van **Scherer** is ook t/m 29/2 bij galerie Caroline O'Breen, Amsterdam.

CITY FLOOR MATERIAL



STRUCTURE MATERIAL



2020 Expo Gate -Dubai

21 x21 x31 m The design was engineered precisely to make the lattice as thin as possible while also able to span tens of meters and support itself. Despite their size, the doors can be pushed open by just one person.

CARBON FIBERS

It is fibers about 5–10 micrometers in diameter”five times stronger than steel, twice as stiff, weighing significantly less.”

High stiffness,
High tensile strength,
Low weight,
High chemical resistance,
High temperature tolerance
low thermal expansion

Expired wind turbine blade

3,800 annually Europe waste of wind turbine blade

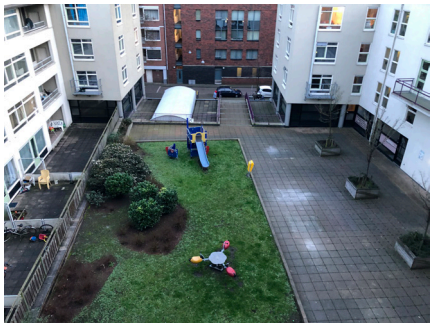
SITE PICTURES





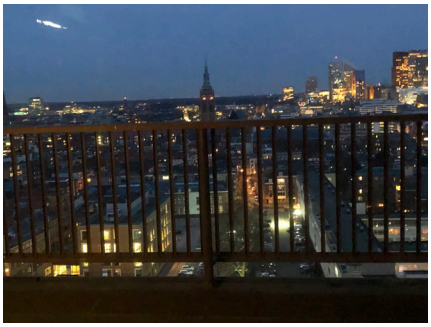
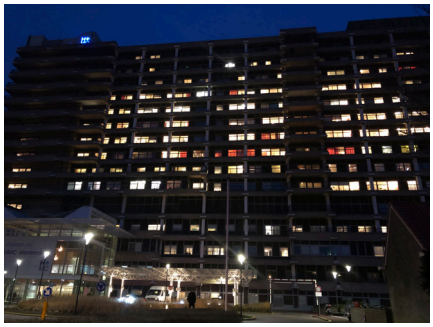

