



Swedish University of Agricultural Sciences
Faculty of Landscape Planning, Horticulture and Agriculture Science
Department of Landscape of Architecture
Självständigt arbete vid LTJ-fakulteten, SLU
Alnarp, 2010, Urban Landscape Dynamics

Digging into the Landscape

- Preserving Stockholm Urban Green Roof

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Title: Digging into the Landscape

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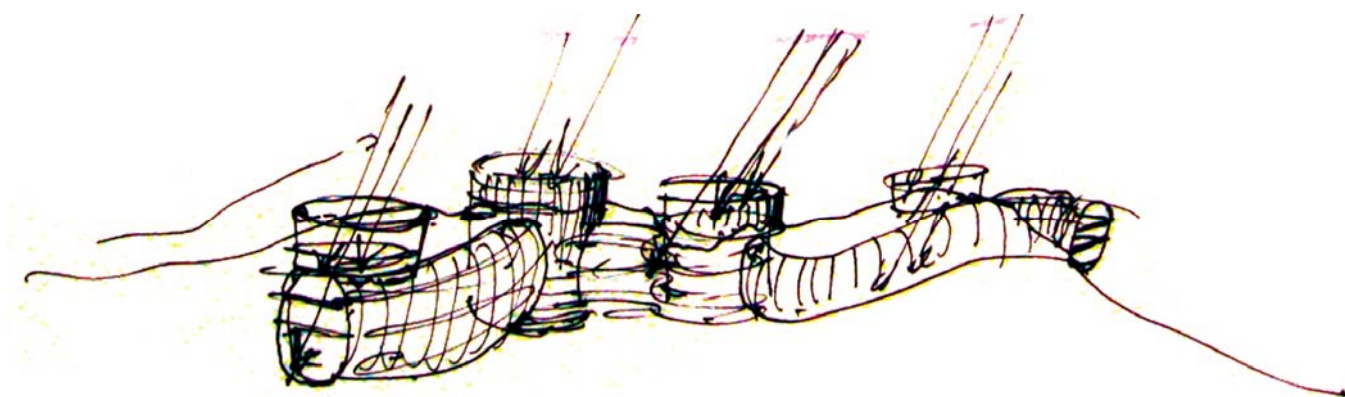
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ABSTRACT

Global warming, heat island, air and water pollution, storm water, greening the environment, social sustainability are issues that green roof is one of best solution to deal with them and that is the reason why green roof strategies are promoting all over the world. Every organization is trying to adopt green roof to its own need and localized it according to its demands and hopefully green roof is the right answer to them. "Digging into the landscape" is a conceptual design approach for a specific site in Stockholm, Sweden not to build another new high technology artificial green roof but to preserve, reengineer and redefine the concept of green roof in urban fabric.

This project is an approach to discover many opportunities that lie in the unknown that dramatically ignored by people and it tries to dress Stockholm in the light and green hues.

Key Words: green roof, networked public places, green urabn infrastructure , underground architecture



Introduction:

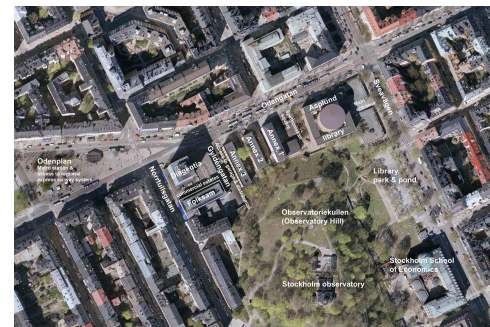
In 2007 Stockholm municipality launched a design competition for the extension of Asplund library. The competition was apparently very successful in term of the quantity of entries and the winning proposal were very eye catching and breath taking designs but surprisingly I noticed that the selected designs didn't take the green potential of the adjacent site into the account and they tried to engulf the green hill by building the surrounded area and therefore blocking the view of this magnificent green hill located at the center of the city so I decided to put myself as a competitor and redesign the project in a very conceptual way and free from program restrictions or construction difficulties to deal with the challenge of redefining the meaning of green roof and preserving the Stockholm urban green roof by the concept of "digging into the landscape".



Issues and aims:

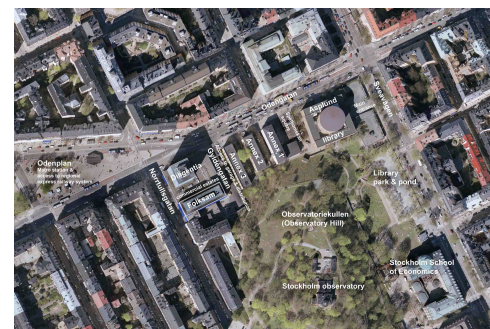
"Digging into the landscape" wants to explore the method after the several and problematical urban sceneries on intertwined and incorporated extent, and finally to generate a different courageous perspective about sustainable design strategies towards the new urban green structure. "Dealing with fragmented land-use map in traditional urban design and architecture, within the open frame of design strategies, urban green structure and the built environment must be reconciled to seek a solution which is both ecologically and systematically effective in response to the global issues we are facing." ¹ In this process I am going to explore these questions:

- Is it possible to redefine a green urban hill to a green urban roof?
- Should we always try to build a green roof or could we take advantage of an existing green surface and make it the green roof of our construction?
- Can I propose a more sustainable, energy saving, environmentally friendly and holistic approach design than winning proposal of the extension to the Asplund library?
- Can "going underground" or "digging into the landscape" help to preserve and promote the existing green urban hill of Stockholm and redefine the meaning of green roof?



Structure:

In the first part of the thesis I am trying to introduce the concept of "green roof" itself, its advantage, systems, type and some case studies of new green roof projects across the globe. The second part will emphasize of the concept of going under ground, its history and some case studies and third part is consist of introduction to the Stockholm urban green hill and the program of designing the extension for Asplund library, exploring the idea of urban green roof and finally sketching a conceptual project on the basis of using opportunity that lie in unknown, beneath the green hill and to dig into the landscape.



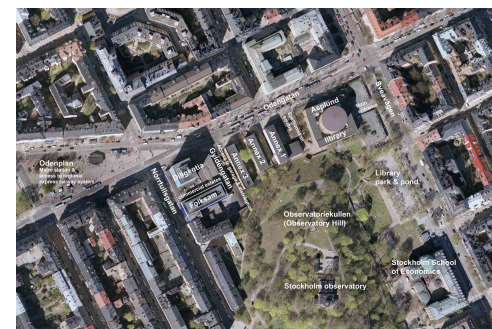
The fundamentals of Green Roof

Green roof as environmental urban infrastructure

"With introduction of the Rio declaration and the Agenda 21 in early 90's, for the first time concept of long-term sustainability of environment was defined. The four independent zones: living, working, recreation, and circulation were derived from the Athens Charter of 1933 as the underlying concept of urban planning." ²

Considering that the world that we perceive is constructed based on substantiality, it's impossible to except cities from other parts of it. From the substantiality point of view, a city can be assumed as a complex network which is made of urban elements, consisting buildings, green space, and the infrastructure. As the most dynamic element, the environment has created the form of the city while formed the space for increasing of urban populations. Beside the infrastructural system which works as the essential practical part, Public green spaces customarily concerned decorating buildings and creation of a ground, welcoming and visually appealing. "This results in an intangible relation among the three constitutive parts (the built environment, green space and infrastructure), which in, buildings take priority." ³ As an answer to the problematic about the solidity of ecosystems, architects and planners proposed the idea of "green building", which can lead to reduction of the overall impact of construction works. Considering that photosynthesis "A single mature tree can absorb co2 at a rate of 48 lbs/year and can support two human being oxygen wise and its effect on absorption of co2 is common knowledge vegetation can be named as an important element in reduction of emission." ⁴

That being said, the need of a system of green infrastructure is obvious. An individual green building can't help us to build a green future for the cities thus greeneries should envisioned as a connected infrastructures within the city and green roofs can visualize the concept of green infrastructure network effectively.

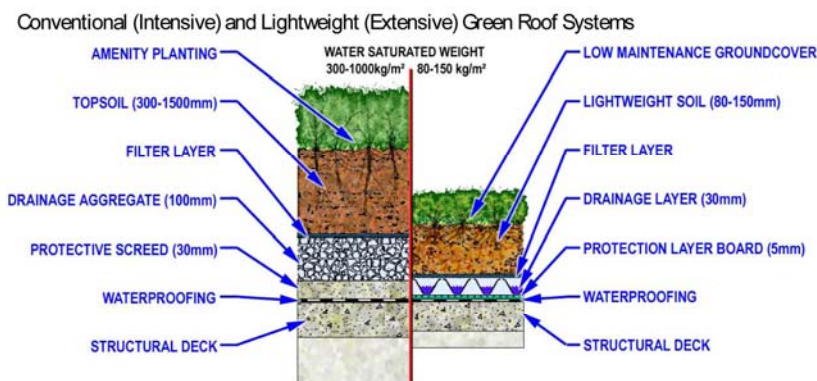


What is Green Roof?

"A green roof can be defined as a roof with some kind of vegetation established either spontaneously or intentionally which could be categorized to extensive and intensive, based on its dependence on water and nutrients.

- Extensive Green Roofs, that are lightweight, have a narrow plant range, and are geared for low maintenance. They don't need watering and nutrients.

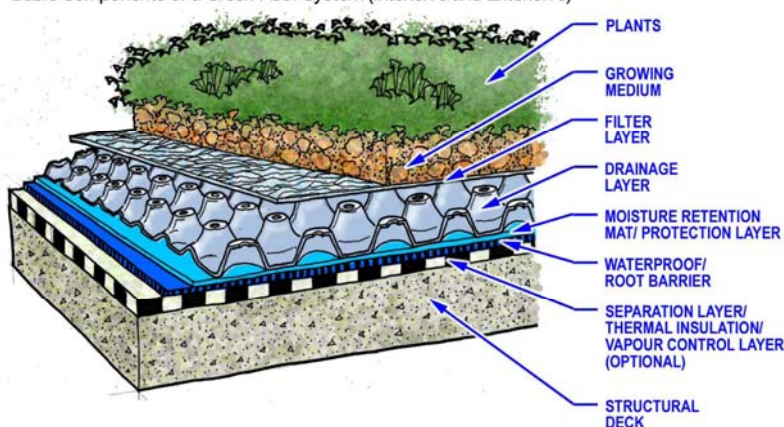
- Intensive Green Roofs that have deep soils, a wide plant choice and are geared for recreational use by human beings. They need watering and nutrients.



(Source and copyright © Urbis Ltd., 2006, adapted from drawings from Greenlink Kusters Ltd.)

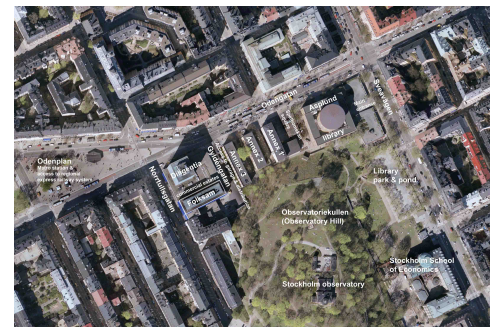
Note: Intensive green roof weights of 300-1000kg/m² refer to the most shallow soil depth needed for amenity groundcover or lawn grass (300mm). A soil depth conducive for successful tree growth (1500mm deep) is likely to weigh around 3300kg/m², excluding the weight and wind-loading pressure of the trees.

Basic Components of a Green Roof System (Intensive and Extensive)



(Source and copyright © Urbis Ltd., 2006)

Intensive and extensive green roof system



Another difference between these two types of green roofs is that the Intensive roof vegetations need attention to prevent the establishment of

unwanted species, whilst extensive green roofs do not. "⁵ In conclusion, the extensive green roof is preferable environmental choice due to the following factors:

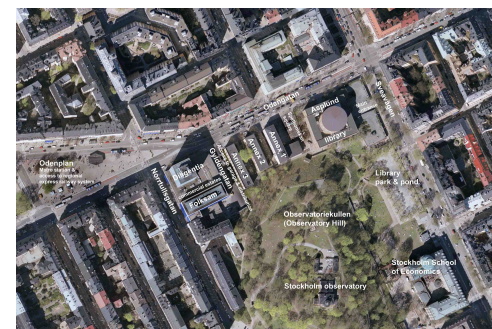
- Lower weight stress on the building,
- Lower capital investment and maintenance costs,
- Lower energy consumption
- Lower water and materials consumption

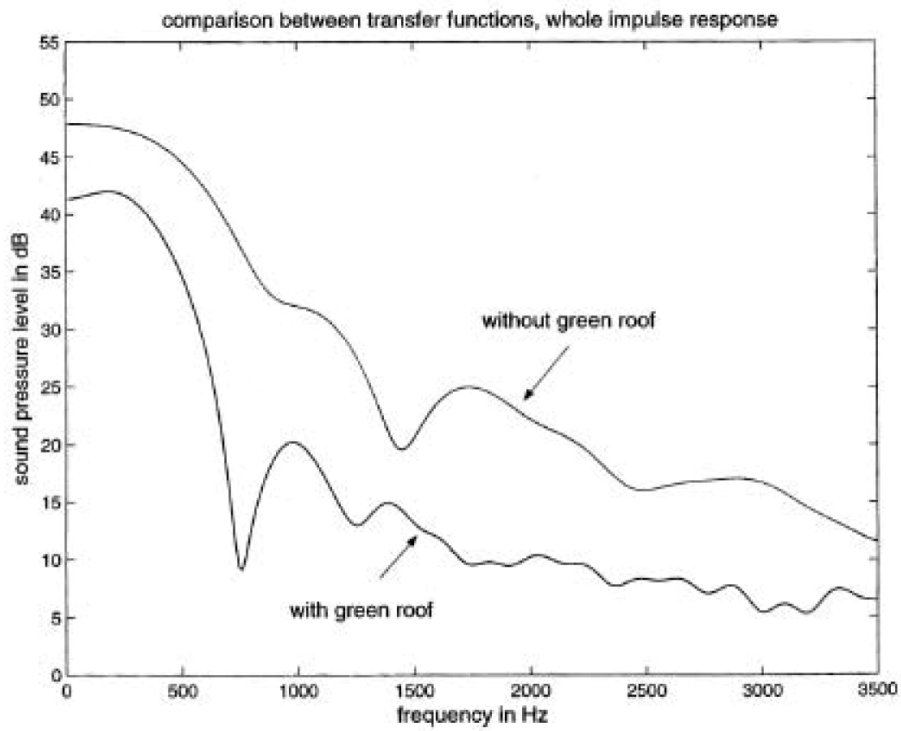
Green Roof and Benefits

"Today, the same concept our ancestors used in order to keep themselves cool in summer and warm in winter, covering their shelters with live vegetation, is regaining popularity." ⁶

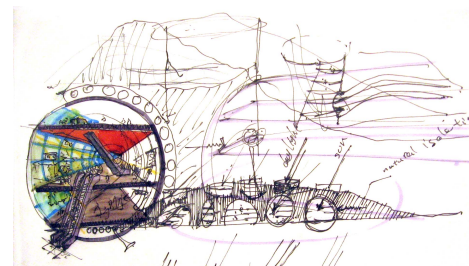
Being energy efficient, having longer life span, filtering harmful air and water pollutants, decreasing the urban heat island effect, Green roofs have many benefits such as :

- **Storm Water Runoff management**
- **Health and Therapeutic Value**
- **Habitat preservation**
- **Reduced Material Use**
- **Reducing Urban Heat Island effect**
- **Increasing Air Quality**
- **Energy Conservation**
- **Increasing average life span of building**
- **Aesthetic Benefits of a Green Roof**
- **Leisure and Functional Open Space**
- **Noise Reduction:**





Comparison between sound pressure level in with and without green roof



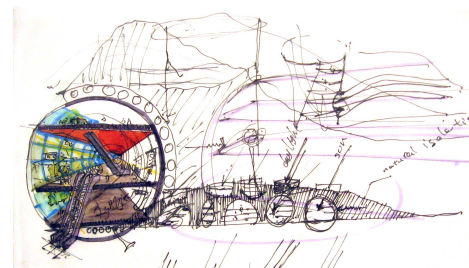
Why digging into the landscape?

Going Underground?

I am going to explore these questions:

- Is it possible to redefine a green urban hill to a green urban roof?
- Should we always try to build a green roof or could we take advantage of an existing green surface and make it the green roof of our construction?
- Can I reach to more sustainable, energy saving, environmental friendly and holistic approach design than winning proposals of the extension to the Asplund library?
- Can "going underground" or "digging into the landscape" help us to preserve and promote the existing green urban hill of Stockholm and redefine the meaning of green roof in much bigger scale?

In recent years, following of expansion of innovative materials and architecture of concrete and glass along with neglecting natural bioclimatic principles and advantages inherited by the humanity, architects and urban planners started to realize the issue of global sustainability of the planet.

