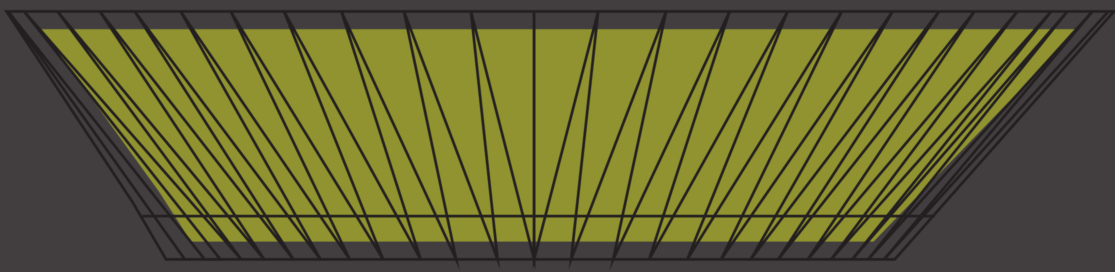

Iceland Cave-Tower

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Supervisor: doc.Ing.arch.Miloš Florián,Ph.D.

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CTU

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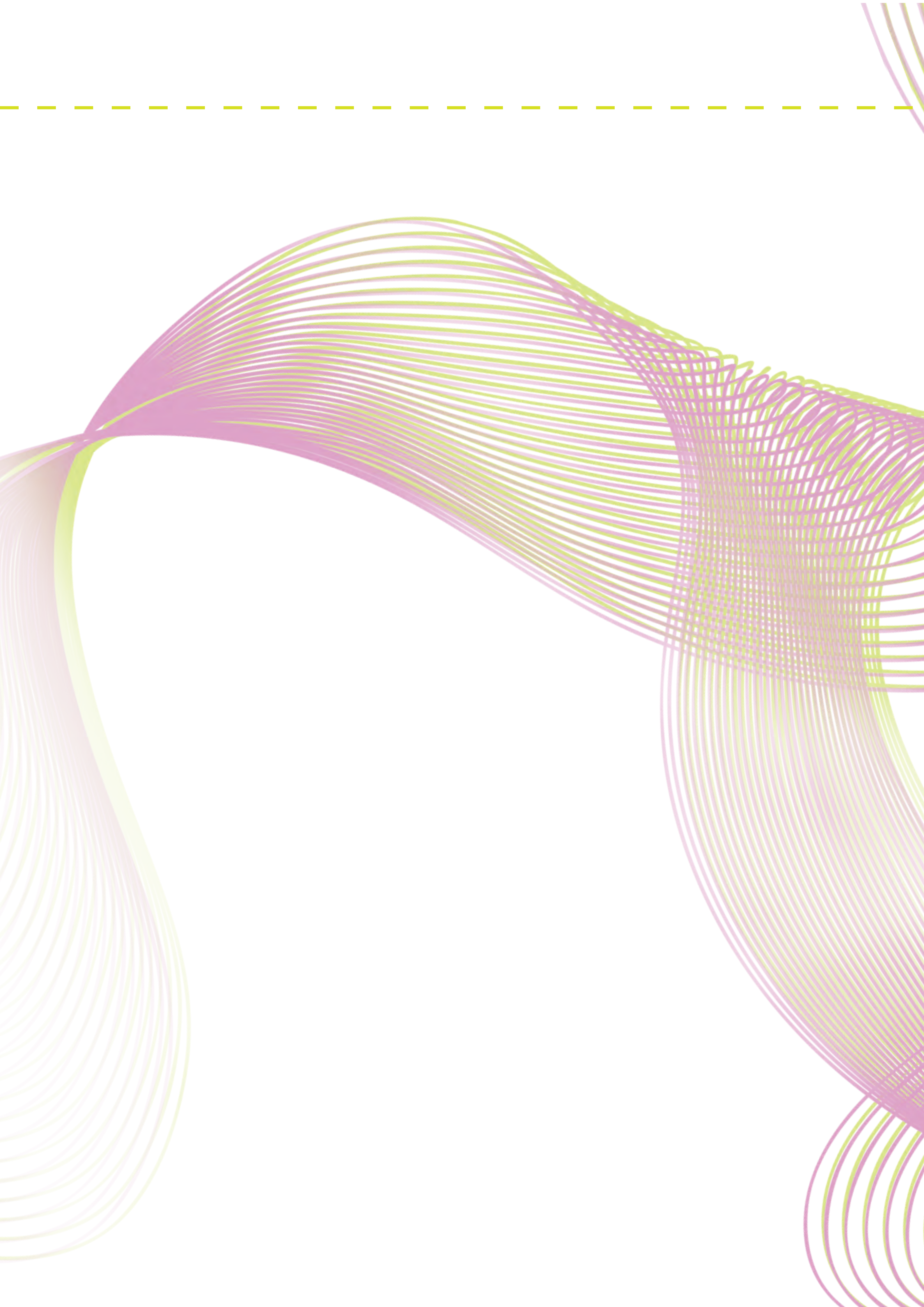

Foreword

The diploma focuses on the design of a new observation tower in northern Iceland at the junction of two lithospheric plates.

At the same time, the possibilities of urban solutions for the immediate surroundings are explored.

This paper is devoted to the study and use of non-standard modern building systems.

CTU
CZECH TECHNICAL UNIVERSITY IN PRAGUE

0

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Conclusion

1

Analysis

Introduction

Iceland is a small Nordic island country situated between the North Atlantic and the Arctic Ocean. With a population of less than 333,000, it is the most sparsely populated country in Europe, with the majority of that population living in the capital Reykjavík and the surrounding areas.

Iceland was first settled on in the year 874 AD, when Norwegian chieftain Ingólfr Arnarson became the first permanent settler on the island. In the centuries to come, many more Norwegian settlers followed, as well as settlers from a few other Scandinavian countries. Iceland was under Norwegian and Danish rule from 1262 to 1814, and finally became a republic in 1944.

Iceland has comparatively low taxes and yet maintains a Nordic social welfare system, which provides universal health care and tertiary education for its citizens. Iceland runs almost entirely on renewable energy, and its main industries are fishing, agriculture, and tourism.

Geography

Iceland's geography is both varied and extraordinary. The island is volcanically and geologically active, and the entire country is 103,000 km2 in size, 62.7% of which are tundra. Iceland's coastline is punctuated with many fjords, around which most of the country's settlements are situated. The interior of Iceland is cold and uninhabitable, consisting of a combination of sand and lava fields, mountains and glaciers, with many glacial rivers flowing to the sea through the lowlands on the exterior of the island.

Despite being just outside the Arctic Circle, Iceland has a temperate climate, as it is warmed by the Gulf Stream. Being closer to continental Europe than it is to mainland North America, Iceland is considered part of Europe, despite its closest land mass actually being Greenland. Geologically, Iceland is situated on the Mid-Atlantic Ridge, a ridge along which the oceanic crust spreads and forms a new oceanic crust. Iceland was created by rifting and accretion through volcanism along the ridge.

Mývatn region

Mývatn is the spectacular region in the north of Icelandthat is home to some of the country's most awe-inspiring natural wonders and is considered the Northern Lights Capital of Iceland. The lake region is home to Iceland's fourth largest body of water, Lake Mývatn, which is 36.5 square kilometers in size and is home to a wealth of natural wonders and wildlife.

Making up part of the Diamond Circle – a popular travel route in the north of Iceland – Lake Mývatn and the surrounding region are an idyllic location to go birdwatching or fishing, or to relax in the natural hot springs and explore the eerily beautiful lava fortress of Dimmuborgir. Of course, one of the most spectacular sights to see are the Northern Lights themselves, which are spotted more often in the northern region of Iceland.

Grjótagjá

The Grjótagjá caves in northern Iceland are home to some of the most beautiful geothermal pools in the world. Unfortunately, excessive tourism is damaging the natural surroundings of this delicate region. Located on the fault of two lithospheric plates, the entrances to the caves allow you to touch the beautiful.

Grjótagjá is a collection of three small caves located near Lake Mývatn in northern Iceland, and features one of the country's most famous and beautiful geothermal hot springs inside. The caves are all in close proximity, with two of them just 50 meters apart, and are located on Vogar farmland. Sitting on the tectonic divide between Europe and America, the caves were first discovered back in the 18th century when the outlaw Jón Markússon made them his home. The jagged rocks, total darkness, and the area's reputation for being the home of trolls made it the perfect hideout for the criminal, as most law-abiding citizens avoided the lava caves. They became popular in 1940 when they were re-discovered by students travelling in Iceland. The landowners then created new entrances so that they could bathe in the geothermal waters. With an idyllic temperature of 39-40 degrees, the caves became popular with other locals, with one cave becoming a dedicated women's cave, Kvennagjá, and another for men, Karlagjá

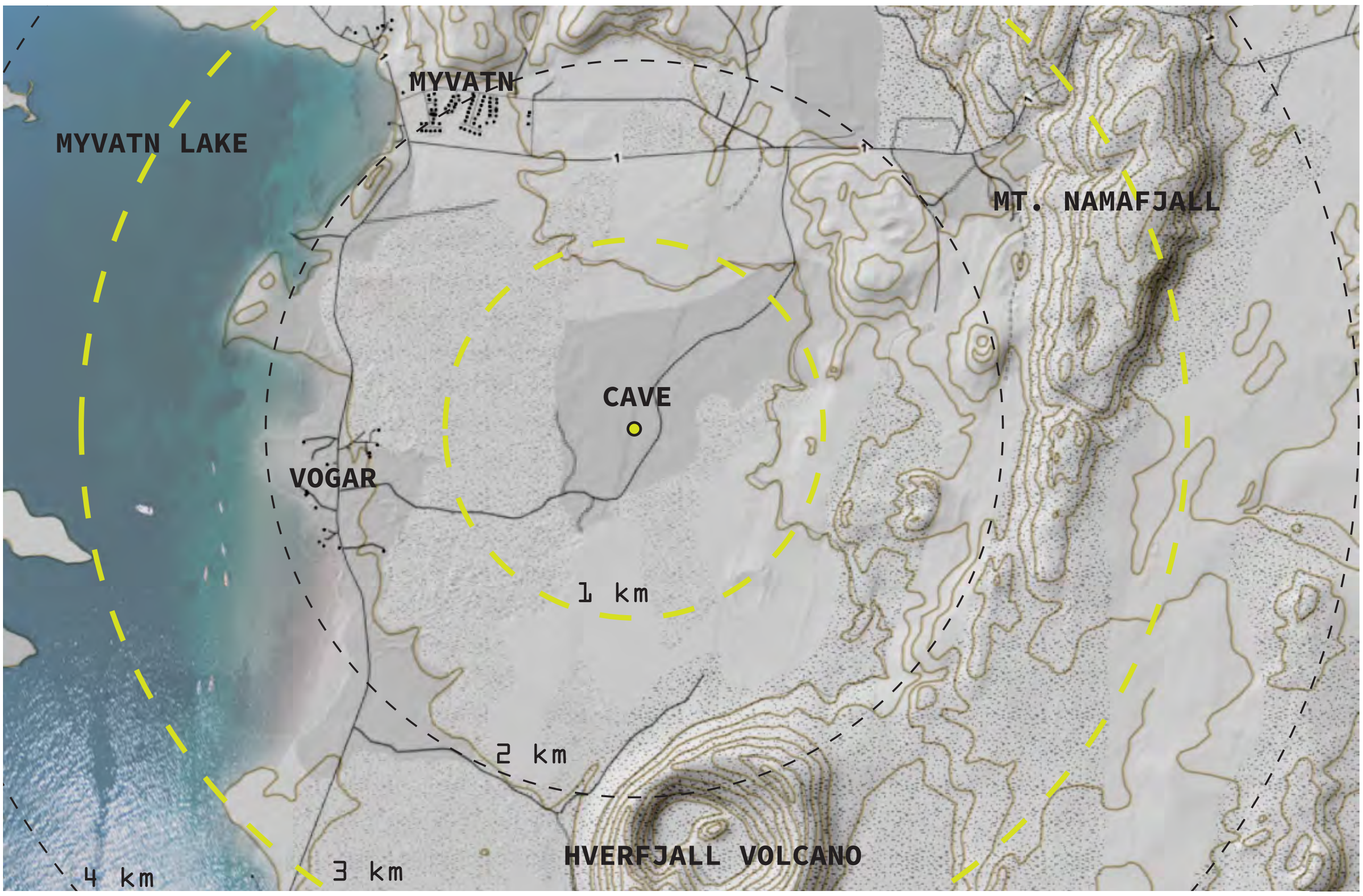
However, during the period between 1974 and 1985, the Krafla volcanic system erupted a total of nine times, which caused water temperatures to increase to 60 degrees; far too hot for people to bathe in. And though the temperatures started to cool after 1984, there is still activity nearby that makes the water temperatures unpredictable.

Vogagjá

Located on the same fissure as the Grjótagjá caves is Vogagjá, which sits about 800 meters south. Vogagjá became popular in the 1990s when the geothermal pools of its neighbour became too hot to bathe in. While Grjótagjá is often referred to as one of Iceland's best kept secrets, the fact remains that Vogagjá is an even better kept secret. Its caves and fissures are more difficult to find and more challenging to reach – by climbing over rocks and crawling down ridges.Despite its beauty, bathing in Vogagjá is not allowed, with landowners putting up signs to inform and deter tourists from doing so.

Grjótagjá is still one of the most popular tourist destinations in the Mývatn area, and the caves are now famous after appearing in an iconic love scene in Game of Thrones.

SITE COORDINATES:@65.6263226,-16.8824532



Iceland has a special w for wishing you **good lu** "hvelreki", which means "have a whale come asho at your homestead."

Cracked rock above the volcanic cave Grjótagjá © Filip Fuxa

A natural hot spring in Grjótagjá caves © Matteo Trolese

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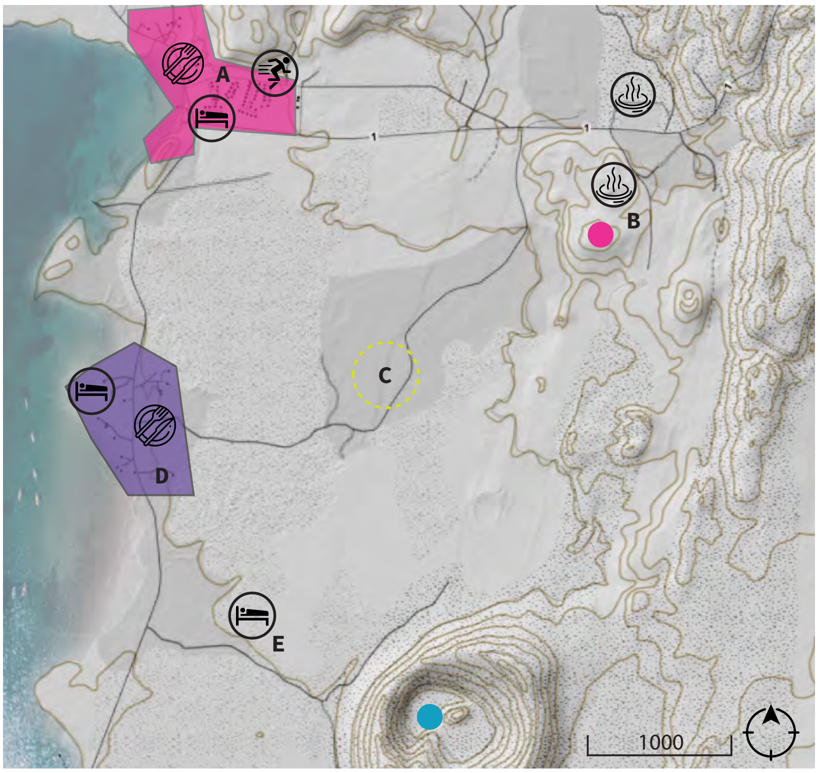
Aerial view of Krafla caldera © Jarrod Ryan Jooste

Entrance to the Grjotagja cave © Ruben Perez Gil

Kirkjufell mountain in Iceland © Robin Lea King

Analysis | Function

FUNCTIONAL ELEMENT SCHEME



- Cave Grjótagjá
- Volcano Hverfjall
- Spa on the lake Myvatn
- Town Reykjahlíð
- Town Myvatn
- Spa
- Restaurant
- Hotel
- Sport area

A

B

C

D

E

Analysis | Nature

LANDSCAPE ELEMENTS SCHEME

Cave Grjótagjá

Forest

Meadows and pastures

Moss lands

Water, lake

Heath

Rarely or non-vegetated natural soil

Cliffs

Artificial habitats

Other

A

B

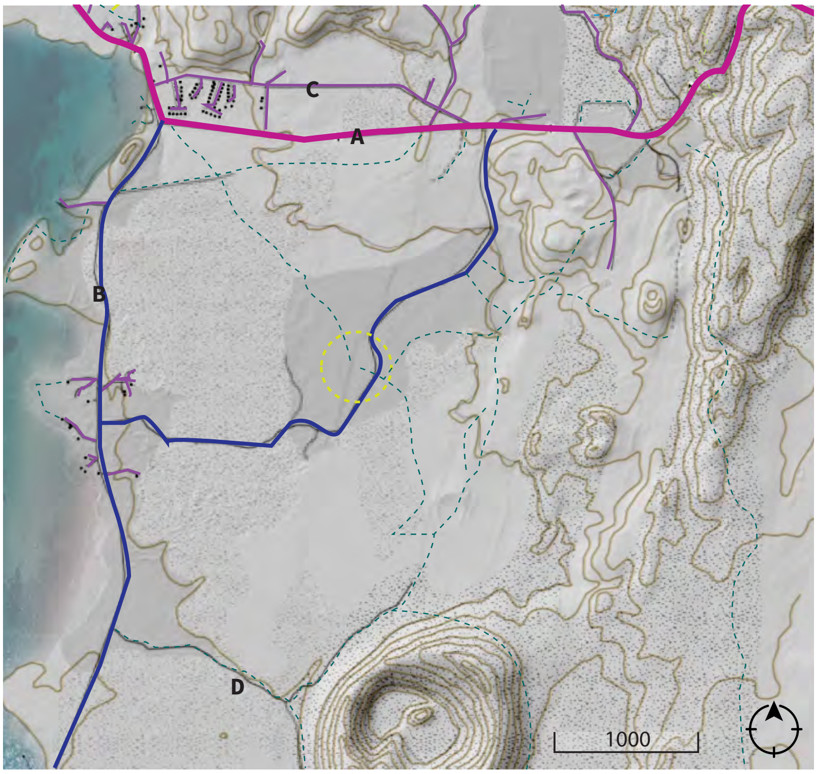
C

D

E

Analysis | Transportation system

TRAFFIC FLOW SCHEME



Cave Grjótagjá

Highway

Road

30 km / h district

Pedestrian streets

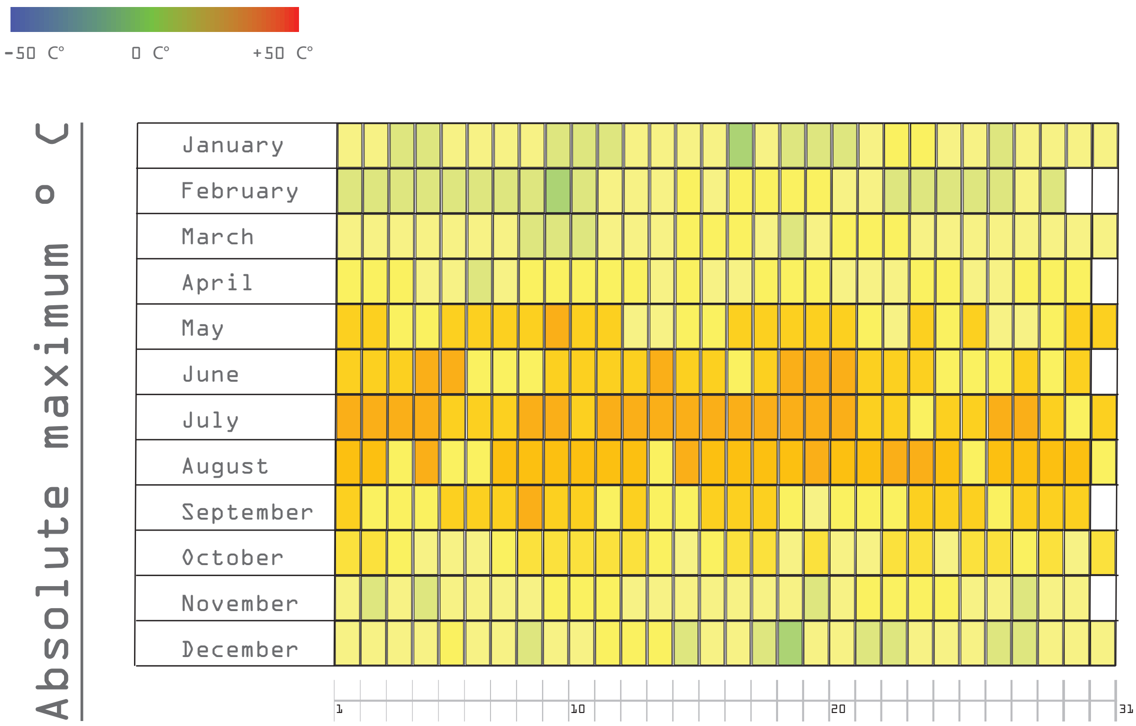
A

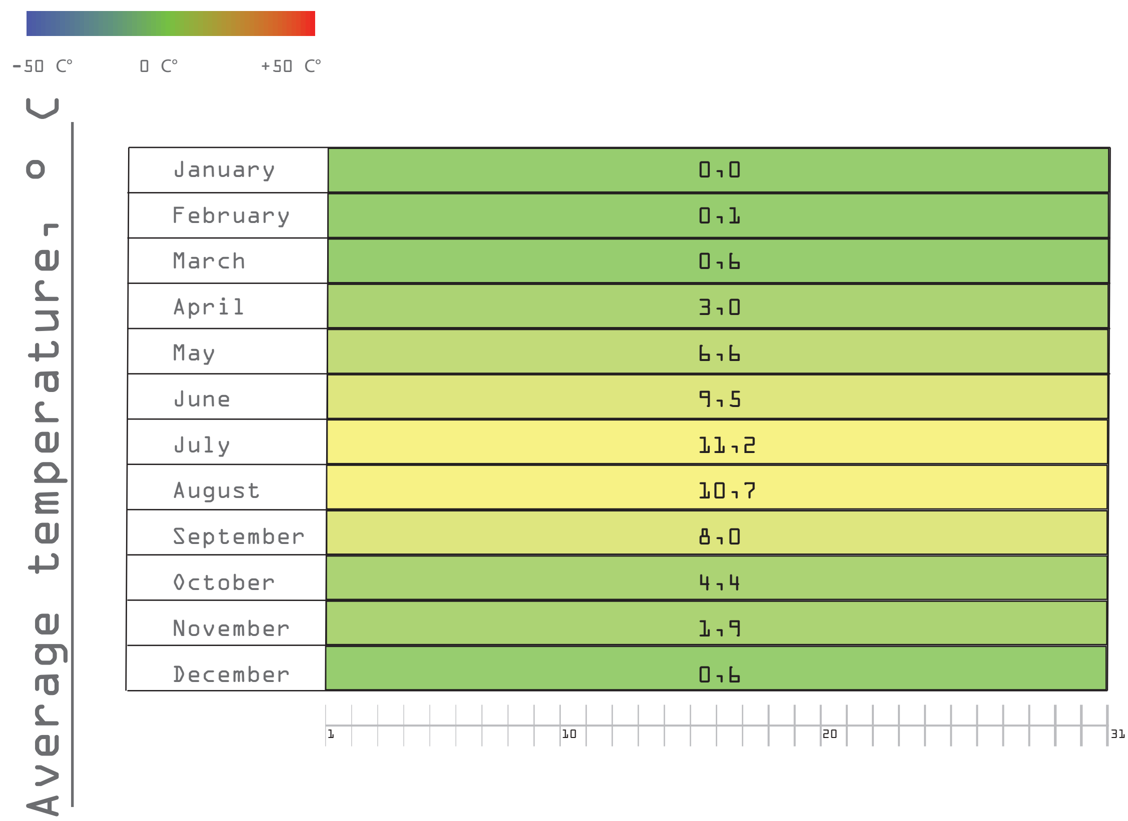
B

C

D

Analysis | Weather

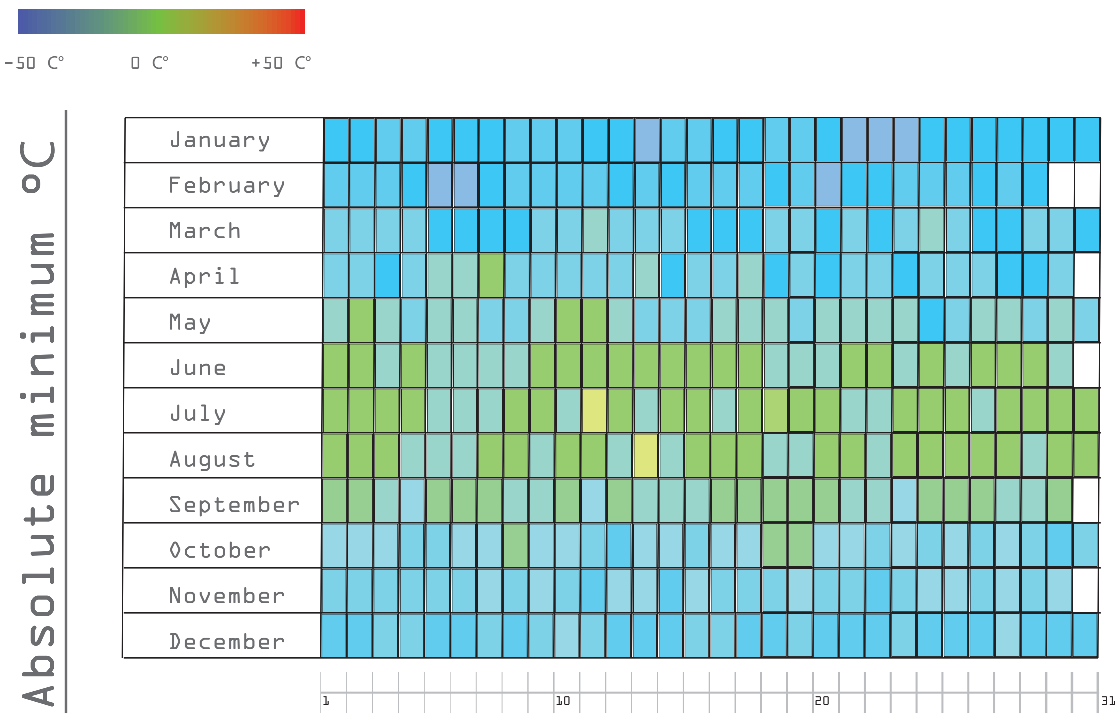


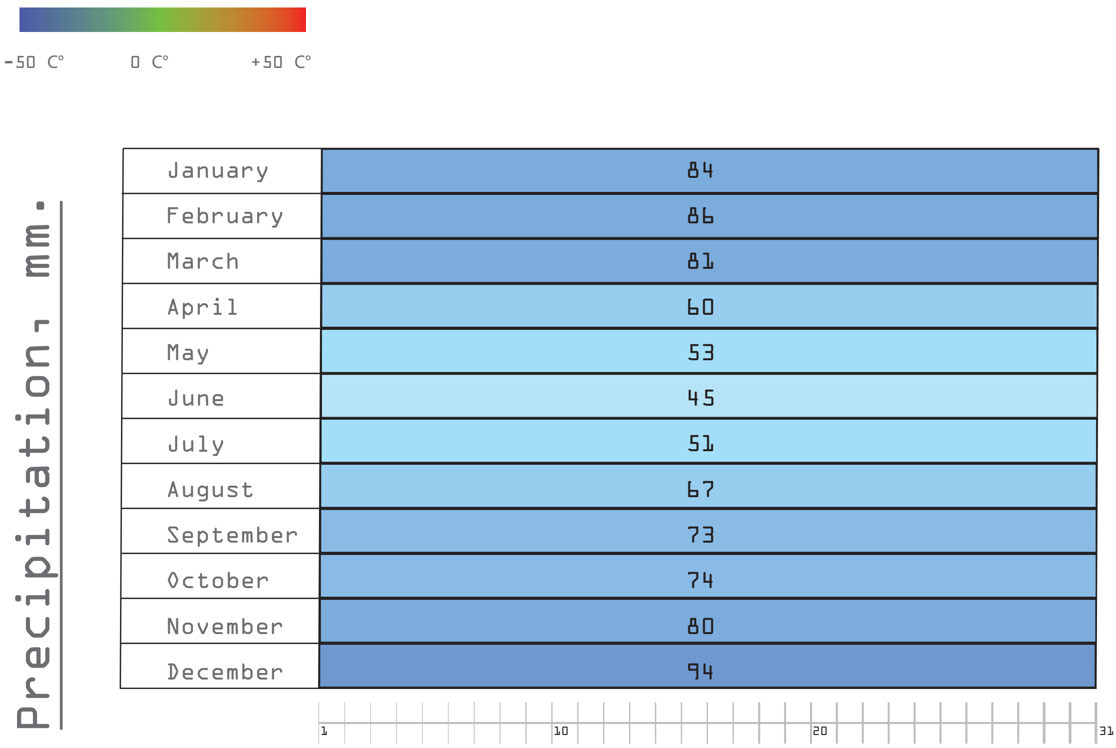


Iceland's climate is cold maritime (Cfc classification), also qualified by Alisov as marine subarctic.