General overview



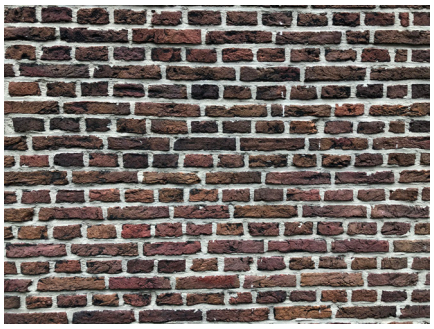
Around the residential block




The hospital

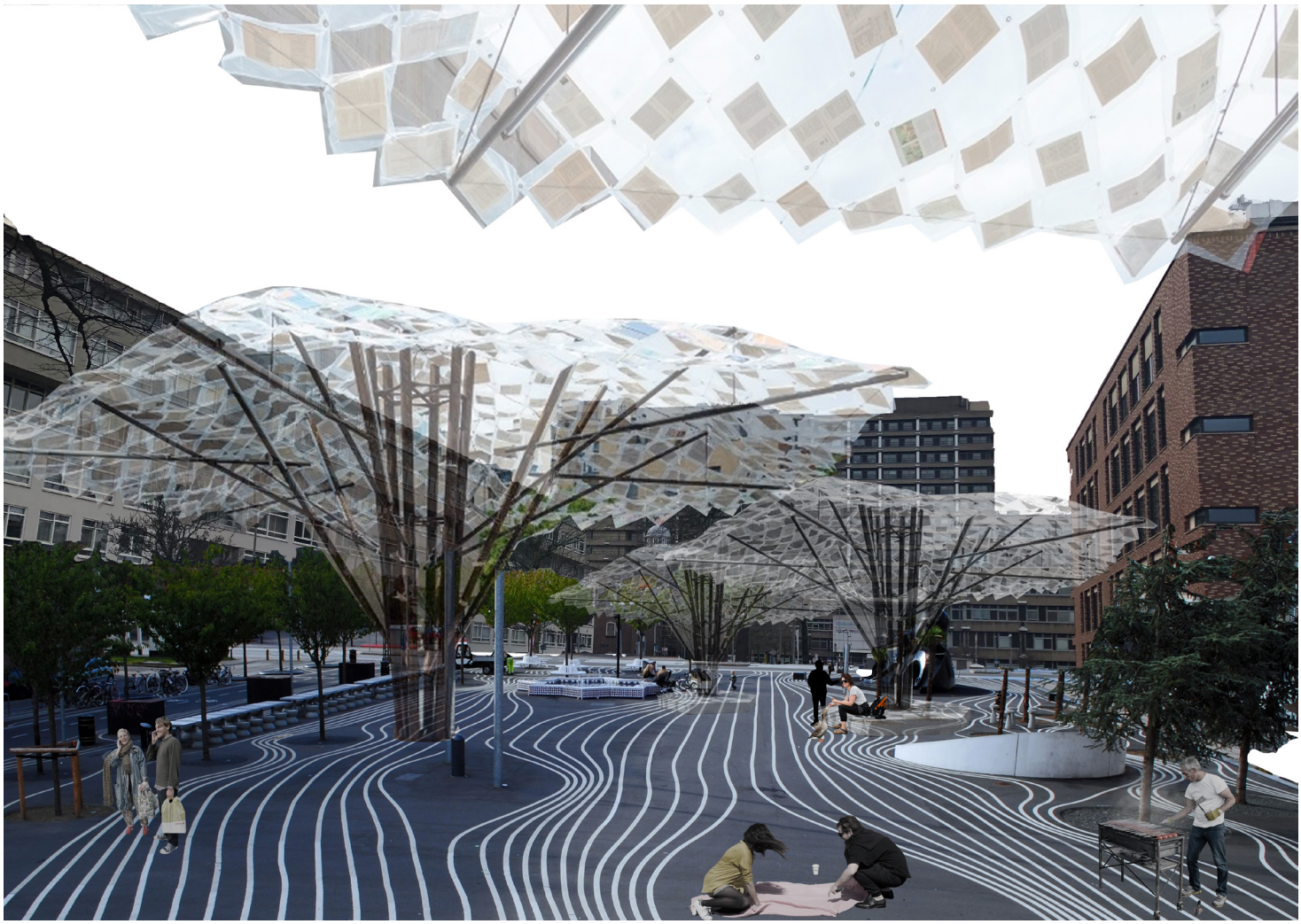
Parking lot

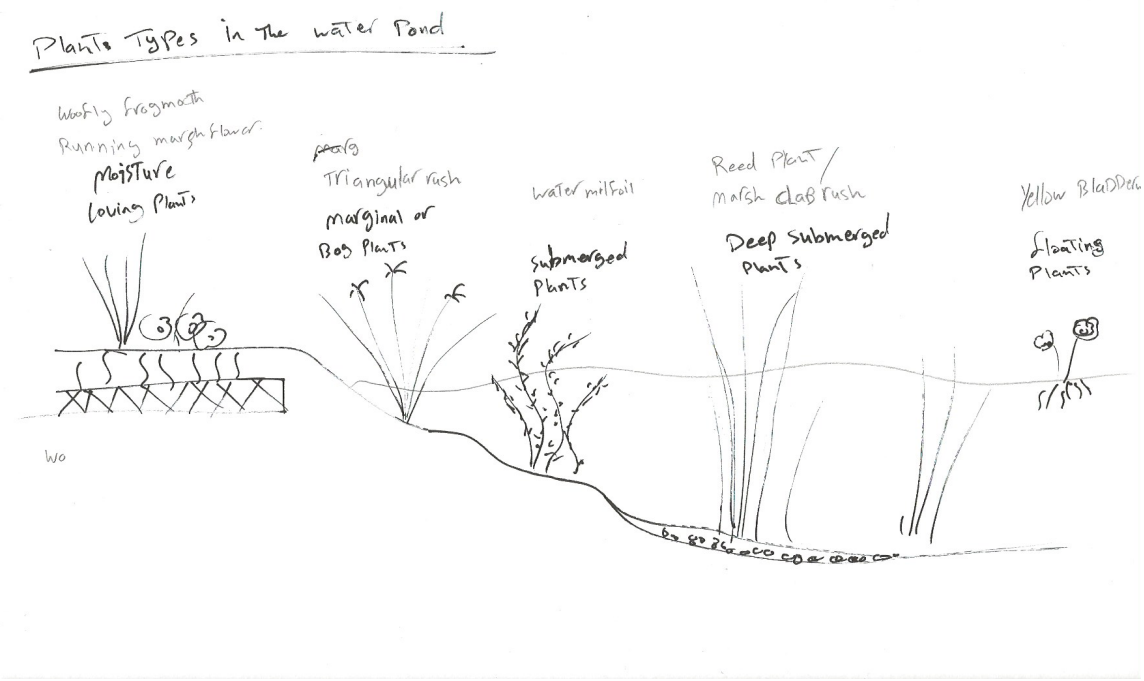


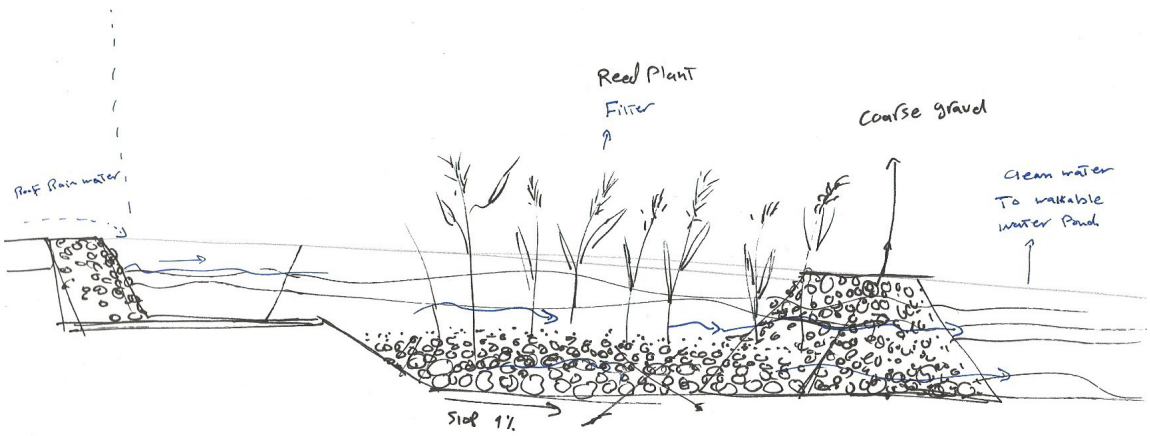


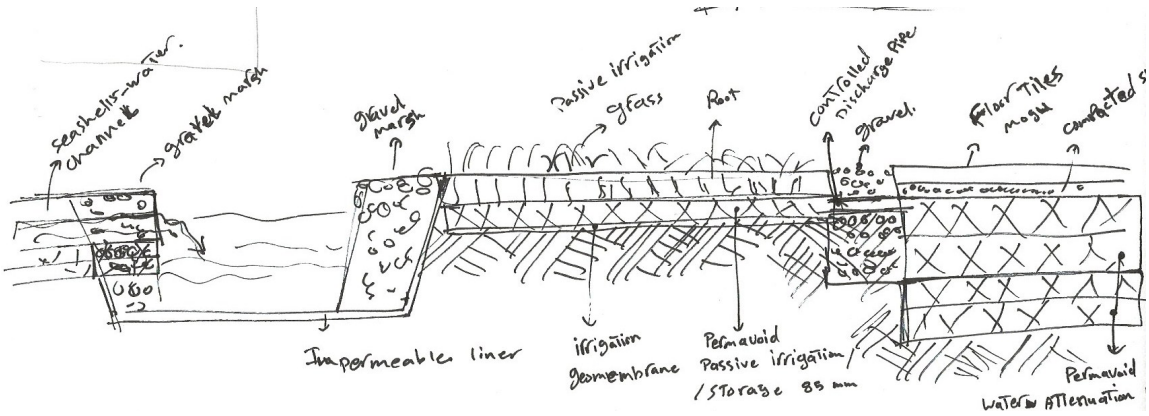

Floor material

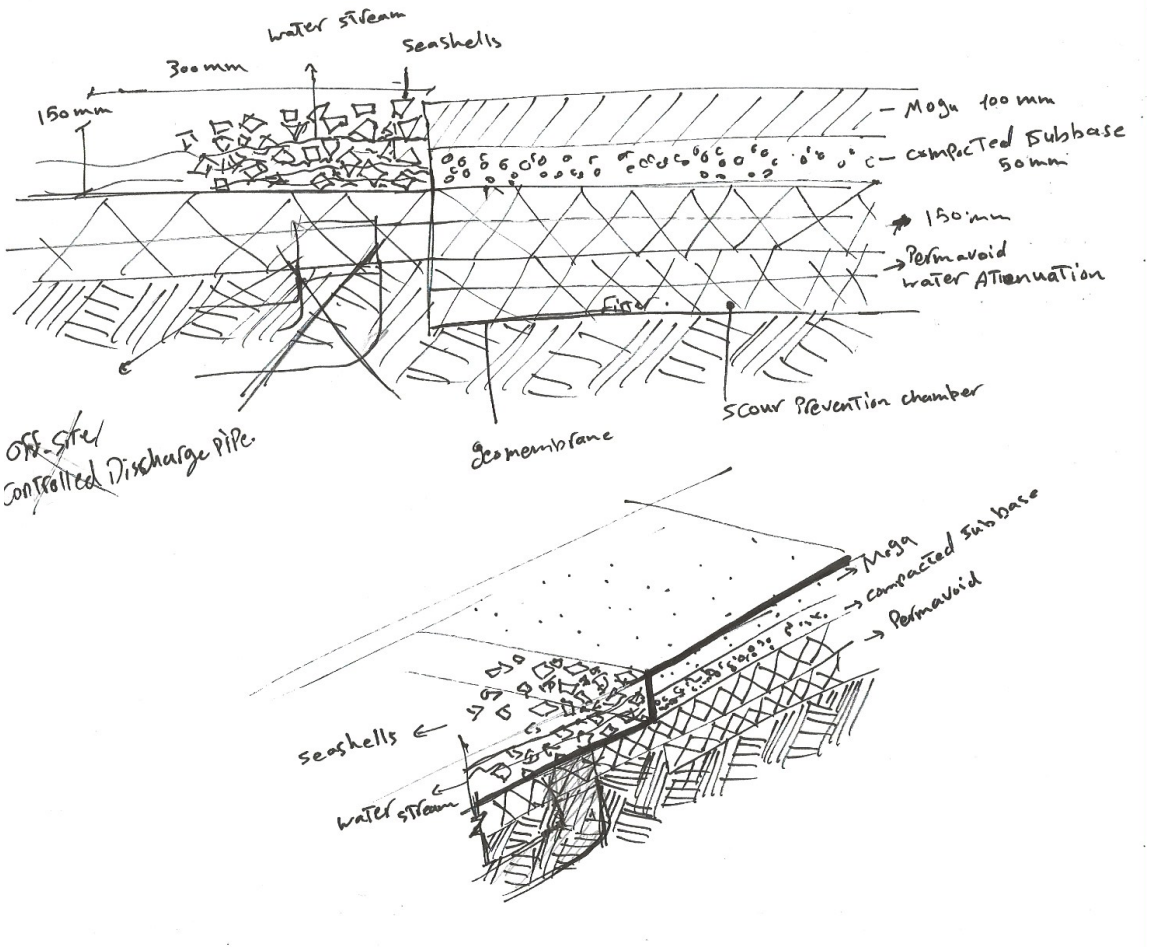
SKETCHES AND COLLAGES

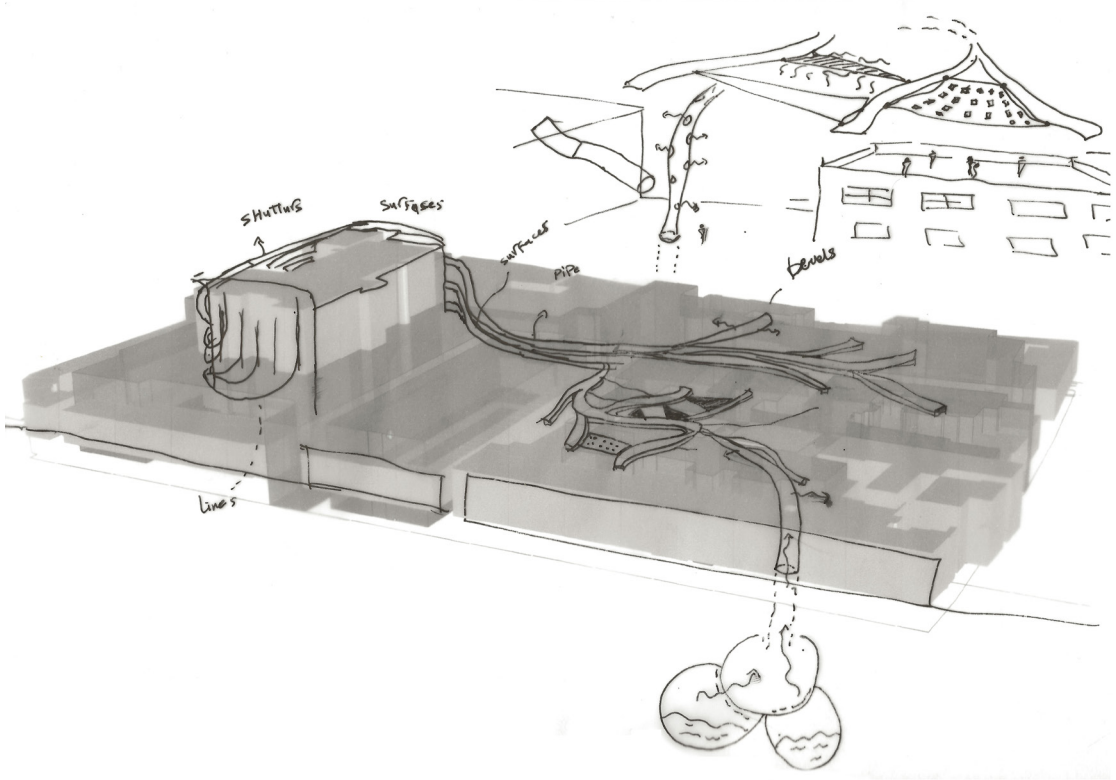