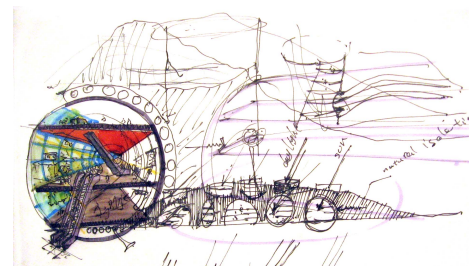


"In case of the heat losses, underground constructions show considerably better results in terms of sustainability." This is not the only advantage of underground architecture so that we can say if 20th century was

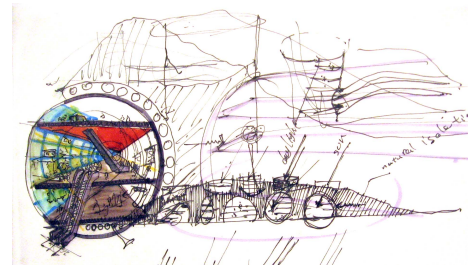
named after skyscrapers, 21st century should be called the age of underground construction.⁷

"System of sustainable development is based on four major resources: space, water, geothermal energy and geo-materials. These are some examples of how this system can contribute to making our cities more sustainable: underground space could be a tool in concentrating urban infrastructures and facilities, in addition placing parking and transportation tunnels; geothermal energy sources stored in the underground can play a major role for heating and cooling, thereby CO2 emissions is decreased; groundwater, as it has been used in many countries, could be the source of drinking water; and geo-materials from urban excavation is a source of construction material which can help in minimizing the transportation."⁸

If properly managed and exploited, digging underground could be a solution for high density and overpopulation problem in certain areas, while it can save valuable agricultural land simultaneously. Considering the high rate of urbanization and population growth, more green space is needed. In this circle of causes and consequences, human kind is the principal beneficiary.



Some of the most ambitious green roof and dug-in projects in the world



Namba Park, by the Jerde Partnership

Year: **2003**

Location: **Osaka, Japan**

Typology: **Mixed Use**

Site Area: **8.33 acres**

Building Area: **130,000 sq meters**

Building Height: **149.05 m**

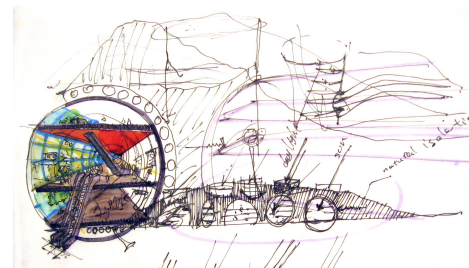
Architectural Design: **Jerde Partnership**



Namba Park creates a dramatic identity for Osaka. A 30-storey office tower and 46-storey residential tower, the project create commercial center with a rooftop park ascending to the street level.⁹

This is a very interesting project because the architects has tried to remodel the whole structure to a green hill in a very dense area of Osaka; in another word they used the green roofs of the offices and commercial buildings for constructing an artificial green urban hill.

The importance of this project is to understand how cities desperately try to build an artificial green urban hill by all means, a situation that already exist in Stockholm ridge; A natural urban green roof, which has survived destruction. However this time the building should be excavated inside the hill.

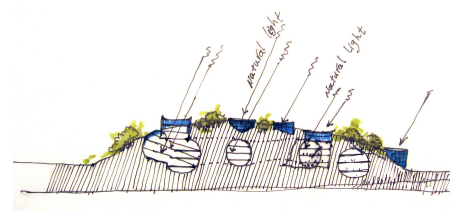




Namba Park is just green hill; its integration with man-made structure creates a very holistic image especially at night.



Namba Park is an effort to utilize the green roof concept in a big urban scale not only in an individual building but also in a larger scale as a network of green infrastructures.

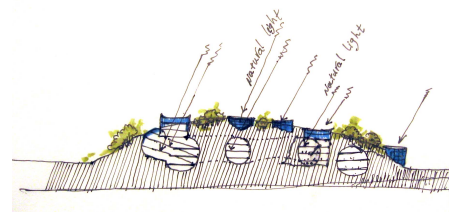


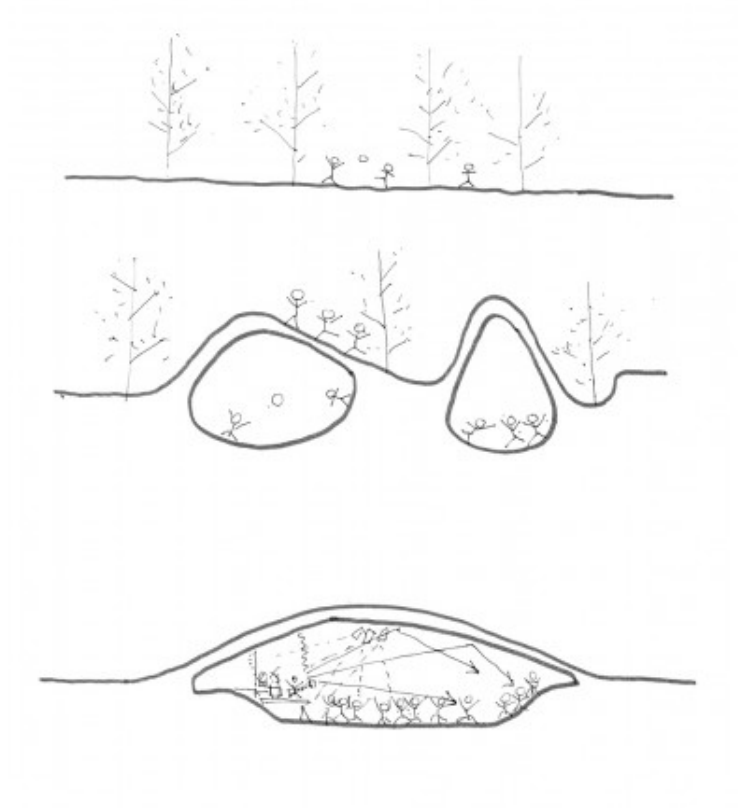
Sports and Leisure Centre, by ACXT



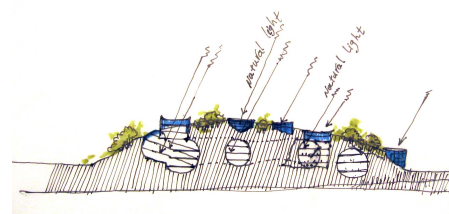
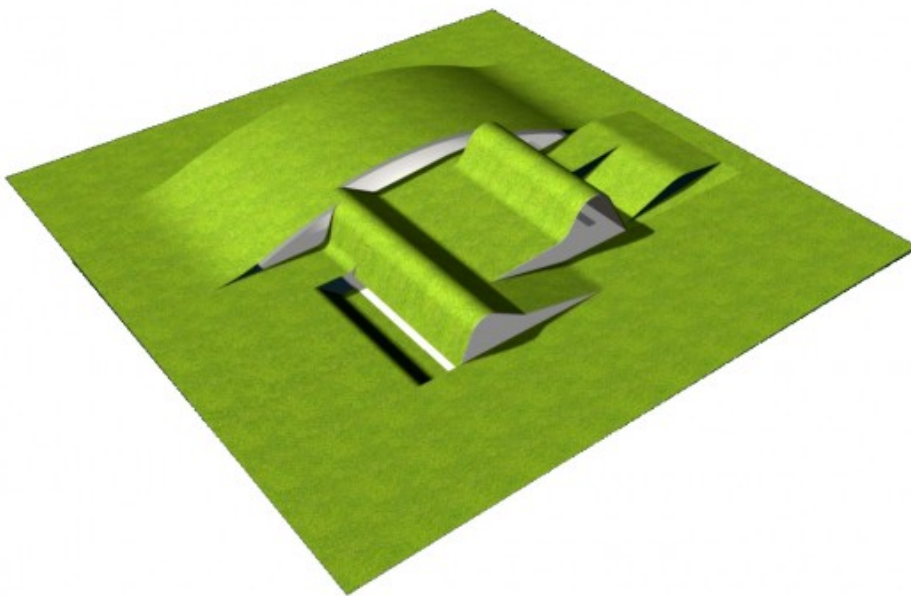
Architects: **ACXT**
Location: **Langreo, Asturias, Spain**
Project Architect: **Javier Pérez Uribarri**
Structure: **NATEC INGENIEROS**
Project year: **2002 – 2006**
Photographer: **Carlos Casariego**

The project concept is to propose a new landscape rather than a new building and also not to waste anything of the existing available land. They have tried to fold the terrain in a way that creates space under and above, so people could walk and play on top as well, the project could be summarized as a curved walk-able green roof on top and a sport facility underneath.¹⁰ However the idea of walk-able green roof didn't work and at the time of inauguration they decided not to let people on top, because of safety measure and maintenance cost. Again this project is an attempt to depict a small green topography in an urban area, however it practically failed, but it does visualize a green hill. Looking at Namba Park and this project shows the trend of creating green hills, even artificially, in dense urban fabric areas.





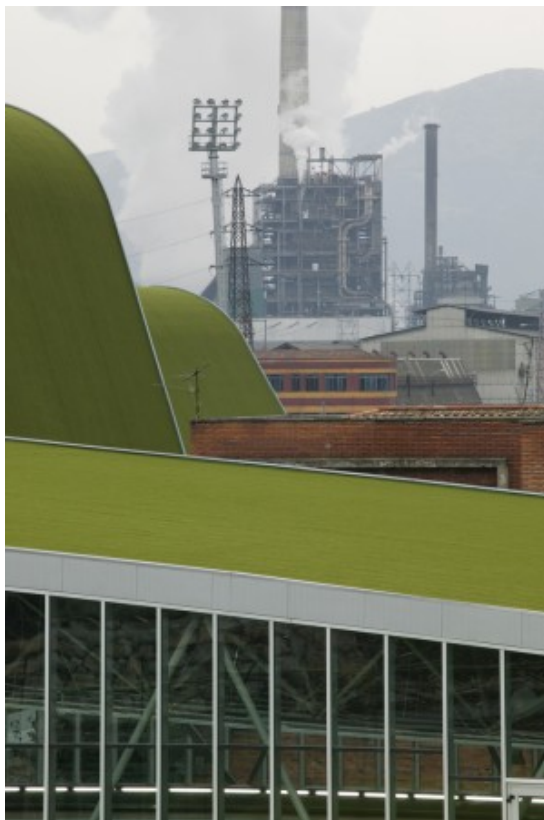
The concept of this project is to fold the terrain and create space underground and on top as sport fields and leisure facilities.



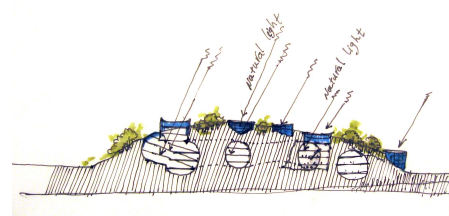
Folded green terrain resembles a giant continuous green roof that provides space for activities on as well as under it.



Constructed project in a very industrial urban context surrounded with a warehouse and residential houses with traditional roofs. The green roof of the project looks like a green topography from distance.



The contrast created by the green roof of the construction and the industrial context of the neighborhood is shown perfectly in this picture.

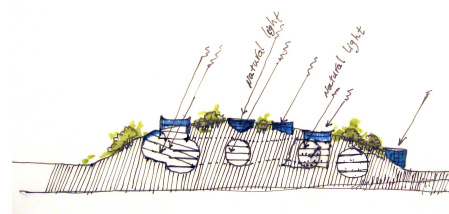
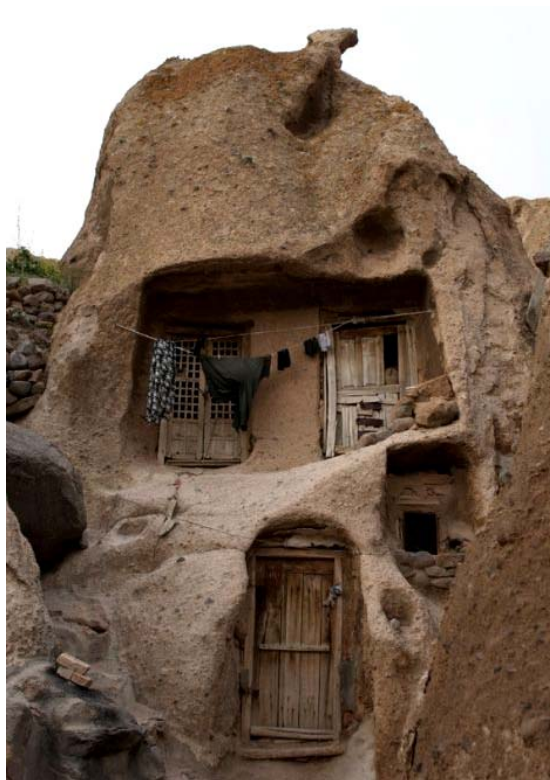


Kandovan, a Dug-in City

Kandovan is a village in the province of Azarbaijan, Iran. It is popular for its troglodyte dwellings. Some of the houses are at least 700 years old and are still inhabited. It is similar to Cappadocia in Turkey. In this village people have carved out the rocks and made their houses inside these rocky cliffs.¹¹ Kandovan is a very primitive but original sample of dug-in project. These People has tried to benefit the most from their surrounding natural infrastructure and make their houses by reducing the mass of the cliffs and excavating them.



An overview of village



Ab Anbar, Water Reservoir

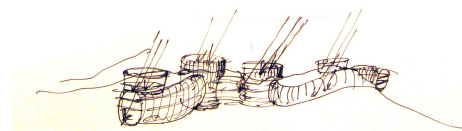
An ab-anbar is a traditional type of reservoir that was commonly built in Iran for preserving water in dry climate, its cylindrical structure dug in the ground and commonly could be recognized by a dome and wind catchers on the earth. These water reservoirs are consisted of four key elements:

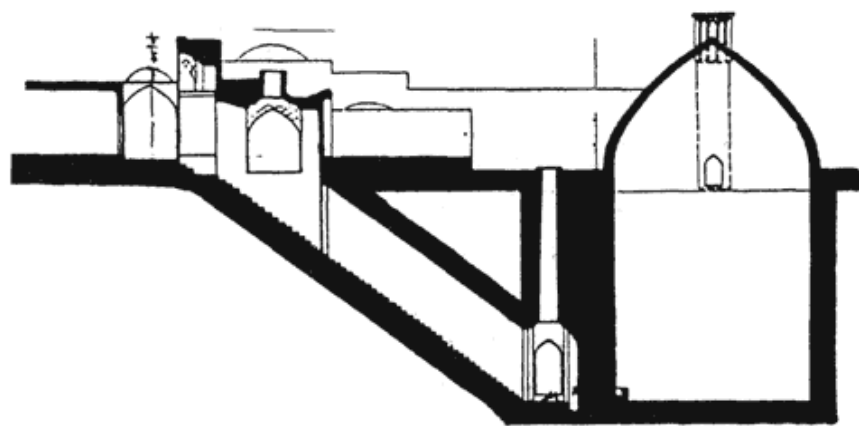
- The underground reservoir
- The Pasheer or platform
- The dome, which is the entrance to reservoir
- The Badgir or wind catcher shafts, which provides ventilation ¹²



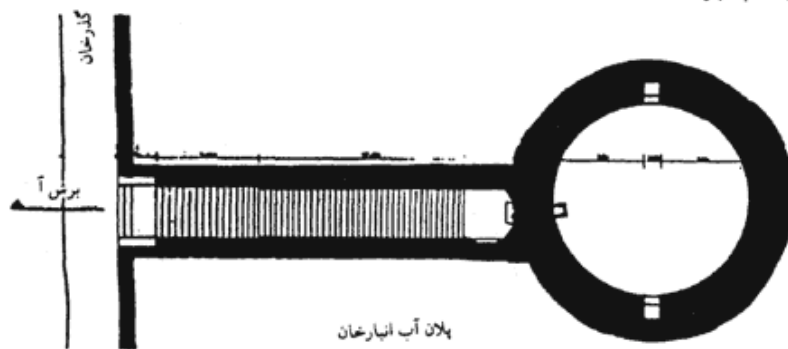
Dome and wind catcher section, the visible on the ground structure

These traditional water reservoirs are another example of underground hybrid architecture. They try to go underground, to benefit from its temperature difference with surface in hot climate, to collect water during the winter, and reserve it during the summer time. Water reservoir is a very good example of my proposal because it shows that building underground structures is an old strategy that has been used for a long time and it still could be an option in sustainable design and reducing the energy consumption in a building.



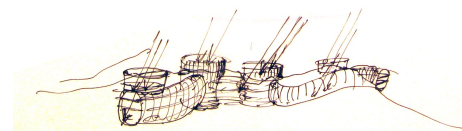


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This picture shows the schematic space underground and on the ground, including water reservoir, dome, wind catcher, stairs and entrance. Apart from the idea of going underground, the layout of water reservoir is very similar to my proposal. It has the same vertical cylinders to let the air and light go inside, a core and the concentration area where belongs to the main function, tunnel shaped stairways to connect the structure, and the entrance.