However, the climatic conditions are mitigated by the North Atlantic Current along the southern and western shores of the island.

The weather is influenced by air masses from the Arctic and ocean waters from the tropics and subtropics. Iceland's climate is also influenced by Arctic drifting ice, which often accumulates near the northern and eastern shores of the island during winter and early spring, bringing lower temperatures and less rainfall.





The weather is windy and changeable year-round, with frequent drizzle and light rain, and frequent snowfall in winter and spring. Thunderstorms and heavy downpours are rare. Annual rainfall ranges from around 500 mm in Akureyri to more than 1500 mm on the Vestmannaeyar Islands. Wind speed in Iceland averages 18-20 m/s and may exceed 50 m/s during storms. Winter in Iceland is mild for the 60th northern latitude, with an average temperature of about 0°C. In summer, the average temperature is about +10°C. It is considerably colder in the mountainous interior at any time of year.

Introduction

Ninety percent of the country's heating and hot water is produced with geothermal energy. The slightly cooled steam at geothermal stations is mixed with cold artesian water to obtain water with a temperature of 90 - 85 degrees Celsius, for transportation through pipes to Reykjavik and other populated areas of the country.

Tanks for storing tens of millions of liters of natural boiling water have been built in different parts of Reykjavik. One of these reservoirs is the famous Perlan building. From there the hot water flows through the city's hot water and heating pipes to consumers in residential houses and all other buildings and facilities, including the city swimming pools. In Reykjavik, for example, roads and sidewalks are always free of snow and ice because they are heated by hot water pipes laid under them.

Household radiators with individual regulators and temperature sensors and underfloor heating are used as heating devices.

Also, there are many places in Iceland where even on the surface the ground reaches temperatures of +60 degrees Celsius or higher. In such places and in places of hot geothermal sources, you can use the installation of a closed system of underground pipes, flowing through which the hot geothermal liquid will heat the artesian water for heating and hot water at home, and after exhausting, simply discharged into the environment.

Heating in Iceland is thought to be geothermal. This is incorrect. The heating system used in Iceland is not geothermal. Only hot water is geothermal in Iceland. A geothermal heating system means that pipes are laid next to the house at a depth below the ground freezing, where the ground temperature remains stable at around +10 degrees Celsius, through which the liquid flows. Flowing through the pipes, the liquid becomes the same temperature as the soil, then depending on the time of year the temperature of the liquid is used by the heat pump to cool or heat the house. The principle of the heat pump is based on extracting energy from the temperature difference. A home refrigerator, for example, works on the same principle. It is cold inside, the refrigerator generates heat outside. We use the cold in the refrigerator, but we can also use the heat it produces. Geothermal heating and air conditioning systems work on roughly the same principle.

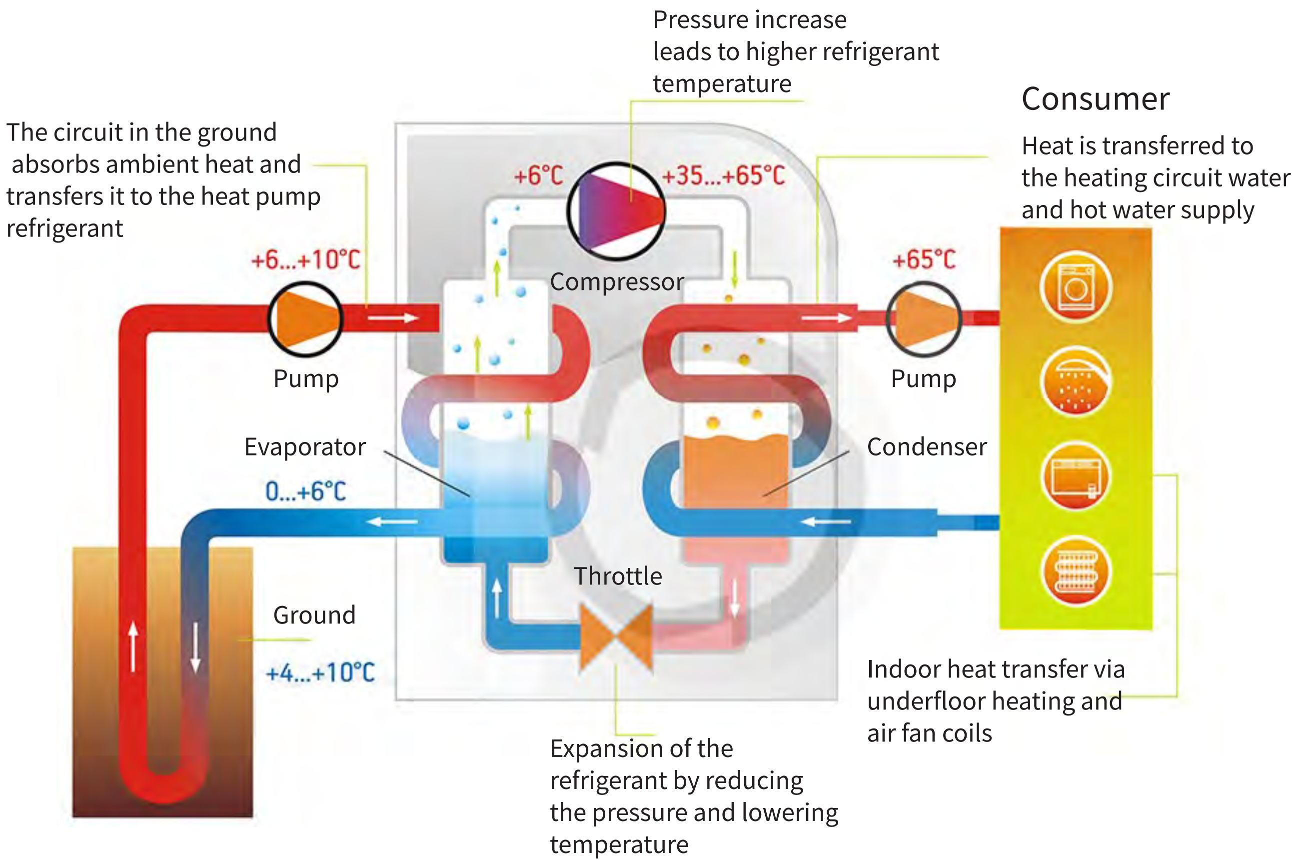
How the heat pump gets heat

Under the ground at a depth of 20m and below, the ground temperature is always the same, around 7-12°C. The heat carrier circulates through geothe rmal probes and draws heat from the ground. The numberof probes is calculated based on the capacity of the device. Further the heat of the earth heats the evaporator filled with freon. Freon has a low boiling pointand goes from liquid to gaseous. The resulting volume of gas is compressed in a compressor, compressing the increases pressure and temperature. The temperature increasereaches 55 °C, this heat transferred to the heating system.

The principle of operation of the heat pump

Further freon entersthe condenser, where it passes into theliquid state and enters the last element of the construction of the throttle, where the pressure and temperature are reduced. The cycle is ready to repeat. In fact, the heat pump spends electricity only to transfer heat from the ground.

Ground source heat pump



What it takes to make a geothermal heat pump work ef-ficiently

1. A properly designed geothermal field. The distance between the wells should be at least 6 meters, Determine the length and number of wells should take into account the compo-sition of the soilsof the place where the house is built. 2. Geothermal probe must be absolutely relia ble and safe.
3. The heating system should be designed for a heat pump. It should be borne in mind that the heat pump can not heat the coolant above 55-60 ° C. The best solution for the heat pump is a floor heating and fan coils.
4. Competently configured automation system of the boiler room, which controls all processes, taking into account the outside temperature and the needs of the building at any given time.

What you get by installing a heat pump

1. cost-effectiveness.

2. safety.

3. reliable.

4. environmental friendliness.

Energy

Today Iceland is the leader in the amount of electricity generated per capita. Iceland has no oil, gas or coal deposits of its own. Therefore, energy is generated from renewable sources: 75% comes from hydropower, 26.5% from geothermal sources, and conventional hydrocarbons account for only 0.5%. Also 90% of heating and hot water is produced by geothermal energy.

There are five thermoelectric geothermal power plants on the island with a total electric capacity of 420 MW, including Hellisheidi, the largest in Iceland and the second largest in the world, with a design capacity of 300 MW (for electricity) and 400 MW (for heat).

Geothermal stations use drilled deep wells to bring to the surface water steam heated by the Earth itself to 200 degrees Celsius and higher. This hot steam rotates turbines and generates electricity. As a result, no gas, coal or fuel oil is burned, there is no need to buy raw materials abroad, and there are absolutely no harmful emissions into the atmosphere.

Water supply

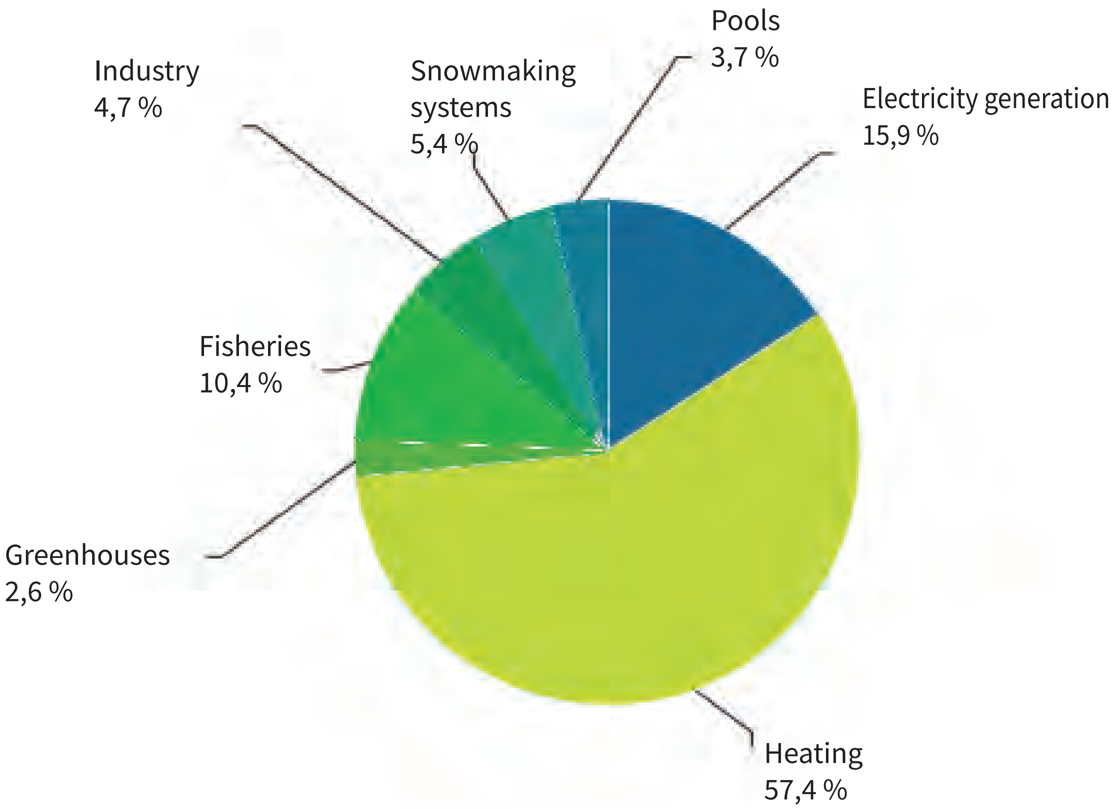
The cold water supply in Icelandic homes comes from artesian wells and runs smoothly. In Iceland there is no need to buy purified bottled water for household needs. This small northern country is one of the few countries, perhaps the only one in the world, which has inexhaustible reserves of clean fresh water.

The cold water that comes out of any tap in Iceland is absolutely pure, having passed through a thick layer of natural filters and does not need any additional treatment. It is used for cooking and drinking raw water without the slightest concern for your health.

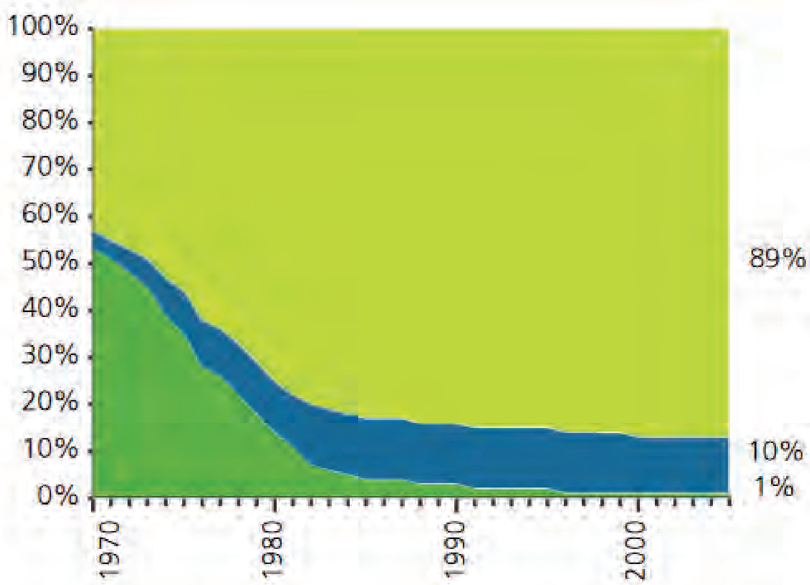
Also the water flows into the homes of Icelanders directly from geysers. And if in European countries it is customary to heat it, here we have to make efforts to cool the water.

Another nice feature of the Icelandic water system is the almost complete absence of blackouts. The Icelandic urban water supply system is constantly monitored by electronics and sensors that monitor the condition of the pipes. Sections of old pipes are regularly replaced with new ones.

Geothermal energy use in Iceland by industry in 2005



Relative share of energy resources used for residential heating



History of observation towers

The oldest observation towers appeared at the end of the 18th century. They were built in their estates by members of the nobility, as a recreational facility. In the 19th century, local authorities in many areas of Europe and the United States began to build observation towers. These objects became the centers of attraction for tourists or a place of rest for city dwellers. The climax of these activities was in the times of the German Empire (1871-1918), when after the resignation of the Reich Chancellor Otto von Bismarck in 1890 the construction of 240 observation towers named after him started in the German states. During the same era, famous structures such as the Kaiserturm[de] and the Kaiser-Wilhelm-Turm[de] towers were created.

In Austria and Switzerland many observation towers were built by alpine and tourist associations.

In the nineteenth century, most towers were built of brick, but wooden or metal structures were also built. Almost everywhere, it was only possible to climb to the top using stairs.

World War I halted the enthusiasm of the watchtowers for a moment. However, it began again during the First Republic. During these 20 years, the Czechoslovak Tourist Club took part in the construction of the watchtowers. In 1938, however, the Munich Agreement was concluded, which plunged not only the population, but also the lookout towers into the darkness of the Middle Ages for half a century. The observation towers built between 1939 and 1989 could be counted on one hand.

After the Velvet Revolution, however, the number of observation towers increased the most in the entire two-century history. The number of new observation towers already exceeded a hundred.

The main types of observation towers

The following types are now found:
- Stone.
- Concrete towers
- Metal towers
- Wooden

There are a total of four subtypes of towers:
- The prismatic model consists of several vertical trusses. They are used to create tall structures. The final height of the tower depends on the number of tanks (trusses) installed.
- The pyramid version is used with a base height of 25 to 40 m.

Towers of Shukhov's system appeared at the end of the 19th century. Their support in the network
- Steel construction. To the advantages of this model can be attributed its lightness. However, it is much more difficult to install a Shukhov tower than a prismatic or pyramidal tower.

form, style, material, place, morphology, creation, life


Czech Republic Fajtův kopec


ChinaSkleněná vyhlídková plošina


Denmark Salling Tårnet


Singapur Gardens by the Bay


Czech Republic Salaš

Belgium Observation tower

Rakousko Pyramidenkogel

Denmark Spiralwalk through the forest

UK The British Airways i360

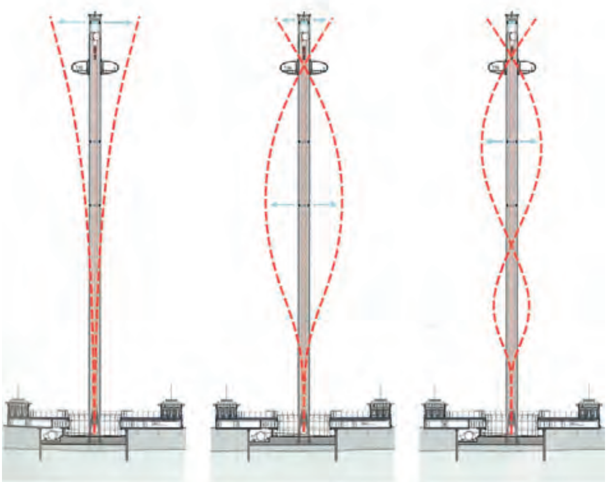
Introduction

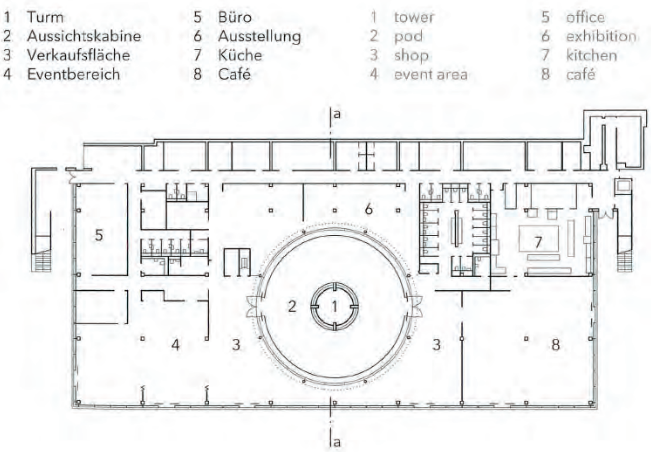
There are many different observation towers. In the next two examples we want to take a closer look at two offshoots. The first where the building, in addition to the observation tower, also has the character of a public building, while the second is an ordinary independent unit.

UK The British Airways i360

British practice Marks Barfield Architects, famous for designing the London Eye, are a step closer to realising their latest urban observation structure: the i360 Brighton.

At 162 metres high, and with a viewing pod rising to 138 metres, the i360 will be the tallest observation tower outside London, offering a new perspective on English coastal city of Brighton. Situated at the root end of the historic West Pier on Brighton’s seafront, the i360 will allow 200 visitors at a time to enjoy the surrounding view in a pod 18 metres in diameter. Alongside the tower, the visitor centre will incorporate a restaurant, shop, exhibition space, and conference centre, and the pod is raised and lowered using state of the art cable car technology, while energy recapture technology activated on its descent allows the tower to generate nearly half of the electricity needed to power its ascent.





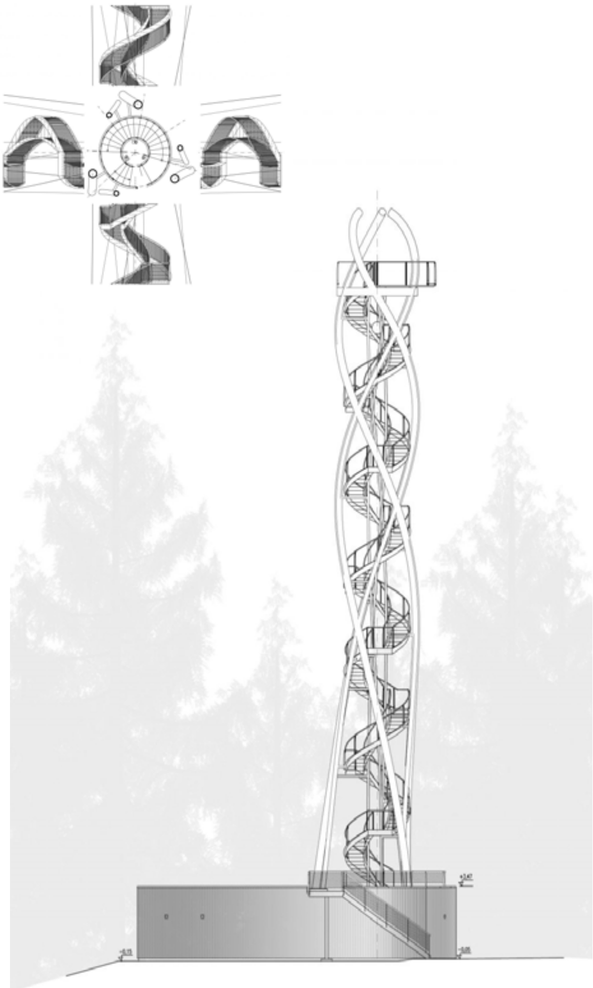
I chose one example from the Czech Republic, because it is quite close to us, and another from the UK because it contains many functions and an interesting and complex construction system based on a moving observation deck.

Czech Republic
Fajtův kopec

The lookout consists of two separate operational units. A one-storey base, which houses the visitor centre, rental of tourist and sports equipment, toilets and technical facilities of the lift. This area is designed very simply and efficiently. The base also serves as a platform for the tower itself.

The tower, whose design was created using a parametric design process, is a unique structural solution with its unique expres.

The steel structure of the tower consists of two triple counter-rotating columns forming the static foundation of the structure. 10 stair arms are inserted into the interior of this structure, which, together with another trio of internal columns, ensure the spatial rigidity of the entire tower, which is 36.00 m high. At the top, all the columns are connected by a circular ring on which the observation platform of the tower is mounted at a height of 32.40 m.



2

Research

Traces in architecture

Inspiration

Manifesto

Intelligent enviorment

Smart materials - bioplastic

3D printing in construction

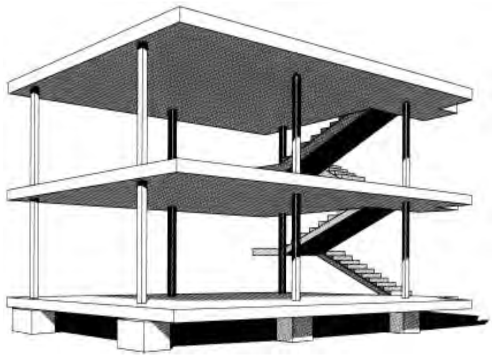
Bioplastic and 3D printing

Research | Traces in architecture

Intangible

Modernism

1950



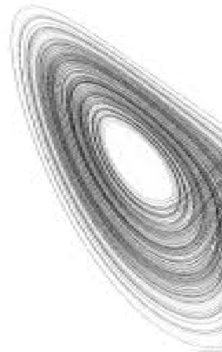
modern architecture

A movement in twentieth-century architecture, a turning point in content associated with a decisive renewal of forms and structures, a rejection of the artistic styles of the past.

