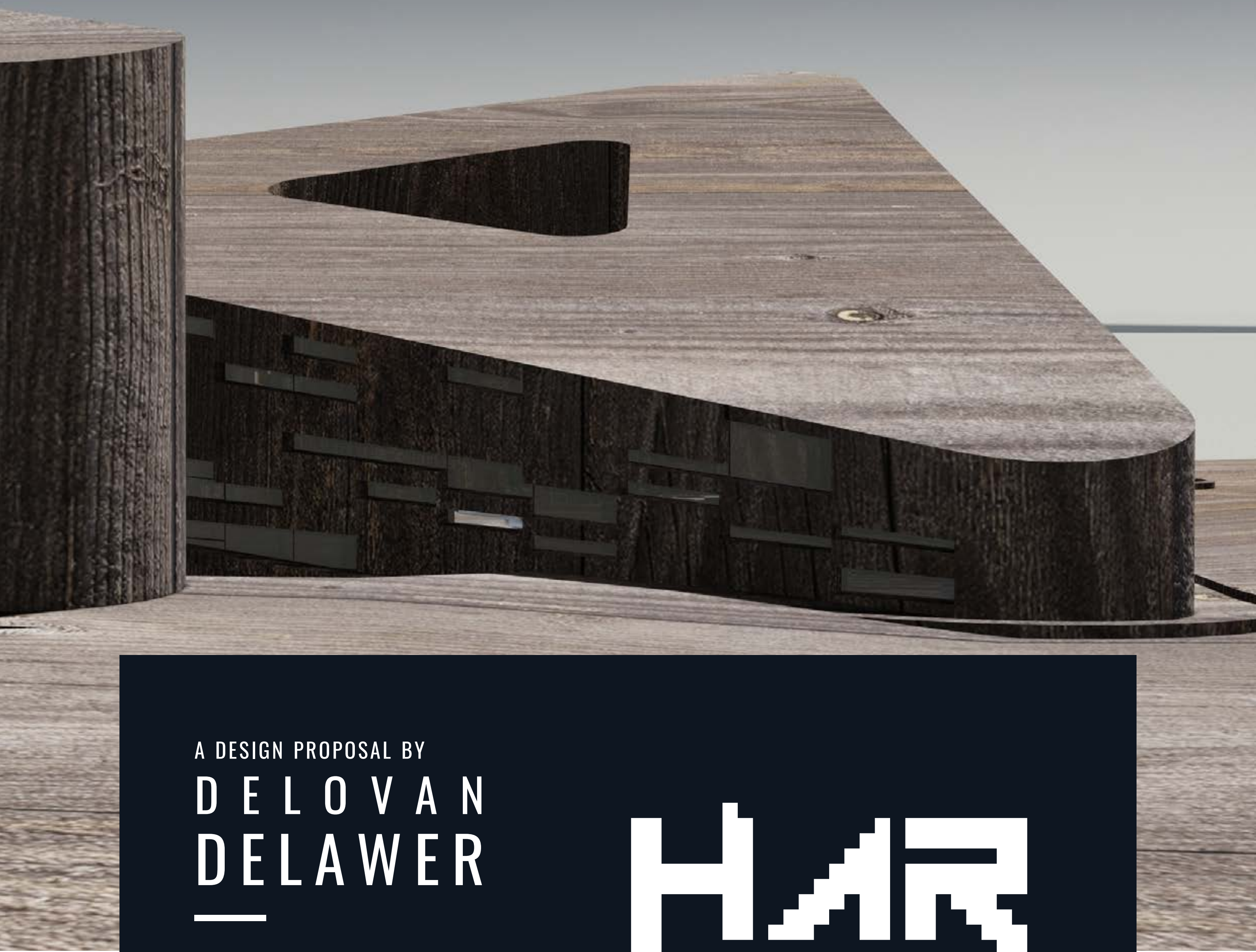
DEPARTMENT **PRACTICE**



A DESIGN PROPOSAL BY

D E L O V A N DELAWER

Complex 1 at Középtanszék - BME
Consultant: Dr. Schrammel **Zoltan** and Mr. Gredics **Guyla**

Budapest University of Technology and Economics
Faculty of Architecture
Department of Public Building Design

This document was created for the department of Public Building Design at the Architecture Faculty, consulted by Dr. Schrammel **Zoltan** and Mr. Gredics **Guyla**

HAR

Harmashatar-hegy Airfield Redevelopment

MŰEGYETEM 1782

HARMASHATAR HEGY AIRFIELD REDEVELOPMENT - BUDAPEST

Project Description: The function of the project is to serve the Airfield of Harmashatar Hegy, and its gliding purposes, the design proposal of Complex 1 is composed of two existing Hangars, that are to be renovated and remodeled, and adding two masses to serve the purpose of housing the program that is composed of entertainment, relaxation, and administration spaces to the visitors and the project's and/or site's users. The Activities of entertainment and relaxation is housed by spaces of restaurants, cafes, small pools, sauna, showers, changing rooms, resting area, congregation areas, lobbies, offices, workshops, lecture halls and storages.
The hill as named after being within the Borders of Three Mountains, which historically was the meeting point of the formation of the city of Budapest, as each hill of the three came out from a different county and region, of which one was of Buda, the second was of Óbuda and the third is of the Pest County, which the three met at this point of land in the 19th century. So to celebrate this site value of the location, the main site composed a fractional representation of these three hills to house the activites of Entertainment, Spa, Workshops and their services, and definitely emphasize the site's main potential activity, the Harmashatarhegy Airfield itself, and its aviation purposes.
The site being worked on has a very good topography. A flat airfield, low hills, and moderatly high hills make a great composition of nature. So many people use the site for walking their dogs, hiking, picnic, biking, paragliding ...etc

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HAR (HARMASHATAR-HEGY AIRFIELD REDEVELOPMENT)
BUDAPEST, 1028, HUNGARY

1

Architectural Designer
Delovan Delawer

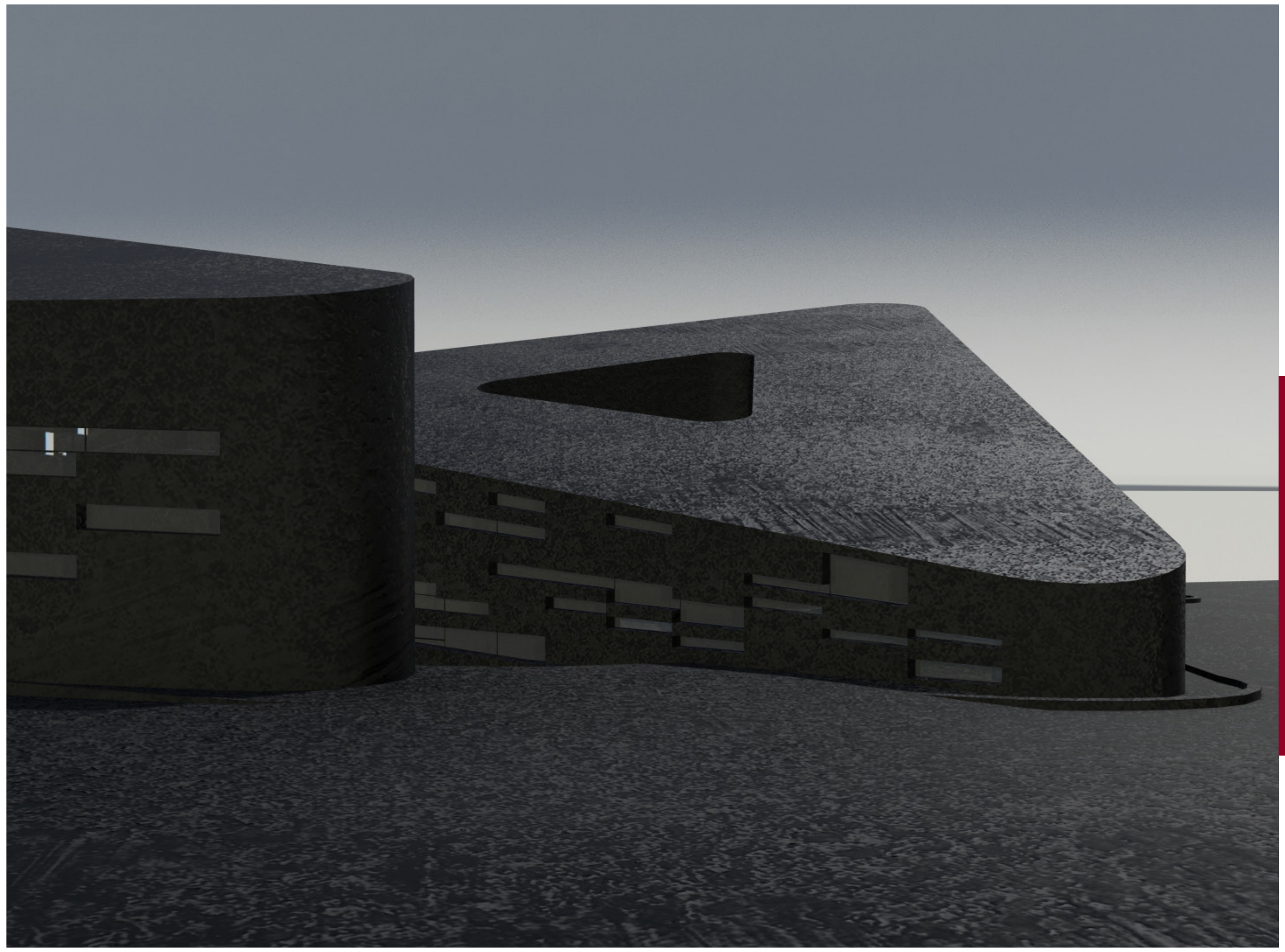
Location
Budapest, 1037, Hungary

Client
Középtanszék - BME

Consultant
Dr. Schrammel Zoltan
Construction Technology and Management Consultant
Mr. Zoltán Rostás
Building Energetics and Plumbing Consultant
Mr. Zoltán Magyar

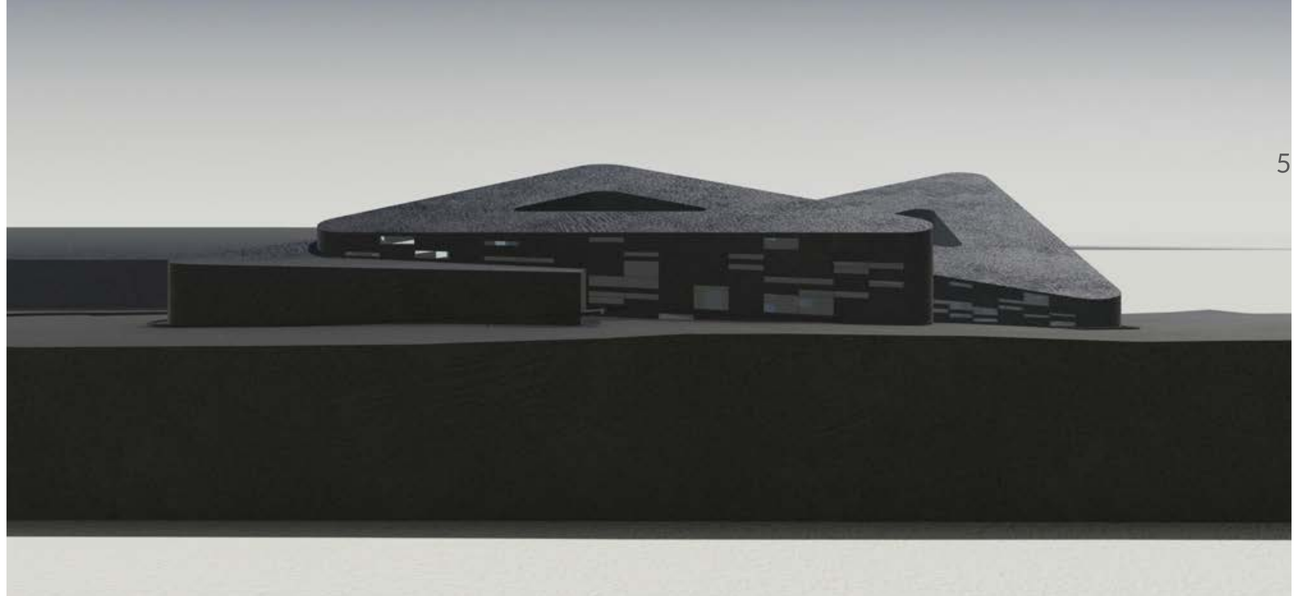
Mechanics, Materials and Structures Consultant
Dr. Sajtos István

Building Construction Consultant
Dr. Fülöp Zsuzsanna



THE MAIN CHARACTERISTICS OF HAR

Two existing hangars are renovated and remodeled, and two new masses have been added from a total of three, of which the latter is to be for a future extention. The two new masses are brick-cladded buildings of 500 sqm and 700 sqm consequentively sitting on the southern-



east side of the 7,500 sqm plot, where it is a bit familiar in the region, to have less building footprint in a site that is on a forest land or a natural side, and that somhow was the reason to build there, due to the existing infrastructure, to cut short any building on a virgin land, as to promote the environmental atmosphere of the site and promote the great open air landscape that is on site, where the HAR celebrates a 5200 sqm of landscape which makes up around 70% of the site, whereas the functions of the buildings are devided on three and two floors, respectively, to use up to an equal of around 60% of net area of the site with only a 16% footprint (of the four buildings combined, and it is noteworthy that the building are to be erected on an existing infrastructure).

The HAR complex is mostly occupied by entertainment and spa facilities in building D and offices and a commercials in building C and ofcourse the dedicated service spaces such as electrical room, mechanical rooms and dedicated storages.

HAR CONFORMS NOT ONLY TO THE HARMASHATARHEGY, BUT TO ITS ENVIRONMENT, AND TO THE NEEDS OF THE PEOPLE FROM THE HILLY SECOND DISTRICT TOO.

FUNCTIONAL DESCRIPTION

The function of the project is to serve the Airfield of Harmashatar Hegy, and its gliding purposes, the design proposal of Complex 1 is composed of two existing Hangars, that are to be renovated and remodeled, and adding two masses to serve the purposes of entertainment, relaxation, and administration to the visitors and the project's and/or site's users. The Activities of entertainment and relaxation is housed by spaces of restaurants, cafes, small pools, sauna, showers, changing rooms, resting area, congregation areas, lobbies offices, workshops, lecture halls and storages.

INTRODUCTION (LOCATION AND HISTORY BREIF) 2

HAR (HARMASHATAR-HEGY AIRFIELD REDEVELOPMENT)

The HAR (Harmashatarhegy Airfield Redevelopment) project is to be proposed for the Harmashatar Hegy of District Two on the Buda (Western) side of the Hungarian Capital, Budapest, 1028. at the coordinates of (47°29'24.1"N 19°03'29.4"E)

Hármashatár-hegy means (Three Border Mountain) is the name of a mountain in the city of Budapest, Hungary. Its name comes from the fact that the borders of 3 cities (Buda, Óbuda, Pesthidegkút) met at this point in the 19th century. Today, these cities have merged into Budapest, but the mountain's name has remained unchanged. However, the border between the II and III districts still bisects the mountain. The mountain is located on the Buda side, at 495m above sea level. The mountain is a popular place for hiking, biking and paragliding. In the winter it is also a place for sled riding. There are several trails in the area, but the only one that reaches the top is the blue trail, also known as the Country Blue Trail (Az Országos Kéktúra). At the summit there are television and radio towers, as well as a restaurant. It is often windy at the peak, due to the lack of trees. Snow may linger up to two weeks after the snow in the city has melted. On average, the temperature is a couple of degrees Celsius less than on the Pest side.
The non-public Hármashatárhegy Airport (ICAO code: LHHH) has a single 1000 x 100 m runway and serves the Budapest-Hármashatárhegy region.
Now the hills history is out of the way, a quick glimse of the city's history to be followed. Budapest, the capital of Hungary, was created in 1873 by the merger of three urban communities: Buda, Óbuda and Pest. It is the regulatory, social, logical, monetary, exchange and transportation focus with around 2 million occupants.

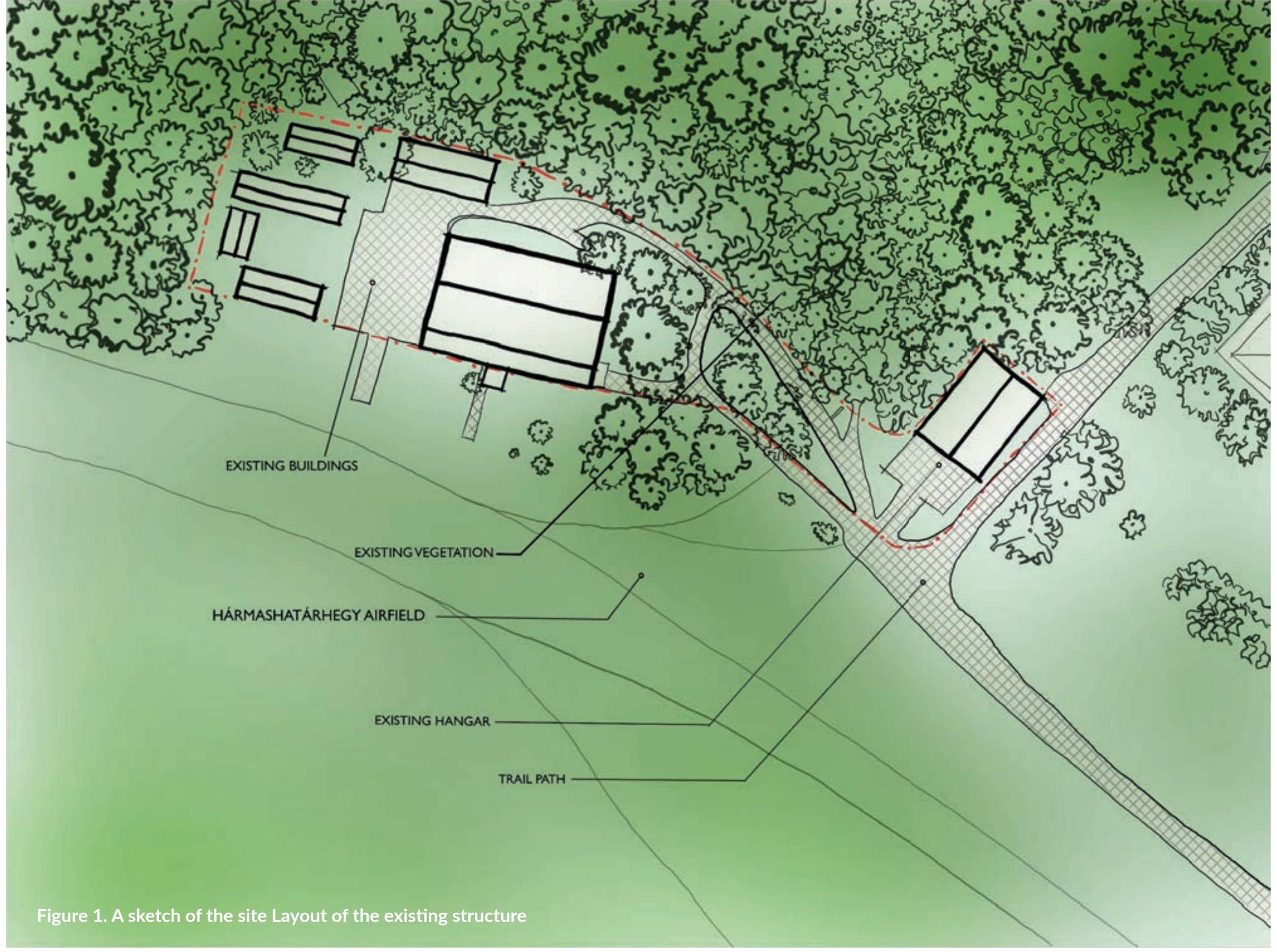
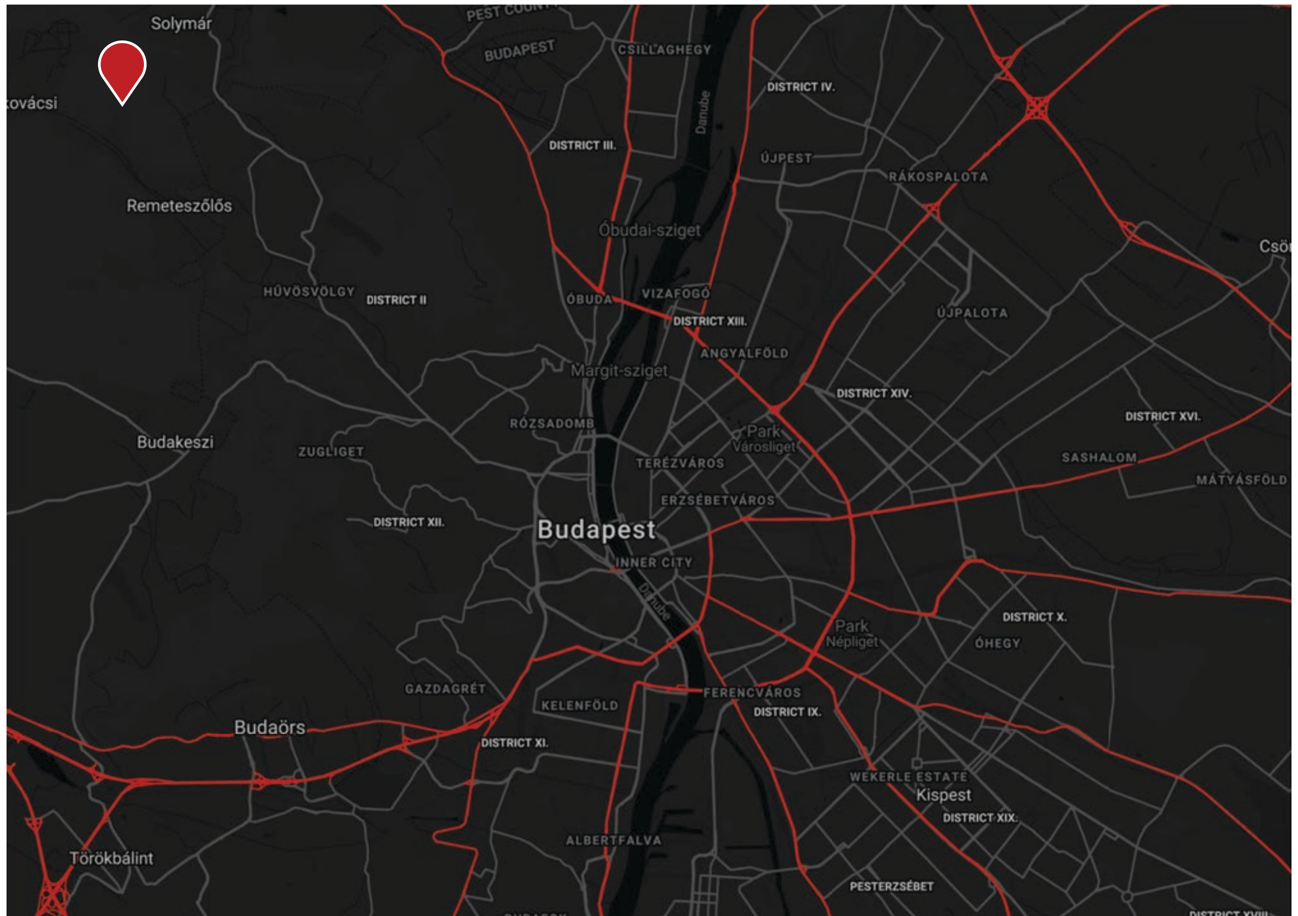
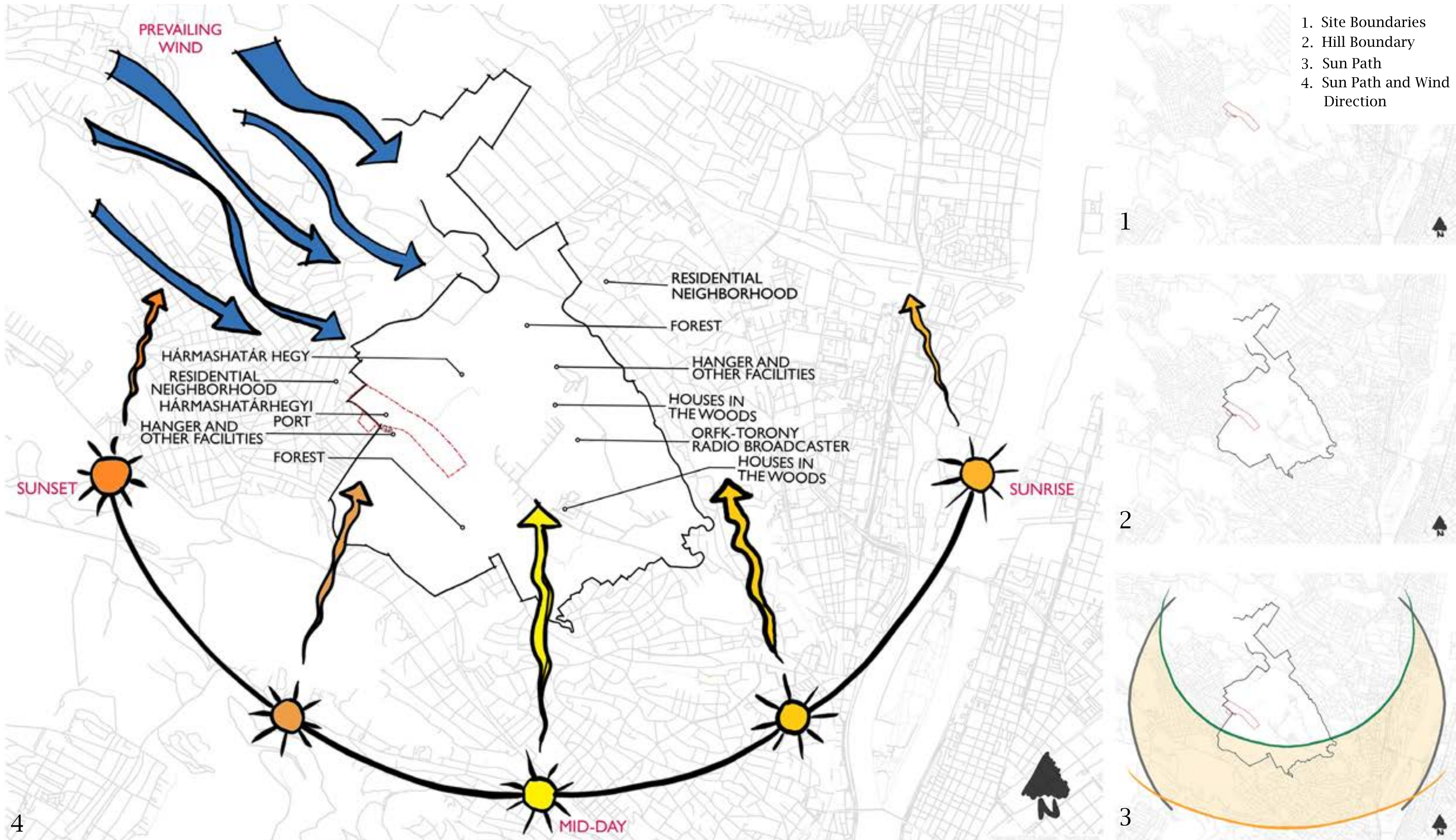


Figure 1. A sketch of the site Layout of the existing structure

The town spreads on the banks of the waterway Danube, and is authoritatively separated into 23 regions, 16 of which are situated on the Pest side, 6 in Buda and 1 on Csepel Island in Danube. Buda reaches out to the slopes on the west bank of the Danube and Pest on the left bank of the waterway in the marshes. In Buda, the 235 m high slope (Gellért-hegy) ascends from the waterway bank and offers an exceptional perspective in general city. There are 7 scaffolds and 2 railroad extensions In Budapest. Aside from one extension (Erzsébet híd), all scaffolds were demolished amid the Second World War were reestablished to the first style.





HARMASHATAR-HEGY HISTORY

Hármashatárhegy Airport is one of Budapest's sports airports . Budapest II. It is located on the border of the town called Kővár and the part of the historical Pesthidegkút in the district of Haryar . It was named after the neighboring Hármashatár hill , which is well known to the Budapest residents for the Kővár hill .

Hármashatárhegy's name originates from the way that the outskirts of 3 urban areas (Buda, Óbuda, Pesthidegkút) met now in the nineteenth century. Today, these urban communities have converged into Budapest, however the mountain's name has stayed unaltered. In any case, the fringe between the II and III districts in Budapdest still cuts up the mountain. Hármashatár-hegy is a piece of the Buda Hills (Budai Hegyek), at 495 m (1623 ft) above ocean level. The mountain is a well known spot for climbing, biking and paragliding. In the winter it is likewise a spot for sled riding. There are a few trails in the region, yet the one in particular that achieves the top is the blue trail, otherwise called the Country Blue Trail (Az Országos Kéktúra). At the summit there are TV and radio towers, just as an eatery. Usually breezy at the top, because of the absence of trees. Snow may wait as long as about fourteen days after the snow in the city has softened. All things considered, the temperature is two or three degrees Celsius not exactly on the Pest side. The non-open Hármashatárhegy Airport (ICAO code: LHHH) has a solitary 1000 x 100 m runway and serves the Budapest-Hármashatárhegy area.

The area is a popular tourist destination, and the airport is often visited by hikers.

Only VFR can be continued at the airport. Non-public airport, motorboat take-offs can only be completed on runway 31, 50m / 150 ft with a higher right-hand bend (~ 340 °) to the right of the line. Motorcycle can not fly a school circle. For runway 13 landing, turn round 4 at 250m / 800ft. For track 31, landing can only take place from the left. The gliders can fly in the upward direction in the 13th direction only in the left ascending direction 31, only to have a better school round. It is forbidden to take off on the 13th level by motorized aircraft. Strong sailboat, paraglider and footbridge movement possible, motorized aircraft training cannot be continued. The airport may be used with the permission of the owner or the keeper, except for aircraft in emergency.

In the landing direction 31, the track slopes down to 1.5 ° to the center of the track. Transverse slope: 2.5 ° in the 030 ° direction. Due to BUD TMA, the airport's airspace is limited. And is not open to the public. The airport is operated by the University of Applied Sciences.

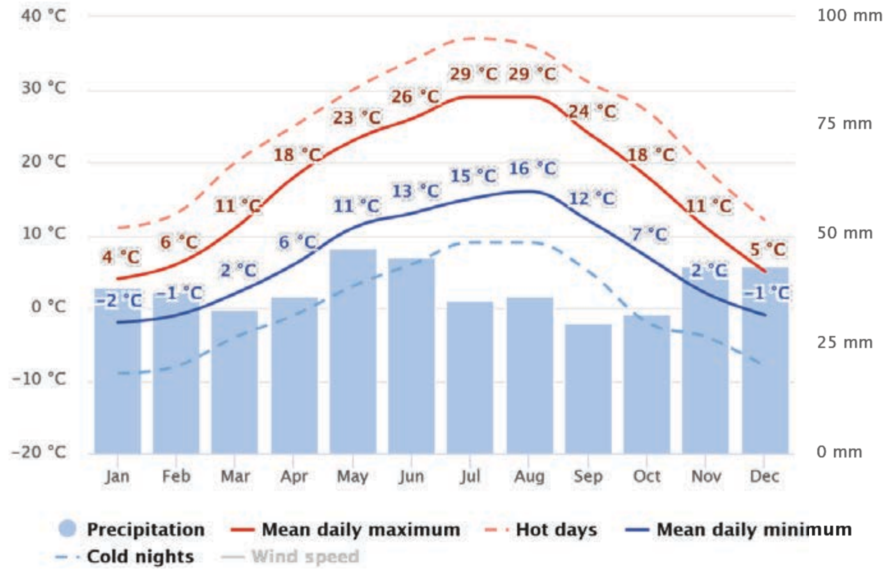
In June 2014, the National Transport Authority withdrew the operating license of Hármashatárhegy Airport.

The inspirational intersection of the two unways of HHH.

BROAD SITE ANALYSIS CLIMATE, NOISE, SOIL AND TERRAIN

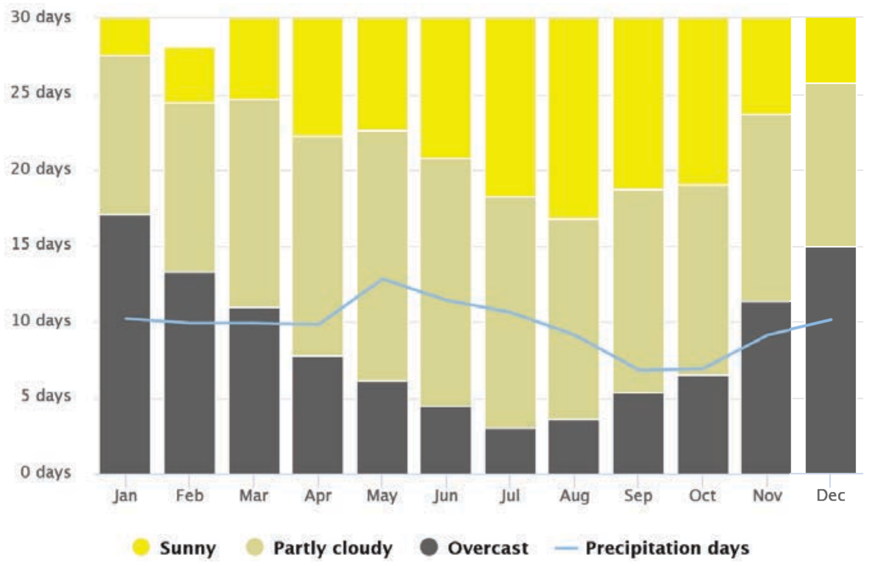
CLIMATE

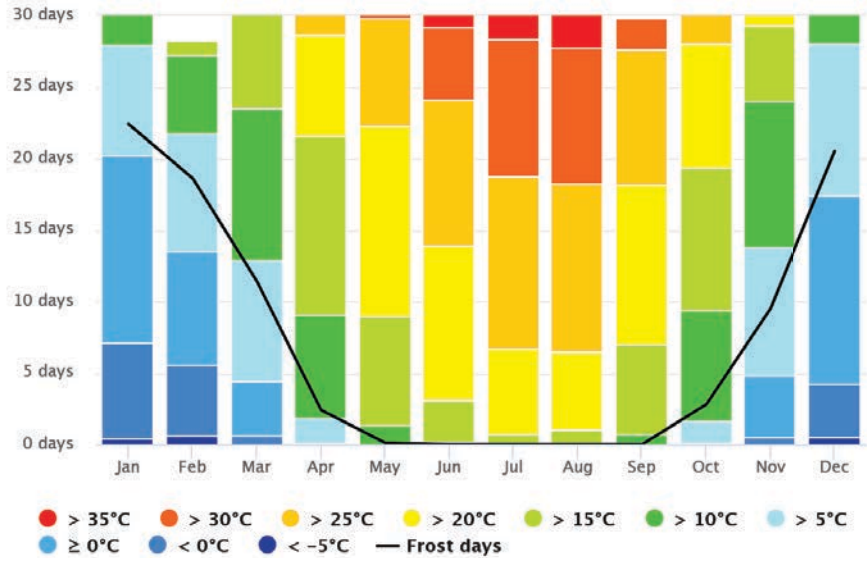
To summerize this chapter's graphs that are to be followed in pin points:
- Temperature in this area rises the most during July and August. In January and February it gets the coldest.
- Rainfall in July is the highest as it reacher 58.6 millimeters.
- As summer starts, days get longer and nights shortet, in June there is 16 hours of daylight on the site.



The (red line) demonstrates the most extreme temperature of a normal day for consistently for Budapest. Similarly (blue line) demonstrates the lowest temperature. Hot days and cold evenings (dashed red and blue lines) demonstrate the normal of the most sweltering day and coldest night of every long stretch of the most recent 30 years.

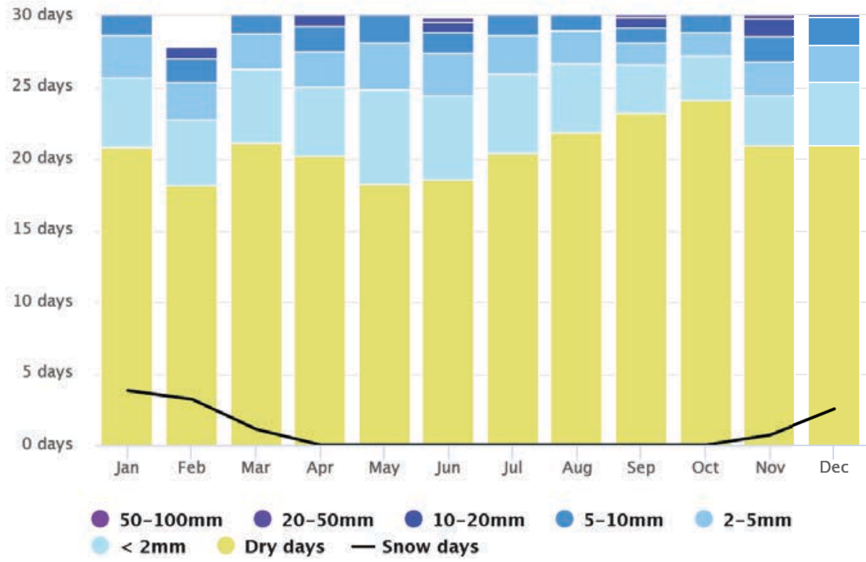
The graph shows the monthly number of sunny, partly cloudy, overcast and precipitation days. Days with less than 20% cloud cover are considered as sunny, with 20-80% cloud cover as partly cloudy and with more than 80% as overcast.

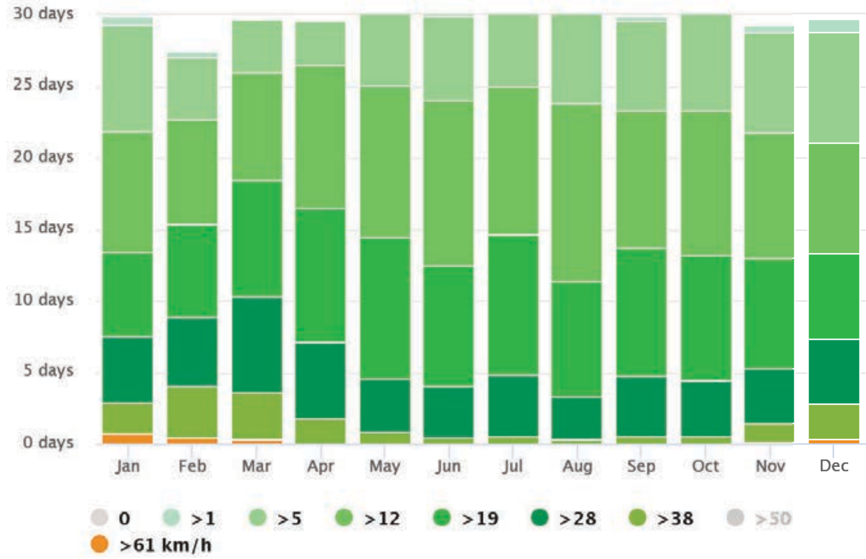




The diagram on the left illustrates (maximum temperatures) showing how many days per month reaches a certain temperature.

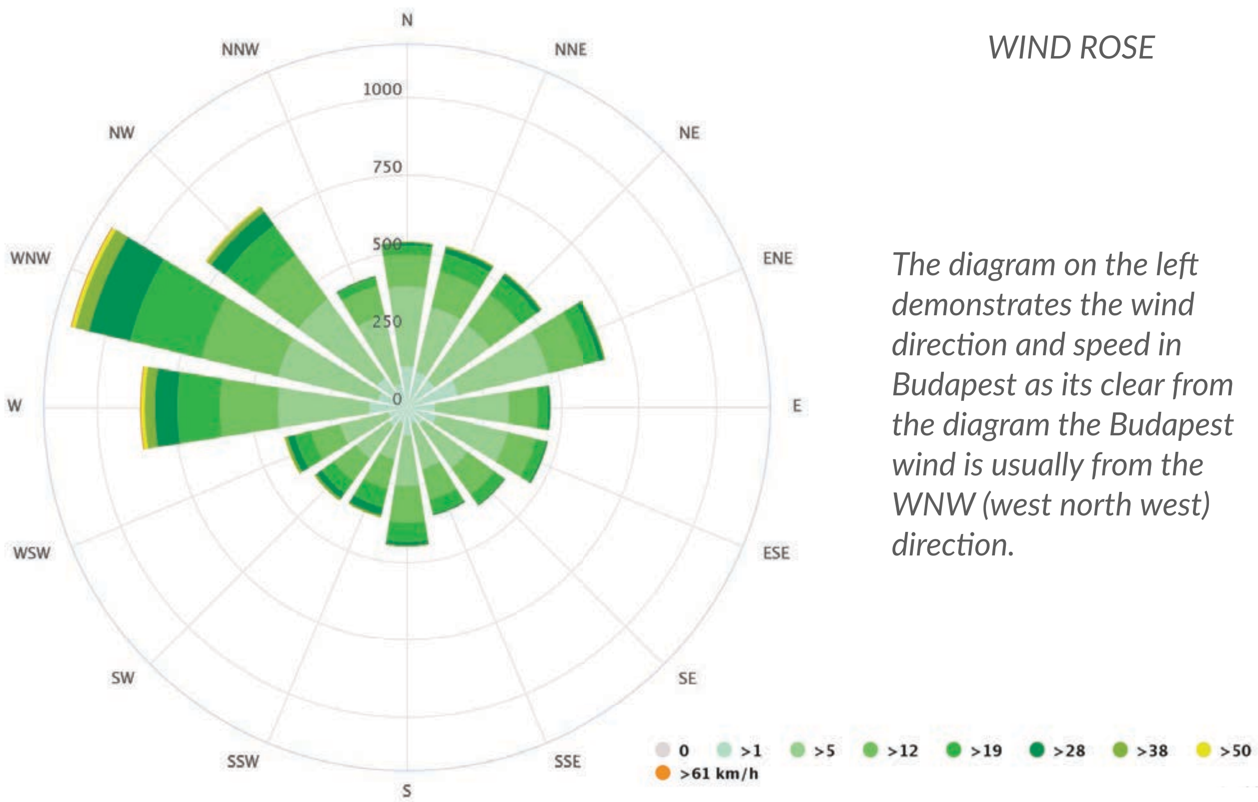
The (precipitation amount) diagram for Budapest shows on how many days per month, certain precipitation amounts are reached. In tropical and monsoon climates, the amounts may be underestimated, it can be seen here that Budapest is mostly a dry city (black line) snowy days.





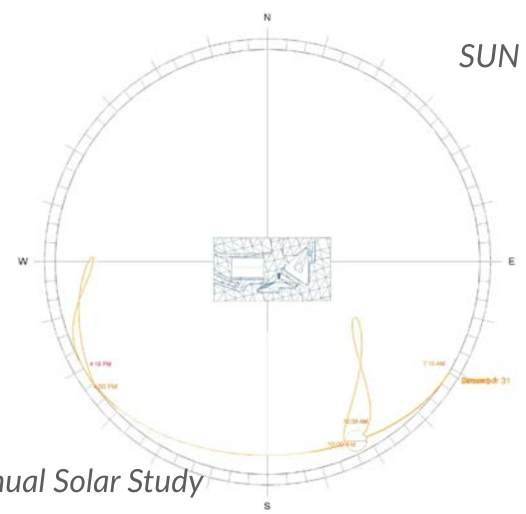
The diagram shows the days per month, during which the wind reaches a certain speed in Budapest.

WIND ROSE

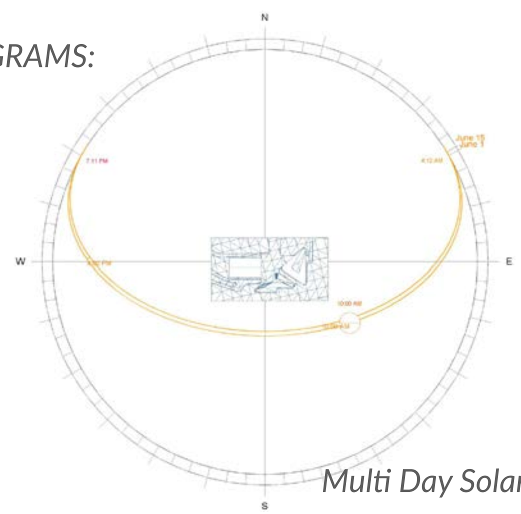


The diagram on the left demonstrates the wind direction and speed in Budapest as its clear from the diagram the Budapest wind is usually from the WNW (west north west) direction.

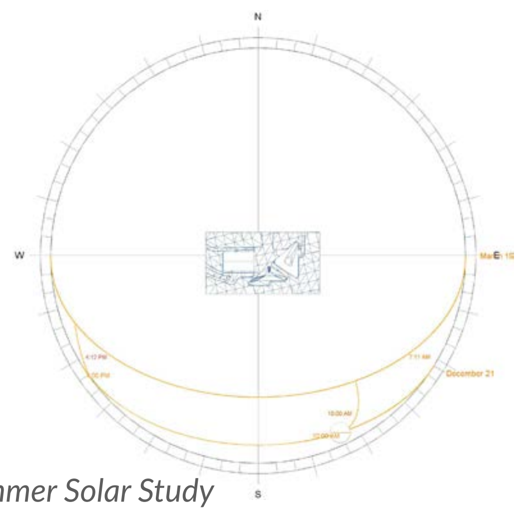
SUN DIAGRAMS:



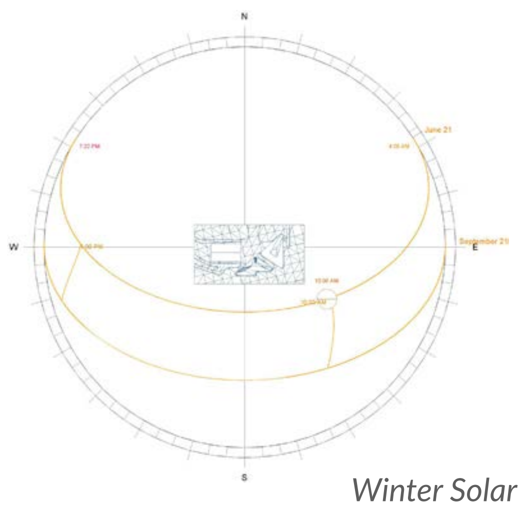
Annual Solar Study



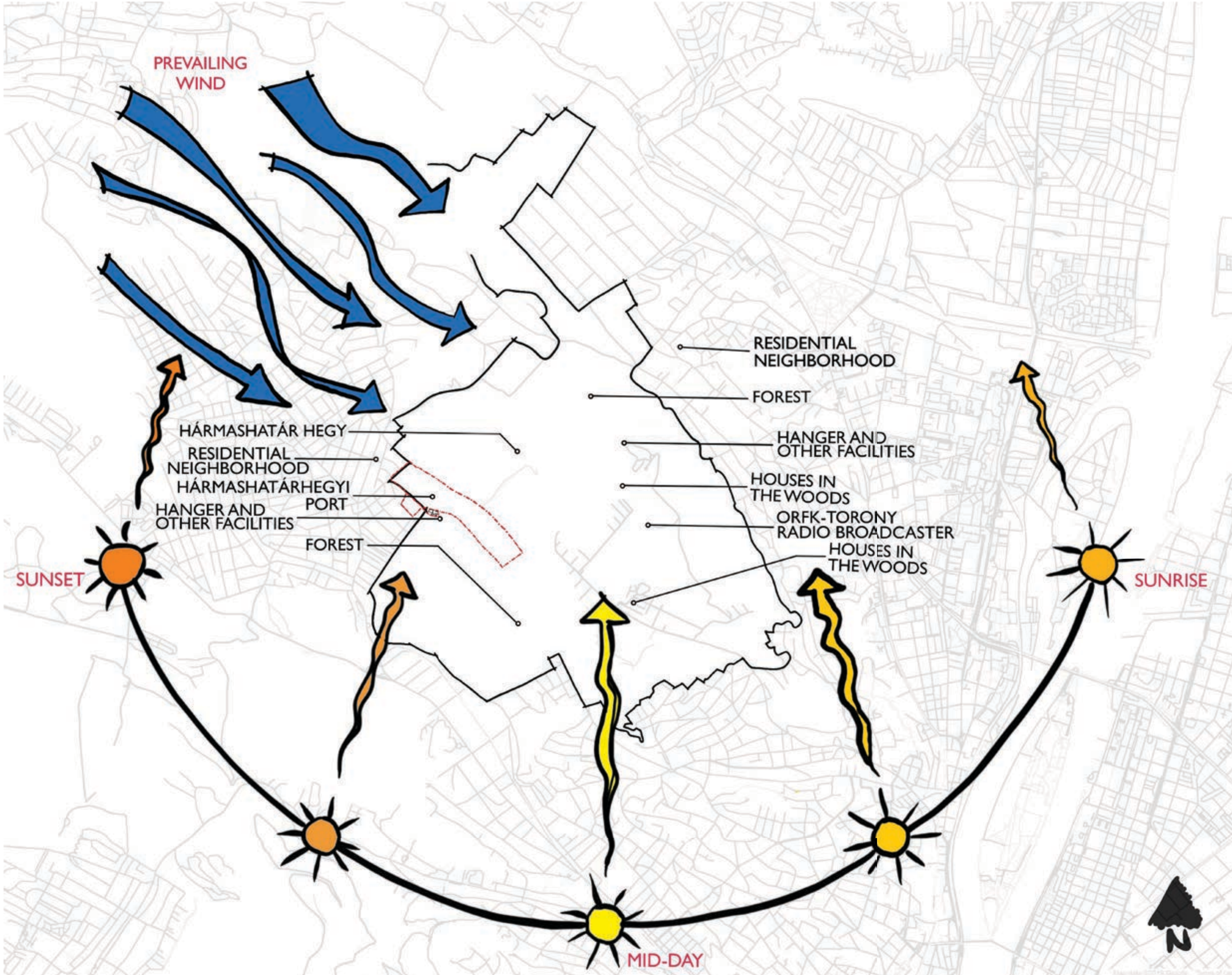
Multi Day Solar Study



Summer Solar Study



Winter Solar Study

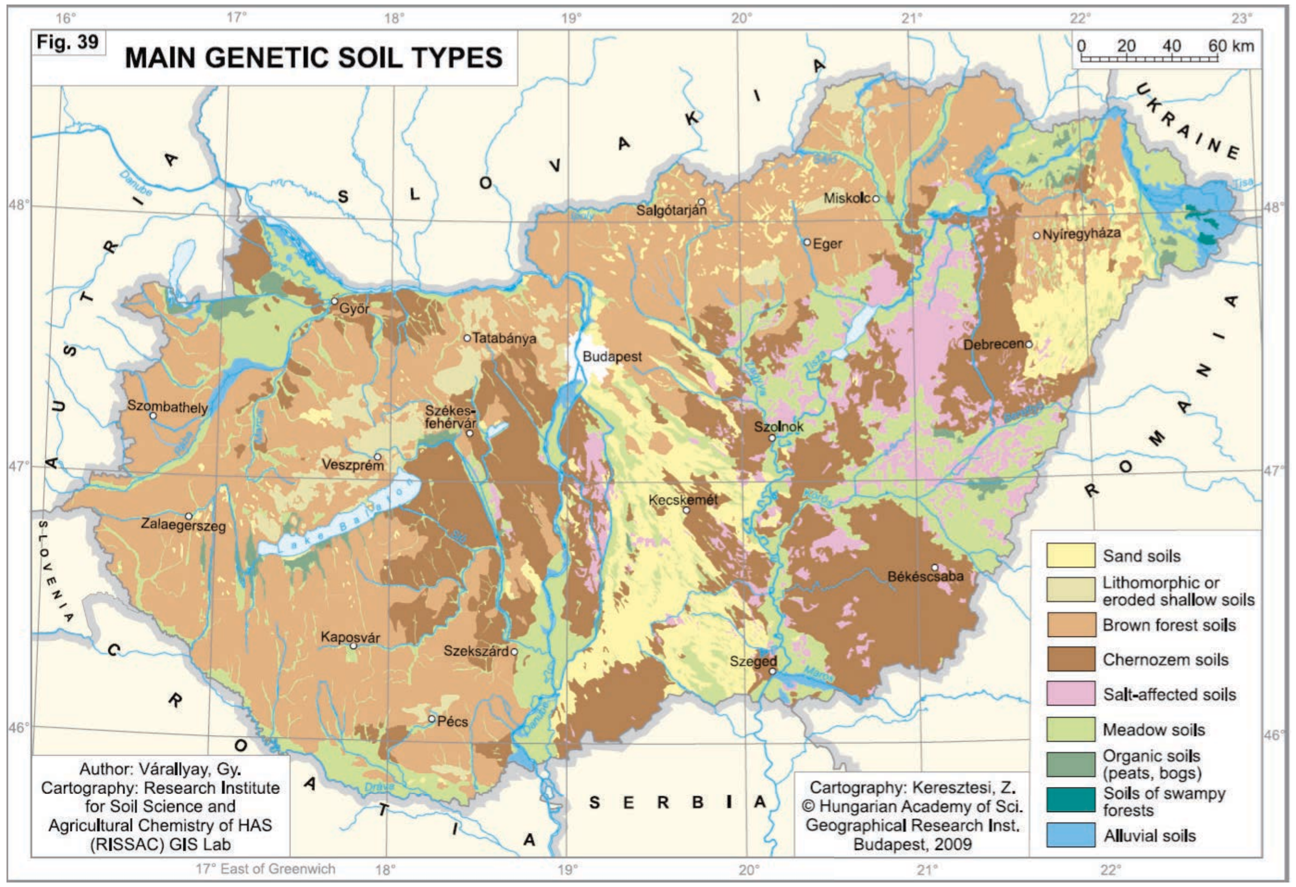


SOURCES OF NOISE

The HAR project is to be located in Harmashatar Hegy, which is at the remote district 2 of Budapest, which is at a huge open-air sport airfield, the site is remoted from traffic, so cars and transporation conjestion is not on the noise source list of the proposed project. The higher source of noise could be the gliders, and their audiences at the time of gliding and air contest events, and all you could hear on ordinary days is the mainstream natural sounds such as the windy blows and birds tweets and so on, if that is considered as noise, which is definitely not. And due to the minimized pedestrian and visitors crowds there is a complete low noise sourced out from them. Noise wise, it could be described as a pretty quite area unless there is an airfield event.

SOIL PROPERTIES AND TERRAIN

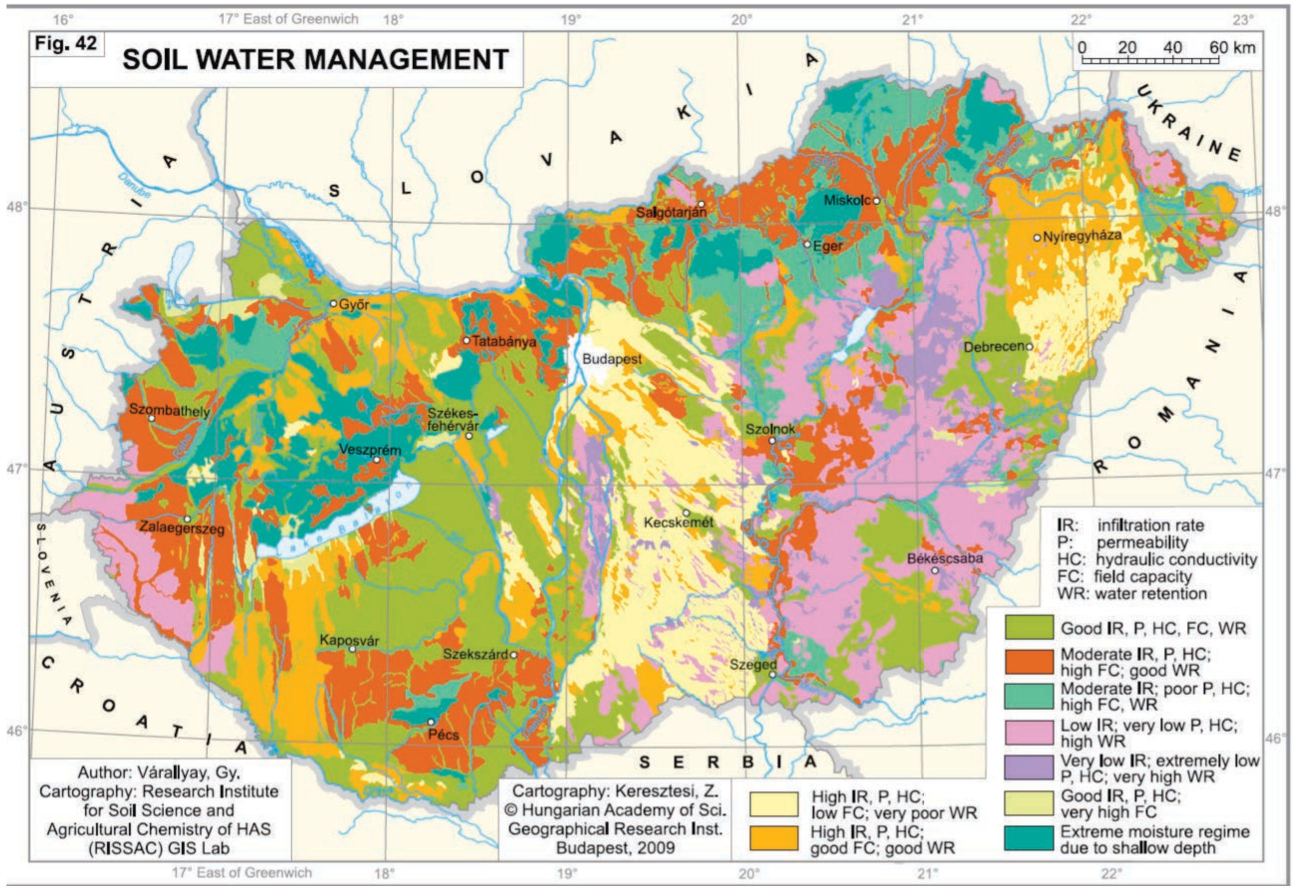
The soil in this site and generally in this region has an agricultural productivity value of 31-41%, the soil productivity expresses naturally fertility percentage of most fertile soil. Also the soil here has coarse texture. The soil in Harmashatarhegy is brown forest soil. Not to mention how Hungary is situated in the deepest part of the hydrogeological closed Carpathian Basin, where the majority of the parent material is of a relatively young geological formation as it was formed from the Budai-hegyseg.
Human activities (such as deforestation, grazing, water regulation, intensive farming, and urbanization) have had both significantly effect on the soil formation and soil degradation processes. Hungarian soil cover is highly heterogeneous. The bedrock could be reached from the top layers of soil that are mentioned below whereas almost every phase of the following soil sequences can be distinguished:
Chronosequence; topo-sequence (catena); leaching sequence; salinity/alkalinity sequence; erosion sequence.