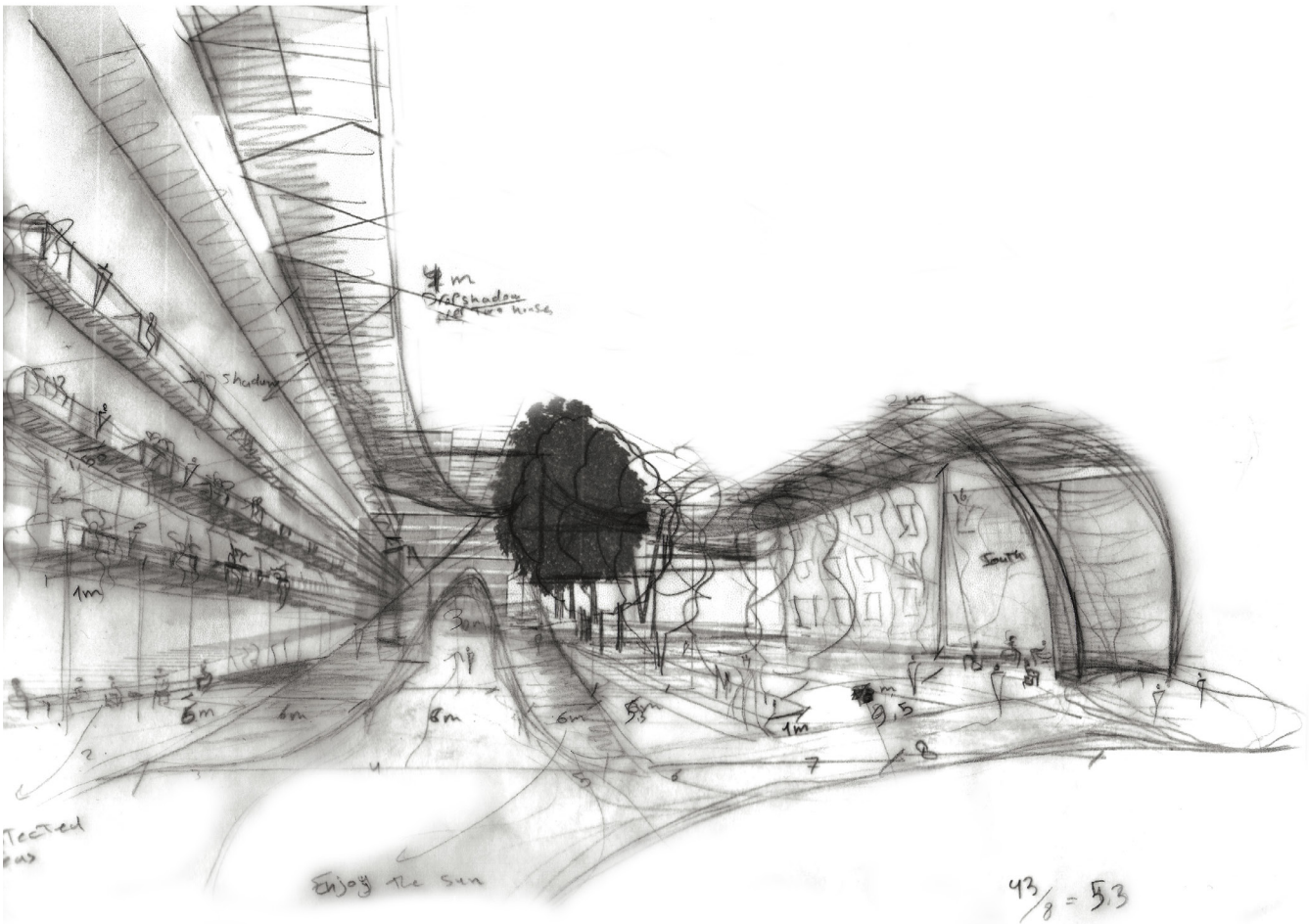

Plants Types in the water Pond
Woolly frogmouth
Running marshflower
Moisture
Loving Plants
Triangular rush
marginal or
Bog Plants
water milfoil
Submerged
Plants
Reed Plant/
marsh club rush
Deep Submerged
Plants
Yellow Bladder
floating
Plants

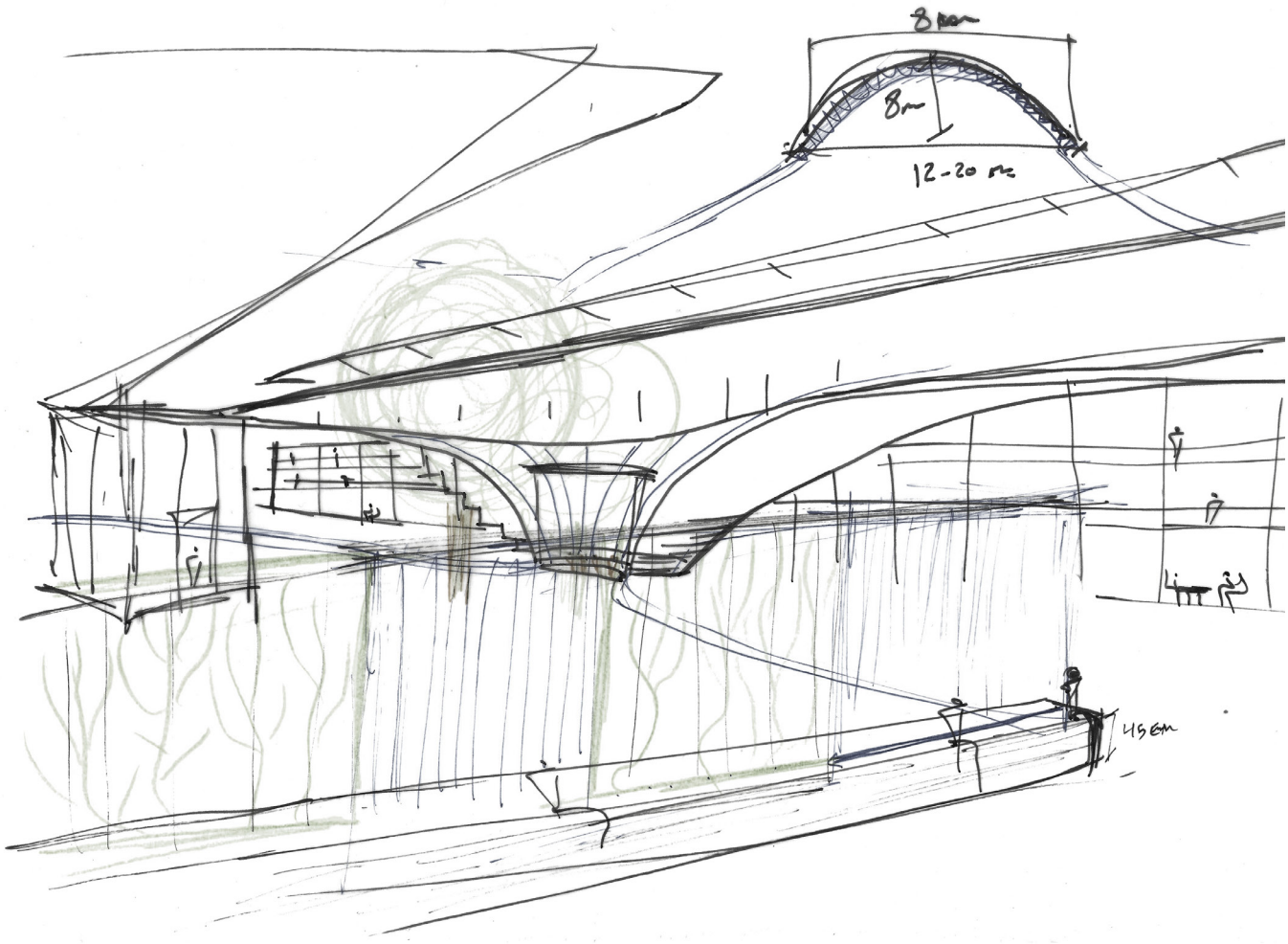

Reed Plant
Filter
Coarse gravel
Roof Rain water
Clean water
To walkable
water Pond
Slop 1%