Mass production

Chaos

19



butterfly

Chaos theory is the co
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Chaotic systems are p
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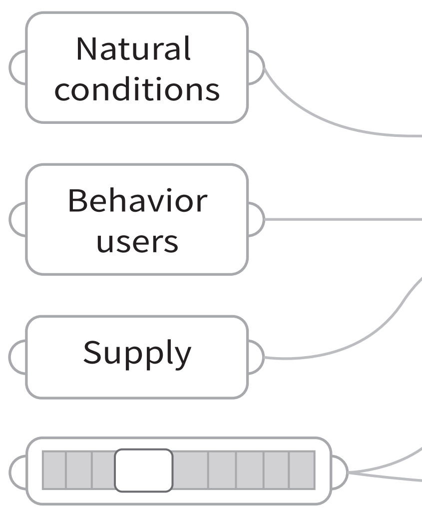
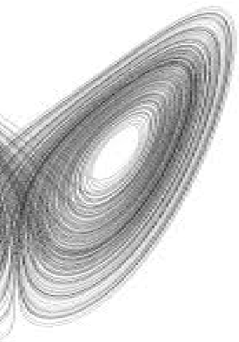
Tangible

Modular design
Standardization



Theory

963



effect

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lomly.

rchitectural element

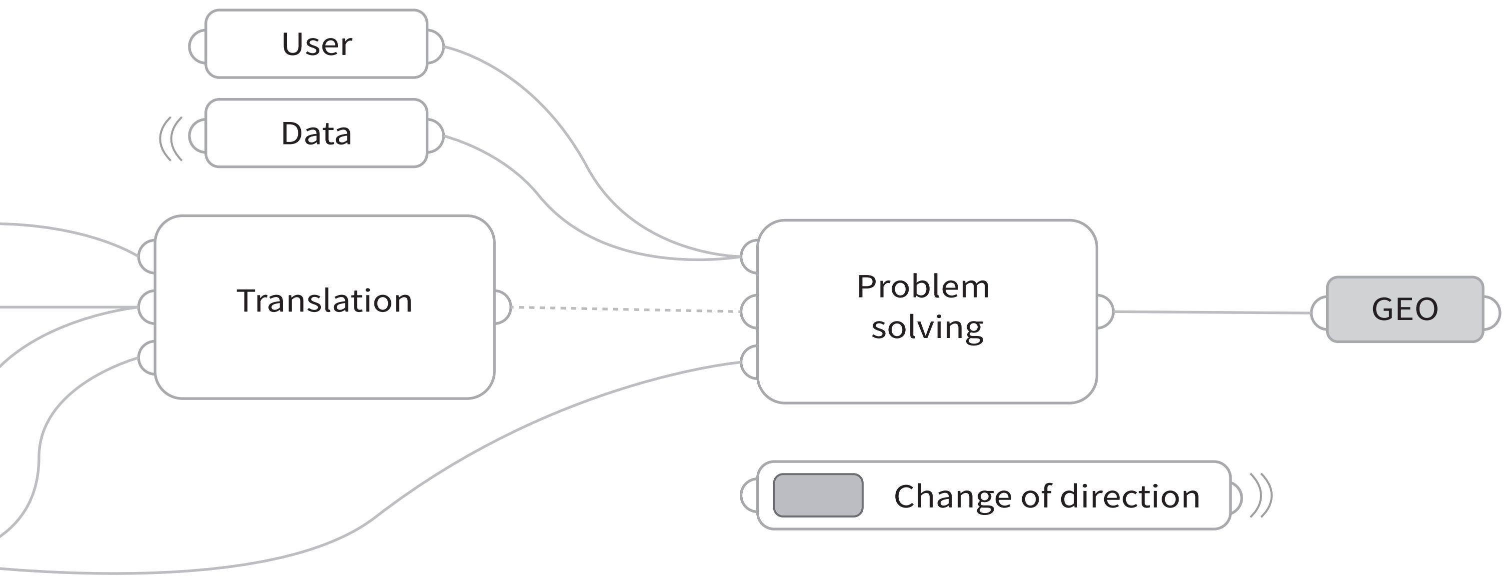
Parametrism

2008

human architecture

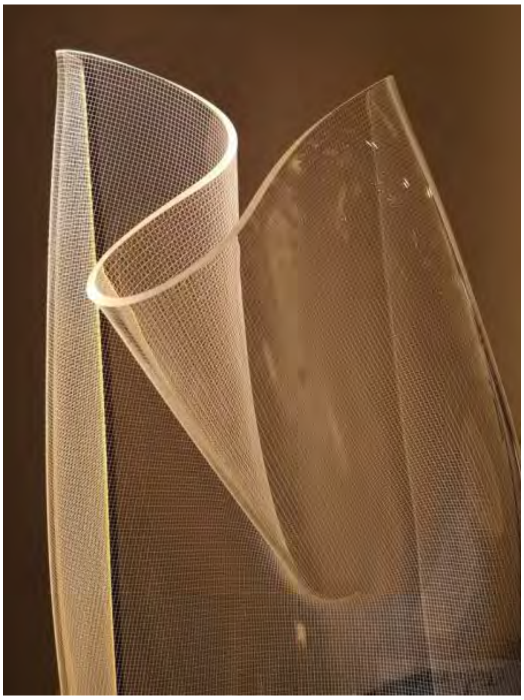
Most people today use computers, and modern architecture has moved from CAD to BIM, from simple computer-aided design to more sophisticated programs. Digital architecture is created by manipulating information.

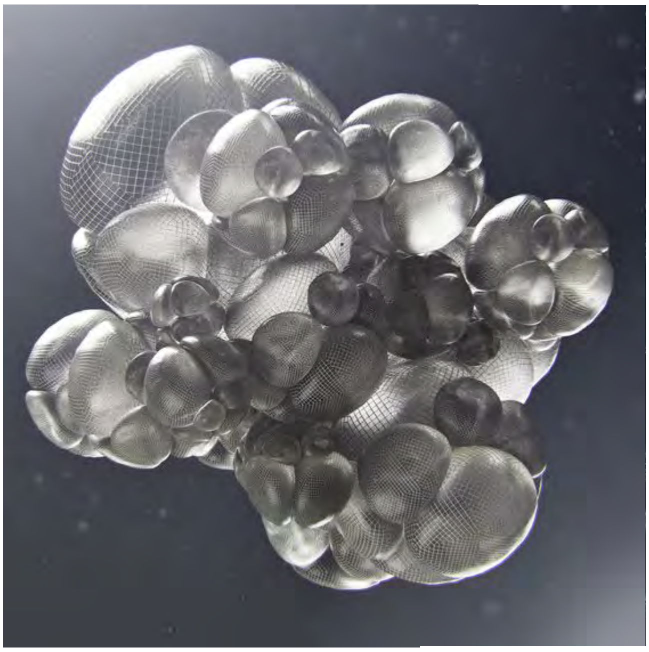
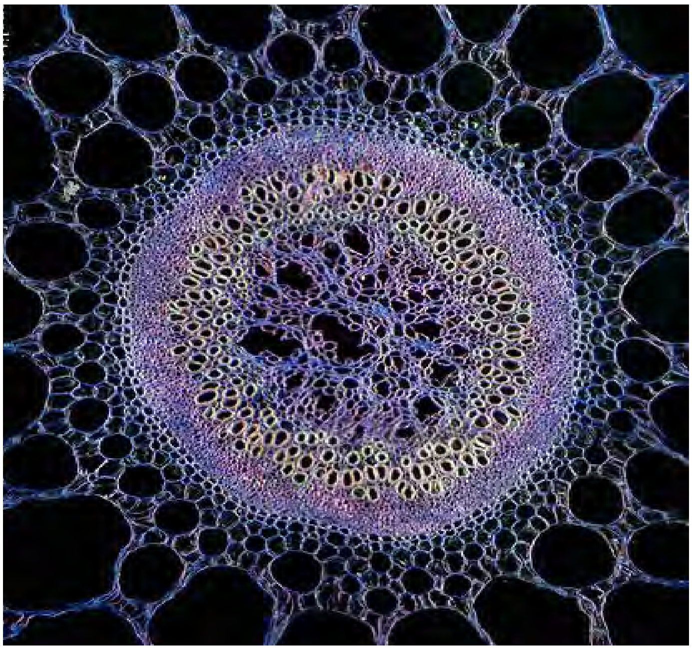
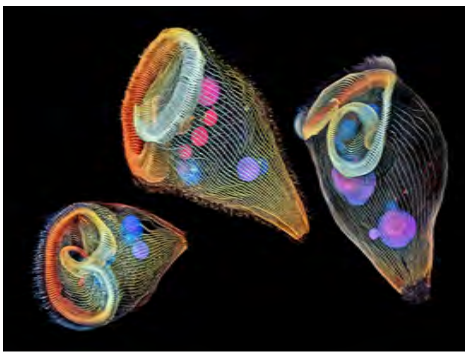
Non-linear thinking

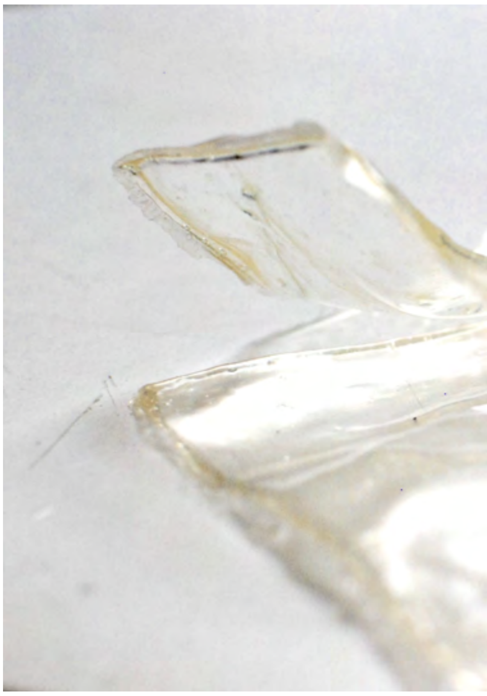


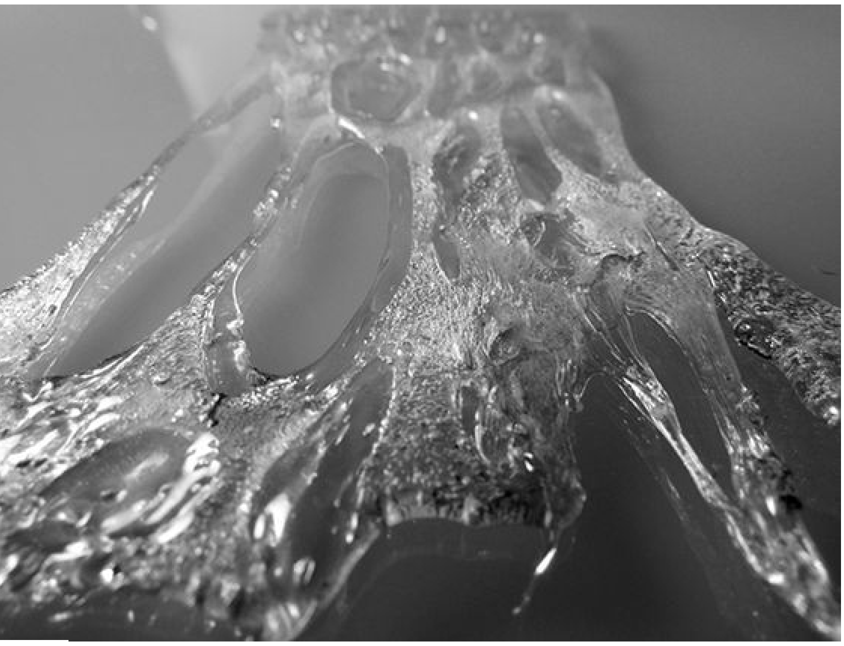
Research | Inspiration

ART, rhythm, texture, order, structure, nature, act

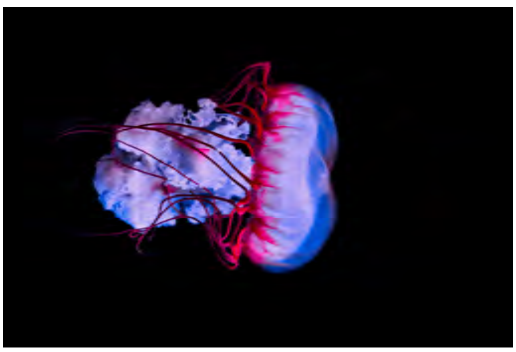








Architecture is a
discipline. Consid
as one of the majo
the world, as an a
has to be aware of
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ability or natural
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problem-solving
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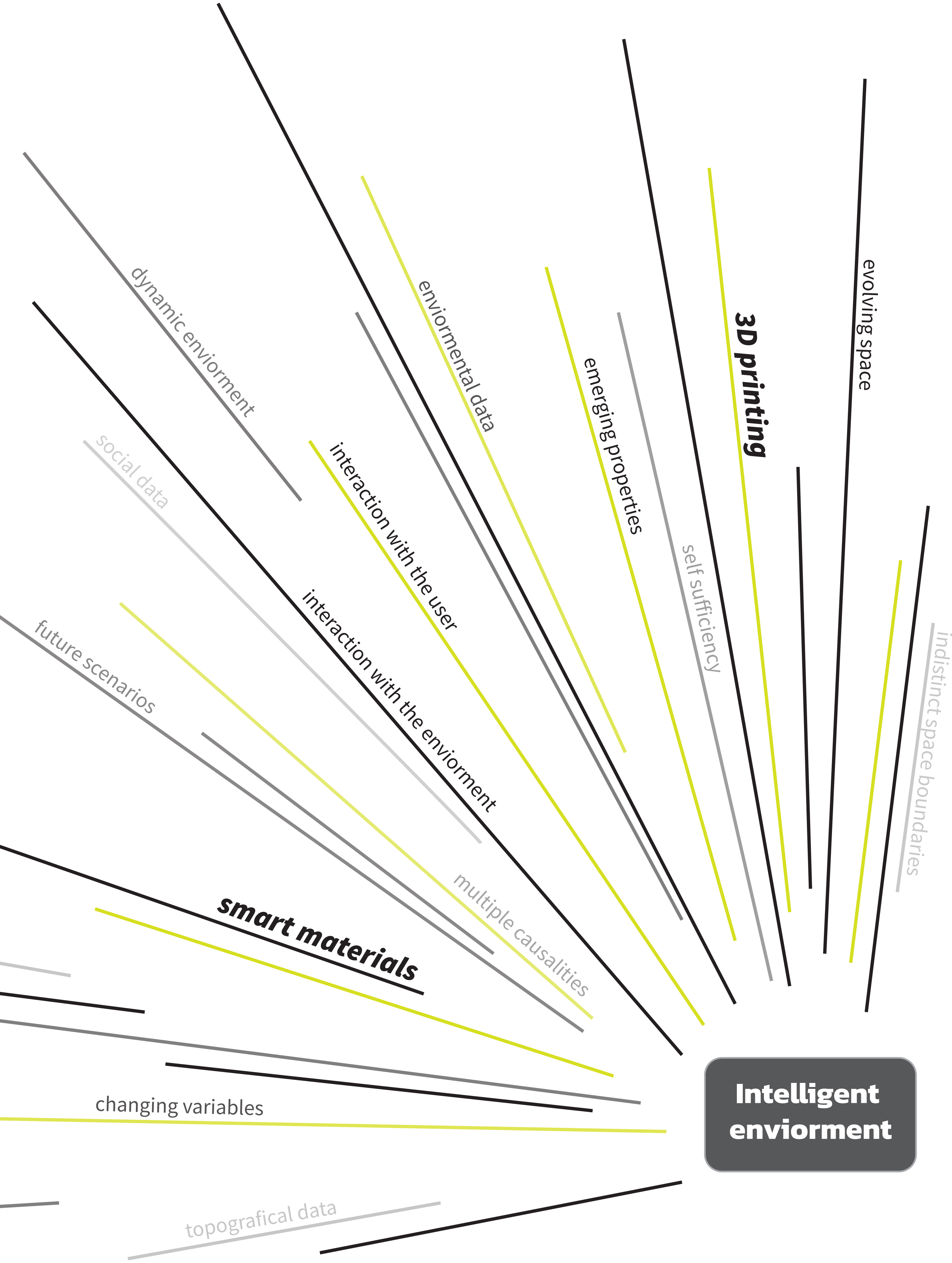
Welkome to the our world

Since the age of industrialization, human beings have littered the oceans with plastic, pumped carbon dioxide into the atmosphere and raked chemical fertilisers across the lands. The impact of the human species is so severe that the current geological time period has been declared by geologists as the Anthropocene. The word combines the root "anthro", meaning "human" with the "-cene", the standard suffix for "epoch" in geologic time. The Anthropocen is distinguished as a new period either after or within the Holocene, the current epoch, which began approximately 10,000 years ago (8000 BC) with the end of the last glacial period. While the idea that humans are changing the earth in a geologically significant way first surfaced in the late 1800s, it was chemist Paul Crutzen who revived the idea in 2000. Earth has changed tremendously over the past two centuries as humans have mined, cultivated, trawled, bleached and emitted their way forward with new technologies and higher populations. New materials, such as plastic, concrete and aluminium have spread across oceans and land. Nitrogen and phosphorus in soils have doubled over the past century as use of fertilisers has increased. Mining tor copper, mercury and nickel has rapidly increased since the mid-20th century and nuclear testing has left its mark across the globe. Not only have these changes been rapid but are still accelerating. Concentrations of carbon dioxide have risen to more than 400 parts per million (ppm), from 285 ppm at the start of the Industrial Revolution around the 1800s Methane concentrations measured in Antarctica ice cores are higher than they have been for the past 800,000 years. Sea levels now exceed the past 115,000 years. Not only have these changes been rapid but are still accelerating.

Evidently, human behaviour has had a great impact on the atmospheric, geologic, hydrologic and other Earth systems and processes. Throughout history, humans have been capable of deciphering environmental conditions and adapting it to changing requirements, but have not been able to do the opposite. Therefore, it becomes necessary to introduce a new dialogue with the goal of achieving constructive engagement between man, nature and technology via architecture and design as a medium - a concept that reduces pressure on the environment and increases our ability to foresee.


dynamic enviorment
enviormental data
emerging properties
3D printing
evolving space
social data
interaction with the user
self sufficiency
interaction with the enviorment
future scenarios
indistinct space boundaries
multiple causalities
smart materials
changing variables
Intelligent enviorment
topografical data

Principle of bioplastics

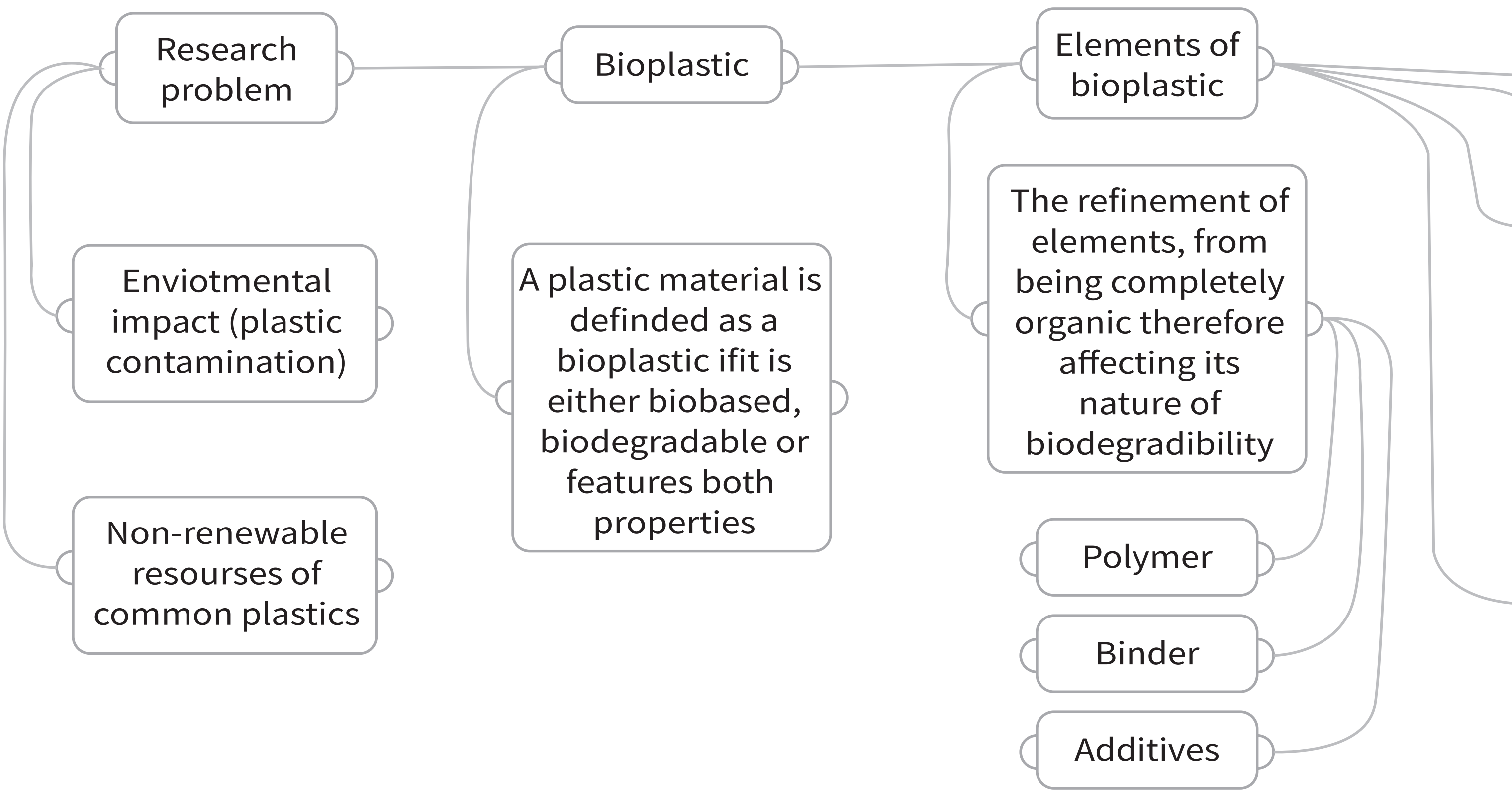
The synthetic plastics we know today have been around for almost a century. Because they are easy to make, can be molded, extruded, molded or drawn into filaments, they are used for a variety of applications. But, being a non-renewable source, increasing demand has led to raw material shortages and rising petroleum product prices. Uncertainty about sustainability and the environmental problems associated with conventional plastics have pushed manufacturers to use environmentally renewable resources.

One of the smart materials of our time is bio-plastic materials.

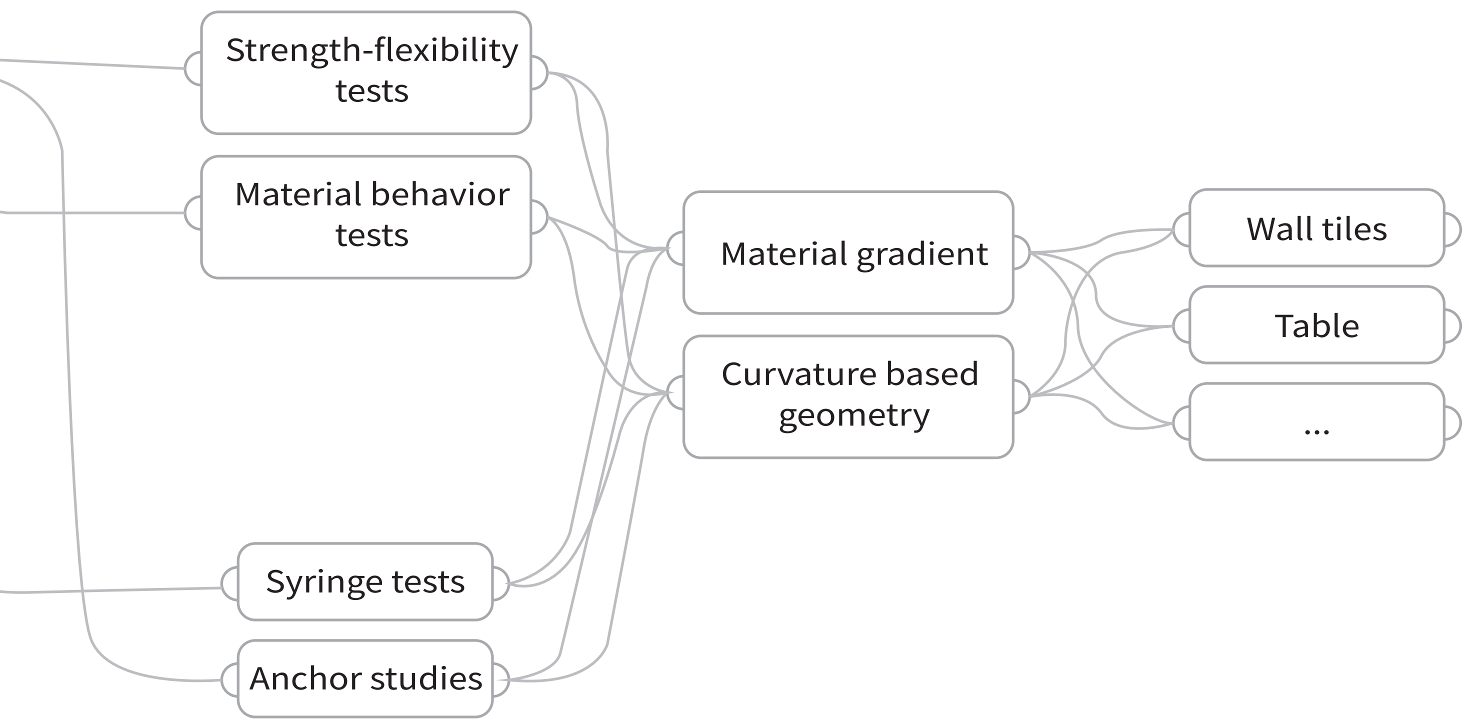
Bio-plastic becomes an increasingly popular material in our urban culture addressing issues created by the extensive use of petroleum based plastic.It is a kind of plastic that is derived from renewable biomass sources, such as starch, agar or gelatin that could be reused from food waste. In this sense, the research suggests a way to locally re-metabolize domestic waste and other organic food waste. So, bio-plastic is not only a new material for us, but also a mediator for us to relook and rethink the urban problem.