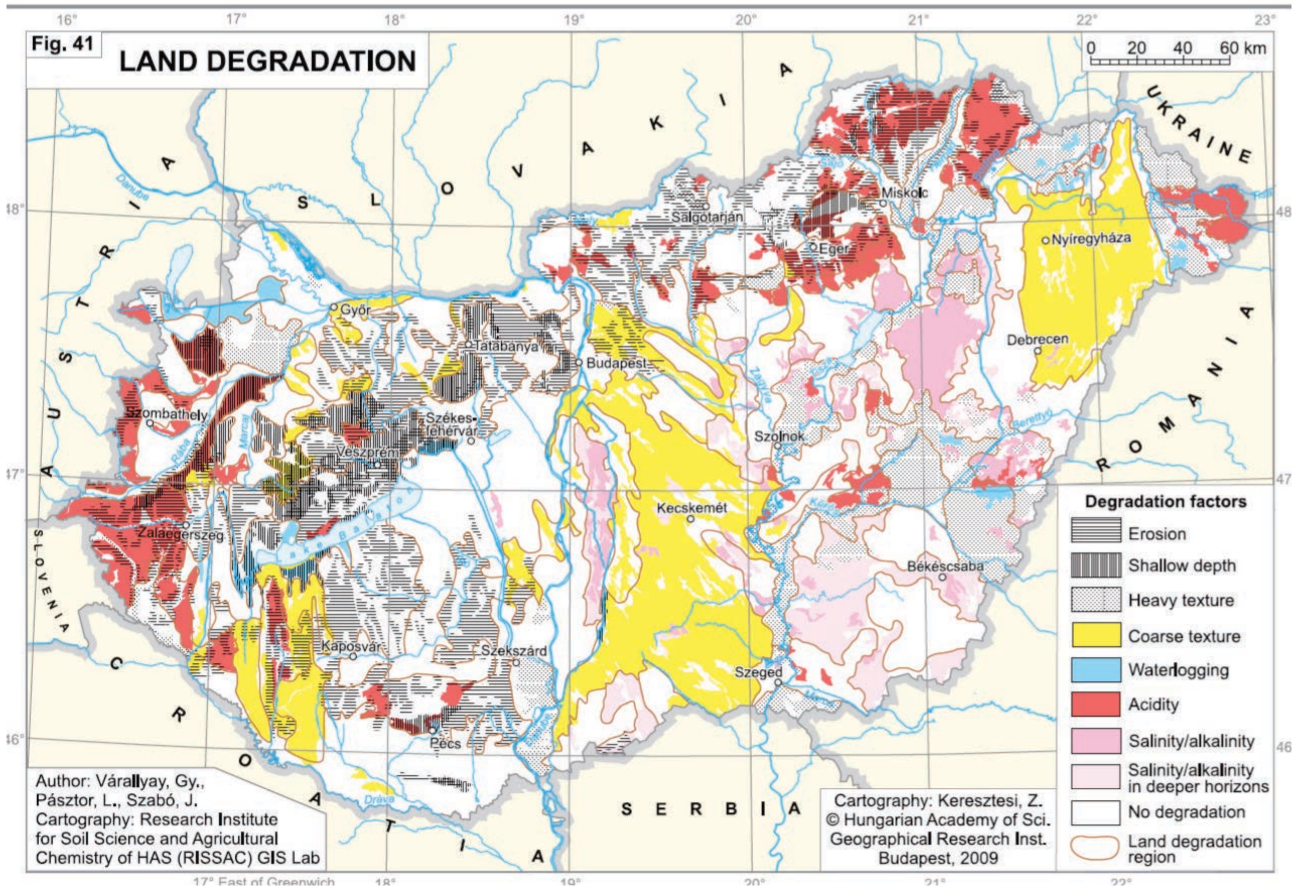


SOIL WATER CONDITION

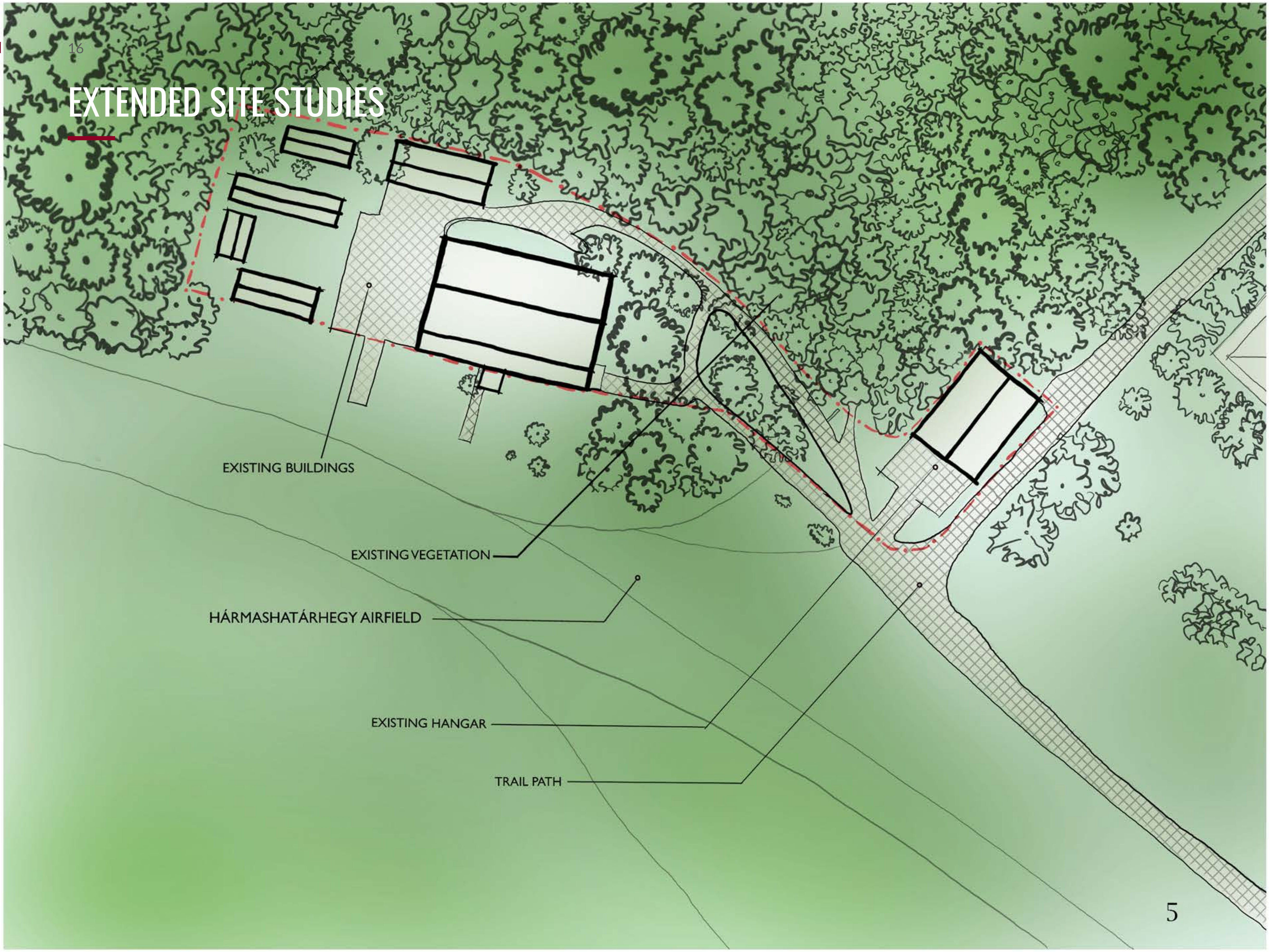
The water soil in this region can be defined as (high IR,P,HC; low HC GOOD WR) Just as the Great Hungarian Plain consists of a variable layered and textured deep aquifer where the groundwater table varies between 0.5 and 4.0 m below surface, with an average fluctuation of 0.5–2.0 m. The shallow water table often causes waterlogging on the lower parts of the fields. Surface aater logging appears also on the low-lying, low permeability plots at the end

of winter, after snowmelt and/or during high-precipitation periods. The high salt content of the groundwater and its high Na+/(Ca++ + Mg++) ratio often result in salinization and alkalinization of the soils.





EXTENDED SITE STUDIES



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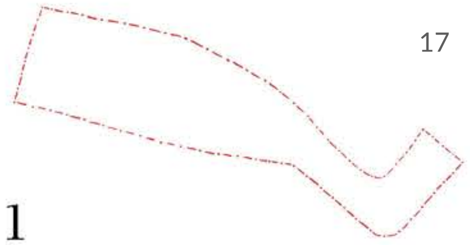

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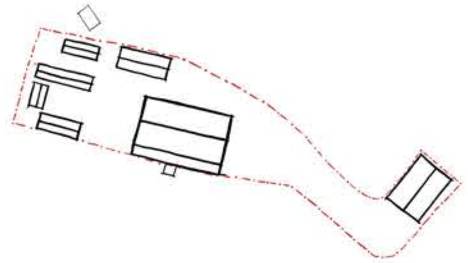

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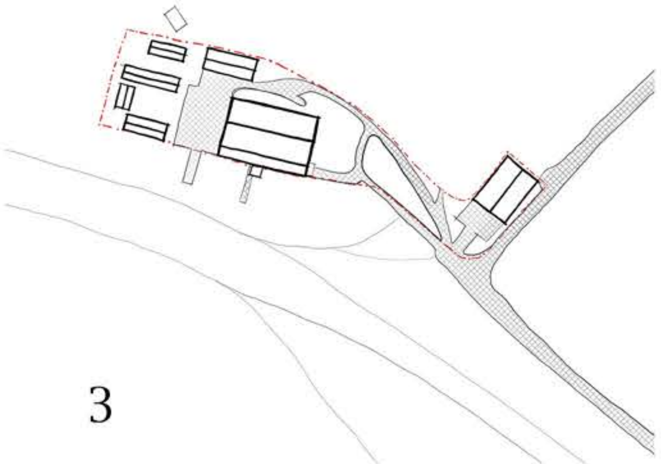

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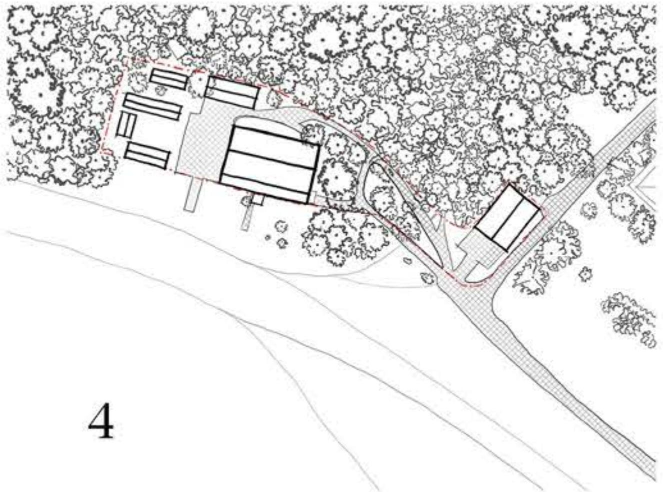

4

1. Boundaries
2. Existing Buildings
3. Routes
4. Existing Vegetations
5. Comprehensive Site Plan

General info

Hármashatár-hegy means "Three Border Mountain" is the name of a mountain in the city of Budapest, Hungary. Its name comes from the fact that the borders of 3 cities (Buda, Óbuda, Pesthidegkút) met at this point in the 19th century. Today, these cities have merged into Budapest, but the mountain's name has remained unchanged. However, the border between the II and III districts still bisects the mountain. The mountain is located on the Buda side, at 495m above sea level. The mountain is a popular place for hiking, biking and paragliding. In the winter it is also a place for sled riding. There are several trails in the area, but the only one that reaches the top is the blue trail, also known as the Country Blue Trail (Az Országos Kéktúra). At the summit there are television and radio towers, as well as a restaurant. It is often windy at the peak, due to the lack of trees. Snow may linger up to two weeks after the snow in the city has melted. On average, the temperature is a couple of degrees Celsius less than on the Pest side.

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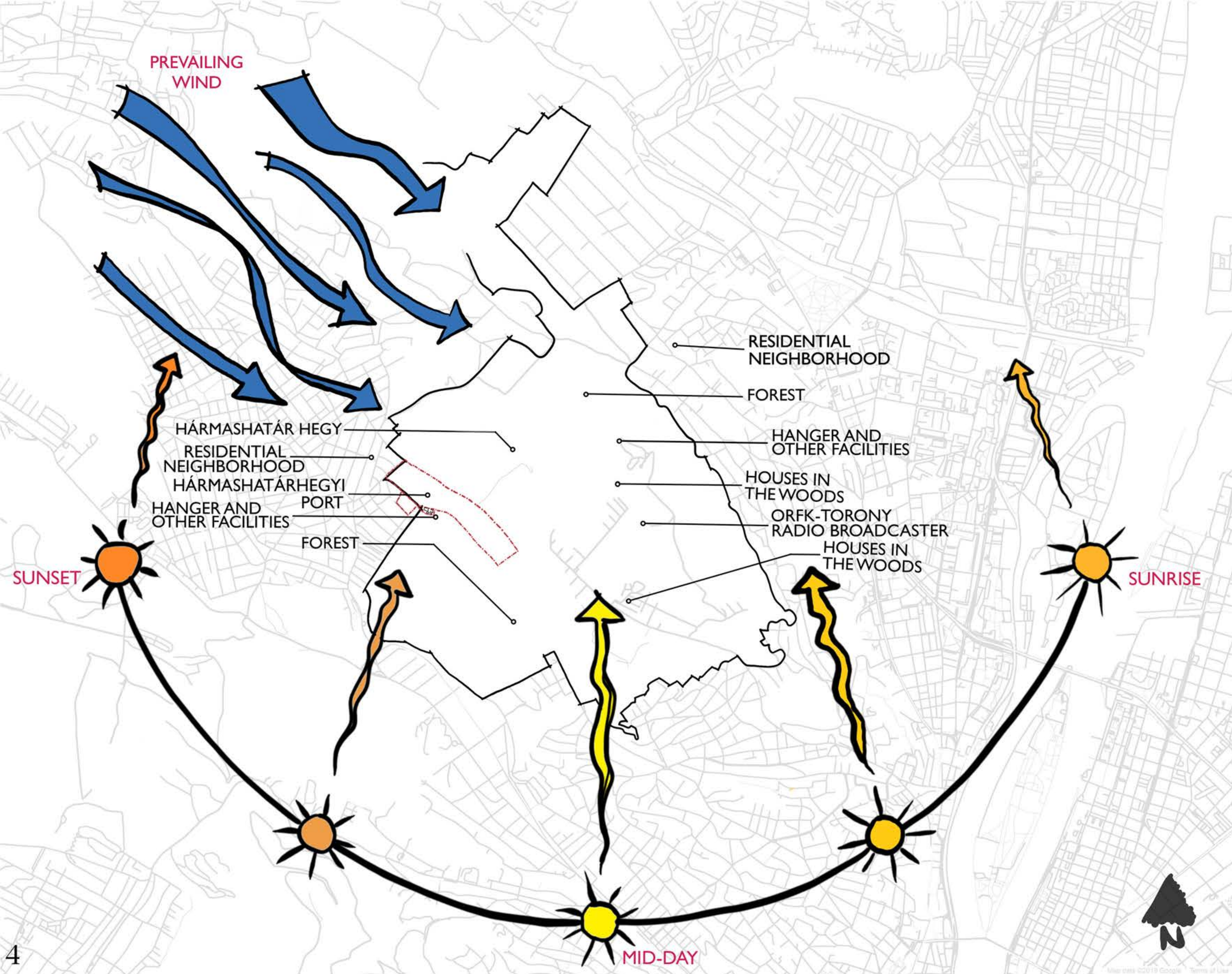

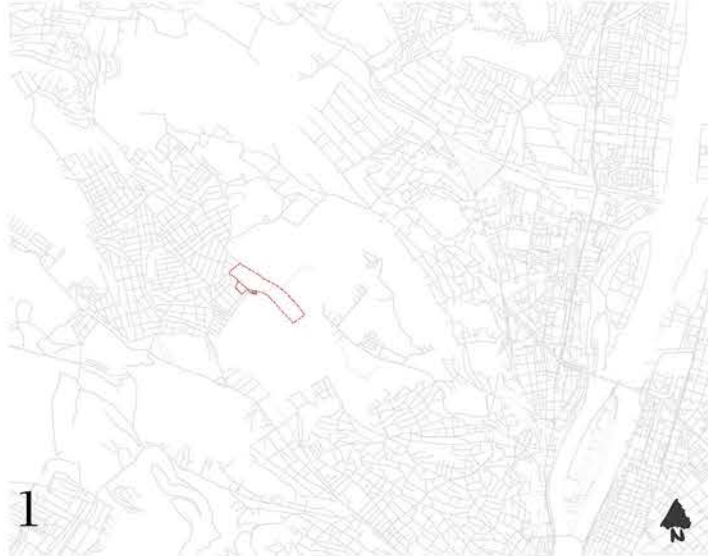

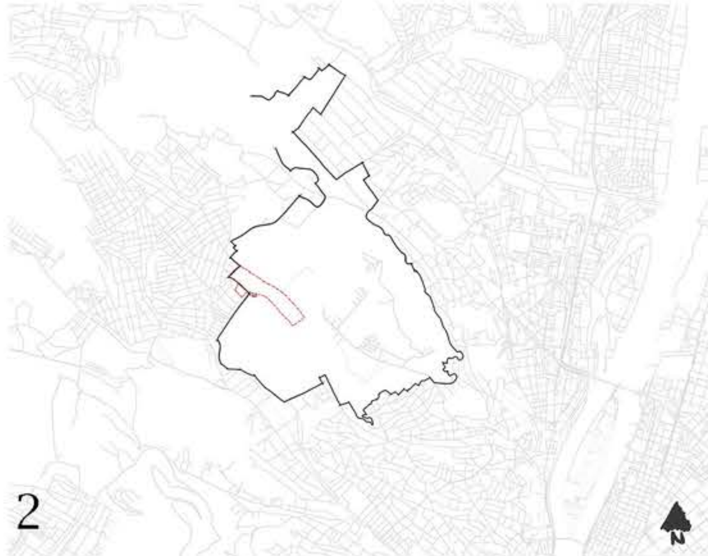

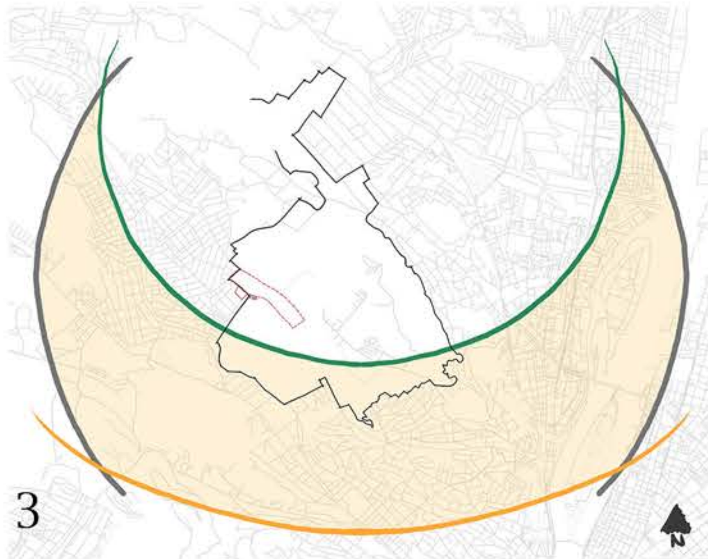

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Rainfall in July is the highest as it reacher 58.6 millimeters.
As summer starts, days get longer and nights shortet, in June there is 16 hours of daylight on the site

1. Site Boundaries
2. Hill Boundary
3. Sun Path
4. Sun Path and Wind Direction

Fig 1: Mass/Void Drawing

Fig 2: Farming Areas Drawing

Fig 3: Forests Drawing

Fig 4: Green Areas Drawing

Fig 5: Railway Drawing

Fig 6: Streets Drawing

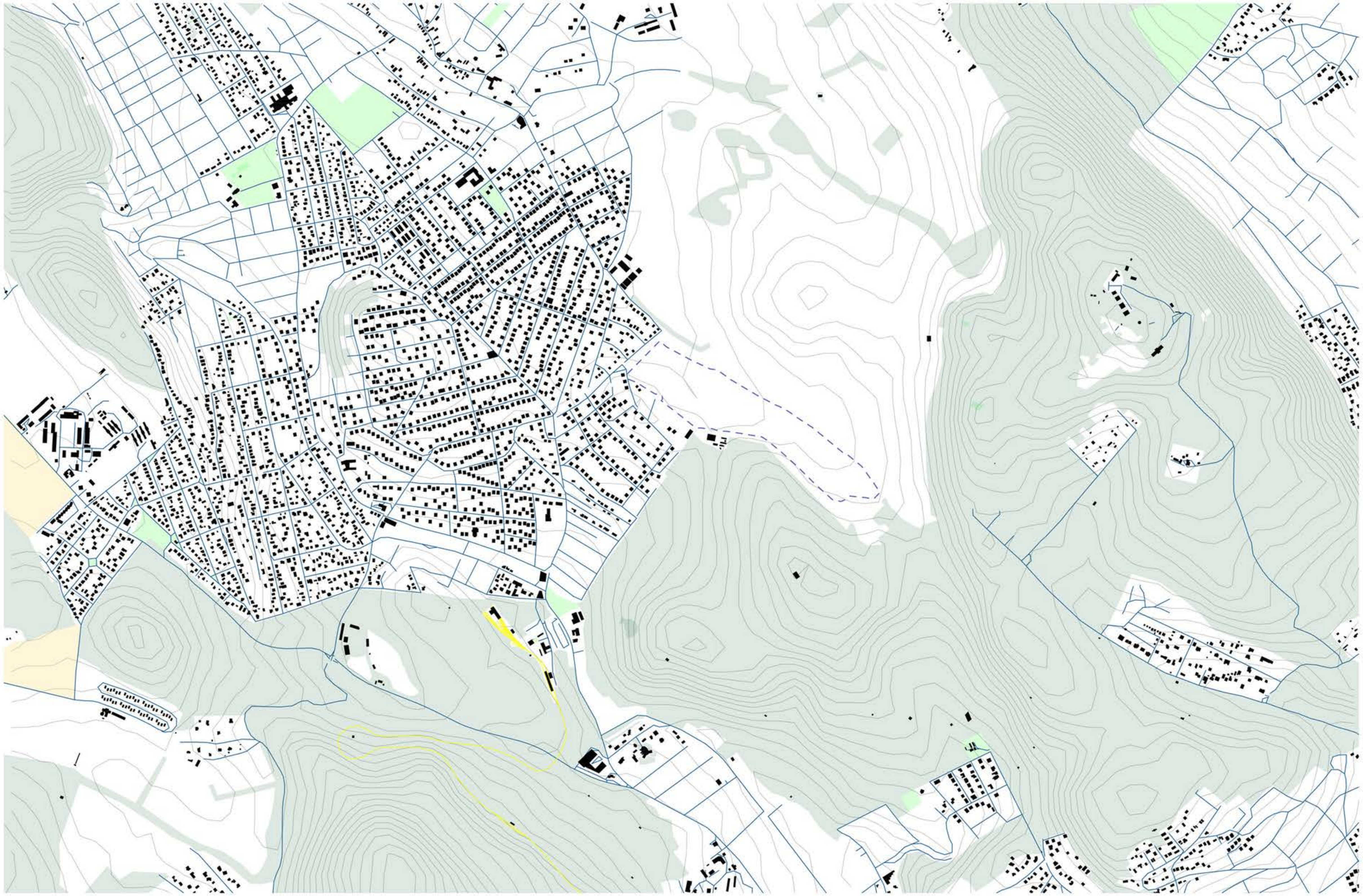


Fig 7: Site Plan Drawing

FUNCTIONAL ANALYSIS OF HAR

Gross Area is 7500 sqm

List of buildings and their programs:

1. Hangar (of Building A)
2. Interactive Hangar (Of Building B) (workshop/exhibition in off-seasons)
3. Reception (Building C)
4. Lobby/Cafe Seating (Building C)
5. Kitchenette + Pantry
6. Kitchen Receiving Area
7. VIP Lounge Area
8. Meeting Room
9. Interactive Space/Exhibition Area
10. Multi-Purpose Hall
11. Unisex Toilet for the Disabled
12. Ladies Toilets
13. Gents Toilets
14. Building C Court Yard
15. Lobby (Building D)
16. Ladies Thermal Pool's Lockers + Toilets + Showers
17. Gents Thermal Pool's Lockers + Toilets + Showers
18. Indoor Pool Lockers + Showers Indoor Pool
19. Thermal Pool Sky Showers
20. Thermal Pool
21. Shared in-pool Utilities
22. Pool side/Gym Bar
23. Gym
24. Sauna
25. Outdoor Pool
26. First Floor Junction
27. Educational Private Class
28. Lecture Hall
29. Building C Plant Rooms
    29.A. Electrical Room
    29.B. Electrical Storage
    29.C. AHU
30. Male Staff Room (Changing Room + Lockers + Toilet + Shower)
31. Female Staff Room (Changing Room + Lockers + Toilet + Shower)
32. HAR IT Department
33. Interactive Work-Shop/Creative Space
34. CCTV Room
35. Spa Zone
36. Massage Room
37. Spa Treatment Room
38. Simulation Room
39. Ticket And Event Office
40. Control Room (for HAR Airfield)
41. Management Open Plan Offices
42. Archive
43. Waste Disposal Room
44. Basement Services Entry

45. 46. Transformer + Battery Room

47. 48. 49. 51. Plant + Filters + Chlorine Room + Heating

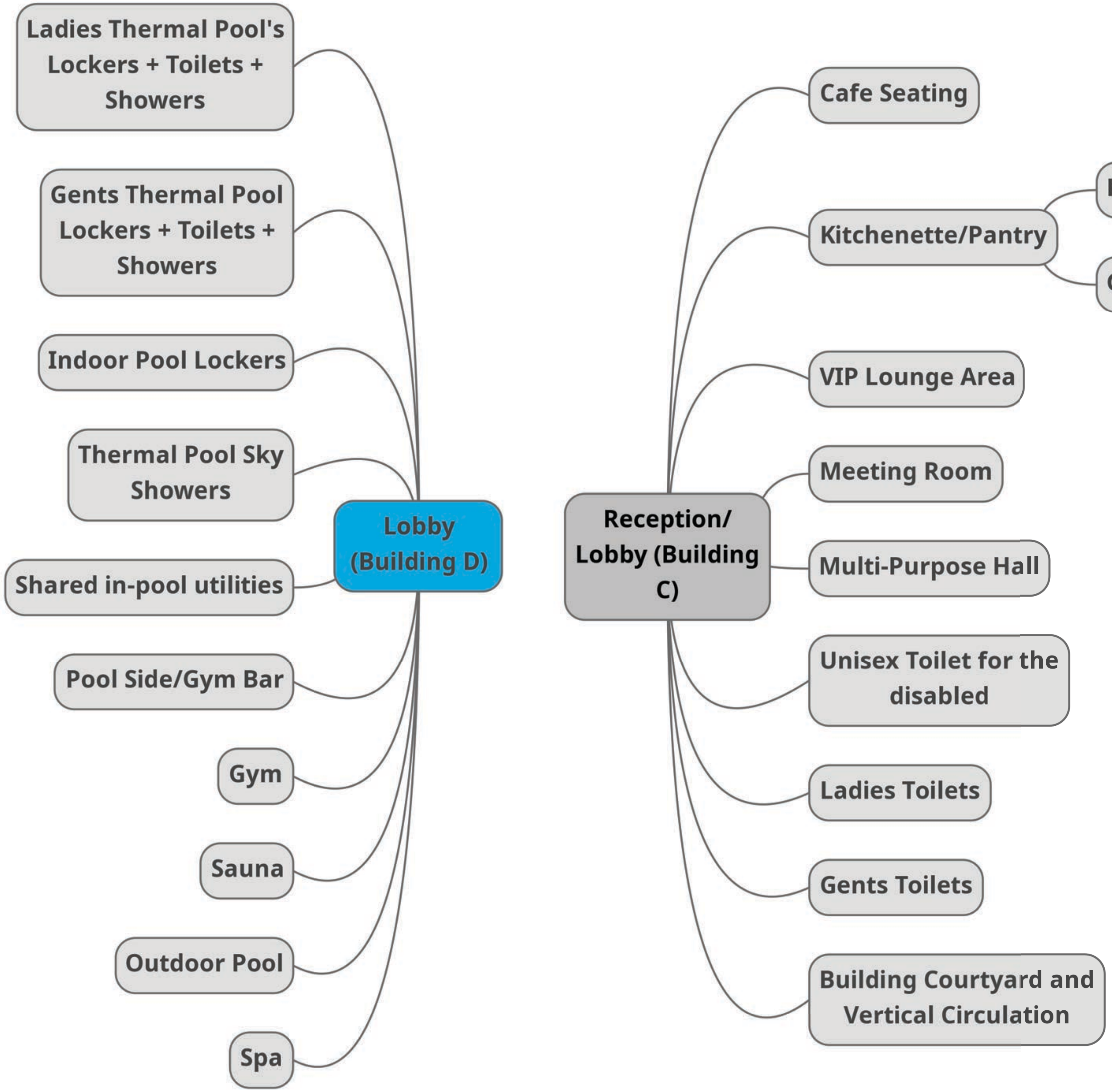
52. 53. Rain Harvesting Tanks + Maintenance

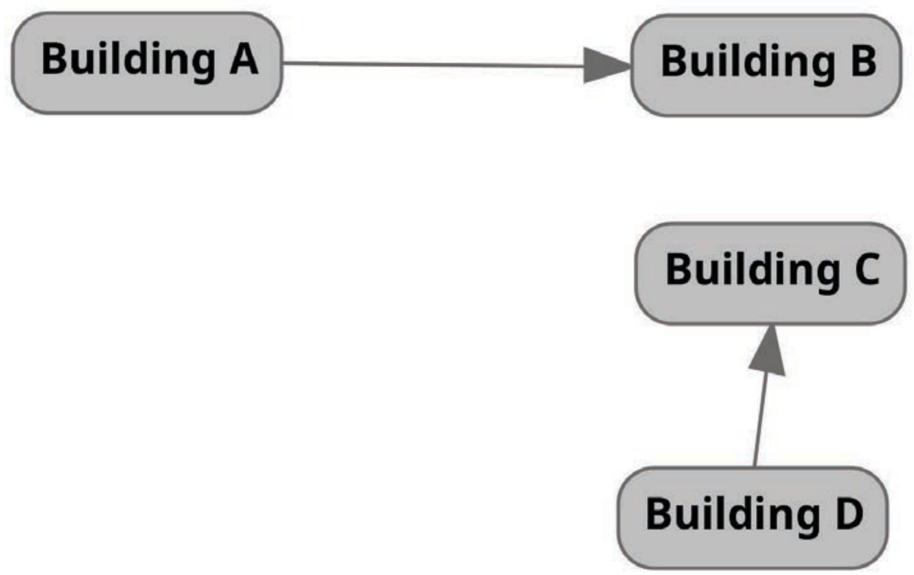
A: An Open Double-Volume Space

7,500

Square Meters of Pure Energy Efficiency, User-friendly Built Environment

FUNCTIONAL SCHEMA

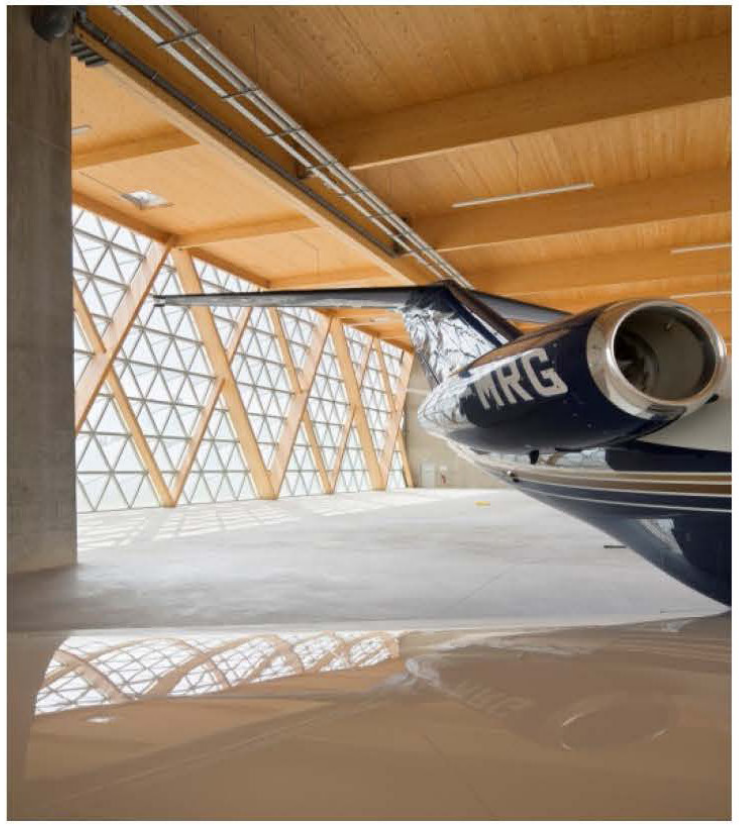


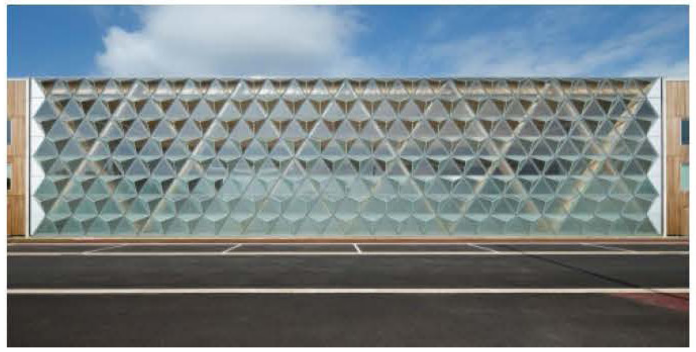


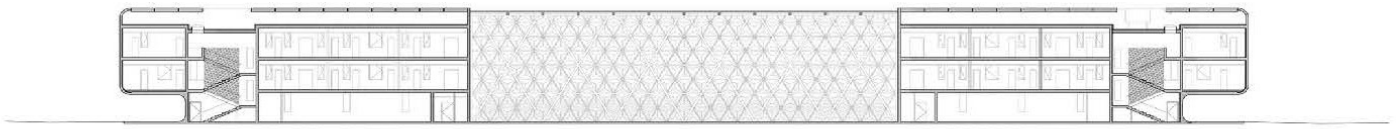
PRECEDENT STUDIES (SIMILAR PROJECTS)

CANNES AIRPORT

COMTE ET VOLLENWEIDER ARCHITECTES





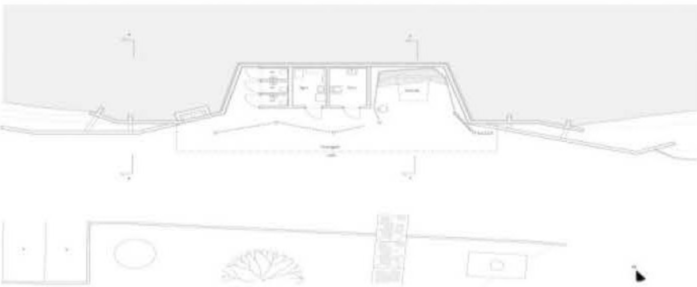


The Cannes - Mandelieu airport is one of the strong points of attraction of the Côte d'Azur. Improving the range of services for business aviation, both in terms of the crew and the performance and maintenance of aircraft, is essential to support the development of air traffic in the platform of Nice Côte d'Azur. The first phase of development corresponds to the north wing of the Cannes - Mandelieu airport, it must be representative of the level of excellence of this project.

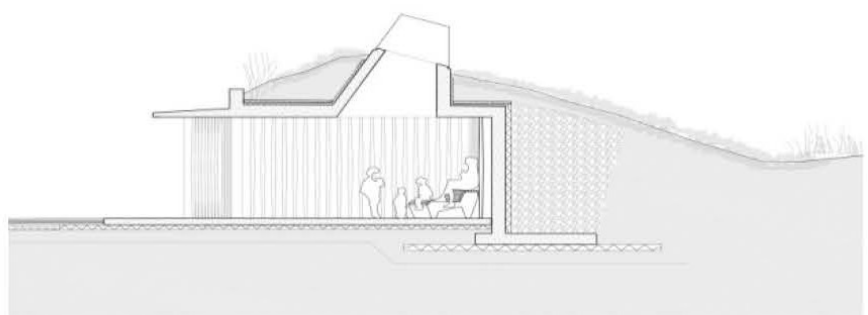
PRECEDENT STUDIES (SIMILAR PROJECTS)

KREKKE REST STOP AREA

PUSHAK + LALA TØYEN



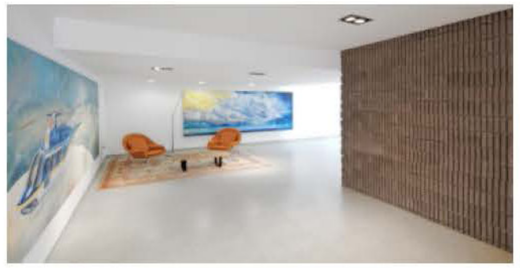
Krekke is a place to stop for a rest along the main road through Gudbrandsdalen, but it's also a park area for the local community of Fåvang, Ringebu. The service functions are placed inside an embankment that works as a noise barrier between the park and the highway.

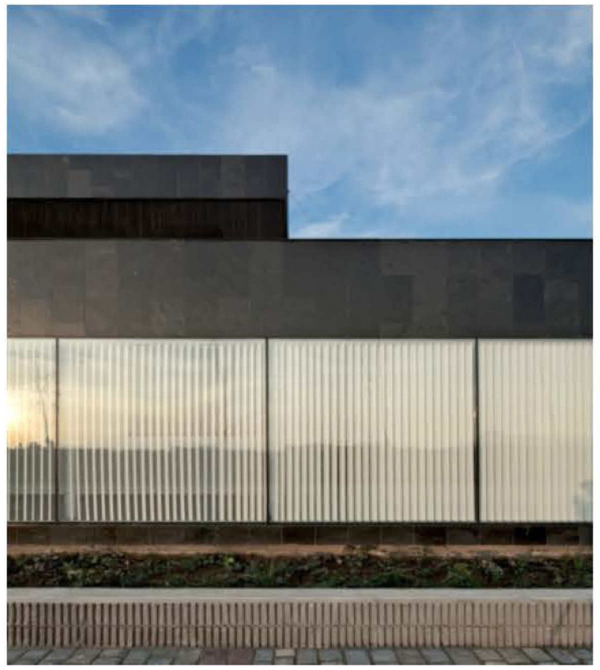


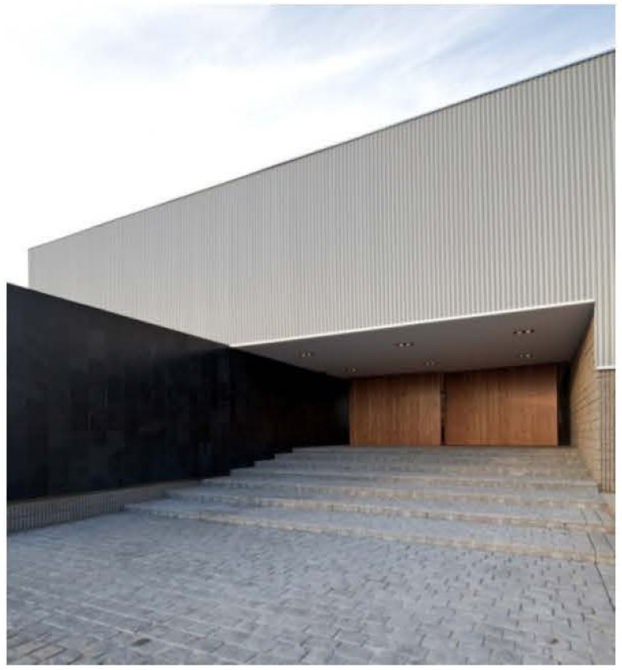
PRECEDENT STUDIES (SIMILAR PROJECTS)

EAGLE COPTERS

NICOLÁS LIPTHAY







The project is located in the district of Colina, next to Chicureo Aerodrome. It consists of the construction of the new facilities for Eagle Copters South America, which is made of administrative offices, customer recreational areas as well as hangars and workshops.
The total surface of the project is 10,457 m2, where volumes are distributed in parallel to edges. The central area of the terrain is cleared for free aircraft traffic, while linked to the different designs.

PRECEDENT STUDIES (SIMILAR PROJECTS)

NIKE AIR HANGAR

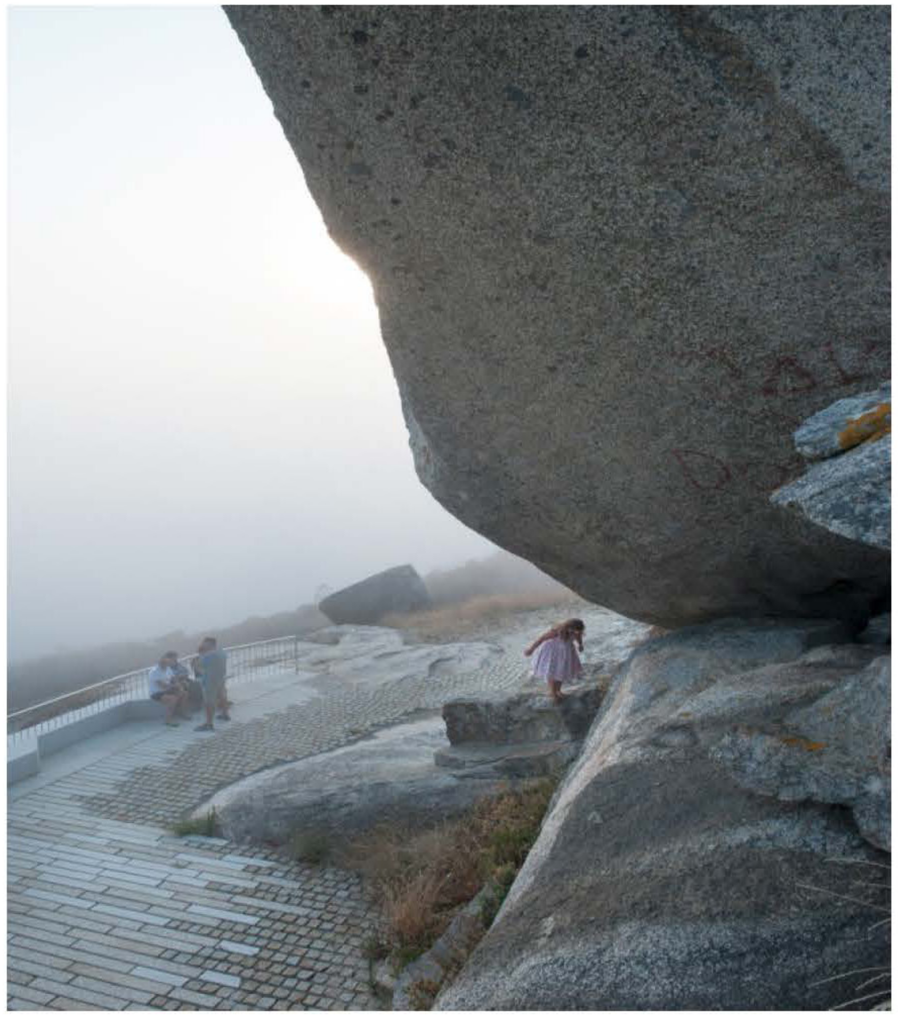
TVA ARCHITECTS

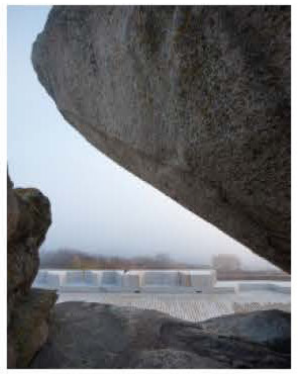
The Nike Air Hangar is a 12192 square meter facility located at the suburban Hillsboro Airport, on the outskirts of Portland. Privately owned by Nike, Inc., it houses three Gulfstream G5 jets for executive business travel. In addition to the requisite support space for flight planning and airplane maintenance, the Hangar provides amenities for travelers and pilots such as a lounge, exercise facilities, executive suites, meeting space, and a gourmet kitchen.

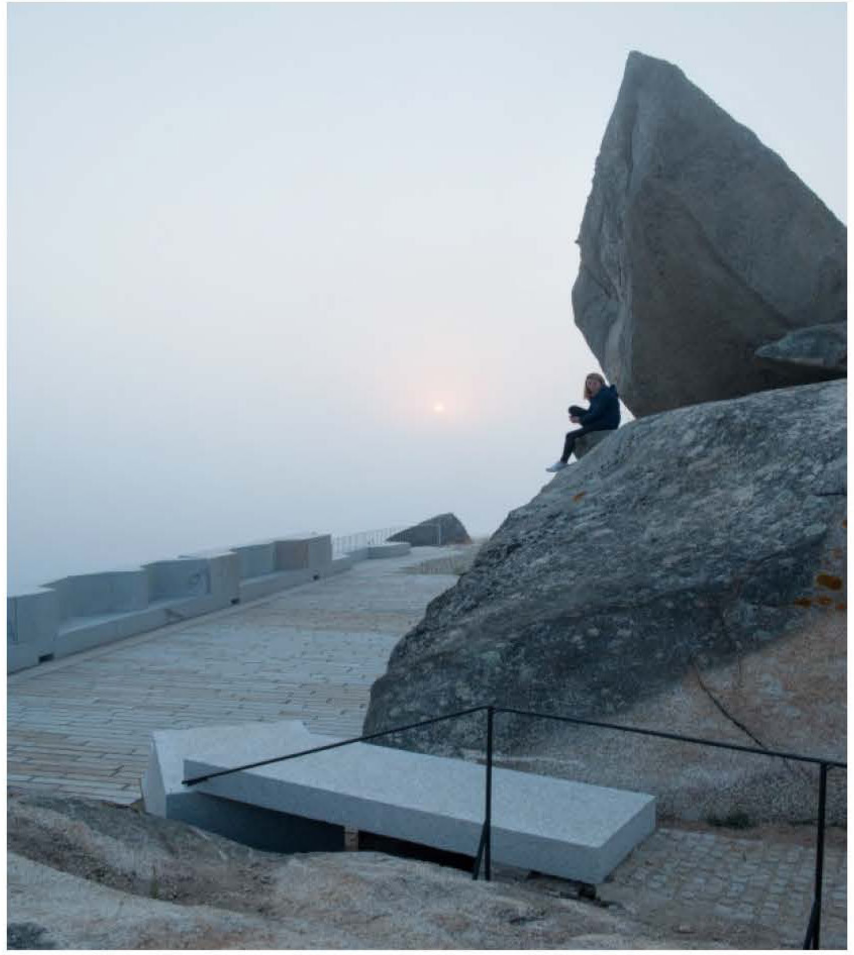
PRECEDENT STUDIES (SIMILAR PROJECTS)

PEDRA DA RA LOOKOUT POINT

CARLOS SEOANE







The project for the "Pedra da Ra" lookout point is based upon a municipal investment Programme which aims to promote the tourist possibilities of the Riveira City Council.
The lookout point known as "Pedra da Ra" has been used as such since the 1980s, when a concrete staircase was built to climb on the rock and from there one could observe the Atlantic Ocean’s horizon. Over time the original staircase deteriorated while losing all its meaning. The project is born out of the necessity for the demolition of that aggressive concrete staircase. This aggression is acted on both the environment and the rock itself. Thus, one sees the need to propose an action towards the recovery of the natural state of the site.

PRECEDENT STUDIES (SIMILAR PROJECTS)

THE LOOKOUT TOWER

At an elevation of approximately **500 meters high**, the lofty structure is perfectly positioned to overlook the city from a whole new point of view – when the weather is clear, this vantage point provides views far beyond the Budapest city limits

PRECEDENT STUDIES (SIMILAR PROJECTS)

STORBERGET VIEWPOINT AND REST STOP AREA

PUSHAK

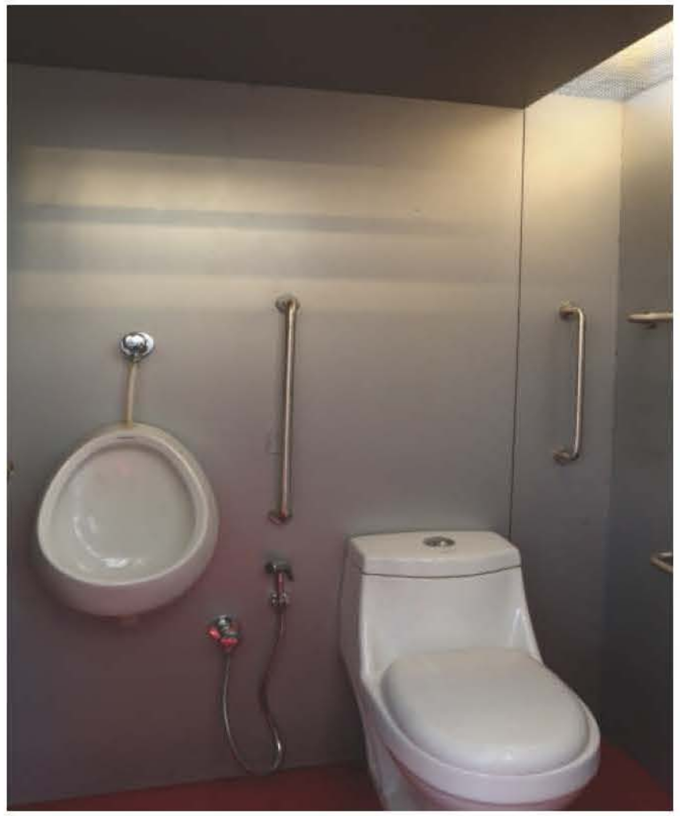
The National Tourist Routes are a selection of roads that stretch through some of the most beautiful landscapes in Norway and are developed and managed by the Norwegian Public Roads Administration. Several rest stops and viewpoints are established along the routes, either to highlight specific sights and outlooks or to mark a point of departure for hiking in the landscape. There is an expressed intention of achieving high architectural quality throughout the tourist route project, and several Norwegian architects have been involved in the various designs.

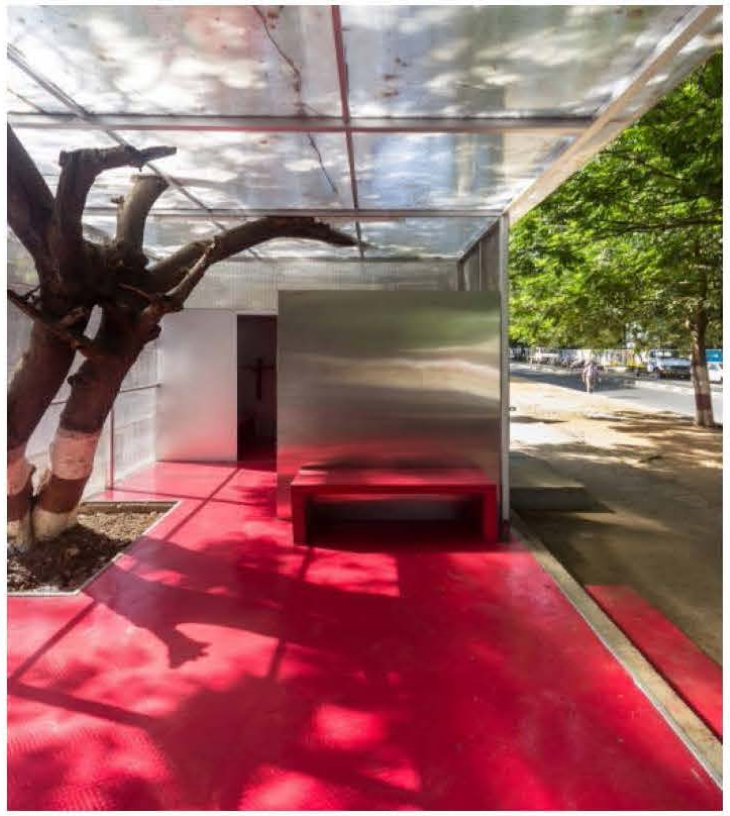
PRECEDENT STUDIES (SIMILAR PROJECTS)

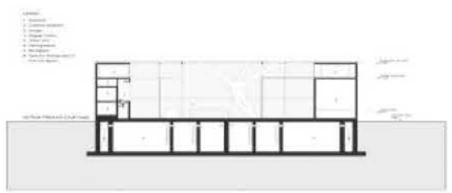
THE LIGHT BOX

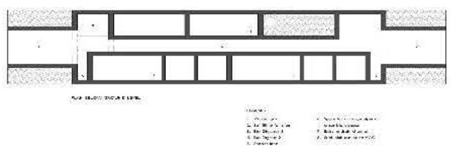
ROHAN CHAVAN

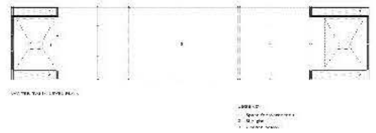
The design of the restroom has been conceptualized around a tree for two reasons. One to express the idea of integrating nature and context in the built form and using its characteristics to protect from climate. Secondly the shade of the tree protects the garden below from the sun allowing filtered light, and then it only needs a transparent cover to protect from rain. This intervention helped to maintain the light quality, as exactly it was when the site was empty. This was a crucial factor from a designer's point of view. As a result of this intervention during the day the natural light lits up the box filtering through the trees and at night the box lights the surroundings.

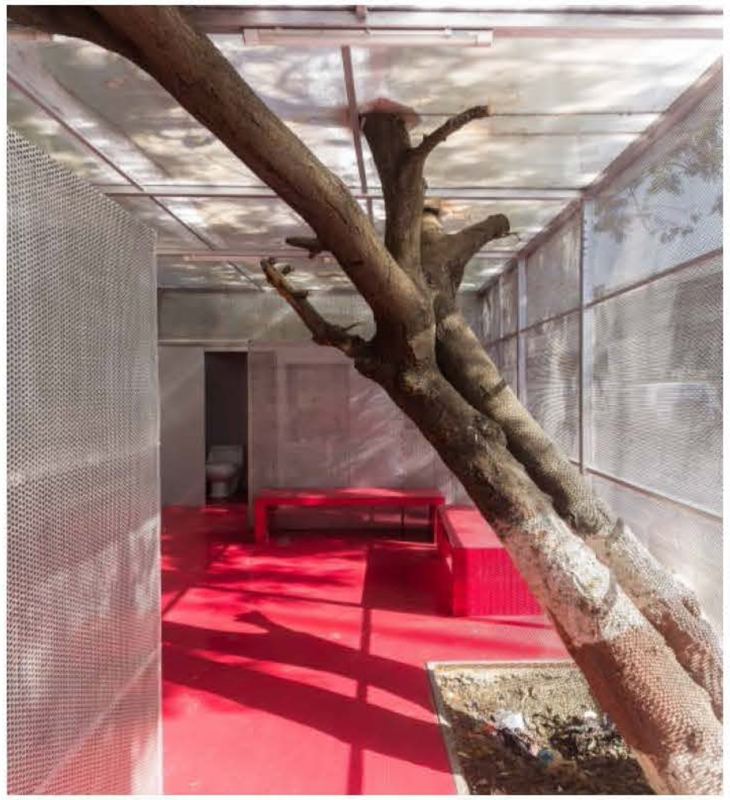






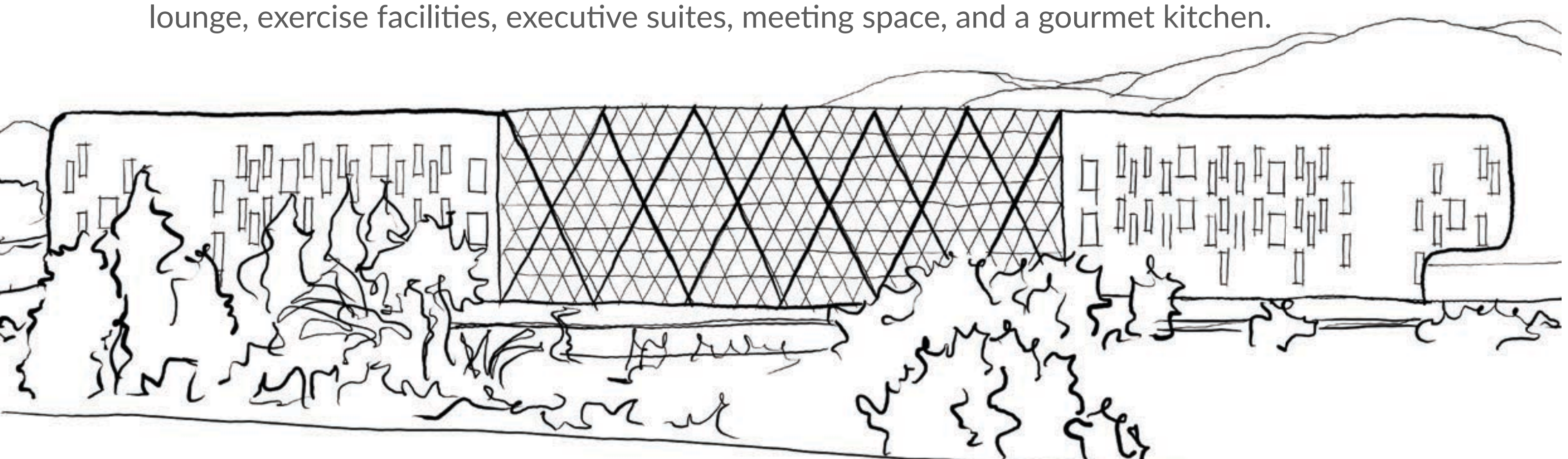




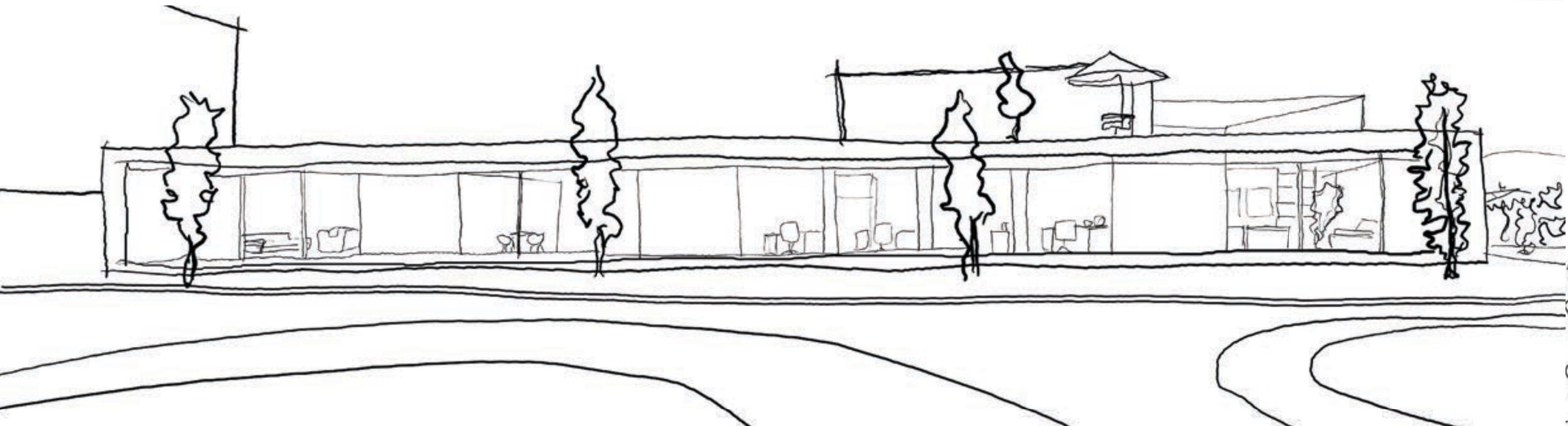


PRECEDENT STUDIES (CONCLUSION)

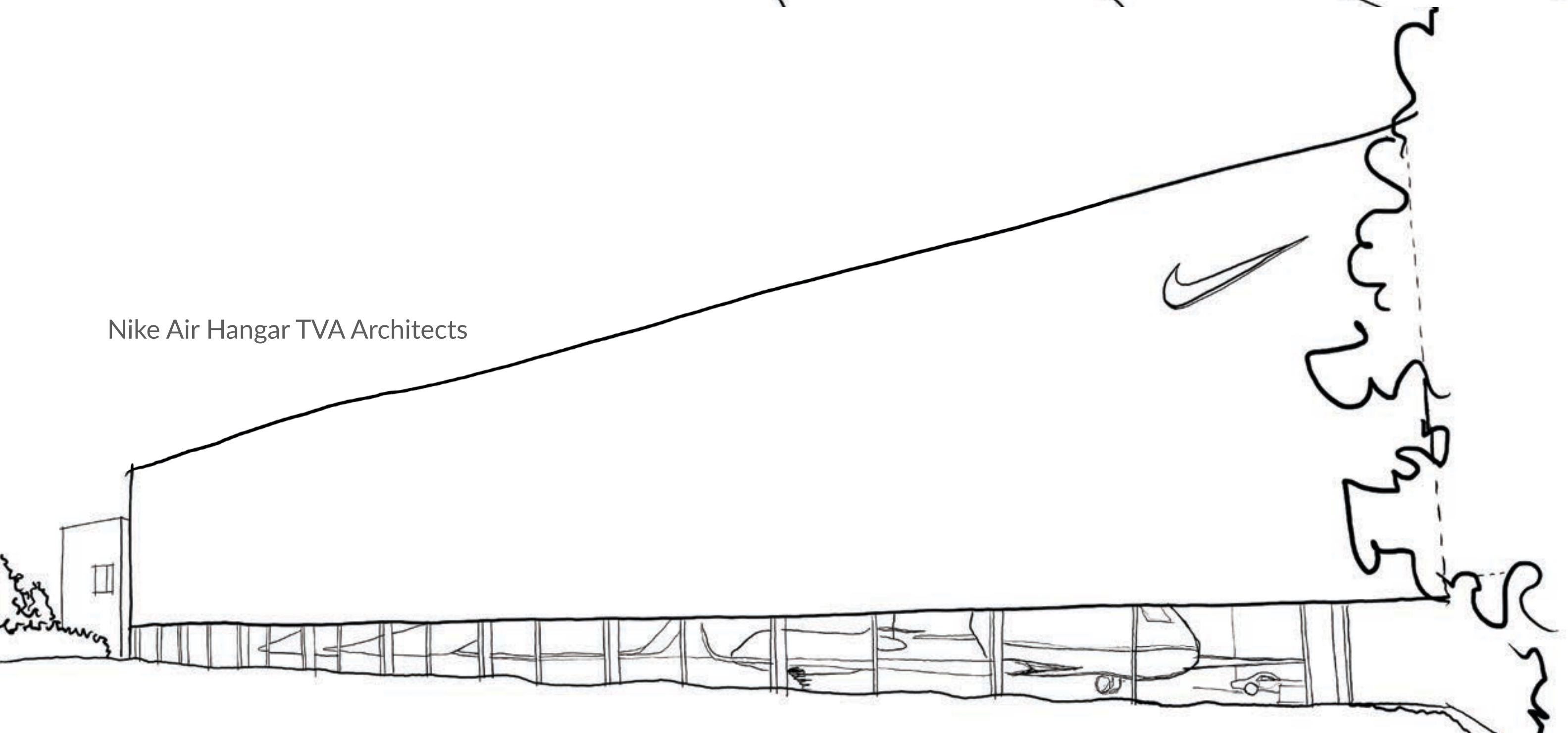
These hangers have glass in their design, which can be a good point for light, unlike the hangars we have on our site. In addition requisite support space for flight planni`ng and airplane maintenance, the Hangar provides amenities for travelers and pilots such as a lounge, exercise facilities, executive suites, meeting space, and a gourmet kitchen.