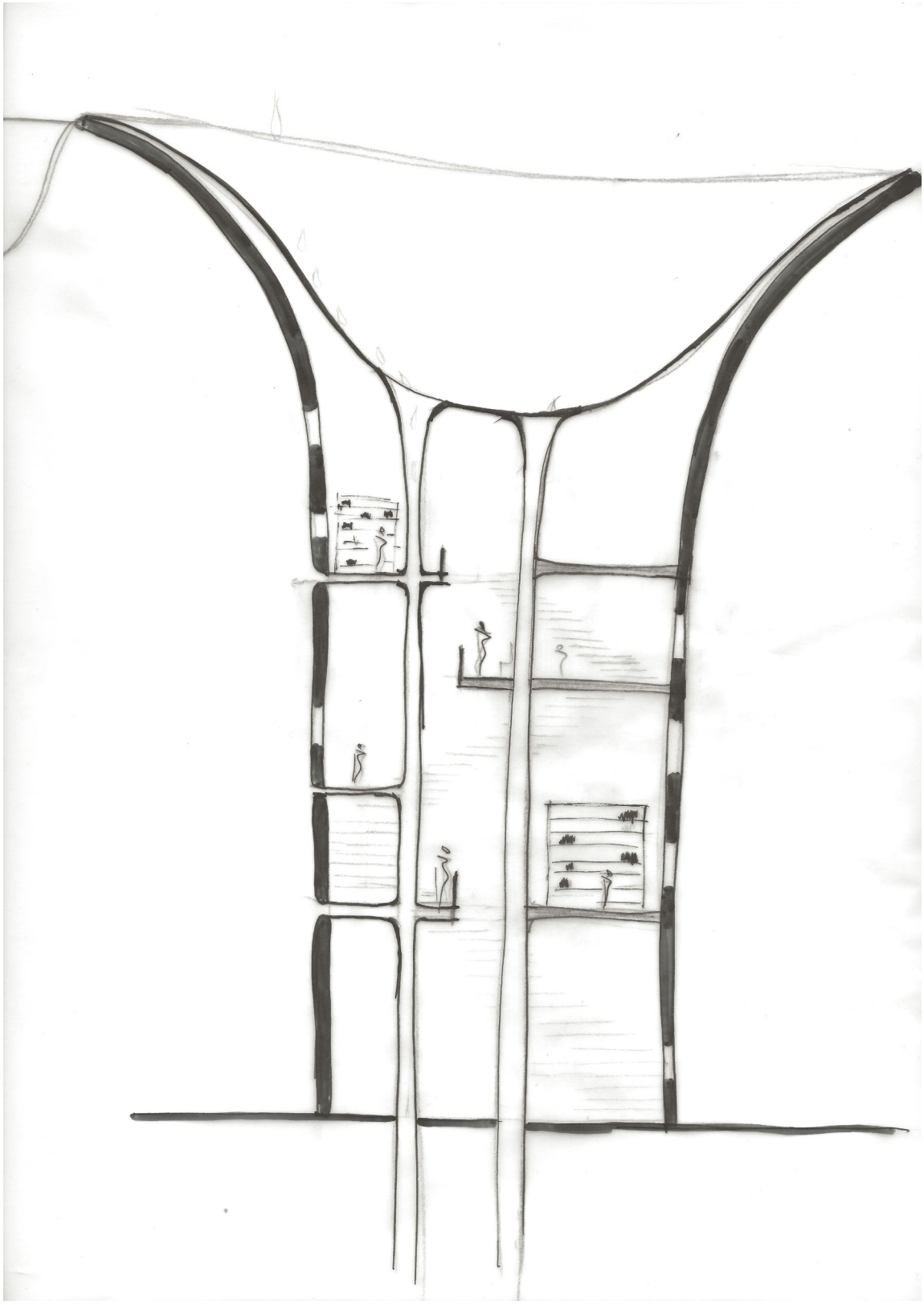

Seashells-water
channel
gravel marsh
gravel marsh
Passive irrigation
grass
Root
Controlled
Discharge Pipe
gravel
Filter Tiles
moss
Impermeable liner
irrigation
geomembrane
Permavoid
Passive irrigation
/Storage 85 mm
Permavoid
Water Attenuation

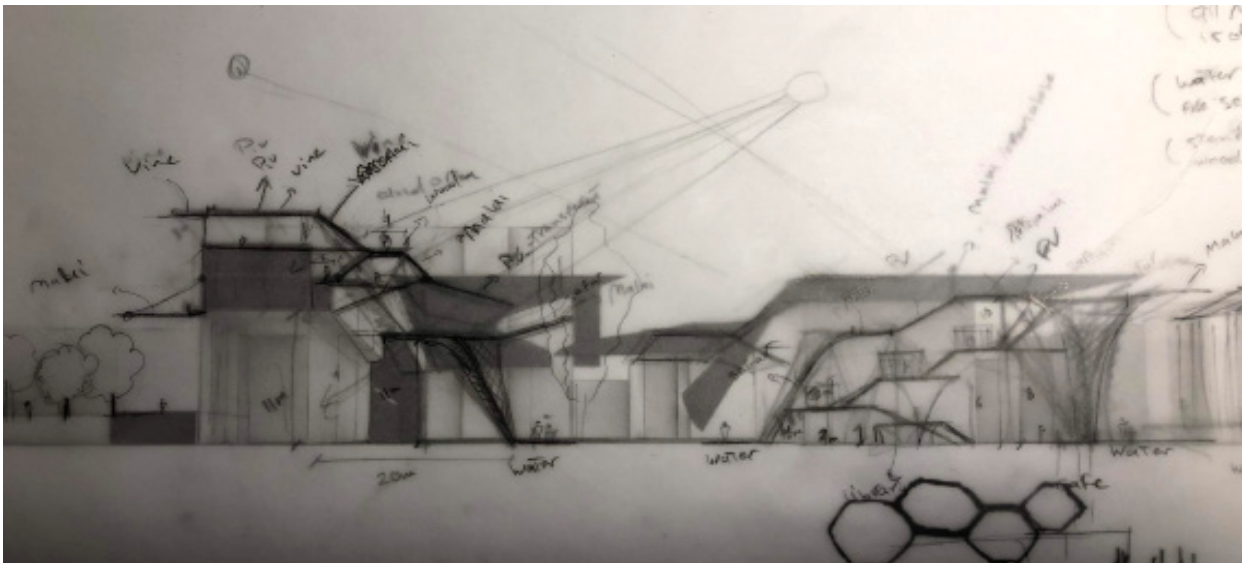

water stream
seashells
300 mm
150 mm
Moga 100 mm
compacted subbase 50 mm
150 mm
Permavoid water Attenuation
filter
scour prevention chamber
Off-Site/ controlled Discharge Pipe.
geomembrane
Moga
compacted subbase
Permavoid
seashells
water stream