Christian Friedrich Schönbei did the very first plastic in 1845, and it was cellulose based. Cellulose is in plant's cell walls, and it's the most abundant renewable resource and makes almost 40% of all organic matter (Sauer). In 1862, he presented a pressure molded plastic that was a tough, transparent and waterproof cellulose derivative from paper, which he named Parkesine. Currently, (made from cellulose nitrate and camphor) is not used, and this set the pace for new applications in several.

The discovery of Celluloid set the course for the biggest and most polluting industry in the world. Throughout the late 19th century up to 1930, cascin was the prime raw material for plastics. Its applications vary from buttons to insulation material in clectrical connections. This is the protein component found in the milk of bigger mammals and which was not developed in wheat (Lörcks). Studies with wheat and soy were also made



by Henry Ford; in 1915 he presented a starter box for the model T Ford. He also kept looking for more applications in products made by soy oil, paint, and lacquers to find a substitute for rubber, but these carly bio based plastics were forgotten by the Oil Boom. It wasn't until the 1980's that the principal interest of products for being biodegradable is that bioplastics became noticed for the eco friendly community. In what Lõrcks describes as the Renaissance of Bioplastics, starch and sugar became the top materials. In this new generation, both partially or fully bio-based materials, gives birth to PLA (Polylactic Acid) and PHA (Polyhydroxyalkanoates). and partially bio based materials such as PET (Polycthylene Terephthalate), which are used commonly and are applied in many ways, from water bottles to filament for 3D printing (PET vs PLA Vs Oxy-PET). These are mostly used in items that are designed for a single use application which quickly become obsolete, with the intention of being reduced in any air form, soil or water. Those that are more generous with the environment are the ones who stay permanent, and they have a similar constitution like oil-based plastics but remain predominantly recyclable. This enriched material has numerous advantages, such as the reduction of CO2 emissions, a smaller amount of toxic waste and many other properties, but still, it's not enough to beat the oil industry. Due to the high cost of production, but also based on losing land for food or increasing deforestation. The main difference between a biodegradable polymer from a natural polymer is their chemical structure. As an example, pigskin gelatin and glycerol have chemical that allow their degradations by microorganisms. These two clements became a bioplastic called ssapoid structures through a process called polymerization. environmental Reducing pollution has led to finding new ways of manufacturing products that are co-friendly, but some disadvantages pushing back bioplasties from commercial use, such as their high cost of production and price, which is not a recent daay discovery (Vicira et al).



What is 3D printing?

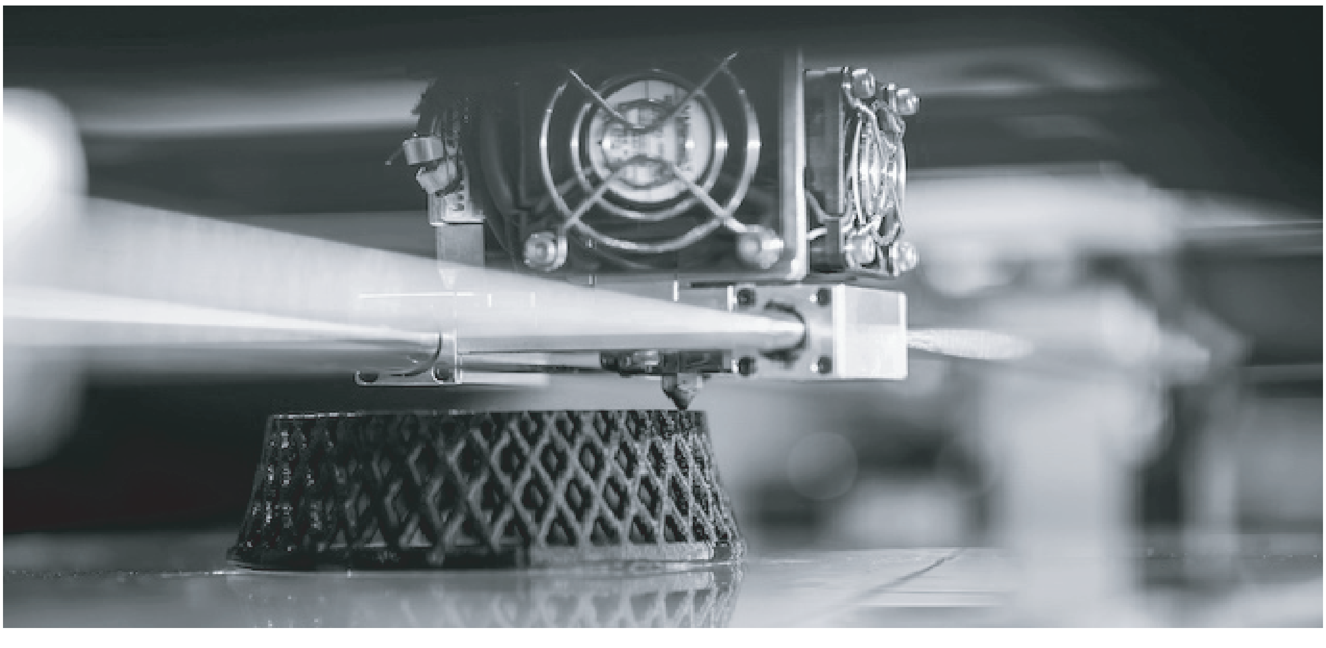
The basic meaning of 3D printing is the ability to create objects by a process of layering in 3D dimensions. For analogy, a printed image is made by a sequence of lines which are 1 dimension objects. In 3D printing the lines are represented by planes that are two dimensional objects. However in physical reality, neither the lines nor the planes are 1 and respectively 2 dimensional since they all have a thickness. This thickness is what makes an image to appear full or a 3D printed object a continuous solid. Thus, the 2D planes are actually 3D layers. By variating the thickness, a less or higher resolution can be achieved. Instead of printing with ink, 3D printers print with materials by a successive deposition in 3D layers that ultimately form a 3D object.

How does it works?

What we need to know is that there are currently two families of techniques: Selective Binding/Fusion and Selective Deposition.

In selective binding/fusion, the printer uses a laser or binding solution to fuse/bind a granular/liquid substance into multiple 2D layers.. The object created is always submerged into the raw material it is made of. In Selective deposition raw material is deposited into layers onto a platform. The raw material is located outside the printed object. It is then fed to the printer that heats it to make it viscous. The extruded material hardens as it makes contact with the last deposited layer, thus forming a3 dimensional object.

The movements of the printer's head are automatically controlled by a computer in a specif pattern that representa cross section of the desired object. This has tremendous implication on the printing process since it is unrestricted by the complexity of the shape to be printed. However there is one important difference on this aspect when it comes to consider one of the two families. The selective fusion can be used to literary print any imaginative shape since its raw material will most of the time(especially if it is powder) support the solidified object by surrounding it in all points. The selective deposition can not do this and a printed object will have to support itself or use temporary printed supports if its shape is not meant to provide it by itself.



The ten principles of 3D printing

In their book, "Fabricated: The New World of 3D Printing", Hod Lipson and Melba Kurman identify 10 basic principles that illustrates the potential of 3D printing technology. These principles outline a different approach to the way we create objects and have high implications on ourmanufacturing production system.

1-Manufacturing complexity is free: printing a complex object does not require more time, money and skill as a simple one.

2- Variety is free: different geometries can be printed by the same printer each time it operates, which differs from the traditional factory machines that needs re-calibration for each new type of object to be manufactured.

3- No assembly required: a traditional multi-parts object can be 3D printed in one shot as a single object thus eliminating the so long time used assembly line. As some components of a product can be produced continents away, this feature can save time and cost on labor and transportation, and making the production more sustainable.

4-Zero lead time: the possibility of on-the-spot manufacturing can engage local companies and individuals to print custom objects on-demand.

5-Unlimited design space: a printer can create such shapes that would have been very hard or impossible to create with the traditional machines, reaching the possibility to create shapes that until now existed only in nature.

6-Zero skill manufacturing: calibrating a printer to create an object requires less operator skills as the process is almost fully automated. This has high advantages for people in remote areas or extreme circumstances.

7-Compact, portable manufacturing: a 3D printer has more manufacturing capacity than a traditional machine as it can print objects as big as its volume or larger if the printhead is attached to a robotic arm.

8-Less waste by-product: as it is an additive manulacturing technique, zero or less waste is produced.

9- Infinite shades of materials: one of the holly-grails of 3D printing is to print with multiple materials to create new type of materials and geometries with new proprieties and behaviors.

10 - Precise physical replication: an object can be scanned and printed in the same shape. Any scientific, medical or design intervention can be made on the replica, thus leaving the original unaltered.

The Prvok

On August 18, the first 3D printed house in the Czech Republic was presented in Prague. The remarkable prototype was built in Ceske Budejovice in just 48 hours. After the components dried, it was shipped to Prague, where it was presented floating on the Vltava River, being tied to a pontoon.

A house called Prvok (Protozoon) is partially self-sufficient and suitable for the countryside as well as for the city or water.

Compared to conventional passive houses, printed houses save up to 50% of all costs and are seven times faster to build. Compared to brick buildings, 3D printing also results in a 20% reduction in CO2 emissions.

The first 43 square meter printed house will be built in the Czech Republic this June. Republic in June this year. The construction work will take two days and completion will take two months.

Prvok from Burinka The building will be anchored on a pontoon, and it will be a year-round livable house.

The house offers eco-technologies such as recuperation, recirculating shower, remote control, green roof, as well as tanks for drinking, utility and sewage water. The home is designed to last at least a century in all conditions. "In the future, the owners will be able to demolish the building when it has reached the end of its useful life and have it printed again from the same material right on site," adds Michal Trpak.

Less waste and less cost

Calculations of the project sponsor, Stavebni sporitelna Ceske spořitelny (Buřinka), show that the printed house will be built seven times faster than a conventional brick house. It will create several times less construction and demolition waste, which today accounts for 46% of total waste in the Czech Republic and similarly in Europe. "Compared to conventional brick buildings, 3D printing also generates up to 20% less CO2 emissions, which the European Union aims to reduce by 30% by 2030.

It only takes about 25 workers to print one house (forty less than a normal house). Prices in series production can reach half the cost of a conventional passive house. Self-sufficiency provides further savings in operating costs," says Libor Wosicki, CEO of Burinka.

ICON, Lennar and BIG

There is a project of 100 houses printed with 3D printing. Construction companies ICON and Lennar are partnering with architecture studio BIG to create a block of 100 3D-printed homes in Austin, Texas.

According to Texas-based ICON, construction is scheduled to begin in 2022, and when completed, it will be the world's largest block of 3D-printed homes.

This project will be created "on site," using state-of-the-art robots and concrete-based construction material.

Digital renderings of the neighborhood, unveiled last week, show rows of houses with roofs covered with solar panels. Each house will take about a week to build, according to the company developing the project.

Although ICON did not disclose the cost of the project, the company said its technology is much faster and cheaper than conventional construction methods - in part because it requires less manual labor. The construction process will involve five 46-foot-wide Vulcan robotic printers that dispense a concrete mix called Lavacrete according to a pre-programmed house design.

Homebuilder Lennar will outfit each home with neutral-colored gabled roofs featuring photovoltaic panels.

"Our design approach modernizes the aesthetics of the suburban home, while 3D printing technology adds texture and creates distinctive touch points for each space," ICON added.

Digitally Native

ICON's tablet-based operating system controls every aspect of print operations via an intuitive, simple, and beautiful user interface. The operating system translates floor plans into print jobs and then directs both Vulcan and Magma, using real-time data down to the millisecond, to produce the highest quality printed structures in the world. From its powerful CAD and print planning to enabling machine learning and predictive analytics for Vulcan robots, this advanced software brings construction into the 21st century.

Pollution

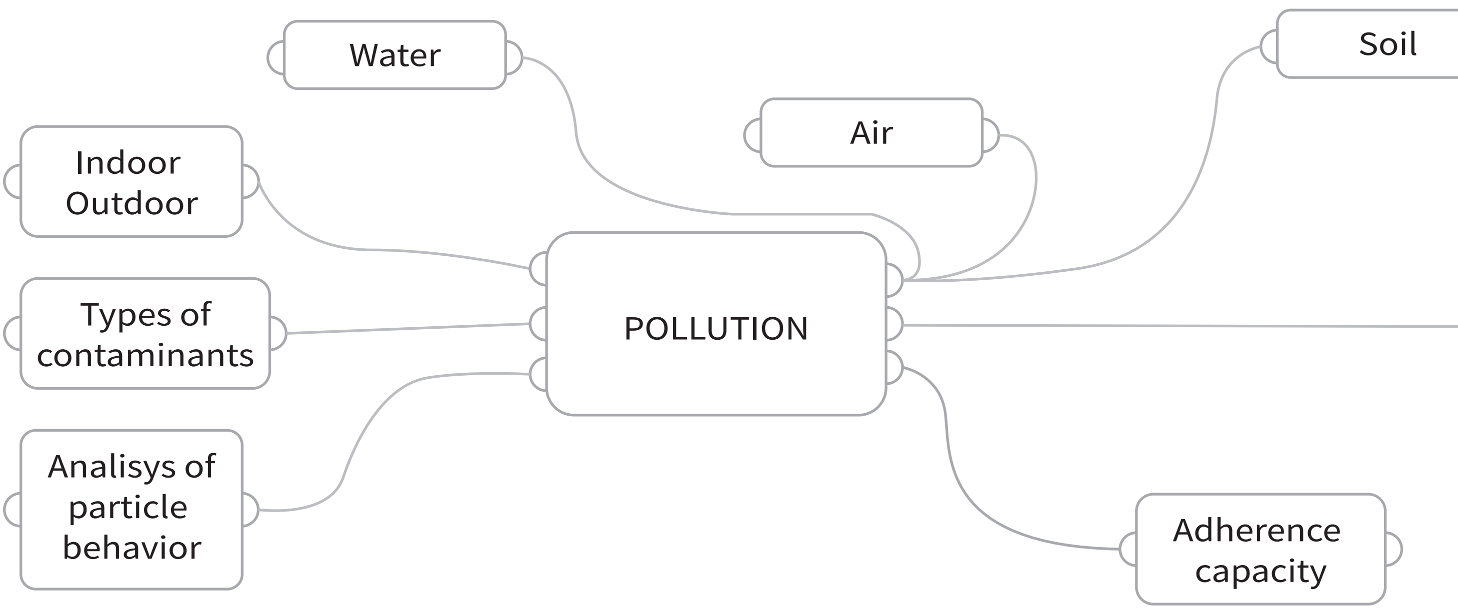
Modern life activities are polluting planet earth. According to The World Health Organization, the panorama of today's world isn't promising. Since the emerge of the industries, the lack of care has been deteriorating the planet, especially during the last decades (World Health Organization).

Bioconstructions

During the last 35 years, additive manufacturing has become commonplace within the realm of academic research as a tool for creating models and full scale working prototypes and, in very rare instances, it is used as a method of manufacture by specialists to fabricate custom componentry for buildings. However, additive manufacturing is still not close to being a commonplace method of manufacture within the construction industry due to the expense associated with the purchase of large, industrial 3D printers and robot arms. Additionally, many materials such as resins, bulk filament andmaterials such as resins, bulk filament and pellets, and proprietary powders are expensive when used for large format printing and in instances where these materials must be shipped long distances. Finally, additive manufacturing requires expertise in 3D modelling and coding, which means additional costs and time must be spent mastering advanced software applications. For many end users, these obstacles have precluded the use of additive manufacturing as a way of building.

Portable Robotic 3D Printing

Portable Robotic 3D Printing The MUD Frontier project is addressing the challenge of creating accessible robotics for construction through the development of a mobile and lightweight 3D printing sel-up that can be transported easily to the jobsite. The scara robotic 3D printer that was developed for this



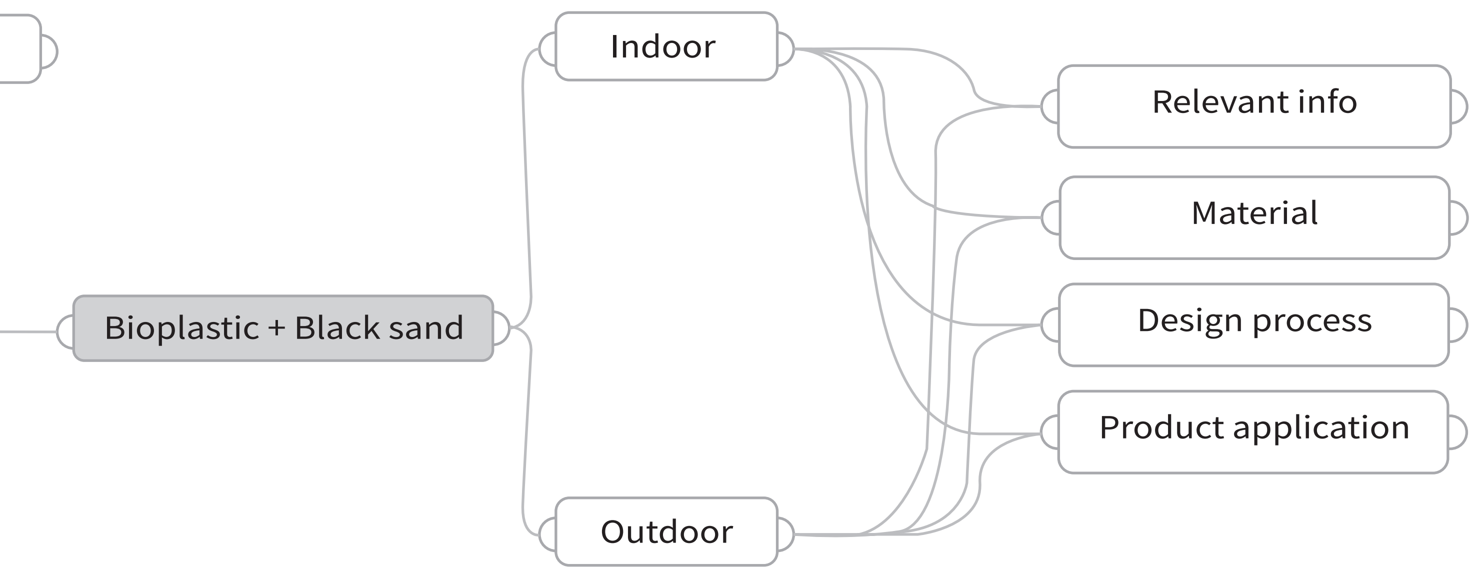
endeavour is combined with a continuous flow hopper that can print wall sections and enclosures of up to 2200mm diameter circle and 2500 mm tall, structures considerably larger than the printer itself The set up can becarried by 1-2 people and relocated in order to continue printing.

Ubiquity:Local Earthen Materials The printer is able to 3D print local soils directly from the work site in order to dermonstrate the possíbilities of sustainable and ecological oonstruction in a two-phase project that explores traditional material craft at the scale of both architecture and pottery. The clays harvested for the projects are free, as they can be dug directly from the ground or surrounding region where the walls, enclosures and pottery are being printed. The material undergoes no chemical transformation, nor are any stabilisers, such as cement, added to the mixture.

Software Custom software, called Potterware, was created to be the underlying control for the 3D printer. In its most accessible form, it is used to design the ceramic vessels. A more robust version is ermployed to design the walls and. enclosures created by the robotic 3D printer. The software is an intuitive design application for 3D printing, that runs in the cloud from a typical web browser, such as Google Chrome; features easy-to-use sliders and automatically generates printable g-code fikes, alleviating the need to learn 3D modelling software, meaning insteed that a novice user can quickly begin to create complex g-code to 3D print functional pottery or earthen environments. Objects, walls and enclosures, at the scale of rooms, can be designed and ready for printing within minutes.

Conclution

The aim of this project is to develop an ecofrendly building, using 3D printing from local materials. Such as: black sand from the surroundings of Hverfjall volcano. The use of bioplastics as the main material of the building structure will help in future biodegradation and recycling.



3

Design

Sketches

Building Concept

Site plan/secion/exterior

Design concept

1st layout diagram

2nd layout diagram

3rd layout diagram

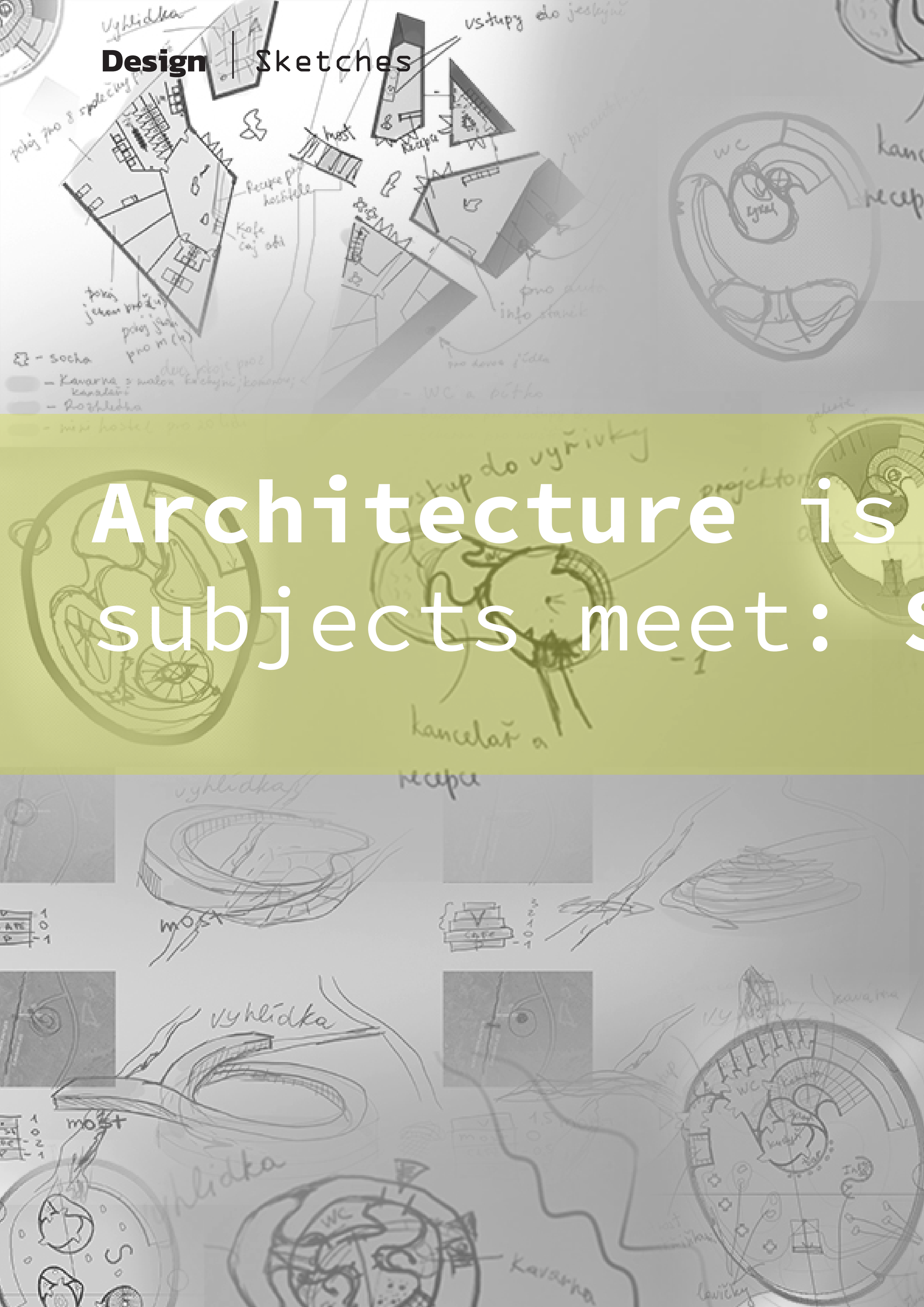
Secion/details

Exterior/facades/bridge

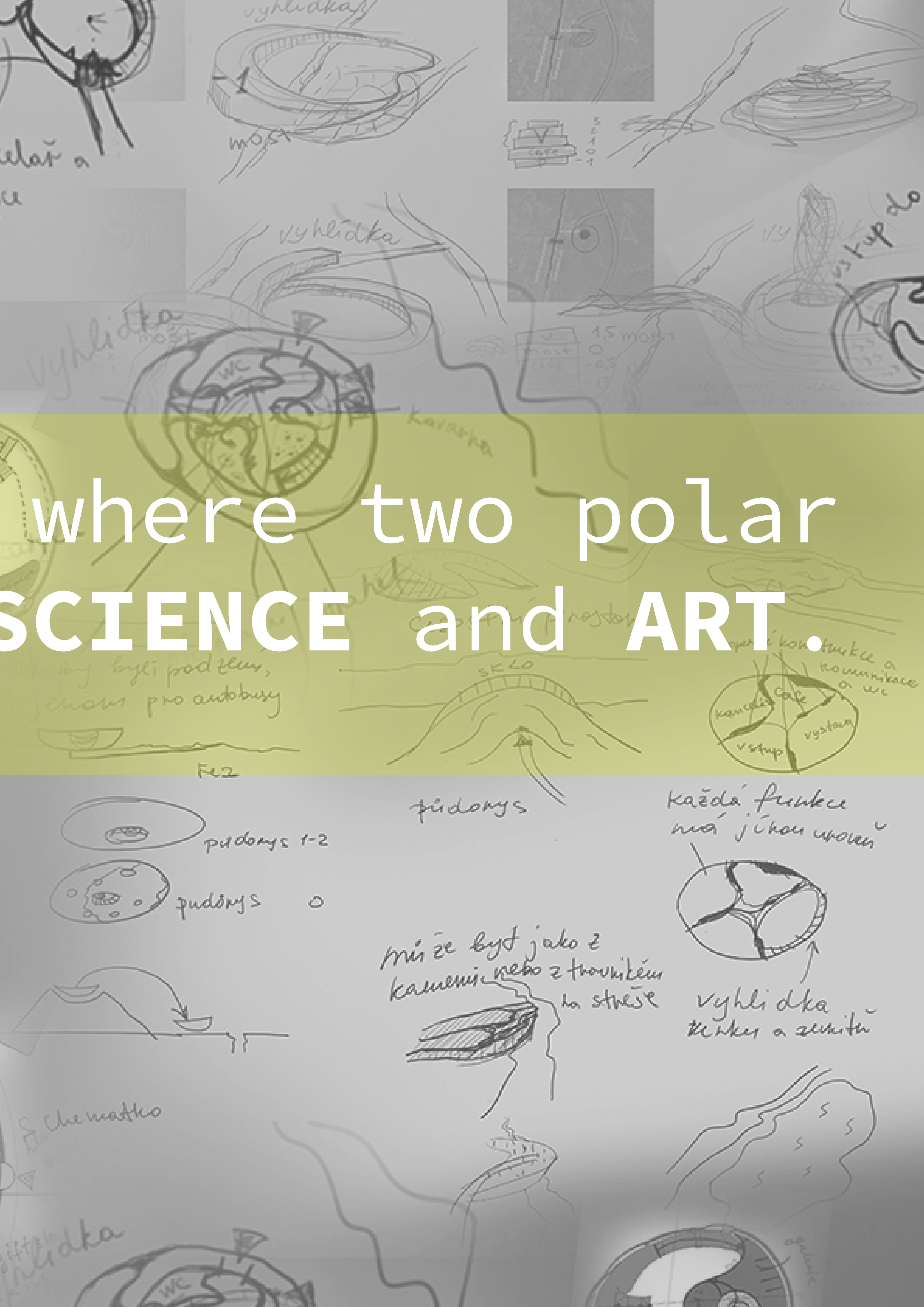
Constructions

Building technology

Visualizations



Architecture is
subjects meet: S



where two polar

SCIENCE and **ART**.