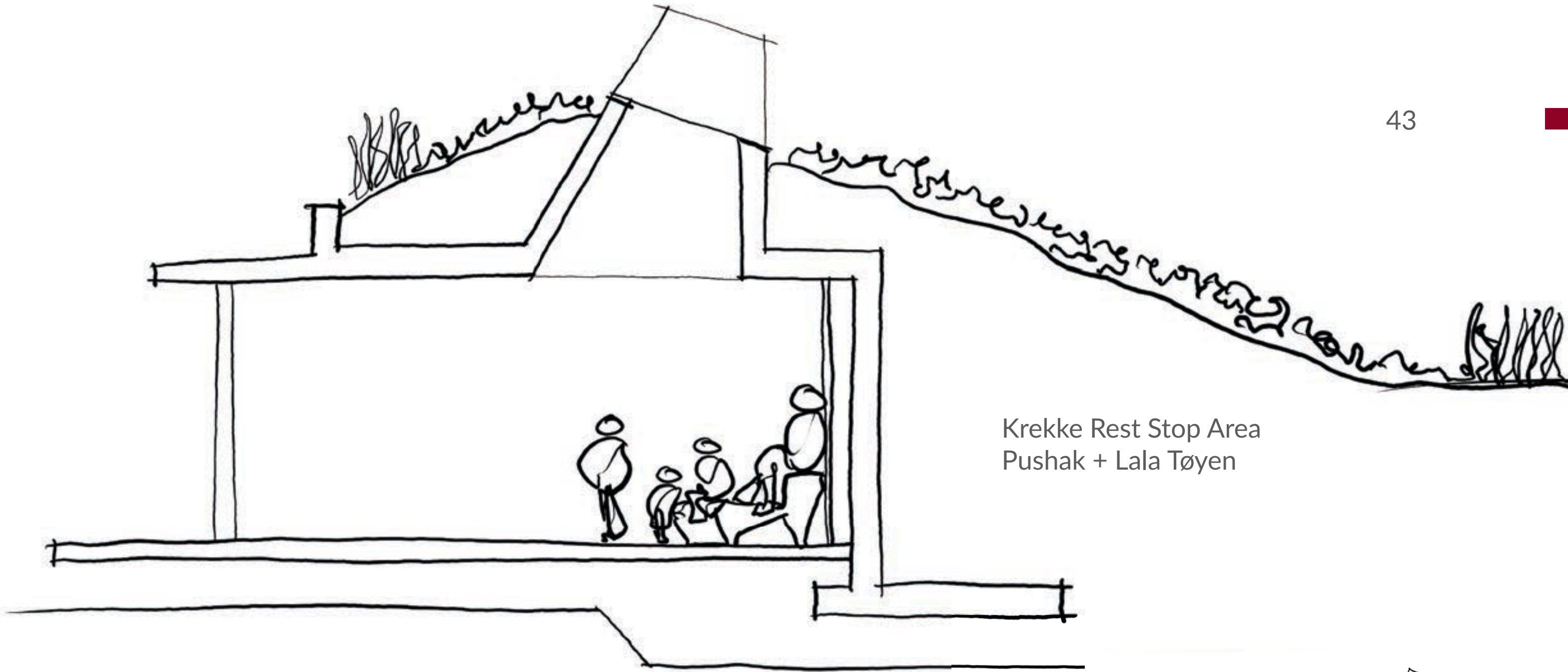
Cannes Airfield / COMTE et VOLLENWEIDER Architectes



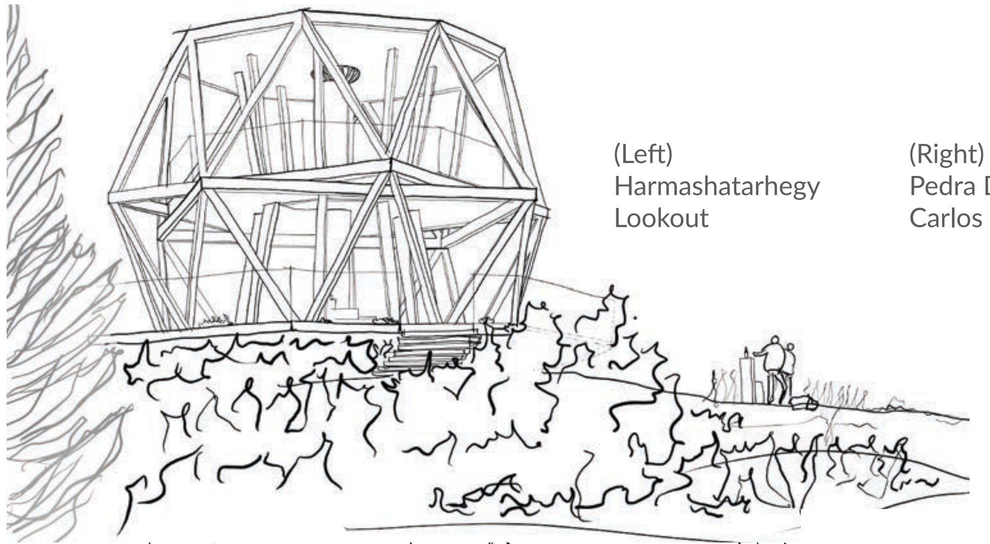
Eagle Copters / Nicolás Lipthay | L2C



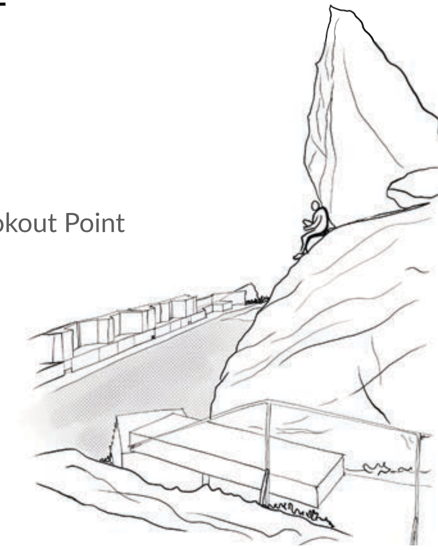
Nike Air Hangar TVA Architects



Krekke Rest Stop Area
Pushak + Lala Tøyen

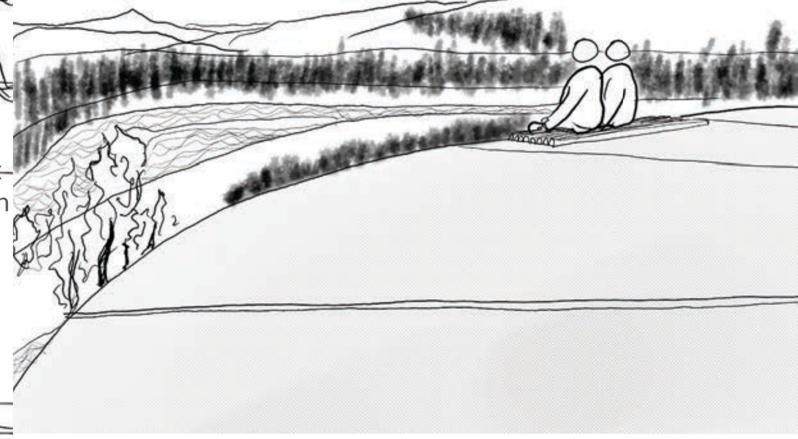


(Left)
Harmashatarhegy
Lookout



(Right)
Pedra Da Ra Lookout Point
Carlos Seoane

(Right)
The Light Box
Rohan Chavan



(Below) Storberget Viewpoint and Rest Stop Area / Pushak

The site being worked on has a very good topography. A flat airfield, high hills, and moderatly high hills make a great composition in nature. So many people use the site for walking their dogs, hiking, picnic, biking, paragliding....etc. These projects were a part of our preliminary studies for the site. There are good points and bad points in them, but we will focus on the good ones and inspire by the ideas. These projects are somehow related to nature and used for resting. When people are traveling, hiking, or walking.....etc sometimes they need to rest, so why not to rest with Design

EXISTING STRUCTURES ON SITE

The existing structures on site, and their conditions are illustrated throughout these photos from the Department of Public Building Design at BME

HAR COMPLEX DESIGN CONCEPT 3

The experiences and activities intended to be given to the users of the Hármashatárhegyi, through the design of the built and unbuilt environment and spaces are meant to be unforgetable and inevetible, through providing new methods to act through the same activities. The aim behind this is to revitalize the Hármashatár Hegy district and make it the spiced up zone that would influence not only the Second District, but also the whole city of Budapest.

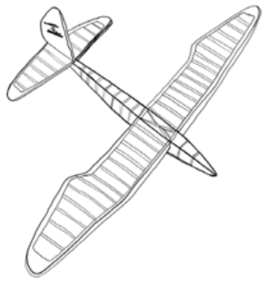


Fig 1: Develop the gliding activities, and revitalize/redesign the existing hangars

Fig 2: Initiate a camping site in the middle plain and fascilitate the functionality of camping within the pine woods.

Fig 3: Facilitate the activities of Paralgliding and create workshop spaces, near the training field. and also Cycling workshops and storages

Fig 4: To Facilitate Hiking, landscape features including shading and resting areas will be supplied throughout the designated hiking routes.

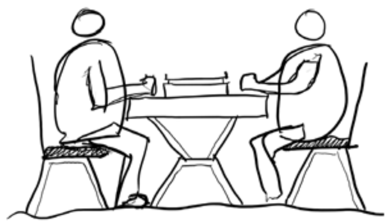


Fig 5: The Picnic friendly hill, lacks the needed landscape features, thus, the design will take care of the needs of a memorable picnic

Fig 6: The high tides of the wind serves as a great Kite attraction, with the scenery of the fascinating pine forests around

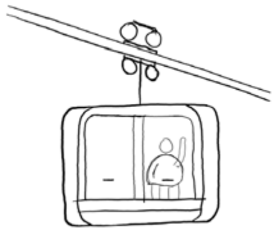


Fig 7: The huge area of the site is hard to be covered by a group of people trying to enjoy every bit of Harmashatarhegyi, thus Cable Carts are to be designed to connect the main attractions

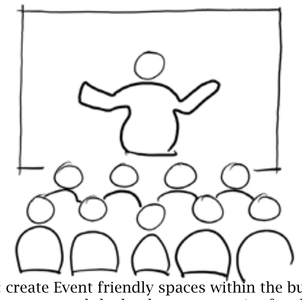


Fig 8: create Event friendly spaces within the built environment and the landscape scenaries for the intended activities to be celebrated

Fig 9: Create Spa activites, to house meditating and relaxing activites for the tiring experiences existing on the site including baths, massages. etc

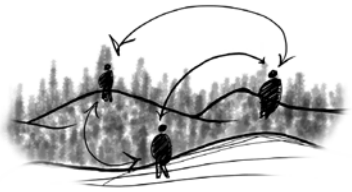


Fig 10: Facilitate the pedestrian movement on the plains and throughout the forests in a well manner by creating resting spaces along the way.

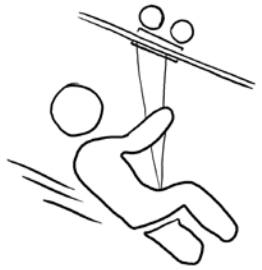


Fig 11: Create Entertainment facilities in the woods, including ziplines, and other facilities, by maintaining a minimum building footprint on site

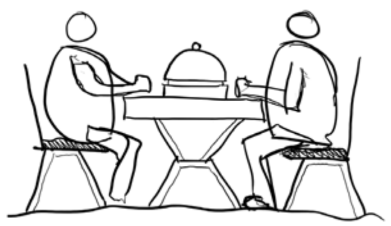
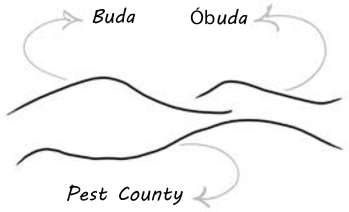
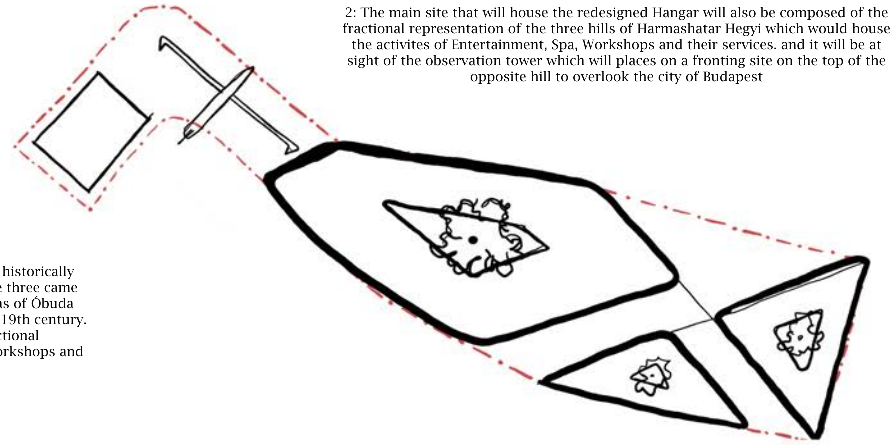


Fig 12: Create catering facilities and temporary Pavilions for when needed

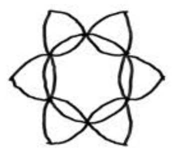


1: The hill as named after being within the Borders of Three Mountains, which is historically was the meeting point of the formation of the city of Budapest, as each hill of the three came out from a different county and region, of which one was of Buda, the second was of Óbuda and the third is of the Pest County, which the three met at this pointof land in the 19th century. so to celebrate this site value of the location, the main site composed a fractional representation of these three hills to house the activites of Entertainment, Spa, Workshops and their services.

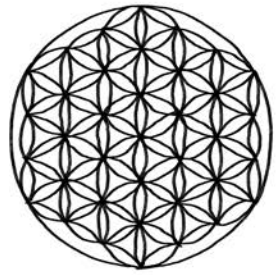


2: The main site that will house the redesigned Hangar will also be composed of the fractional representation of the three hills of Harmashatar Hegyi which would house the activites of Entertainment, Spa, Workshops and their services. and it will be at sight of the observation tower which will places on a fronting site on the top of the opposite hill to overlook the city of Budapest

3: The vast amount of the available pine forest with its verticality and how it could be found everywhere, you stomp your feet on a pinecone, this initiated an intimate inspiration for the Observation tower due to its verticality and height, along side with the properties of the pinecone during its life circle and how it opes outwards which could create a fascinating biomimic high tech engineering that could light up the city of Budapest



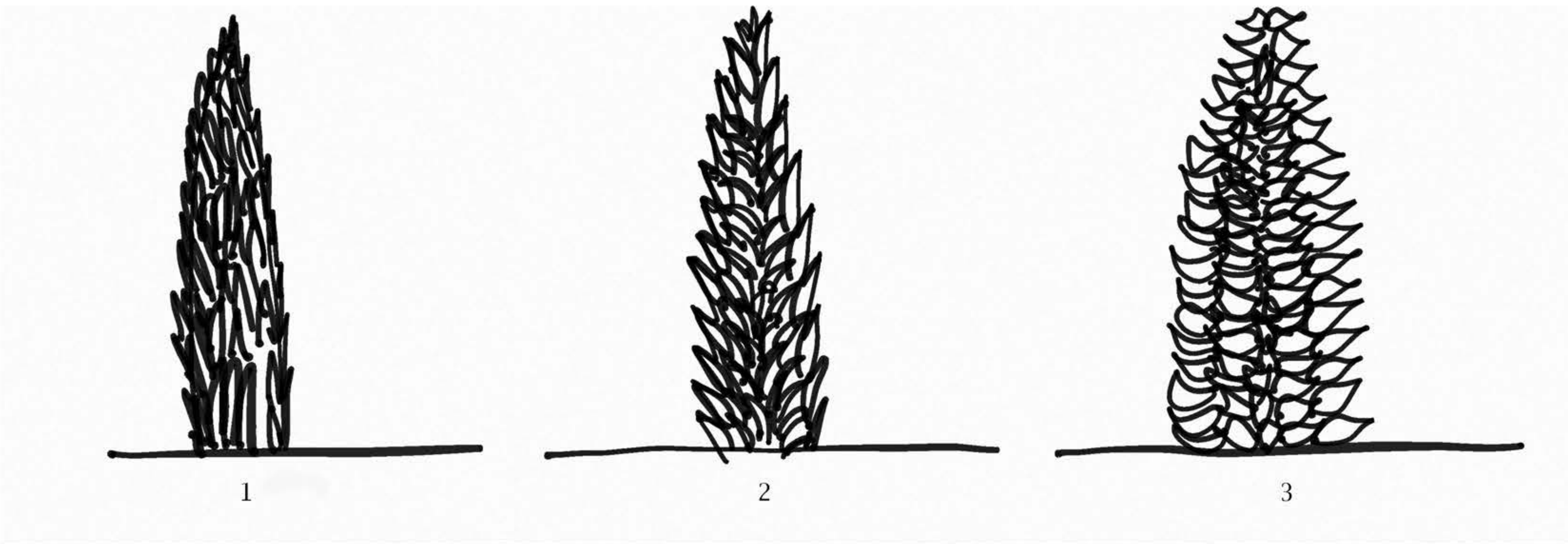
4: A great way to inspire the Observation tower program, and to serve the reasoning of the opening leaves of the vertical lookout tower, was to orient the program within the articulations of the circle of life, which could be a great example for multiple, biomimc, variations within a building, due to its vast amount of flexible alternatives of form and geometry.



5: The circle of life (or Tree of Life) wont only serve as a program layout for the observation tower, but also will be a set out example of routes for the Camping site, which is mentioned in the previous section of activities, whereas a camp to be laid out at the nodes of the sacred geometry.

6: A sample layout of the complexity of the changing and dynamic tower with its multiple look-out customed balconies. The tower is meant to be erected at the heigh peak of the hill, which is the second selected site, to overlook Budapest and give another meaning to the night lighting scheme of the city.

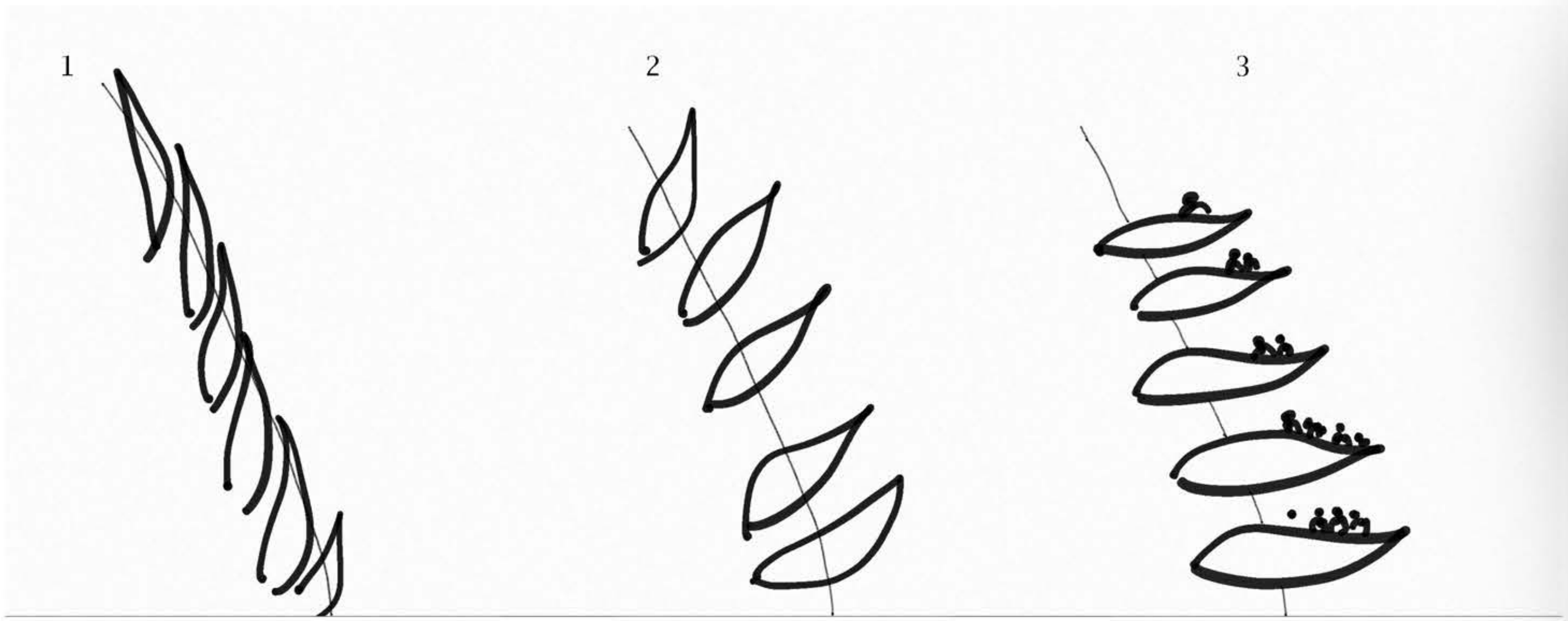
INSPIRATIONS AND EXPIREMENTAL FORMATION

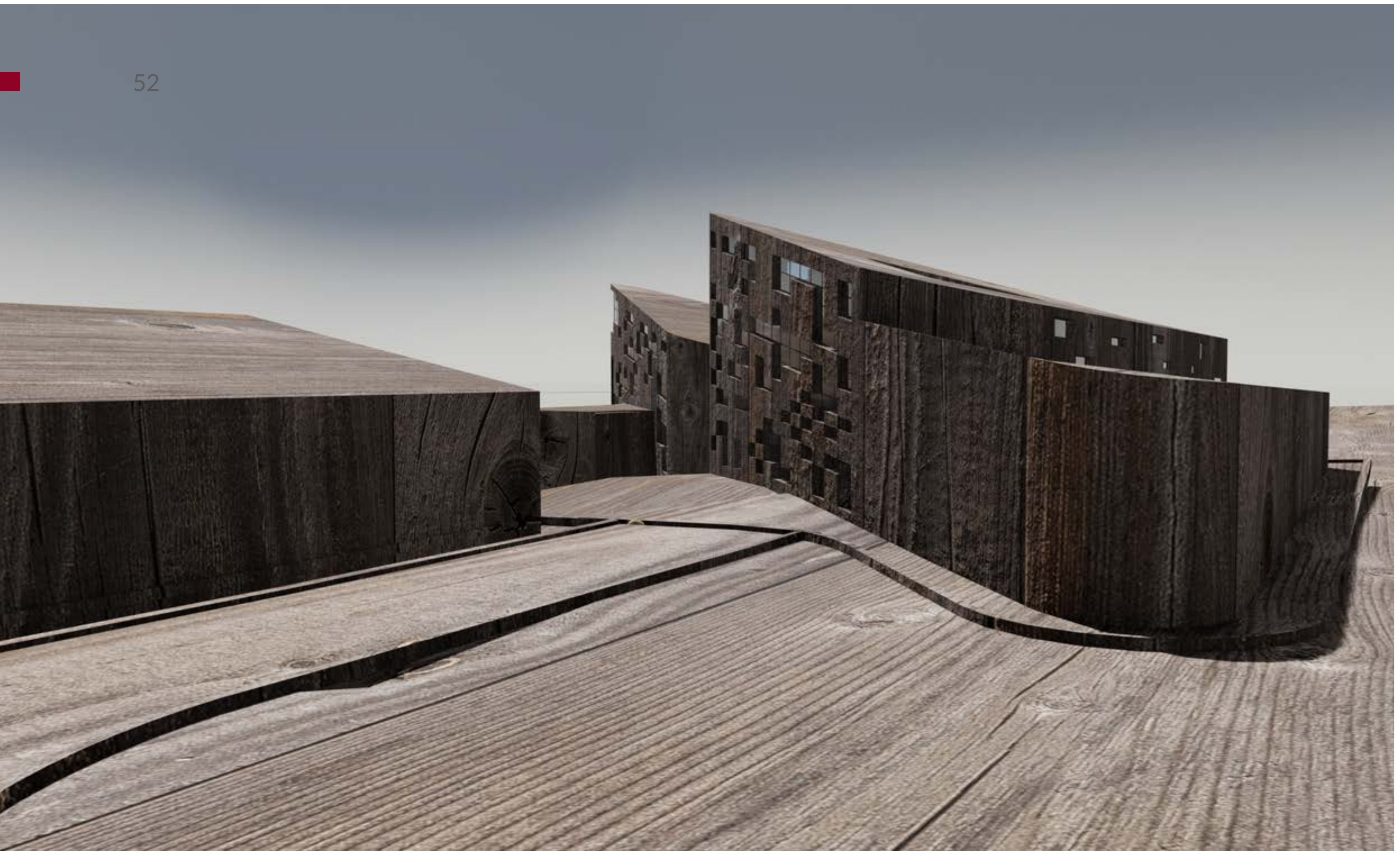


7- The shape-changing and dynamic tower with its multiple look-out customed balconies. The tower is meant to be erected at the heigh peak of the hill, which is the second selected site, to overlook Budapest and give another meaning to the night lighting scheme of the city. (Figure on the right)

8. The shape changing and opening balconies that open out to panoramic views of the city during the day and evening, and close at midnight to give this different lighting sensation for the light scheme of Budapest. (Below Figure)

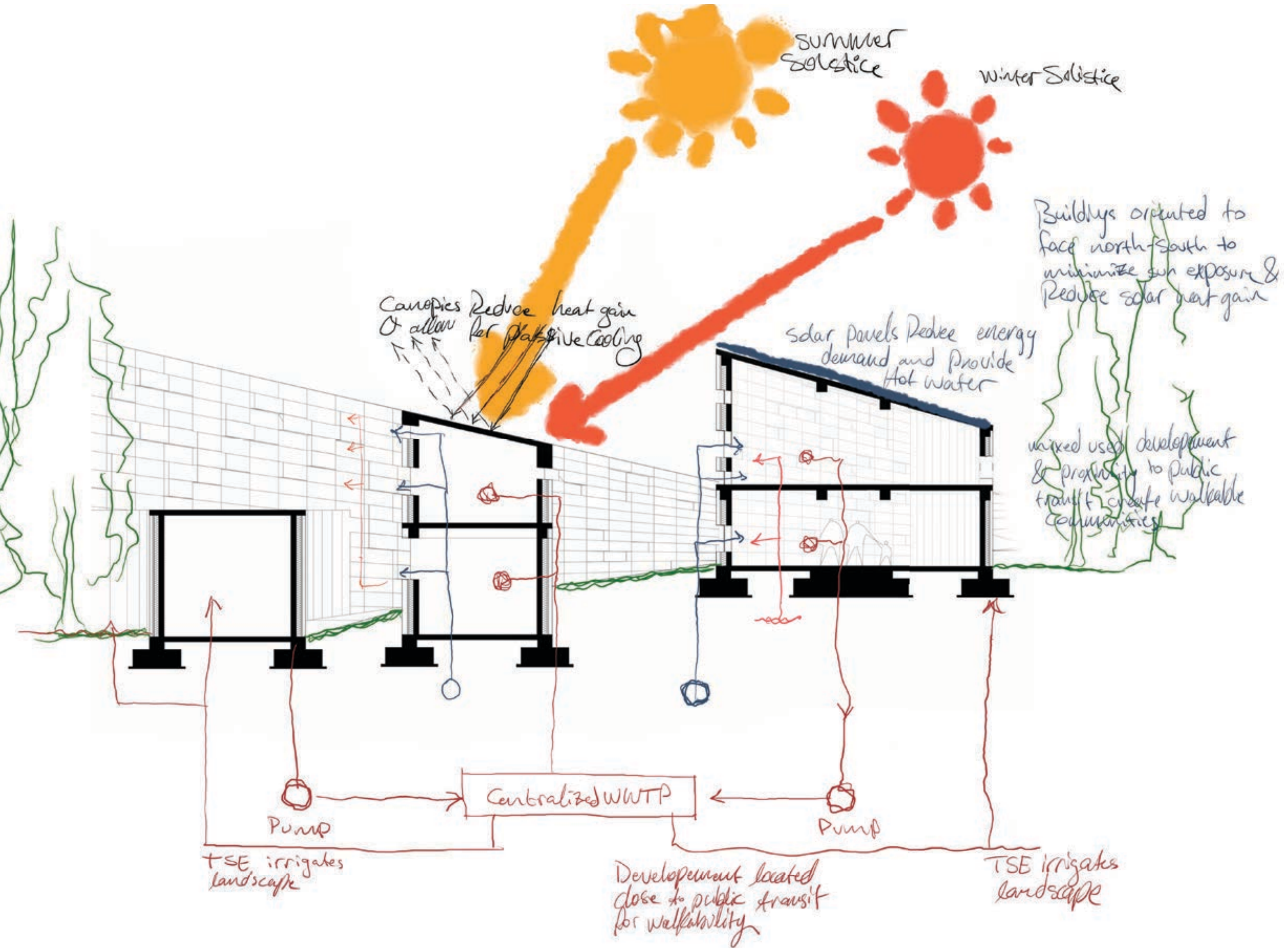
9: The multiple acostumed colored sky-beam-lights of the tower will be a spiced up addition to the beautiful light scheme of the city of Budapest during the night with the beams hitting the sky. (Figure on the Left)

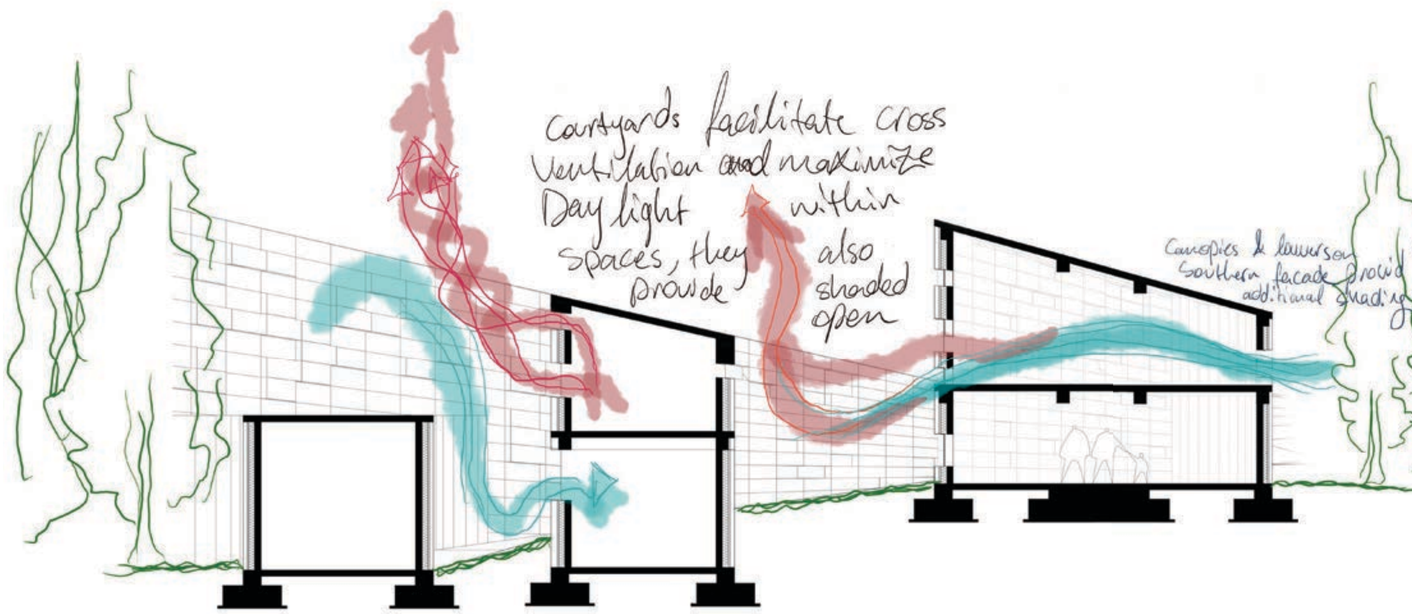




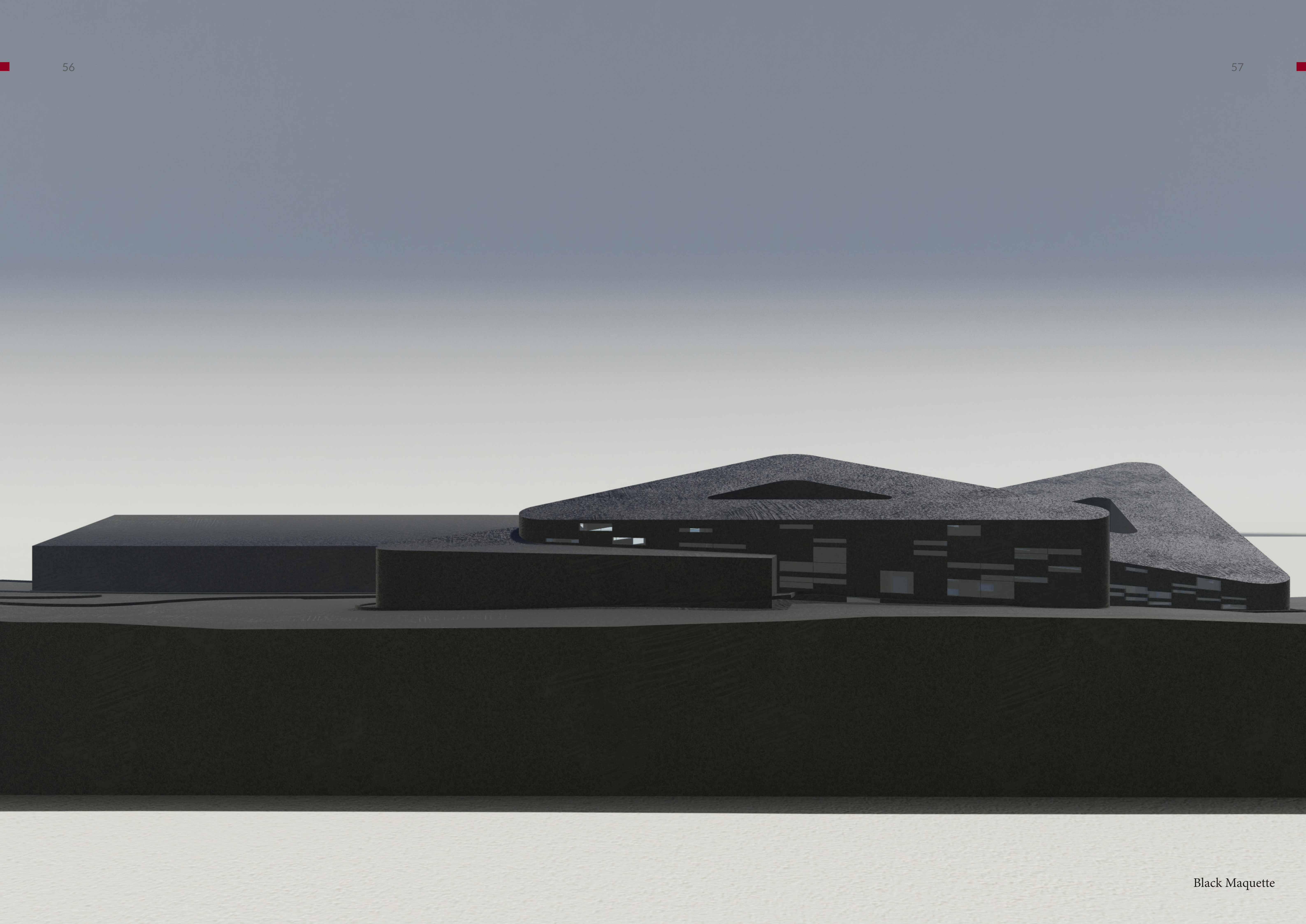
Potential Experiences
Concept Relevancy

Fig 13: A conceptual interior imagination illustrating the intended integration of the revitalizing activities such as the cafeteria, lounges and spa with the site's main function which is the airfield, by creating visual connection with the Hangars, and the fascinating landscape of the Hill of Harmashatar Hegyi. To celebrate the latter, and also to celebrate the beauty of Budapest from the heights of the hill, an observation tower is to be proposed on the highest peak.



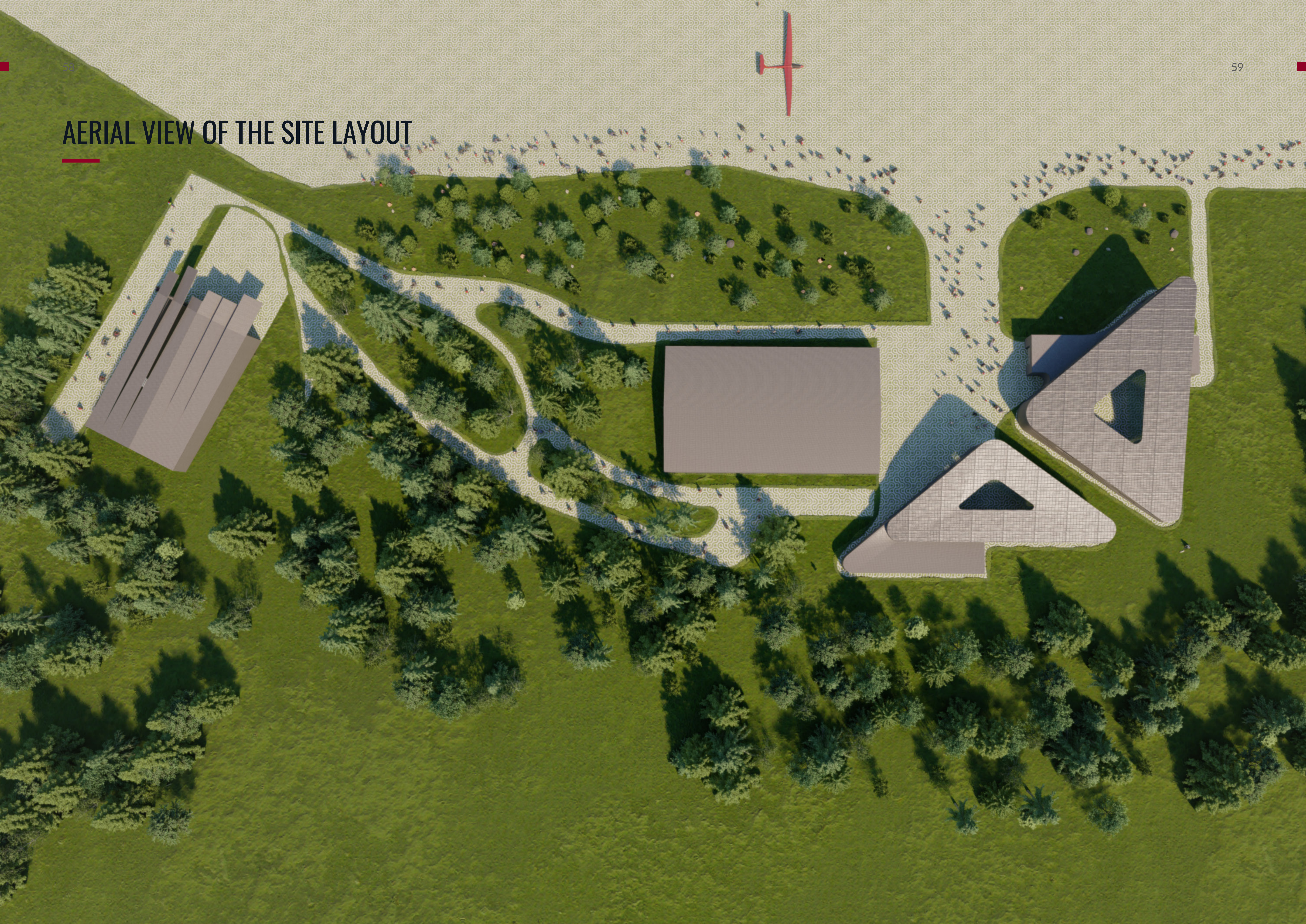


HAR MODEL

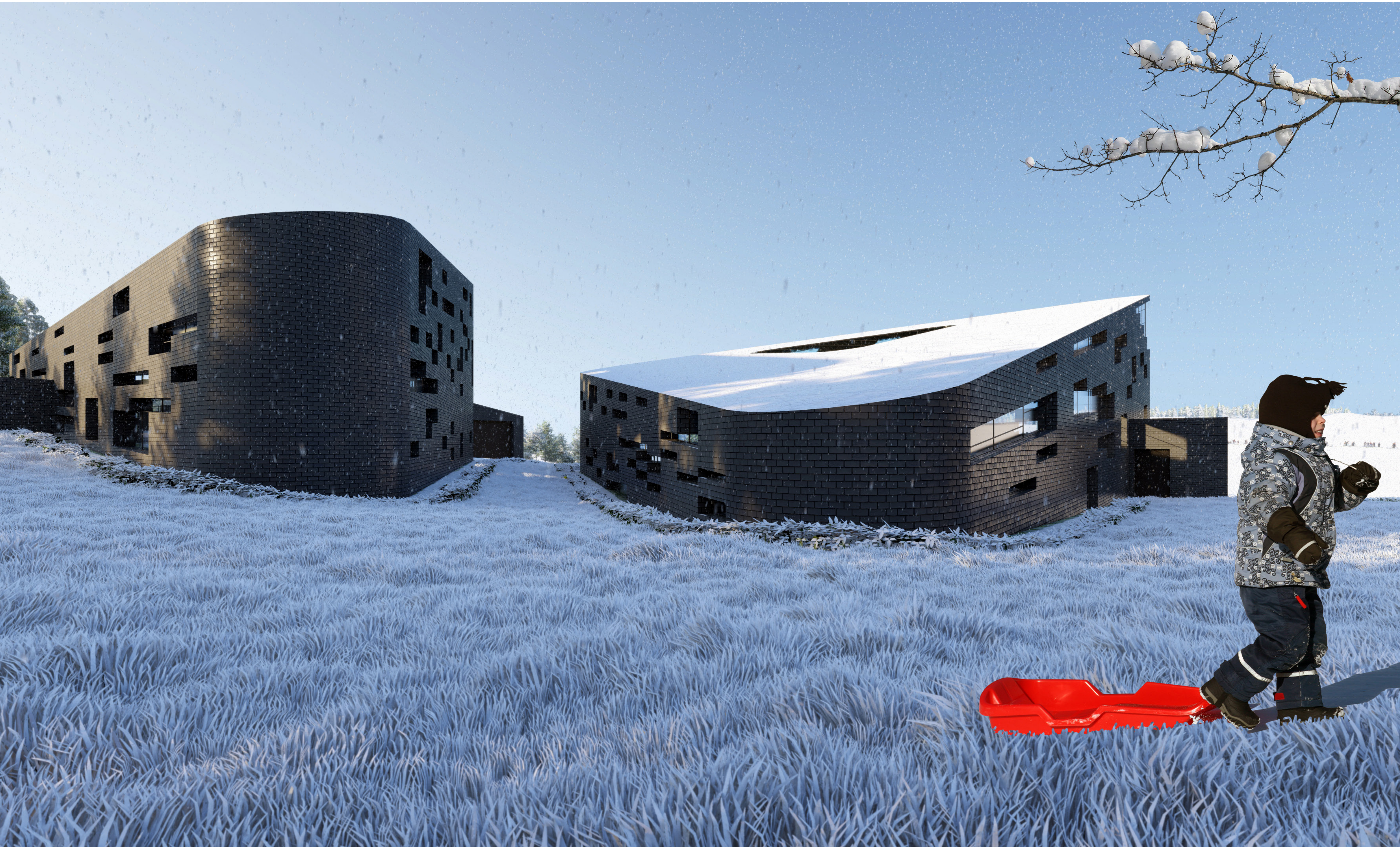


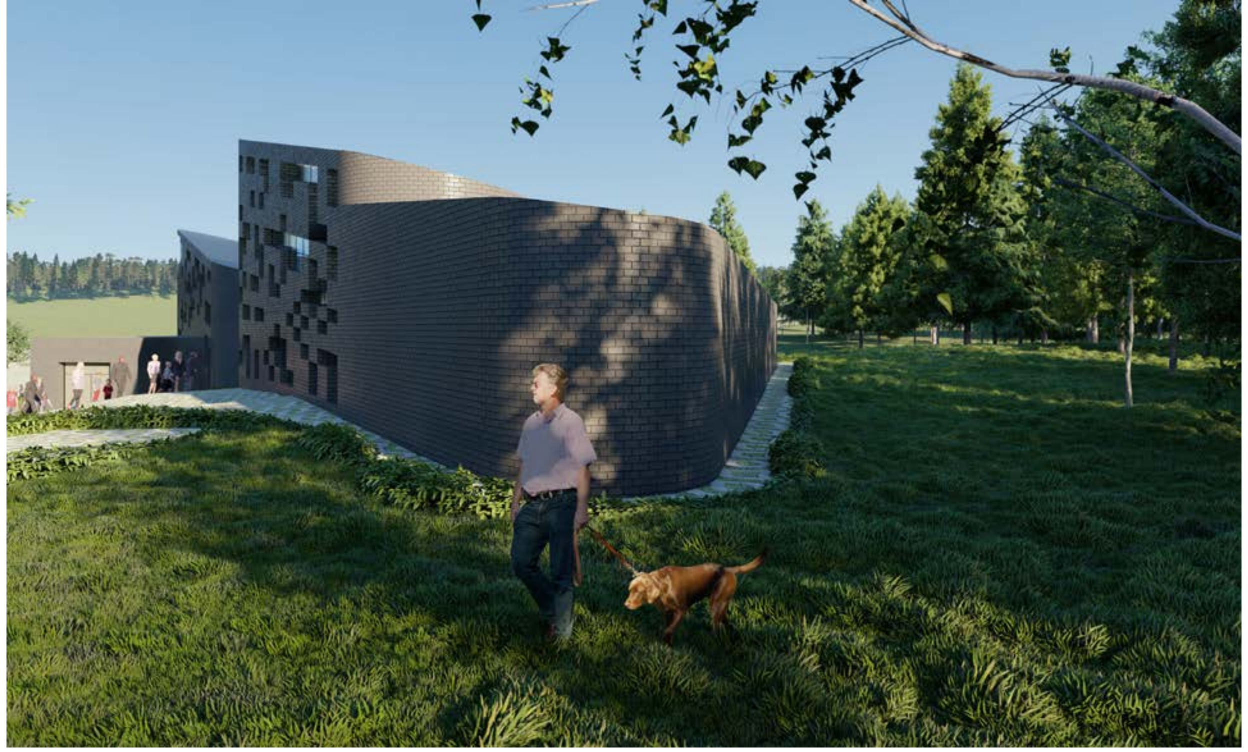
Black Maquette

AERIAL VIEW OF THE SITE LAYOUT



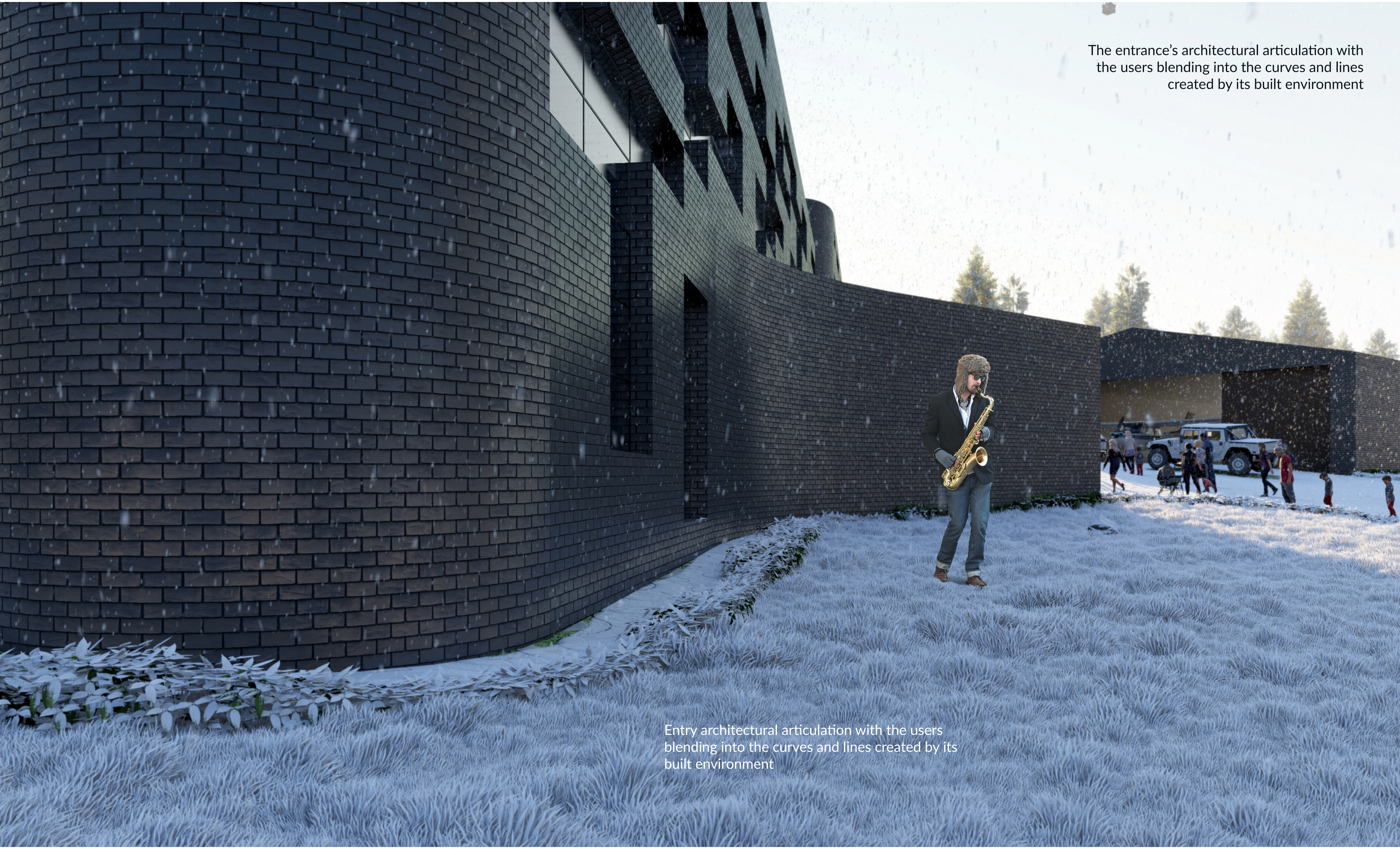
3D IMAGERY TO ILLUSTRATE THE DESIGN IDEAS





Views of the buildings from the Back yard showing how the building fades to the meet the scale smaller than human, create a good angle for PVC, and water harvestment.

HAR emerging from the forest, from a previously almost-abandonded site, into a new horizon on a snowy day.



The entrance's architectural articulation with the users blending into the curves and lines created by its built environment

Entry architectural articulation with the users blending into the curves and lines created by its built environment

HAR during winter

HAR imposes a great farming life around itself with its minimum intervention to the virgin lands of Harmashatar hegy

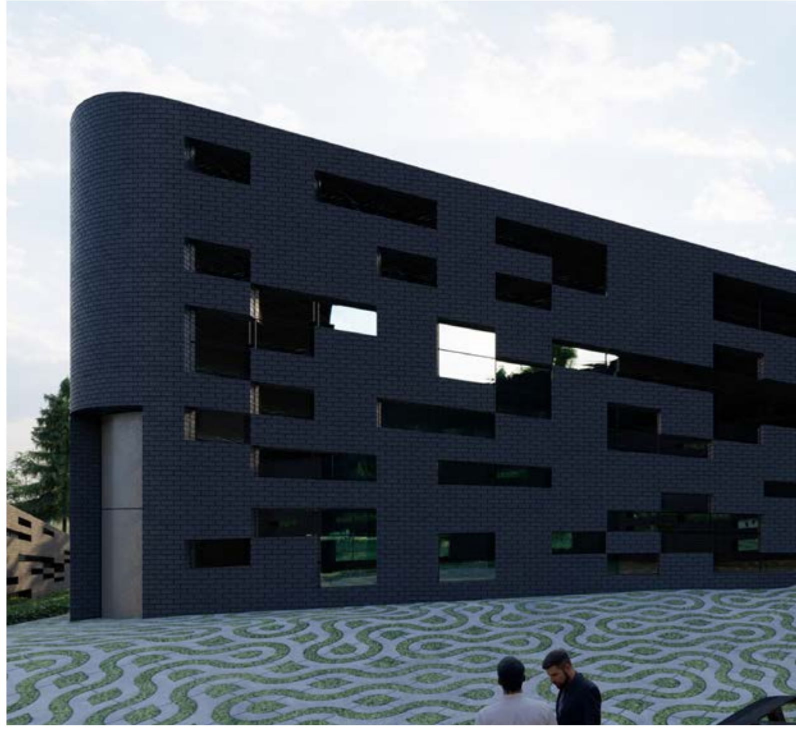
User-experience based landscape design is illustrated in this overall perspective from a glider-eye level of the whole complex of HAR

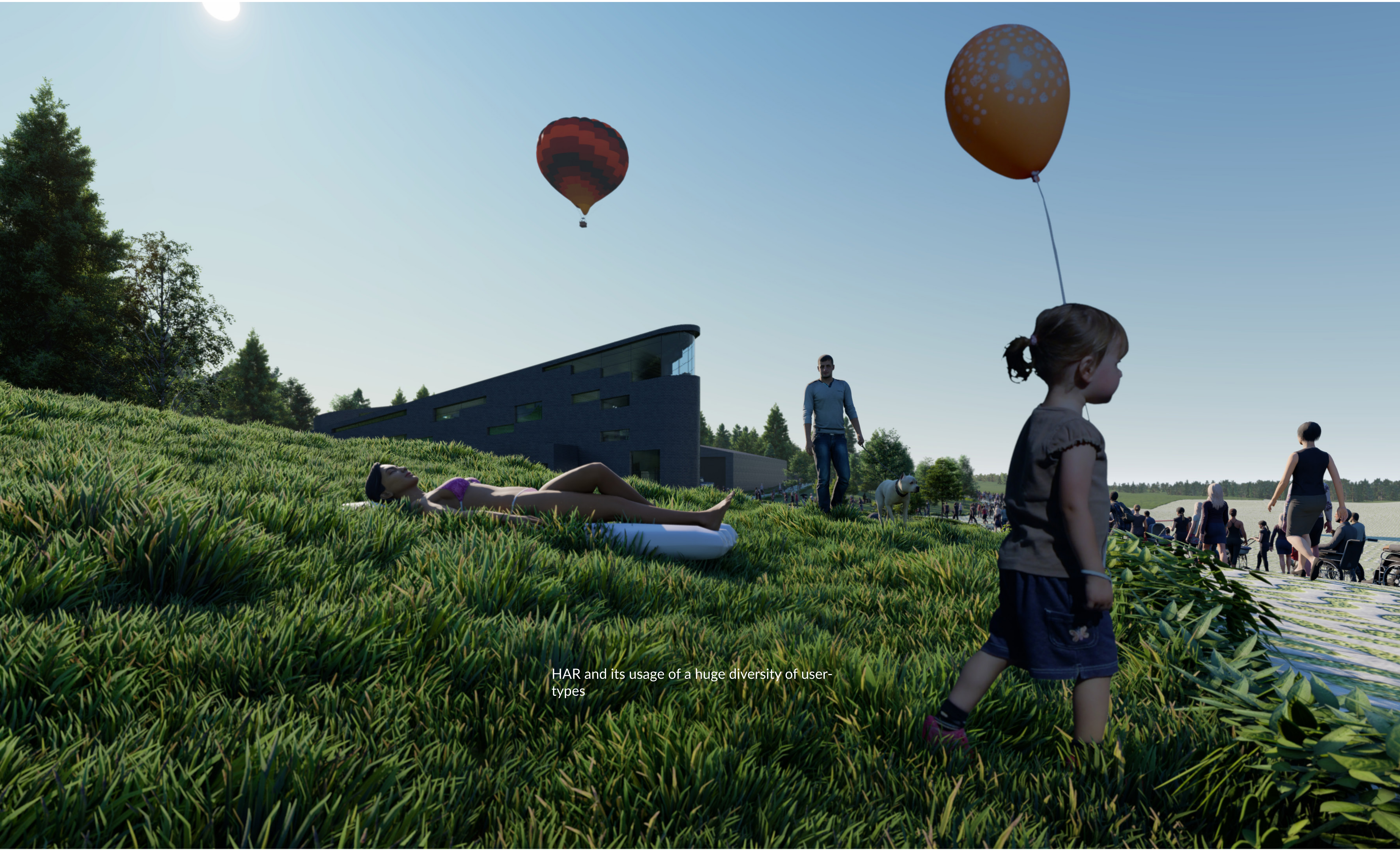
Perspectives overviewing parts of HAR


HAR During winter

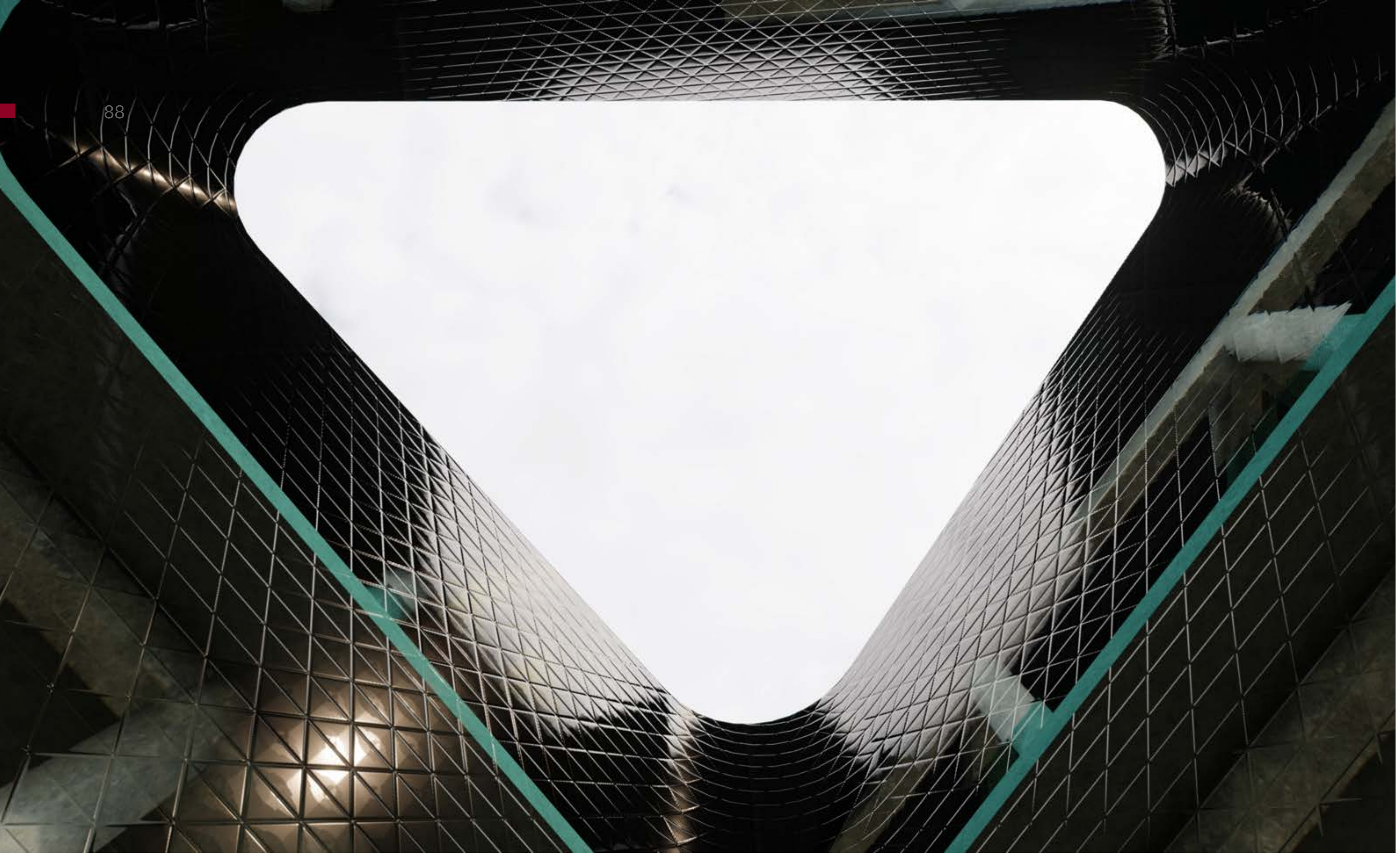
A set of images showing off the HAR and how it emerges from the landscape as a part of it rather than imposing its structure on the site. Different renderings showing the scale of the buildings, the fading into the forest, and the farming life that it would initiate around itself.