Sky Table, by Ayrat Khusnutdinov

Year: **2009**

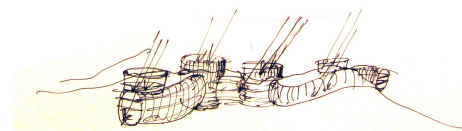
Typology: **Mixed Use**

Architectural Design: **Ayrat Khusnutdinov**



Ayrat Khusnutdinov has designed the "skyscraper table" for the evolo 2010 skyscraper competition which brought him the special mention for his proposed entry. "This project unintentionally tries to depict a hanging garden or a hanging green hill. The necessity of a green topography in a dense urban context is depicted here once again, the will to have an artificial green hill at any price".¹³

To me, aside from the beautiful design and interesting issue that it addresses, this project is too ambitious, not to mention being somehow technically impractical. Also the sky table blocks the view to horizon while it casts shadows on the buildings beneath. As much as this construction provides a good view for its residents, I think it harms the total scenery of the city.



Miho Museum, by I. M. Pei

Year: **1996**

Architectural Design: **I. M. Pei-Architect**

Location: **Shigaraki, Japan**

Typology: **Museum**

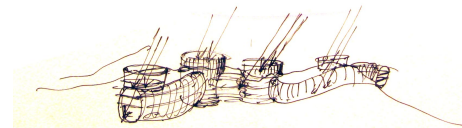
Site Area: **1,002,000 m²**

Building Area: **9,241 m²**

I. M. Pei's design, which he came to call Shangri-La, is executed in a hilly and forested landscape. More than 70% of the project situated underground, carved out of a rocky mountaintop.



This is a very interesting design in term of constructing. They excavated the ground and then built the museum. After completion they have put back the soil on the top of the structure and planted the greenery back just like before the construction. The main entrance to the museum after a bridge is a tunnel to the main section and the idea of going underground in this project mainly used to maintain the existing situation of hill and fulfill the local concern of environment. The scale, the tunnel shaped base, and the objective of this project is very similar to my strategy for design and it is very inspiring to me.

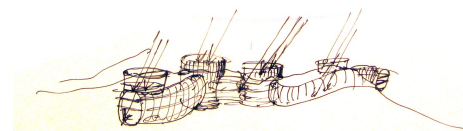




Crossing from the bridge to the tunnel structure dug inside the green hill



More than 70 % of the project laid underground and the green hill engulf the project.

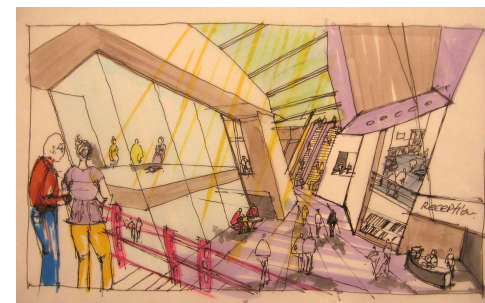


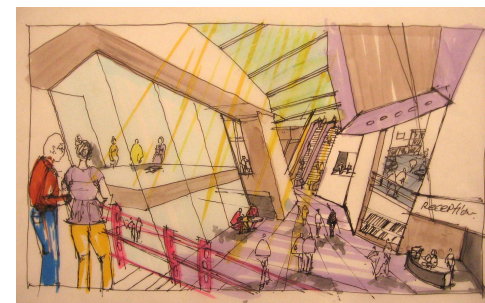
High Line, New York

Changing the rustling dilapidated overhead rail structure on the far west of Manhattan to an urban green roof path in New York is a project proposed to reuse an abandoned existing urban infrastructure of the public transportation as a greenery. A very good lesson that I learned from this project was to see how by being ambitious, courageous, and imaginative a threat and left over space in a very dense area of Manhattan could be redefined as a very pleasant green pathway.¹⁴



A two miles curved green path running through the dense urban area in Manhattan with the highest property value could be only a dream, but they made it happen. This case, like the projects mentioned before, shows the trend of the network of green structures in the dense urban fabric all over the world from Osaka to New York.





Urban Forest, by MAD

Architect: **MAD Ltd**

Location: **Chongqing, China**

Structural engineer: **ARUP Group Ltd**

Design Year: **2009**

Site Area: **7,700 sqm**

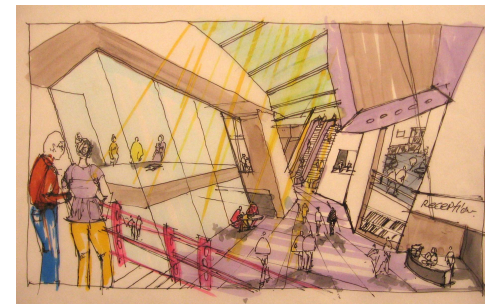
Construction year: **design-in-progress**

Constructed Area: **216,000 sqm**

Building Height: **385 m**

Photographs: **MAD**

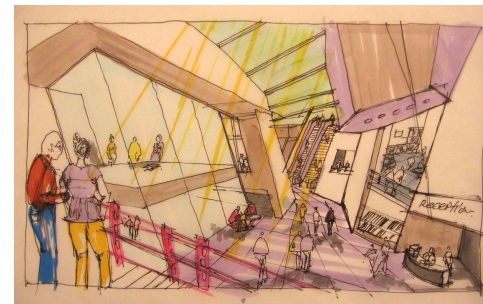
In 2009, MAD designed a 385 meter high cultural complex in the city of Chongqing, The Urban Forest. The concept of project is recreating the image of green hill.

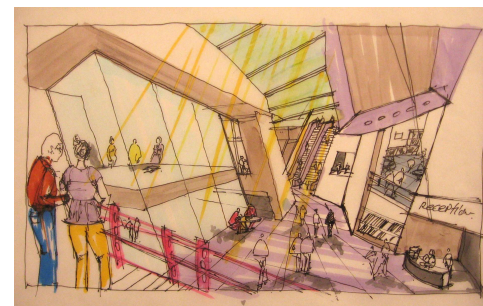




The original concept derived from an old Chinese painting representing a green typical topography

As it is shown in these buildings again the concept of the project is retrieving an image of a green mountain in urban fabric. As a result of rapid urbanization all the natural and green areas were demolished and now the designers search for a way to reproduce the concept of mountain and green hill in one of the densest urban space in the world by proposing the concept of urban forest.¹⁵ By looking to similar projects we can understand the value of Stockholm green roof and its existence in the urban fabric. At the time when many metropolitans are seeking desperately for urban green topography and network, such green infrastructure already exists in Stockholm. The only thing we need to do is to preserve it and give it a more important role, by defining a constructive and sustainable strategy for the future of its urban development.





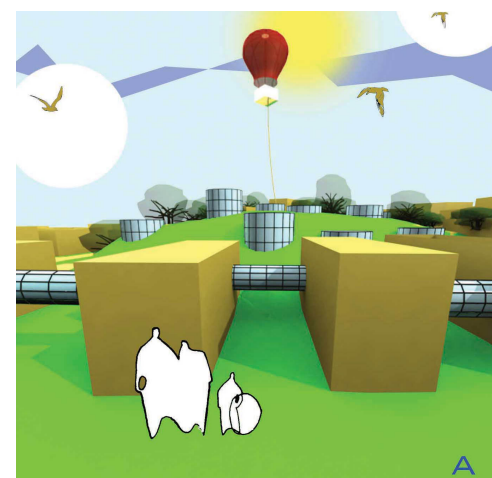
Green Roof, by Samoo Architects & Engineers



The giant green roof design for Seoul covers 131 acres that gives an “eco-upgrade” to the existing commercial center by inserting an extensive public roof garden. The roof itself is a huge urban park.



The concept of this project, as it has been shown in the picture, is covering a market with a green roof. The biggest green roof proposal I have ever seen, and it shows the existing interest for green-networked infrastructure and the need to create green topography in urban fabric.



California Academy of Sciences, by Renzo Piano



Year: **2008**

Location: **San Francisco, USA**

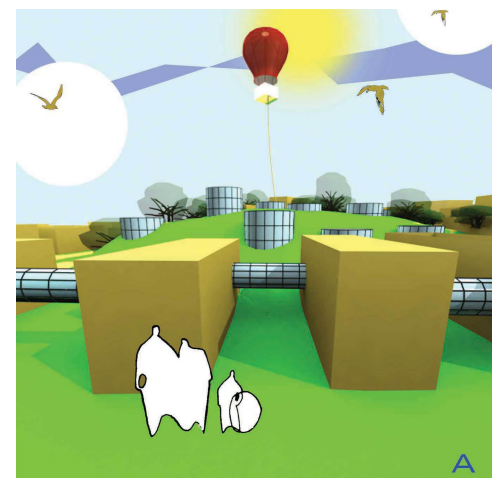
Typology: **Museum**

Site Area: **2.5 acre**

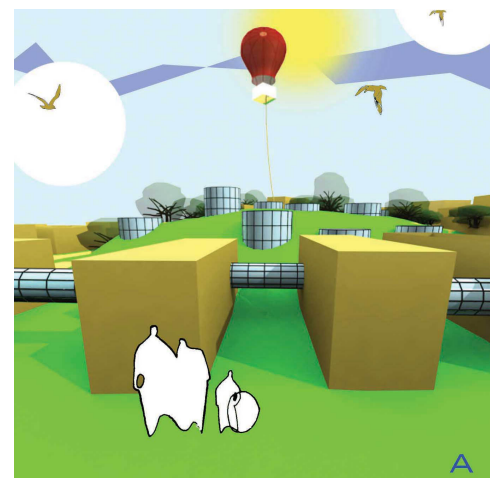
2.5 acre green roof blends and mixes with the native plants and surrounding of San Francisco, the building is one of the ten pilot projects of green building and it use 30 percent less energy than standard code for this kind of a buildings.¹⁶



The section of this project is very interesting as it shows how the architect has tried to assimilate his design to the surrounding area and topography. The curved shape of the green roof is blending with the surrounding nature and environment. The trend of creating topographical green structures could be traced in this project as well. And an innovation is to bring the natural light in by the circle shaped windows



on the roof, which is a very good adaption of Islamic architecture in the terms of taking the light from the top of the dome into the interior space.



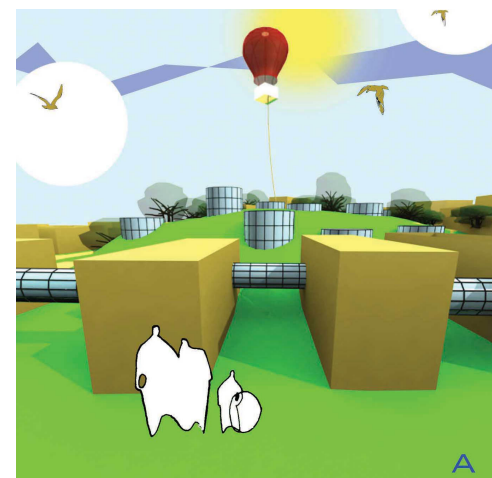
Slowtecture M, by Shuhei Endo



Architects: **Shuhei Endo**
Location: **Hyogo, Japan**
Project year: **2008**
Site Area: **1,124,000 sqm**
Constructed Area: **16,168 sqm**

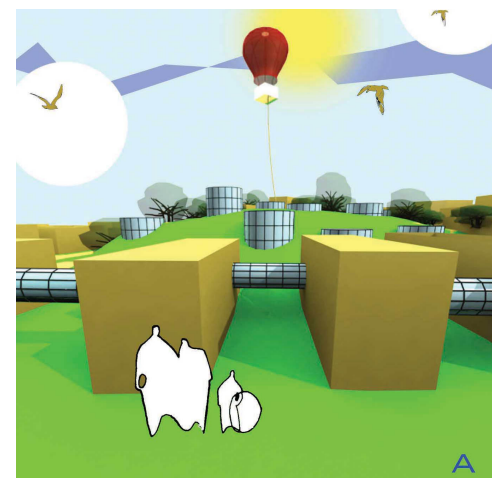
This project, including two main courts and 1500 seats, basically served as an emergency center for unpredicted natural disasters. Its outside shell is covered by vegetation and serves as a green roof.¹⁷

Covering the outer shell with the vegetation make this project look like an artificial man made hill in a very green area which has two main benefits. First assimilating the project to the neighborhood and then decrease the consumption of energy for heating and cooling the interior. Also creating a green network with the surrounding green area is considerable.



Conclusion:

As we saw in these case studies, a trend to create a green urban landscape is obvious. This goal has been approached by different means varying from a high rise building devoted to offices and green space "urban forest", resembling a typical Chinese mountain, to a folding strategy which create playground and walking space or even artificial green topography in urban context. The common points between all these projects are that first they want to answer the need for more green space in a dense urban fabric and second they all have the agenda to resemble a green hill. In "Stockholm College District" the urban green hill already exist so the design should be done vice versa by creating a function under the hill to empower its urban role as an existing greenery, which has surprisingly survived yet, and try to preserve it not by a "don't touch policy" but by redefining its meaning and its role with a lasting, sustainable solution.



Where, Why and What to Dig

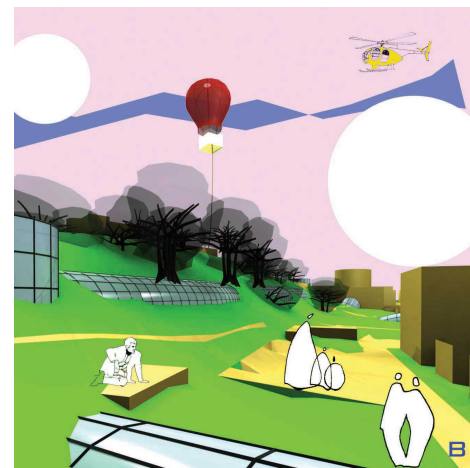
A Taste of "The Stockholm Ridge" In "Stockholm College District"



Asplund Library designed by Gunnar Asplund



Stockholm ridge known as Stockholm College district as shown in above photo



"Stockholm College district lies in the northern part of Stockholm Ridge and due to its great cultural values it has been named an area of national interest by the Swedish National Heritage Board. In other words, this environment is considered, to have such great cultural values and to be of great importance to the whole country." ¹⁸ This area is characterized by both its distinctive topography and its unique buildings, designed for learning and education purposes by the most prominent Swedish architects of the time including Gunnar Asplund, Paul Hedqvist, Ivar Tengbom and Erik Lallerstedt.