Welkome to the designing of CaveTower

Modern methods of tourism business require renovations in terms of architecture, construction of a more comfortable environment for people, developed infrastructures. The architecture of the health and wellness area should be more focused on the needs of holidaymakers, so for the city of Grjótagjá there was a need to build public buildings with the view area and infrastructural facilities of various purposes as close to one to one.

The designed object is created about 2 km northwest of the volcano Hverfjall, as its continuation. My project draws inspiration directly from an ancient form formed by nature over millions of years. The body of the building was created by casting the characteristic crater of the volcano Hverfjall. Also, the material used will be partly made up of volcanic black sand. The structure will be in a location justified by the viewing axes. The axis created between the volcano, the building and the observation deck creates a perspective illusion - the building and the volcano complement each other perfectly.
It creates a visual connection between the interior spaces and the vast natural environment of the island.

Building

My task was to create the building in such a way that it would be virtually untouchable and would not spoil the nature around it. It was very important for me to use local materials in everything, as well as eco-constructive systems and production technology.

Once the building is built, it can last as long as it takes, with proper maintenance. The important thing is that the moment they decide they don't need it they can tear it down, melt it down on the spot and scatter what's left. In fact, the material that comes out at the end of the destruction of the building will be local and can quickly take root.

So I'm creating an object that will leave exactly what was there before it.

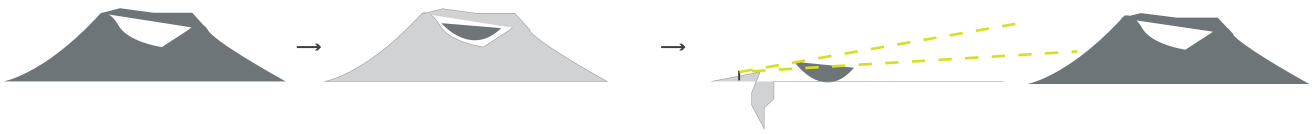
Construction

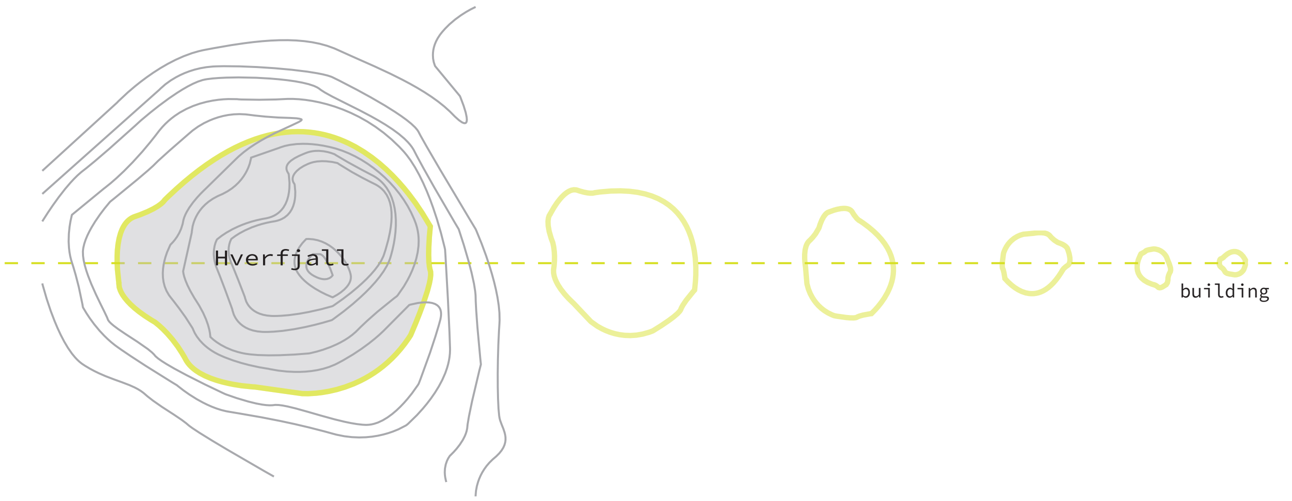
For the structural scheme of the designed building is a three-top structure-frame with the use of spacious shells construction made by the technology 3-D printing bioplastic material.

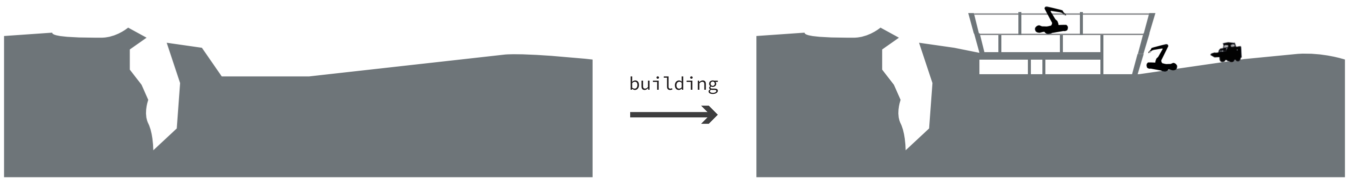
Some designs will be printed in the factory and brought to the site for further installation, and some, if necessary, will be printed directly on site by portable 3D machines.

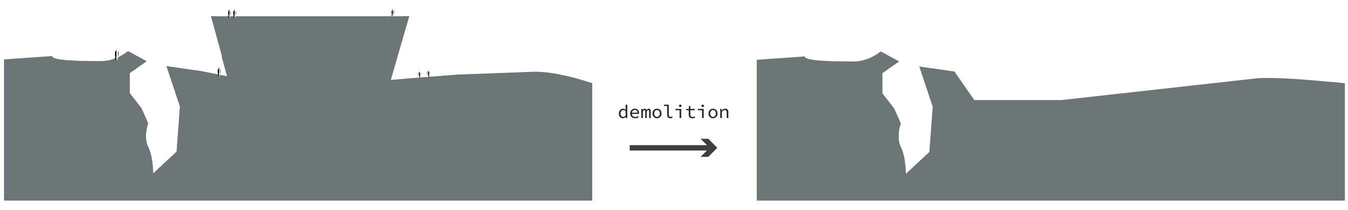
Basic structures: foundation - monolithic slab on a rocky base; columns, floors and coverings, external and internal walls, descents - 3D bioplastic. Windows and exterior doors - double glazed aluminum profile, equipped with mechanical drives. Coating combined roll inversion type, performed on the envelope coating thickness of 300mm. As a support for the cover used spacious structures of the central columns and walls made of biplastic technology 3D printing. Water drainage from the coating is organized internally. All elements of the coating are designed with the necessary conditions (according to the regulatory documents).

Also in the collons installed a system of drainage with the use of rainwater. A green roof system is installed along the perimeter of the roof.

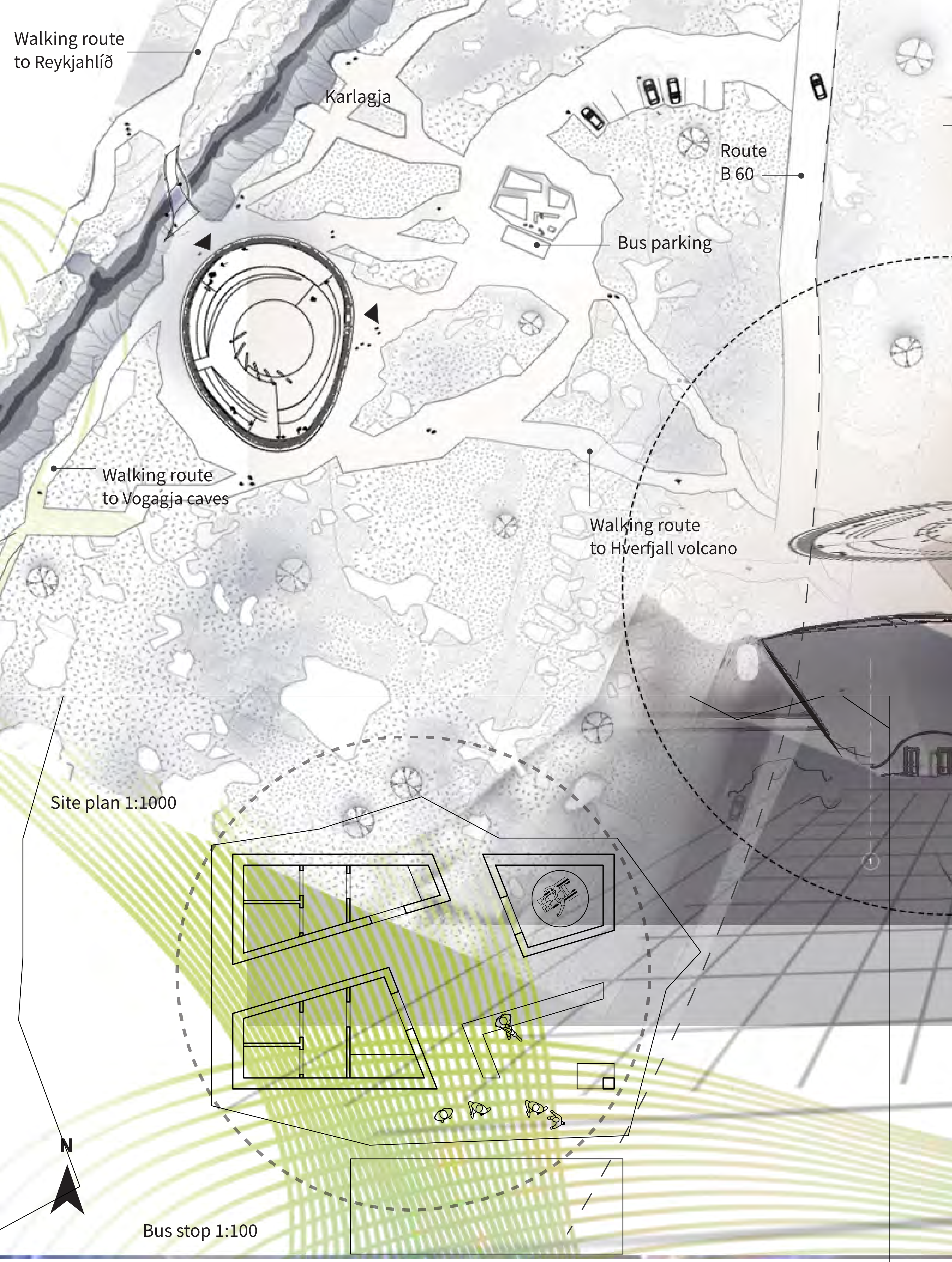


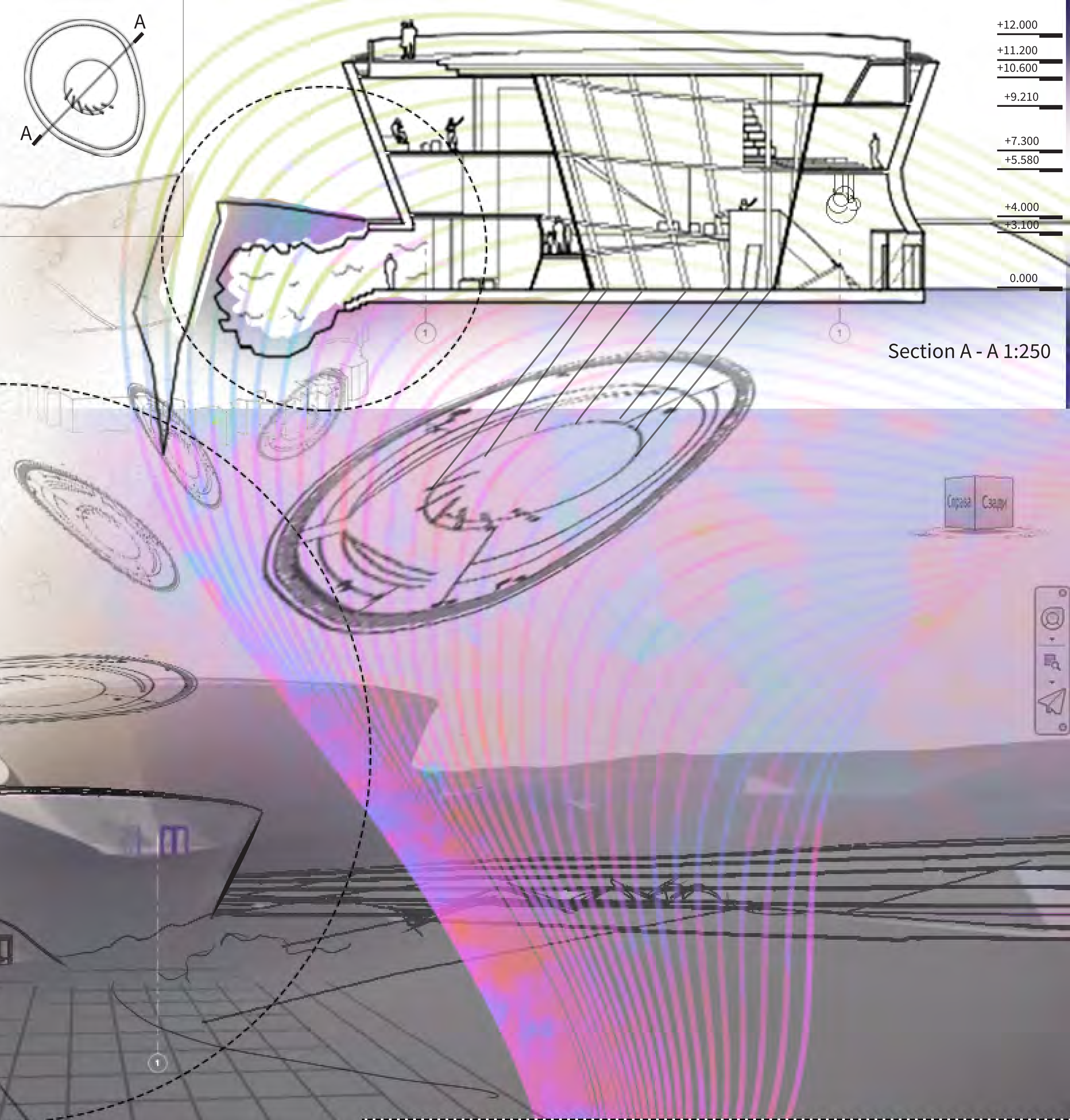

Hverfjall
building


building


demolition

Design | Site plan/secion/exterior





Input data

The plot is 3.600 ha, located 1.92 km to the east of Reykjahlíð and 1 km to the eastwest of the volcano Hverfjall. This area is free of construction and specially designated for the facility.

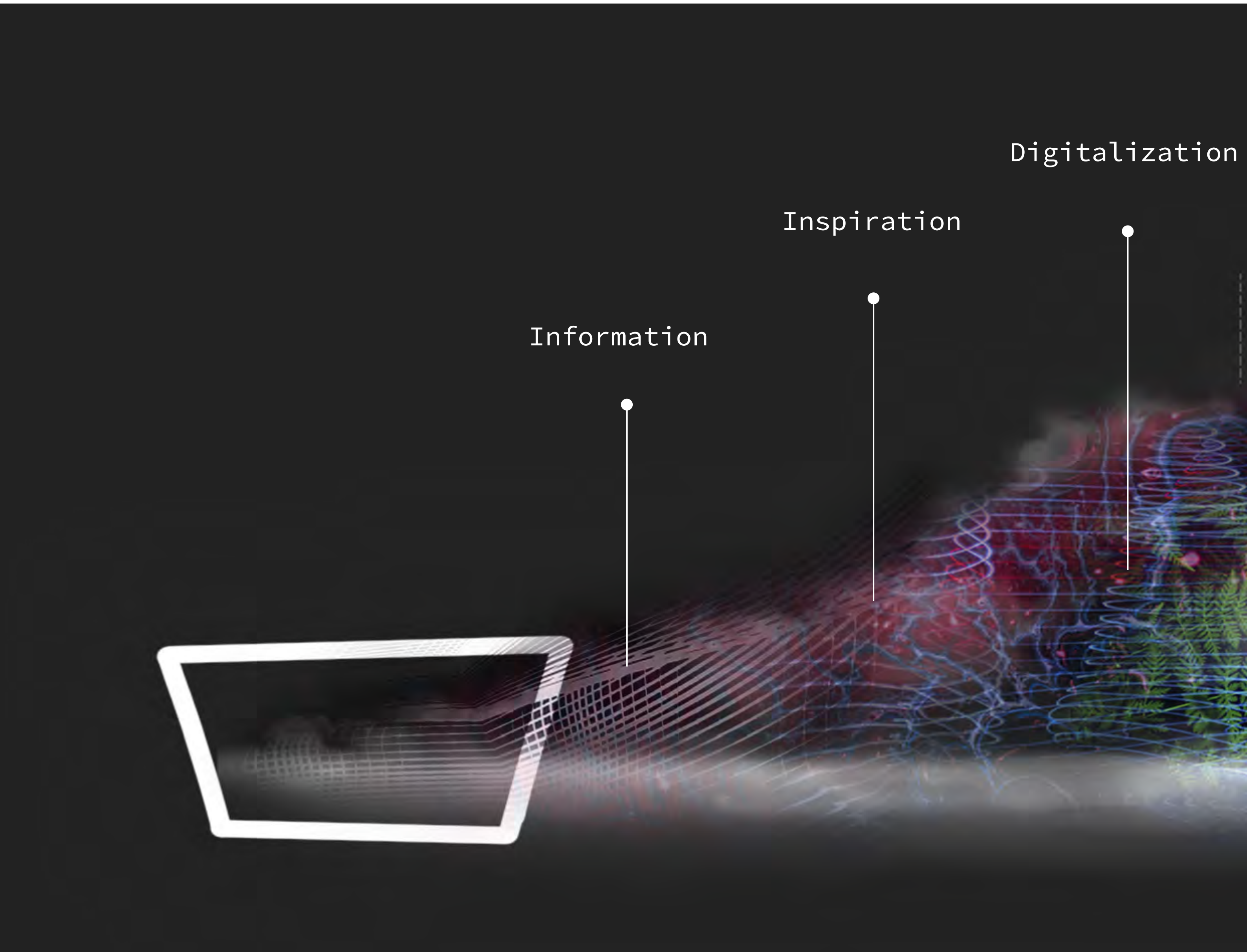
Anyone wishing to visit the building can reach their destination on foot, by bicycle or skis, by private car or by a shuttle (eco-friendly, electric and autopilot) from the nearest village. The bus stop is equipped with a comfortable waiting area and toilets, including toilets for the disabled. Anyone passing by can easily go to the bathroom, get warm and fill up with water.

Knowledge is power

We are moving into the future, we need to constantly think not only about the past and preserve our history, but also to strive for the future and gain as much knowledge as possible. We have to build our buildings in such a way that they meet all the parameters that have already been created and that can presumably arise in the future.

The created gallery goes upward in a spiral, crowned by an observation deck. With each new turn we dive more and more into the digitalization system. At each stage a divided, structured space awaits us, in which each separate and subsequent dedicated space is responsible for a different function and shows us how the world has already changed and teaches us how to be in touch with the world.

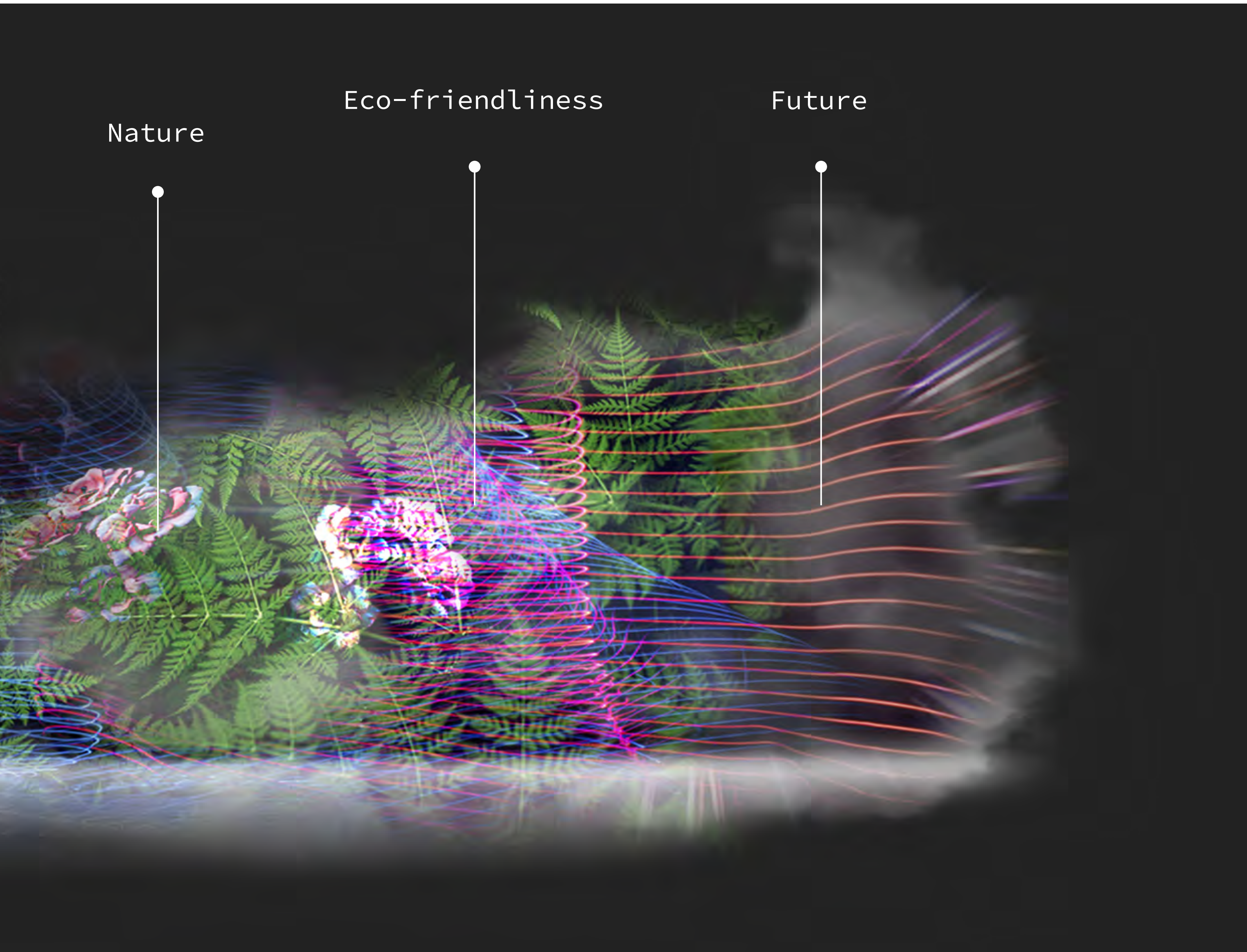
The future is already her



All of the epithets in the chart below reflect not only the fullness of the building, but also, in part, our world today. The year 2019, together with the envelope virus, showed us that we have long been adapted to remote work, people are already ready to move into the virtual world. That line where the present ends and the virtual continues is disappearing with each passing year. In some ways this is frightening, but for the most part, all that is unknown is frighteningly interesting.

Inside the Iceland cave tower we can find several different functions that connect the walls of the building. At this point, almost all of them are automated. If you want, you can control the building from afar, online. But there is also an office inside for one or more people to configure the whole thing.

e, we just haven't seen it.