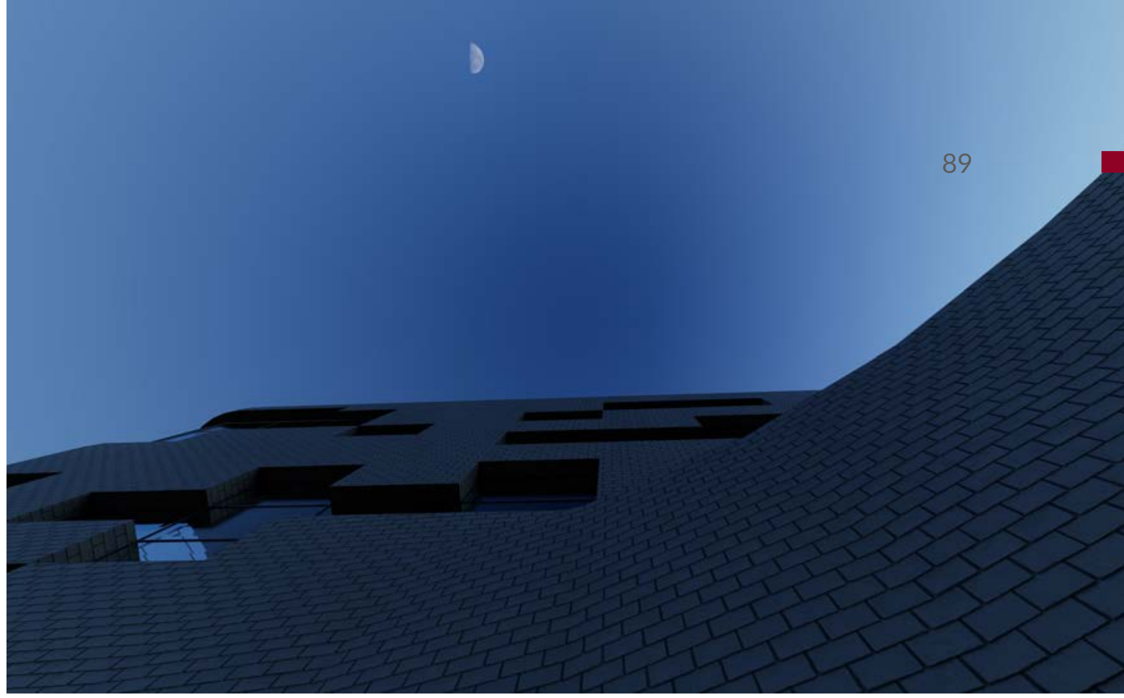
A set of images showing off the HAR and how it emerges from the landscape as a part of it rather than imposing its structure on the site. Different renderings showing the scale of the buildings, the fading into the forest, and the farming life that it would initiate around itself.





HAR and its usage of a huge diversity of user-types





Interior, exterior, and landscape perspectives
overviewing different parts of HAR

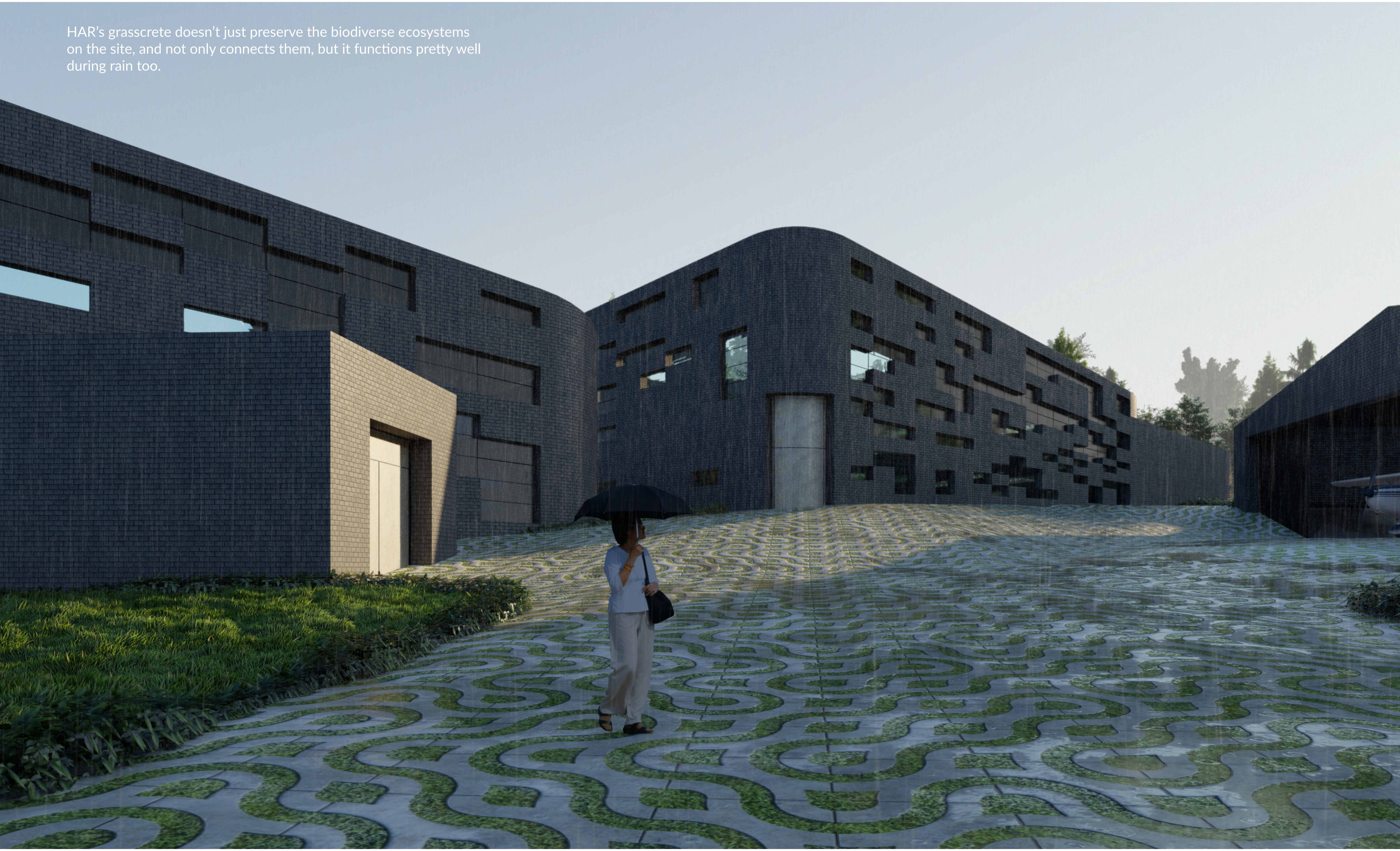
VIP Access to the Hangars

Figures illustrating how the project revitalizes the area during evening hours through these night renderings

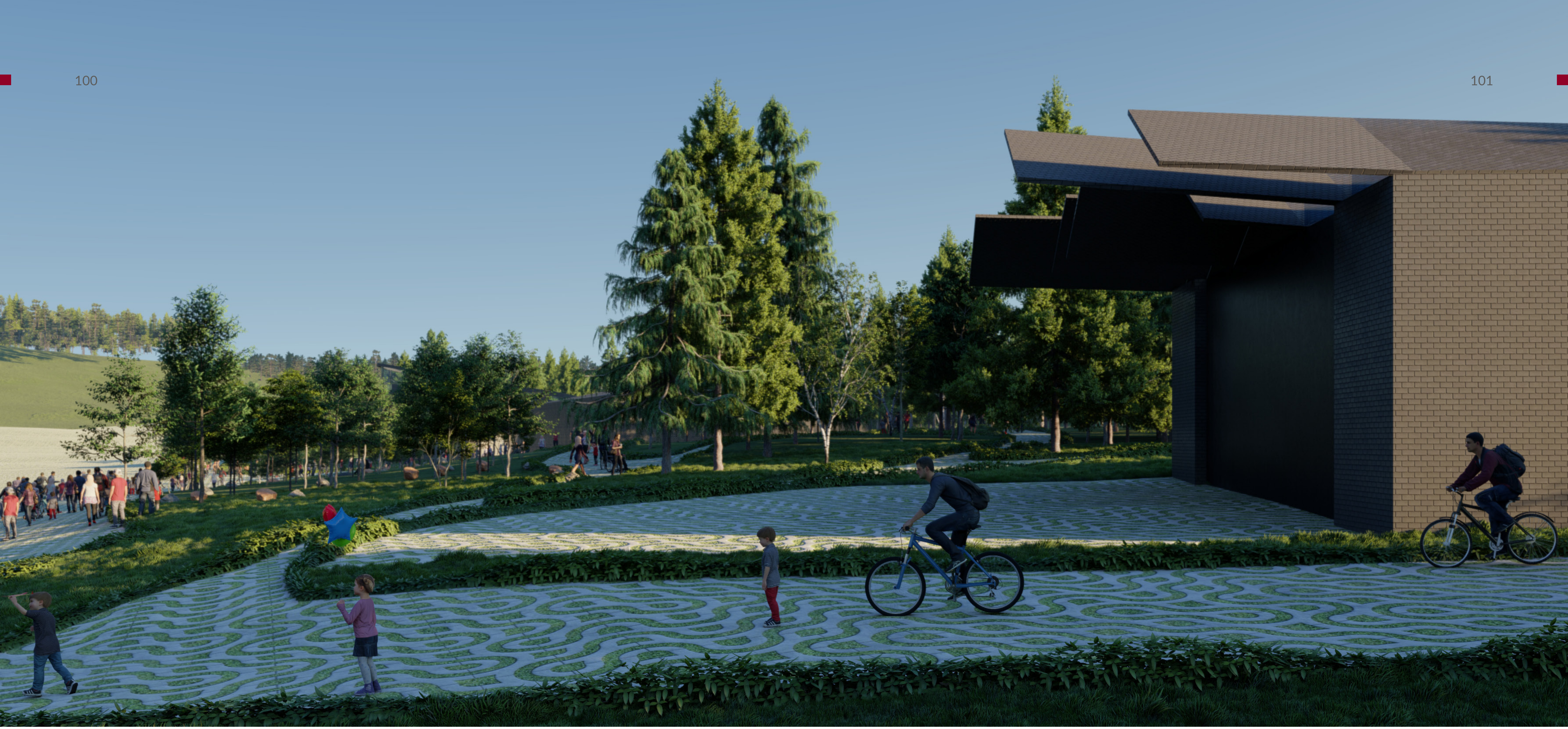
Figures illustrating the Interior structure of Building C

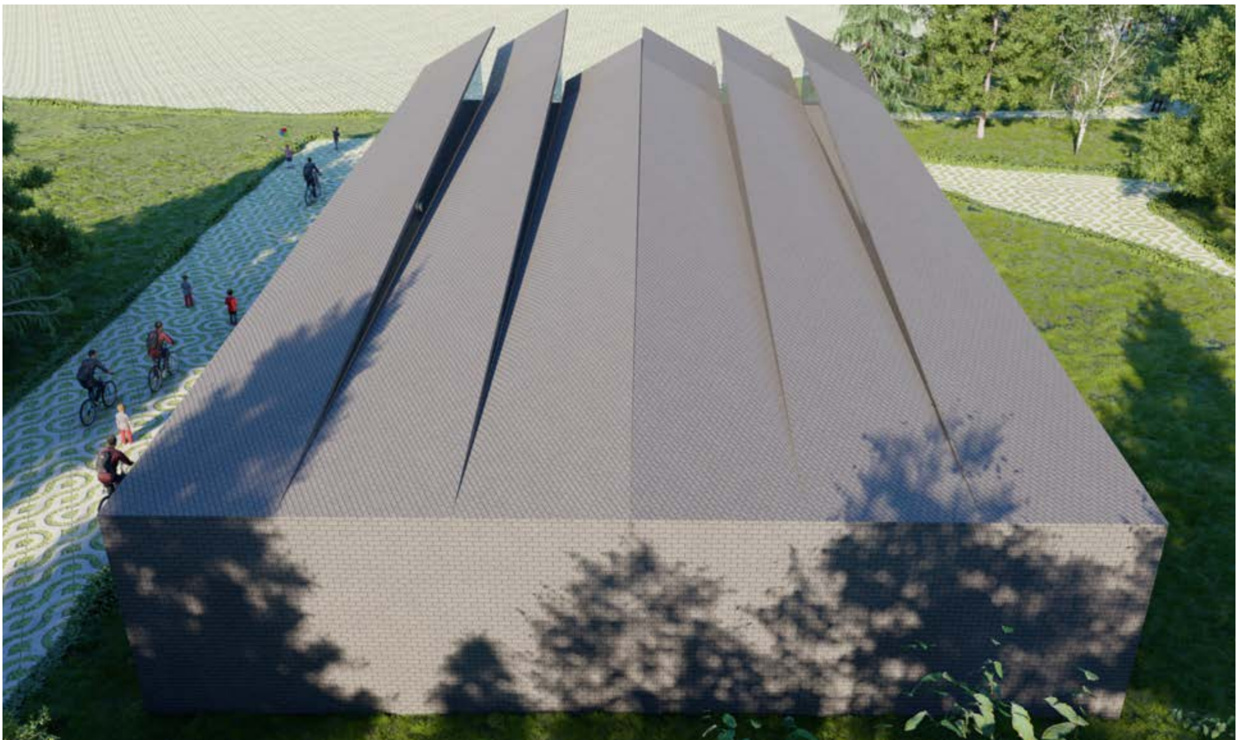
THE RENOVATIONS OF THE EXISTING HANGAR WILL MERGE THEM INTO THE SURROUNDING LANDSCAPE AS WELL.
IT IS NOTEWORTHY TO ILLUSTRATE HOW THE LANDSCAPE WAS DESIGNED BASED ON THE USER-EXPERIENCE PATH THAT WERE CREATED BY PEDESTRIANS ON THE SITE PREVIOUSLY, THAT WAY THERE WILL NOT BE ANY SHORTER CUTS THROUGH THIS OPTIMUM SOLUTION.

THE LANDSCAPE FEATURES NOT A CONCRETE SOLID WALKABLITY, THAT PROHIBITS AND CUTS THE BIODIVERSITY IN THE FOREST OF HARMASHATAR HEGY, BUT IT PROMOTES THE EXISTANCE OF THE CURRENT BIODIVERSITY BY PROPOSING A GRASSCRETE FLOORING THAT WILL CONNECT THE BIO DIVERSE ECOSYSTEM, RATHER THAN BREAK IT.

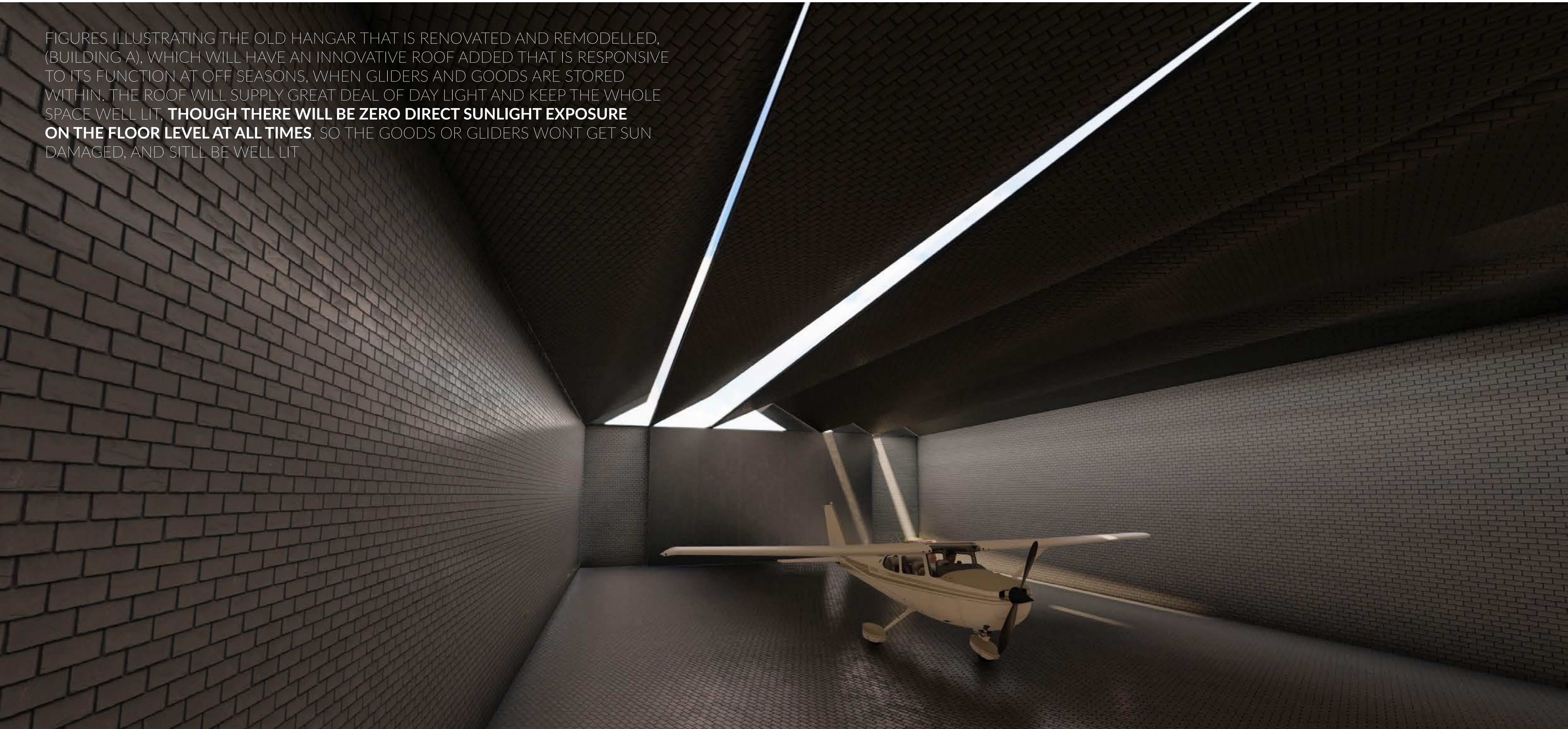


HAR’s grasscrete doesn’t just preserve the biodiverse ecosystems on the site, and not only connects them, but it functions pretty well during rain too.





FIGURES ILLUSTRATING THE RENOVATED HANGAR OF BUILDING A



FIGURES ILLUSTRATING THE OLD HANGAR THAT IS RENOVATED AND REMODELLED, (BUILDING A), WHICH WILL HAVE AN INNOVATIVE ROOF ADDED THAT IS RESPONSIVE TO ITS FUNCTION AT OFF SEASONS, WHEN GLIDERS AND GOODS ARE STORED WITHIN. THE ROOF WILL SUPPLY GREAT DEAL OF DAY LIGHT AND KEEP THE WHOLE SPACE WELL LIT, **THOUGH THERE WILL BE ZERO DIRECT SUNLIGHT EXPOSURE ON THE FLOOR LEVEL AT ALL TIMES**, SO THE GOODS OR GLIDERS WONT GET SUN DAMAGED, AND SITLL BE WELL LIT

TECHNICAL INFORMATION OF HAR COMPLEX 4

The 7500 sqm site of the HAR Complex planned in District II, is a previous infrastructure of Barracks and Hangars constructed on the closest point of the approaching street to the site

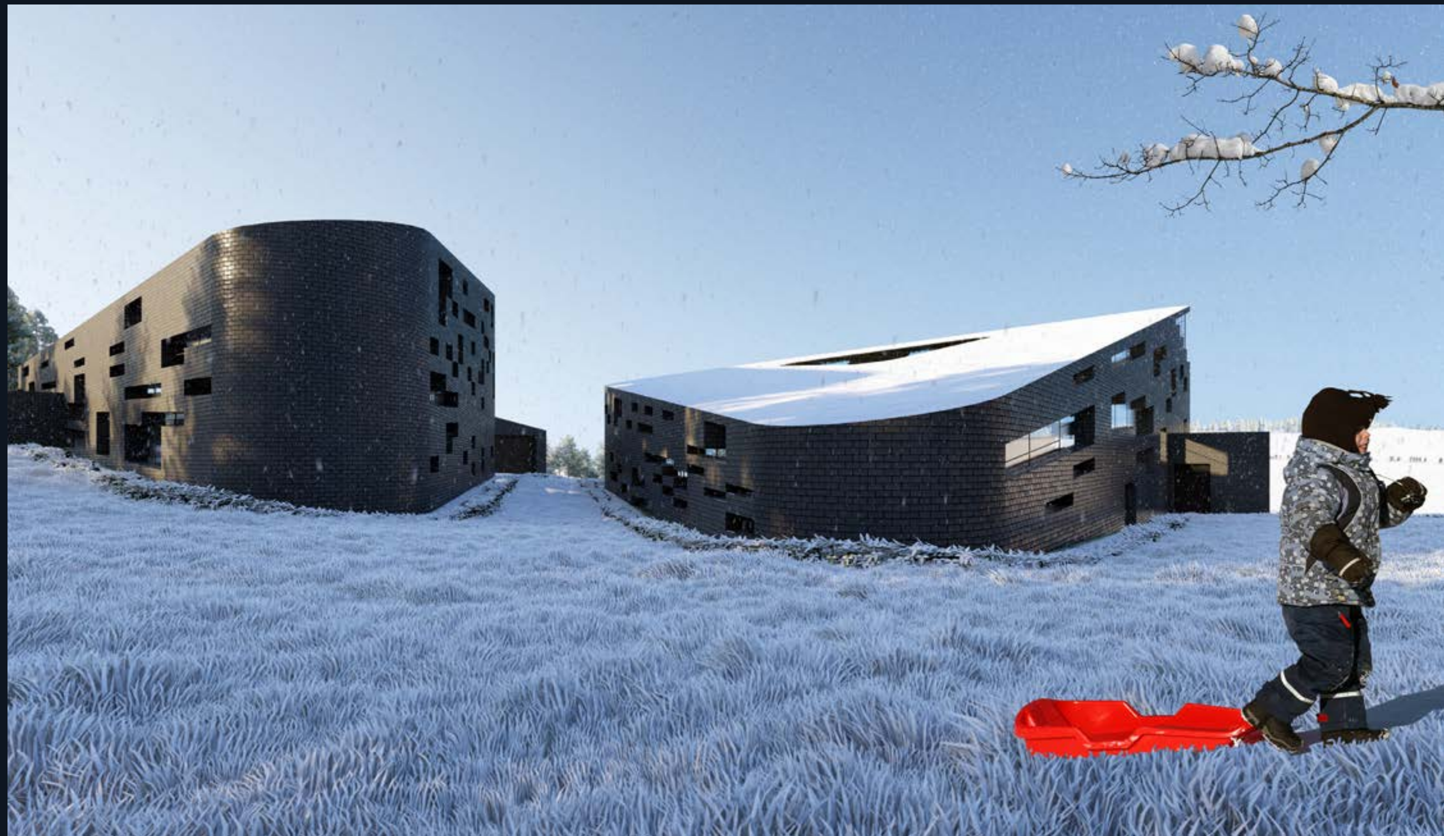
of Harmashatar-Hegy (It is more of a path than a street of 15 meters width). There is a very weak street network around the site due to the natural features of the hilly landscape, though it is a great potential to preserving the natural side of the city, although it could be pointed out as a weakness due to the hassle it brings to mobilization, the site of HAR itself could be very easily accessed since it will sit on a previous, existing infrastructure (mentioned earlier), although it will have a fense during the process of construction, but the huge plane around it, clean off any built structures, will be in turn an easements for all the construction activities to be clearly and comfortablly laid out on the site, from the bench marking Total Station to the bench marks of the to-be-built structures, offices for the PM, staff rooms, and their waterclosets, the workshop and fabrication areas to even the machinery parking (the transportation trucks) and the gaurd room as well. The new structures' infrastructure must be added and connected to those of the surrounding sites of the project, from a main drinking water supply line branch, and sewage network, let alone the power lines, and telecommunication lines. That from the perspective of the construction management.

To discuss the technical information of the buildings themselves, the footprint of the new stuctures are erected up to 3 floors. The finishing is to be of insulated thermal Brick cladding over the RC walls. To Speak of the function of the project is to serve the HAR, and its gliding purposes, the design proposal is composed of two existing Hangars, that are to be renovated and remodeled, and adding two masses to serve the purposes of entertainment, relaxation, and administration to the visitors and the project's and/or site's users. The Activities of entertainment and relaxation is housed by spaces of restaurants, cafes, small pools, sauna, showers, changing rooms, resting area, congregation areas, lobbies offices, workshops, lecture halls and storages.

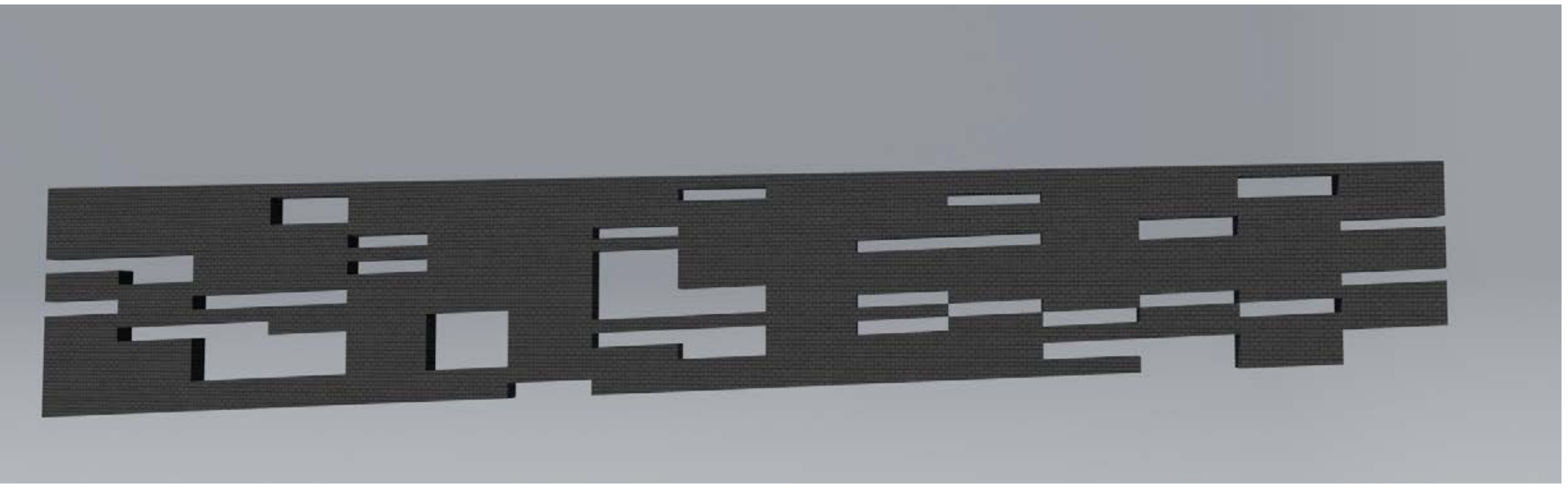
All the details of the finishings as well are added in a table to Annex E along with the site plan and other drawings of the project.

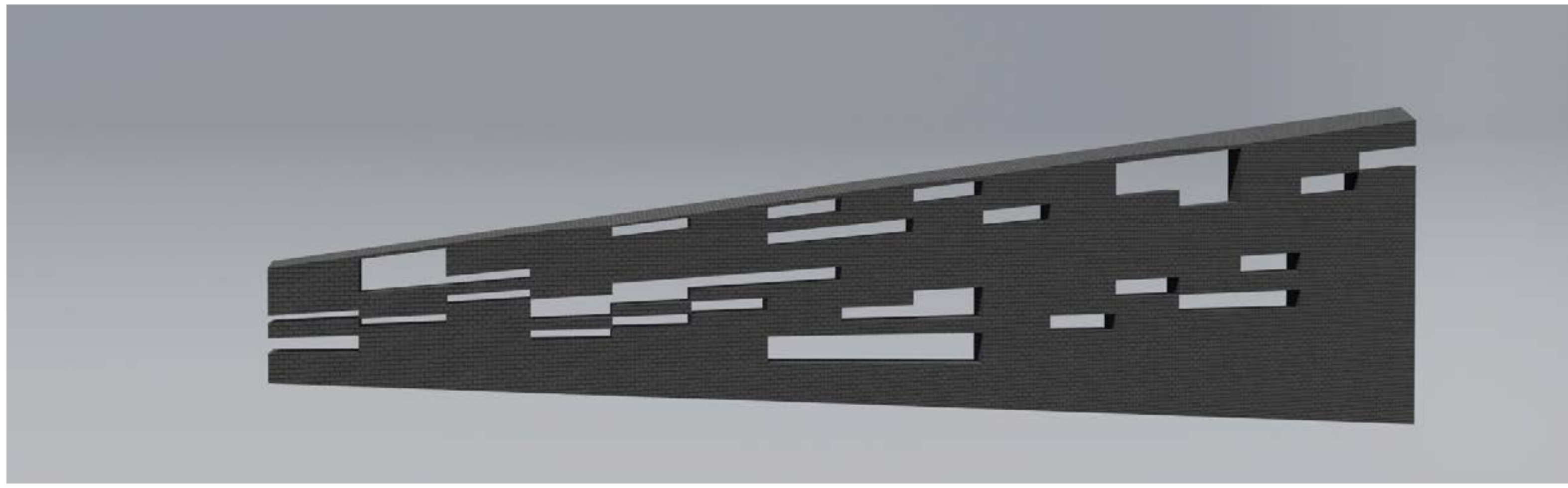
FINISHING MATERIAL LIST (FACADE + ROOF)

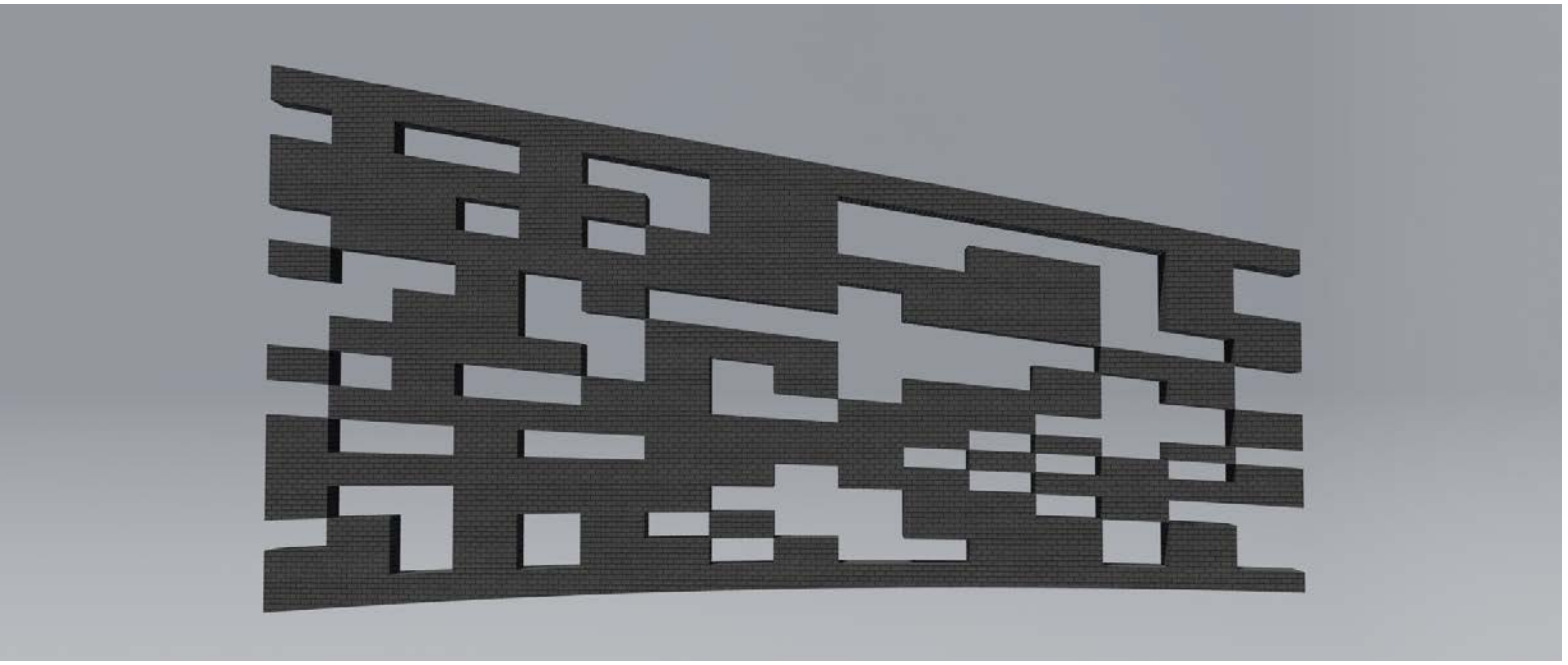
1. Hangar (RED BRICK + OXIDIZED STEEL ROOFING)
2. Interactive Hangar (RED BRICK + CERAMIC TILE ROOFING)
3. Administrative + Education Mass
   (BLACK BRICK CLADDING + CERAMIC TILE ROOFING)
4. Entertainment + Relaxing Mass
   (BLACK BRICK CLADDING + CERAMIC TILE ROOFING)

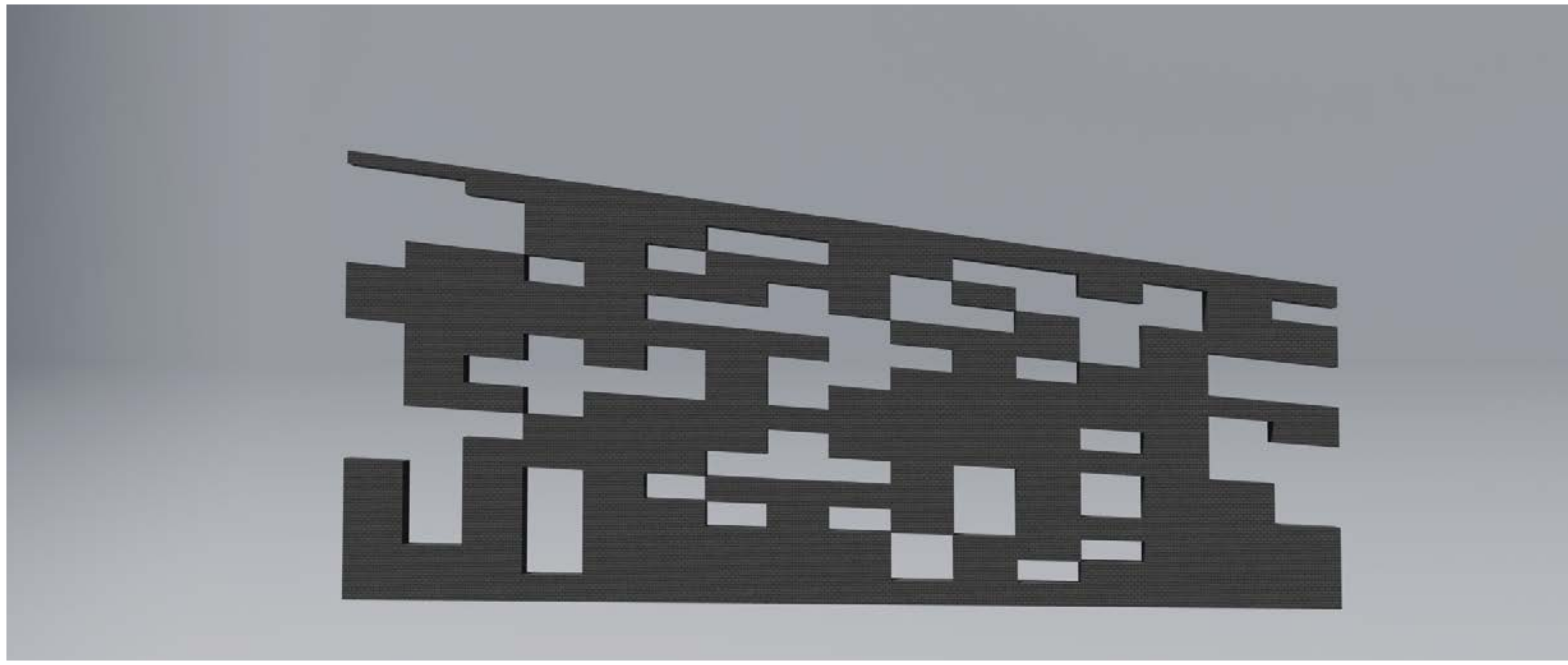


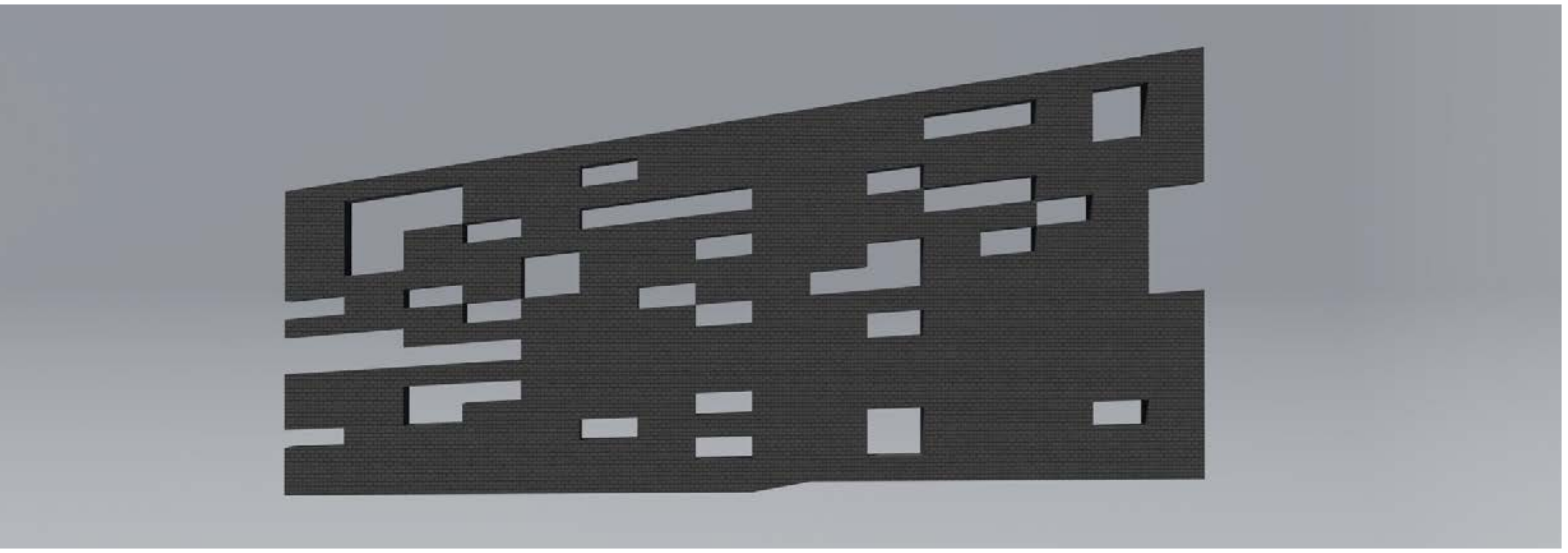
FACADE ANALYSIS

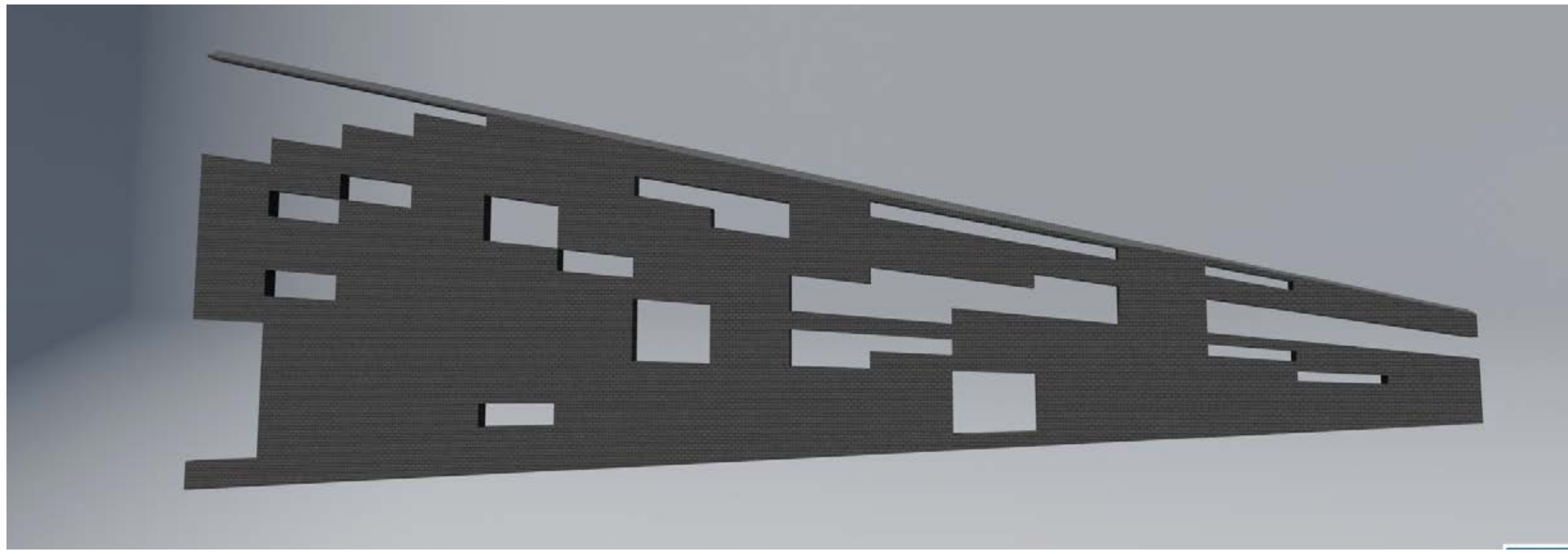


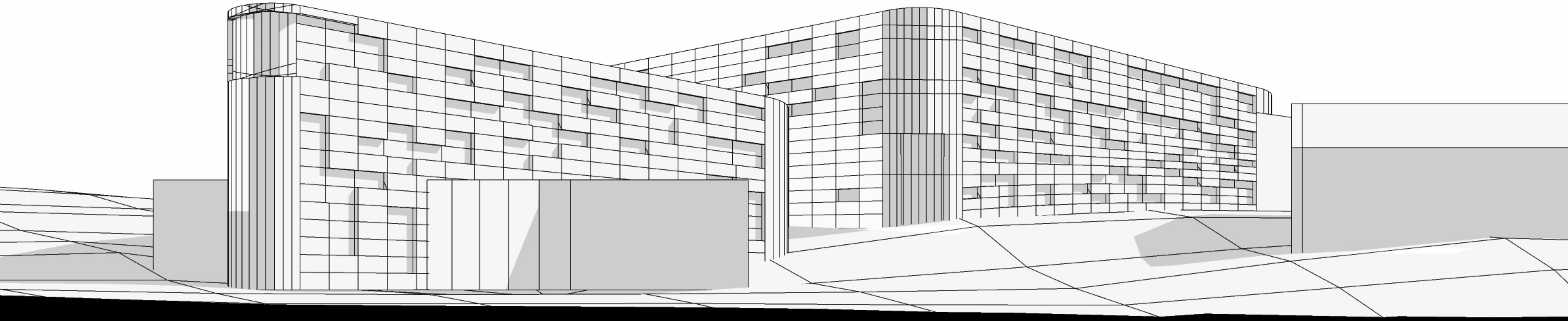




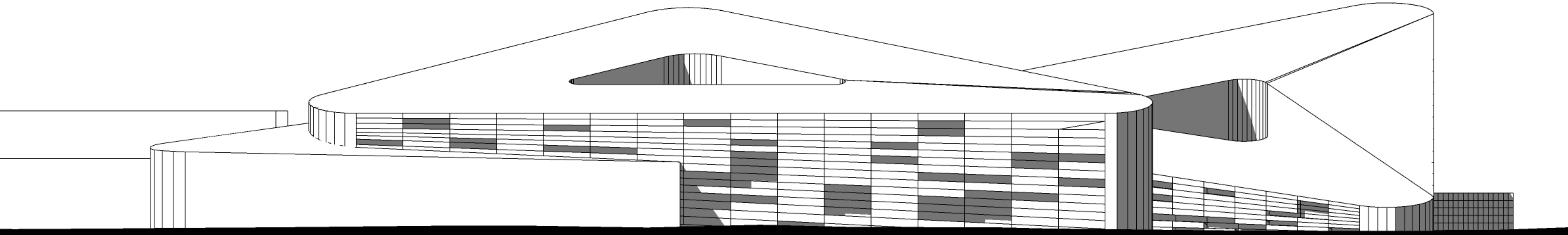




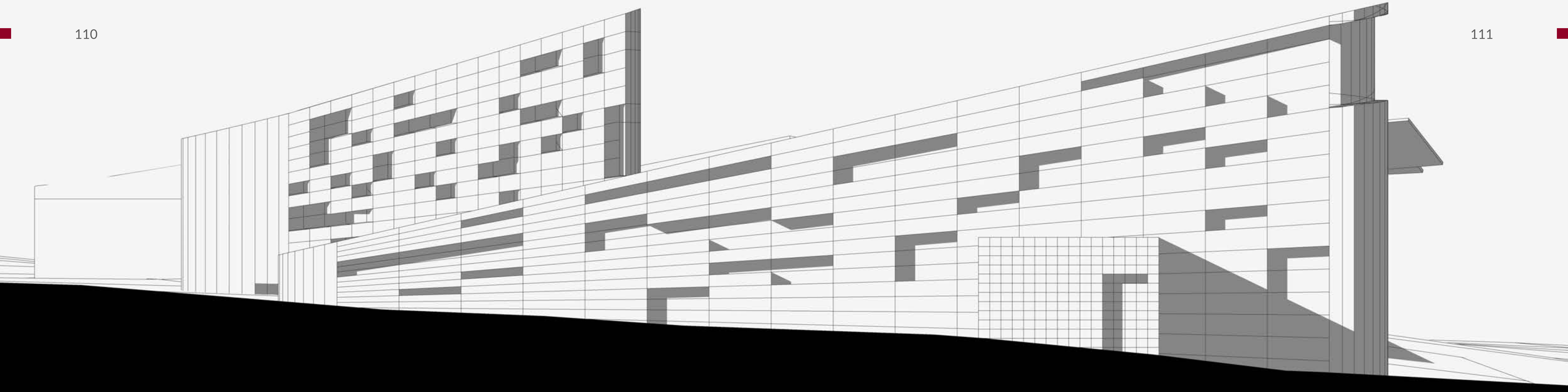




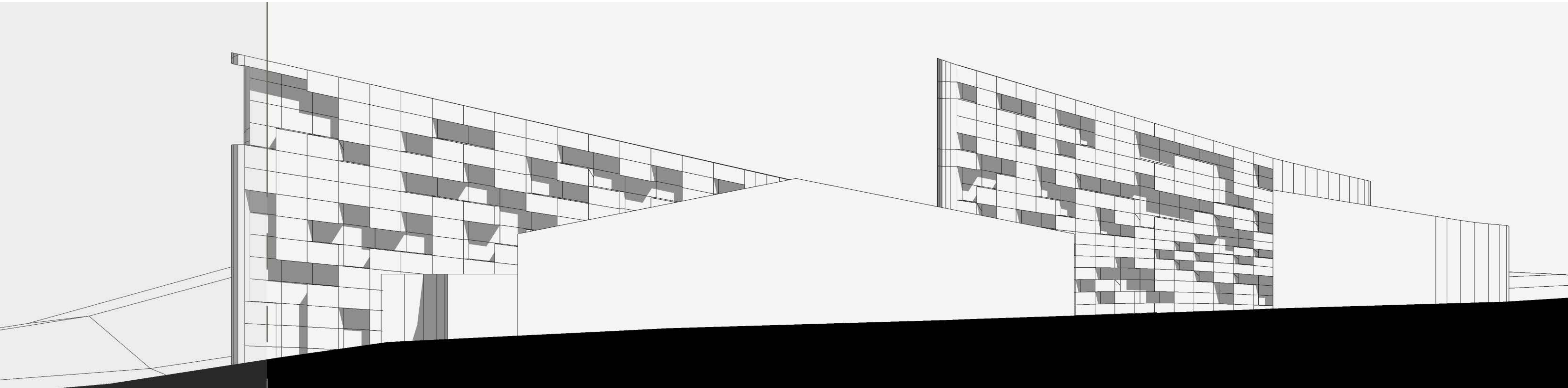
NORTH EASTERN FACADE ILLUSTRATION



SOUTH WESTERN FACADE ILLUSTRATION



SOUTH EASTERN FACADE ILLUSTRATION



NORTH WESTERN FACADE ILLUSTRATION

ARCHITECTURAL STANDARDS

DESIGN CRITERIA

General

During the process of developing these design criteria, certain assumptions had to be made because of the lack of commitment of large STOL aircraft to civil production. Therefore, these standards represent considered judgment of what constitutes a practical set of criteria considering available data, safety, noise, environment, and economics. It is apparent that the shorter the runway the easier it will be to locate a STOL port site, and the greater will be its compatibility with the local environment. On the other hand, the criteria cannot be so restrictive that aircraft manufacturers will be unable to produce a vehicle which can operate safely and economically from the STOL port.

Design Criteria

The following criteria have been developed based on STOL aircraft, bidirectional runway operations, and a precision instrument approach. See Figs. 1 and 2 and Table 1 for illustration of specific dimensions.

Runway Length Determination

A discussion of takeoff and landing runway lengths is needed to establish a common understanding of the terms used. This is particularly necessary for the case of the elevated STOL port, where reference to Federal Aviation Regulations (FAR) field length cannot be considered in the same context as the conventional airport.

Microwave ILS

Microwave instrument landing systems for STOL operation are currently being evaluated by the FAA. The type of equipment has been designed specifically for steep gradient approaches. The siting of the microwave system may be relatively simple since the localizer and glide slope functions may be collocated. (See Fig. 1.) Offset instrument landing system (ILS) approaches would be advantageous under certain site conditions and are under study. Nevertheless, an offset approach should be considered only where obstructions in the approach would prevent a straight-in ILS procedure.

Planning and Design Criteria for Metropolitan STOL Ports, Federal Aviation Administration, Department of Transportation, Washington, D.C., 1970.

Obstruction Clearance

The imaginary surfaces for protection of the STOL port are shown in Fig. 3.

General The surfaces have been defined on the basis of operational tests with the microwave ILS. The 15:1 slope for the approach/departure surface is predicated on adequate obstruction clearance for steep gradient approaches and also for takeoff climb.

Curved Paths For VFR (visual flight rules) operations, a curved path for approach or departure is quite practical and may be necessary in some cases to provide a suitable route. For example, an IFR (instrument flight rules) procedure may be feasible from only one direction. Under adverse wind conditions, it would be desirable and perhaps necessary to complete the IFR approach, transition to VFR and land from the opposite direction. The radius of the curved path will vary according to the performance of individual aircraft and the angle of bank used. For planning purposes, a radius of 1,500 ft may be used.

Runway Orientation

One of the primary factors influencing runway orientation is wind. Ideally, the runway should be aligned with the prevailing winds. It is recognized that the limited number of STOL port sites will minimize the opportunity for the runway to have optimum wind coverage. On the other hand, it is also recognized that the availability of a crosswind runway on a metropolitan STOL port will be rare. Accordingly, the designer should attempt to obtain maximum wind coverage. The minimum desirable wind coverage is 95 percent based on the total hours of available weather observations. In other words, the objective is to attain more than 95 percent usability (preferably 98 percent). The allowable crosswind component will be determined by the crosswind capabilities of the most critical aircraft expected to operate at the STOL port.

Parallel Runways—STOL Port

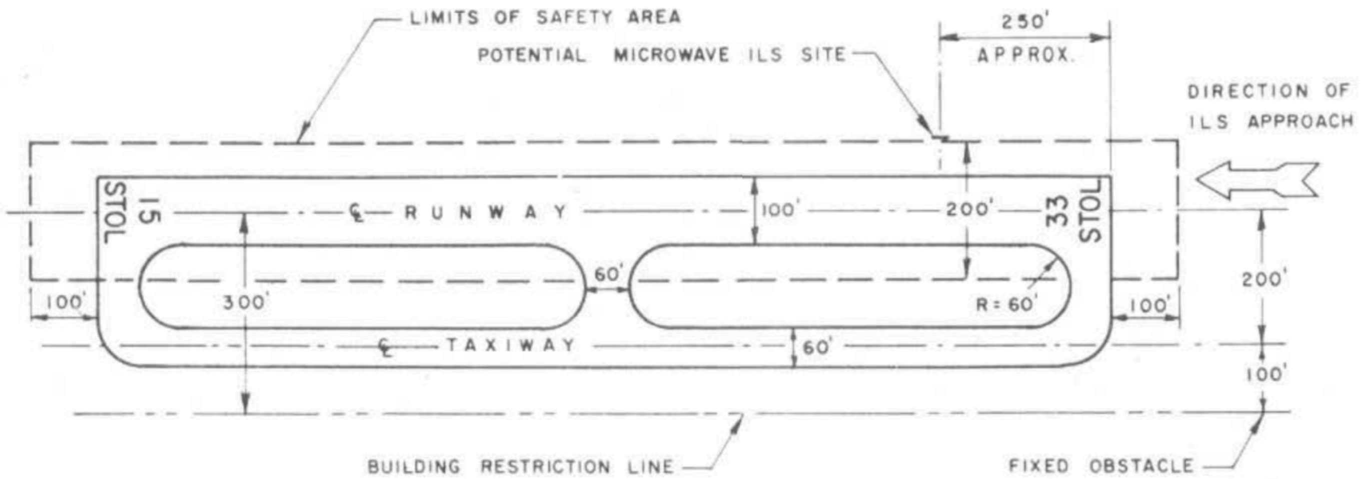
For simultaneous VFR operations on a STOL port, the minimum separation between the centerlines of parallel runways should be 700 ft.

Runway Capacity

The capacity of a runway is the number of aircraft operations (landings and takeoffs) that the runway can accommodate in a limited period of time. The operational capacity of a STOL runway will be lowest during IFR conditions. To obtain maximum IFR capacity, the STOL runway should be equipped with a microwave ILS and radar surveillance (including an air traffic control tower). A method for calculation of capacity values is given in Advisory Circular 150/5060–1A. This publication discusses the numerous factors which must be considered in a capacity analysis. However, as a general guideline, with current procedures, the IFR capacity of a single STOL runway will be approximately 45 operations per hour. It is expected that this capacity will be considerably expanded when adequate data have been collected and analyzed.