Paul Hedqvist



Gunnar Asplund

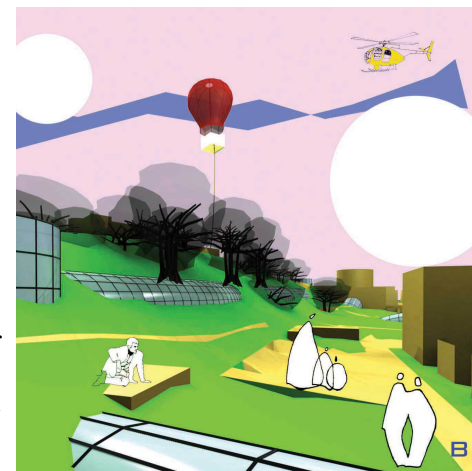


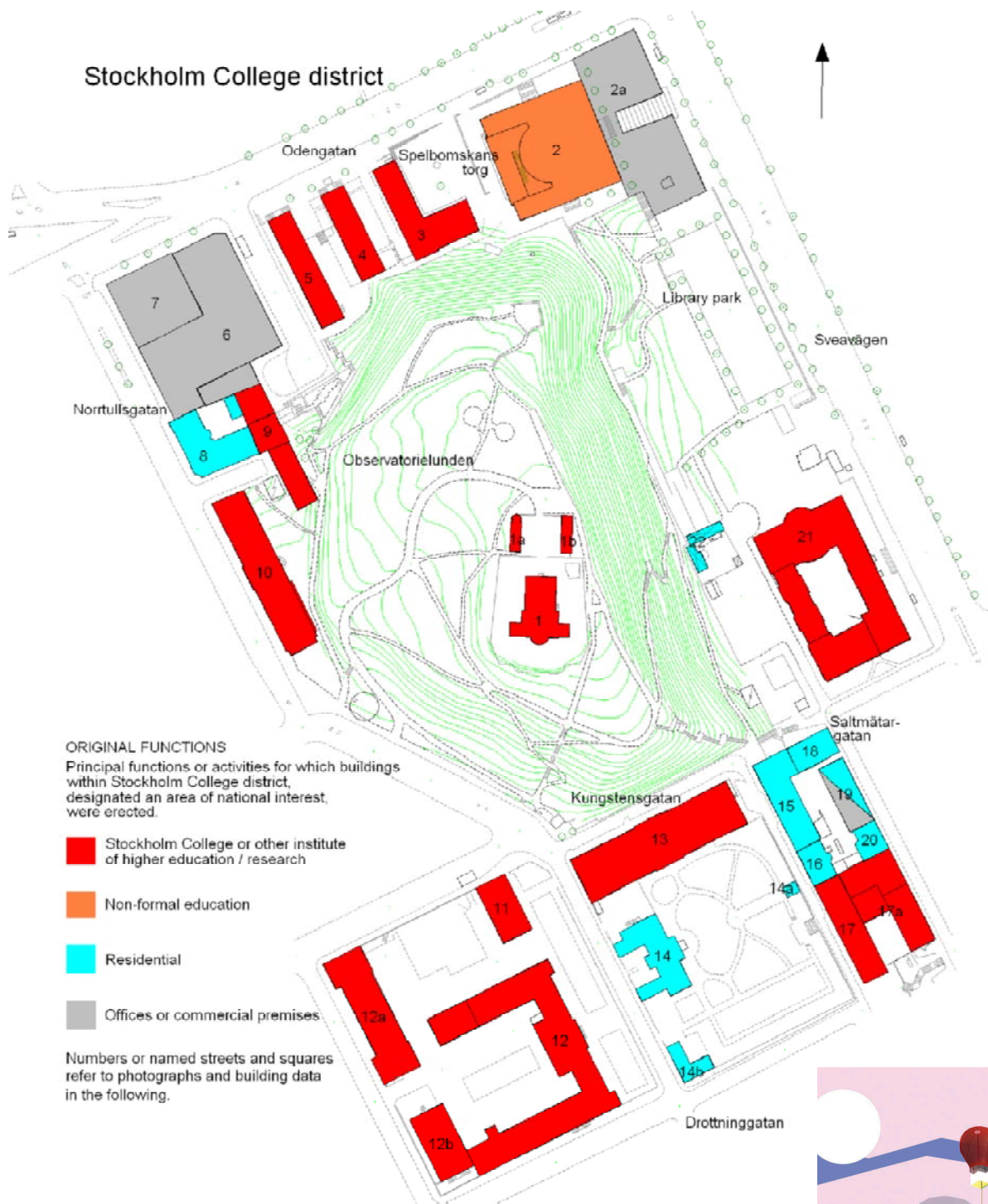
Ivar Tengbom



Erik Lallerstedt

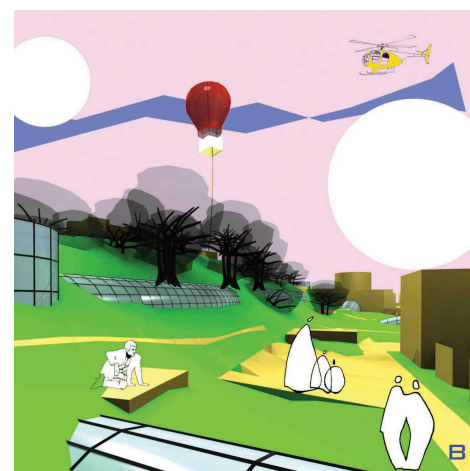
These four famous Swedish architects were engaged with design of Stockholm college district, including Annex 1, 2, 3, observatory and Asplund library. As a result the area has a great architectural value.





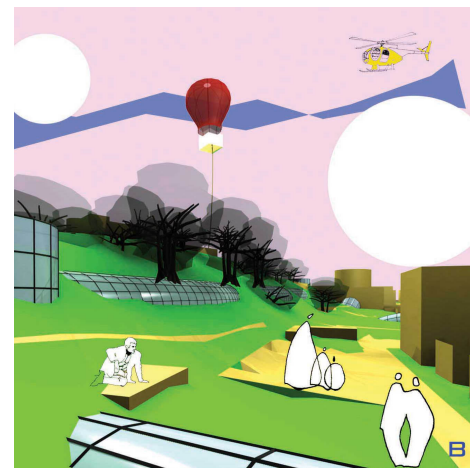
As it is shown in above map all the buildings are marked by different colors categorizing their function. Below is the list of all these building:

- 1, 1a and 1b: The Old Observatory: observatory for the Royal Academy of Sciences, Architect: C. Hårleman
- 2: Asplund Library, Architect: Gunnar Asplund
- 3: Art Library
- 4: Annex 2, Architect: Erik Lallerstedt



- 5: Annex 3, Architect: Erik Lallerstedt
- 6 and 7: office property
- 8: Residential Building
- 9: The Stockholm college institute of organic chemistry, Architect: Paul Hedqvist
- 10: The Stockholm college law and arts faculties, Architect: Erik Lallerstedt
- 11: The Stockholm institute of technology mining school
- 12: The Stockholm institute of technology
- 12a: The institute of technology laboratory building
- 12b: The Stockholm college zootomical institute
- 13: Stockholm College, the oldest of the Stockholm college buildings
- 14: the suburban residence, Scheffler Palace, The Palace garden, known as Spokparken- the Ghost Park
- 15: the Stockholm college student union building
- 16 and 17: Residential building
- 17a: extension to the union building
- 18, 19 and 20: residential building
- 21: the Stockholm school of Economic
- 22: a small house with a playground

As it is indicated, this area is full of buildings designated for educational and cultural activities. These buildings engulf the existing green topography, which has remained from Stockholm ridge. The only building on top of the hill is observatory tower, which was built in mid 18 century. It is the highest building and it is well recognizable from the four corners of the site. Its height and its visibility from the street has been set as a limit for any building that was going to be erected on this area, even for designing Asplund library it was an obligation to limit the its height to an extend that observatory tower would be visible from the street.

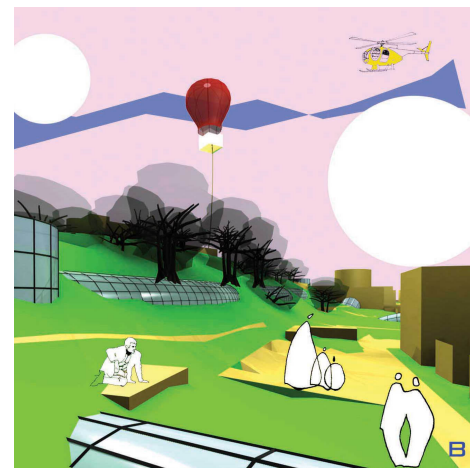




Asplund library, view from observatory hill



View to the hill from Odengatan Street, the hill is visible through the annexes





The north View of the library and hill, the visibility of hill and the library was an obligation in each development in college district.



View from northwest to library and hill





Library and hill are almost visible from any angle in surrounding area but future plan for this site put this privilege in danger and it will probably block the pedestrians view from certain angles.

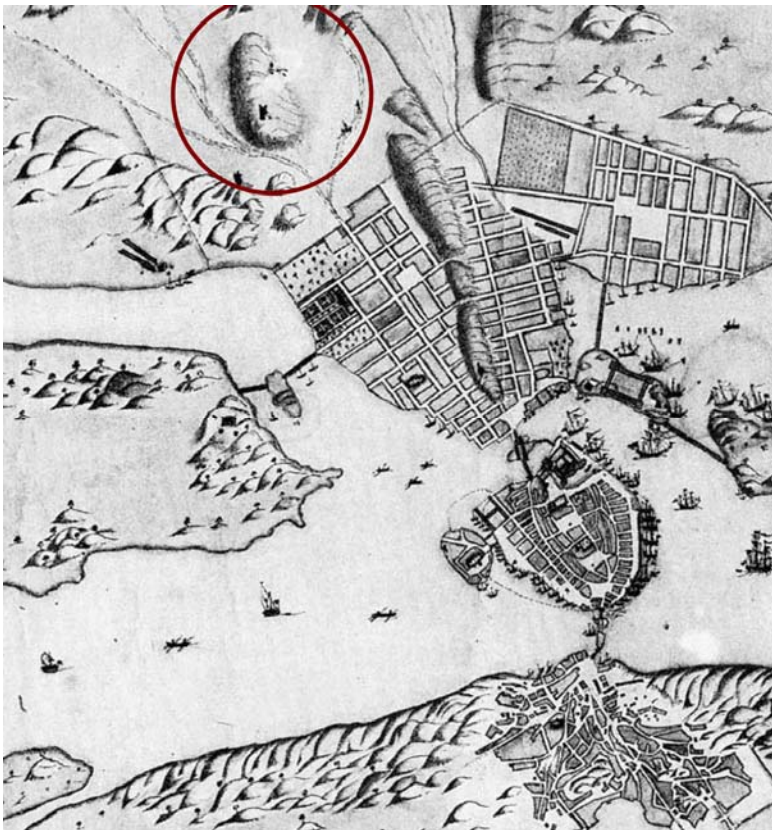
As it has been said, the area benefits from different and various cultural and educational institutes while a green topography enrich the space value of the district. Then again, the green hill is operating more as an obstacle than a green yard for these building which gives them the chance to connect and interact with each other properly .In addition, even though the visibility of hill from the street has been remained, it barely attracts pedestrian to itself from shopping center and metro stations.

The Stockholm college district is an exceptional example of buildings and a green hill interwoven in an urban fabric and as far as I know no other example could be found anywhere else.

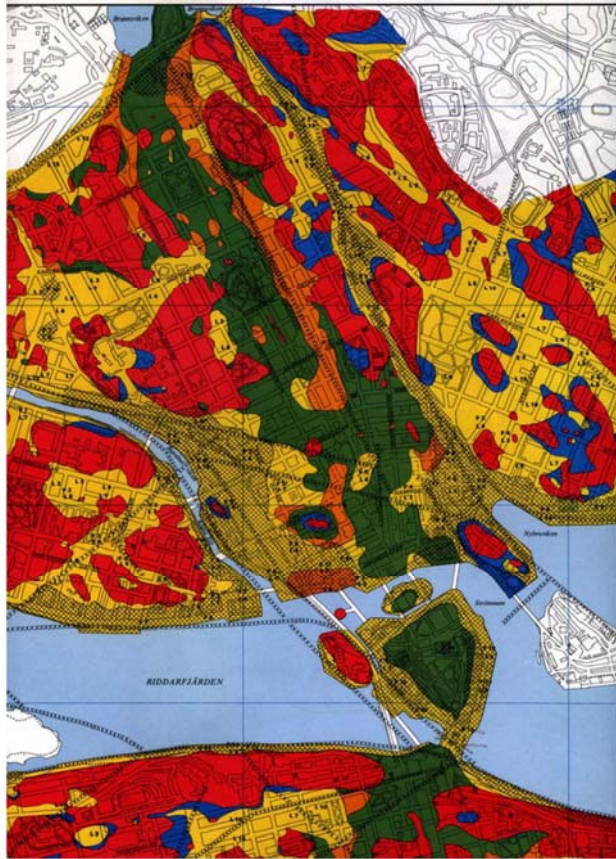


The development of the area, old maps and drawings

"Stockholmsåsen (the Stockholm Ridge), runs from north to south through the city. As the city grew, this ridge proved to be both an obstacle and a resource. It was an obstacle to laying out straight streets and uniform city precincts, but a resource in form of gravel that could be used for building purposes." It has in any sense put its stamp on the urban landscape and still does so. Today the Stockholm Ridge is visible in only three places in the City of Stockholm, of which Observatoriekullen (Observatory Hill) is the only one in the inner city. The Observatory was built on what was remained of the ridge because it was one of the highest points in the city. The Observatory in return has been an important reason why educational institutes have been erected around the hill. Basically we can say that Stockholm Ridge is the origin of this development.¹⁹



Mid 17th century, the Stockholm Ridge appears as a very visible and characteristic element in the city



Geological map, Green represents the direction of the ridge

Extracted from the map of the whole city, dated 1751. Observatory hill can be seen and the ridge is still half remained extending to the north.

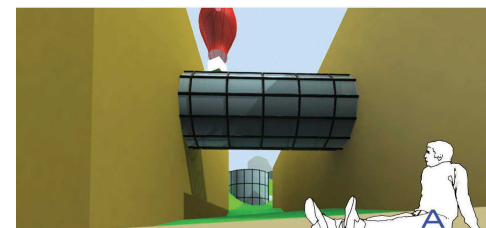


North east of observatory hill in 1780s



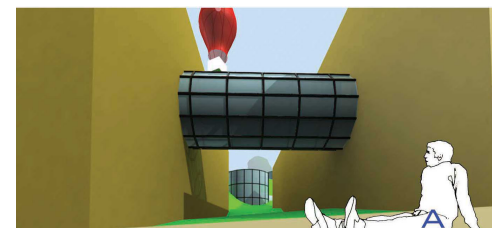


Observatory Hill, 1853, most of the ridge is excavated and exploit nothing is remain except the present hill and observatory.





Part of city map, 1930. Streets have been laid out, library has been built and observatory Hill is very clear on the hilltop. The current network of streets around the Observatory has now been laid out. Stockholm Public Library has been built. Observatory Hill is by that time the only visible remnant of the Stockholm ridge in the inner city.

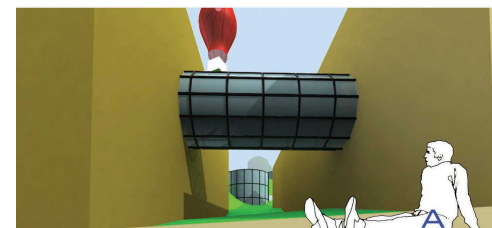




North-east, 1924.before library has been build



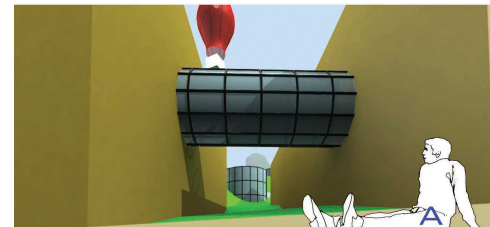
Public library and library Park in 1938



Conclusion

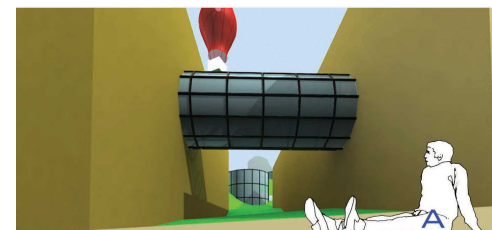
Green roofs have numerous benefits as mentioned before and in my belief it is necessary to create the concept of green network in urban structure to benefit the most from this phenomenon. Through my research of green roofs I accidentally found the site “Stockholm college district”. I studied its history and became aware that during the time the “Stockholm Ridge” has been treated more or less as a barrier than an opportunity in every development plan. People have always tried to eliminate it and this intervention process has been shown in the history of the site. I find this site an opportunity to redefine this green hill as an urban green roof by going inside the existing topography. Usually in green roof projects architect design a building and then, if there is still budget, they make the rooftop green. But here we have a natural green roof, which is filled with soil and rocks underneath so I assume by going underground I could redefine the existing situation in a constructive way. I accept that it is not by definition the typical green roof but it conceptually can conceive as an urban green roof.

For Clarification, by "existing green roof", I metaphorically mean the hill's shell. If we excavate the hill and go inside, it could be interpreted as a green roof in a big scale because in the end it is a green surface, which covers our construction.



Why and How to Dig

In 2007 Stockholm municipality launched a design competition for the extension of Asplund library, the competition was apparently very successful in term of the quantity of entries and the winning proposal were very eye catching and breath taking designs but surprisingly I noticed that the selected designs didn't take the green potential of the adjacent site into the account and they tried to engulf the green hill by building the surrounded area and therefore blocking the view of this magnificent green hill located at the center of the city so I decided to put myself as a competitor and redesign the project as a very conceptual and free from program restrictions or construction difficulties to deal with the challenge of redefining the meaning of green roof and preserving the Stockholm urban green roof by the concept of "digging into the landscape".