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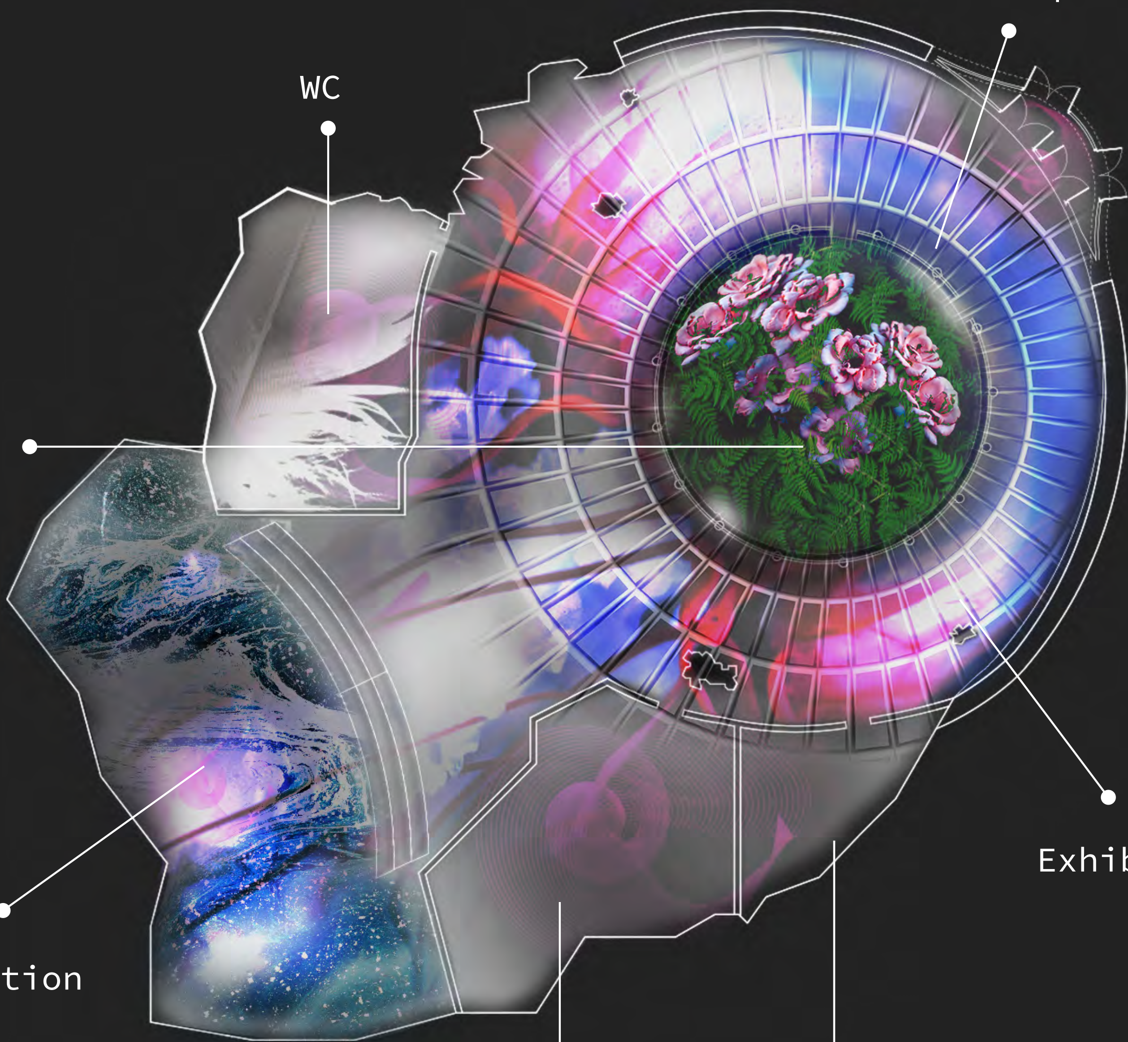
Pieces of local rock exhibition

7

Exhibition in a semi-enclosed room with displays
Shelves display local rocks and fossils

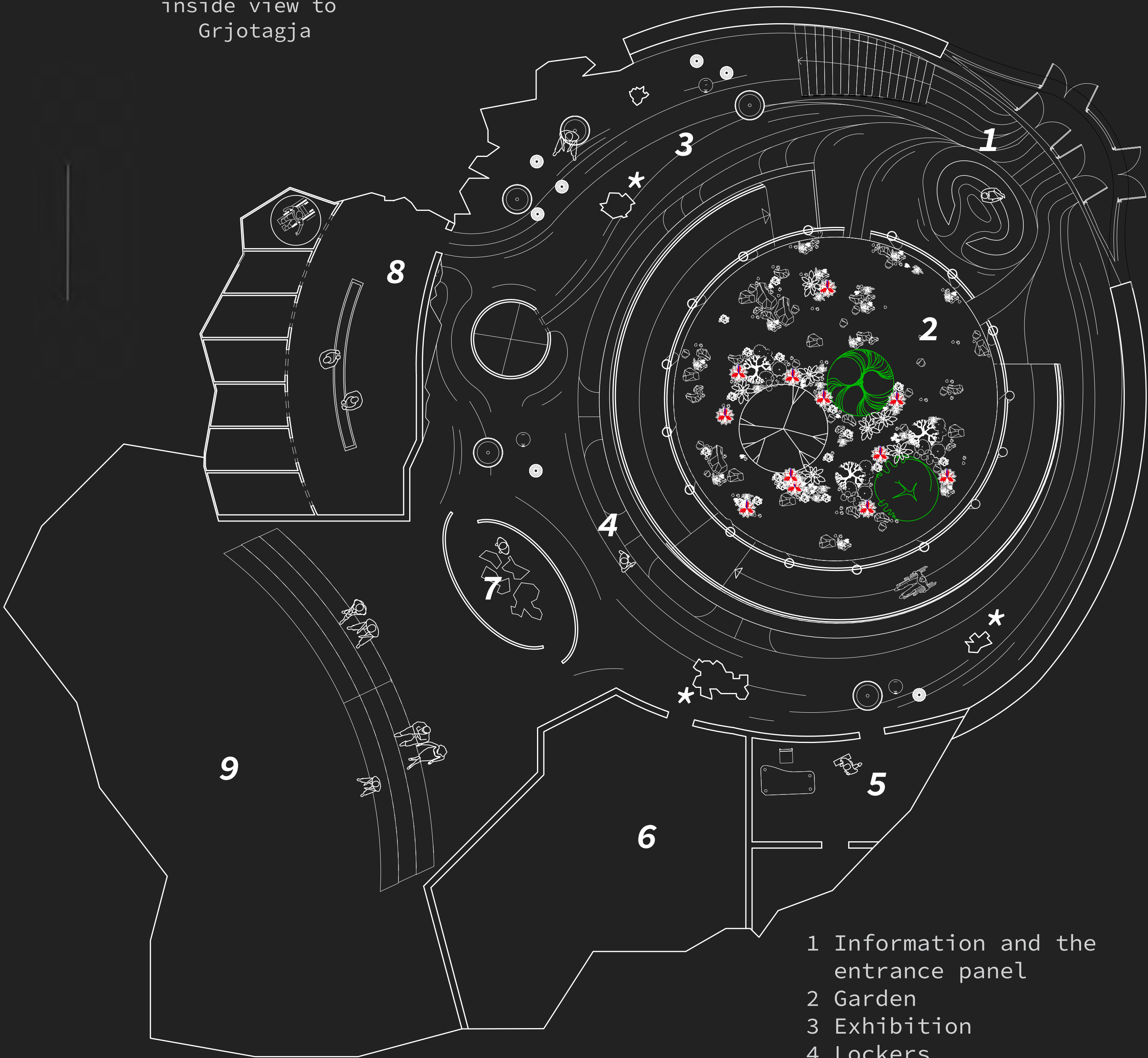


9

Rock
and thermal water
inside view to
Grjotagja

In the ramp
are hidden lockers
alternating with computer
displays
where you can find any
information or learn
something new

4



1 Information and the entrance panel
2 Garden
3 Exhibition
4 Lockers
5 Office
6 Technical support
7 Local Fossils Exhibition
8 WC
9 Thermal Source

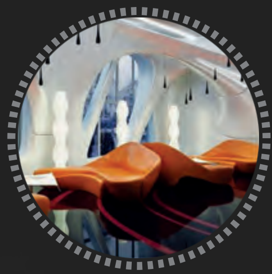
1st floor 1:200

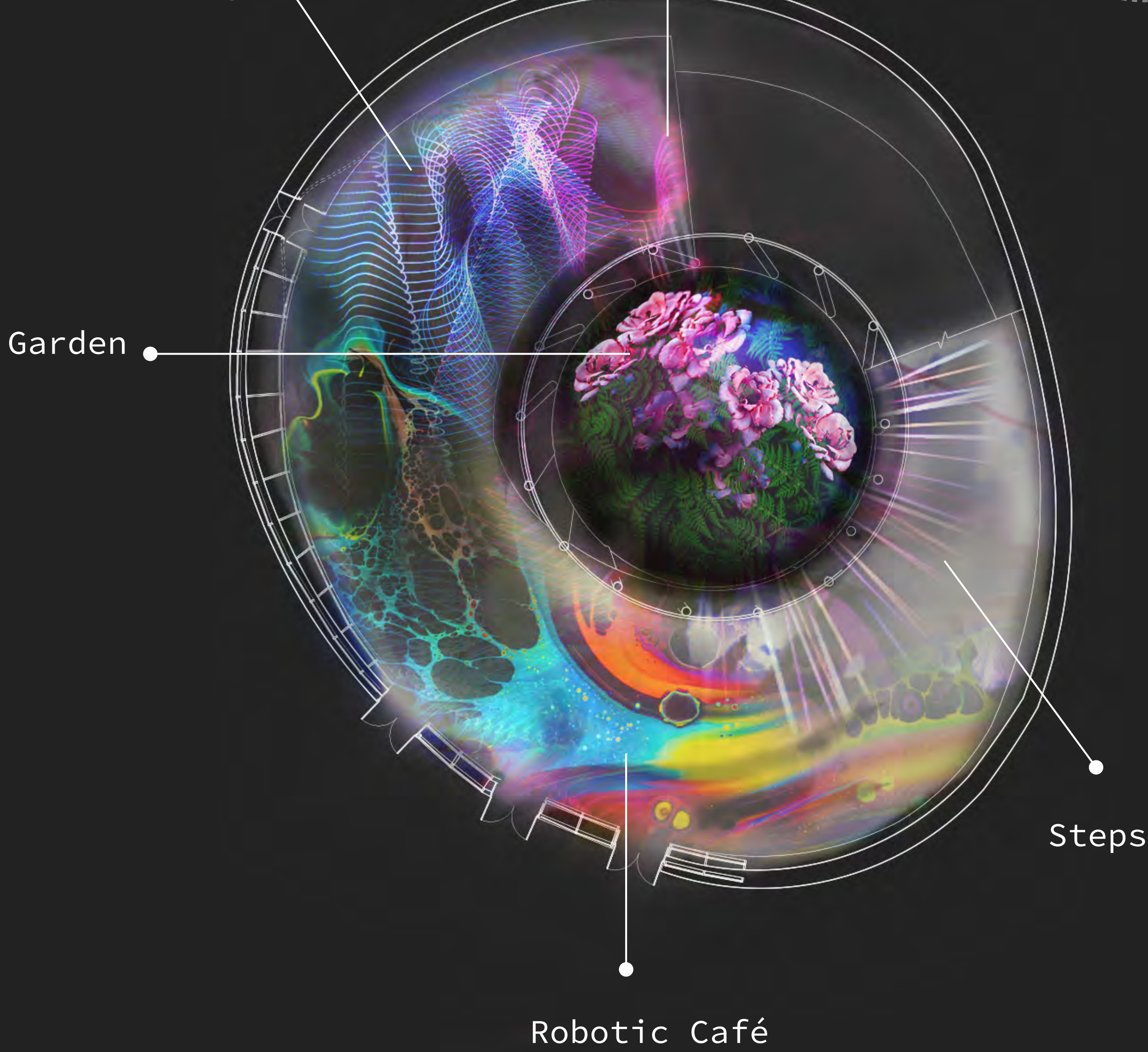
14

Rest
and exhibition
steps

*

11





*/

Controlled lamp

13

Barista robotic arms
There cant only make
coffee and tea,
but also serve cakes
or reheat sandwiches
from the refrigerator

Display
so you can control the color,
the light of the lamp above
the entrance group
Here you can create
your own picture
or upload your own picture
and project it
onto the chandelier

10 An exhibition that
can be managed
11 Café
12 Robotic Café
13 Storage
14 Steps

2nd floor 1:200

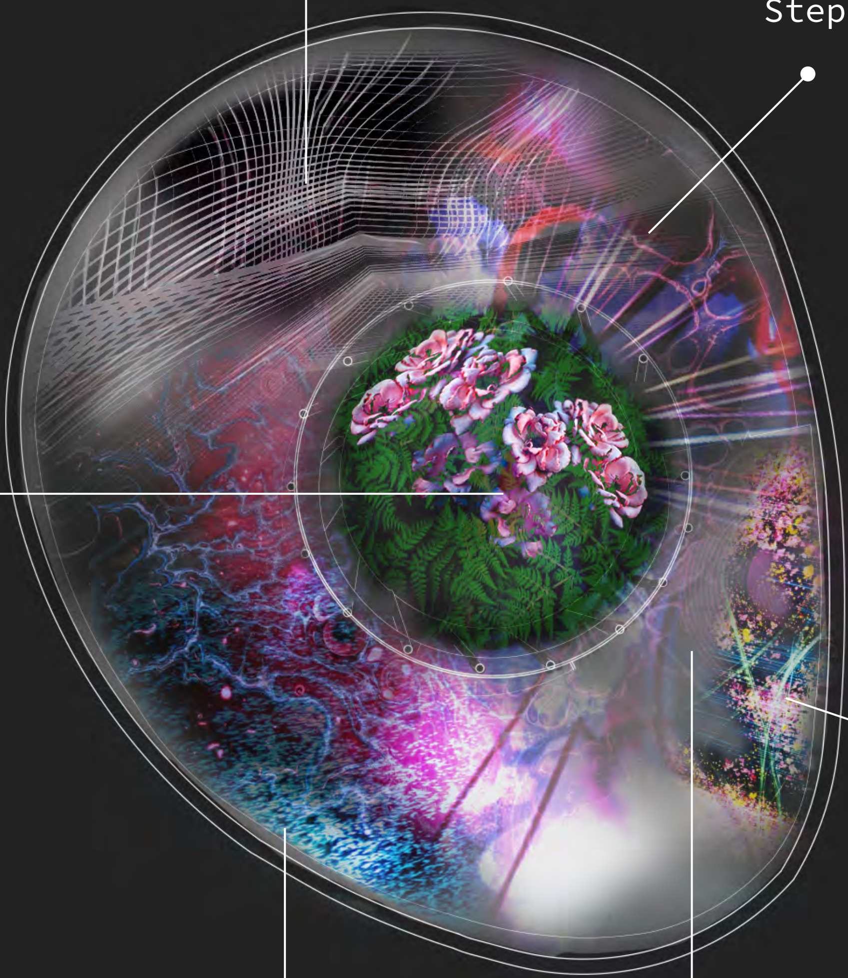
16

Beginning
of the exhibition area
The Info Labyrinth

16*

The Info Labyrinth
an exhibition area
surrounded by over 120
monitors
where visitors are invited
to experience multiple facets
vision of
Future City

17



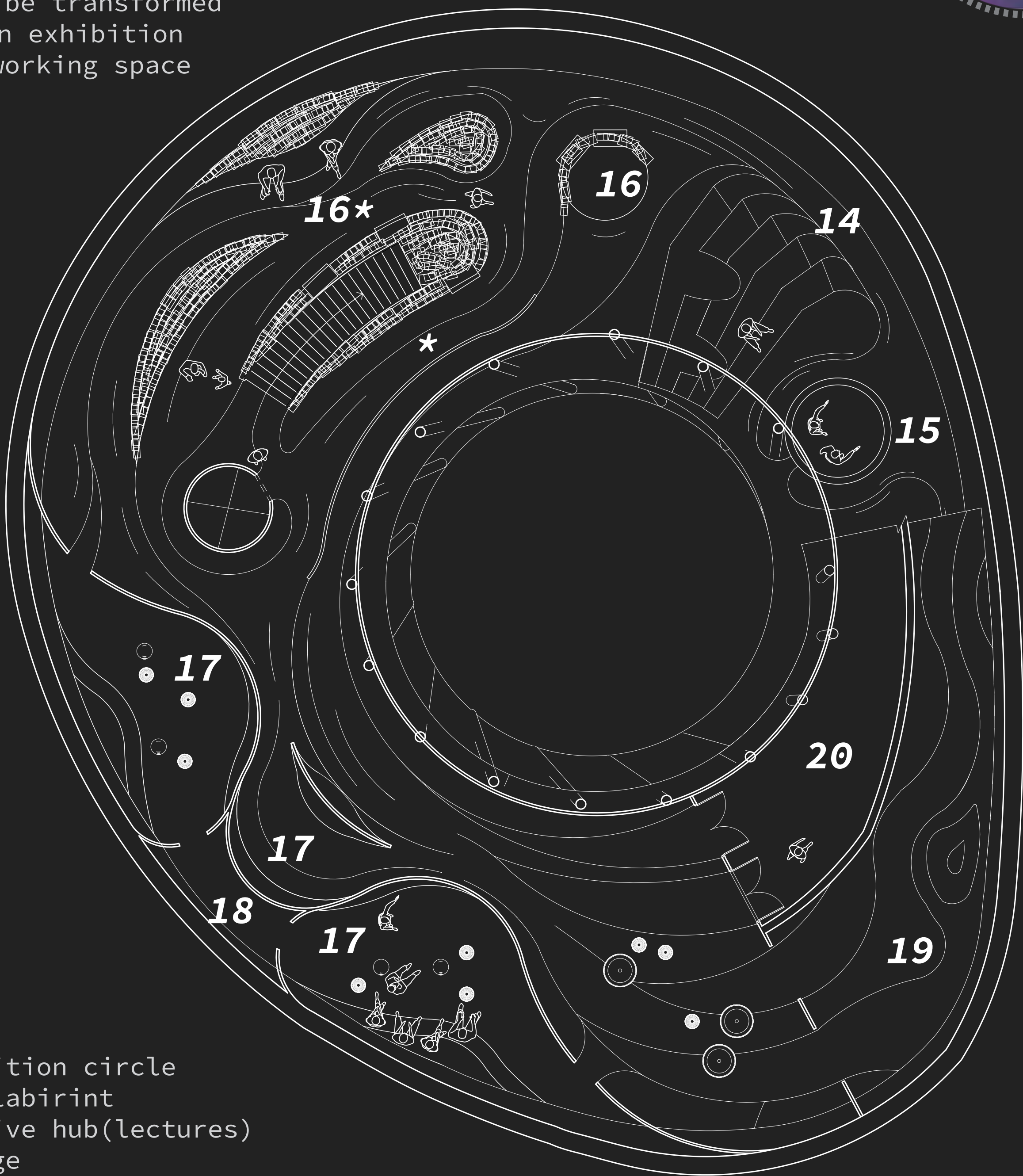
15

Flexible LED display
exhibition

*

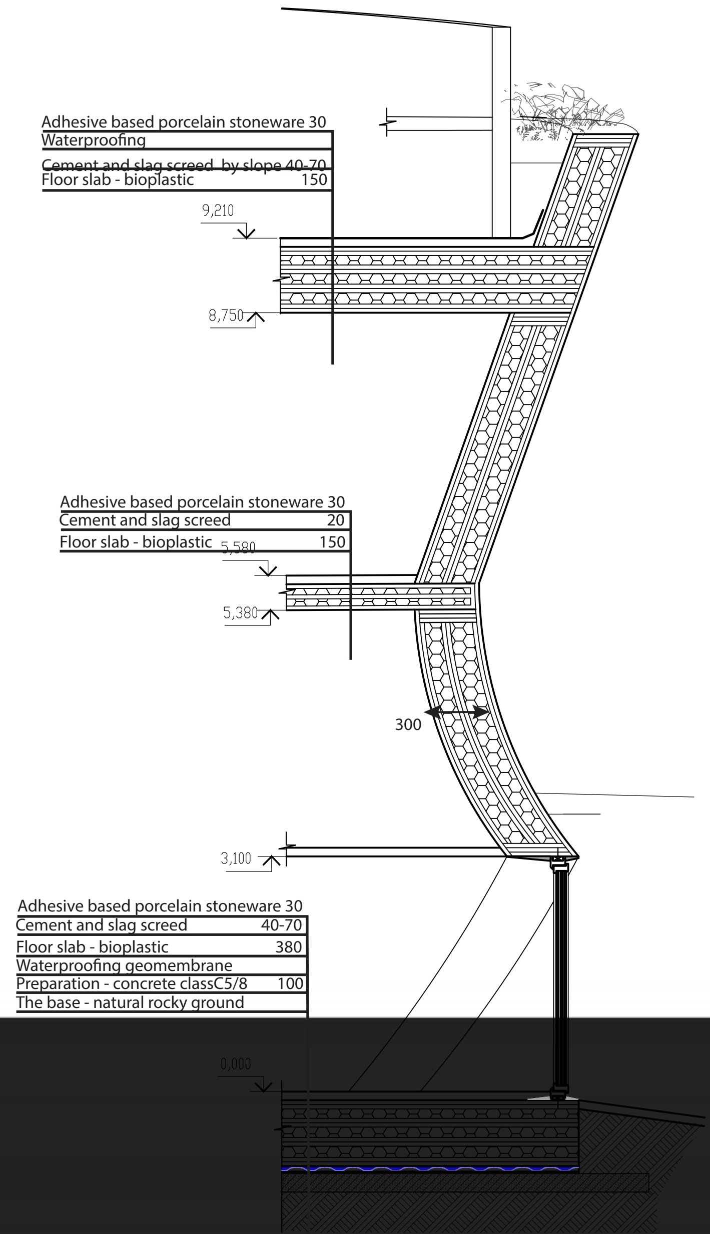
A display
built into the wall
that you can control
exhibition

Creative hub
A kind of lecture hall
that can be transformed
into an exhibition
or co-working space



14 Steps
15 Exhibition circle
16 Info labirint
17 Creative hub(lectures)
18 Storage
19 A soft and bright room
20 Roof access

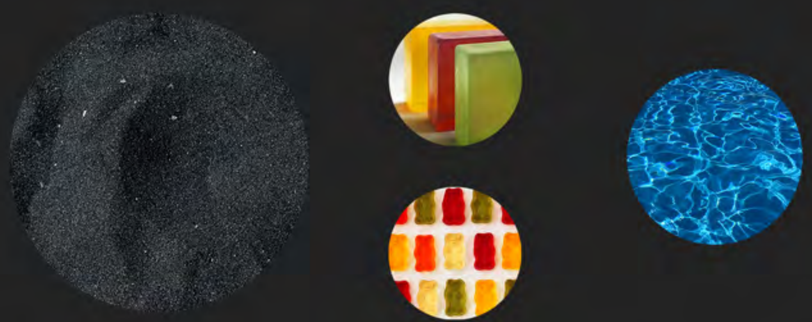
3rd floor 1:200



Building

The 3D printing system is started via a computer, and the printer prints in layers according to a given contour (depending on the building form chosen by the customer) loaded into the system computer. First, the floor of the building - the so-called future floor - is arranged on the substrate. It is formed by 3D printing horizontally one layer after another, which provides a sort of monolithic slab. Then, on the laid slab, the printer prints the walls of the building layer by layer (taking into account the openings for windows and doors). Upon reaching the set height, the layers begin to shift slightly, thereby rounding the walls of the building to the top (shifting the layers relative to each other) so that eventually in place of the roof appears a kind of reverse dome.
One of the features of the technology we offer is the rejection of thermal insulation. The necessary thermal insulation properties of the building are provided by the composition of the material, as well as the design of the wall itself.