Potential Configurations

In many metropolitan areas, siting of a STOL port may necessitate an elevated structure. At such sites, the designer should strive to achieve vertical loading and unloading of pas-



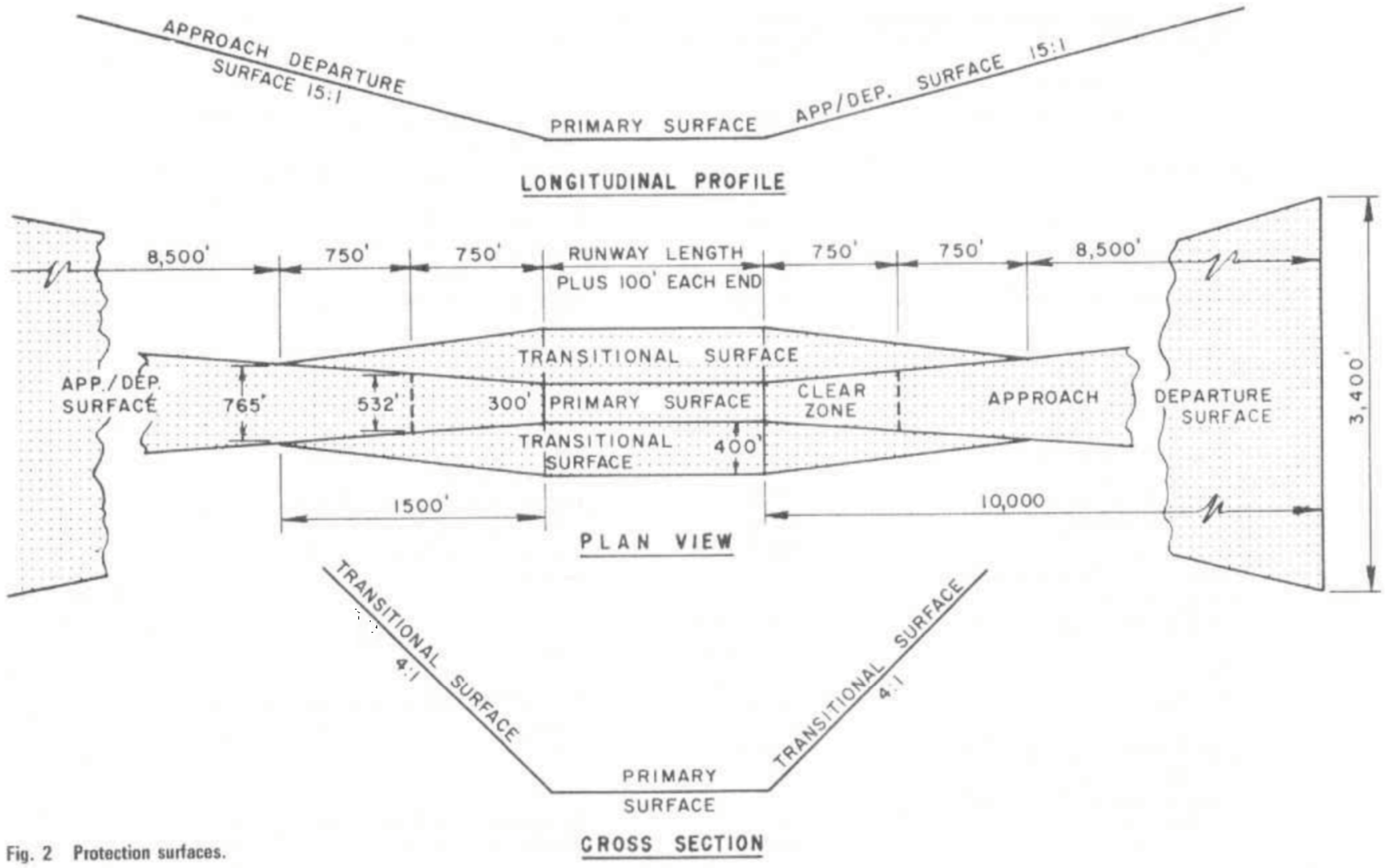


Fig. 2 Protection surfaces.

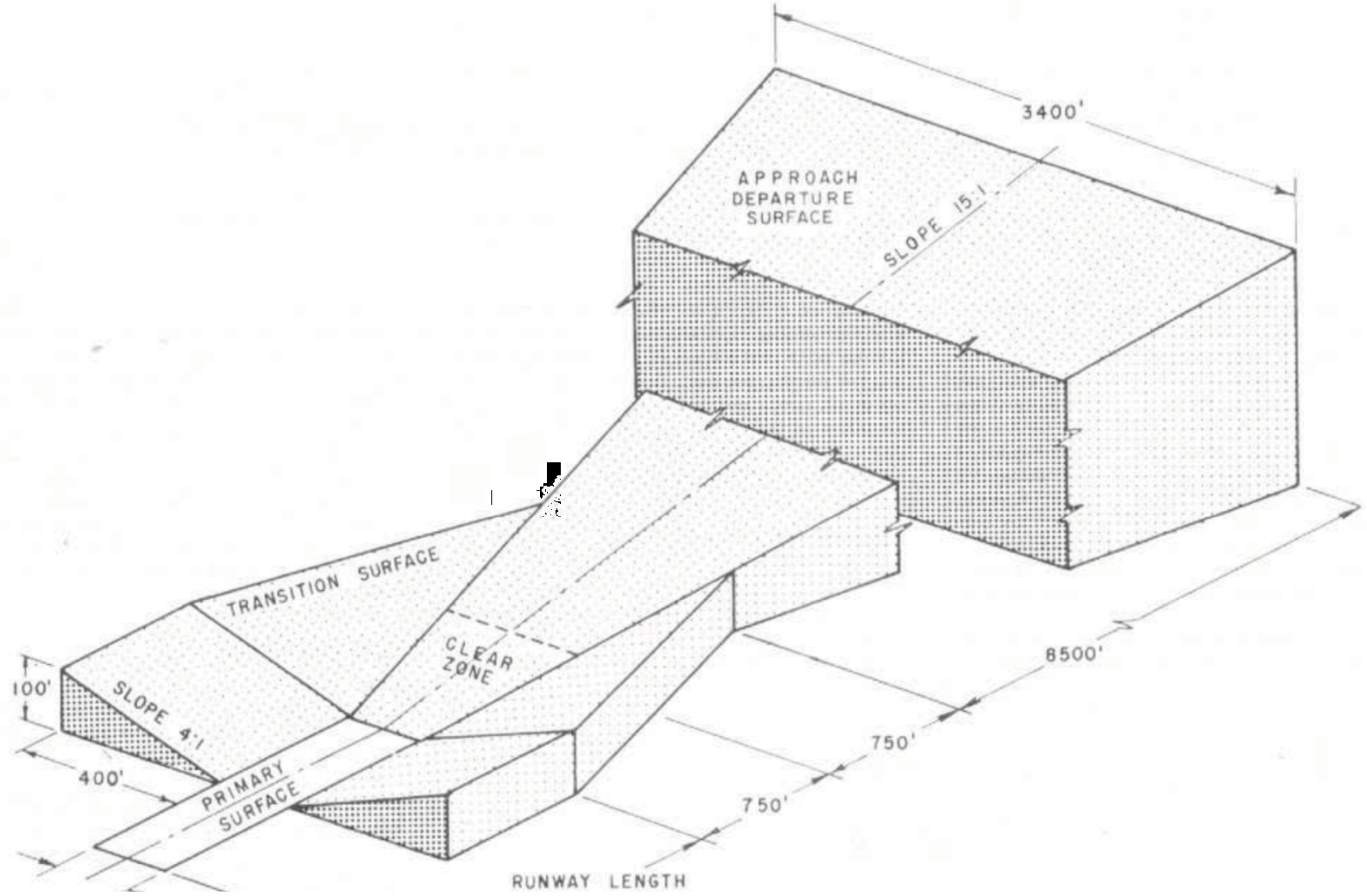


TABLE 1 Design Criteria for Metropolitan STOL Ports*

Design item	Recommended criteria	Comment
Runway length at sea level and 90°F	1,500 to 1,800 ft	Correction for elevation and temperature to be made on the basis of individual aircraft performance.
Runway width	100 ft	Widening may be desirable if wind coverage is less than 95 per cent.
Runway safety area width	200 ft	Widening may be desirable if wind coverage is less than 95 per cent. If elevated, a 300-ft width is recommended for the structure.
Runway safety area length	1,700 to 2,000 ft	If elevated, the structure would be within this range.
Taxiway width	60 ft	Based on expected configuration of second generation aircraft.
Runway C_L to taxiway C_L†	200 ft	Based on expected configuration of second generation aircraft.
Runway C_L to edge of parked aircraft	250 ft	Based on expected configuration of second generation aircraft.
Runway C_L to building line	300 ft	Height controlled by transitional surface.
Taxiway C_L to fixed obstacle	100 ft	Based on second generation aircraft.
Runway C_L to holding line	150 ft	Based on second generation aircraft.
Separation between parallel runways	......	See text.
Protection surfaces:		
Primary surface length	Runway length plus 100 ft on each end	
Primary surface width	300 ft	Based on the use of microwave instrument approach equipment.
Approach/departure surface length	10,000 ft	
Approach/departure surface slope	15:1	
Approach/departure surface width at:		
Beginning	300 ft	Approach/departure surface is 765 ft wide at 1,500 ft from beginning.
10,000 feet	3,400 ft	
Transitional surface slope	4:1	
Transitional surface maximum height	100 ft	
Clear zone:		
Length	750 ft	
Inner width	300 ft	Begins at end of primary surface.
Outer width	532 ft	
Pavement strength	150,000 lb gross weight on dual tandem gear	Based on second generation aircraft. Also see paragraph headed "Structural Design."

* The criteria are subject to change as further experience is gained.
† C_L = centerline

sengers and cargo; i.e., from one level to another. Such a design will allow an operational area that is virtually free of fixed obstacles. Each STOL port should be designed with due consideration of local conditions, particularly the configuration of the land available and surrounding land uses. Figure 4 shows one possible layout of the staggered runway concept. One runway is used primarily for landing and the other for takeoff. This configuration allows a considerable reduction in the total operational area by eliminating parallel taxiways. Also, the flow of traffic is optimized, since no aircraft backout or turning around is involved. Figure 5 shows the tandem runway concept. Again, one runway is used for landing and the other for takeoff, but not simultaneously. Spacing must be provided for taxiing past parked aircraft and aircraft backout for turning around. The figures are intended to illustrate the new approach which must be taken in the planning and design of STOL ports; they are not intended to require a parallel runway configuration.

ELEVATED STOL PORTS

General

The siting of a STOL port involves a series of tradeoffs. One of these is the optimum site for the origin/destination of passengers versus availability of a practical and economic site. In metropolitan areas, this causes a detailed look at elevated STOL ports. For example, in New York City, several waterfront sites on Manhattan Island have been studied. In Los Angeles and San Francisco, sites have been analyzed over railroad yards. All are intended to provide air transportation integrated with surface transportation. Such a facility appears to have a great potential for accommodating the short-haul air passenger demand. However, since it is elevated, there are some unique design problems which must be recognized.

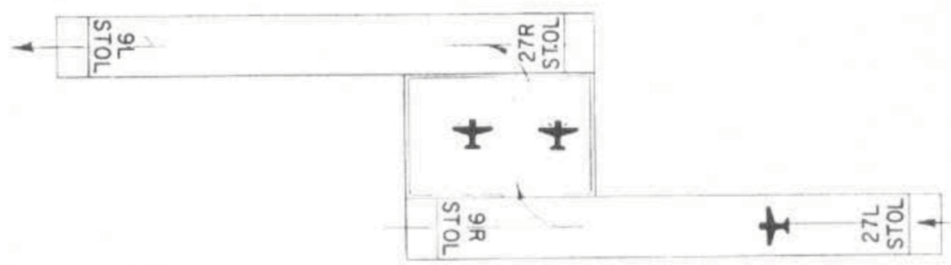


Fig. 4 Potential layout.

Operational Surface

Essentially, the same standards are used for elevated STOL ports as surface facilities. Nevertheless, the question arises as to what is the recommended minimum.

Length of Structure The length of structure recommended is a range between 1,700 and 2,000 ft.

Width of Structure The recommended width of the structure is 300 ft for the runway operational area. However, this is dependent upon the emergency arresting system selected for lateral containment, the degree of wind coverage, and the need for a parallel taxiway. The lateral arresting system may require a greater or lesser area width, adjacent to the runway. Also, if the runway is not aligned with prevailing winds, it may be appropriate to have a wider runway. For most STOL ports, a parallel taxiway will be needed. In this case, the structure should be at least 400 ft wide.

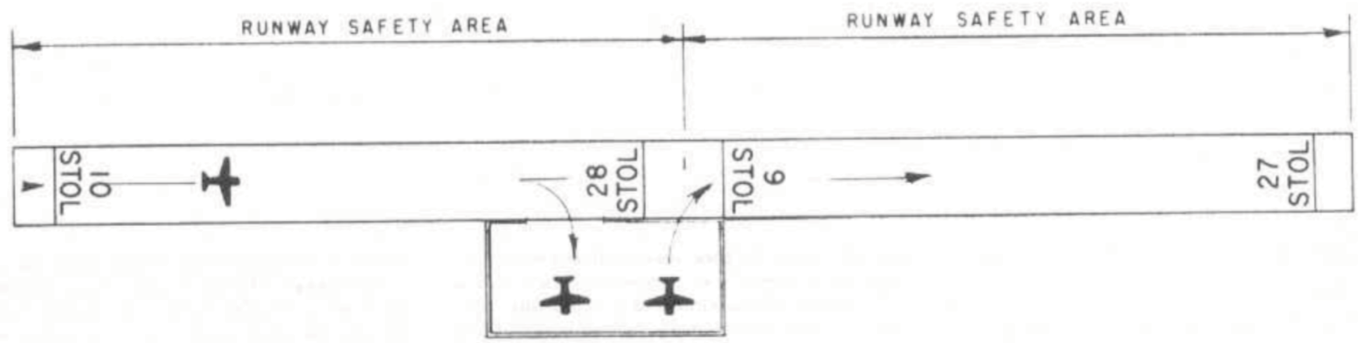


Fig. 5 Potential layout.

Structural Design

The landing area should be designed for the largest aircraft expected to use it. The maximum weight aircraft anticipated by 1985 is 150,000 lb. Other types of loads, such as snow, freight equipment, etc., should be considered in the design of the area and the structures as appropriate.

Emergency Equipment

Provision should be made for equipment on the operational area to handle emergency medical and fire situations. Consideration should also be given to some type of built-in hydrant system.

Aircraft Maintenance and Fueling

Due to the limited parking space available, it appears logical to plan only for emergency maintenance. The decision to install an aircraft fueling system will depend on several factors, among which is the requirement of the local building code.

Floating STOL Port

A STOL port located on water (floating or semisubmersed) is not truly an elevated facility. However, many of the operational problems associated with a floating STOL port are the same as for an elevated STOL port. For example, emergency arresting systems should be provided to ensure that the aircraft does not fall into the water. On the other hand, wind flow should be considerably less of a problem. In many metropolitan areas, a floating facility, on either an interim or permanent basis, may provide the best solution to establishing STOL service.

TERMINAL AREA

General

The primary purpose of the terminal area on a STOL port is the same as the terminal area on a conventional airport—to provide for the transfer of passengers and cargo from one mode of transportation to another. However, due to the specialized function of the STOL system, attention should be given to possible innovations in the terminal area, such as gate processing and vertical movement of passengers. The STOL system, which is aimed at short-haul, high-density air transportation, must be efficient in every aspect.

Terminal Building

The terminal building should be designed to accommodate a steady flow of passengers rather than long-term holding of passengers. This means secondary features of the terminal, such as concessions and eating facilities, should be minimized. To aid in efficient passenger handling, consideration should be given to passenger processing at the gate. Since the majority of short-haul passengers are business-oriented, time-conscious, and carry relatively little baggage, gate processing should be quite feasible. Also, mutual-use (or common use) gates appear to be a requirement.

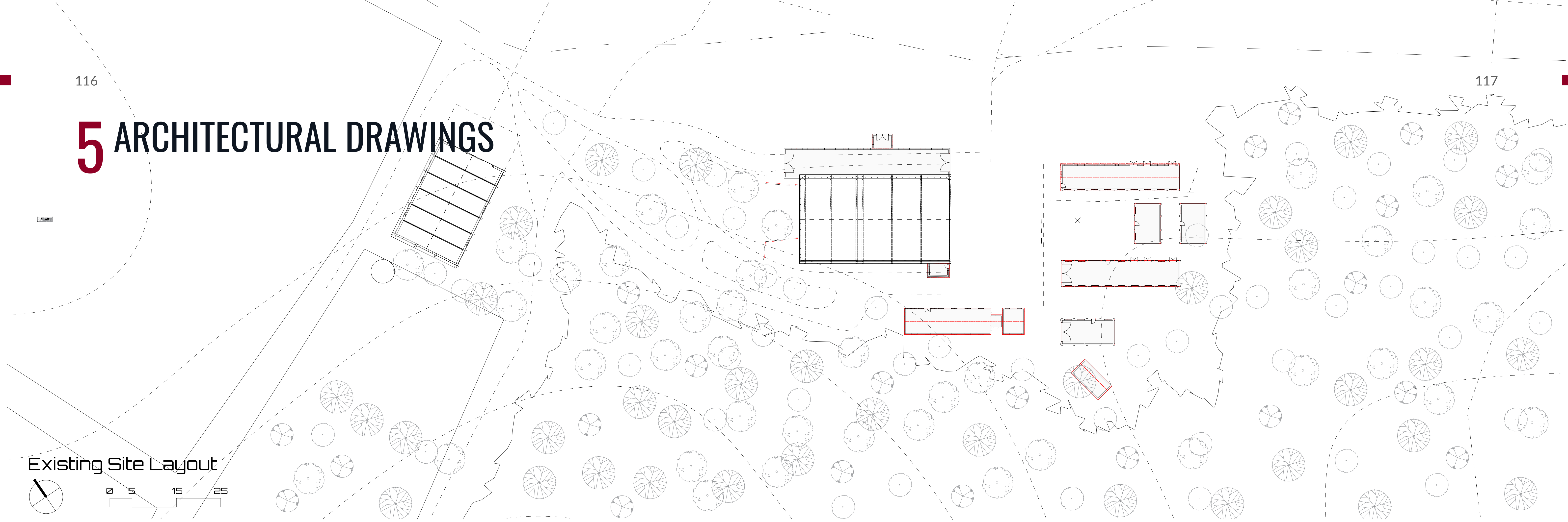
Vertical Movement

On elevated STOL ports, it may not be feasible to locate the terminal on the same level as the operational area. This would, of course, require vertical movement of passengers and baggage. Several methods of accomplishing this have been studied. Among these are escalators, elevators, and loading bridges. The escalators would involve the least cost but would create a fixed obstacle in the aircraft maneuvering area. The elevators can be located on the side of the structure but are expensive and preclude a steady flow of passengers to the aircraft. The loading bridges completely protect the passenger from the weather but are expensive and create an obstacle. At surface STOL ports, vertical movement of passengers may be feasible between mass transit vehicles and the aircraft gate area. This should be given careful evaluation during the initial planning of the terminal.

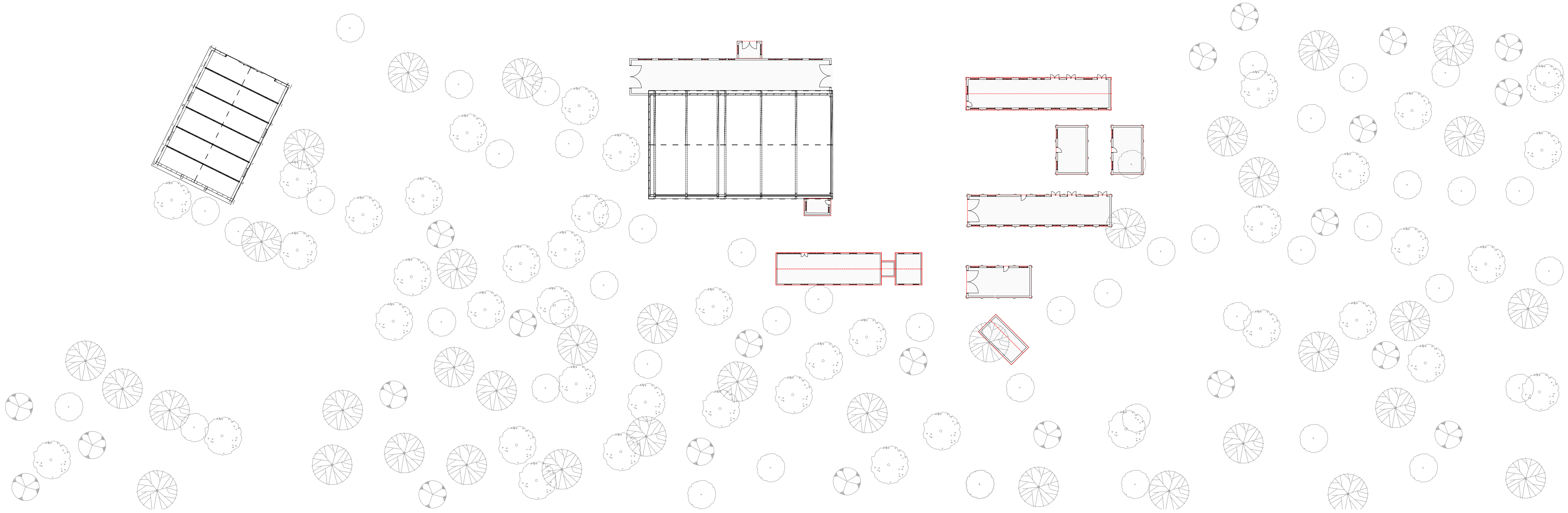
Capacity

The size of the terminal is determined by the peak-hour volume of passengers and cargo. The forecast of the peak-hour volume must be made recognizing the maximum capacity of the runway (in VFR conditions), the aircraft passenger capacity, the aircraft load factor, and the frequency of service. Further, an analysis must be made of the maximum capacity of the surface access systems. Surface congestion has a direct effect on the efficiency of the air transportation system.

5 ARCHITECTURAL DRAWINGS



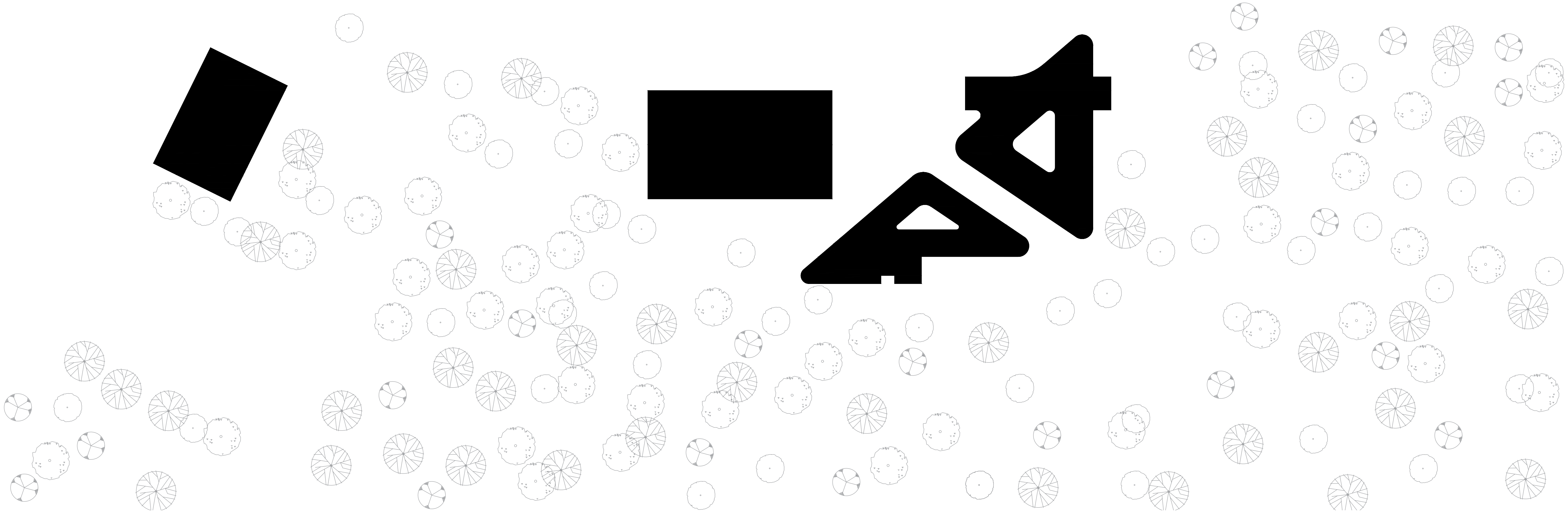
Existing Site Layout



Existing structures

Proposed massing articulation

Conforming the program
volumes on the existing terrain

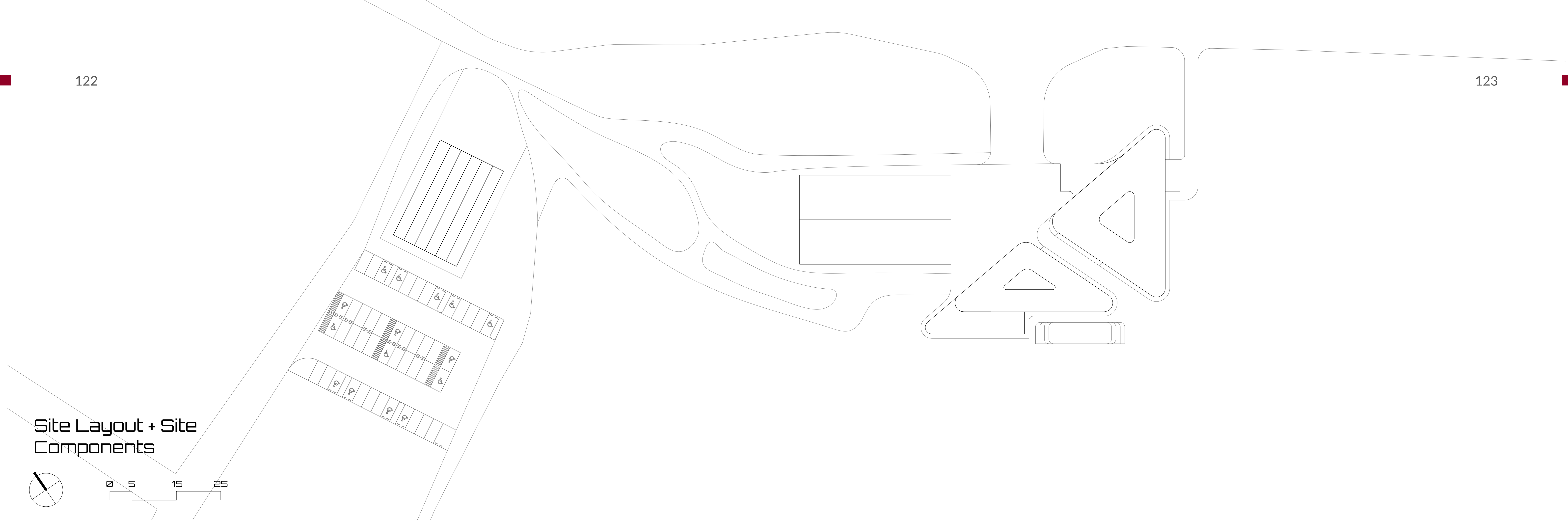


Proposed Masses with existing vegetation

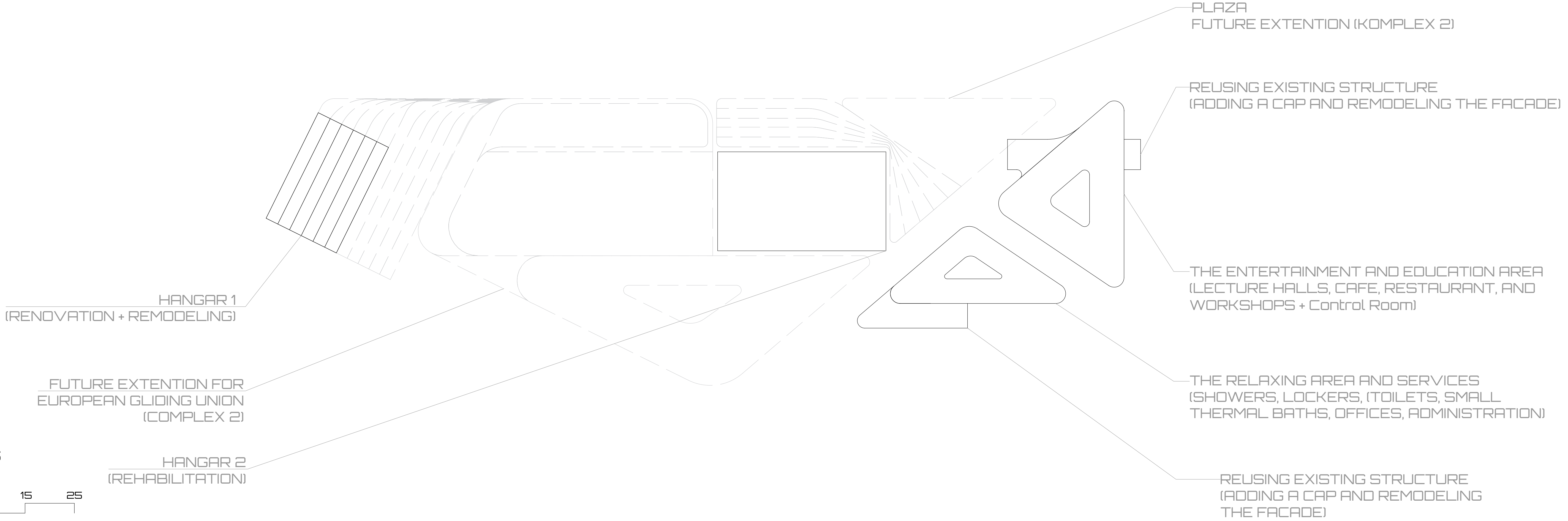
0 5 15 25

Proposed Site Layout

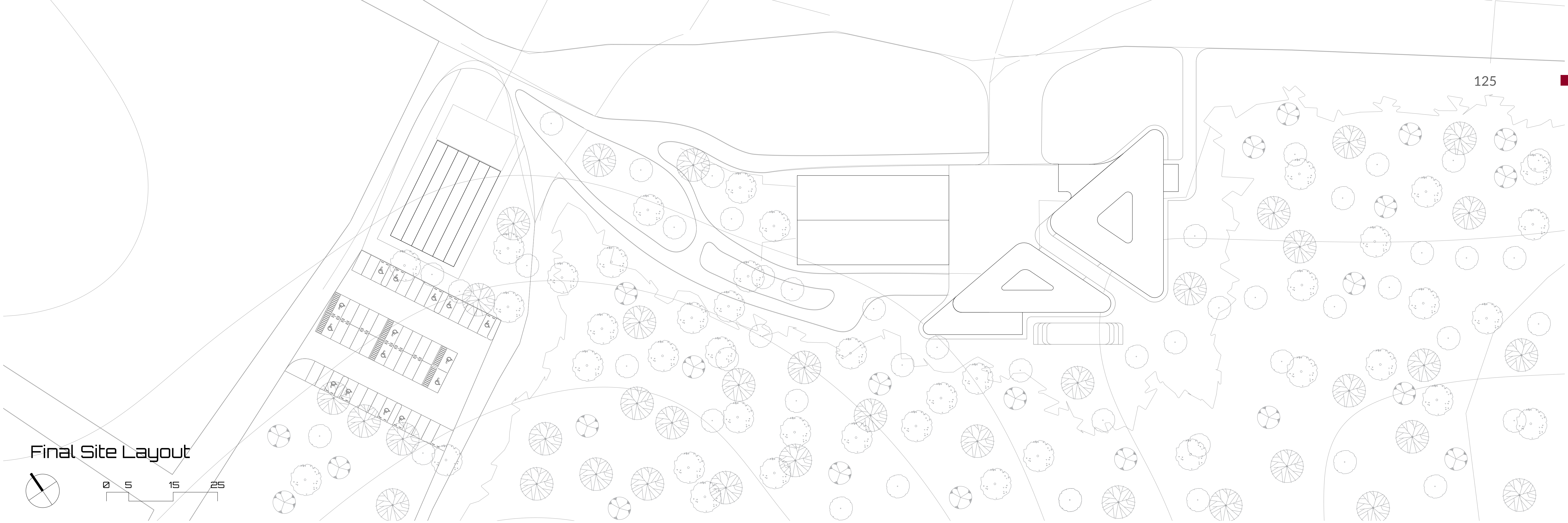
0 5 15 25



Site Layout + Site Components



Project's Components


Final Site Layout
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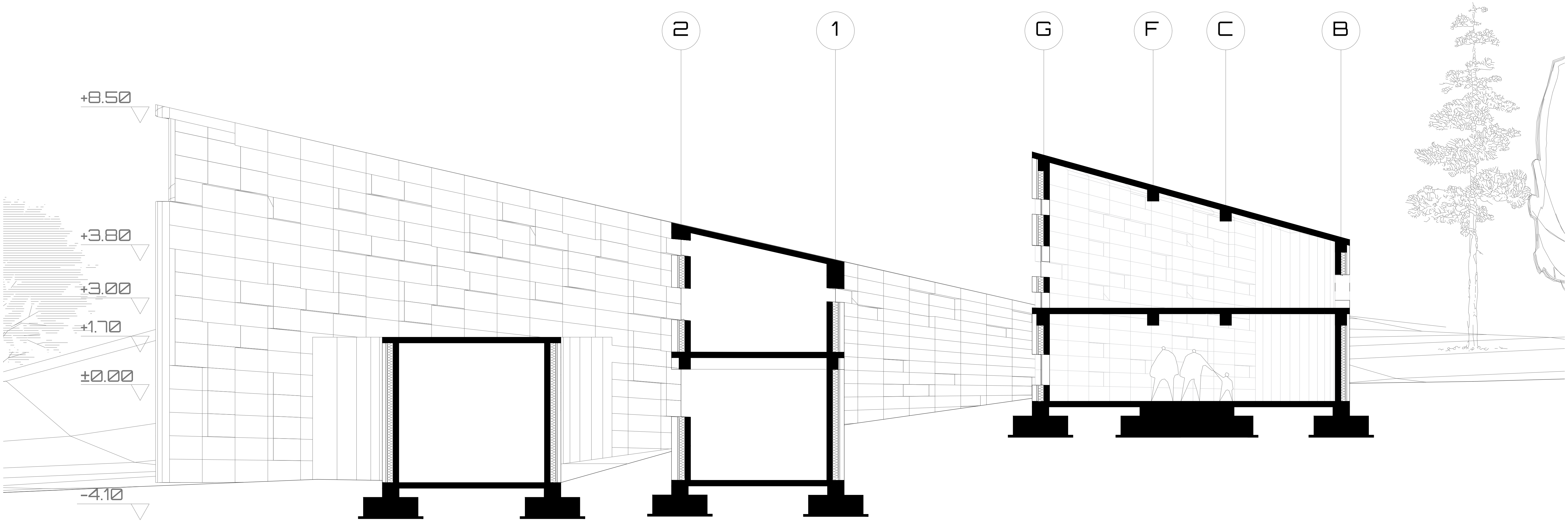
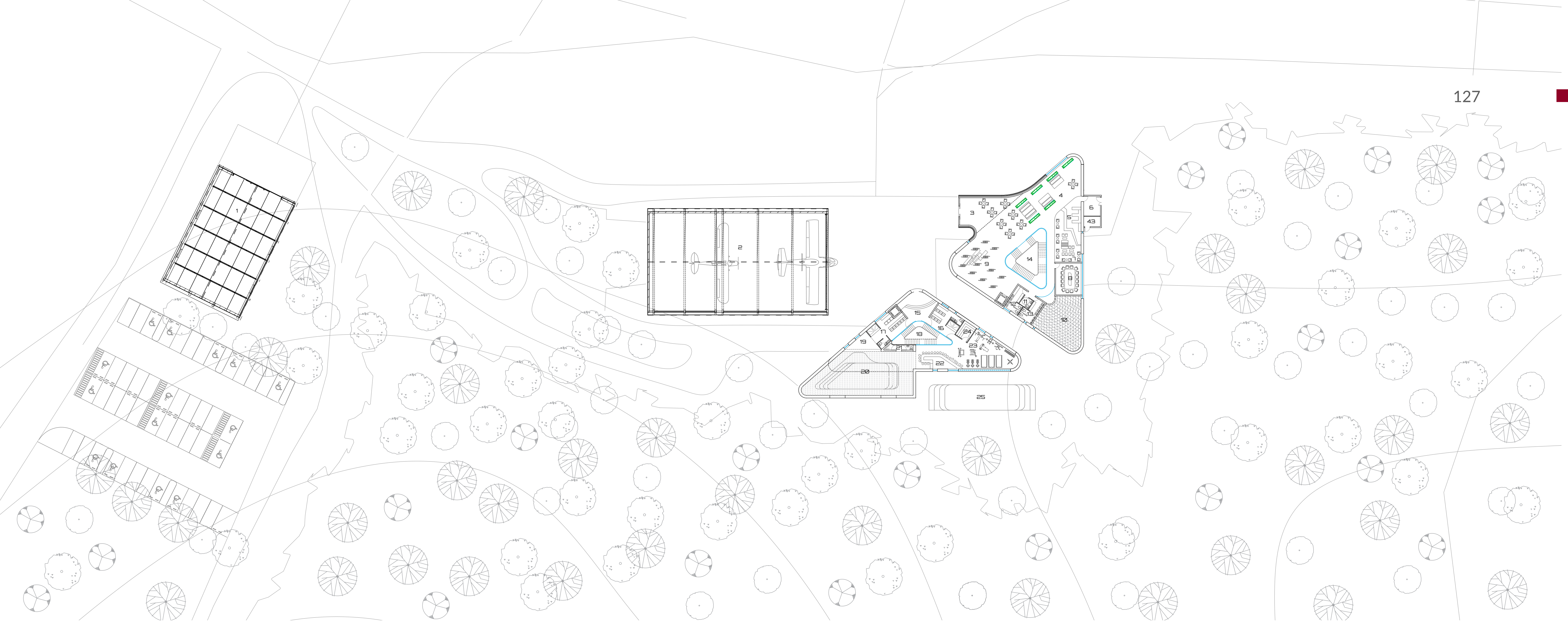

2
1
G
F
C
B
+8.50
+3.80
+3.00
+1.70
±0.00
-4.10

1. Hangar (of Building A)
2. Interactive Hangar (Of Building B) (workshop/exhibition in off-seasons)
3. Reception (Building C)
4. Lobby/Cafe Seating (Building C)
5. Kitchenette + Pantry
6. Kitchen Receiving Area
7. VIP Lounge Area
8. Meeting Room
9. Interactive Space/Exhibition Area
10. Multi-Purpose Hall
11. Unisex Toilet for the Disabled
12. Ladies Toilets
13. Gents Toilets
14. Building C Court Yard
15. Lobby (Building D)
16. Ladies Thermal Pool's Lockers + Toilets + Showers
17. Gents Thermal Pool's Lockers + Toilets + Showers
18. Indoor Pool Lockers + Showers Indoor Pool
19. Thermal Pool Sky Showers
20. Thermal Pool
21. Shared in-pool Utilities
22. Pool side/Gym Bar
23. Gym
24. Sauna
25. Outdoor Pool
26. First Floor Junction
27. Educational Private Class
28. Lecture Hall
29. Building C Plant Rooms
   29a. Electrical Room
   29b. Electrical Storage
   29c. AHU
30. Male Staff Room (Changing Room + Lockers + Toilet + Shower)
31. Female Staff Room (Changing Room + Lockers + Toilet + Shower)
32. HAR IT Department
33. Interactive Work-Shop/Creative Space
34. CCTV Room
35. Spa Zone
36. Massage Room
37. Spa Treatment Room
38. Simulation Room
39. Ticket And Event Office
40. Control Room (for HAR Airfield)
41. Management Open Plan Offices
42. Archive
43. Waste Disposal Room
44. Basement Services Entry
45. 46. Transformer + Battery Room
47. 48. 49. 51. Plant + Filters + Chlorine Room + Heating
52. 53. Rain Harvesting Tanks + Maintenance

A: An Open Double-Volume Space

Ground Floor Layout

0 5 15 25



1. Hangar (of Building A)
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44. Basement Services Entry
45. 46. Transformer + Battery Room
47. 48. 49. 51. Plant + Filters + Chlorine Room + Heating
52. 53. Rain Harvesting Tanks + Maintenance

A: An Open Double-Volume Space

First Floor Layout

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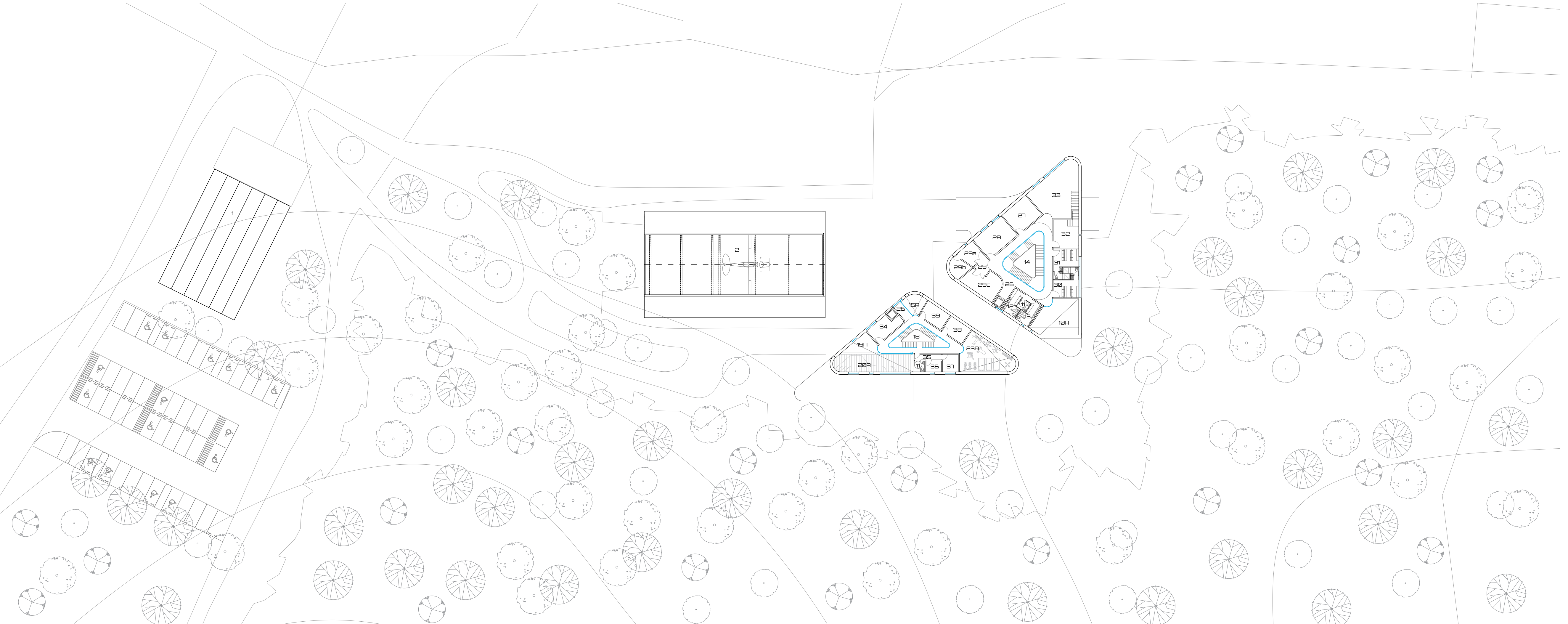

1. Hangar (of Building A)
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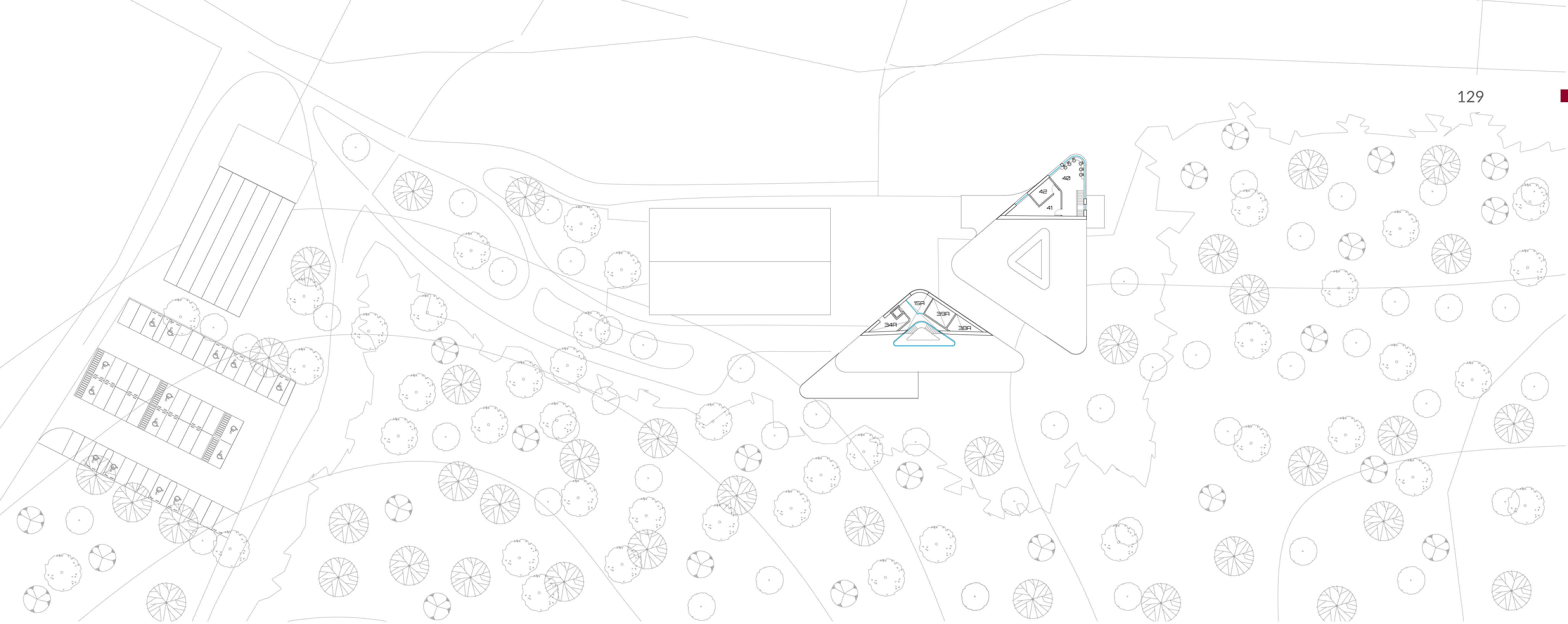
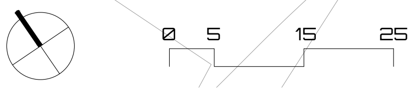
A: An Open Double-Volume Space



Second Floor Layout



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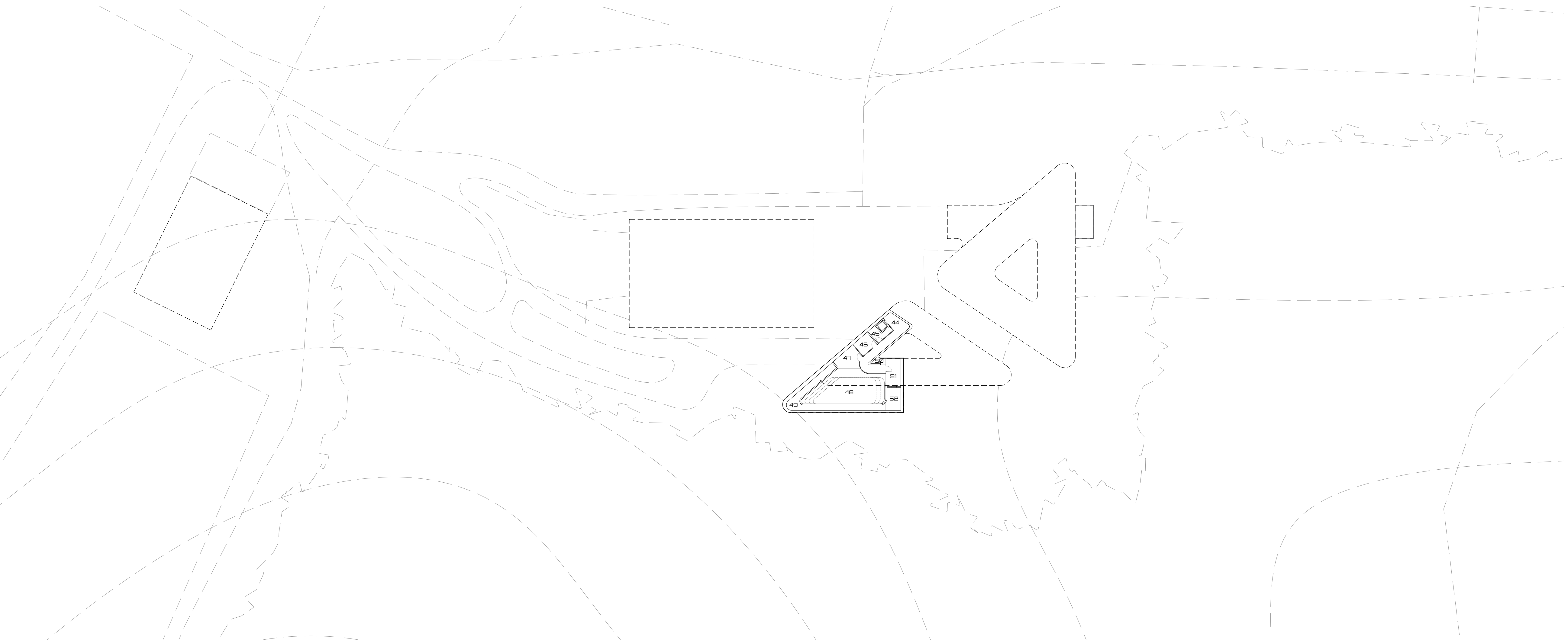
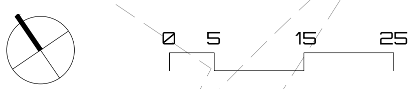
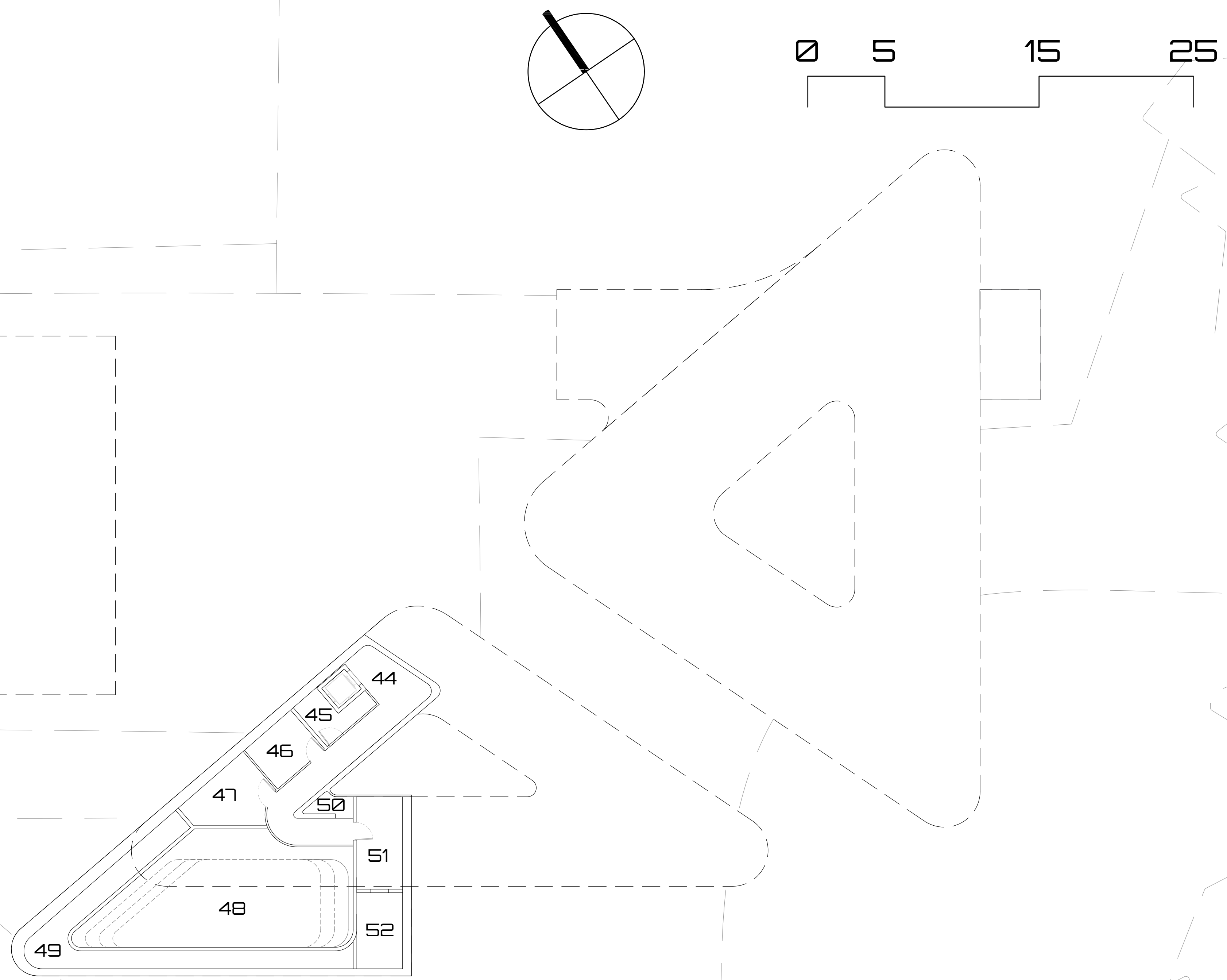
A: An Open Double-Volume Space



Basement Floor Layout



BASEMENT FLOOR LAYOUT



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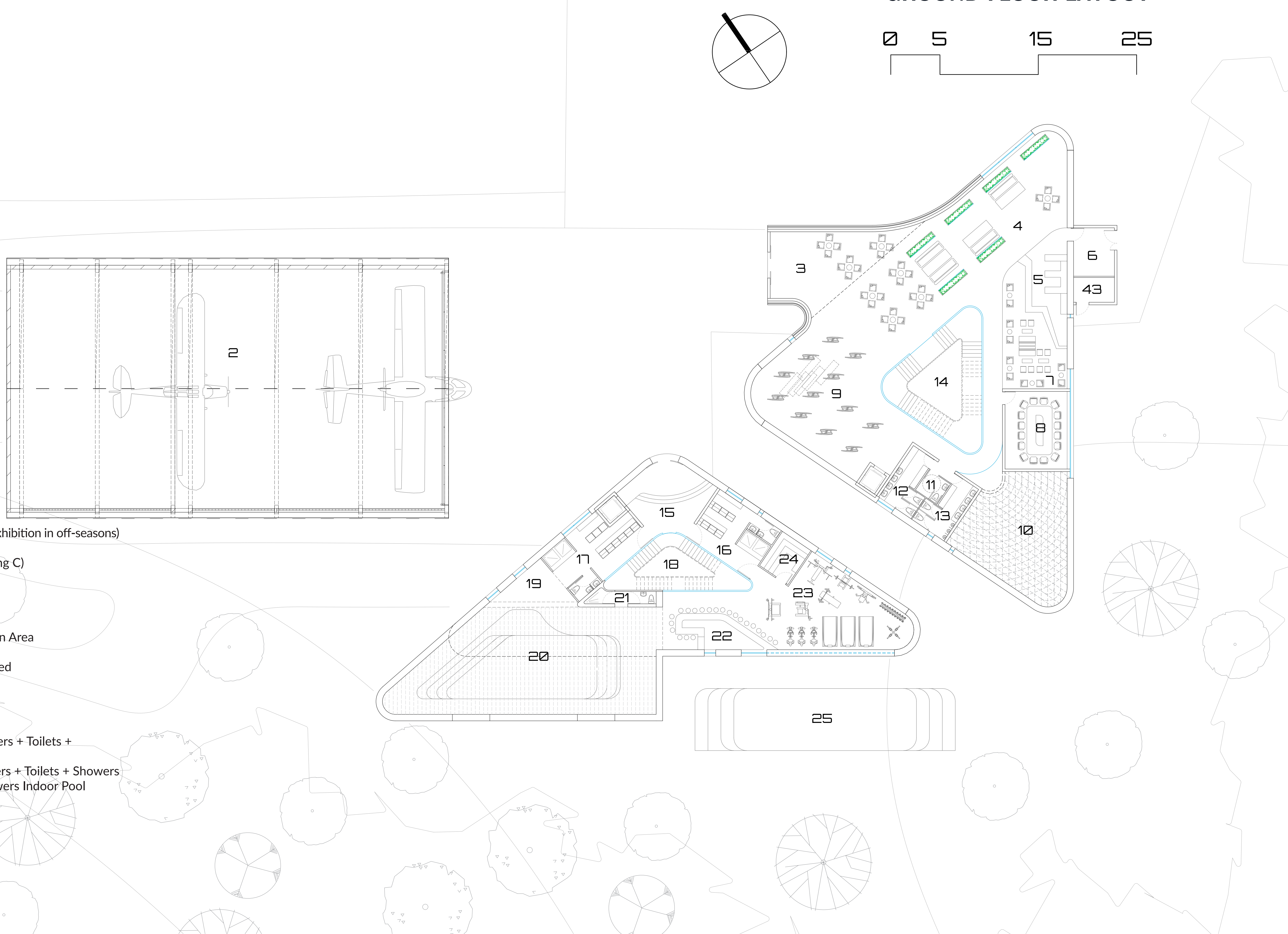
    Room + Heating
52. 53. Rain Harvesting Tanks +
    Maintenance

A: An Open Double-Volume Space

GROUND FLOOR LAYOUT



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22. Pool side/Gym Bar
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24. Sauna
25. Outdoor Pool
26. First Floor Junction
27. Educational Private Class

FIRST FLOOR LAYOUT

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A: An Open Double-Volume Space