The winning Projects

DELPHINIUM, First prize winner

Architect Dipl. Ing. Heike Hanada, Laboratory of Art and Architecture
Supporting team: Ivan Dimitroff, Enno Efkes, Johannes Kettler



Nosce te ipsum, Fourth prize winner

Nicola Braghieri, ARC HITETTO NICO LA BRAGHERI



OZ, Honorary mention

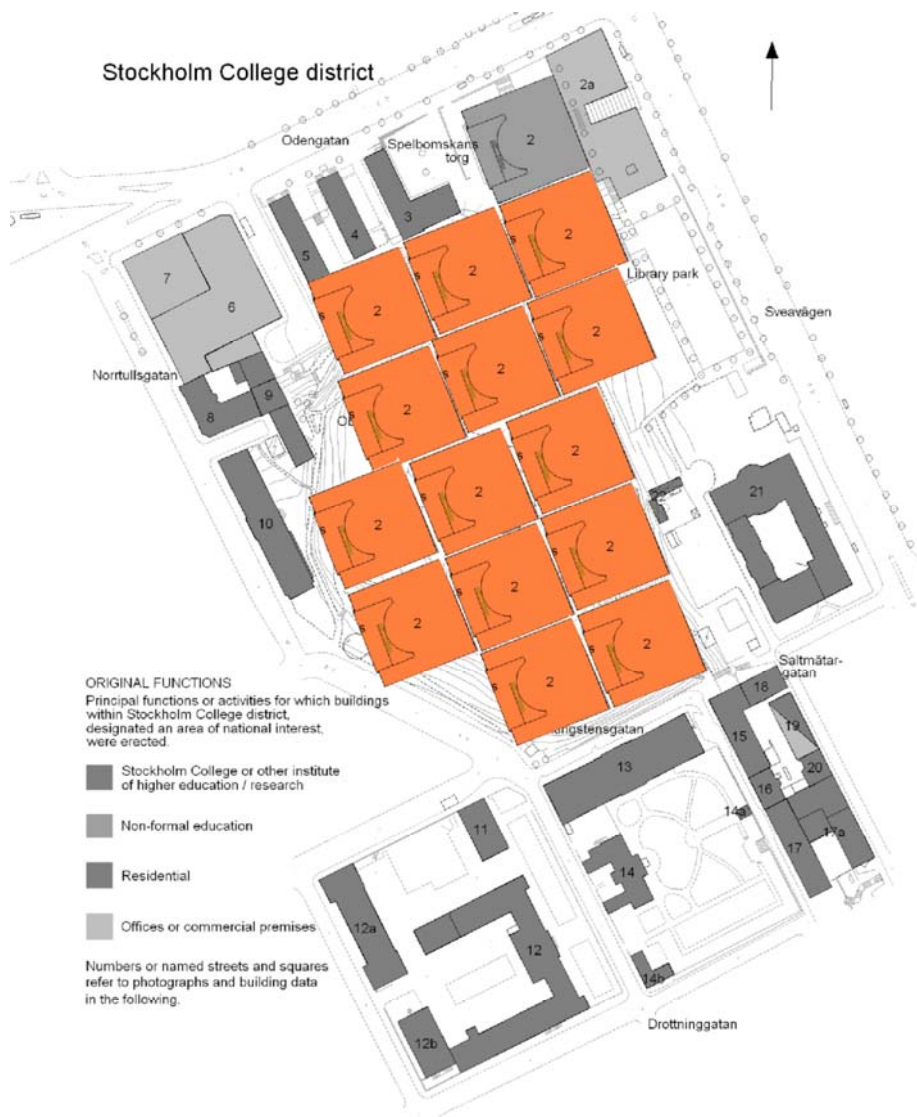
Sara Gutarra and Andri Gartmann,
S+A, Gartmann +Gutarra
Collaborator: Chantal Zwingli



As we can see these projects neglect the green hill by designing a construction alongside the street, which isolates the hill to a great extent and block the pedestrians' view, or in worse cases they try to intervene with hill by cutting it off in some parts.

To understand how much space we have inside the hill, I took the Asplund Library as a module of space (48*48* 31 meter) cube and stamped it across the hill (the highest point of hill is 42 m and the average height is almost as high as the library, so here is result:



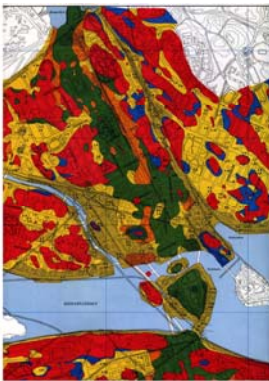


The hill could be filled with 14 more libraries like Asplund Library, so it means: $14 \times 48 \times 48 \times 31 = 999936 \text{ m}^3$ which is approximately equal to one million cubic meter space which is completely unused, full of possibilities and potentials. It is laid beneath the green surface of our hill, in another word there are 14 libraries underneath the hill and it is somehow not reasonable to add construction and any buildings to this site. The hidden potential of the space underneath the hill is not a threat as it has been considered during the last two centuries, which has been shown in the history of the site. So, if we just excavate the hill without going under zero level ground, still one million cubic meter space will be provided, therefore I am going to use this space as the canvas of my proposal.



Concept:

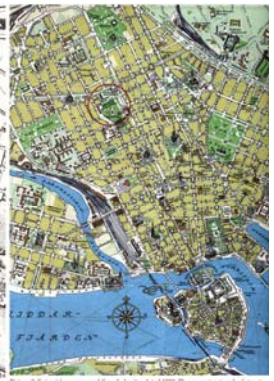
As we have already known, Stockholm college district has more than 21 educational and cultural buildings and institutes engulf the hill. It is clear that almost all of them need an extension to their existing space in near future. Learning from extension applied to Asplund library it could be the case for most of these buildings in near future. As a result of this construction and human intervention for extending the existing infrastructure, in some decades no hill will exist anymore. This idea is strongly supported by looking at the history of Stockholm Ridge which was excavated and vanished during the last past 150 years. It has happened because of high demand for more urban space and physicality. This hill is the only thing that has remained from Stockholm ridge.



green area is Stockholm Ridge



Topography around Stockholm Ridge



Shrinking Ridge

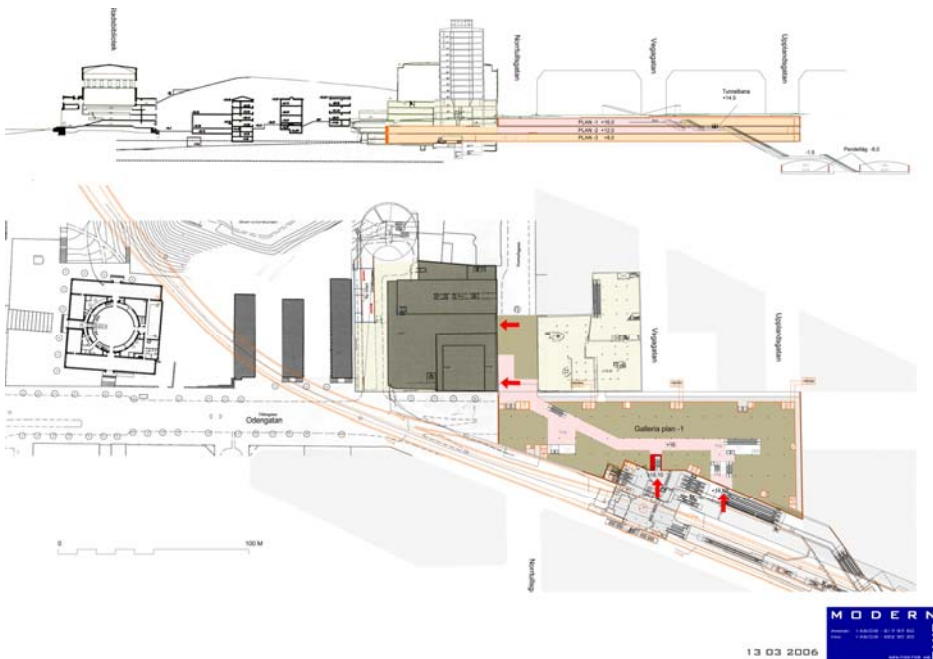
The process of Shrinking the Stockholm Ridge through time

So we have to define a strategy that first of all ensures the preservation of Stockholm's green hill and second of all finds a solution for future development of other institutes around it. Considering this area's future plan for metro line, an underground commercial complex that will be constructed with its connections with existing metro stations, the necessity of physical connection of educational and cultural buildings around the hill is evident. Finally the one million cubic meter of potential space beneath the hill can trigger the idea of "network" that is consisted of connecting these buildings and underground public transportation stations by a web shape tunnel network that crawled under the hill according to the layout of extension of the library.





Future plan for extending the underground metro line, the hill would be surrounded by two new line and two new stations



Future plan of constructing a new commercial center and its connection to metro line by Stockholm municipality

As we see in these photos two metro lines surround the hill and there are two metro stations on both side of the hill, which provide us with lots of visitors and underground infrastructure for the idea of "network". Also connecting red metro line to existing commercial building, which is proposed by Stockholm municipality, is another incisive and attraction point for the network. Even though two different metro lines and the

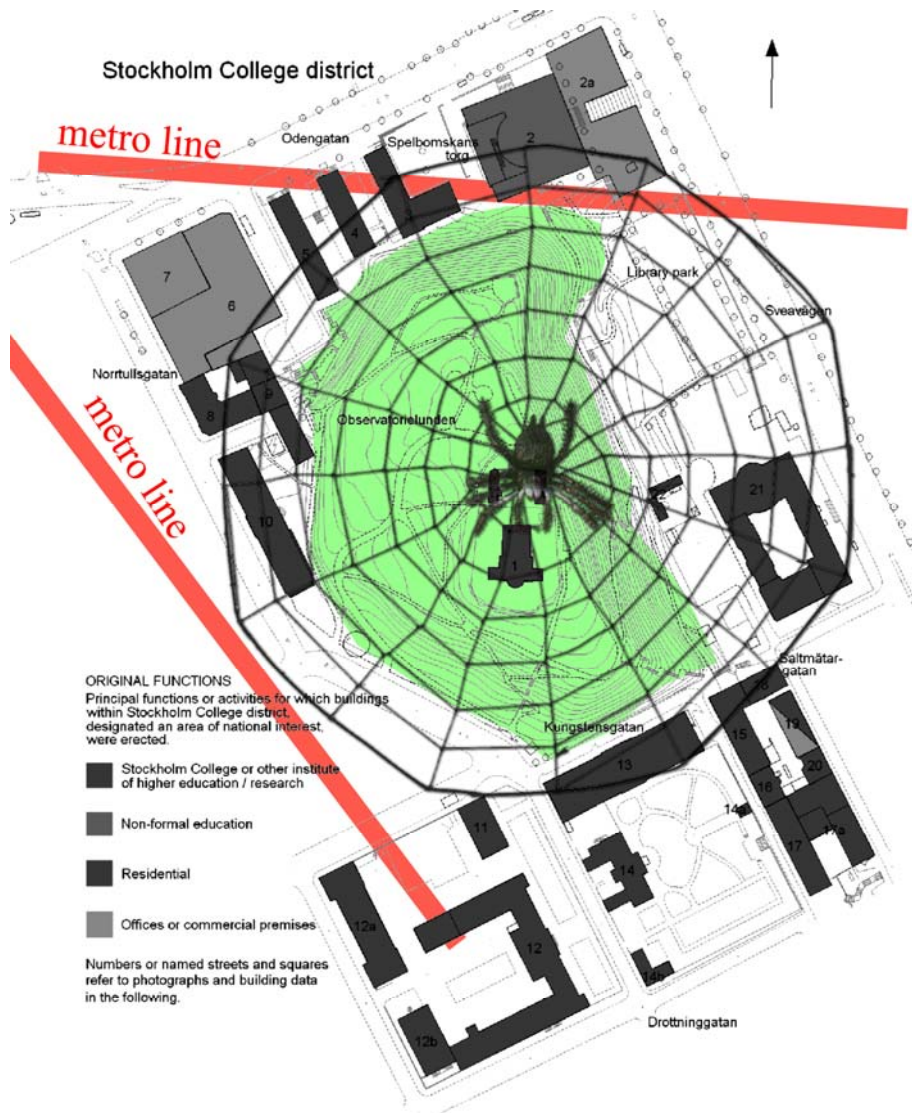


The existing library was built in 20th century, however the extension is going to be built in 21 century which is the time of “world wide web”, “network”, “E-characteristics; like e-mail, e-book”, “digital ink”, “virtual social network” and “Global warming”.

For making an extension to existing library, there is no need to construct and add mass to this beautiful site, we should just find the potentials. The space under the hill has been forgotten for years, why not dig under the hill to create our library. In this way we reduce the unseen mass of hill without intervening its surroundings and landscape while creating a poetic and holistic networked library and public space.



The idea of "network" is consisted of connecting these buildings and underground public transportation stations by a web shape network of tunnels which crawl under the hill according to the library's layout for extension.



A network library, which is underground as a connector and public space of the surrounding cultural and educational buildings, is my proposal for this site.

As we know all the educational buildings are already virtually connected to the library (by the internet); they also need to be physical connections and network spaces can help society to reach a further degree of interaction and social sustainability. This concern will be empowered by



the functions of the space, which are basically educational and cultural. Another very important privilege of networked space is that, for these buildings the hill is not an obstacle anymore; on the contrary it is an umbrella, a roof, like the title of my proposal suggests: "an urban green roof". Virtually and physically it covers these networks entirely while works as a hidden green agenda; this gives even more credibility and suitability to the proposal. It could be used not only as a green yard for the institutions but also it could give one million cubic meter further space, needed for extension of all surrounding educational buildings.

Who am I?

I am a Stockholm's library

I am the benchmark for 21st century library

I am an underground library

I am a connector

I am the integrator of Stockholm college district

I spread myself from library to annexes and then dig under the observation hill, reach the art school and plug myself into all surrounding educational buildings and finally penetrate into metro station.

Why me?

What's my advantage?

I redefine the concept of green roof and green roof helps me to benefit from all its advantages.

I help to create an urban green roof for Stockholm.



I am green.

I am sustainable.

I am networked, extendable and unpredictable.

I am cost effective in construction because I don't need any exterior façade, which decreases construction cost dramatically.

I am cost effective in maintenance because the hill is my shelter against many destructive elements.

I am cost effective in cooling, heating and ventilation because I am underground so the loss of energy decrease to the minimum and I could be ventilated naturally.

I cause the minimum intervention to site and its environment.

I am not an object; I am a timeless process and strategy for the future urban and building space in neighborhood.

I am extendable up to at least one million cubic meters.

I enrich and integrate whole the buildings around the hill.

I guaranty 250,000 visitors as passengers of underground transportation system of Stockholm.

What we should not do in this site:

We have better not to build.

We have better not to add to existing buildings' mass.

We have better not to increase the mass.

We have better not to build an eye catching form.

We have better not to erect a building to provide space.

We shouldn't decrease the area of hill and greenery.

We shouldn't block the pedestrians view to this green roof by erecting anything.



What we should do in this site:

Find the hill

Go underground

Crawl there

Dig it

Reduce the mass

Create the space

Be imaginative

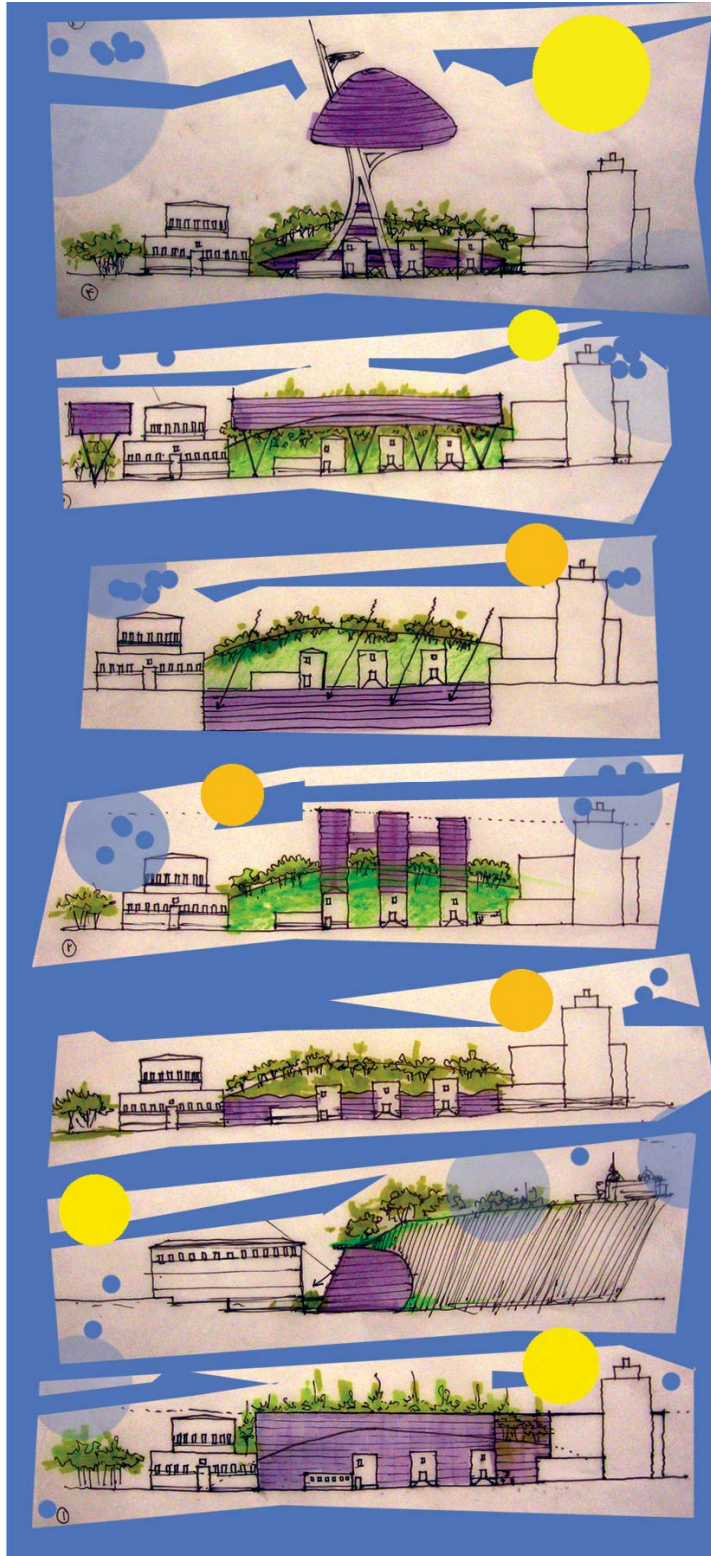
Spill the beans to the whole area

Plug the tunnel to all surrounding buildings

In above sections I tried to deliver my design process as a recipe to show that it systematically has a very clear process. If we know what we are going to cook, which is "a networked public space", with ingredients consisting of a library, an extension to the library, educational and cultural institutes, public transportation, and a green hill then the hill works as a Petri dish and the rest is our ingredients while greenery is just the spice.