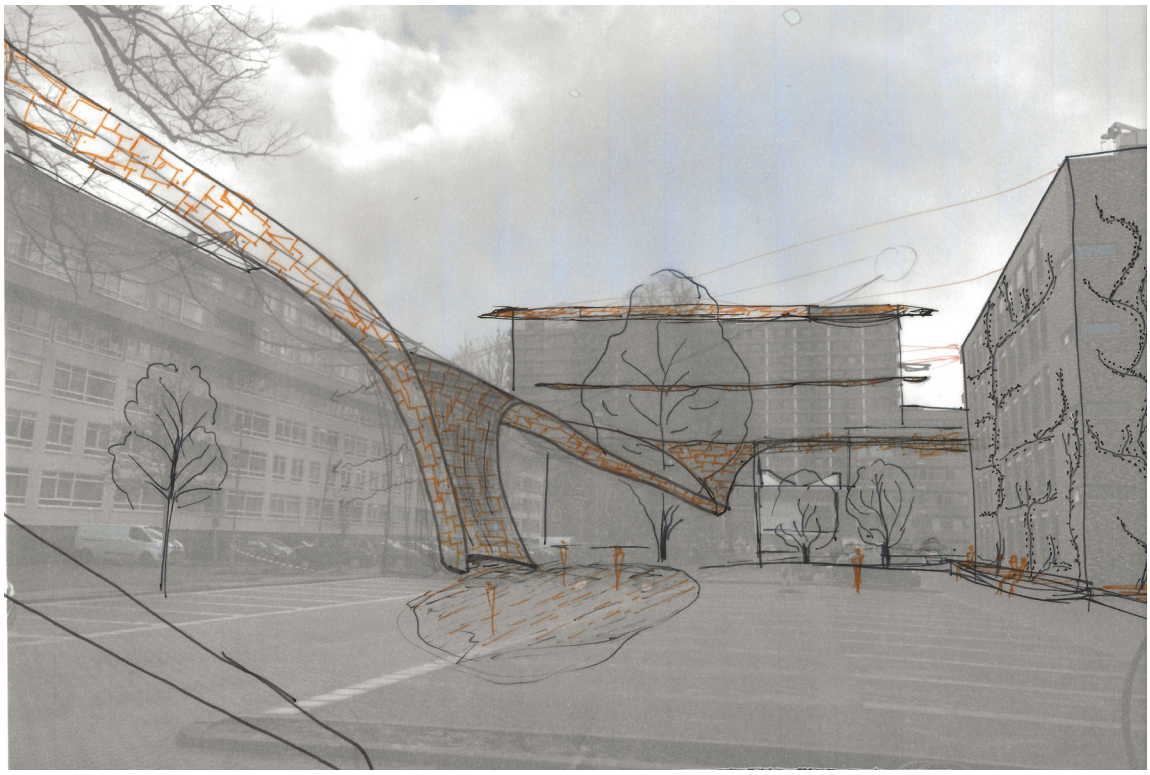

shutting
surfaces
surfaces
pipe
levels
lines


Shadow
South
Enjoy the sun
43/8 = 5.3


8m
8m
12-20 m
45cm

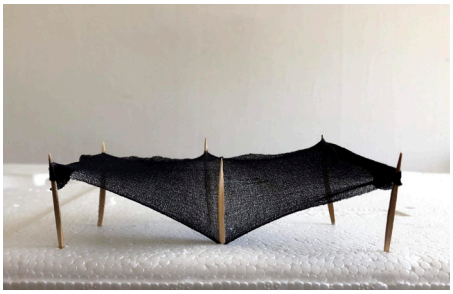



PV
wind
water
20m
water
water

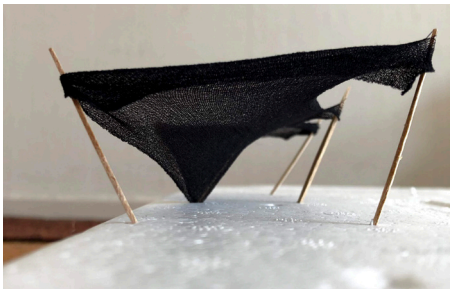
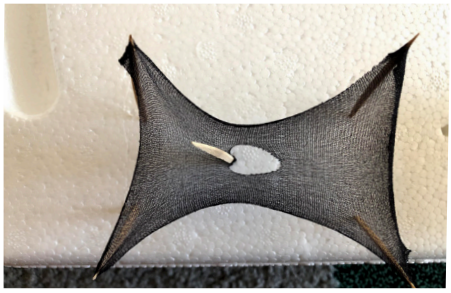