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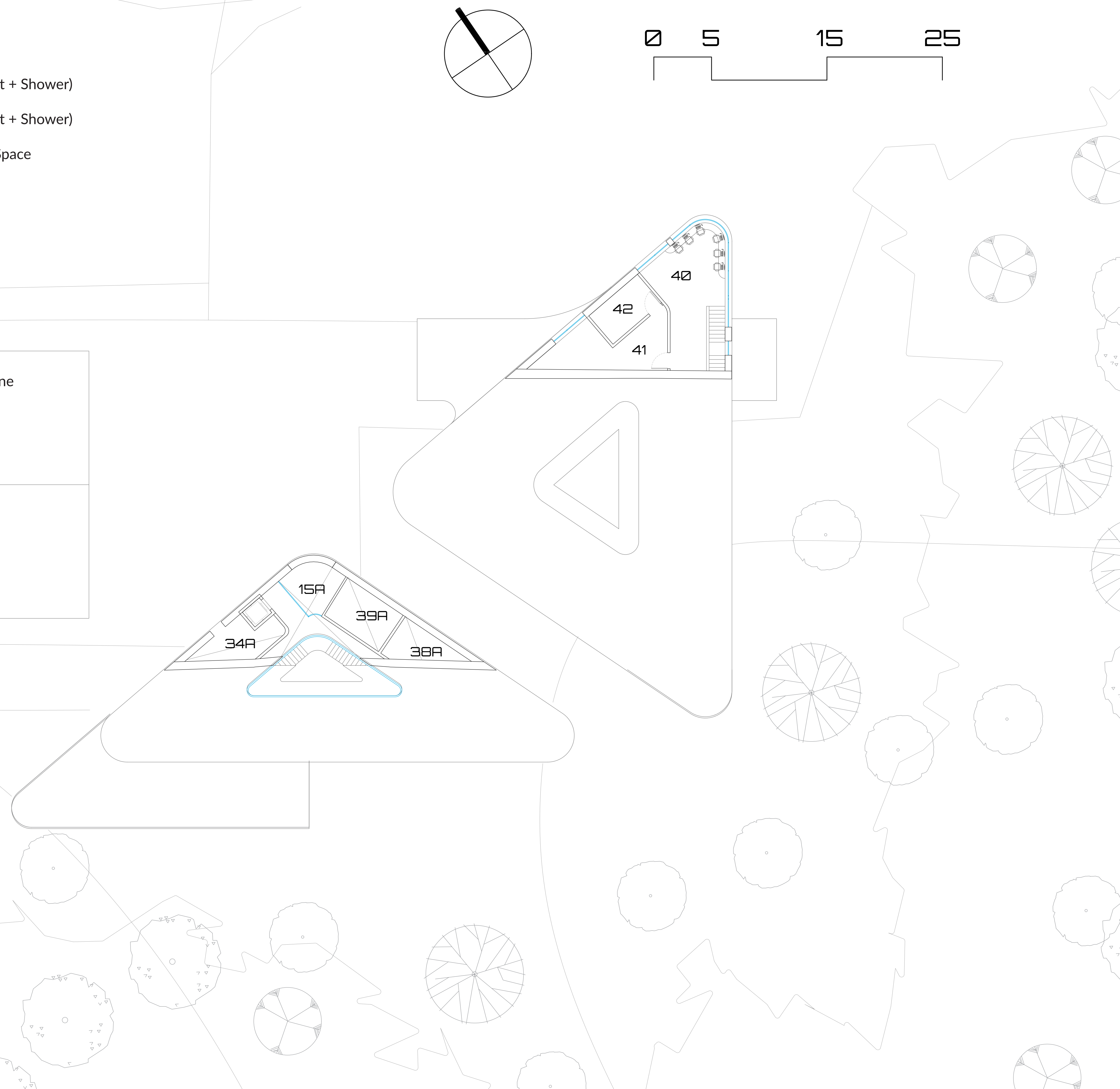
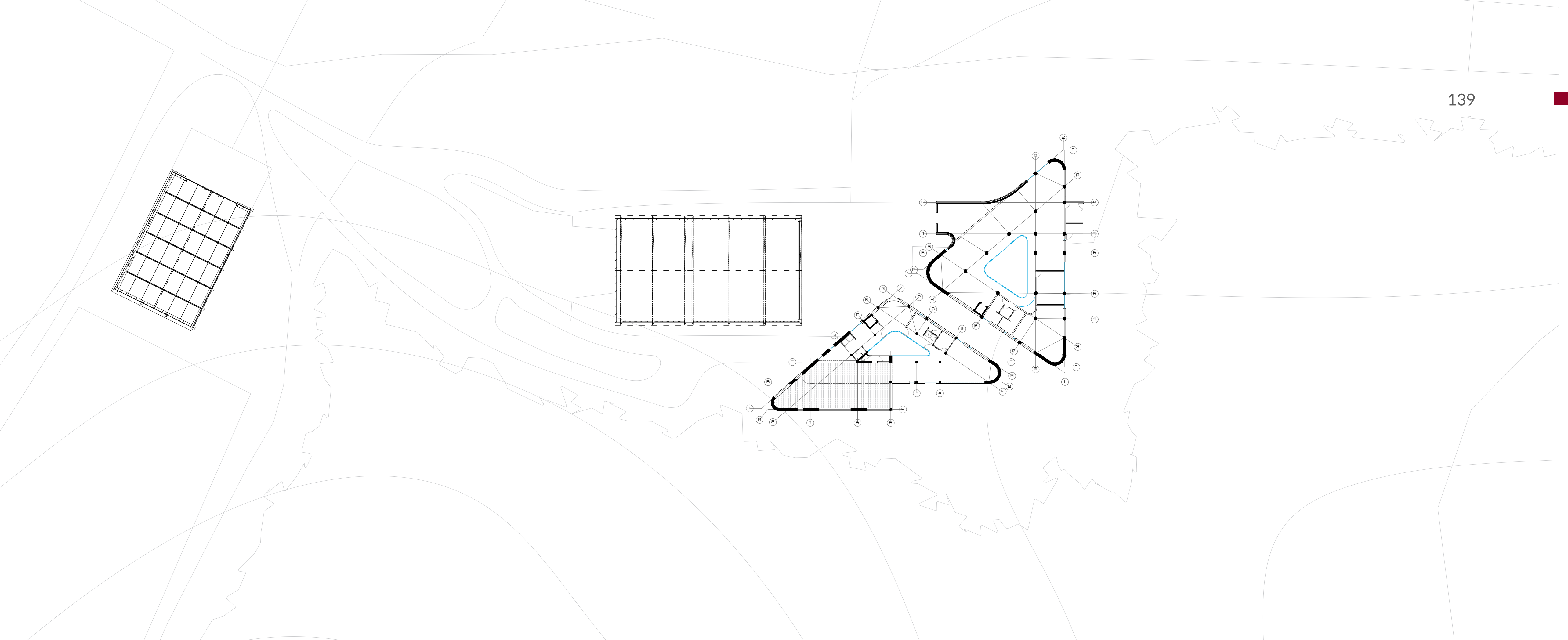
A: An Open Double-Volume Space

SECOND FLOOR LAYOUT





Ground Floor Structural Layout

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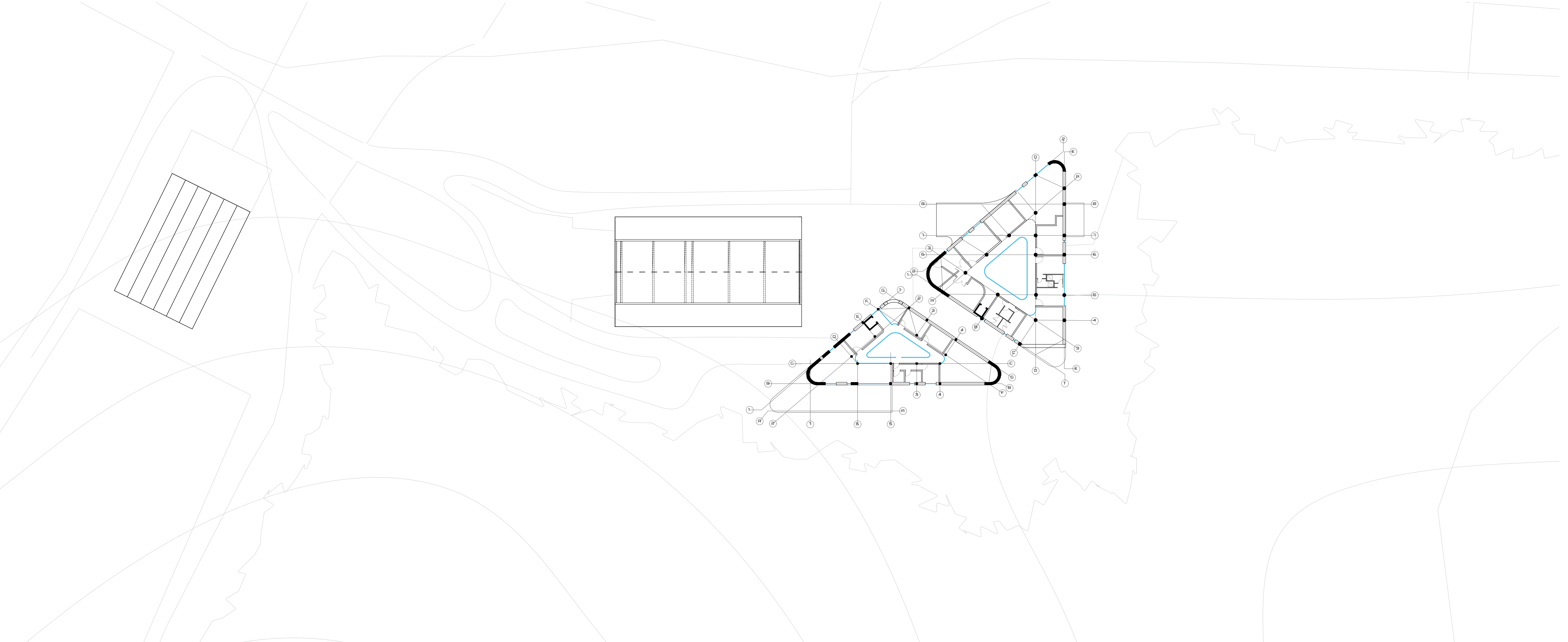

First Floor Structural Layout

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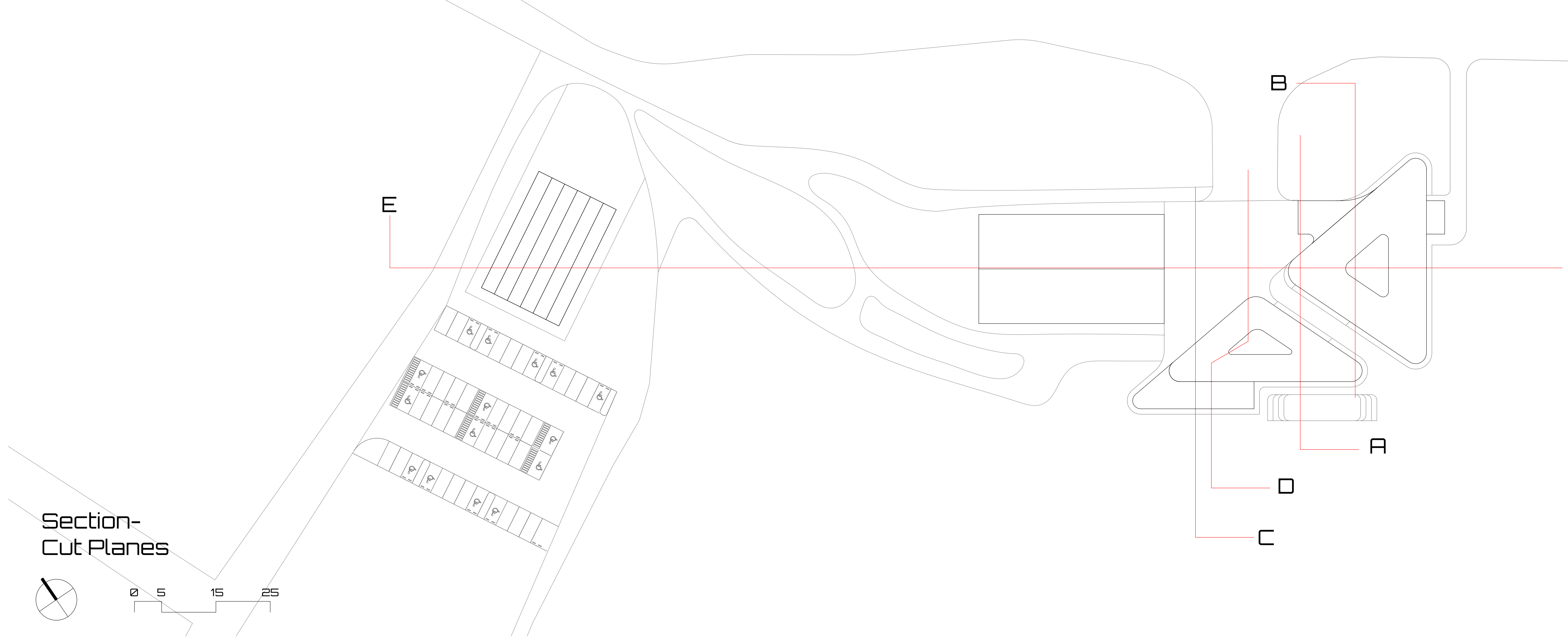
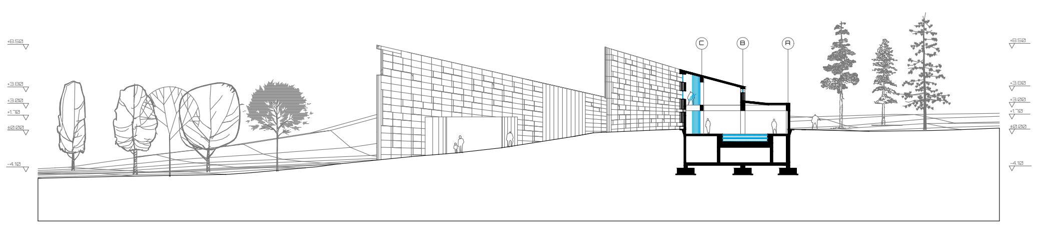
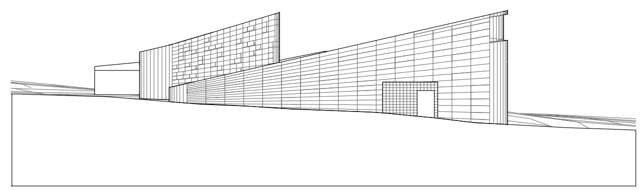
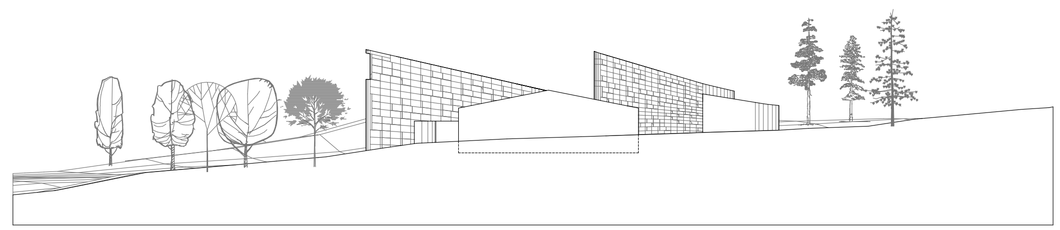
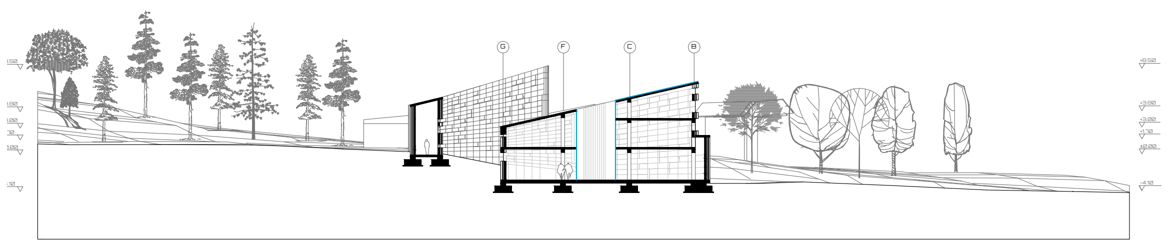


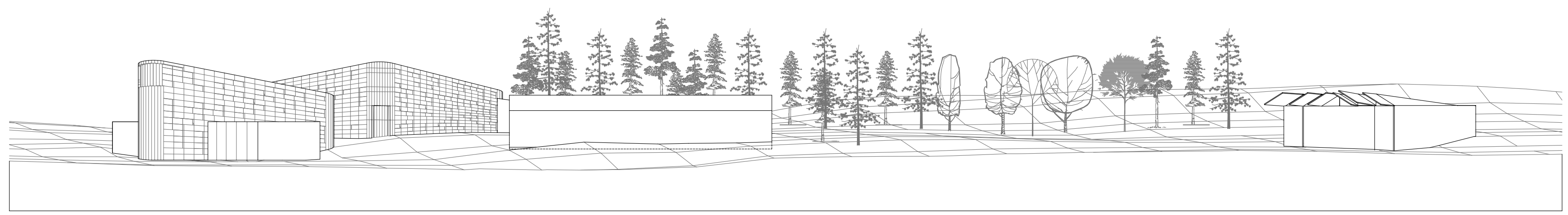
Section-
Cut Planes

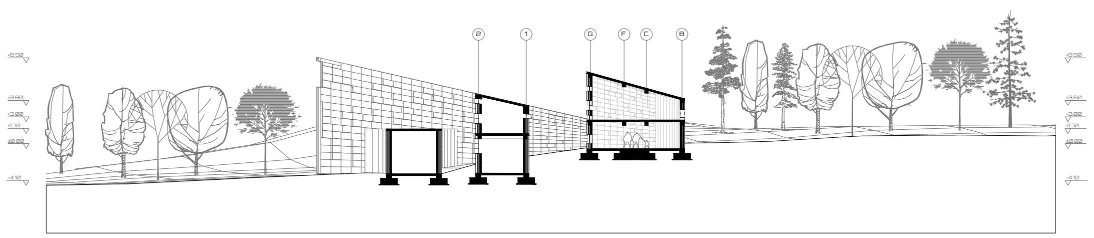

Section C-C

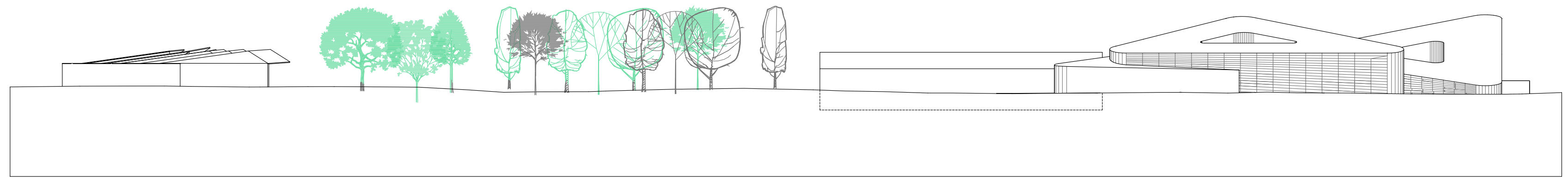

South-Eastern Facade

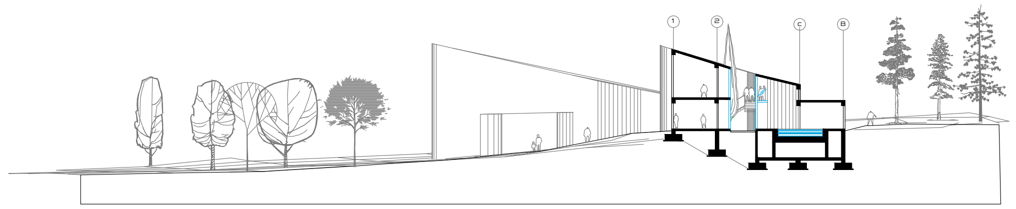

North-Western Facade


Section B-B


North-Eastern Facade


Section A-A


South-Western Facade



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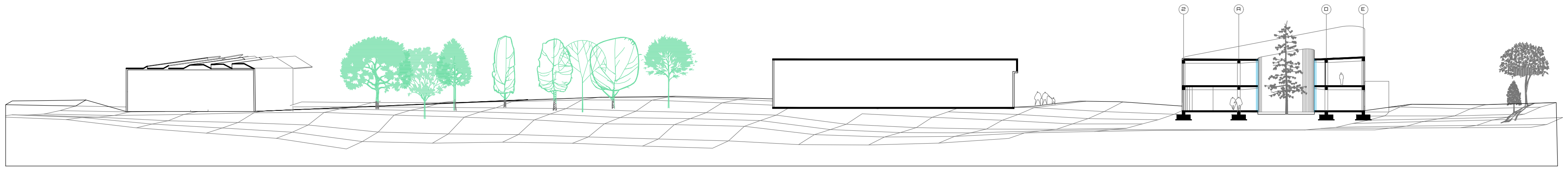
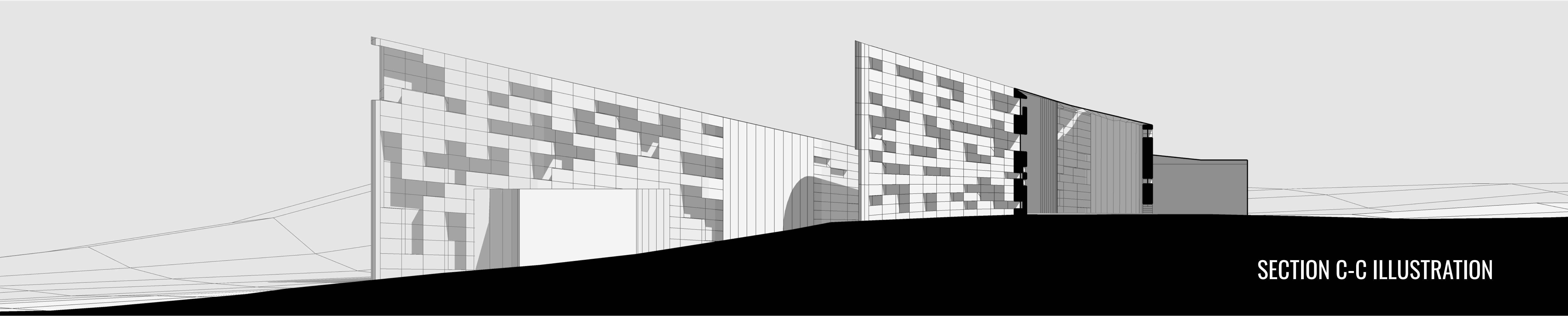
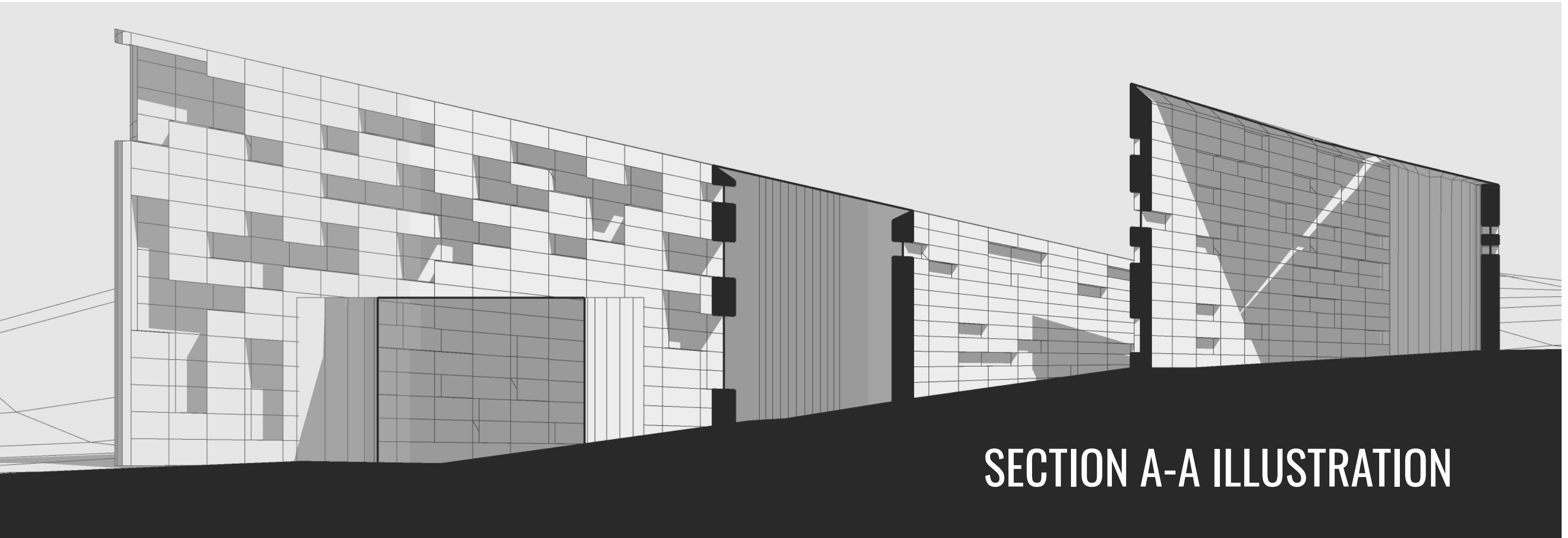


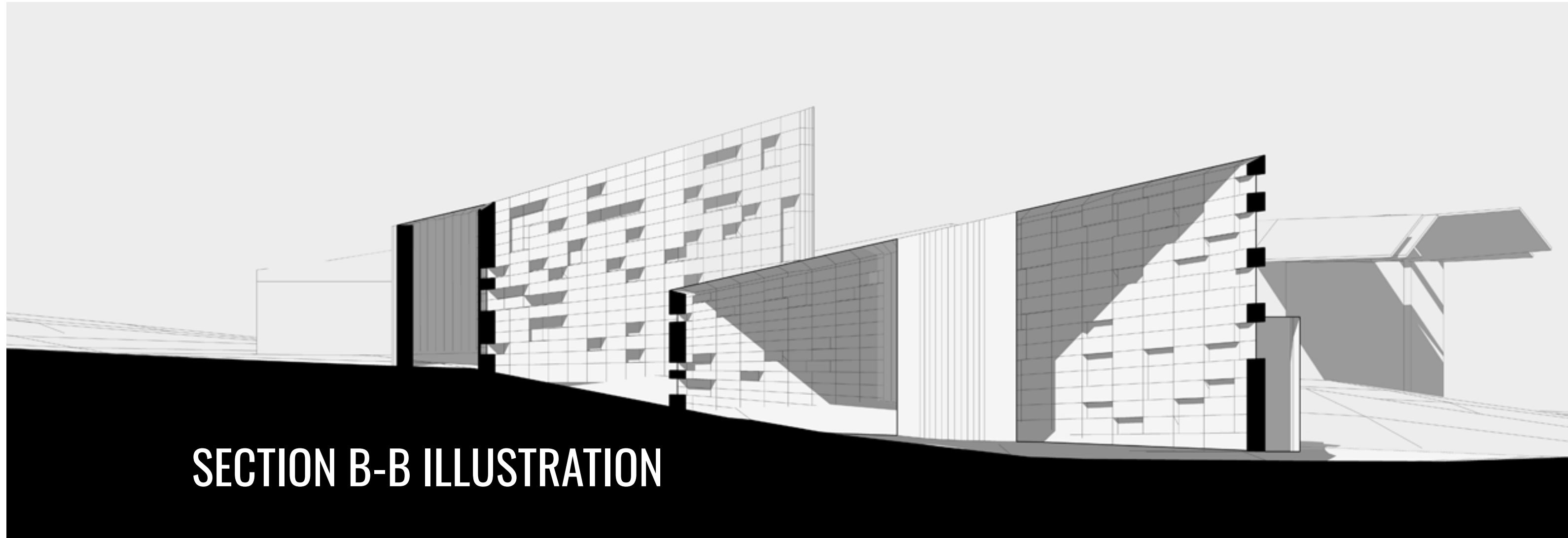
Section E-E



SECTION C-C ILLUSTRATION

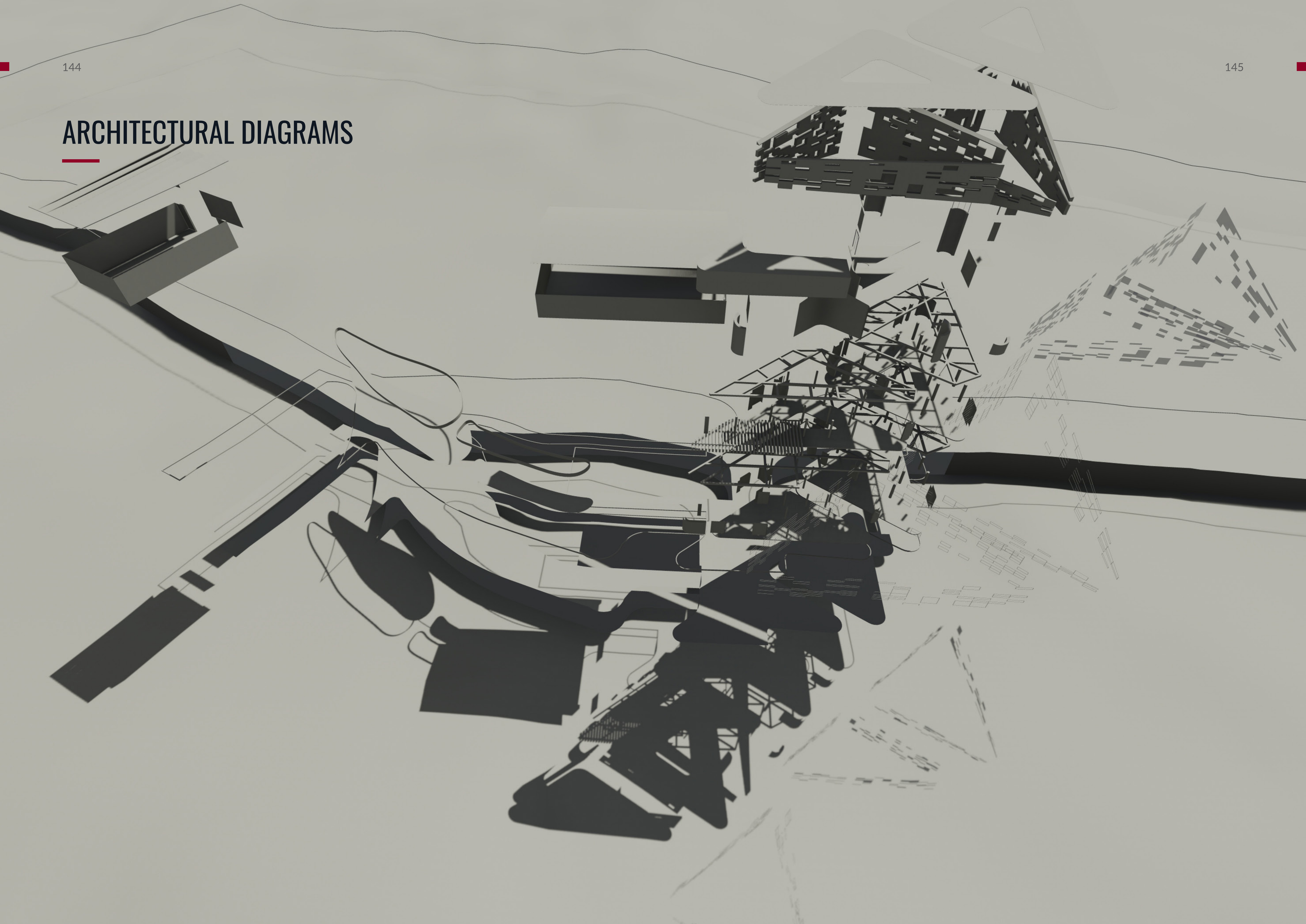


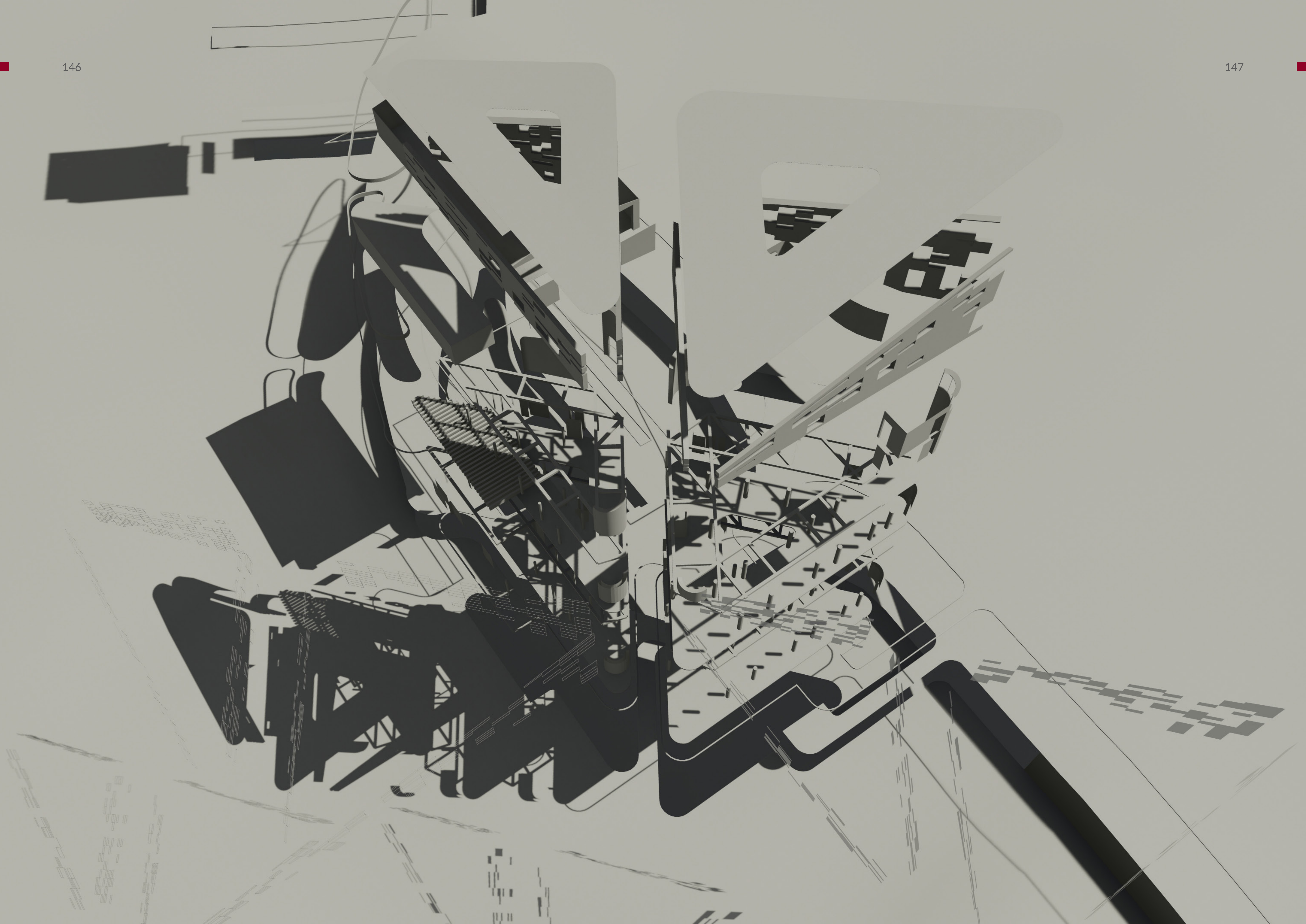
SECTION A-A ILLUSTRATION

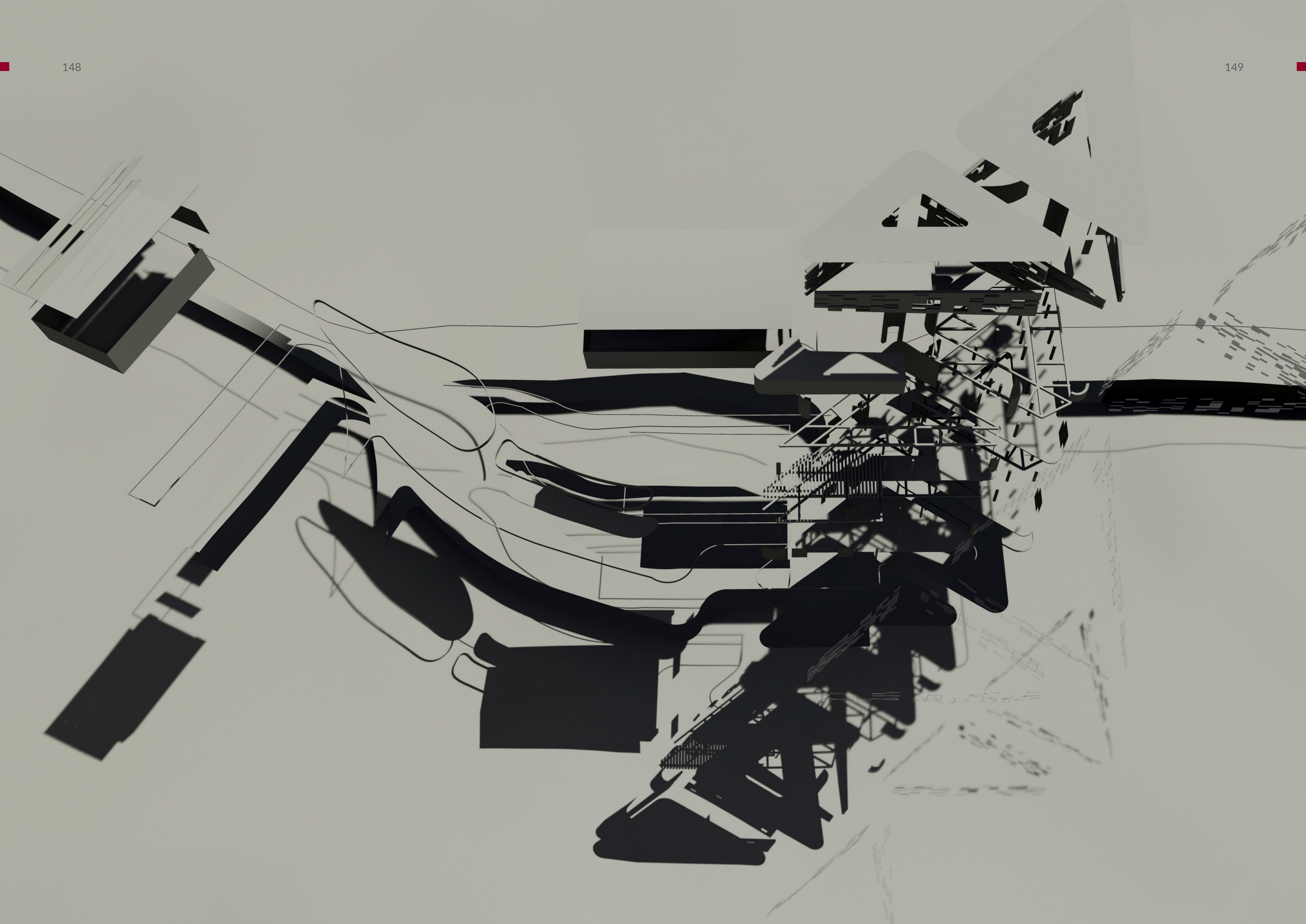


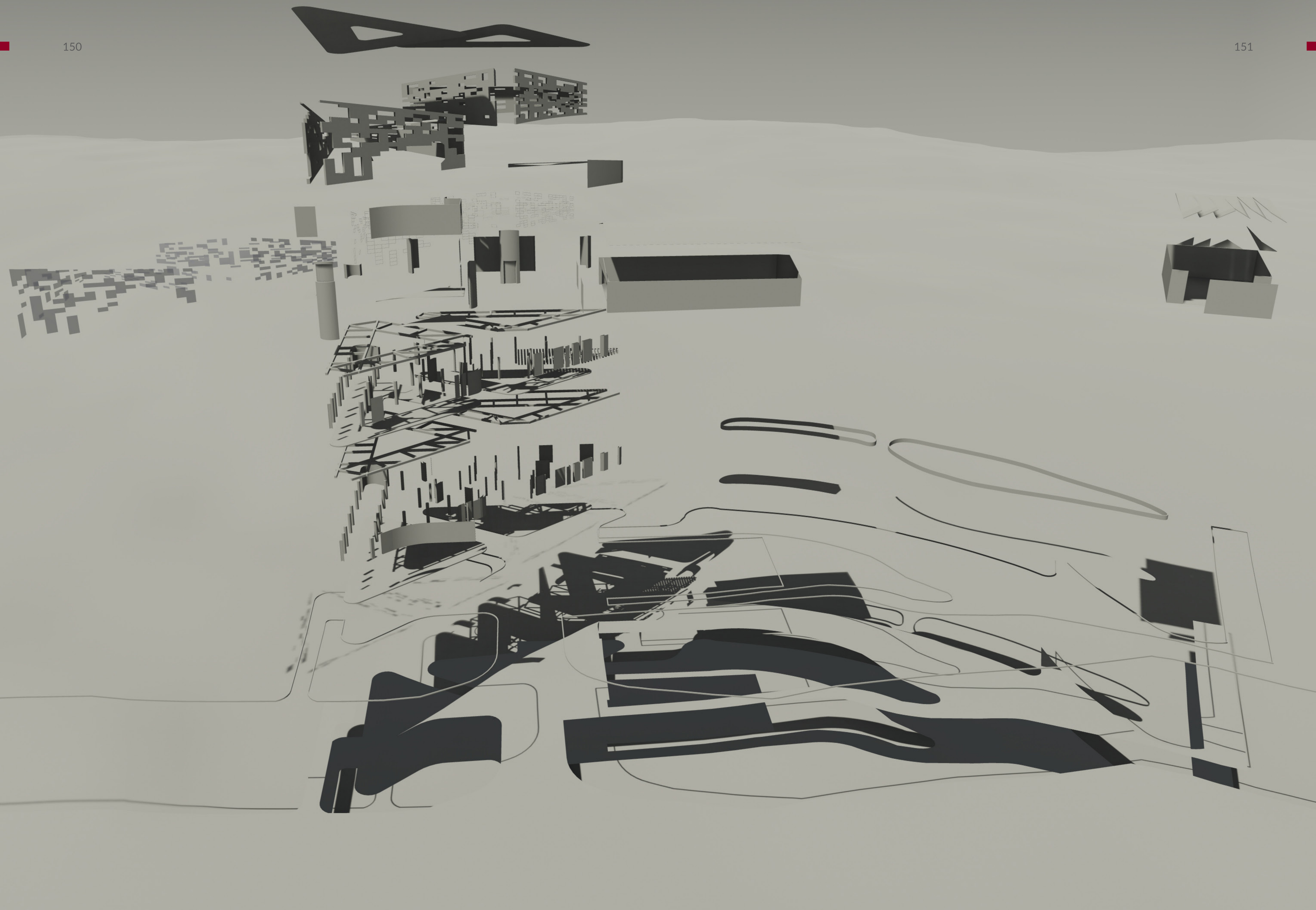
SECTION B-B ILLUSTRATION

ARCHITECTURAL DIAGRAMS

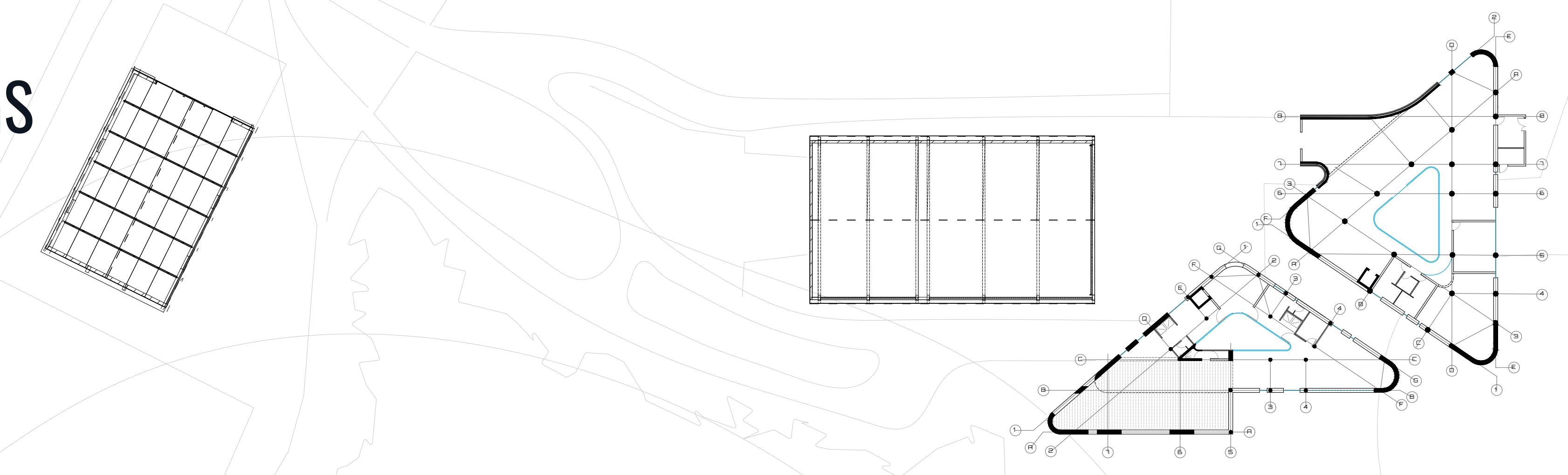








6 STRUCTURAL DRAWINGS



Ground Floor Structural Layout

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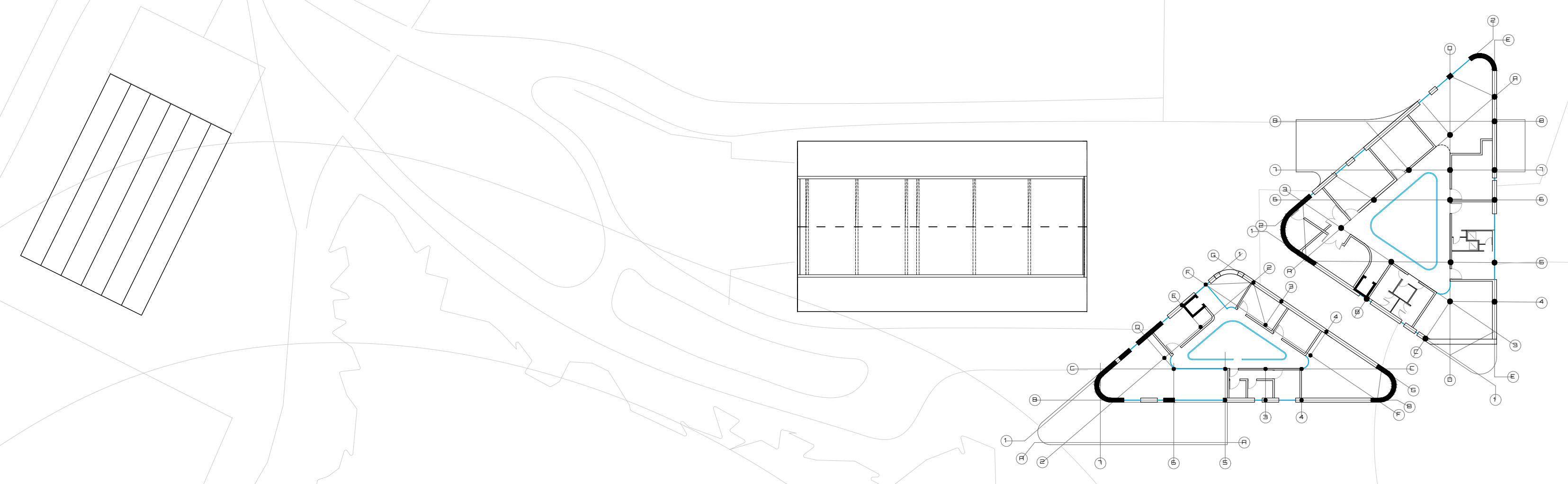

First Floor Structural Layout

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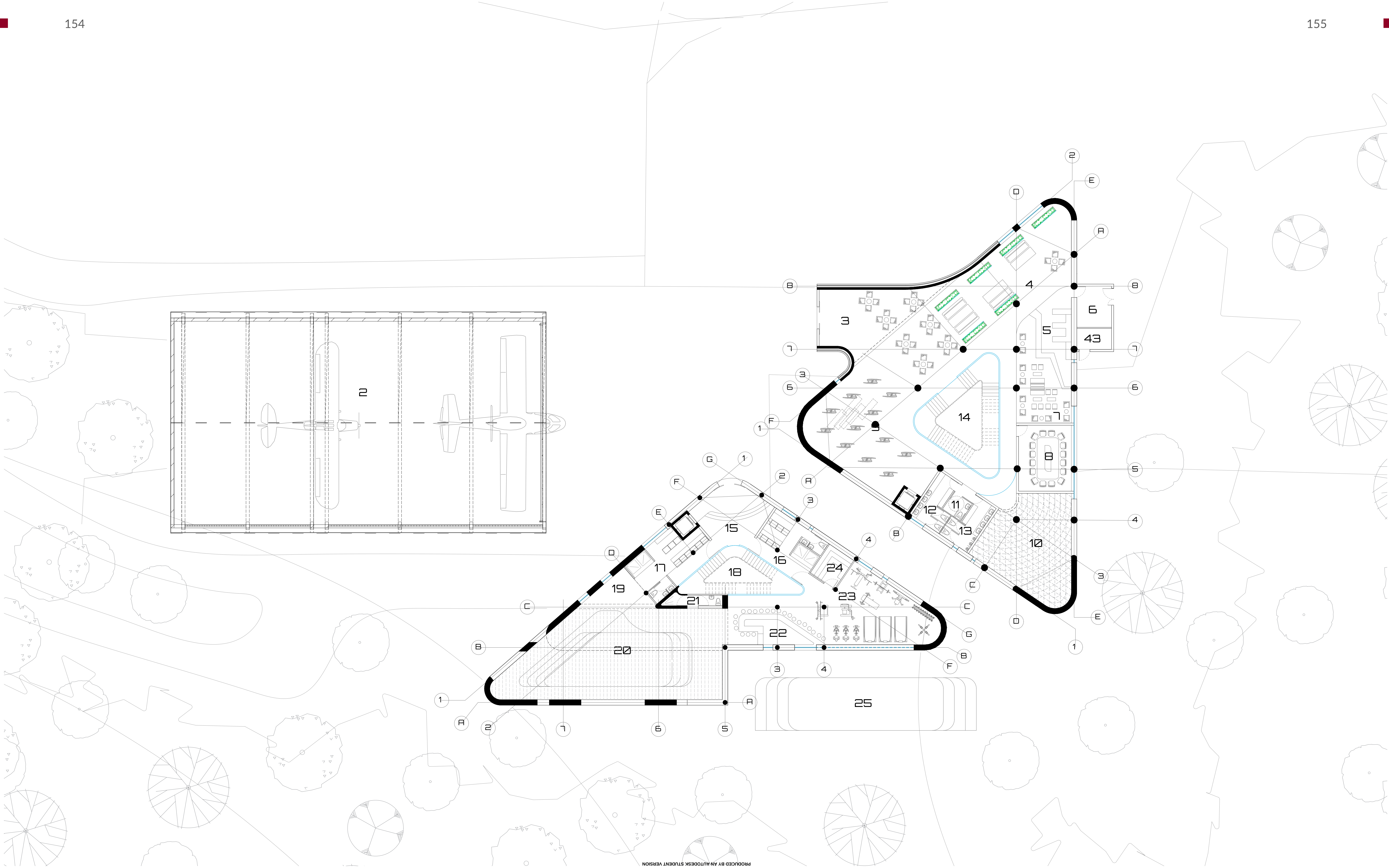
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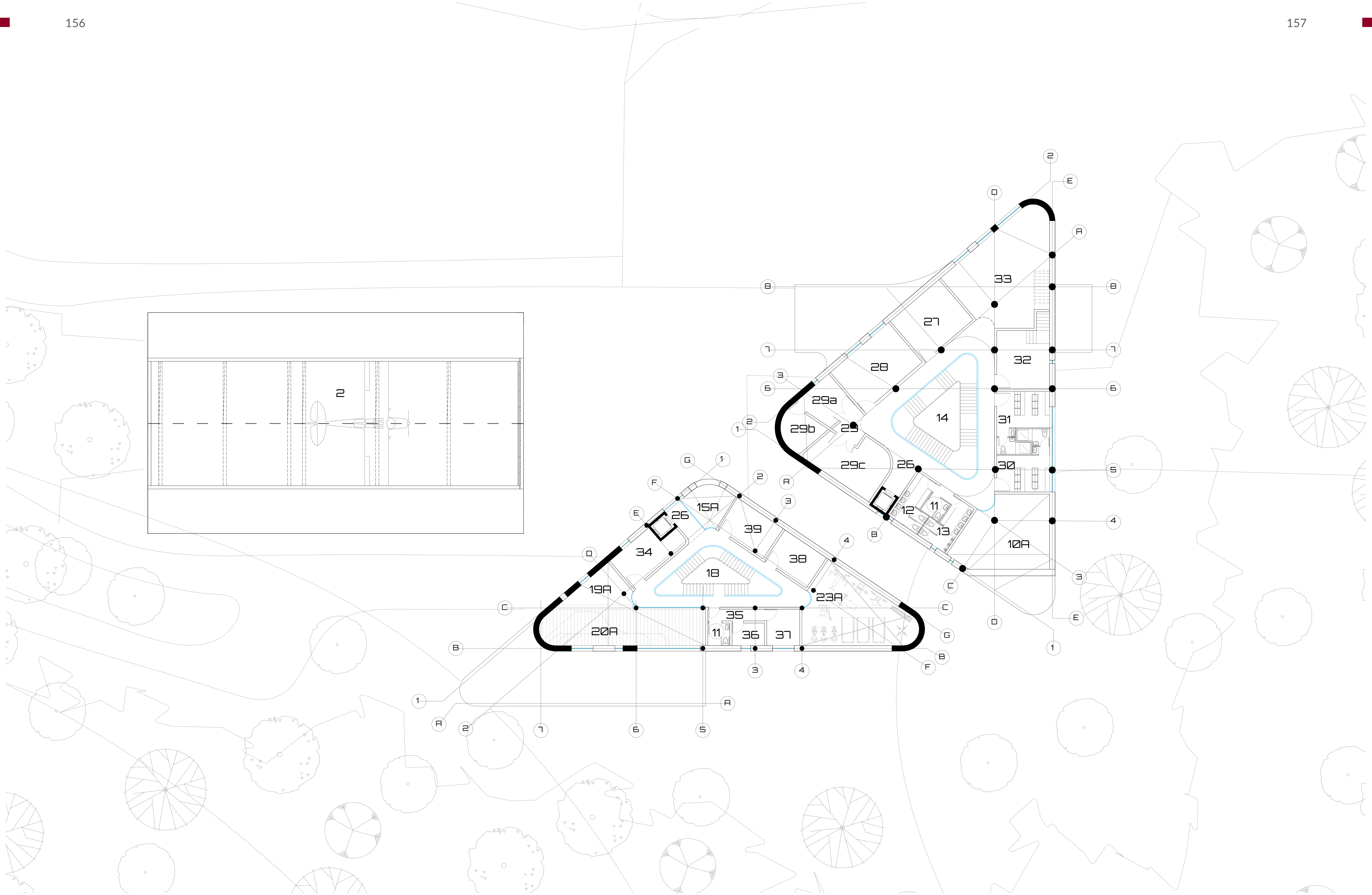
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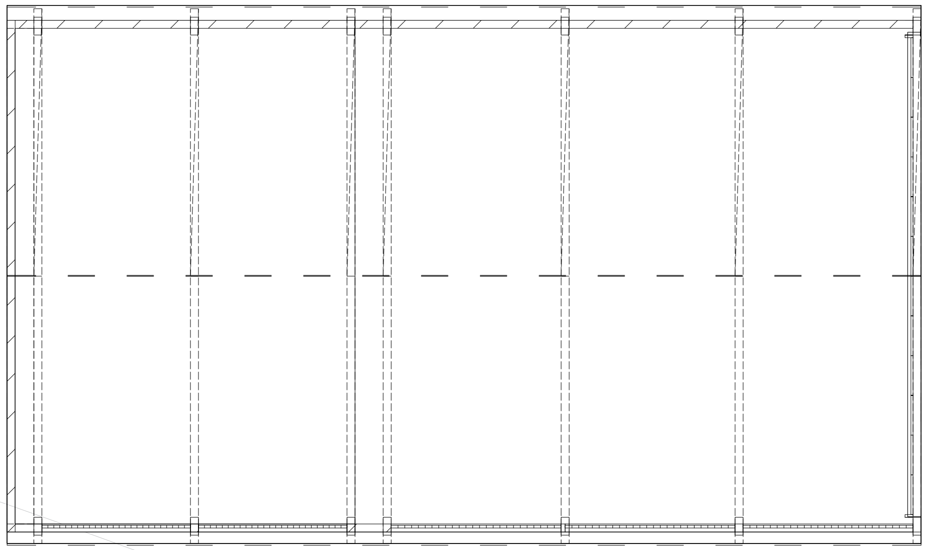
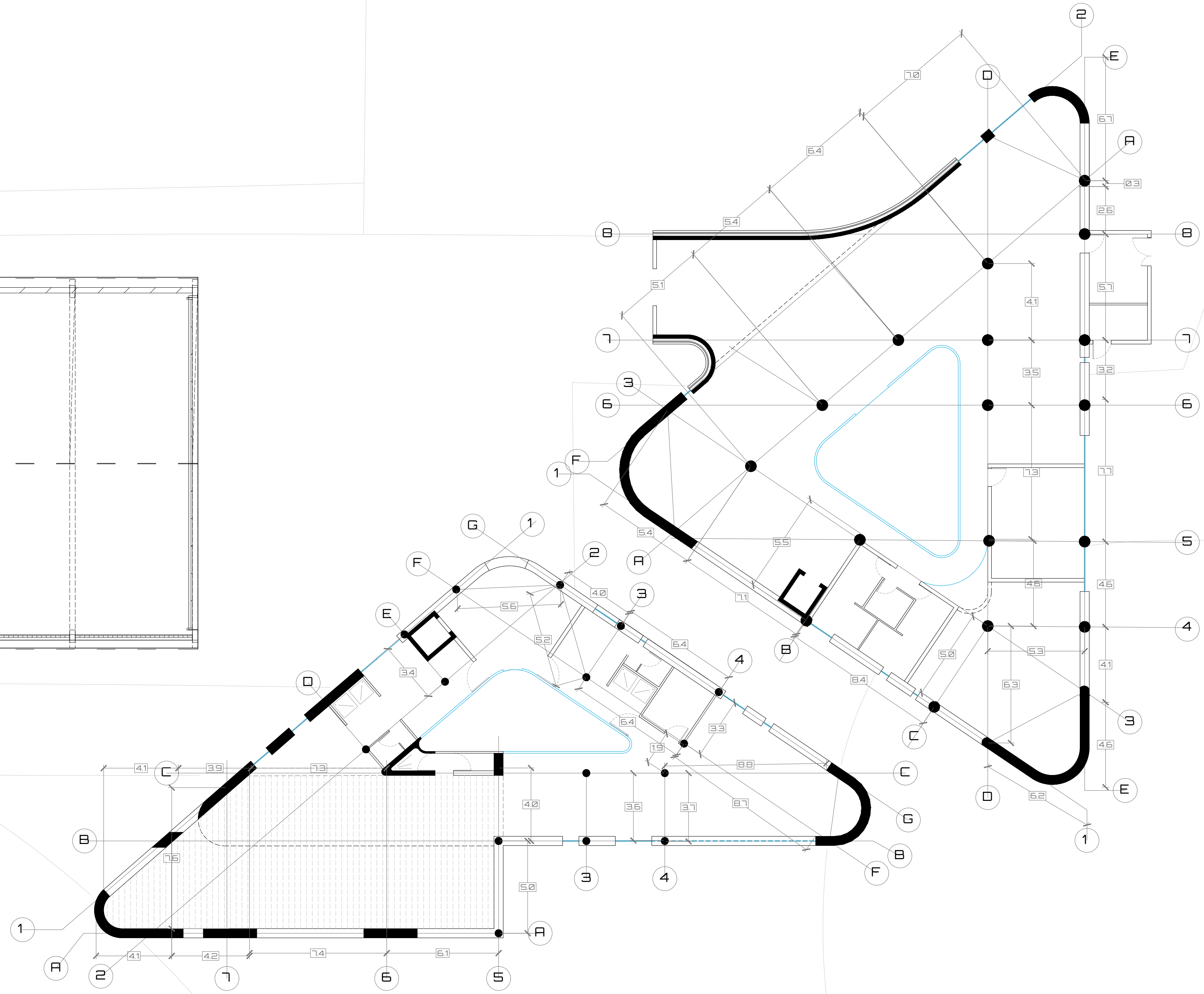
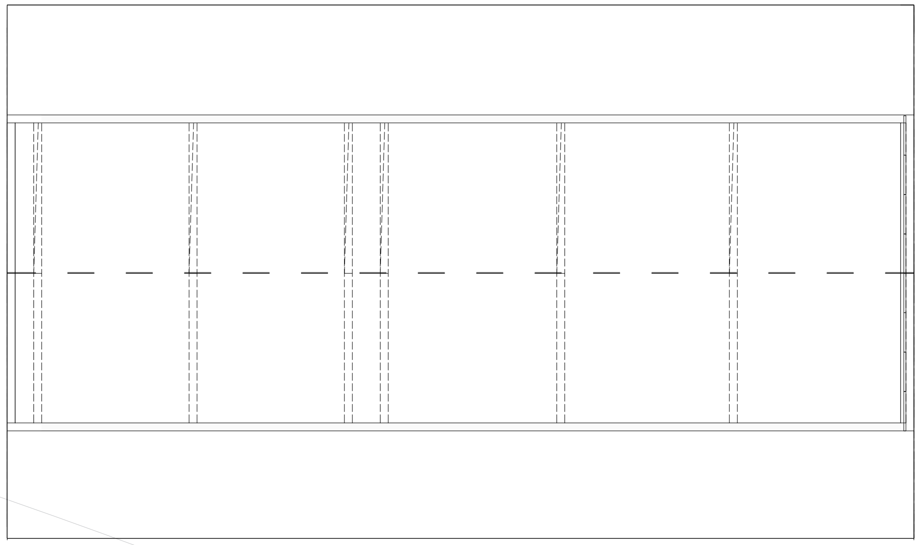
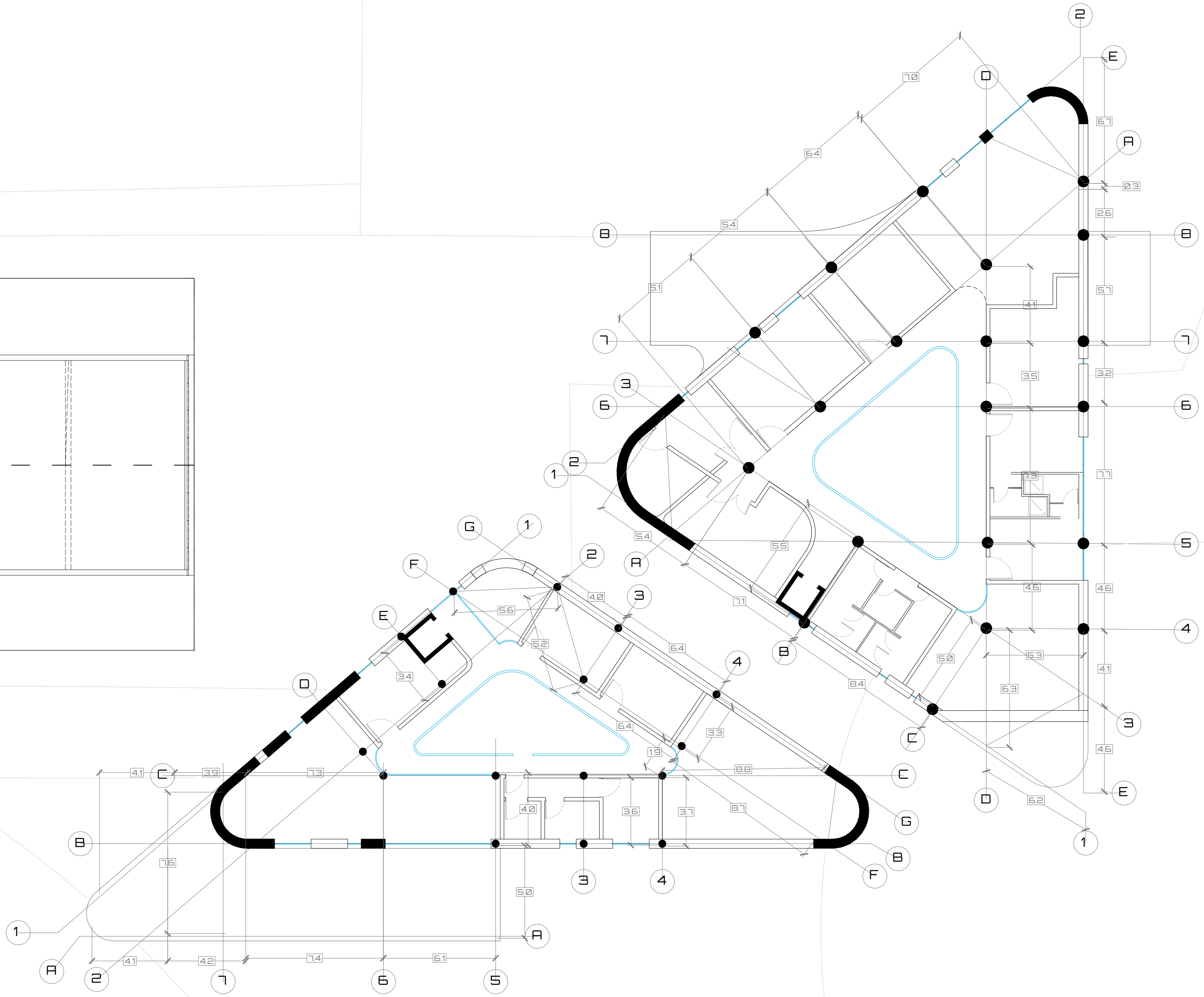
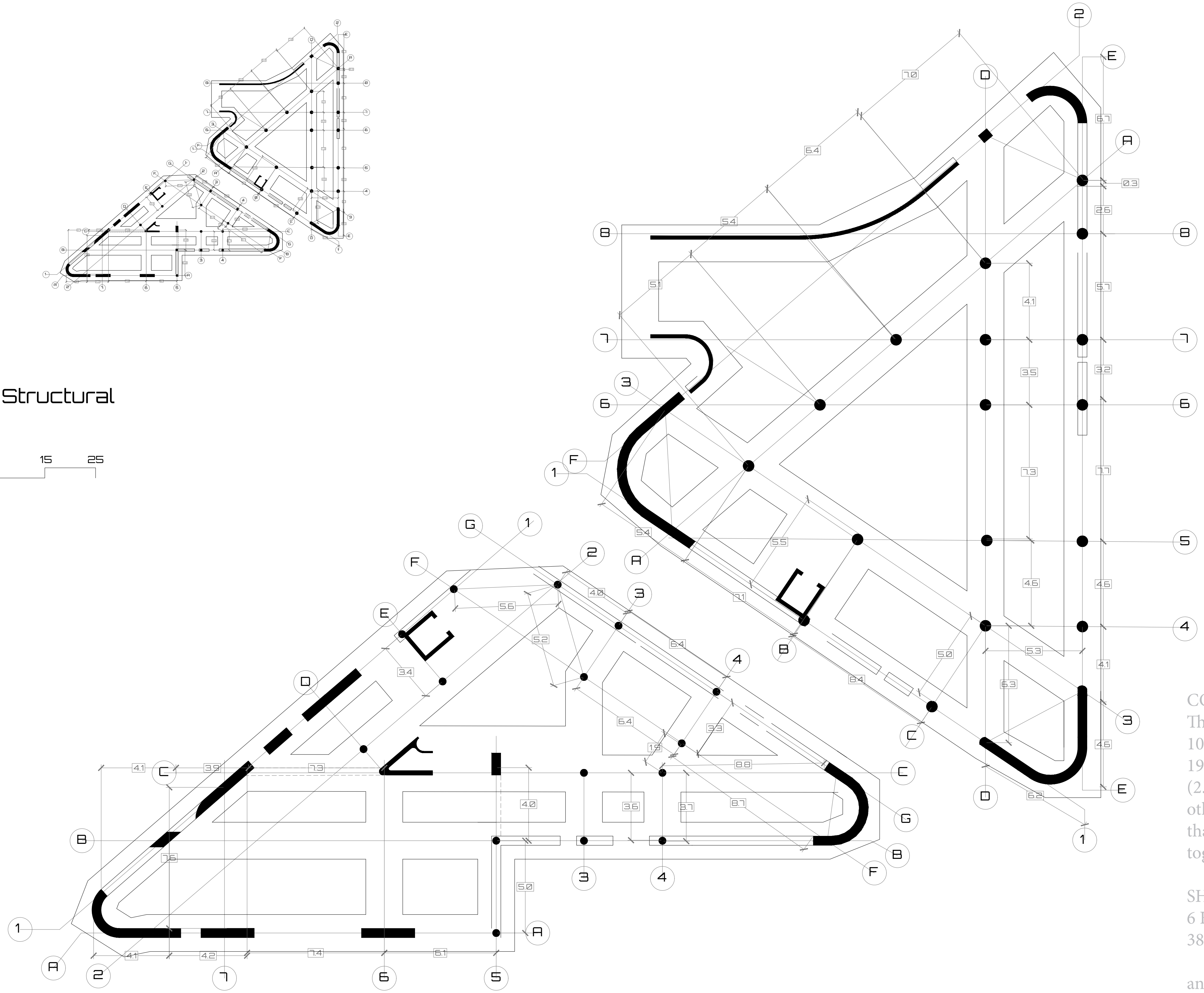