Possible Unsuitable Scenarios for the extension



Seven Big Sins!

Seven strategies that should be avoided in this site are depicted in the picture above.

- A high-rise structure standing on the top of the annexes:

In this strategy although the current situation would not be intervened but the center of attention would be changed from library or green hill to this building; also the structure would dramatically change the skyline of Stockholm, which is not a suitable solution.

- A low-rise structure standing on the top of the annexes:

Unlike the pervious structure this strategy would not change the skyline, and center of attention but it would block the view of green hill for pedestrians. Moreover, it makes the hill more and more isolated from its urban context.

- An underground structure under the annexes:

In this strategy there would be the least intervention on the site and the view of the hill won't be blocked; however the underground structure would not be represent properly and it hides itself from pedestrians. It won't be eye catching and also it doesn't make any difference on the existing situation in term of quality of space and livability.

- Separate extension on top of the annexes and attached to them:

This strategy will change the city skyline in case of being very high and it also will change the center of attention from the green hill and library to the extension. If the extensions are very big in size, this will also block the view of the hill from street, especially when the extensions are connected to each other with bridges.

- Filling the space between the annexes:

This strategy is somehow the worst that could be done because the view of the hill would be totally blocked while the natural light of the annexes and extension would be an issue. In addition, the hill will be isolated from urban context and would be more like an isolated green island than a truly livable green hill in urban fabric.

- Cutting out a piece of the hill with or without demolishing the annexes:



In this strategy the process of shrinking the hill would be continued and it becomes a model for any further development of surrounding buildings, also the value of hill would be degraded and it would be seen as a threat not, as an opportunity.

Conclusion

None of these seven strategies enrich the public aspect of green hill and in the most optimistic situation they ignore the hill, if not degrading it. Also these strategies fail to bring a fundamental and universal solution for all the urban issues in this specific site; such as educational and cultural institutes and their future need for space, the relation between these institutes and the library, the fact of being engulfed by underground public transportation and the beauty of having a mid-sized green hill right in the middle of dense urban fabric. These solutions are merely a response to the need for extra space also the concept of networked space, which helps to connect all of these functions and take advantage of green hill, could not be investigated in them.

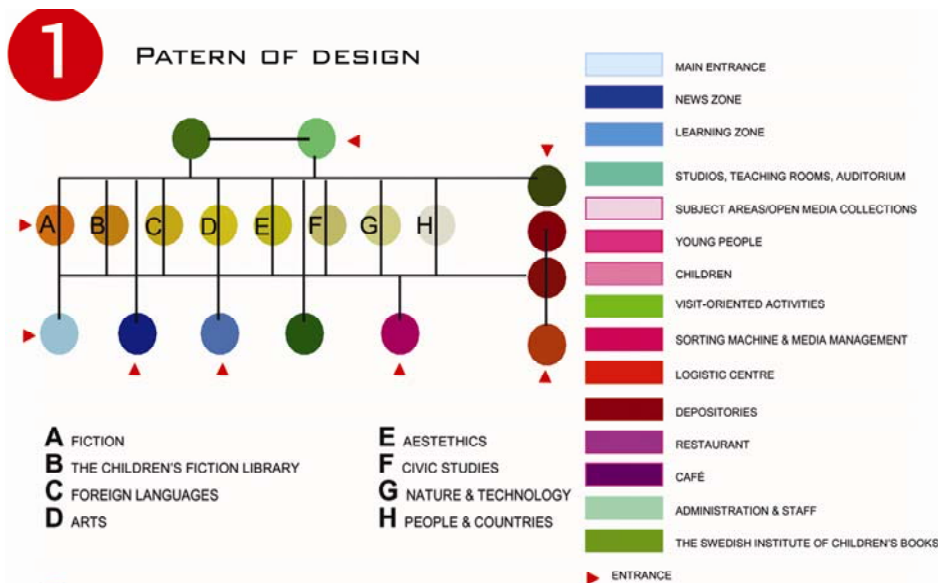




H_{ow to Dig}

The process of design consists of putting the programmatic layout of library on the hill and extruding it along while forming the layout according to the existing topography and surroundings. In order to bring in the natural light and provide vertical access to the underground tunnel, some vertical tubes, excavated from the top of the hill, has been considered.





Programmatic layout of library (provided by Sweden organization of Architecture)

The design process is very basic but very flexible. The program itself will become the structure for arranging the function of the under hill. The program and the layout of library acts as the skeleton of design and by displacing, moving, extruding and revolving the layout according to the program all the needs for the space would be satisfied automatically. Depth, height and length of revolving and extruding that should be done depend on the required space in term of quantity.

Undoing the relation of layout and program

There are two groups of circles, the first group which is the main one represents the function including:

- Fiction
- Children
- Language
- Art
- Aesthetic
- Civil studies
- Nature and technology



- People and countries

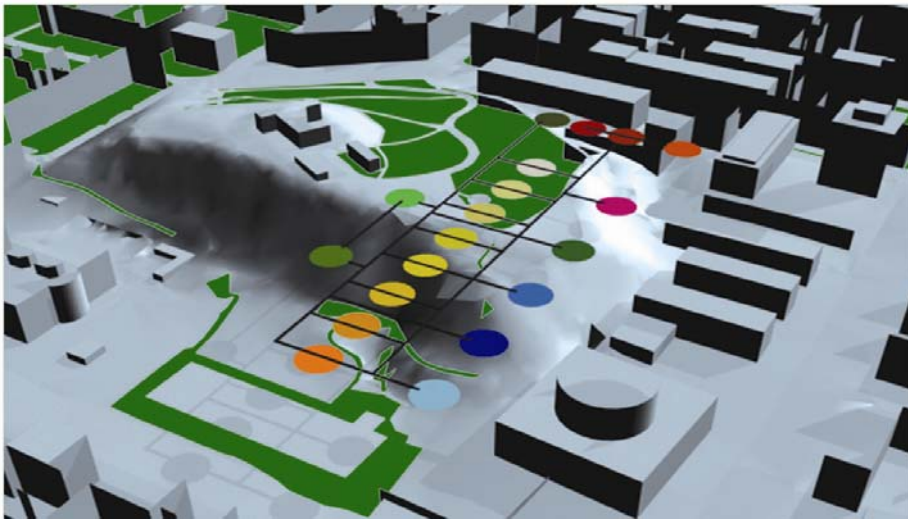
The second group represents the complementary functions that are showed by colors such as:

- Main entrance
- Learning zone
- News zone
- Studio and teaching room
- Subject area
- Open media collection
- Young people
- Children
- Visit-oriented activities
- Sorting machine
- Media management
- Logistic centers
- Depositories
- Restaurant, café
- Administrative, staff
- The Swedish institute of children books

These two groups represent the shape of a circle which will extrude upward or inward of the zero level ground and they shape the focal point of each library function as well as allowing natural light and fresh air to come down into the network. Some of these vertical tubes will be also used as an access point from the top of the hill to help the tube populate more and to be engaged with the whole network structure.

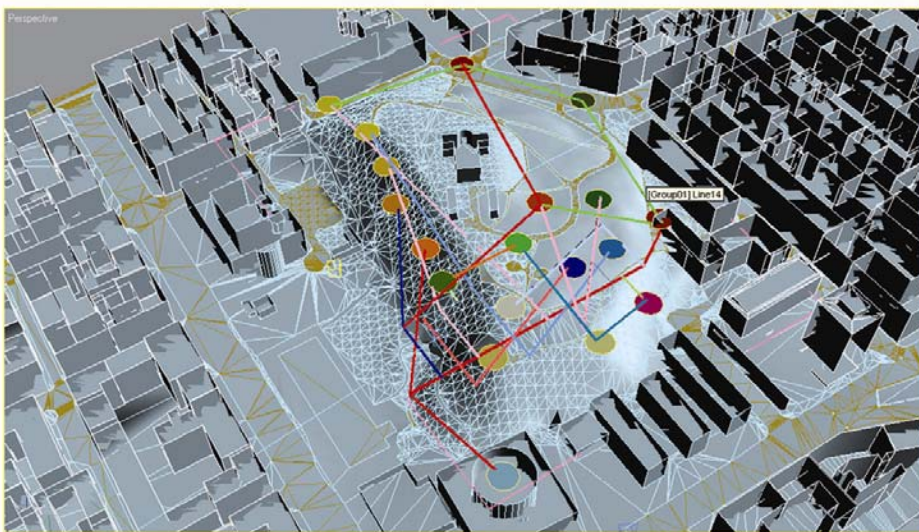
The third group is the lines that connect the two functional groups as described before. Lines depict the access route and the spatial relation between these groups therefore here I remodeled the lines to the transitional space between two or more main functions. In other words this access line can work with a spectrum of functions where they are close to the main function of the line. They act as a complementary space accordingly to the main functions and also have a general role as a connector and transitional space but they are considered to be big enough in order to handle other activities inside them.





Putting the layout on the hill

The first step of design is to put the library program layout on the hill accordingly. As it is shown, the main entrance is placed near Asplund library in order to preserve its main role and create a good connection between the library and the extension.

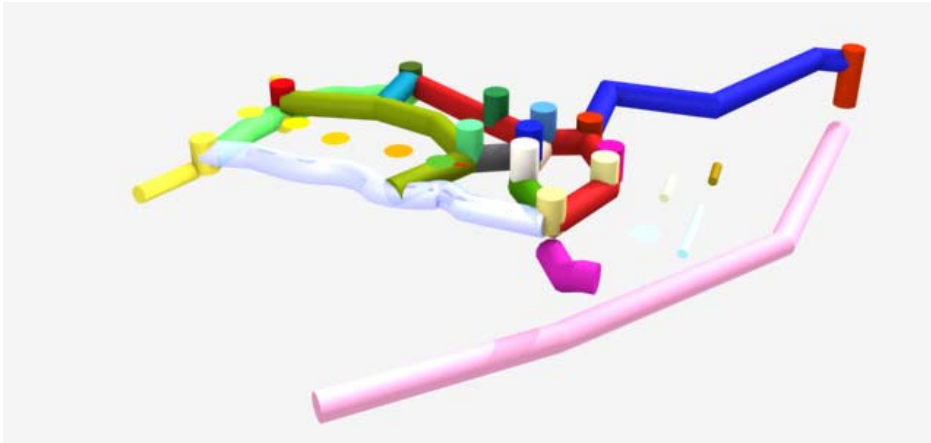


Conforming the layout according to topography and surrounding area

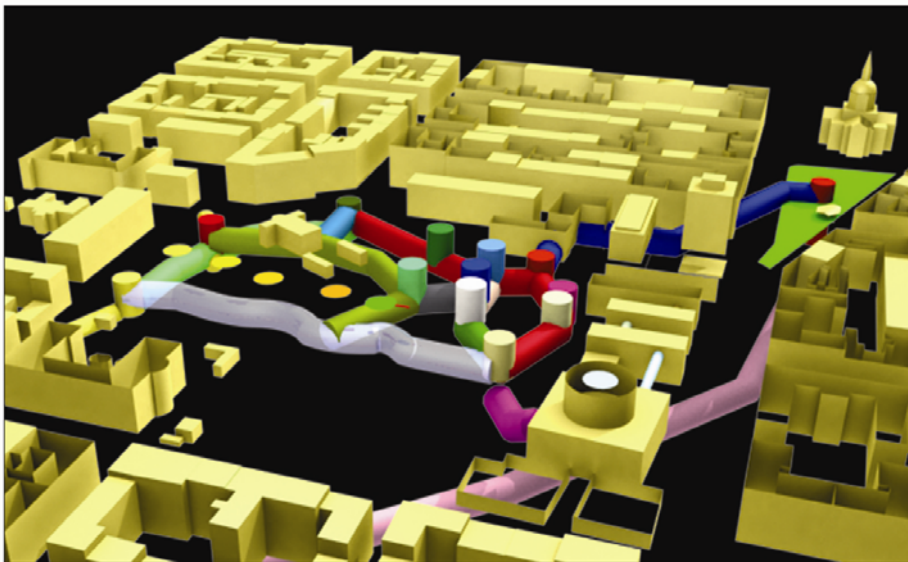
Next step is displacing and conforming the layout according to the existing functions around and on the hill (cultural institutes, annexes, commercial center, library and observatory tower) and also locating the circles as future vertical cylinders on parts of the hill in order to avoid cutting allot of trees. These two parallel displacements happen simultaneously until reaching the optimum level in terms of the



minimum intervention on the site and the optimum access to the major functions around.



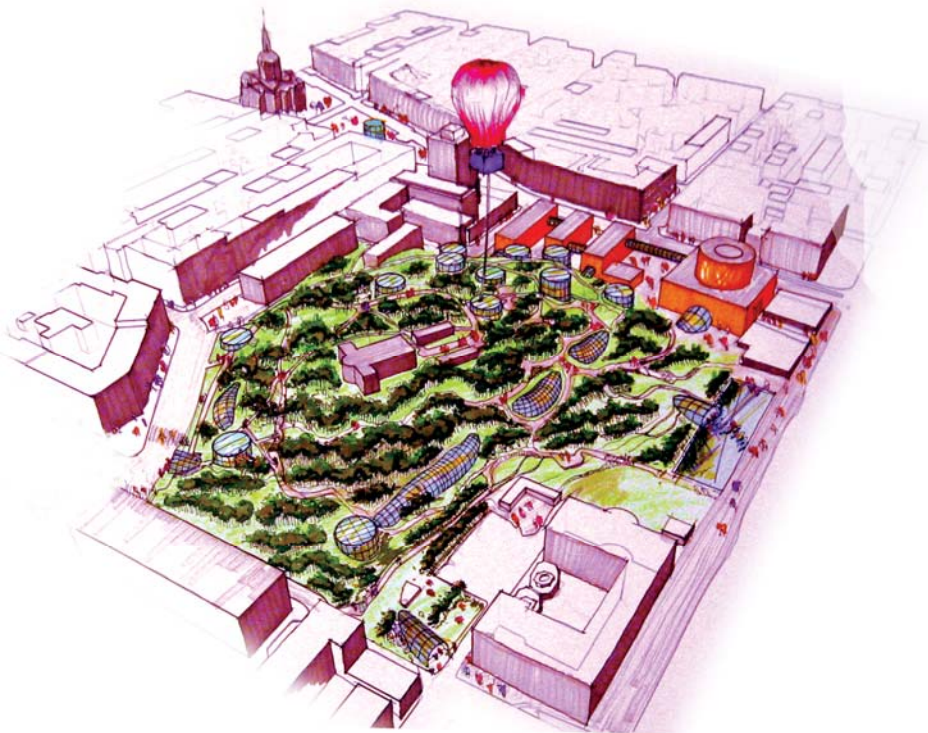
Extruding the conformed layout, the colors represent the assigned function of each part. The next step as it is shown is revolving and extruding the tube on desired paths and also extruding the circles vertically. In this part of the design process we could catch a schematic view of final structure. The colors assigned to the tubes are their main functional role, which they have to play because of the lack of space due to constrain aspects and height limitation for extruding the circles vertically. In this picture the long pink tube is the metro line that passes near the project and it is connected to the library and the network by a joint tube shown in dark pink.



Connecting the underline network to metro station and also excavating the vertical tube to the network for bringing natural light and natural ventilation.

In this step of design process, for giving a glimpse of what I have done, I recreated the neighborhood virtually and I tried to make it as accurate as possible by visiting the site and estimating the height of the buildings, then I overlapped the network structure on the 3d version of the neighborhood's plan.

Looking at the result, we see the red cylinder in upper right corner which is the entrance of metro station and an existing gallery which is connected by the blue tunnel to commercial building and finally to the core of structure. In the mean time from the entrance of metro station the pink tunnel show the path of metro, which go under the library and connect to the network within a small pink tunnel. At the lower part of the picture, some of the unnecessary vertical cylinders are omitted and their functions spread along side of their tunnels to prevent too much intervene on the hill and also reduce the cost. Generally the omitted cylinders had the functions, which do not require lots of spaces and could be fit in the tunnel without compromising the quality of design.