PHYSICAL MODELS

CANOPY MODELS EXPERIMENTS

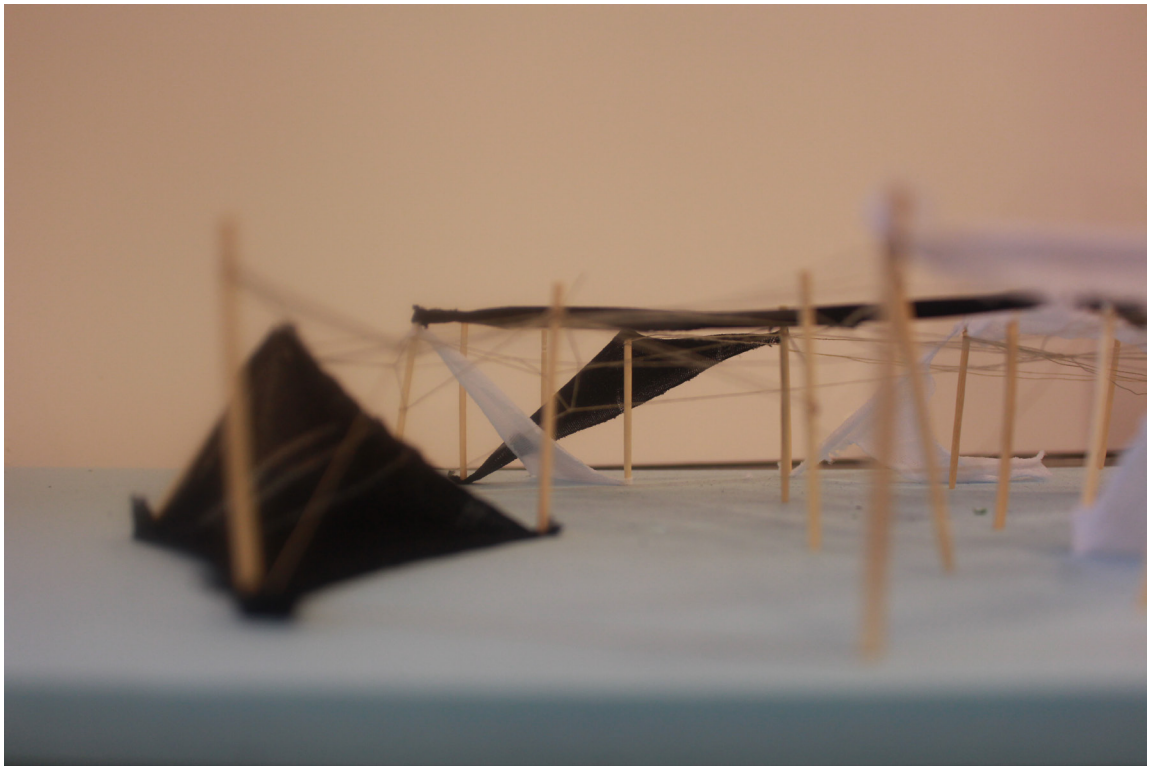



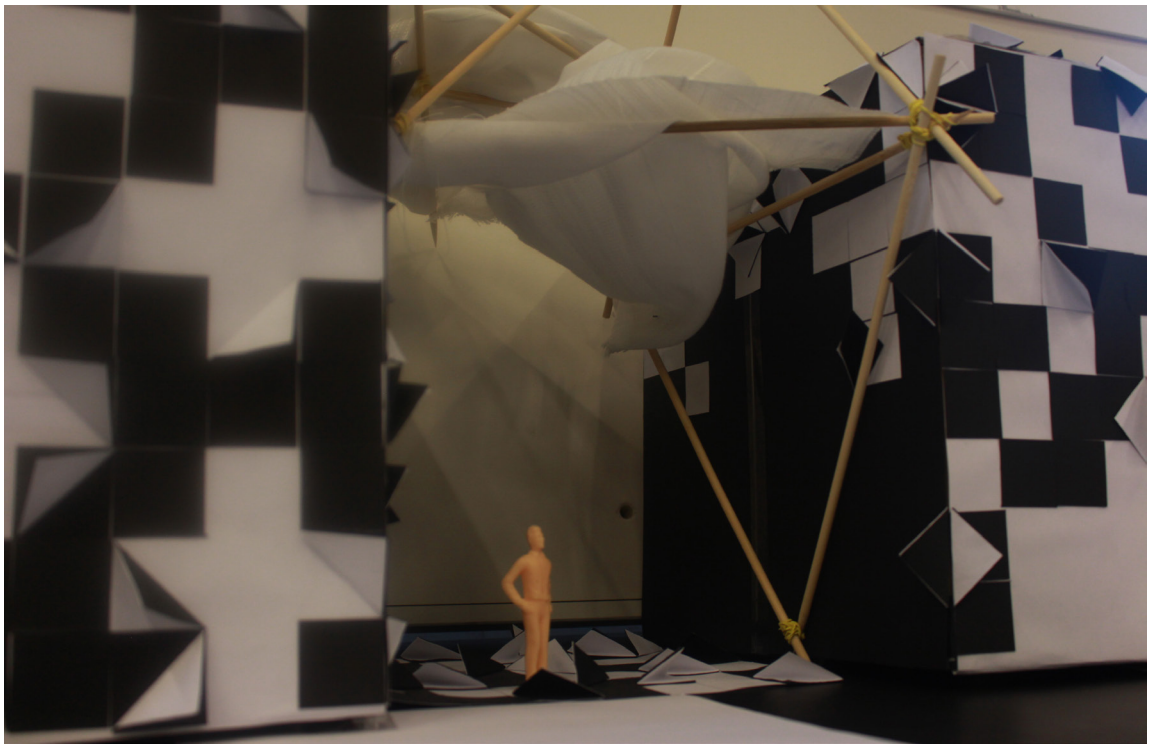


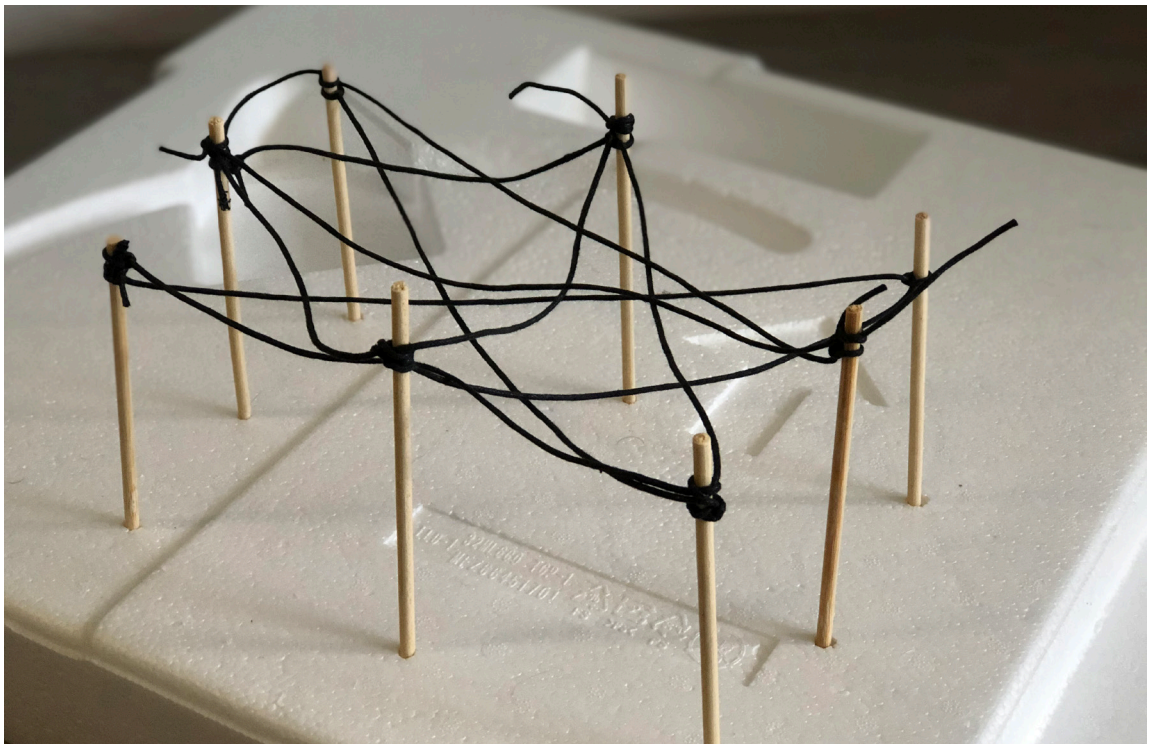



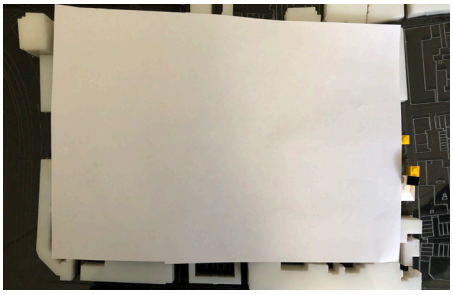

Inspired by Frei Otto soap bubble experiment

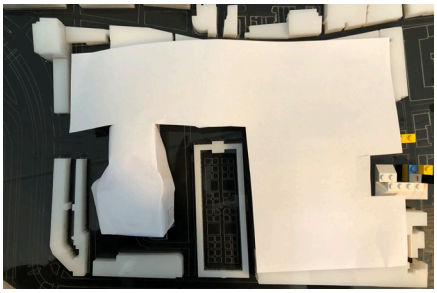
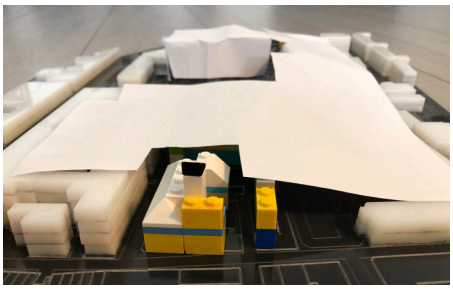
Cover the maximum area with less structure