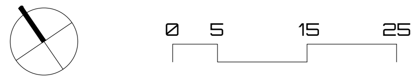








Foundation Structural Layout

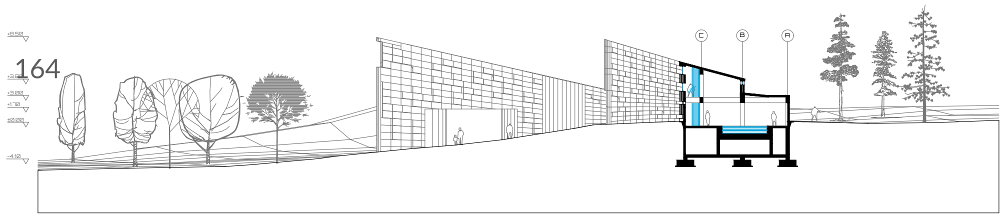


COLUMN FOUNDATION CALCULATIONS
Those that carry 3 floors:
10 KN/SQM X 64 SQM X 3 = 1920 KN
1920 KN/SQM / 250 KN/SQM = 7.68 SQM
(2.8 M X 2.8 M) as they would be too close to each other it was decided to have a strip of 2 m x 21.3 m that would be composed of the area of the columns together

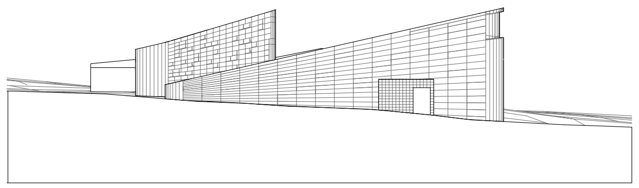
SHEAR WALLS OF BASEMENT:
6 KN/SQM X 64 SQM X 1 = 384 KN
384 KN / 250 KN/SQM = 2 SQM

and for the shear walls of the ground floor:

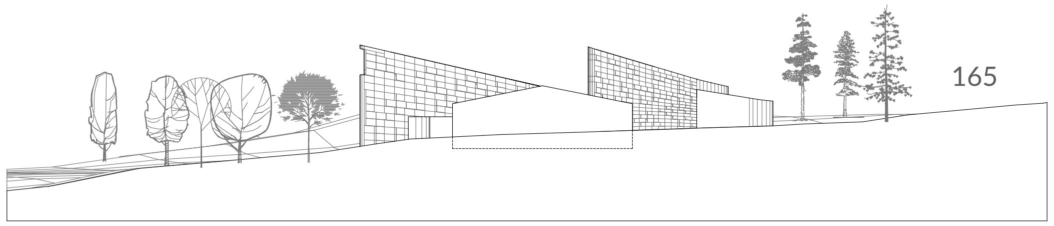
10 KN/SQM X 64 SQM X 2 = 1280 KN
1280 KN/SQM / 250 KN/SQM = 5 SQM
(2.3 M X 2.3 M) same methodology as above, combined two foundations of two columns to give the same area.



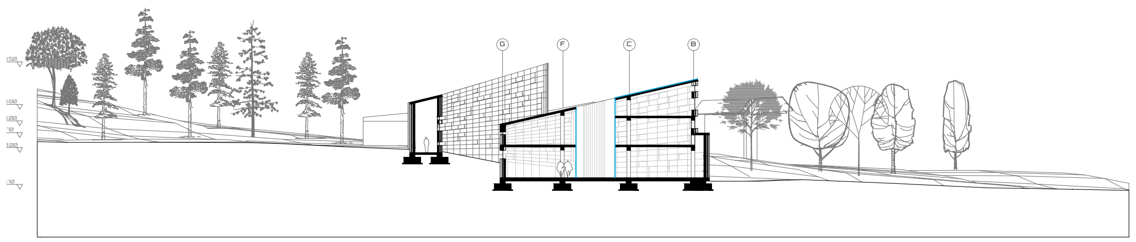
Section C-C



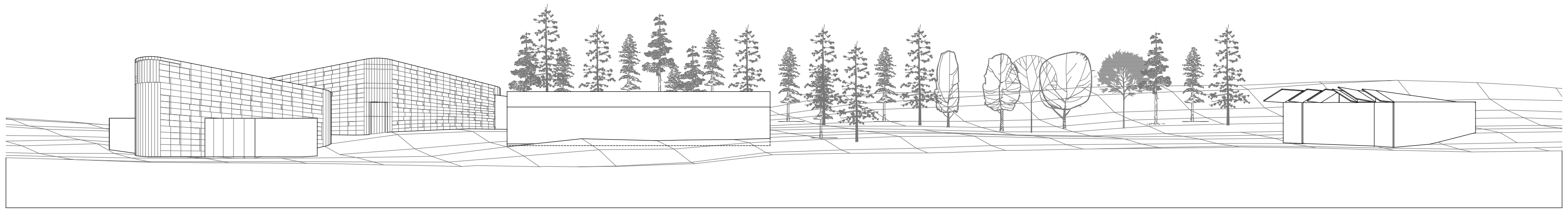
South-Eastern Facade



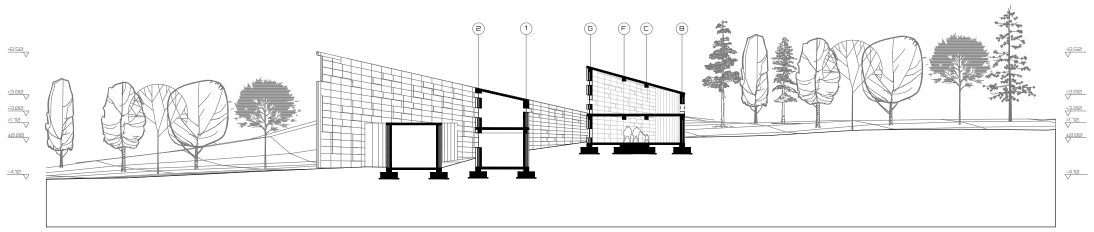
North-Western Facade



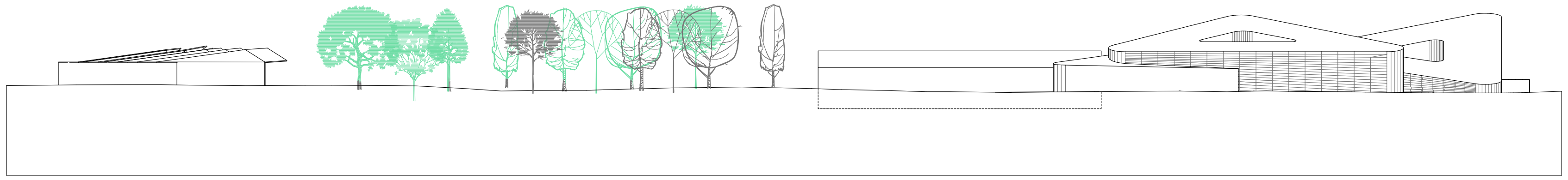
Section B-B



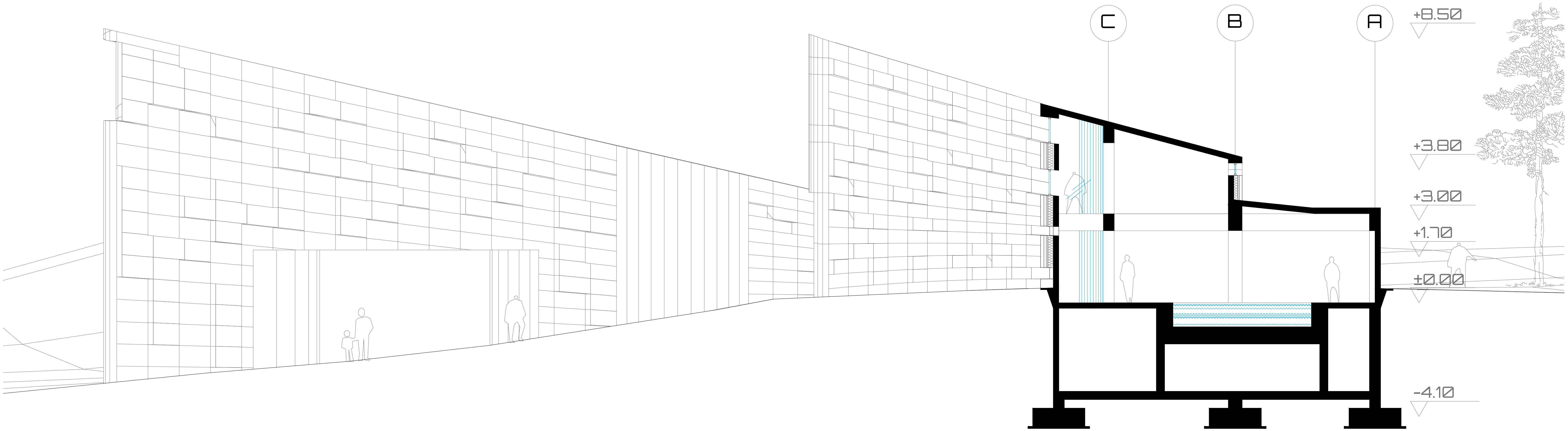
North-Eastern Facade

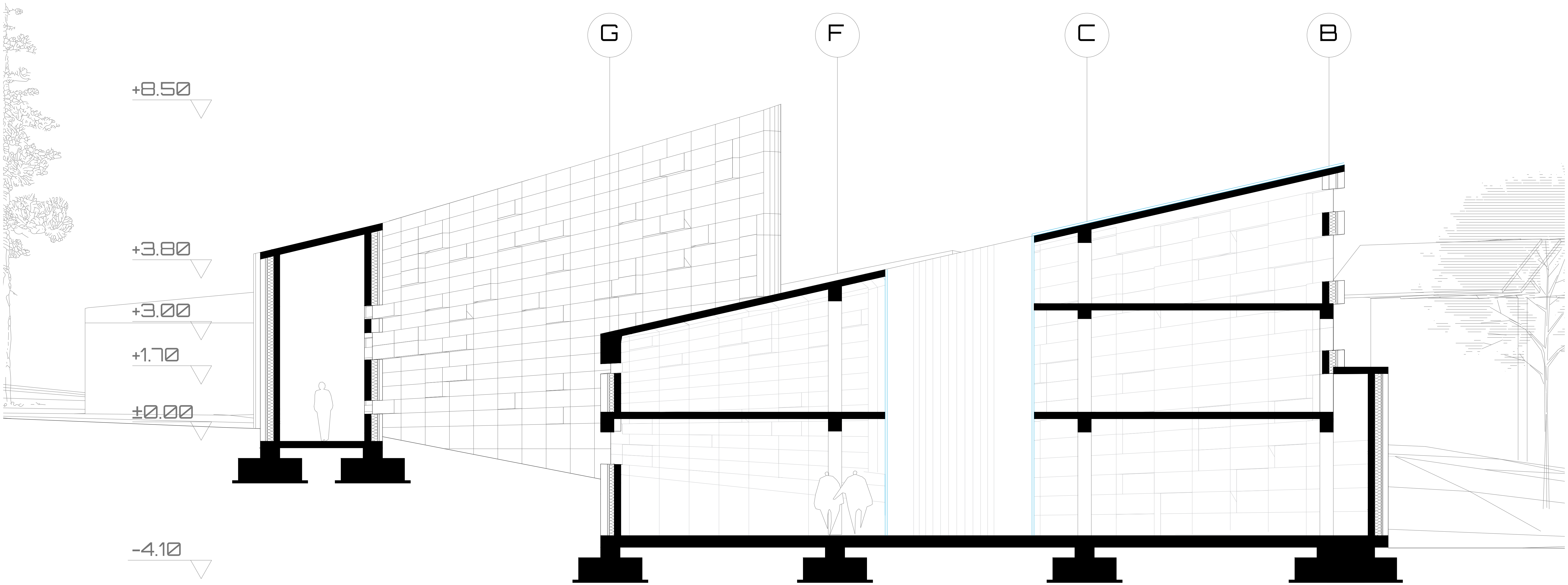


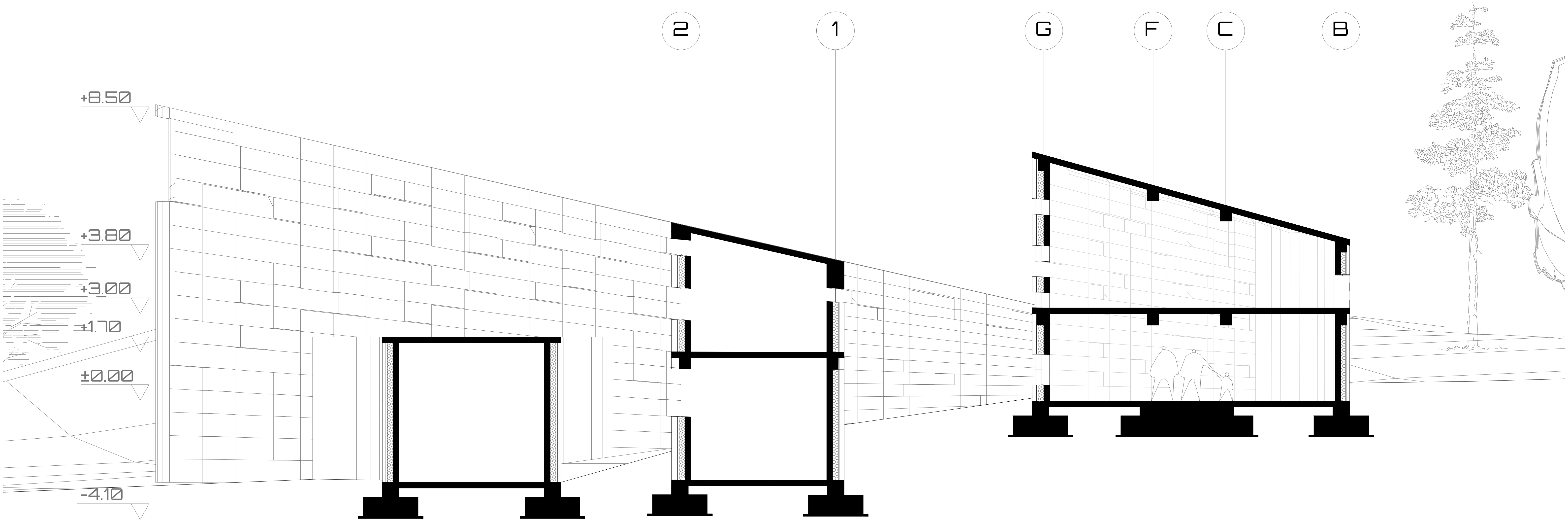
Section A-A



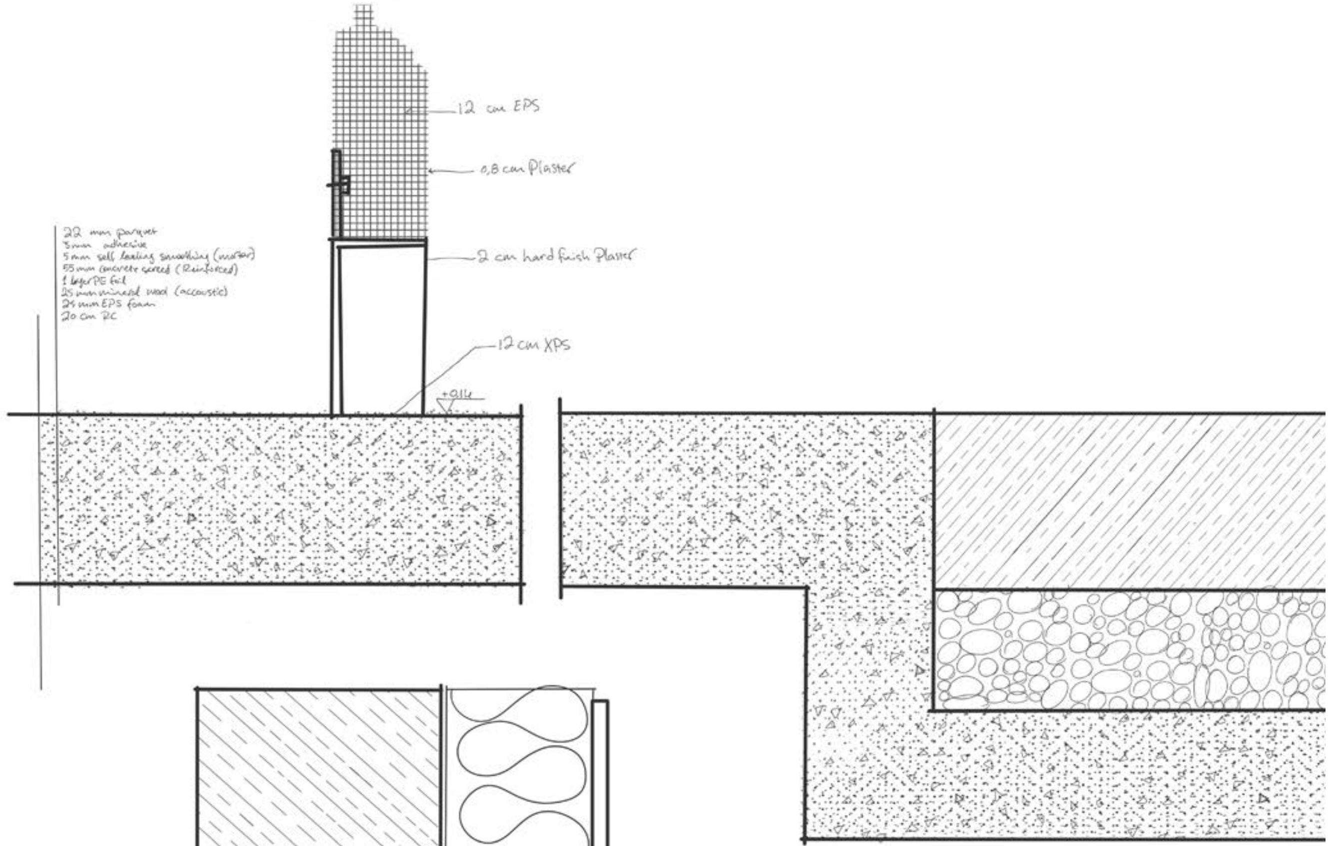
South-Western Facade

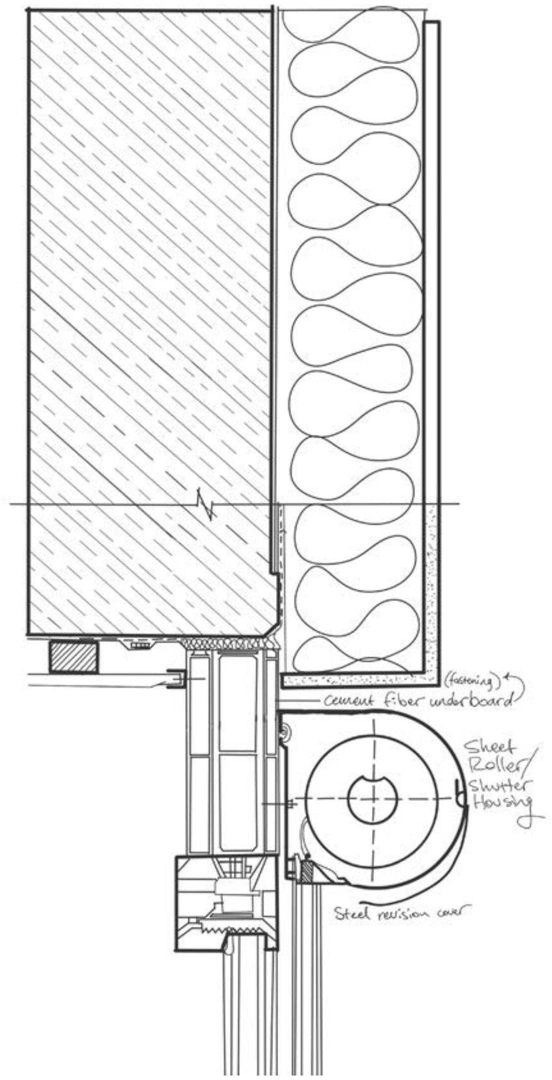


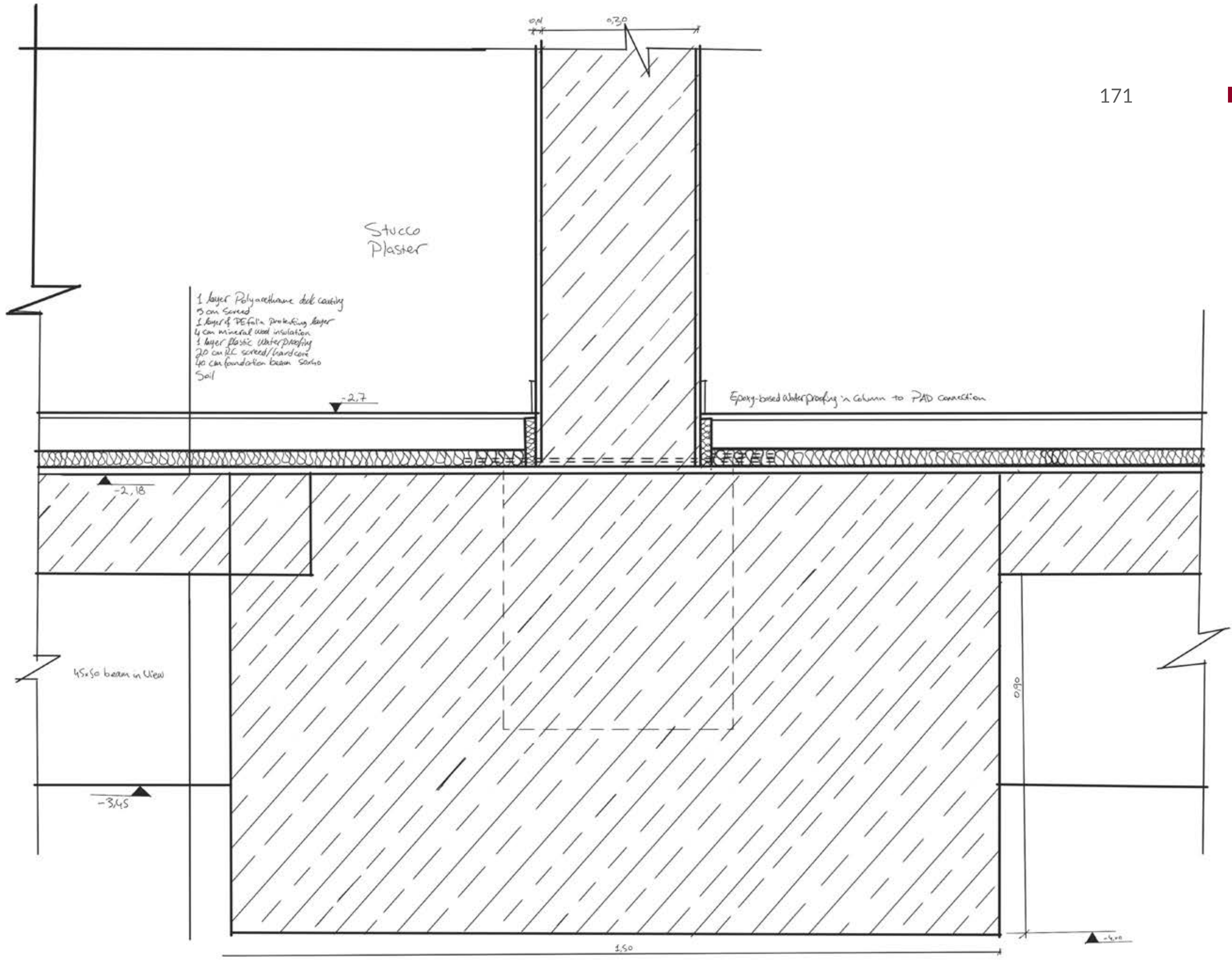

G
F
C
B
+8.50
+3.80
+3.00
+1.70
±0.00
-4.10

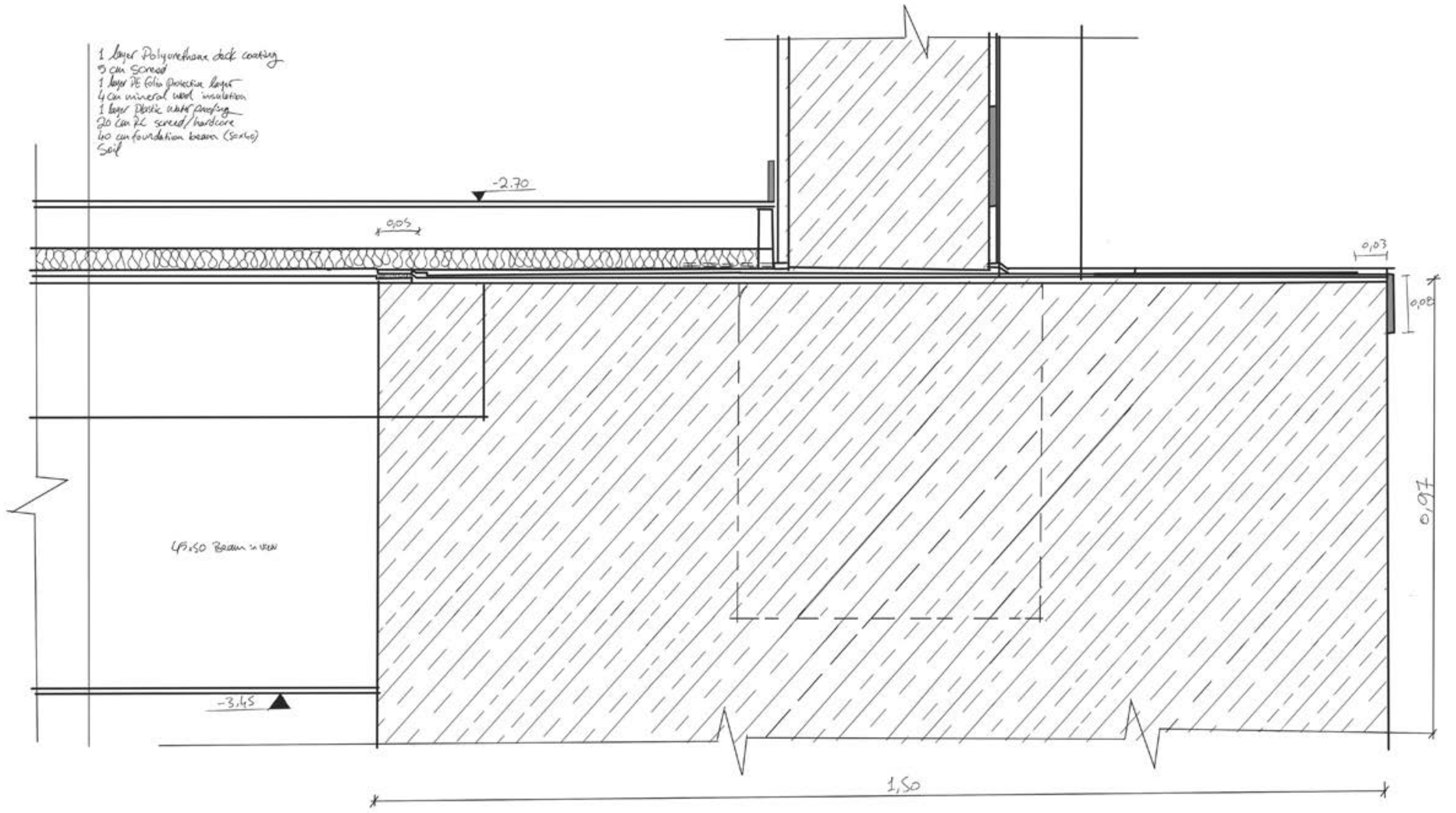


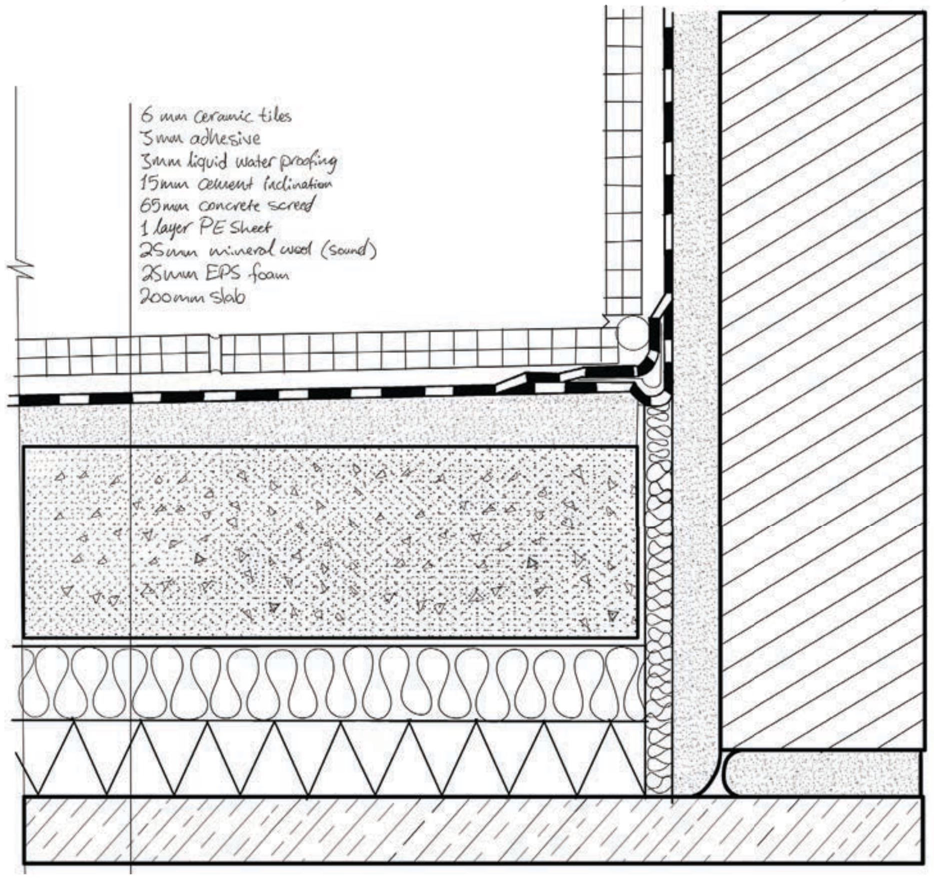
+8.50
+3.80
+3.00
+1.70
±0.00
-4.10
2
1
G
F
C
B

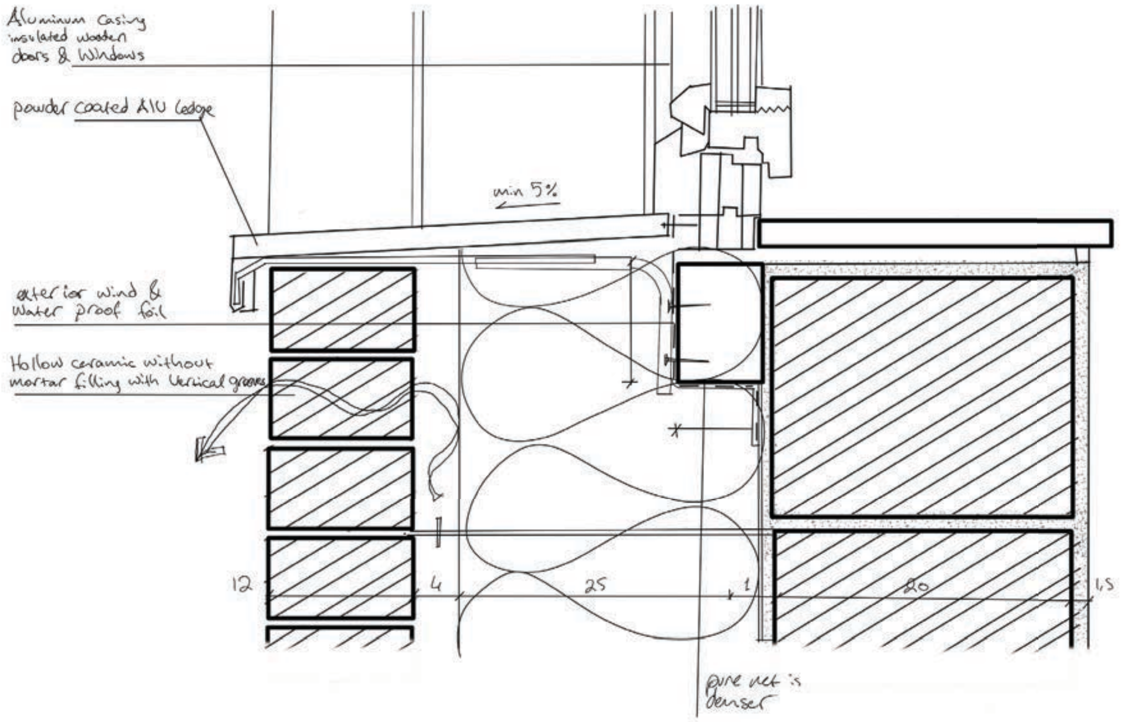

12 cm EPS
0,8 cm Plaster
2 cm hard finish Plaster
12 cm XPS
+0,14
22 mm parquet
5mm adhesive
5mm self leveling smoothing (mortar)
55mm concrete screed (Reinforced)
1 layer PE foil
25 mm mineral wool (accoustic)
24 mm EPS foam
20 cm RC

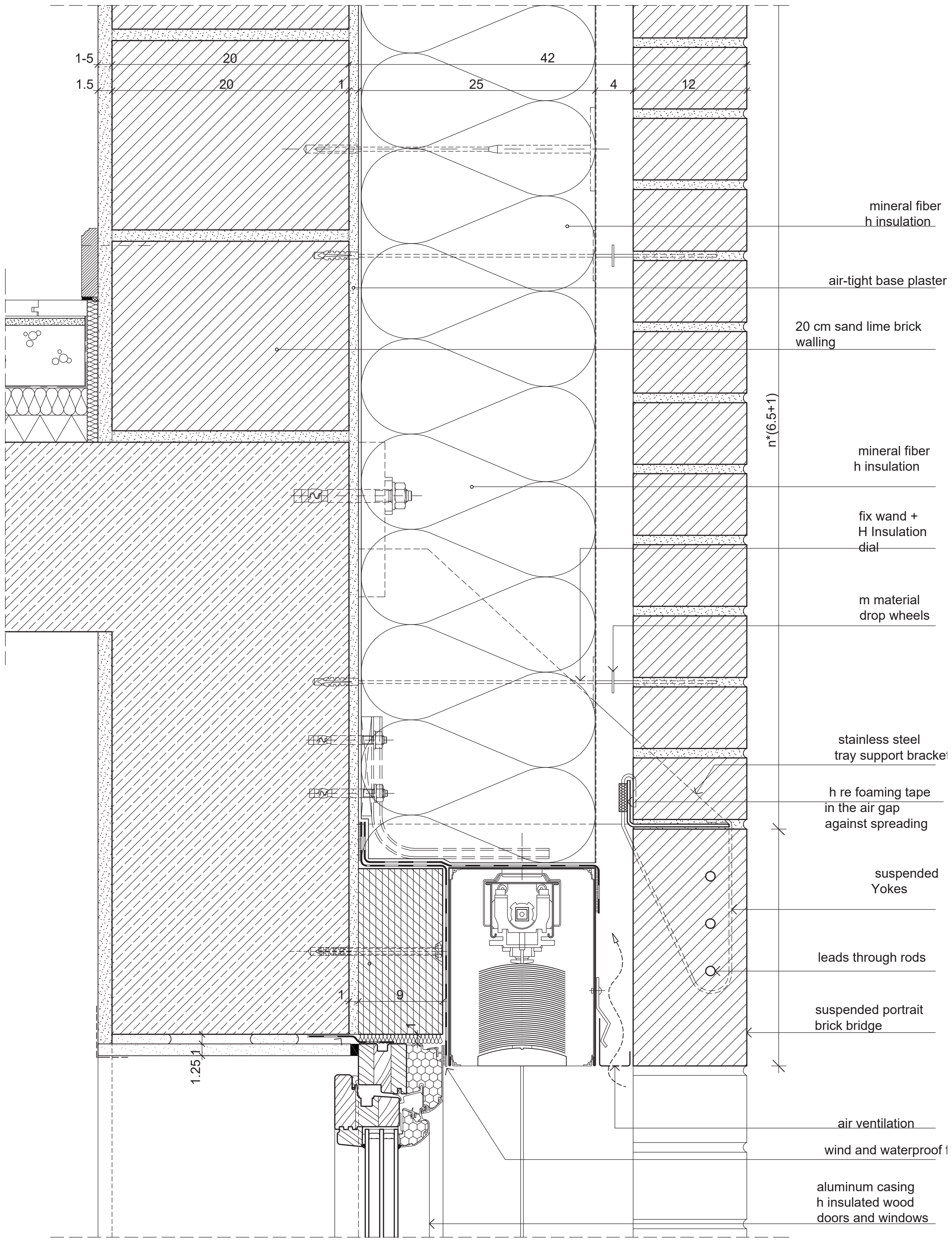

(fastening)
cement fiber underboard
Sheet Roller/ Shutter Housing
Steel revision cover


Stucco Plaster
1 layer Polyurethane deck coating
5 cm Screed
1 layer of PE foil in protecting layer
4 cm mineral wool insulation
1 layer plastic waterproofing
20 cm RC screed/hardcore
40 cm foundation beam sarko
Soil
-2,7
Epoxy-based waterproofing in column to PAD connection
-2,18
45x50 beam in view
-3,45
0,90
1,50


1 layer Polyurethane deck coating
5 cm Screed
1 layer PE folia protection layer
4 cm mineral wool insulation
1 layer plastic waterproofing
20 cm RC screed/hardcore
40 cm foundation beam (50x60)
Soil
-2.70
0,05
0,03
45x50 Beam in view
-3,45
0,97
1,50


6 mm ceramic tiles
5mm adhesive
5mm liquid water proofing
15mm cement inclination
65mm concrete screed
1 layer PE Sheet
25mm mineral wool (sound)
25mm EPS foam
200mm slab

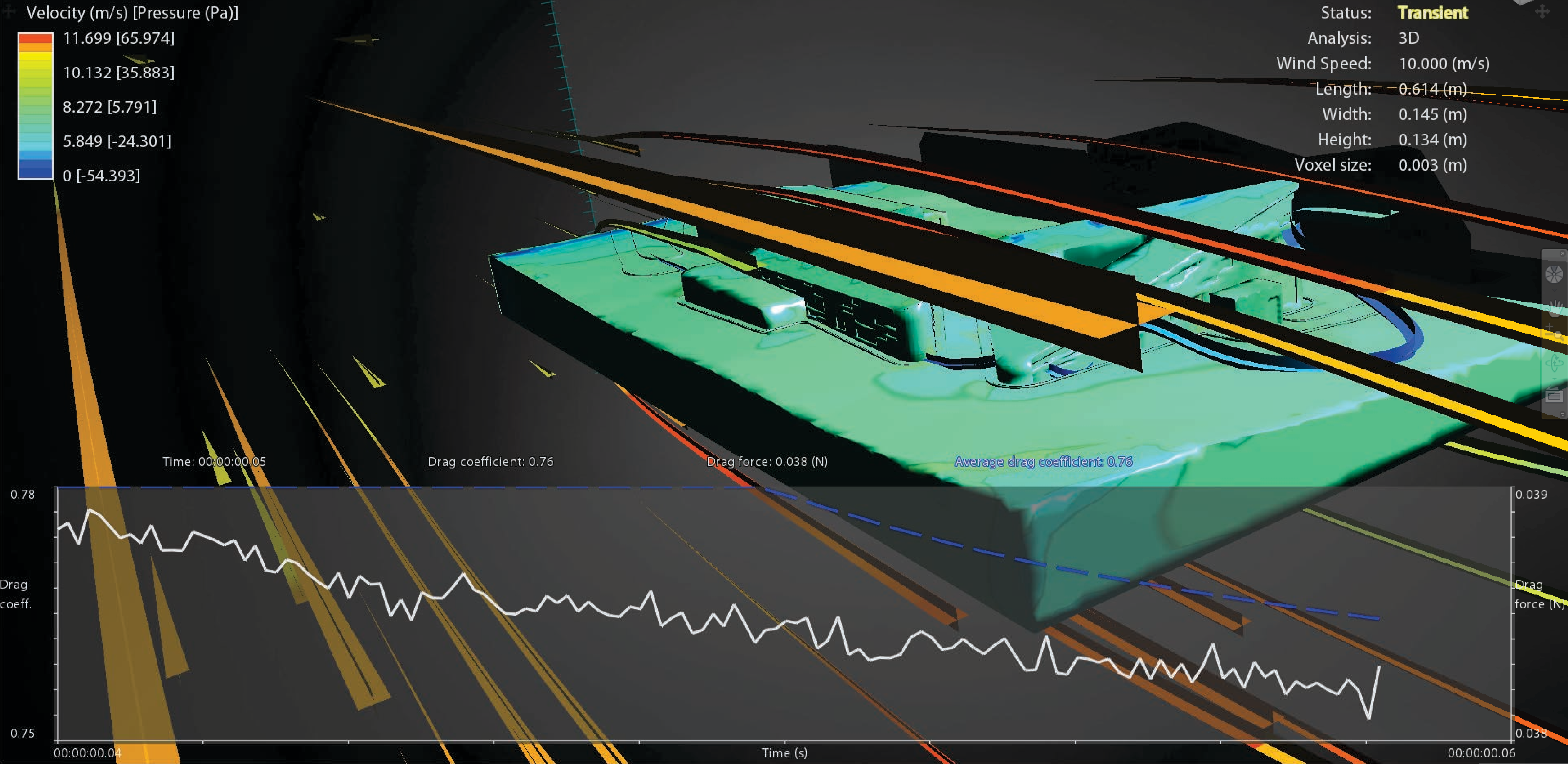

Aluminum casing insulated wooden doors & Windows
powder coated ALU ledge
min 5%
exterior wind & water proof foil
Hollow ceramic without mortar filling with vertical grooves
12
4
25
1
20
1.5
pure net is denser


1-5
1.5
20
20
42
1
25
4
12
n*(6.5+1)
mineral fiber
h insulation
air-tight base plaster
20 cm sand lime brick
walling
mineral fiber
h insulation
fix wand +
H Insulation
dial
m material
drop wheels
stainless steel
tray support bracket
h re foaming tape
in the air gap
against spreading
suspended
Yokes
leads through rods
suspended portrait
brick bridge
1
9
1.25
air ventilation
wind and waterproof f
aluminum casing
h insulated wood
doors and windows

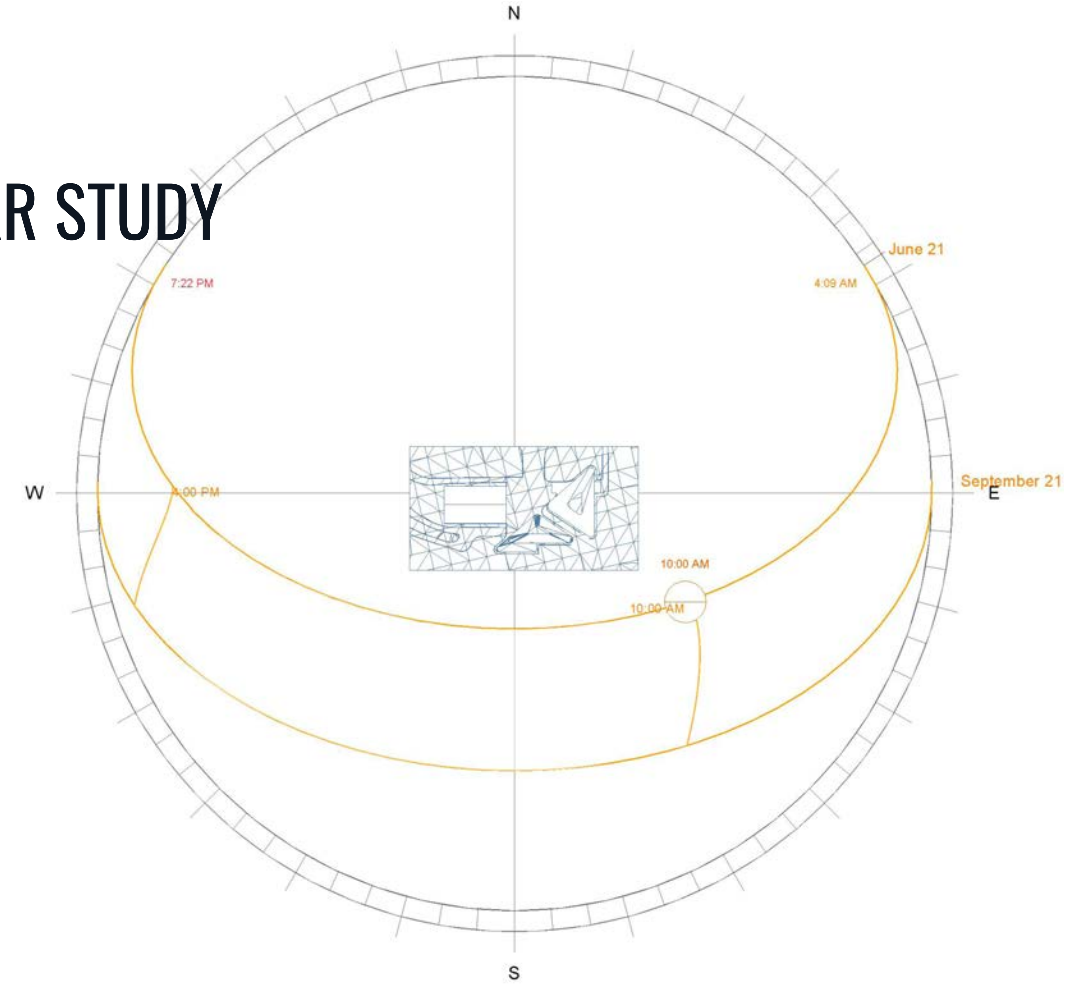
ANNEX A ENERGETICS STUDY BREIF

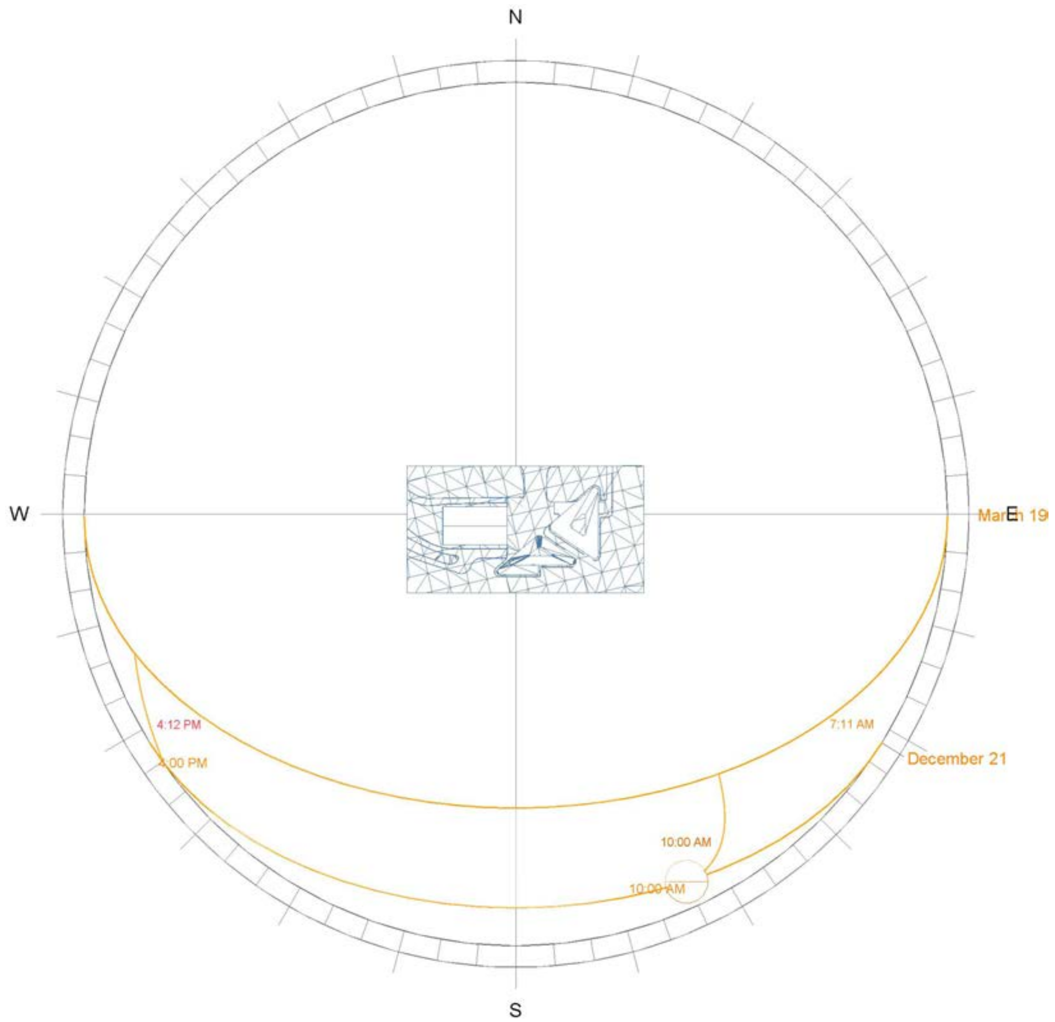
AIR FLOW STUDY

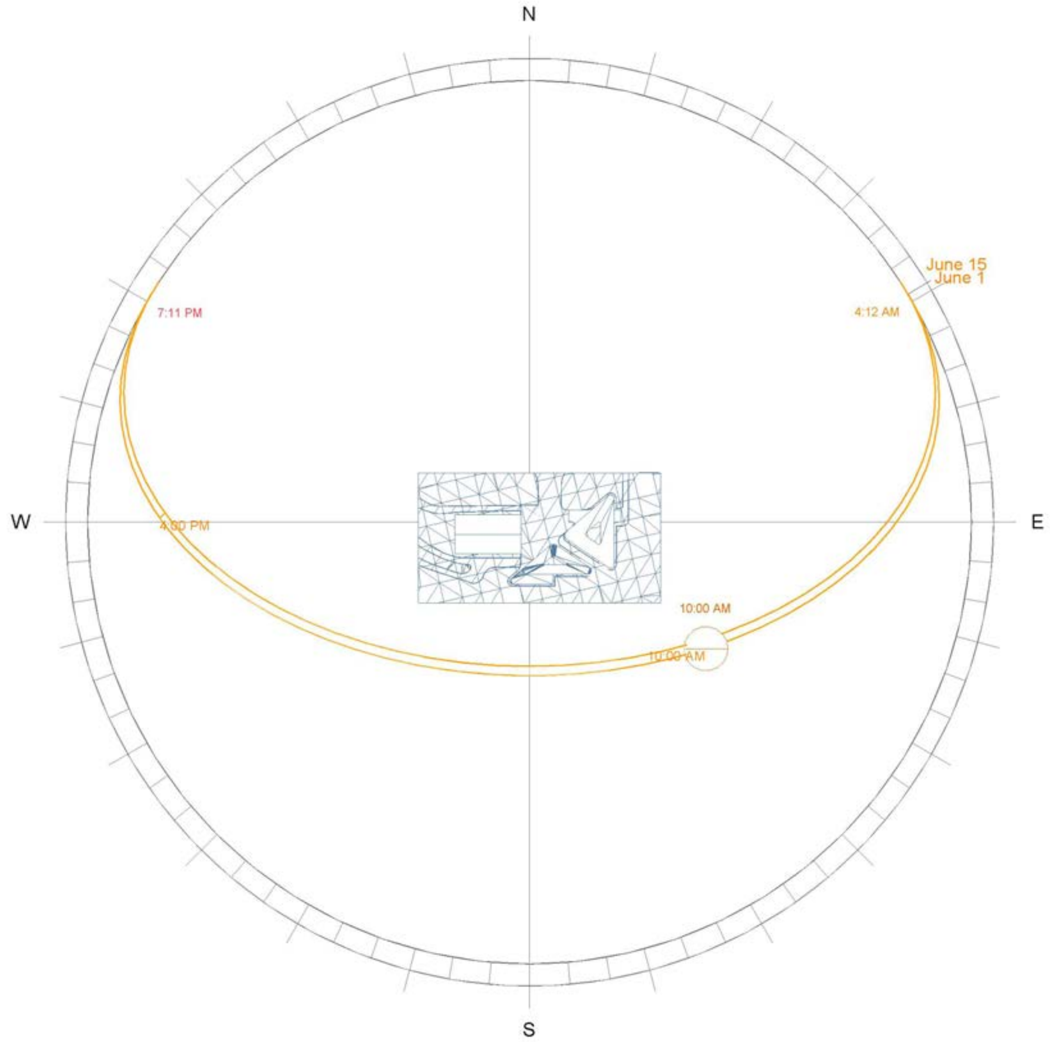
The HAR complex is highly responsive to the air flow at Harmashatar Hegy, to maximize the cross ventilation and natural flow within the building through the considered punctured courtyards that face the forest behind the project that acts as a wind barrier and reflect the cold breezes back into the project, and the tilted roof as well maximizes a 100% rain water harvestment.