The whole structure



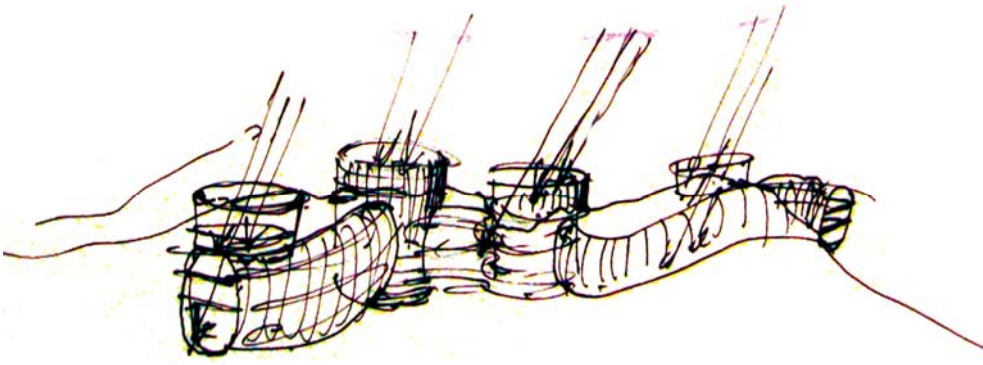
Here I sketched the whole project as it is shown. The balloon on the top of the hill is a part of the section for children and technology, near the observatory tower, which has a very similar function. Also it could be used as a complementary function for library, which is one of the main concepts of the design. In addition the balloon could pin point the project from other part of the city and it also can help the project to be eye catching in a very constructive way as a solution that this underground structure has not a very catchy visual outer representation.



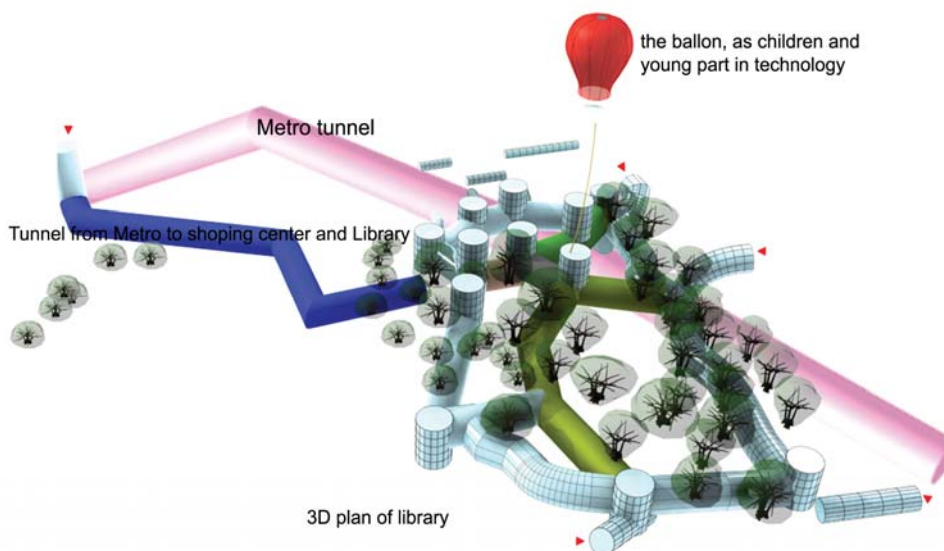
A schematic section, daylight and natural ventilation

Here is the sketch of the conceptual section of the structure, the vertical cylinders provide light, fresh air and access to the underground structure that is depicted as above and they help the structure to be ventilated naturally. Furthermore these tubes give the people on the hill a vision of what is happening inside the hill and persuade them to go inside. The same thing could happen for the visitor inside to go outside on the hill.



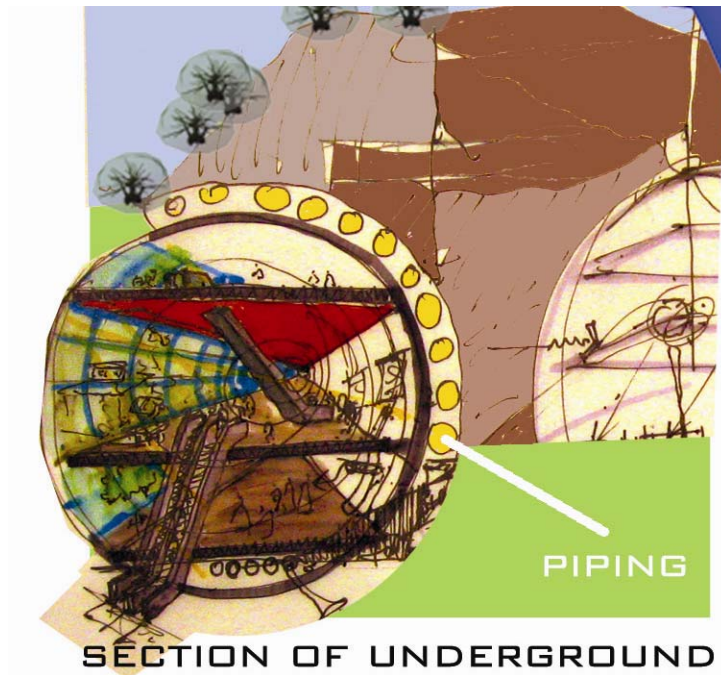


Using natural light and natural ventilation and also being underground is very cost effective in terms of energy consumption and maintenance while vertical cylinders are used as access and emergency exit.

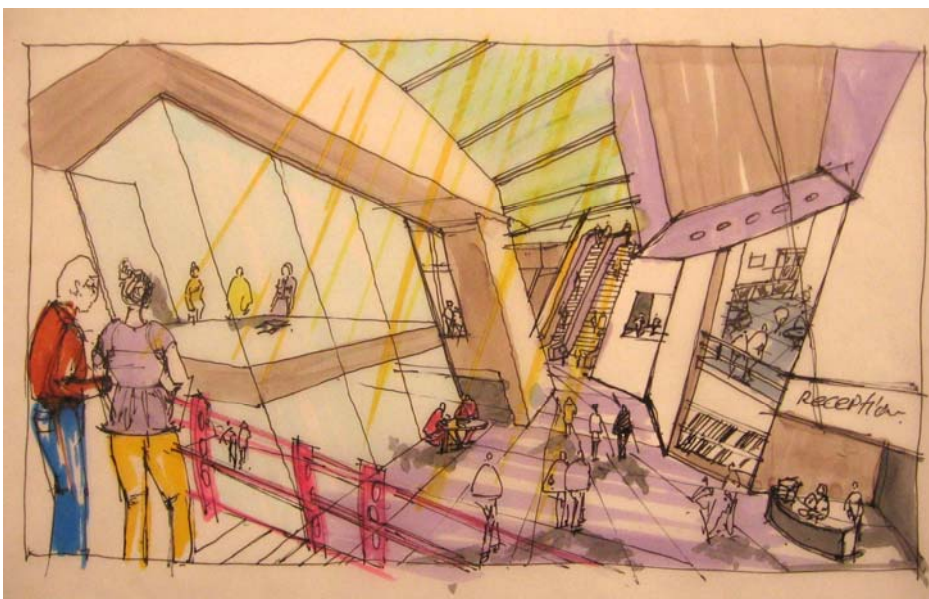


The 3d plan of the underground library extension, showing the tubes and vertical cylinder under the hill and also library functions that spread to them and connect to the metro station and surrounding building like the art school. The balloon represent symbolically the technology section of library for children, above the observation center and could empower the whole structure and is used as a landmark to pinpoint the complex which does not have strong visual representation because of laying underground.





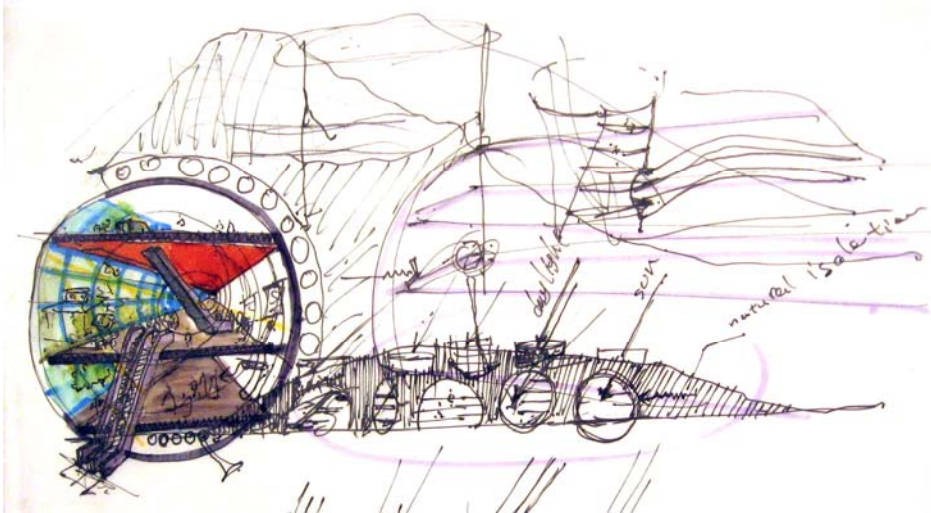
A schematic conceptual sketch of the part of the tunnel under the hill, a two skin tunnel that outer layer is used for mechanical, electrical, ventilation, water infrastructure, and technical support for the whole building. Some part of tunnels in some places exposed to the outer space and this part could be used as a glass façade, envisioning a big window, to give a quite good impression of what is going on under the hill for pedestrians or visitors as an inviting factor and visual representation for the whole network.



Connection of library to metro station



This is the conceptual sketch of what it may look like in the joint section of metro tunnel and vertical cylinder. However this could be envisioned on all part of the library where tunnels and cylinders intersect with each other.



So in the proposed design and planning strategy, I tried to empower the public aspect of the hill by populating and bringing people on top and under it by means of connecting public transportation, library and cultural institutes to each other and make the hill as a shelter on top of the network. Also to populate it more, some vertical cylinders coming out of the hill are considered to provide the network with fresh air, natural light and access to the hilltop.

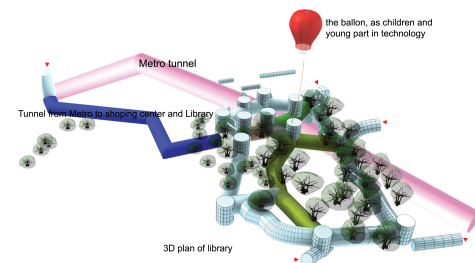


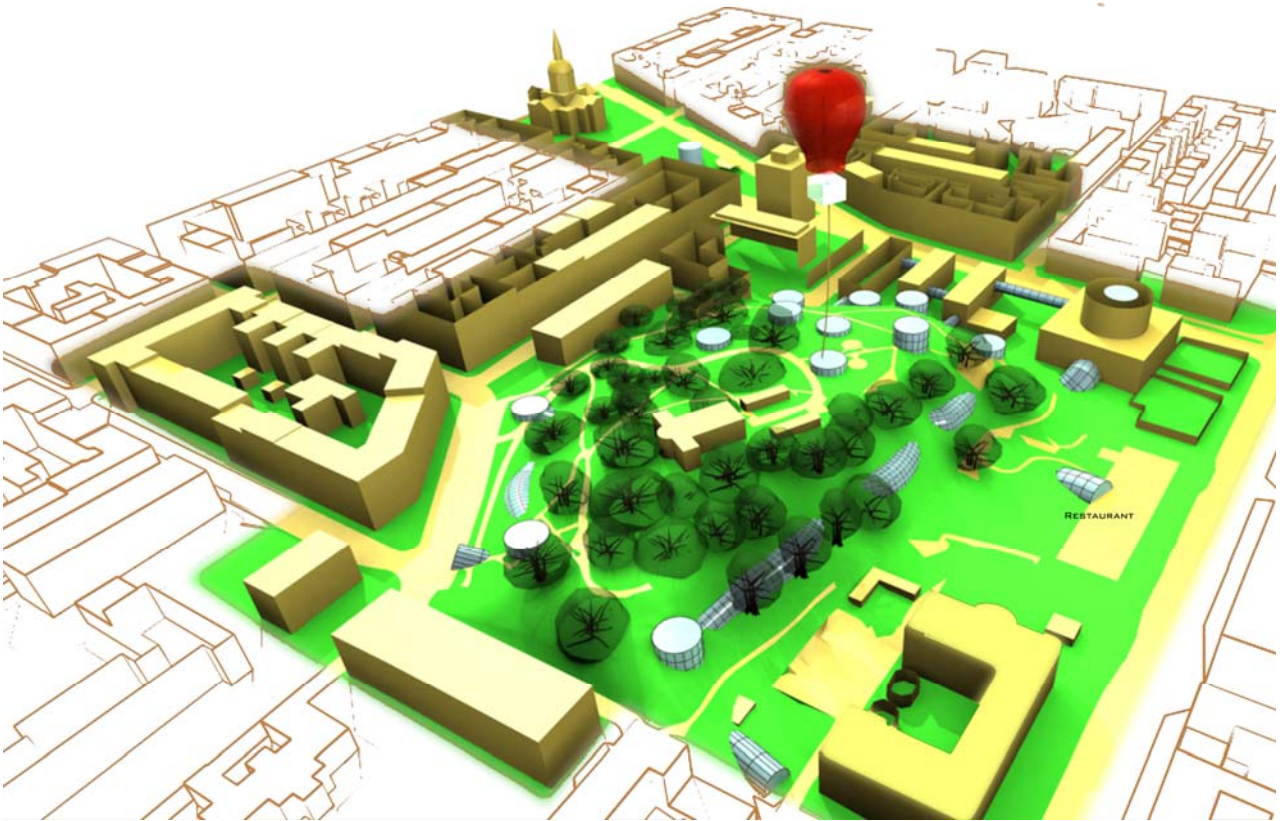
Stockholm Urban Green Roof

"Digging into the landscape" wants to explore the method after the several and problematical urban sceneries on intertwined and incorporated extent, and finally to generate a different courageous perspective about sustainable design strategies towards the new urban green structure. "Dealing with fragmented land-use map in traditional urban design and architecture, within the open frame of design strategies, urban green structure and the built environment must be reconciled to seek a solution which is both ecologically and systematically effective in response to the global issues we are facing."

²⁰ In this process I am going to explore these questions:

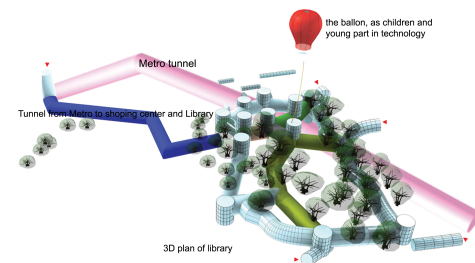
- Is it possible to redefine a green urban hill to a green urban roof?
- Should we always try to build a green roof or could we take advantage of an existing green surface and make it the green roof of our construction?
- Can I propose a more sustainable, energy saving, environmentally friendly and holistic approach design than winning proposal of the extension to the Asplund library?
- Can "going underground" or "digging into the landscape" help to preserve and promote the existing green urban hill of Stockholm and redefine the meaning of green roof?





And finally, the network would be like this

This project is deeply engaged with urban fabric and the city cluster and tries to connect the educational, cultural, commercial and public transportation with an underground tunnel based system to benefit from each individual building and also to enrich the whole urban block while reviving the green hill by populating it and using its capacity metaphorically as an urban green roof. As we see in the above picture, the entrances that are close to the surrounding building are clear, and the parts of the tunnel that is exposed from the hill, in parts where there is no trees, give a good impression of the whole network to the people outside.



How Stockholm urban green roof looks like?

Here is a visual essay of how the urban green roof in Stockholm college district could look like:

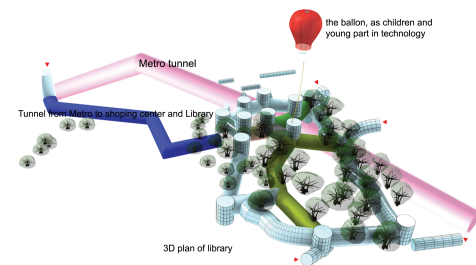


Before

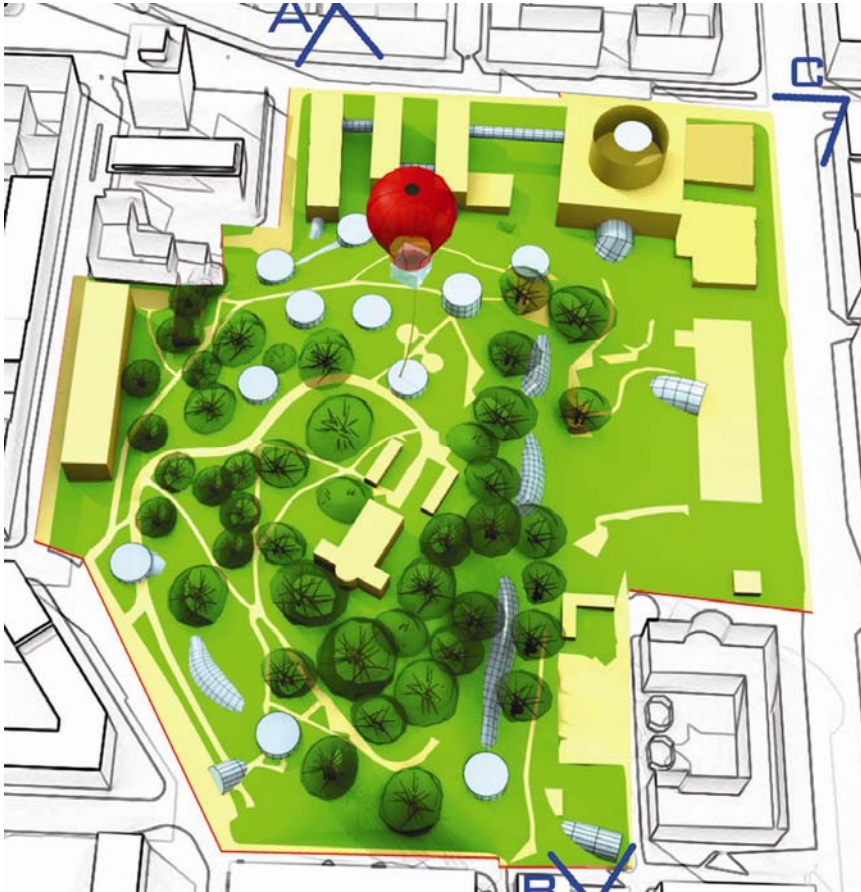


After!!!!!!