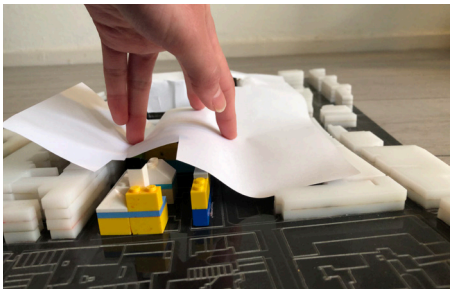


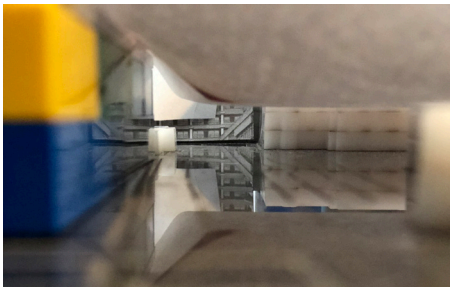


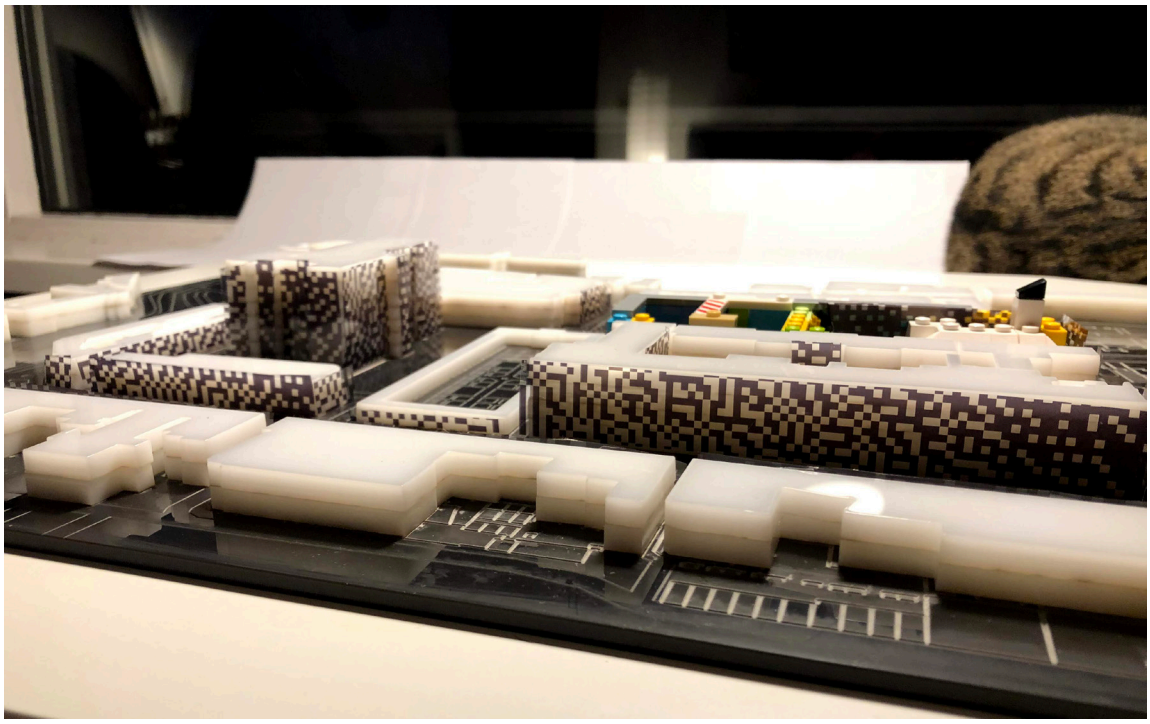


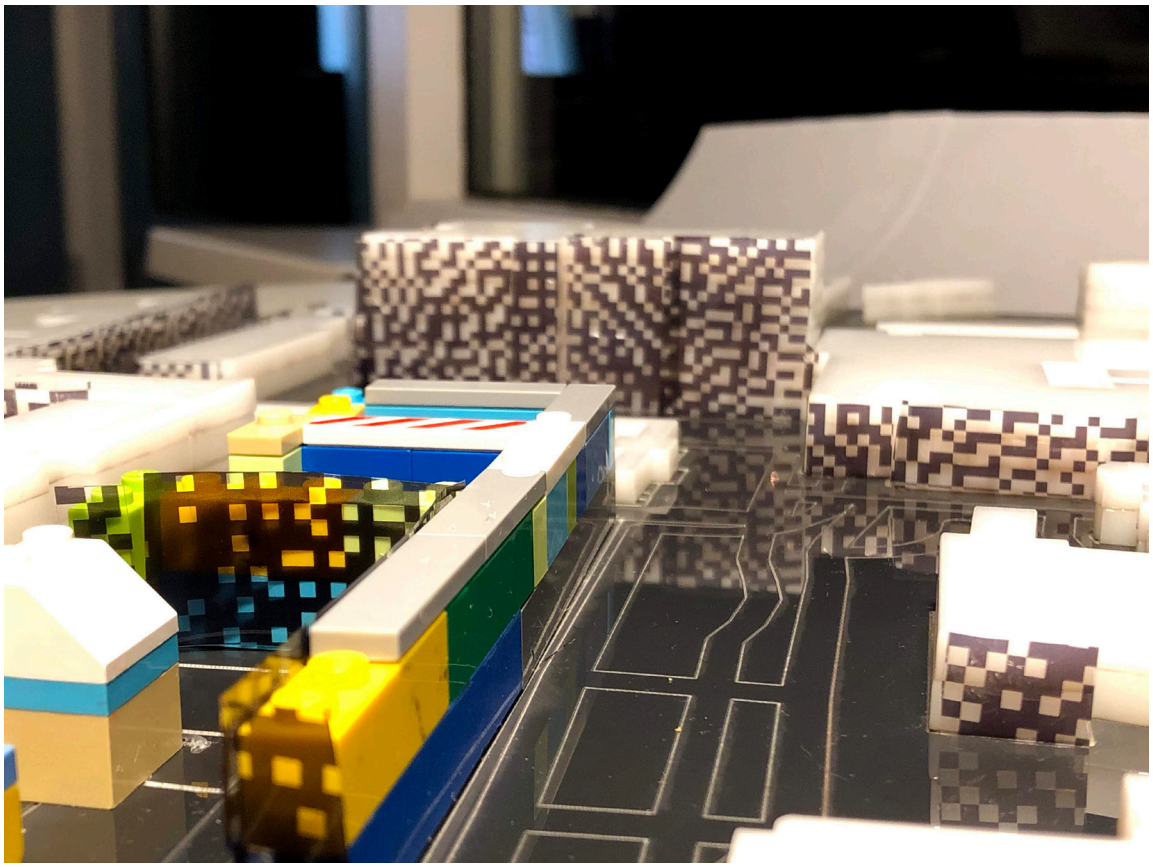


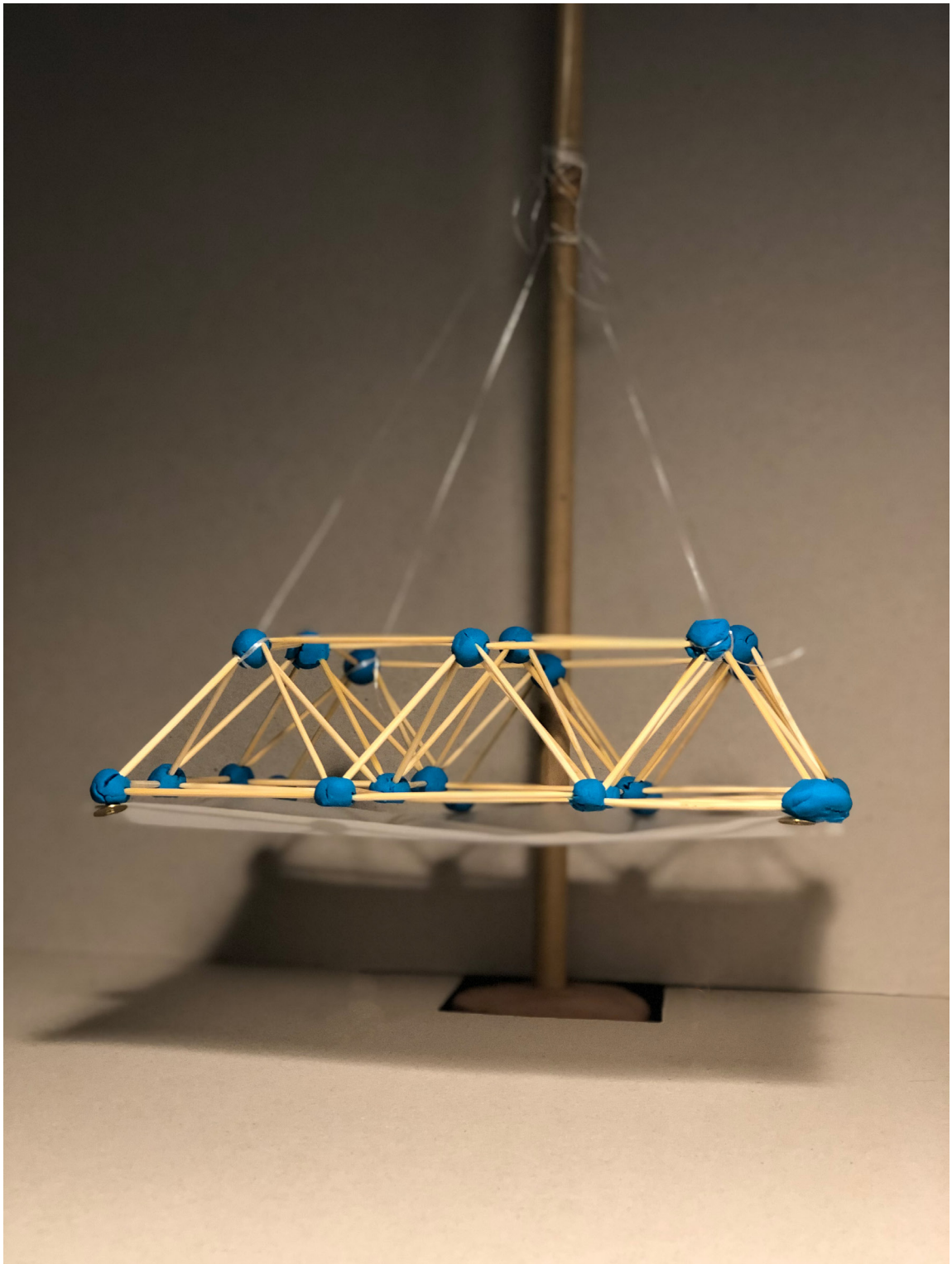