- Black volcanic sand
- Gelatin (ribs, shells of crustaceans, certain algae)
- Glycerol
- Water

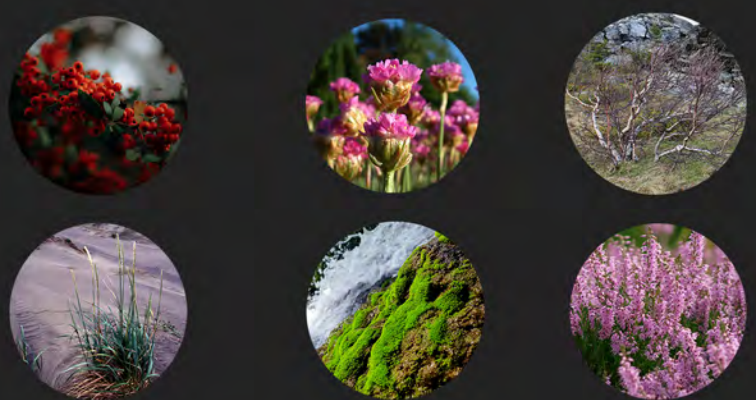


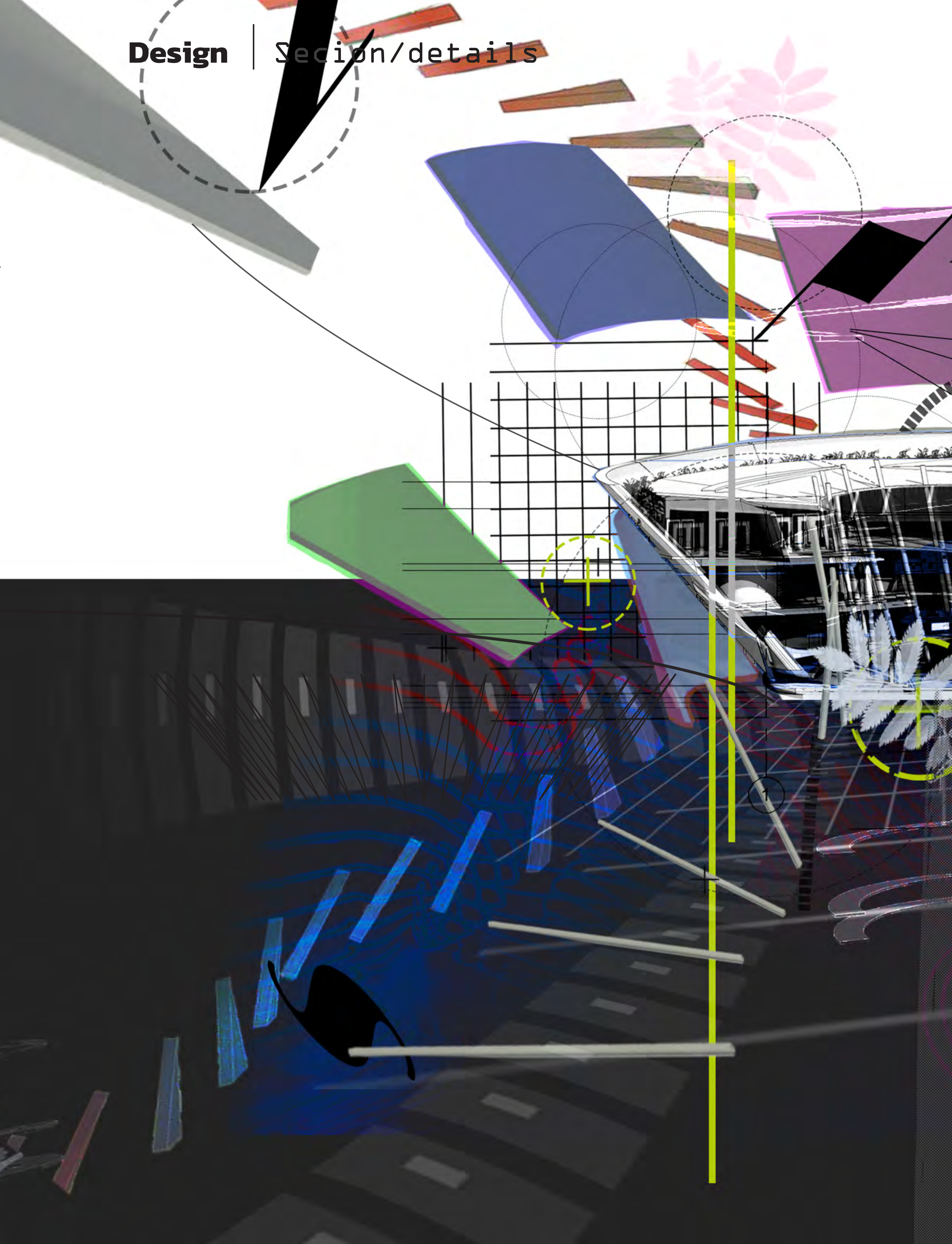
Atrium

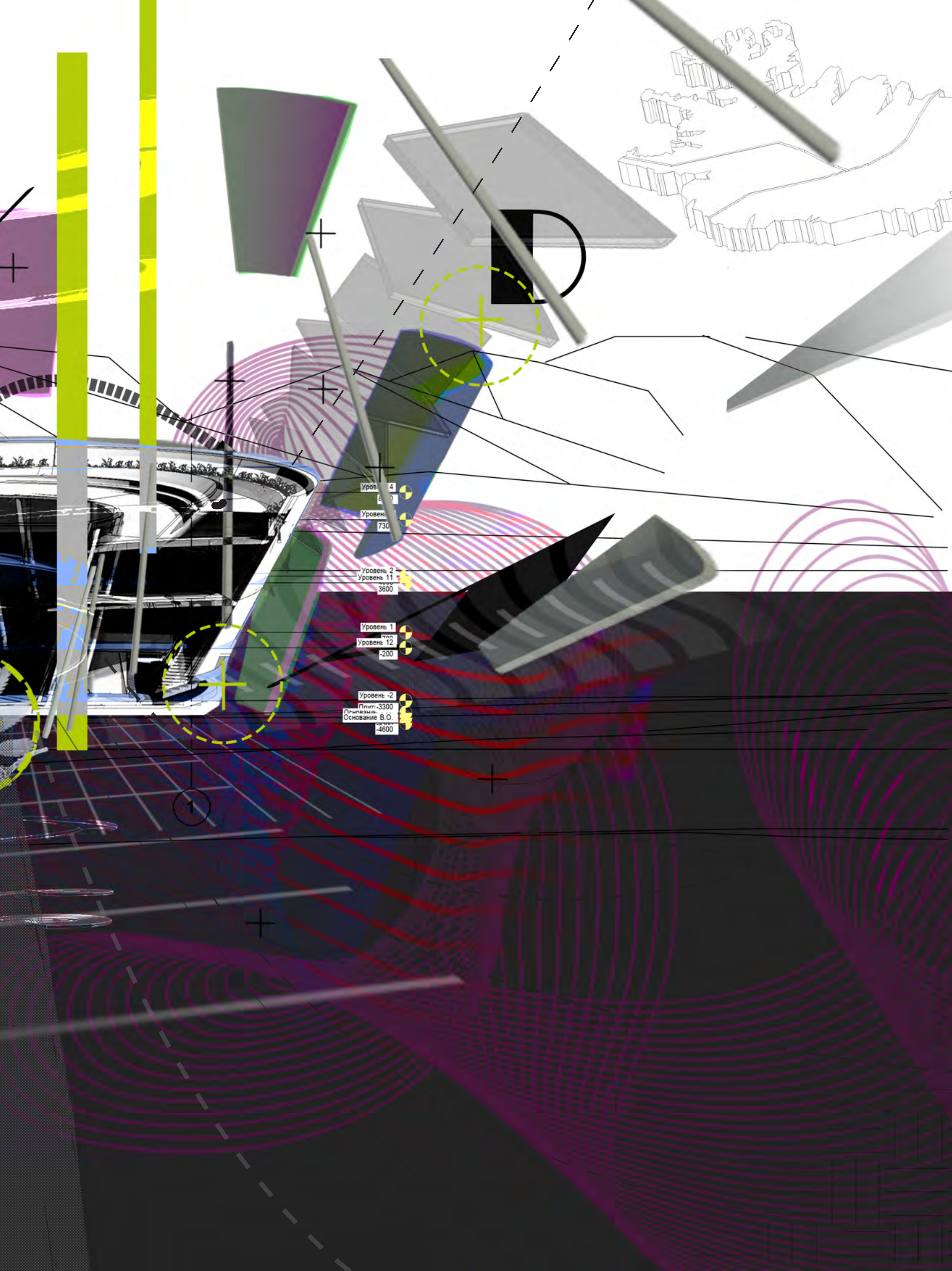
The atrium space is located in the center of the building, 10 meters in diameter. It is a place of tranquility and communion with nature in our information overloaded world. The corner of tranquility also has a light function, thanks to the glass walls. From below, the grounds are heated and gitrotized thanks to the underground water supply.

The plants used were native to the area:

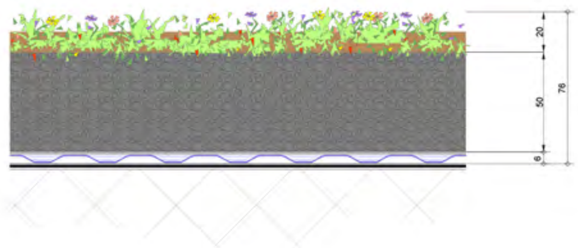
- Moss (lat. Bryophyta)
- Leymus (lat. Léymus)
- Heather (lat. Calluna)
- Rowena (lat. Sórbus)
- Dwarf willow (lat. Sálix)
- Armeria (lat. Armeria)







Green roof

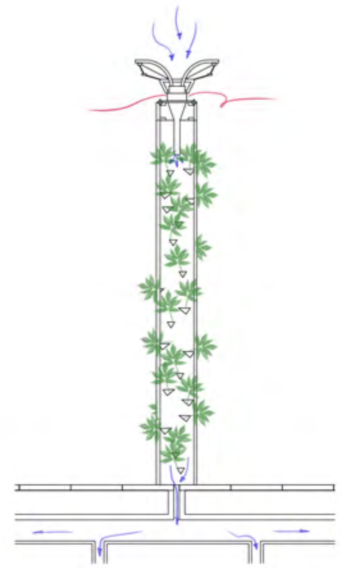


With a small section of green roof around the perimeter of the entire building, I organize the space for rainwater suction and treatment.

Also the installation of a green roof reduces the need to manage any stormwater that accumulates, as well as the stress put on local sewer systems.

Since your roof is covered by plants, the amount of it exposed to the elements is limited, enabling the roof membrane to last much longer than if unprotected.

- SOIL DEPT 50mm
- SEMPERGREEN SEDUM - MIX MAT 20mm
- F ILTER LAYER DRAINPLATE 6mm
- PROTECTION SHEET MEMBRANE ARCHITEC TURAL SUBSTRUCTURE



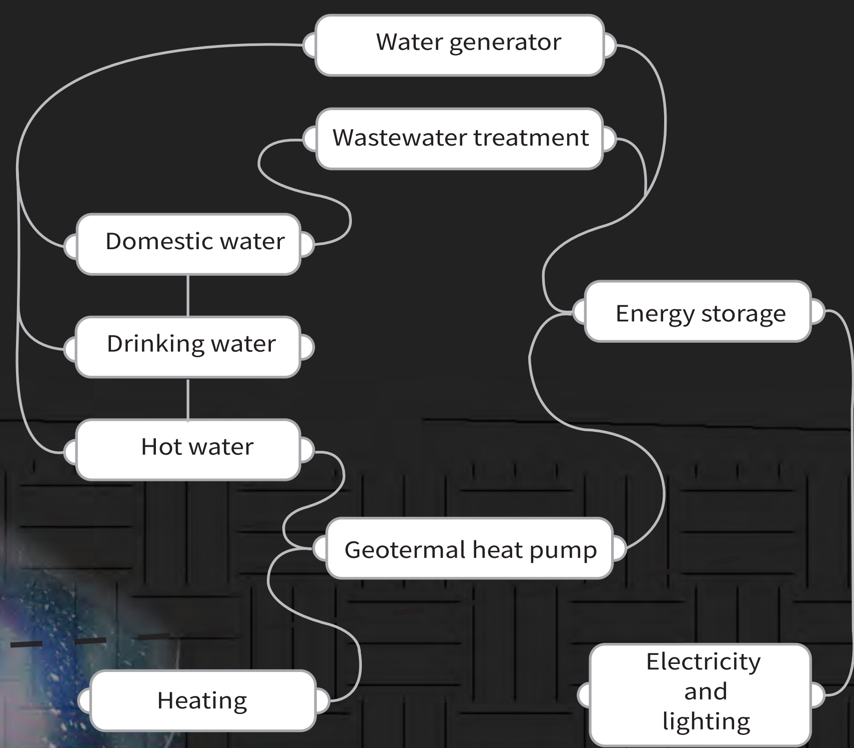
Aeroponic tower system

An aeroponic tower collects rainwater in its funnel, the roof. The water enters the filter where nutrients from the nutrient extraction system are added. The flow of water is controlled by a drip nozzle that distributes the water to the suspended roots inside the aeroponic tower, spraying the nutrient-rich water. The water then flows back into the ground so it is not wasted.

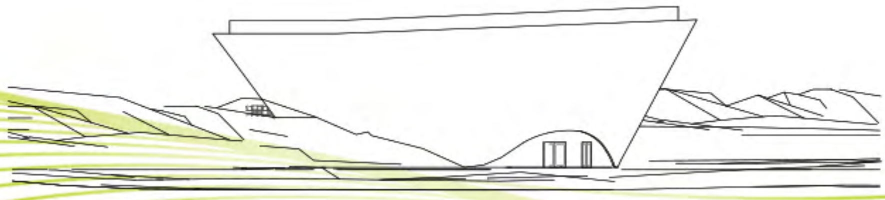
Self-sufficient building engineering system

Water, heat and electricity are supplied to the building through the treatment and further use of thermal water.

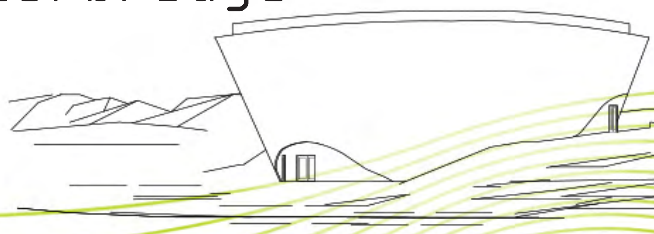
A detailed description will follow.



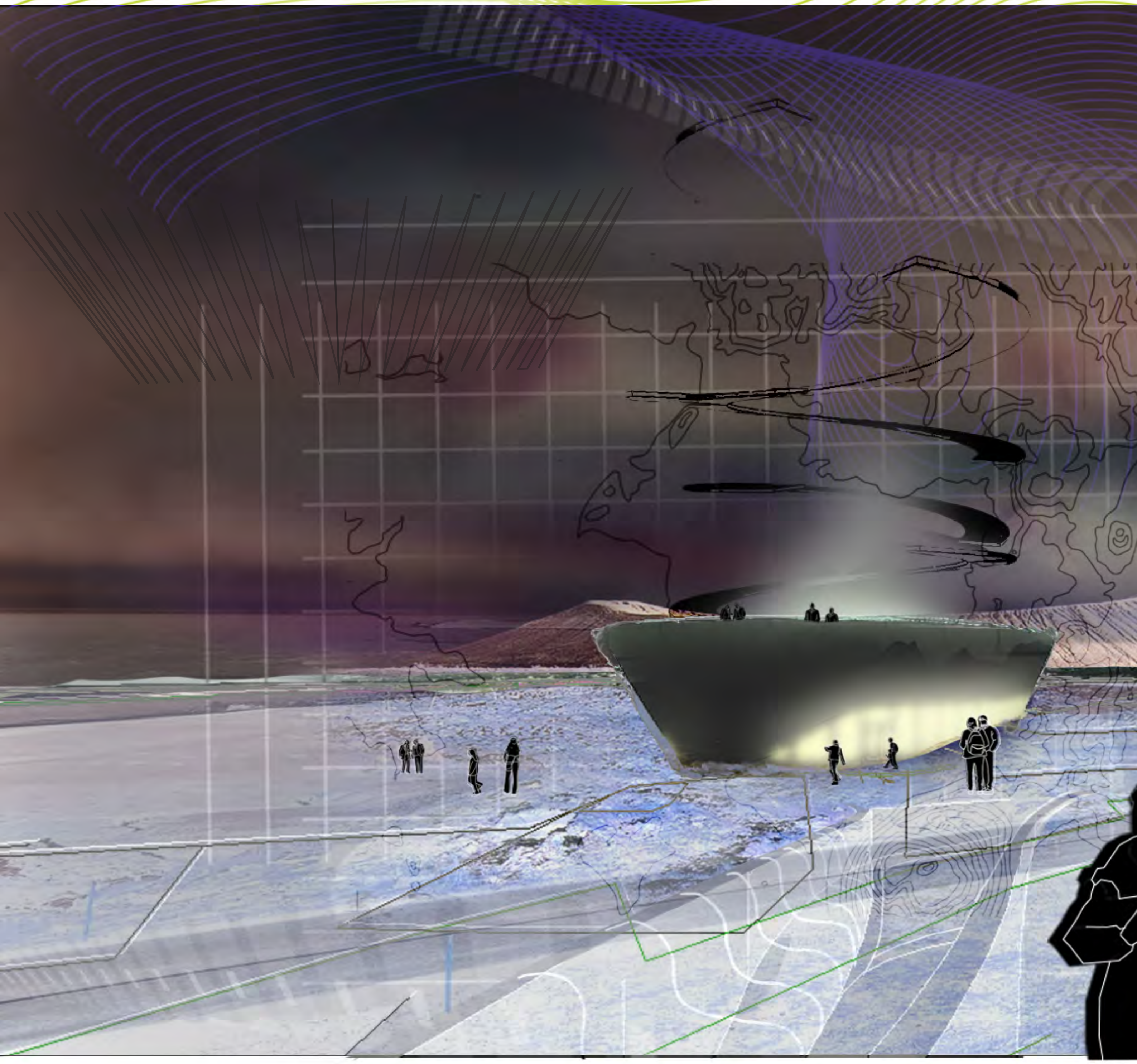
Design | Exterior/facades/bridge



Facade North

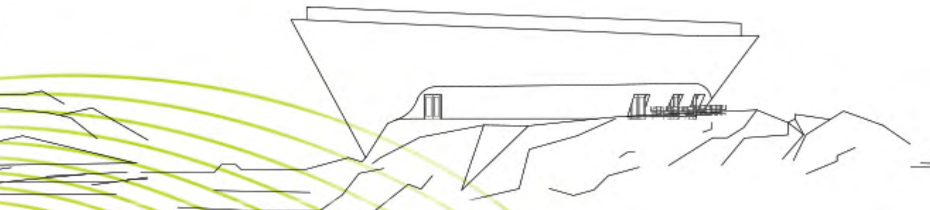


East facade

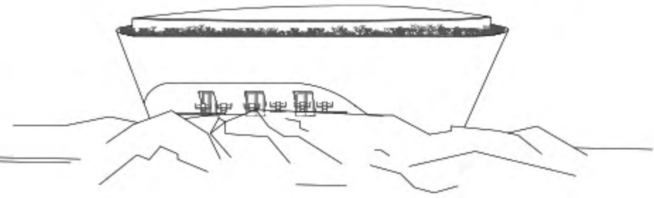


Bridge

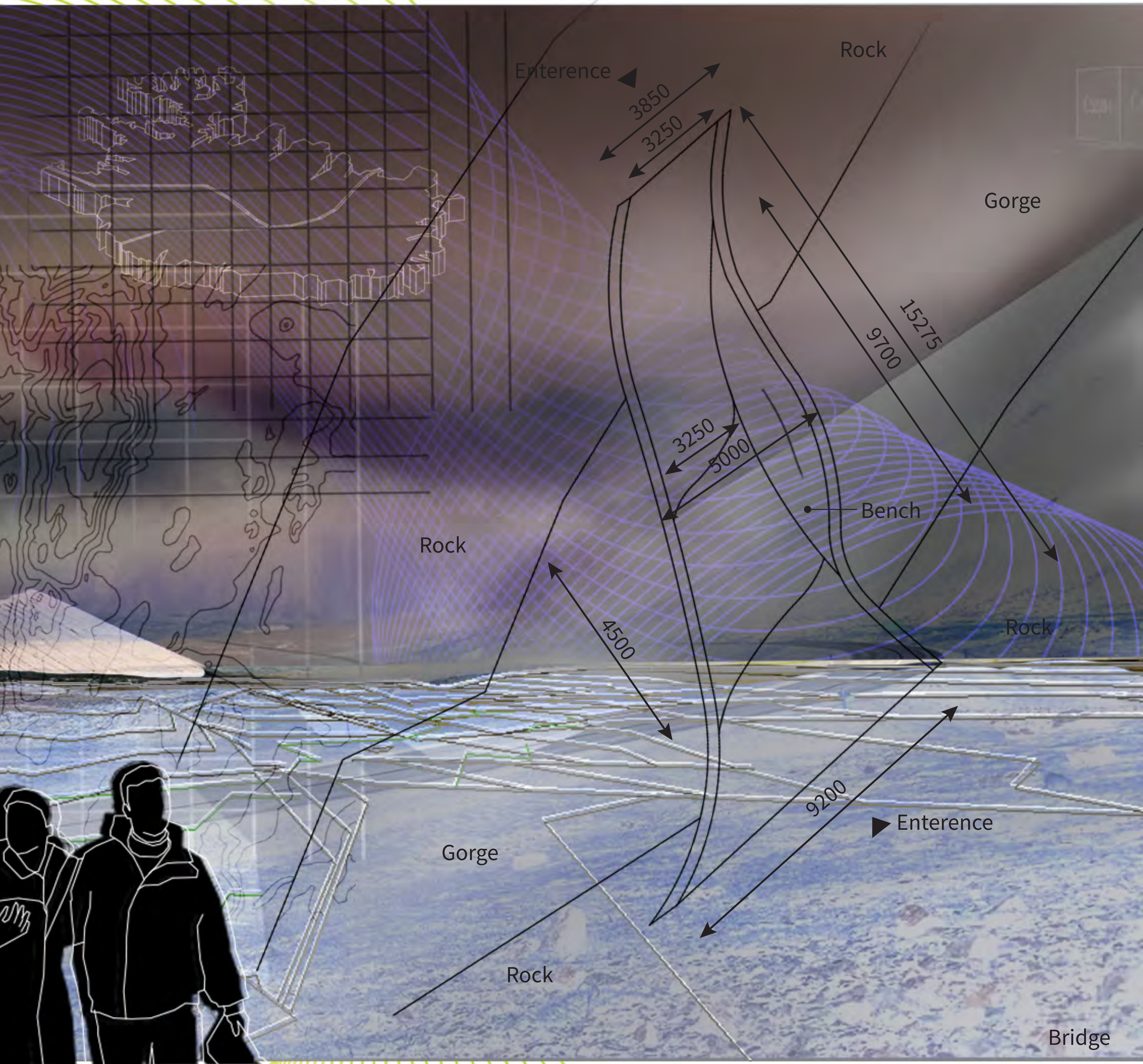
The bridge across the gorge is a single-arch pedestrian bridge with an overall length of 16.0 m and a width of 3.6 m. In the plan of the bridge is located on a straight plot. Runway structure and the bridge fabric is made of individual blocks of bioplast technology for 3-D printing. Stands - obsipnogo type of massive monolithic on foundations on a natural rock base, made of bioplast technology for 3-D printing. In the building is installed monitoring system, which detects changes in the state of the material of the structure, which will help smoothly repair it.



West Facade



South Facade



Directly above the gorge, in the middle of the bridge, there is a glass surface. It is a great way for people passing by to look down for a while and thus appreciate the beauty of the rock formations. There is also a small branch in the bridge that imitates the construction of a bench. You can sit on the bridge and look down through a window over-looking the rocks.

Bioplastic

The material, which was adopted as the main structural in this project, was recently developed by Estonian scientists. The main components of the mixture are organic waste from the fish processing industry (fish flakes, shells of crustaceans, some algae), geopolymer reagent, as well as a special premix of inert materials, which gives enough strength to bioplast and provides the required speed of solidification of the mixture. The reaction of potassium oxide and tungsten metals contained in the geopolymer reagent with the acid contained in the organic waste chitin creates a solid material similar to concrete in strength, but with a significantly smaller volume of volume. At the same time during the reaction is isolated atmospheric carbon dioxide. Part of the volcanic sand is also added to the composition of the mixture to improve the physical and mechanical properties of the material. Specific data on the composition and recipe for the mixture is a trade secret of the manufacturer. [Liiv Jüri. Novel ecosustainable peat and oil shale ash-based 3D-printable composite material / Jüri Liiv, Tõnis Teppand, Ergo Rikmann, Toomas Tenno //Sustainable Materials and Technologies. - 2018. - V.17. - P. 24-29.]

As a result of the research, the following material parameters were established: coefficient of thermal conductivity λ=0.087 V/me-C; compressive strength 21.2-25 MPa; compressive strength at rest 2.6 MPa. Due to the unique composition of the mixture is possible to regulate the terms of compliance of the material and the set of strength. The material is completely solid for 24 years, but its elasticity can be preserved for a certain period of time. Bioplastic is resistant to high temperatures and humid climate.

Advantages of using Bioplast for 3D printing: resistance to chemical and biological influences, durability, water impermeability, incombustibility, good soundproofing and thermal insulation properties; naturalness and environmental friendliness; lightness and strength; relatively low cost (100-150 m3 of structures will cost 5000 euros).

Heat engineering calculation of the walls and coverings made of bioplastic material
Initial data:

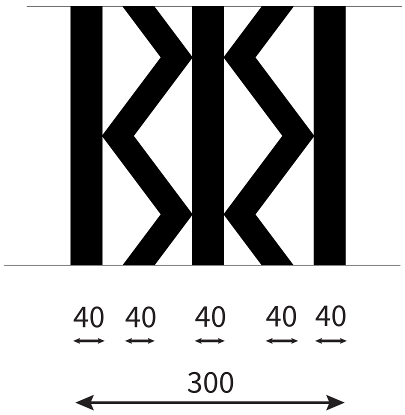
1. type of building - public
2. Location of building - Iceland (climate region Cfc).
3. Design outdoor temperature: text = -28°C (the average temperature of the coldest five-day period with a probability of 0.92)
4. Duration of the heating period 218 days.
5. 5. Average temperature of the outdoor air: tht = -6.5°C.
6. Estimated temperature of indoor air: tint = 18°C
7. Value of normative resistance to heat transfer: for walls Rreg = 2.8; for roof Rreg = 5.5
8. Thermal conductivity coefficient: bioplastic λ=0.087 W/m-C; air λ=0.026 W/m-C
9. Rsi = 1/ αimt = 1/8.7 W/m2 = 0.115 m2×°C/W - heat transfer coefficient of internal surface of the enclosing structures
10. Rse = 1/ αext = 1/23 W/m2 = 0.043 m2×°C/W - heat transfer coefficient of the internal surface of the enclosing structures

Calculation results:

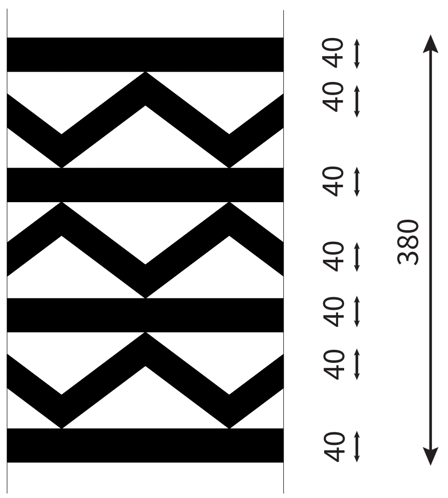
Thermal resistance of the wall: (need to insert a figure: the structure as in Fig.29 only the total thickness of 300 mm)
$R0 = Rsi + Rse + \Sigma\delta i/\lambda i = 0{,}115 + 0{,}043 + 5\times0{,}04/0{,}087 + 2\times0{,}05/0{,}026 = 6{,}303$ (m× ° C / W) > Rreg = 2,8 m× ° C / W - the condition is satisfied

Thermal resistance of the coating:

(insert figure: the structure as in Fig. 30, only rotated horizontally)
$R0 = Rsi + Rse + \Sigma\delta i/\lambda i = 0{,}115+0{,}043+7\times0{,}04/0{,}087+2\times0{,}05/0{,}026 = 7{,}222$ (m×°C/W) > Rreg = 5.5 m×°C/W - the condition is satisfied



Detail 1 - Wall



Detail 2 - Overlap

Environmental protection measures

Looking at the current situation, we can assure that the projected activity will not lead to the deterioration of the state of the soil and the surrounding area.
The project includes measures to protect the natural environment during the construction and operation of the facility:

- rational use of space, formation of the lateral and transverse profile of the plot and the ground bonds in the presence of the covers that are projected, by giving them normative dilutions, which ensure reliable surface water drainage into the closed water supply system with subsequent drainage to sewage treatment plants;
- during the construction and planning works, the full removal of natural vegetative soil for the further storage and use of the soil on the r' runnery; development of vegetative soil in the bark of the piece covers, creation of a reliable turf, which prevents erosion of the soil;
- construction by progressive technology, which allows to minimize the formation of construction waste during construction and provide recycling of the object at the expense of its complete natural deposition after the completion of the term of operation.