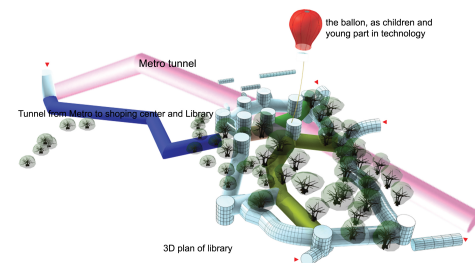
**Yes, no difference, no more destructive intervention, no more
nothing but GREEN**



As it has been shown above my design has a minimum intervention on natural green hill. I try not to posture by erecting an eye-catching form but on the contrary this project is about preserving one of the most exceptional green topography right in the middle of Stockholm by not building something on top or around it.

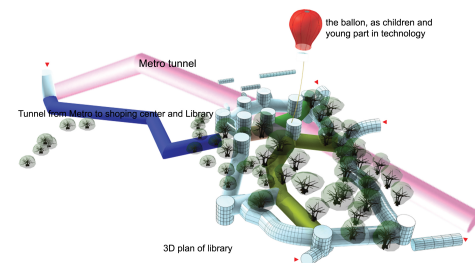


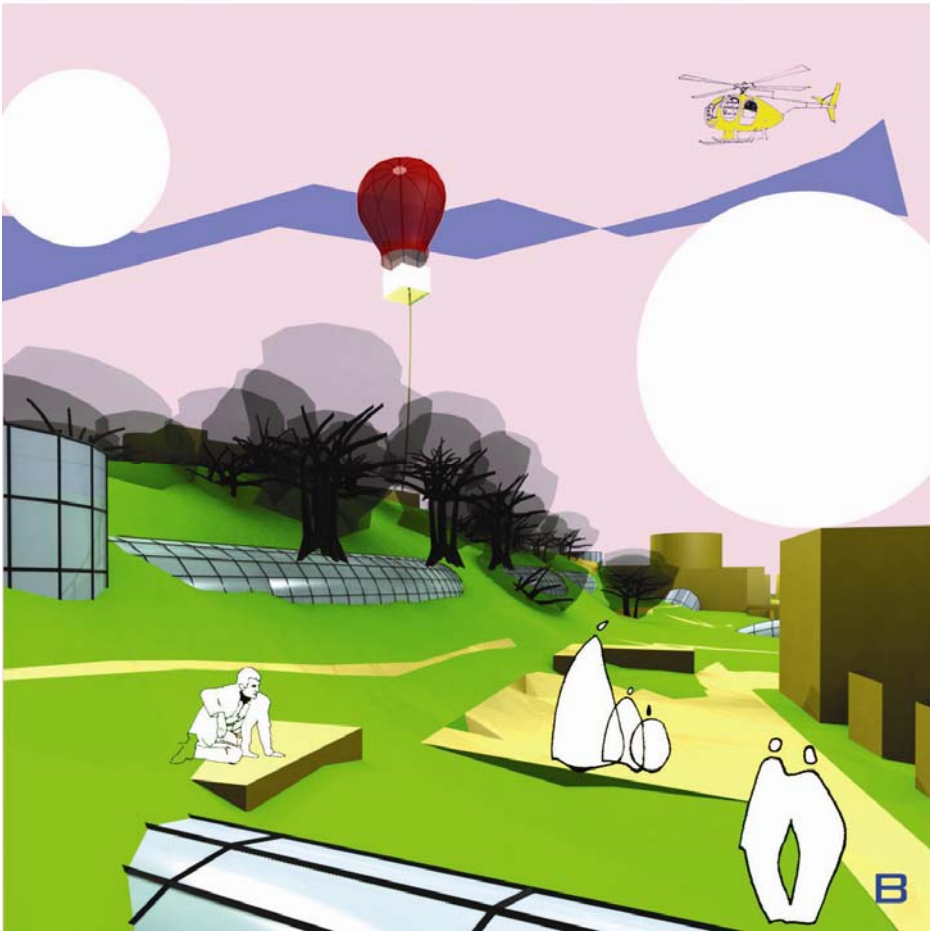
The areal view



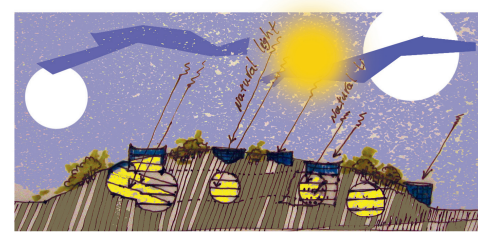


A very user-friendly network that tries not to dominate its physicality by blocking the view, on the contrary it is very flexible as it is preserving of the natural environment, by minimizing the intervention on the site.





People can still enjoy all parts of the hill easily and the mysterious exposed tunnels try to invite them inside to participate in what is happening underneath and this enriches the user experience on and under our green roof.



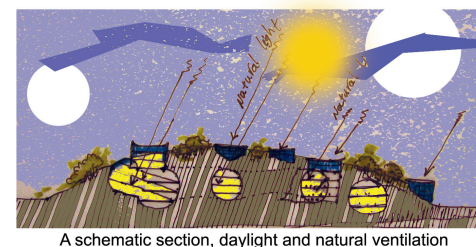
A schematic section, daylight and natural ventilation



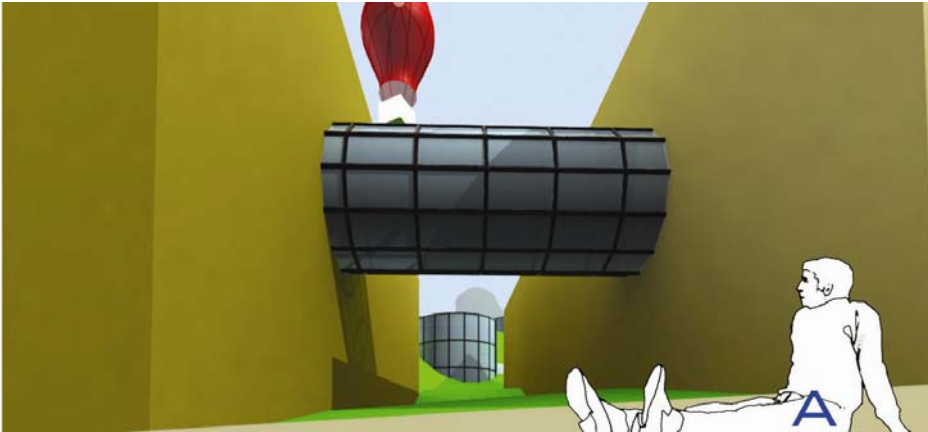
The balloon as a part of children and technology center near the observation tower helps to pinpoint the project from different part of the city and it act as an inviting element to get the passer-by's attention.



The view from the metro station and gallery; even where the project is not recognizable the balloon is showing off.



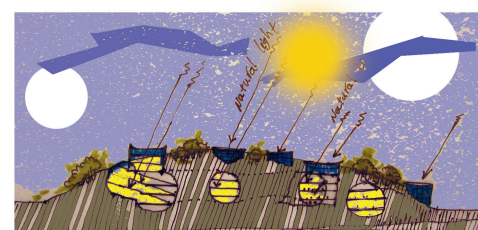
A schematic section, daylight and natural ventilation



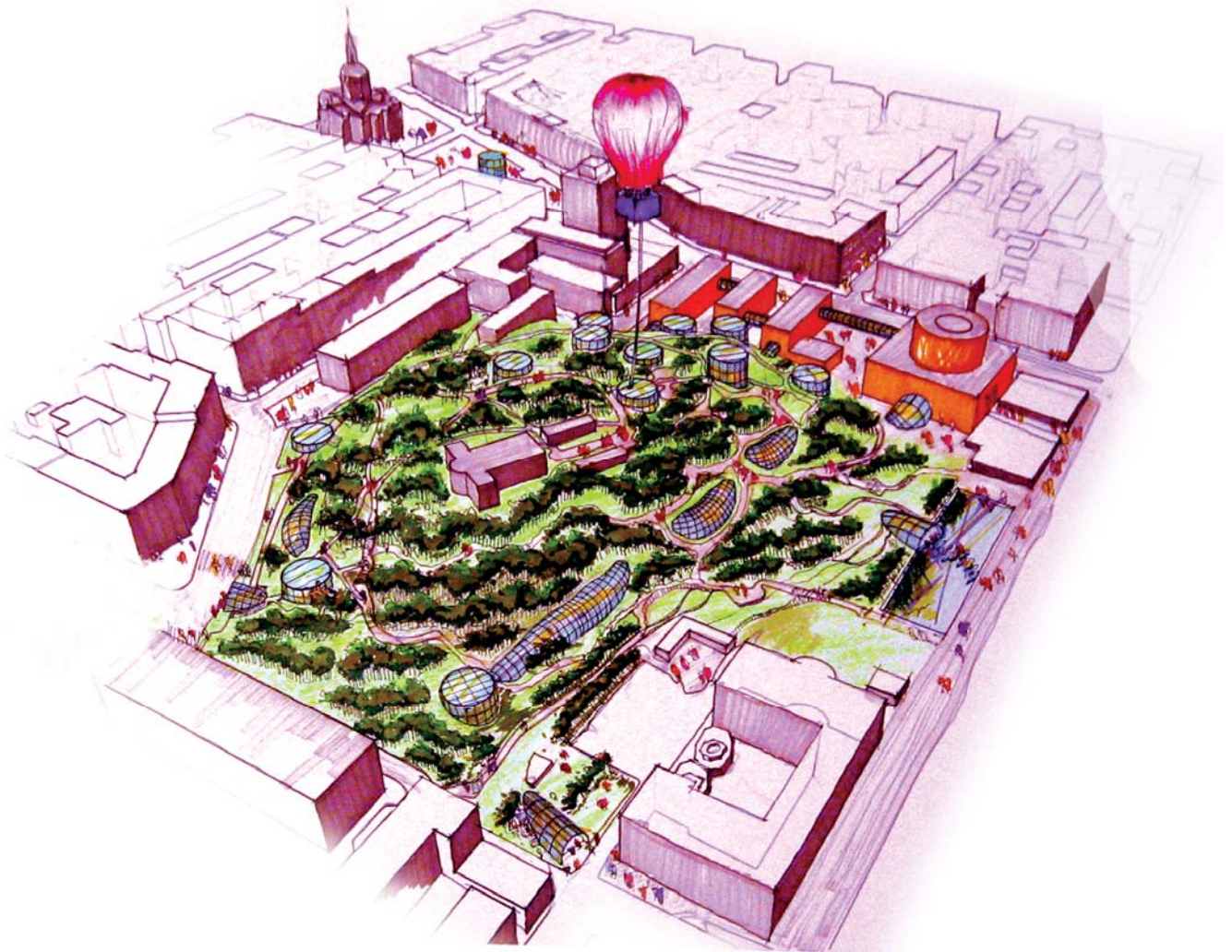
The view to the hill is not blocked in any part of the project and by bridging the annexes to each other people inside the building can also enjoy the greenery.



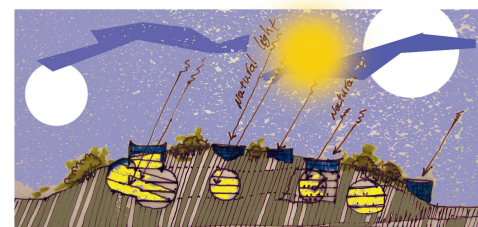
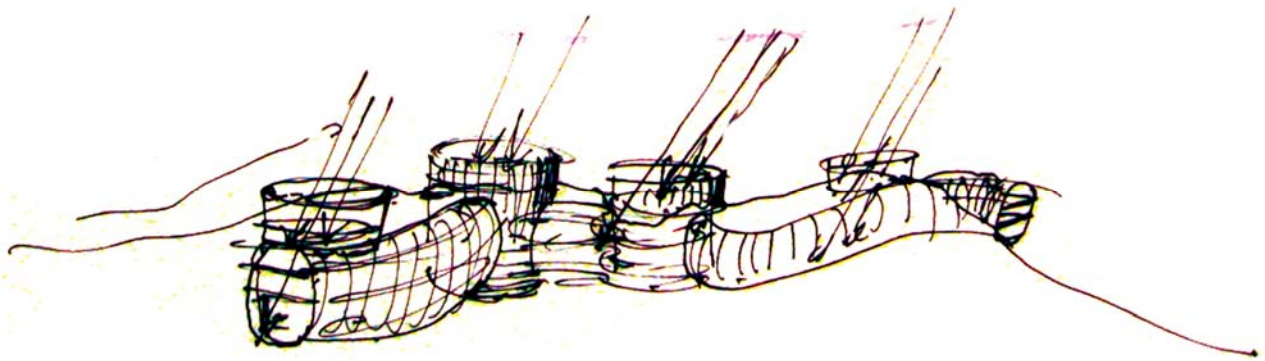
The project is a playground for visitor; a view from annex to the hill .At the end of the picture the Asplund library can be seen.



A schematic section, daylight and natural ventilation



A schematic section, daylight and natural ventilation



A schematic section, daylight and natural ventilation

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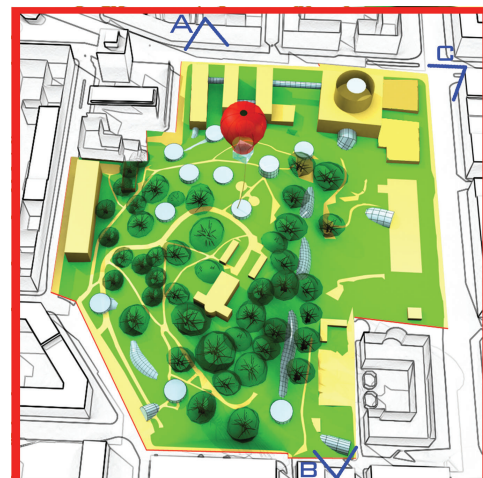
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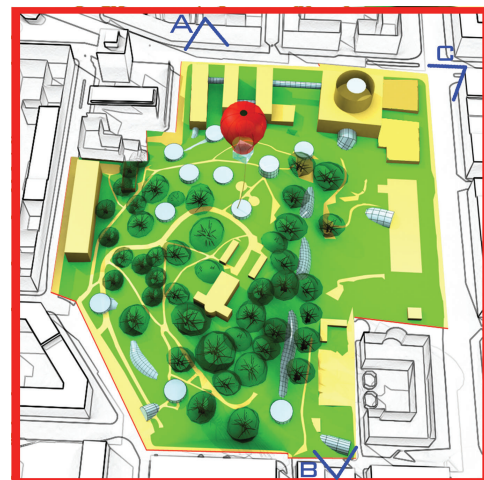


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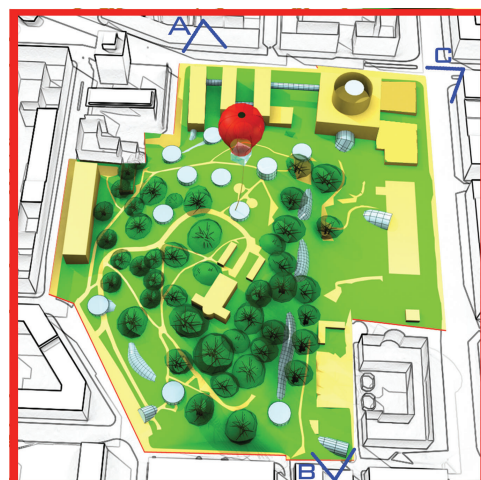


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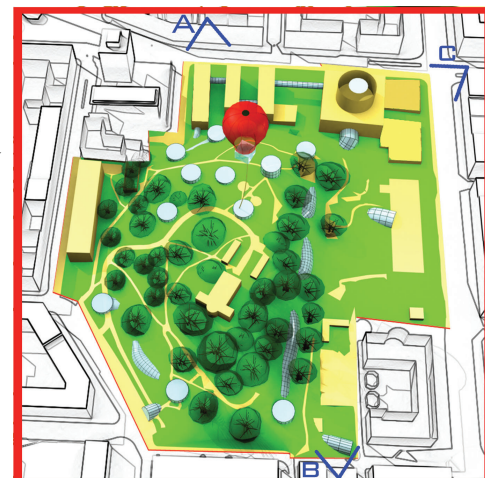
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