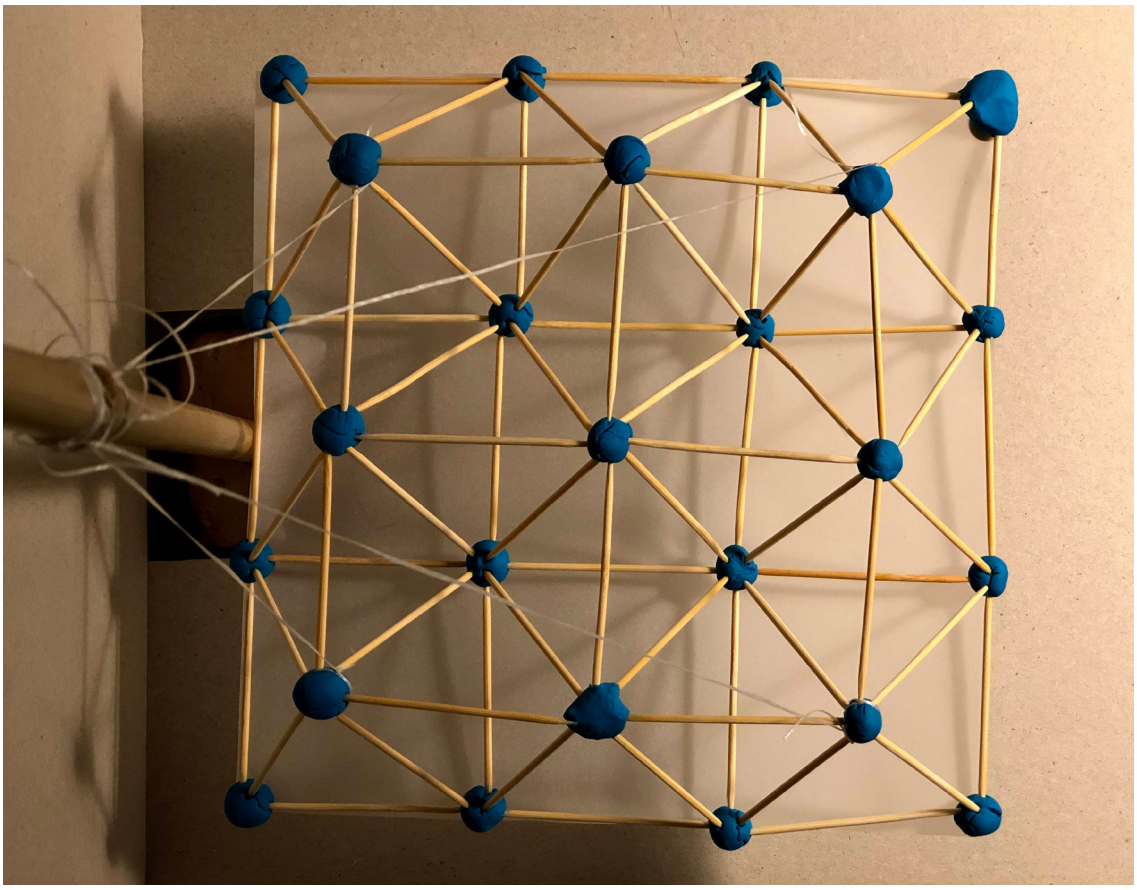


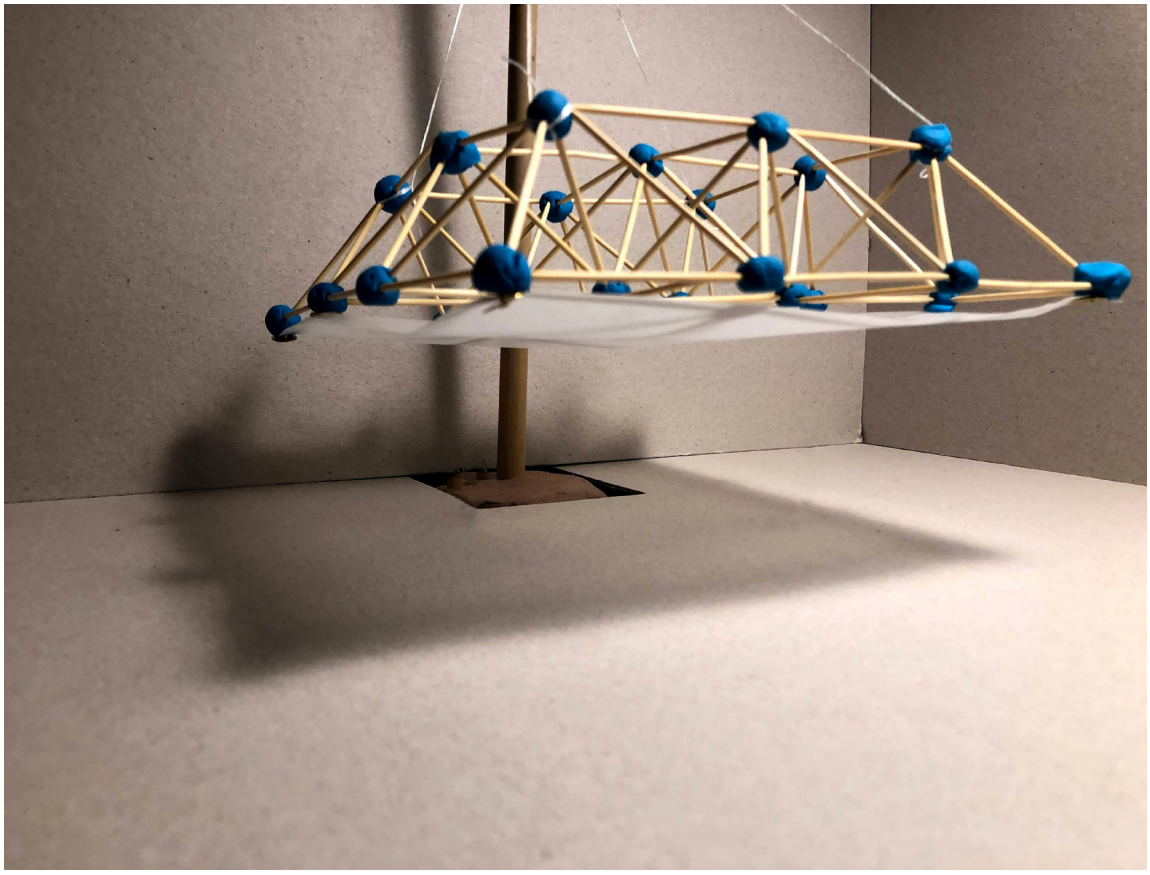


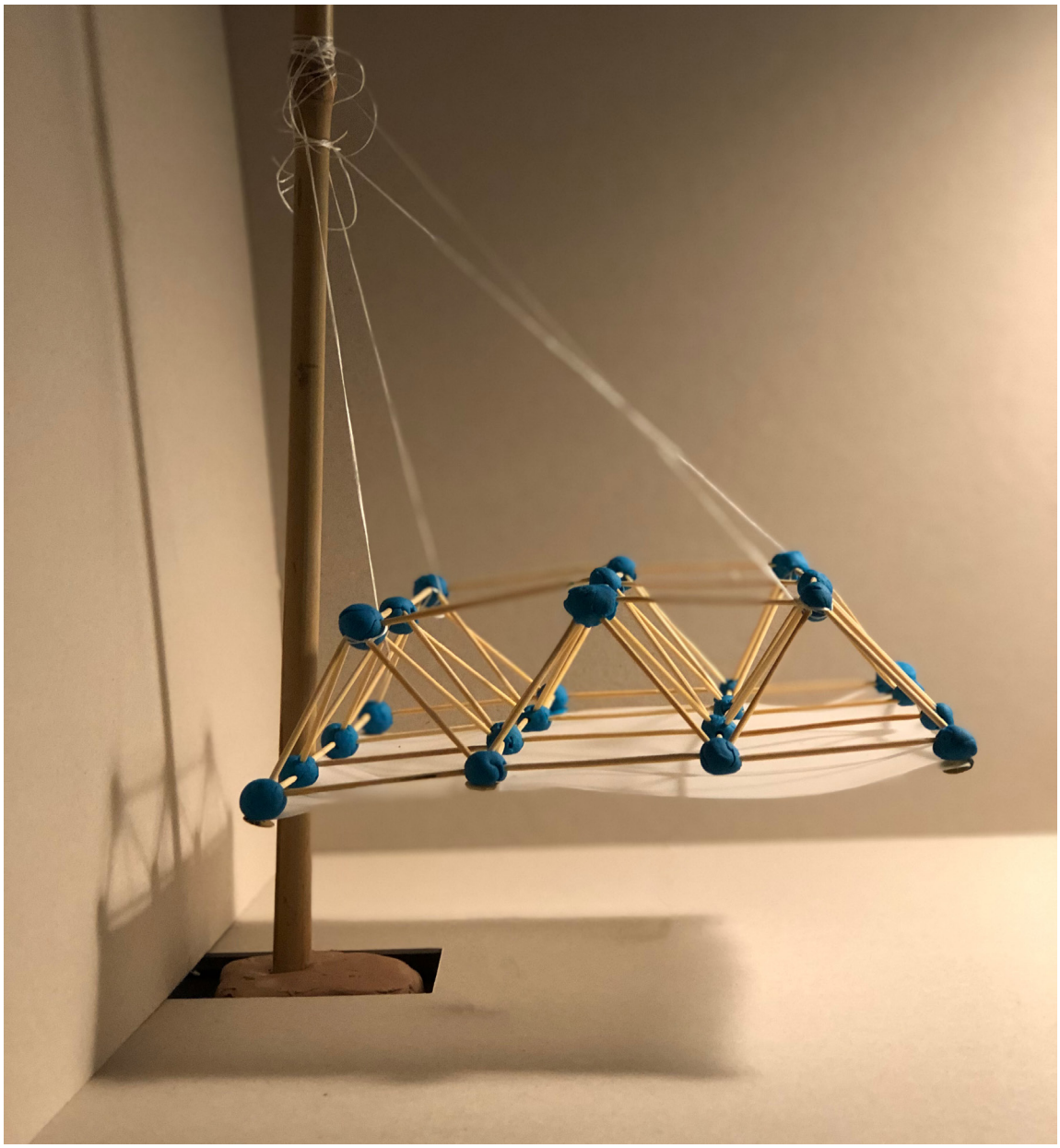


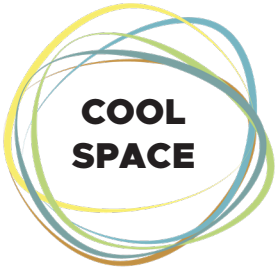











COOL
SPACE