The facility does not have any toxic discharges of substances that harm water, air and soil, so the impact on land resources and the landscape is insignificant, and the measures envisaged reduce the possibility of contamination of the ground and groundwater. The impact on plant and animal life is insignificant and is controlled by the size of the zone of influence on atmospheric air.

Location of the facility at this location does not create a deterioration of living conditions of the population, does not affect the social environment and does not degrade the technogenic environment.

Conditions of construction (climatic, geological, hydrogeological)

The site is located in the subpolar maritime climatic zone. According to the meteorological station of the city of Rijk'varik, the average temperature of the air is plus 4.7°C. Winter is mild, with average temperatures in the middle of the month being near 0.0°C, with frequent cold spells and long hot spells. Spring is cool, with frosts occurring in the first half of the year. Precipitation during this period occurs in the form of drizzle or wet snow. The summer is cool, with daytime air temperatures ranging from 10 to 16 degrees Celsius. Autumn is warm and dry during the first ten days, but in the second half of the year it is drizzly, foggy and with frosty nights. The weather throughout the year is slow, with frequent snowstorms and light showers.

The area is characterized by constant winds, the average speed of which is 18.0 m/s. The greatest repetition in the average per year have the winds of the pivnichnoe and pivnichnico-nordic directions, the greatest speeds are observed in the winter, the lowest - in the summer.

For the location of the planned activity characteristic feature are natural landscapes, the creation of which is associated with seismic activity and the impact of the ice. The natural terrain of the area is skeletal with a significant drop to the east and north. The surface of the area is flat, in some places piecemeal. Absolute tolerances of the surface of the land are 50.30 - 51.00 m. The normative depth of seasonal freezing of the ground is 49 cm. The seismicity of the construction district is 9 points.

The ground cover of this region consists of a thin globe of sod-pidzolic soil on ancient diluvial and water-algal deposits, which were under the grass-grass-garlic-mossy vegetation on a crystalline base.

The area belongs to the ecoregion of Icelandic boreal forests and alpine bows. Rustic cover is represented by the flora of usual broadly distributed species with the prevalence in the herbage of grasses with a significant participation of mosses, lichens and sheep's mosses.

In view of the fact that this area is characterized by almost complete absence of wild land SAV (the only land SAV that lived in Ireland before people came, fox), the fauna is dominated by species of farm animals and domestic animals such as the Icelandic sheep, cow, hen, goat, goat and sheepdog, as well as the caribou.

On the area of the planned activities there are no objects of natural reserve fund, as well as areas promising for the creation of reserves, wildlife sanctuaries, paths of migrations of animals and birds.

Engineering support

All engineering systems are designed taking into account the autonomy and conditions of safe operation of the object.

Water supply and water disposal. The design solutions provided for the construction of separate water supply systems: domestic and drinking water and fire-prevention.

The source of water supply of the building for domestic and drinking water consumption and internal firefighting are two artesian wells located at a distance of 85 meters one from the other. Water supply to the sanitary equipment is carried out by the pumping equipment located in the technological room of the building.

To ensure the external fire extinguishing, the project provides for two fire tanks and a fire fighting pumping station. Fire tanks - the buildings of complete supply of 100 m3 of sloplastic, which are installed underground on a plank bed and secured with clamps to the rock base. The reservoirs are filled from the production water supply system. Fire-prevention pumping station - complete supply equipment, which is located in the technological premises of the building. Hot water is supplied directly from a geothermal source with a water temperature of 60°C. Drainage of utility wastewater is provided from the sanitary units by a self-fueling measure to the treatment facilities of utility wastewater. Conditionally clean water after treatment plants in the water-intake facilities flows into the wastewater well. For drainage of sewage and melt water from the territory is provided by means of reasonable planning of the outlets in conjunction with the natural terrain with the subsequent drainage of the closed drainage measure to the drainage water treatment plants.

Electricity is provided by geothermal power mini-power plant brand manufacturer of complete supply capacity of 25 kW installed at 500 m from the public buildings through the distribution board installed in the technical premises of the buildings complete transformer substation. Distribution networks designed by cable VVGng in the appropriate nodes. Consumers of electricity is external and internal lighting systems, ventilation systems, air conditioning, fire extinguishing, water supply, technological electrical equipment, monitoring systems, security, alarm, video surveillance and communication.

The project provides working and evacuation lighting premises svitlodiodnymi lights, exterior lighting svitlodnymi spotlights.

Bliskkozahist buildings provided in accordance with regulatory requirements, before the main provisions of electrical safety.

Heating, ventilation and air conditioning. Heating is provided by geothermal. Water of 90-70°C is used as heat carrier. Radiators with automatic thermostats are accepted as heating devices.

The ventilation is designed as a total supply and exhaust with mechanical and natural ventilation. The rooms for cooling the air in the warm period is provided with the installation of a centralized air conditioning system.

Communication systems and signalization. For the organization of the monitoring system, control and communication the project provides for establishment of main (using 24-fiber optic cable in a lightning cable) and reserve (creation of an interval for radio communication and data transmission) communication channels of different purposes which will be connected to the operating equipment of the corporate data communication and transmission network.

Fire protection measures

According to the master plan fire protection measures provided by rationally planted buildings on the master plan with the possibility of access by fire-engine vehicles on a well-planned area to the facility, architectural planning of the surfaces of the building with the provision of comfortable ways of evacuation taking into account the requirements for inclusiveness.

The project provides for a standard class of fire resistance of building structures and engineering systems through the use of certified fire-extinguishing materials, construction of fire alarm systems, automatic fire extinguishing systems inside and outside.

Interiors

When I designed the interior of the building, I was guided by the idea of integrity. I wanted it to sensitively combine incompatible things and thus be unique and relevant.

The building is completely self-contained and has 2 entrances - the main, on the north-east side of the road, having a sort of inviting view, and the secondary on the west, on the side of the rocks and the bridge. If you want you can also go inside through the doors of the cafe. The building houses not only the observation tower, but also a huge spiral-shaped floor in which there are various functions and rooms, exhibition and spaces with recreations, as well as technical room and storage. The center of the entire composition is nature within the atrium, which gradually, cone-shaped increases with the entire building to the top, thus reminiscent of the impression of a crater of a volcano. Gradually going up from the entrance the visitor can find a lot of interesting and interactive. In the middle of the way there is a robotic cafeteria. Where coffee and snacks are served by two robotic arms. It is believed that one robotic arm is capable of serving 100 coffee orders per hour, which is about the productivity of four people. In addition to recreations and exhibition spaces there is also a lecture hall and a coffeekindow space in the building. Anyone interested can book them for their own purposes or check the building's website for hours and topics of

upcoming lectures. At the very end, in front of the exit to the roof is the so-called A soft and bright room. Inside there are no windows, but only artificial lighting, which every hour launches a different meditative light music, and everyone can lie or sit, relax or even recharge on the soft floor. The space of the building is crowned by an observation tower with a small amphitheater, multilevel platforms and a 360 degree viewing space.

The entire space of the structure is equipped with modern furniture and equipment and adapted to the progressive systems of the future. All engineering communications ensure a comfortable stay.

The finishing materials have been chosen with high performance and environmental friendliness in mind.

The action of light, sunrise, sunset, the departure of the last light, the appearance of the lamp, lighting - this is a dialogue between space and time. That is why it was so important to create a space with both natural light and computer systems. On every floor you can see computer ice panels, which glow continuously and the visitor can choose what will be shown to him. It can be just colored spots or information about the history of the place and the local rocks. Each lamp repeats the curves of the composition of the floor, thereby giving a sense of wholeness to the building.

Iceland cave tower is a rational combination of the function of an escape route and an art object


73%


27 %
Геотермальная
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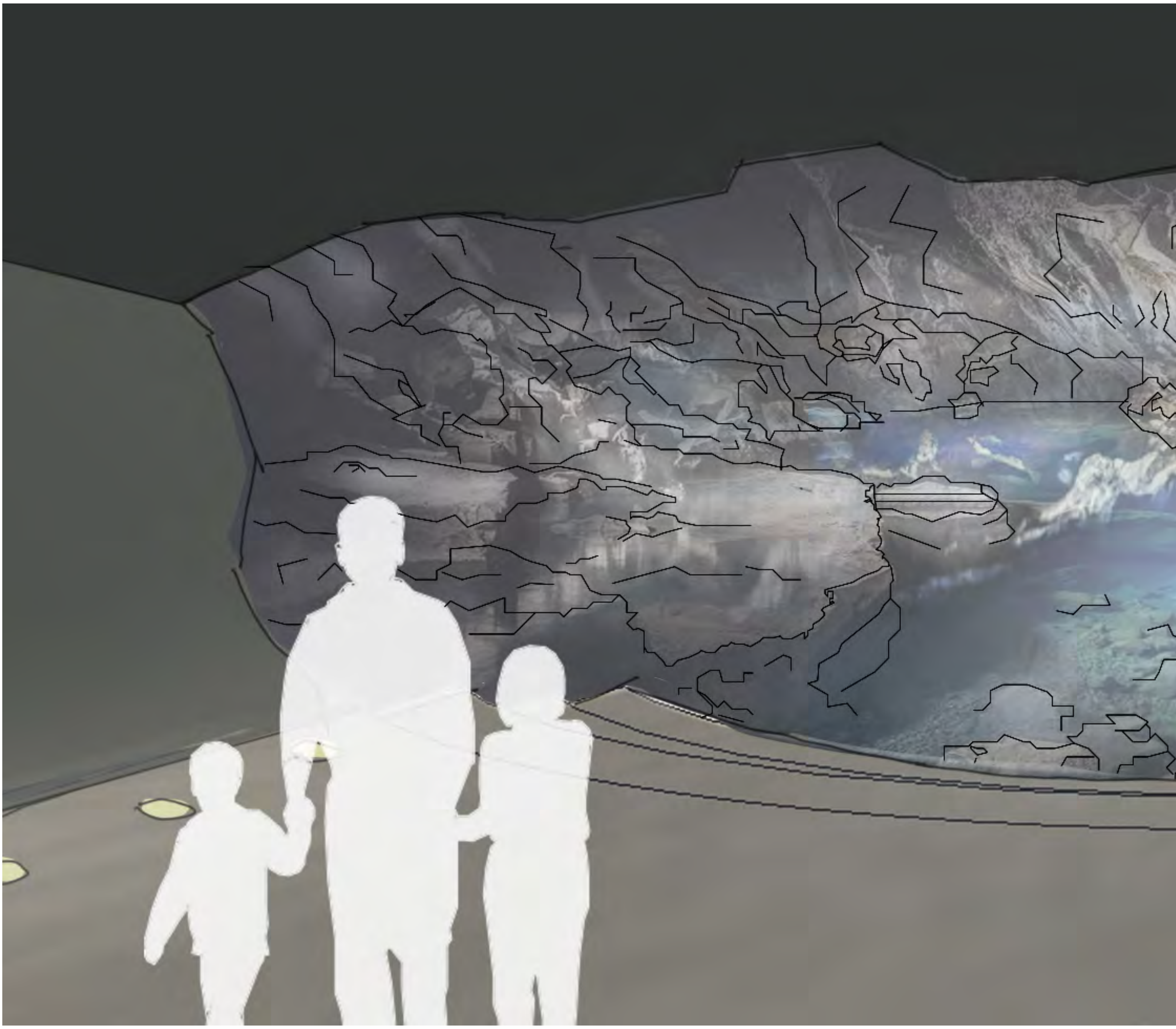

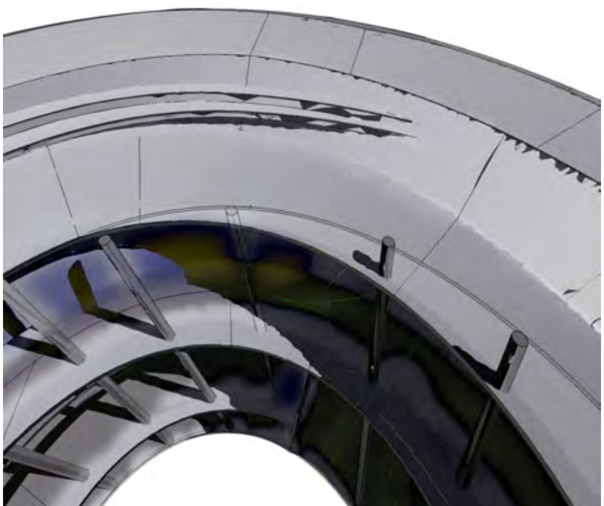

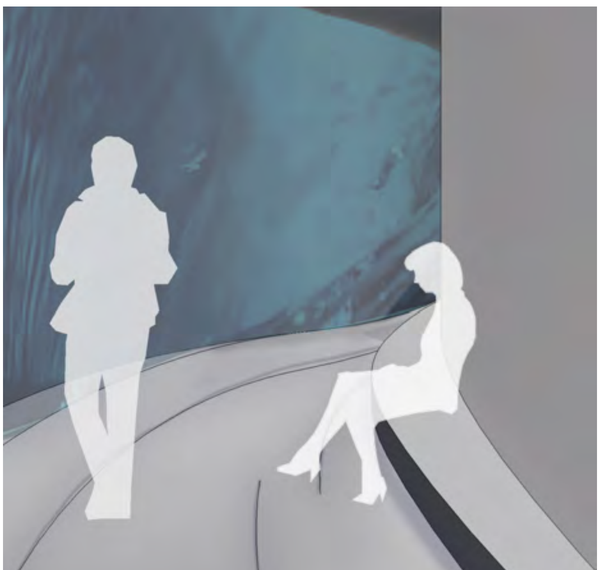

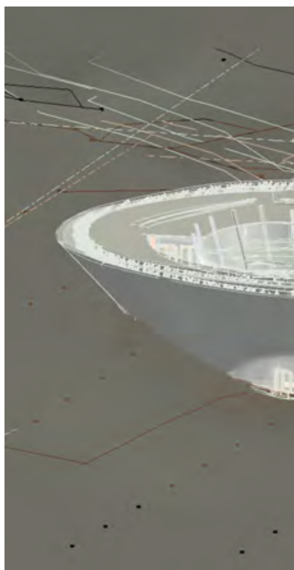

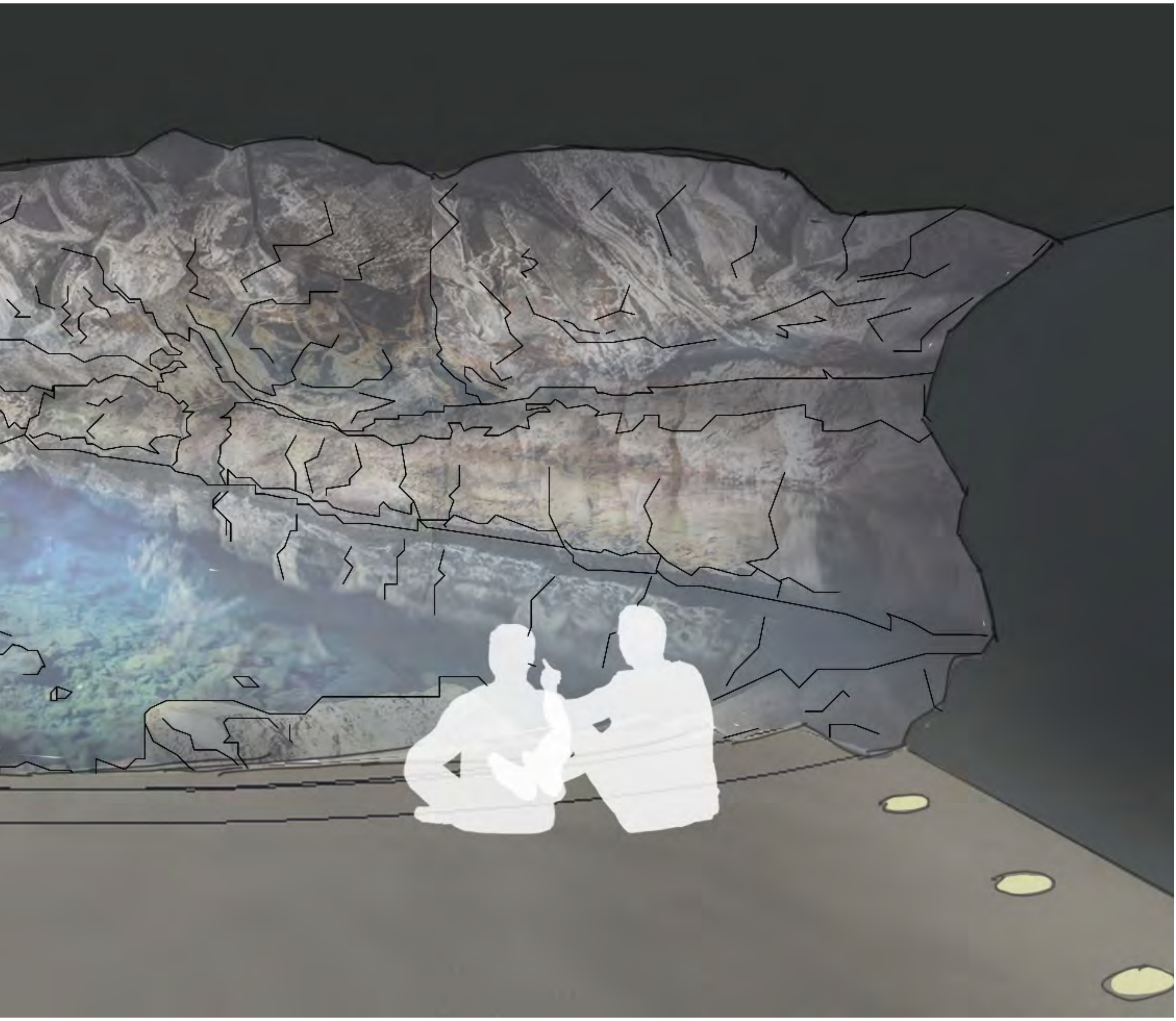

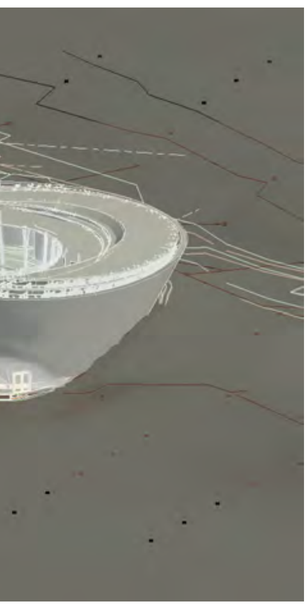

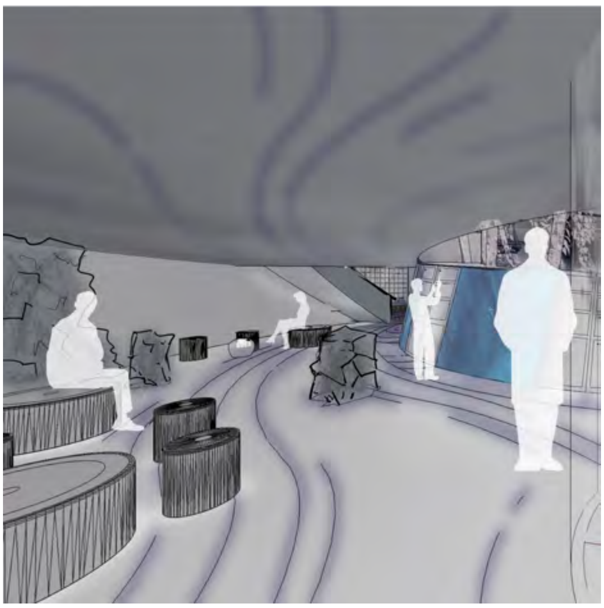

4

Conclusion

Resources

Documentation

Maps and geographic data, web

https://architecturecompetitions.com/?gclid=Cj0KCQiA_c-OBhDFARIsAIFg3ezZOkphaltHMP3bRqu_O9SIyEf9VdmuYW0evWB3F6Tu5W6C9XzyCucaAq4lEALw_wcB

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https://www.lmi.is/

Photos and pictures

https://pixabay.com

https://unsplash.com

https://stocksnap.io

https://pexels.com/

Or they are signed

České vysoké učeni technické v Praze, Fakulta architektury

2/ ZADÁNÍ diplomové práce

Mgr. program navazující

jméno a příjmení: Oksana Nebohatkina

datum narození: 30.07.1995

akademický rok / semestr: ZS 2021/2022
obor: Architektura a urbanismus
ústav: 15116 Ústav modelového projektování
vedoucí diplomové práce: doc. Ing. arch. Miloš Florián, Ph.D.

téma diplomové práce: Islandská rozhledna

zadání diplomové práce
1/ popis zadání projektu a očekávaného cíle řešení

Diplomní práce se zabývá návrhem nové rozhledny na severu Islandu na přelomu dvou litosférických desek. Zároveň prověřuje možnosti urbanistického řešení jejího bezprostředního okolí. Táto práce se věnuje prozkoumaní nestandardních, moderních konstrukčních systému, čím nabízím řešení svého projektu pomocí 3d tisku a za pomoci používaní bioplastu.

2/
Pro AU/ součástí zadání bude jasně a konkrétně specifikovaný stavební program
Pro D/ součástí zadání budou jasně a konkrétně specifikované jednotlivé fáze projektu, které jsou nezbytnou součástí řešení

Rozhledna (schopná pohodlně hostit 5 osob najednou)
Čekárna pro návštěvníky (schopná pohodlně hostit alespoň 5 návštěvníků najednou)
Informační stánek (plakáty, bannery, letáky)
Kancelář (1 pracovní stanice)
Kavárna s nabídkou nápojů a občerstvení (maximální kapacita 20 osob)
WC

3/ popis závěrečného výsledku, výstupy a měřítka zpracování

Odevzdány budou postery v rozsahu dle požadavek FA ČVUT, 2 portfolia (jedno pro účel FA, jedno bude archivováno na ústavu) a CD. Diplomová práce bude zveřejněna dle požadavku studijního oddělení FA ; autorský text, analytická část, koncept řešení znázorněný pomoct schémat, situace 1:1000, půdorysy všech podlaží v meritku 1:200 pohledy, návrh interieru zvoleného prostoru, detail, vizualizace (exterier, interiér). Případne další výstupy potřebné pro prezentaci návrhu. Výstupy a jejich měritka mohou byt vzhledem k vývoji práce upraveny dle dohody s vedoucím DP.

4/ seznam dalších dohodnutých částí projektu (model)
Model

Datum a podpis studenta 8. 9. 2021

Datum a podpis vedoucího DP 8. 9. 2021 Miloš Florián

Datum a podpis děkana FA ČVUT 8. 10. 2021

registrováno studijním oddělením dne 8. 9. 2021

ČESKÉ VYSOKÉ UČENÍ TECHNICKÉ V PRAZE
FAKULTA ARCHITEKTURY

AUTOR, DIPLOMANT: Bc. Oksana Nebohatkina
AR 2020/2021, ZS
NÁZEV DIPLOMOVÉ PRÁCE:
(ČJ) Islandská rozhledna

(AJ) Iceland Cave Tower

JAZYK PRÁCE: ANGLICKY/ENGLISH

Vedoucí práce:	**doc. Ing. arch. Miloš Florián, Ph.D.** **Ústav: 15116 Ústav modelového projektování** **projektování**
Oponent práce:	**doc. Ing. arch. Vladimír Šimkovič, CSc.**
Klíčová slova (česká):	3D tisk, ekologičnost, bioplast, budoucnost, sopka, technologie a design.
Anotace (česká):	Diplomová práce se zaměřuje na návrh nové vyhlidkove věže na severním Islandu na rozhraní dvou litosférických desek. Současně jsou zkoumány možnosti urbanistického řešení bezprostředního okolí. Práce se věnuje studiu a využití nestandardních moderních stavebních systémů. Práce využívá bioplasty a 3D tisk.
Anotace (anglická):	The diploma focuses on the design of a new observation tower in northern Iceland at the junction of two lithospheric plates. At the same time, the possibilities of urban solutions for the immediate surroundings are explored. This paper is devoted to the study and use of non-standard modern building systems. The work uses bioplastics and 3D printing.

Prohlášení autora

Prohlašuji, že jsem předloženou diplomovou práci vypracoval samostatně a že jsem uvedl veškeré použité informační zdroje v souladu s „Metodickým pokynem o etické přípravě vysokoškolských závěrečných prací."

V Praze dne 03.01.2022

podpis autora-diplomanta

Tento dokument je nedílnou a povinnou součástí diplomové práce / portfolia a CD.

Words
of gratitude

I want to express my gratitude to Mr. Florian, for guiding me and always supporting me and for reaching my potential.

To my family for having patience :)

And I would also like to thank ČVUT University for the opportunity to implement my skills through training. It means a lot to me.