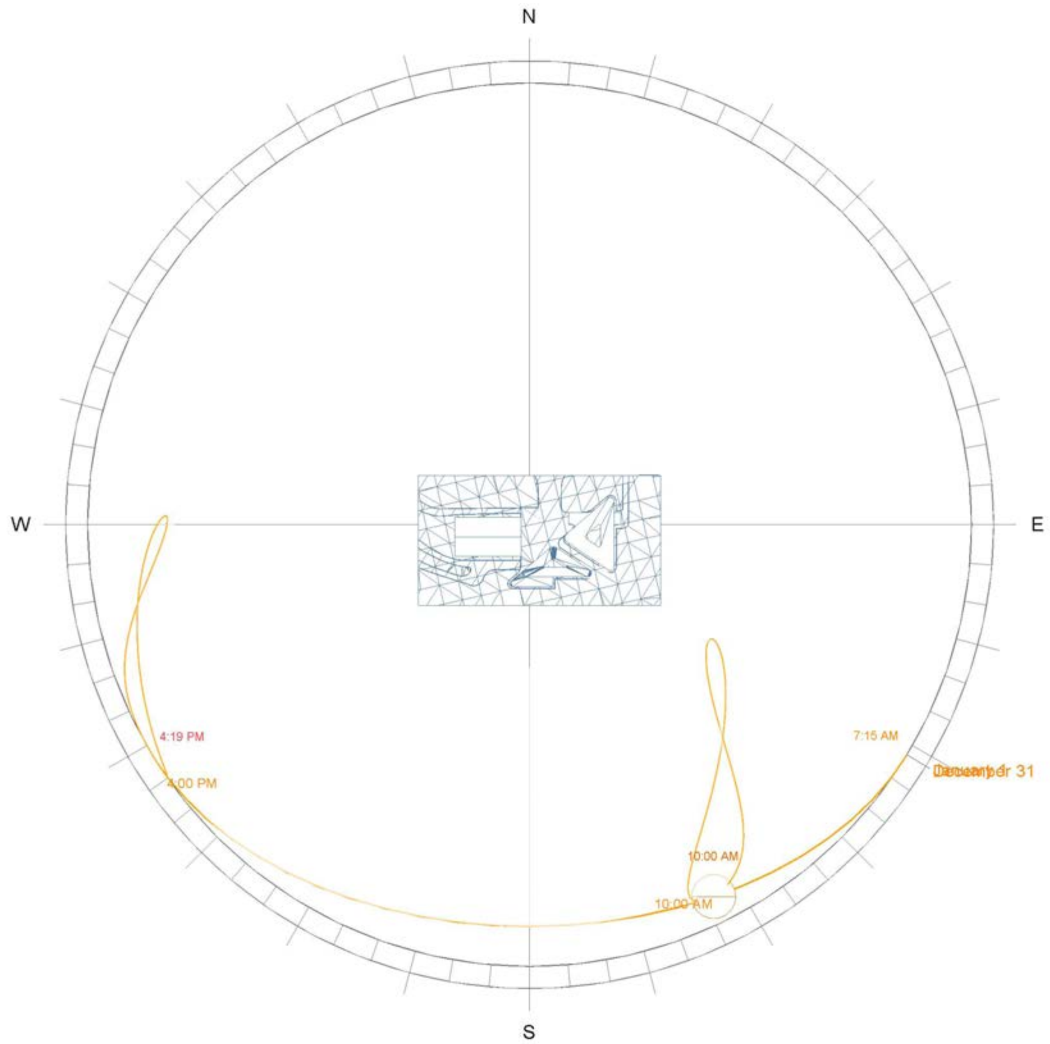


SOLAR STUDY


N
June 21
7:22 PM
4:09 AM
W
4:00 PM
September 21
E
10:00 AM
10:00 AM
S


N
W
E
4:12 PM
4:00 PM
7:11 AM
December 21
10:00 AM
10:00 AM
S


N
June 15
June 1
7:11 PM
4:12 AM
W
4:00 PM
E
10:00 AM
10:00 AM
S


N
W
E
4:19 PM
4:00 PM
7:15 AM
10:00 AM
10:00 AM
S

The HAR complex is responsibally responsive to solar energy, not only through active systems, but also through the passive design of the roof, mass orientation, and fenestration. HAR's roof is designed to be tilted at a certain angle and the masses are oriented in throughly to maximize the amount of captured sun light and turning it into power through the roof installations of the PVC all over the roof top. HAR's solar harvesting doesnt stop there, the Facades are designed to eliminate the direct solar gain, instead every place is lit through north light. The northern facade has above 60% of glazing, whereas the southern/eastern and western overlooking facades have these small narrow slits of triple glazed glass that forms nothing more than 25 percent of that certain facade. Not to mention the Cavity External Insulated walls, this way, the inner spaces of HAR are far from heat loss and heat gain problems in an optimum way.

HEATING

BUILDING TYPE	HEATED FLOOR AREA, A [M²]	HEATING,Q [KW]
RESIDENTIAL	<500	30 Kw
	500...1000	60 Kw
	>1000	V m^3 . 20 W/ m^3
OFFICE	<1000	80 Kw
	1000 ... 2000	150 Kw
	> 2000	V m^3 . 15 w/ m^3
EDUCTIONAL	< 1000	80 Kw
	1000 ... 2000	150 Kw
	> 2000	V m^3 . 20 w/ m^3
HEALTH CARE	<1000	80 Kw
	1000 ... 2000	150 Kw
	> 2000	v m3 . 25 w/ m^3

HEATING SYSTEM	ROOM AREA , A [M²]
WALL - MOUNTED BOILER	2-15 M²
HEAT PUMP	5-20 M²
SOLID FUEL BOILER	15-30 M²

HEATING DEMAND Q [KW]	PLANT AREA , A [M²]
Q < 450 KW	17 M²
450 KW < Q < 800 KW	17-22 M²
800 KW < Q < 1.630 KW	22-35 M²

Building C

Heating Demand = V * 15 W/m³
HD = 22050 * 15
HD = 330750 W/m³
HD = 330.75 KW

Building D

Heating Demand = V * 15 W/m³
HD = 7000 * 15
HD = 105000 W/m³
HD = 105 KW

POWER (RENEWABLE)

Building type	Total floor area, A [m²]	Power Demand, P [kW]
Residential	A < **500** m²	**50** kW
	500 m² < A < **1000** m²	**75** kW
	> **1000** m²	**A** m² · **60** W/m²
Office	A < **1000** m²	**150** kW
	1000 m² < A < **2000** m²	**200** kW
	A > **2000** m²	**A** m² · **175** W/m²
Educational	A < **1000** m²	**100** kW
	1000 m²< A < **2000** m²	**150** kW
	A > **2000** m²	**A** m² · **125** W/m²
Health care	A < **1000** m²	**200** kW
	1000 m² < A < **2000** m²	**400** kW
	A > **2000** m²	**A** m² · **300** W/m²

Building C

Electricity Demand = A * 60 W/m²
ED = 2100 * 175 W/m²
ED = 367500 W/m²
ED = 367.5 KW

Building D

Electricity Demand = A * 60 W/m²
ED = 1000 * 175 W/m²
ED = 175000 W/m²
ED = 175 KW

URBAN Downtown	0.4 KV - 10 KV	200 KW
Rural areas	0.4 KV - 20 KV	100 KW

ELECTRIC POWER DEMAND, P (KW)	ELECTRIC ROOM , CABINET DIMENSIONS
P < 50 KW	wall mounted cabinet : width :1.20 m , depth: 0.30 m , heigh :2.0 m
50 KW < P < 100 KW	wall mounted cabinet : width :2.50 m , depth: 0.30 m , heigh :2.0 m
100 KW < P < 200 KW	electric switch room : A= 4 m²
P > 200 KW	electric switch room : A= 12 m²

WATER

water demand V [m³/day]	water pressure booster plant dimmenssion
V < 41 M³/day	floor area : 5 m² ,headroom 3,00 m
41M³ <V < 153 M³/day	floor area : 5-13.5 m² ,headroom 3,00 m
V > 153 M³/day	floor area : 13.5 m² ,headroom 3,00 m

VENTILATION AND AIR QUALITY

BUILDING TYPE	ventilated space	ventilation demand
residential buildings and units	WC exhaust	50 m³ / h
	Shower exhaust	70 m³ / h
	bathroom exhaust	30 m³ / h
	living spaces with heat ,exchanger units	2 m³ / h
offices	office spaces	3.6-6 m³ / h . A m²
	meeting rooms	10 m³ / h . A m²
	car parking	200-300 m³ / h per car
educational	ventilation with heat	36 m³ / h per person

ventilation demand Vair [m³/h]	ventilation plant dimenssion
V air <20000 m³/h	floor area : 30 - 50 m²,headroom 2.65m
20000 m³/h < V air <30000 m³/h	floor area : 50 - 60 m²,headroom 3.00 m
30000 m³/h < V air <40000 m³/h	floor area : 30 - 50 m²,headroom3.50 m
V air > 40000 m³/h	floor area : > 80 m²,headroom 4.00 m

Ventilation Demand = V * 0.8
VD = 280 * 0.8
VD = 224 m³/h

VD = 224 m³/h + 30 m³/h
VD = 254 m³/h

ELEVATOR KONE A MONOSPACE®

Description: Machine-room-less elevators for low-rise residential buildings
Speed: 0.63 m/s
Max. Travel: 20 m
Max no. of stops: 8
Max Load: 544 kgs.
Max Persons: 8
Max Group Size: 2
Control System: Down collective (standard)

GO GEARLESS
Machine-room-less

Features

EBD A	Emergency Battery Drive Automatic (ARD)	O
CEL	Car Emergency Lighting	S
FRD	Fireman's Drive	S
COD	Correction drive to next level	S
ABE M	Alarm Bell	S
ISE C	Emergency Intercom car-Machine room-control	O
DCB	Door close button	S
DOB	Door open button	S
NUD NB	Nudging	O
SRC	Curtain of light in car	S

ACL C	Accurate releveling, automatic, closed door	S
CCB	Car call backwards	S
OCL	Operation of car light - automatic	S
OCV	Operation of car ventilation - impulse and automatic	S
ATS IN	Attendant service, India	O
PAD C	Parking at pre-defined floor, door closed	O
BLF	Bypass load function	S
OLF C	Overload function, constant indication/buzzer	S
ACU	Lift Announcer (LAS)	O

S Standard O Optional Energy saving feature

KONE A MonoSpace®	
Application	Machine-room-less
Speed	0.63 m/s
Max Travel	20 m
Max no. of stops	8
Max Load	544 kgs
Persons	5, 6 & 8 Passengers
Max Group Size	2
Control System	Down Collective (standard)

The machine-room-less technology that benefits all


KONE EcoDisc®
the pioneer in gearless
Machine-room-less technology

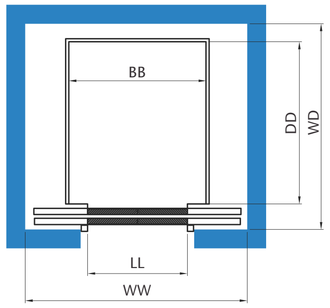
KONE A MonoSpace is powered by KONE EcoDisc, a proprietary machine-room-less, gearless technology that revolutionised the elevator industry. This gearless solution consumes less power which means smaller back-up generators for residential projects. It also results in no losses due to inefficient gears, resulting in savings in running energy costs while ensuring smooth, safe and comfortable rides every time.

Advantages of Gearless Elevator over Geared Elevator

KONE EcoDisc Gearless Elevator	Traditional geared Elevator
Consumes less start-up-power. Small back-up generator sufficient.	Consumes more start-up-power. Large back-up generator needed.
Oil not required.	Needs oil.
No gears, energy saved.	Gears consume more running energy.
Comfortable ride experience due to minimal vibration.	Uncomfortable ride experience due to more vibrations produced by gears.
Automatically checks brake condition everyday. Improved safety & reliability.	Manual checking of brakes, every day checking not feasible.
No machine room required. Saves building space, construction cost & time.	Machine room required. Consumes extra space, construction cost & time.
Highly accurate car levelling.	Car levelling may not be precise.

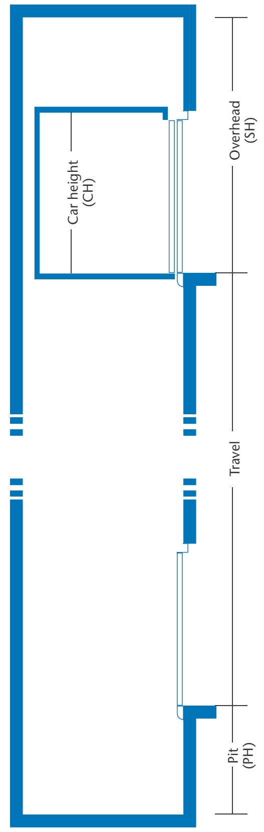
Layout and Dimensions

Single entrance car
Center opening



KONE A MonoSpace®	
Speed	0.63m/s
Standard Inside Car Height (CH) mm	2200
Standard Door Height (H) mm	2000
Maximum Travel (m)	20
Standard Pit Height (mm)	1300
Standard Headroom Height (mm)	3600

Elevation layout



WW - Well Width **WD** - Depth **BB** - Car Width **DD** - Car Depth **LL** - Door Opening

Shaft Information

SL. No.	No. of Persons	Load [kgs]	Car Width BB [mm]	Car Depth DD [mm]	Door Opening LL [mm]	Shaft Width WW [mm]	Shaft Depth WD [mm]
1	5	340	950	1000	700	1550	1475
2	6	408	950	1150	700	1550	1525
3	6	408	1100	1000	700	1650	1475
4	6	408	950	1150	800	1750	1525
5	6	408	1100	1000	800	1750	1475
6	8	544	1100	1300	700	1675	1600
7	8	544	1100	1300	800	1775	1600
8	8	544	950	1400	700	1575	1700
9	8	544	1300	1100	800	1875	1500

Note
• All shaft measurements specified are taken over plaster • Shaft dimensions are to be maintained to a tolerance of 0, +25mm
• For more details on minimum shaft sizes contact our sales team

PHOTOVOLTAIC SOLAR PANELS

Invisible Solar Cells

Customize the amount of electricity your Solar Roof produces to fit your energy needs. This feature is made possible by using two types of glass tile, solar tile and non-solar tile. Both appear the same from street level.

Infinite Tile Warranty

Made with tempered glass, Solar Roof tiles are more than three times stronger than standard roofing tiles. That's why we offer the best warranty in the industry - the lifetime of your house, or infinity, whichever comes first. Watch our hail test video to see how we take durability to a whole new level.

TESLA POWER CELLS

Tile warranty: Infinity, or the lifetime of your house, whichever comes first
Power and Weatherization warranty: 30 years
Roof Pitch: 3:12 to vertical
Hail rating: Class 4 ANSI FM 4473 (best hail rating)
Wind rating: Class F ASTM D3161 (best wind rating)
Fire rating: Class A UL 790 (best fire rating)

BUILDING ENERGY PERFORMANCE

Energy Sources	e_{primal} value
Electric energy (peak)	2,50
Electric energy (off peak)	1,80
Natural gas	1,00
Fuel oil	1,00
Coal	0,95
District heating	1,20
District heating with co-generator	1,12
Wood, biomass	0,60
Renewable energy	0,00

Building type	Heating [Wh/m2a]		Ventilation [Wh/m2a]	Cooling [Wh/m2a]	Hot water [Wh/m2a]	Lighting [Wh/m2a]
	q_{heat}	p_{heat}	$p_{ventilation}$	$p_{cooling}$	$p_{hot\ water}$	$p_{lighting}$
Residential	40	3	30	25	40	8
Offices	30	2	45	45	15	22
Educational	55	4	45	10	20	12
Industrial	30	2	35	15	20	10

$E_{heating} = A\ (q_{heating} \cdot e_{heating\ primal} + p_{heating} \cdot e_{electric\ primal})$ [Wh/m²a]

$E_{ventilation} = A \cdot p_{ventilation} \cdot e_{electric\ primal}$ [Wh/m²a]

$E_{hot\ water} = A \cdot p_{hot\ water} \cdot e_{hot\ water\ primal}$ [Wh/m²a]

$E_{lighting} = A \cdot p_{lighting} \cdot e_{electric\ primal}$ [Wh/m²a]

$E_{renewable}$: should be estimated based on the **area of the renewable systems**:

- **PV panels** may produce about **360.000 Wh/m²a** electric energy in a year,
- **Solar collectors** may produce **590.000 Wh/m²a** energy in a year in Hungary.

E heating = 2100(30*2.5+2*2.5) = **168000 Wh/m²a**

E ventilation = 2100*45*2.5 = **236250 Wh/m²a**

E hot water = 2100*15*2.5 = **78750 Wh/m²a**

E lighting = 2100*22*2.5 = **115500 Wh/m²a**

E renewable = **590.000 Wh/m²a**

$$E_p = (E_{heating} + E_{ventilation} + E_{hot\ water} + E_{lighting} - E_{renewable}) / 1000\ [kWh/m^2a]$$

Ep = 168000 + 236250 + 78750 + 115500 - 590000 / 1000 =
8.5kWh/m²a

A/V ratio	E_p Residential [kWh/m²a]	E_p Office [kWh/m²a]	E_p Educational [kWh/m²a]
A/V ≤ 0,3	110	132	90
0,3 ≤ A/V ≤ 1,3	74 + 120 · (A/V)	94 + 128 · (A/V)	40,8 + 164 · (A/V)
A/V ≥ 1,3	110	260	254

$$100 \cdot E_{performance} / E_{regulation}\ [\%]$$

100*8.5 / 132 = 6.4%

NOTE: This calculation is based on the dimensions of building C

Building C has scored a A+ for its high energy efficiency

Classification classes		Ratio [%]	Classifications
A+	A+	< 55	Very energy efficient
A	A	56 - 75	Energy efficient
B	B	76 - 95	Better than requirement
C	C	**96 - 100**	**According to requirement**
D	D	101 - 120	Close to requirement
E	E	121 - 150	Better than average
F	F	151 - 190	Average
G	G	191 - 250	Close to average
H	H	251 - 340	Weak
I	I	341 >	Bad

Please note that the overall building energy performance must reach A+, A, B or C class to receive an approval.

E heating = 1000(30*2.5+2*2.5) = **80000 Wh/m²a**

E ventilation = 1000*45*2.5 = **112500 Wh/m²a**

E hot water = 1000*15*2.5 = **37500 Wh/m²a**

E lighting = 1000*22*2.5 = **55000 Wh/m²a**

E renewable = **590.000 Wh/m²a**

$$E_p = (E_{heating} + E_{ventilation} + E_{hot\ water} + E_{lighting} - E_{renewable}) / 1000\ [kWh/m^2a]$$

Ep = 80000 + 112500 + 37500 + 55000 - 590.000 / 1000 =
-305 kWh/m²a

A/V ratio	E_p Residential [kWh/m²a]	E_p Office [kWh/m²a]	E_p Educational [kWh/m²a]
A/V ≤ 0,3	110	132	90
0,3 ≤ A/V ≤ 1,3	74 + 120 · (A/V)	94 + 128 · (A/V)	40,8 + 164 · (A/V)
A/V ≥ 1,3	110	260	254

$$100 \cdot E_{performance} / E_{regulation}\ [\%]$$

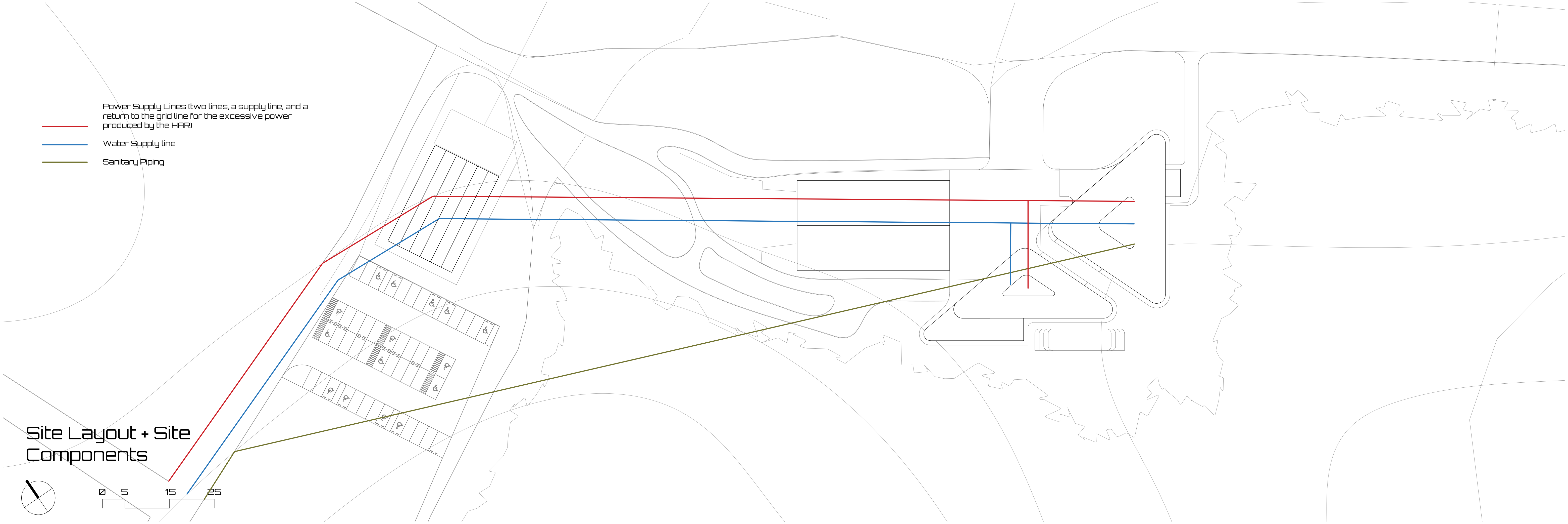
100*(-305) / 132 = -231.06%

NOTE: This calculation is based on the dimensions of building D

Building D has scored a A+ for its high energy efficiency

Classification classes		Ratio [%]	Classifications
A+	A+	< 55	Very energy efficient
A	A	56 - 75	Energy efficient
B	B	76 - 95	Better than requirement
C	C	**96 - 100**	**According to requirement**
D	D	101 - 120	Close to requirement
E	E	121 - 150	Better than average
F	F	151 - 190	Average
G	G	191 - 250	Close to average
H	H	251 - 340	Weak
I	I	341 >	Bad

Please note that the overall building energy performance must reach A+, A, B or C class to receive an approval.



Site Layout + Site Components

29. Building C Plant Rooms
29a. Electrical Room
29b. Electrical Storage
29c. AHU

34. CCTV Room

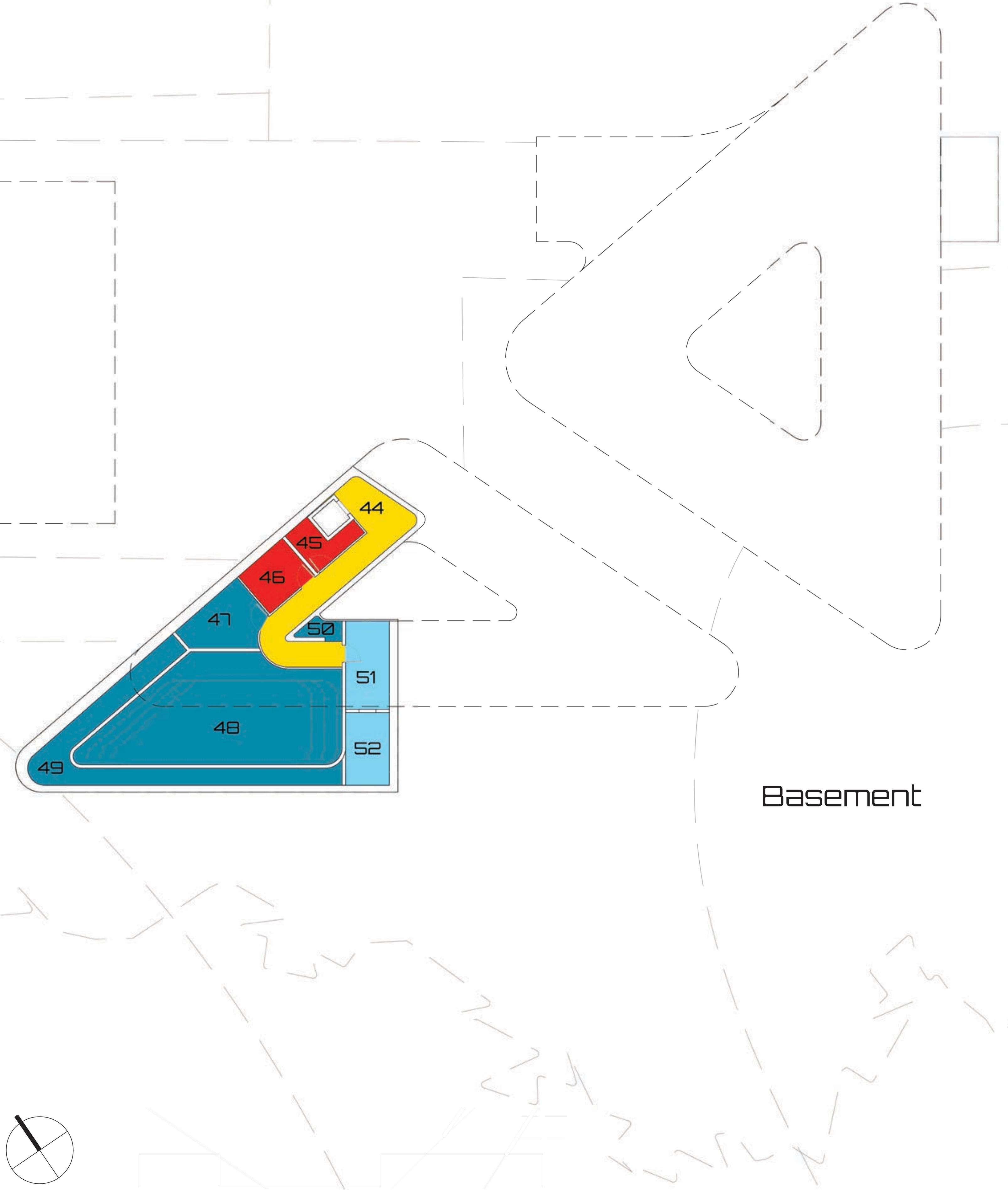
43. Waste Disposal Room

44. Basement Services Entry

45. 46. Transformer + Battery Room

47. 48. 49. 51. Plant + Filters + Chlorine Room + Heating

52. 53. Rain Harvesting Tanks + Maintenance



29. Building C Plant Rooms
29a. Electrical Room
29b. Electrical Storage
29c. AHU

34. CCTV Room

43. Waste Disposal Room

44. Basement Services Entry

45. 46. Transformer + Battery Room

47. 48. 49. 51. Plant + Filters + Chlorine Room + Heating

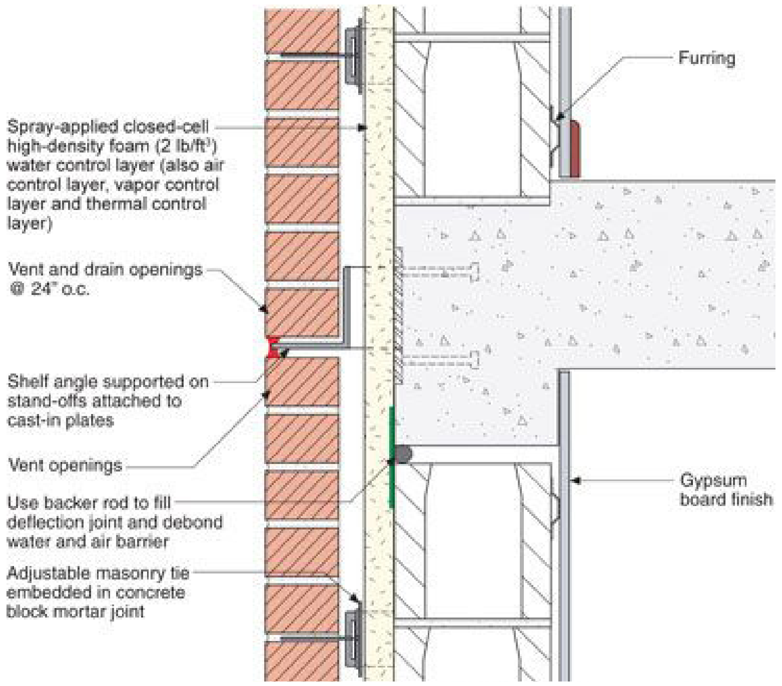
52. 53. Rain Harvesting Tanks + Maintenance

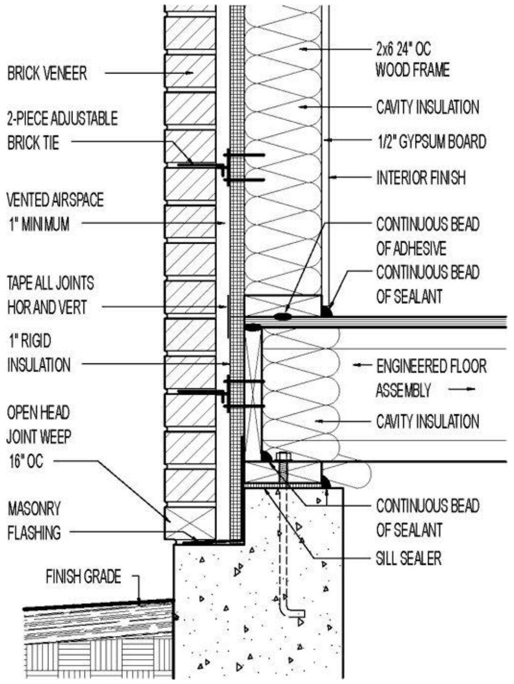
Ground floor

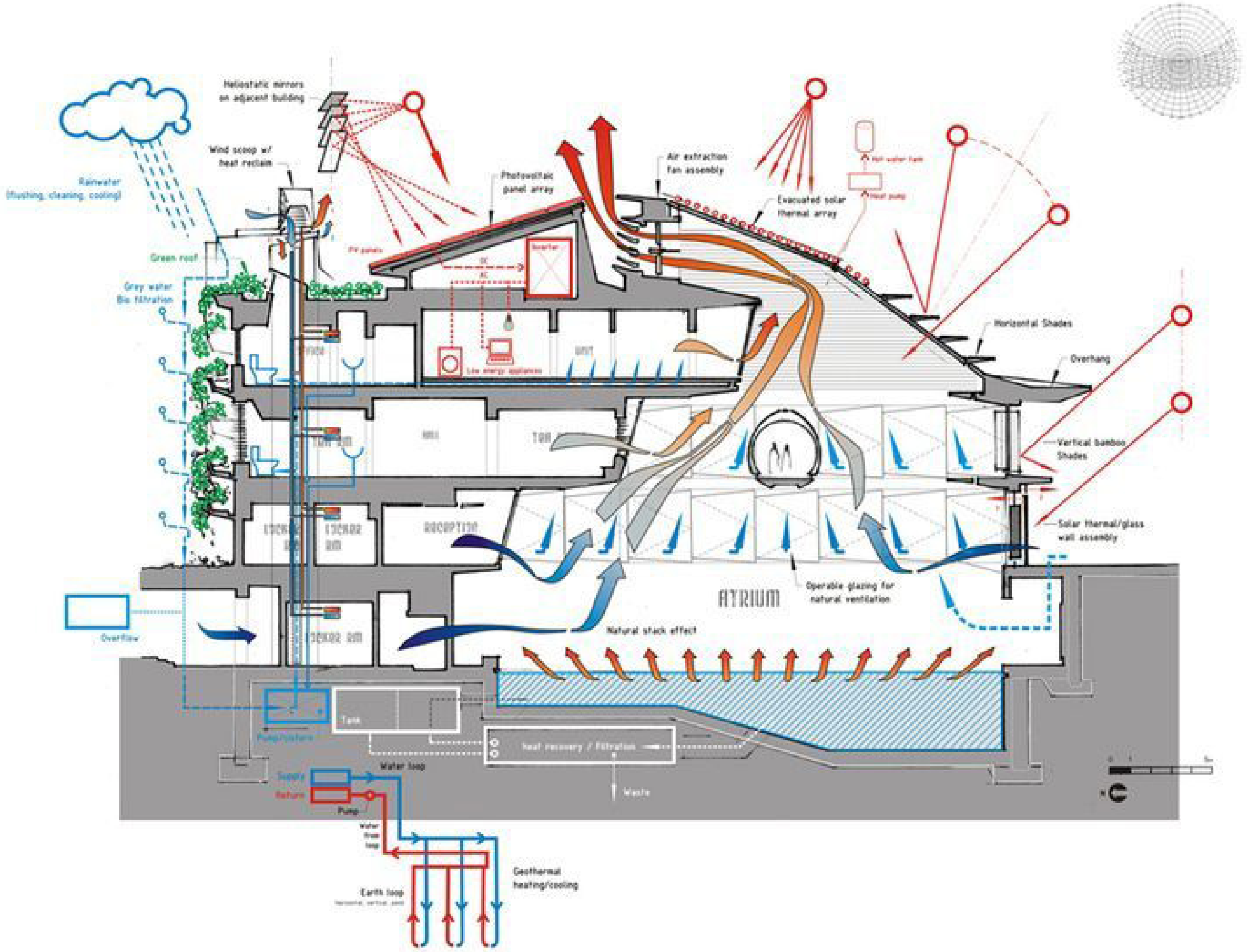
First floor

ANNEX B BUILDING CONSTRUCTION STUDY BREIF

REQUIREMENTS (ENERGY, INSULATION, FINISHING)







Fire

In most European countries there is different fire regulations related to the height of the building or its proximity to the site boundary or adjoining buildings. Firstly, it is important to note the differences between reaction-to-fire and fire resistance.

Reaction to Fire

Reaction-to-fire focuses on the behaviour of the materials during the development of a fire. This allows a designer to choose a material suitable for an application.

The European standard EN 13501-1: Reaction to Fire provides a number of performance criteria to measure the fire characteristics of building materials. These cover spread of flame and contribution to fire as well the generation of smoke and the production of burning droplets.

The designations are:

Spread of flame

A1, A2, B, C, D, E, F.

A1 and A2,s1,d0 are both classed as non-combustible, while at the other end of the scale an F rating is easily flammable

Smoke

s1, s2, s3

s1 refers to a material generating little or no smoke. Where as, S2 rated materials generate medium smoke and S3 produces heavy smoke.

Burning droplets

d0, d1, d2

d0 rated materials produce no droplets within 600 seconds. While d1 rated materials will produce droplets within 600 seconds but do not burn for more than 10 seconds.

d2 material are all those which do not fall in d0 or d1 designation.

EQUITONE panels achieve a A2,s1,d0 classification.

Fire Resistance

Fire resistance is based on EN 13501-2 and encompass the whole structural element and not just the façade material. This may consist of the complete façade wall from the outer rainscreen panel to the internal wall finish. The entire element should resist the impact of fire on its structural ability for as long as possible.

Local requirements

In addition to the European Standards there may also be some specific local requirements needed. For example in Denmark a local K10 test is needed.

Height of Building

There seems to be a similarly in most countries that buildings over 18-20 metres high require that the façade panels has a higher rating, A1 or A2-s1, d0 in accordance with EN 13501-1.

This is an important factor due to the effectiveness of fire fighting equipment. EQUITONE fibre cement panels with their excellent fire resisting performance achieve A2-s1, d0 rating and has unrestricted use on buildings, no matter what height.

Proximity to other buildings and site boundary

Some countries regulations also restrict what materials can be used on facades which are near other buildings or the site boundary. This is intended to prevent a fire from one building jumping to the next. Restrictions on the amount and size of openings such as windows are also limited by the regulation.

Cavity Fire Barrier

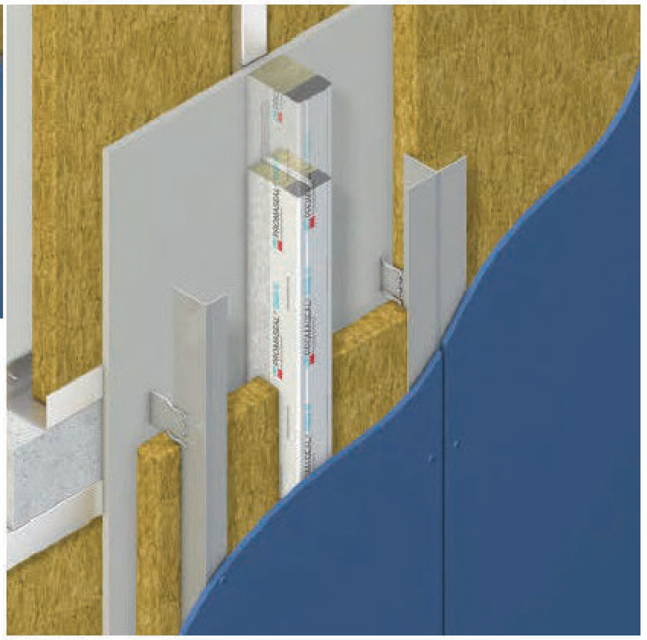
In some designs it is a requirement for the designer to use fire barriers as part of the overall building fire protection plan. Normally this occurs at floor levels on higher or larger buildings. They are used to compartmentise the building and help control the passage of fire and stop it spreading over the whole building. The barrier must extend to the back of the rainscreen panel.

A vertical fire barrier can be a standard approved cavity barrier.
As the barrier runs vertically it does not effect the air movement.

Promat PROMASEAL® RSB-V and RSB-N are ventilated and non-ventilated cavity barriers for use in rainscreen cladding systems. The products comprise of a rock wool section with an integral Intumescent strip bonded along one edge. In the event of direct exposure to fire, the Intumescent strip rapidly expands to fill the air gap within the rainscreen void.

Other options from the support frame suppliers can be used.
Please note that these will have different fixing requirements.

Alternatively, if a solid barrier is used then provision needs to be given to allow the air to exit the cavity below the barrier and re-enter the cavity above the barrier. At times the horizontal joint between the panels is used for this. These must be positioned close enough to prevent any dead-end space with no air movement and not to-close to allow any flames to exit and re-enter the cavity.

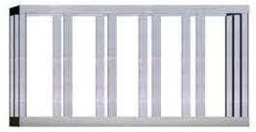


Walls

Structural Wall

The backing wall is critical to the performance of a ventilated facade system. If air movement through the backing wall is too great then the risk of water penetration is increased. Air leakage through the backing wall also represents a path for energy loss, and so must be limited.

It is important for the designer to consider what fixing will be used to secure the panel's support frame. Some of the wind loading is transmitted back to the backing wall and this should be allowed for.



Masonry Wall

Depending on what is the predominant local material, masonry walls can consist of clay, lightweight (clinker) block, concrete blocks or indeed a solid cast-in-situ or precast concrete panels. The wall can either be a full self-supporting load bearing structure or an infill between floor beams and columns.

This type of wall may be existing or a new build. For renovation projects it is advisable that the project engineer checks all masonry walls to ascertain whether the wall is sound and can support the added load. Many fixing suppliers will perform a pull-out test on a wall to confirm it capabilities.

Lightweight Wall

A lightweight structure of metal or timber stud is another form of backing wall. This is commonly used as an infill wall between concrete floors. This type of wall may need special fixings to hold the frame within the main building structure. It is also possible to construct complete structures.

The face of the frame requires a panel such as Duripanel or a fibre cement building board to act as a "wind-shield". The board may be required to offer some frame racking resistance or fire resistance should be sized correctly. This wind-shield must be air tight. This can be achieved by using the correct wind-shield board and tapping the joints with suitable long lasting tape.

With this type of construction, consideration needs to be given to the best way to fix the EQUITONE's support framing. By fixing a horizontal rail or batten over the wind-shield and into the vertical studs the designer has the freedom to place the EQUITONE panel vertical support profiles anywhere. Therefore, the EQUITONE panel support profiles do not have to coincide with the structure studs. The space formed by these horizontal rails or battens can be utilised with the insertion of extra insulation.

Floor-to-Floor or Frame Wall

In this construction the rainscreen supporting framework is fixed to the primary structural elements such as the concrete floors. The framework needs to be designed to span the floor-to-floor height. The connectors or angle brackets that are fixed to the ends of the floors are specially designed by the supporting frame supplier. Note that depending on the wind-load the vertical support profiles will need to be increased in thickness to safely span between the floors. This system normally involves the construction of a separate inner wall.

Windows and Doors

Whether the main structural wall is a timber/metal lightweight frame or a massive masonry construction, the wall should be airtight especially around openings such as windows or doors.

Air tightness prevents moisture ingress and ensures the building remains thermally efficient. Fix the windows or doors to the backing wall and seal the edges with appropriate materials to reduce the risk of any moisture ingress.

Movement Joints

The term "movement joint" or "expansion joint" refers to the isolation joints provided within a building to permit the separate segments of the structural frame to expand and contract in response to temperature changes without adversely affecting the building's structural integrity. In simple terms they relieve any stress on the structure. Failure to incorporate these movement joint gaps into the structure will result in cracking under the stress.

The size and location of any movement joint is related to the choice of structural building materials and local climate. The ventilated façade has its own built in movement joints, with its combination of fixed and gliding points. However, the main building movement joints must be continued through the rainscreen. The ventilated façade cladding should not be fixed to both sides of the structural movement joint.

Insulation

Lets not forget that insulation not only prevents heat loss from a building, saving on energy costs but in warmer countries it also can prevent the building gaining heat and can help reduce the energy needed for air-conditioning.

Lambda Value

The most common characteristic is the lambda value (λ). The lambda value is expressed as W/mK (Watts per metre Kelvin) and defines a materials ability to transmit heat. The lower the lambda value the better the insulation performance.

U-Value

This is a well known term. The U-value is expressed as W/m^2K (Watts per metre squared Kelvin) and defines the ability of an element of a structure (such as a complete wall construction) to transmit heat under steady conditions. The lower this value the better the performance of the wall. For instance a 0.90 W/m^2K rated wall is considered poor performance while a 0.15 W/m^2K wall is very good. Each country has its own requirements and regulations and in some countries they are even local differences between one region and another.

Ideally, the insulation should be rigid, fireproof, water resistant and breathable. To meet these criteria a number of insulation suppliers have a proprietary board for ventilated facades. Each one has its own characteristics and level of performance. Those insulations that are suitable can be broken down and classified as mineral fibre, or foam based.

Insulation boards which can be considered are:

Mineral Fibre / Mineral Wool

Polyurethane (PUR, PIR)

Phenolic Foam

Foamglas

Comparison of Insulation Types

As well as the cost differences between the insulation boards, other factors such as fire resistance, condition of the backing wall, easy of use amongst others should also be considered when specifying the board.

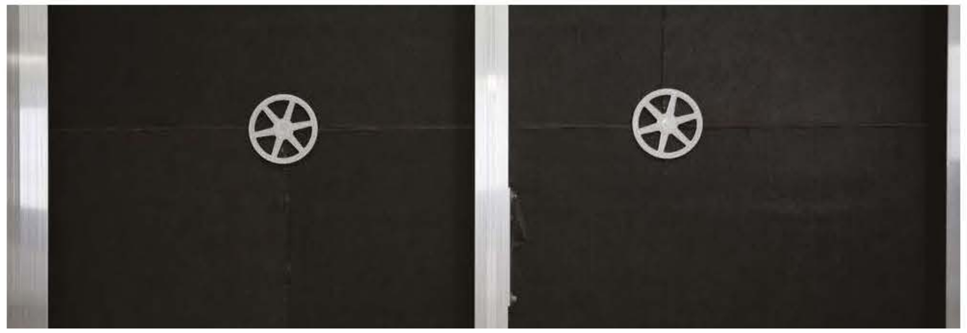
One way to look at insulation and its properties is to compare thicknesses. For a typical wall with concrete blocks these are the thicknesses of insulation required to reach a U-value of 0.30 W/m²K. Therefore, a lower lambda rated insulation allows for thinner insulation to achieve a rating when compared to higher lambda insulations.

Product		AD	Required thickness in mm to achieve U = 0.3 W/m²K insulation material
FG	Foamglas	0.041	135
SW-RW	Rockwool	0.038	125
GW	Glasswool	0.037	122
PUR	Polyurethane	0.024	79
PIR	Polyisocyanurate	0.023	76
PF	Phenolic foam	0.022	66

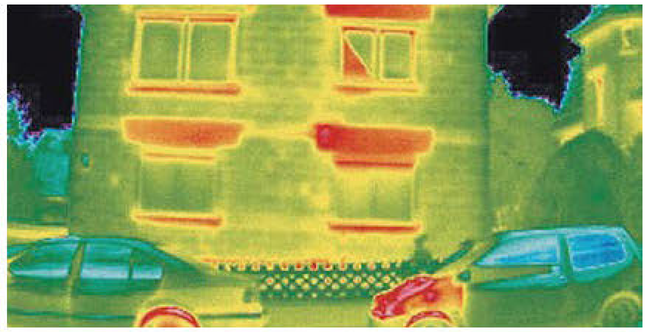
Securing the Insulation

It is important that the insulation is securely fixed in place and remains there for the lifetime of the façade. If the insulation moves or falls away from the wall then there is a risk that the cavity will become partially or completely blocked, therefore eliminating the benefits of the ventilated façade. In addition to the heat loss or gain that would occur via these gaps there is also an increased risk of condensation and mould growth. It is also important that the insulation has no gaps at its joints and fits tightly around the supporting frame to reduce heat loss and the effect of thermal bridging.

While each insulation manufacturer has their own requirements for fixing their insulation boards, an average of 5 fixings per m² is normally used. An alternative to mechanical fixing is the use of special adhesives. In most countries there is a requirement that a minimum one fixing per m² is a non-combustible type. This will prevent detachment of the insulation in the event of a fire and reduce the risk of damage to the structure.



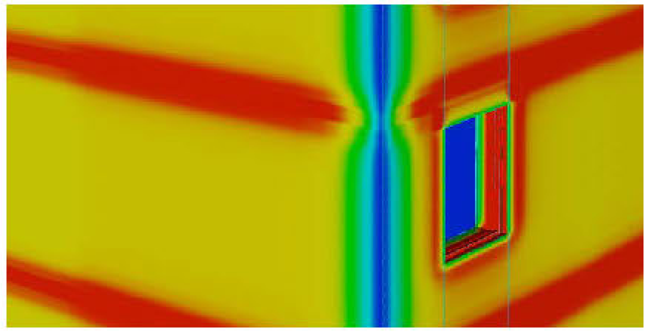
Thermal Bridge



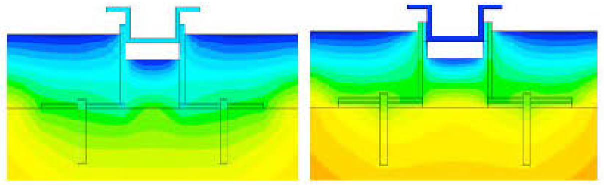
In a building, areas such as where the floor meets the external wall or where an internal wall meets the external wall, can result in the phenomenon of Thermal Bridging. However, by placing the insulation on the outside of the external wall this phenomenon is eliminated. This is one of the main benefits ventilated facades bring to the building.

Another form of thermal bridging can also be created when materials that are poor thermal insulators come into contact with each other, allowing heat to flow through the path of least resistance. Thermal bridging is not only the loss of heat from the inside of a building, but is also the gaining of heat from the outside particularly in warm countries.

Ventilated facade supporting frames require that metal brackets which penetrate the insulation layer can lead to thermal bridges; however this can be reduced by suitable bracket design. Adding extra insulation around a bridge offers only a little assistance in preventing heat loss or gain due to thermal bridging.



The most common solution used today is to place a "Thermostop" between the metal angle bracket and the backing wall. This thermostop is a piece of rigid strong PVC which is predrilled to suit the angle bracket. It breaks the bridge, therefore preventing the passage of heat. This is illustrated in the thermal modelling pictures below. The blue and green areas show the higher heat loss while the yellow areas perform better.



Temperature distribution of aluminium bracket without (left) and with (right) a thermostop (thermal separator)

While these thermostops are more than adequate for today's requirements, insulation and supporting frame manufacturers are altering their designs and developing new ways to reduce or even eliminate the heat loss or gain.

General

The maps shown in this section are only indicative and local more detailed information must be used when designing the facade.

EU Climate

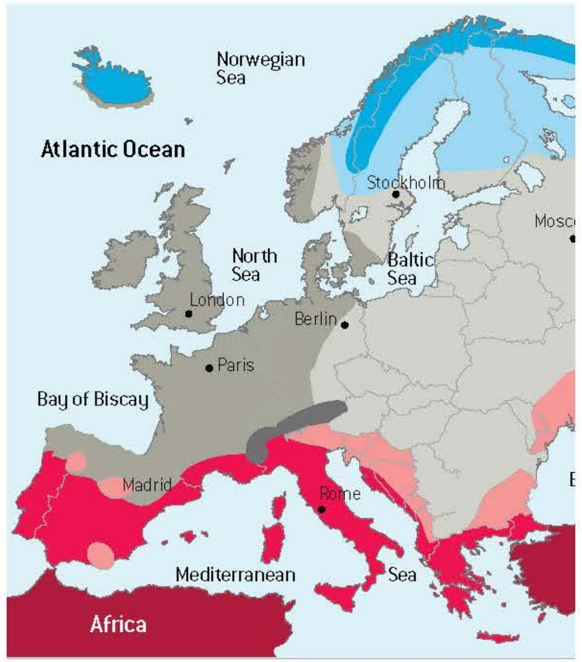
The climate of Europe is of a temperate, continental nature, with a maritime climate prevailing on the western coasts and a Mediterranean climate in the south. The climate is strongly conditioned by the Gulf Stream, which keeps mild air over the high latitude north-western region over the winter months, especially in Ireland, the UK and coastal Norway. Whilst Western Europe has an oceanic climate, Eastern Europe has a drier continental climate. Parts of the Central European plains have a hybrid oceanic/continental climate. Four seasons occur in Eastern Europe, while southern Europe experiences distinct wet season and dry seasons, with prevailing hot and dry conditions during the summer months. The heaviest precipitation occurs downwind of water bodies due to the prevailing westerly's, with higher amounts also seen in the Alps

Seismic

While minor earthquakes are not uncommon in Europe, large earthquakes which make the headlines are rare in central, western, or northern Europe as these occur mainly in southern and eastern areas.

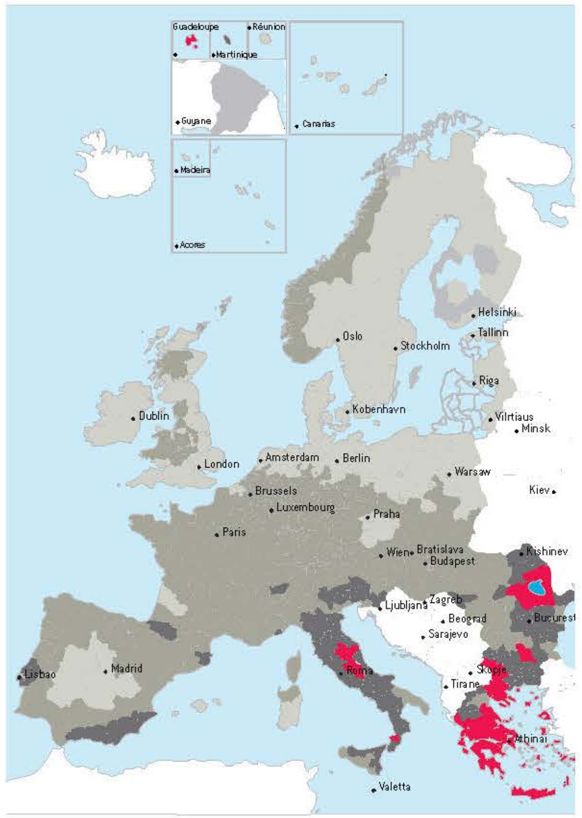
Therefore in certain parts of Europe consideration to seismic activity should be given to the design of the façade. Local regulations must be adhered to. This can involve adjusting the design of the main building structure.

Refer to Eurocode 8 "Design of structures for earthquake resistance" for further information.



Semiarid
Subtropical dry summer
Humid subtropical
Humid oceanic
Humid continental
Subarctic
Tundra
Highland

Source: World Book



Earthquake hazard potential

Very low hazard
Low hazard
Moderate hazard
High hazard
Very high hazard
Non ESPON space

Source: European Spatial Planning Observation Network (ESPON)

Wind

Wind load is one of the factors caused by climatic conditions, which has a variable effect on buildings. Firstly, the building location will be considered and then the building design.

Building Location

The key factors influencing the extent of the wind load are those of the location with the local wind climate and the topography. The wind climate is recorded in the Eurocode 1 using a wind zone map, which provides a time-weighted average wind speed for various geographic regions. The topography and nature of the site surrounding the building location are provided in the standards through the terrain categories.

Effects of Terrain or Topography

Terrain has a strong influence on local wind speeds. Wind blowing over smooth terrain, such as grass or water will maintain its strength and have little turbulence. As the wind blows over rougher terrain, such as towns and cities, the wind speed is reduced due to the frictional drag at the surface but at the same time the turbulence in the wind increases.

Proximity to the sea

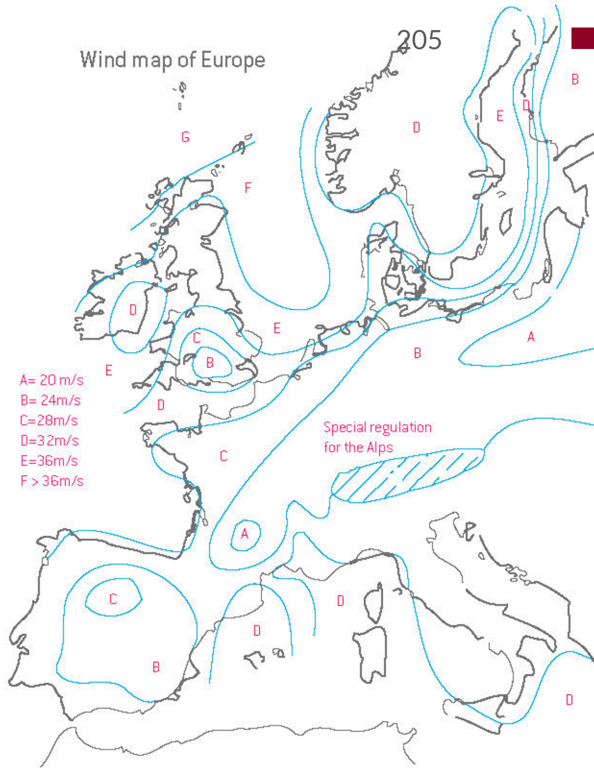
Wind and driving rain can increase the closer the building is to the coast. Another consideration the designer needs to address is the choice of materials. Not all materials are suitable for use next to the sea. For example, it is advised to use stainless steel fasteners instead of aluminium.

Building Design - Design for wind loading

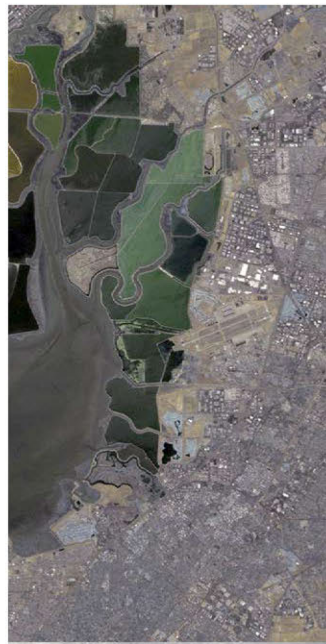
During the design process the engineer will refer to standards and regulations such as the Eurocodes or national standards.

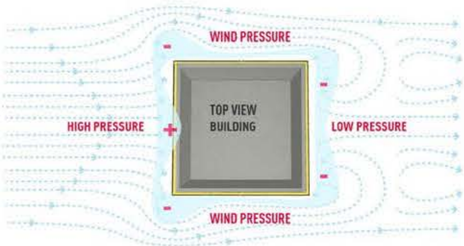
An Engineer can confirm the dynamic pressures of the wind (including the appropriate pressure coefficients for the building) in accordance with EN 1991-1-4. This is then used to calculate the effective wind speed and dynamic wind pressure on the building envelope, by applying a series of factors to account for terrain, topography, building height and length etc. The spacing of the façade's supporting frame is determined by calculation once the wind forces on the structure have been determined. This is normally carried out by the support frame supplier and then approved by the engineer.

Wind map of Europe



Source: ESDEP WG



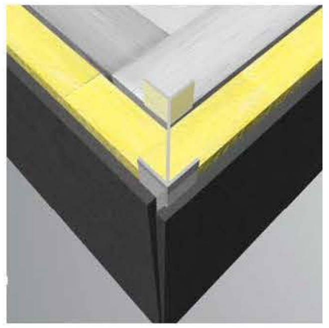


Wind flow around buildings

All buildings obstruct the free flow of the wind, causing it to be deflected and accelerated, resulting in complex flow patterns. When a wind strikes the building, it will give rise to pushing or positive pressures on the windward face and suction or negative pressures on the sides and leeward face of the building. The negative pressures on the side walls will generally be greater at the front end and reduce further back along the building towards the rear. This means that the wind is trying to pull the panels off the wall. This is known as "wind-loading" and is normally expressed as KN/m^2.

Façade Design

Where open joints are utilised between the cladding panels, a proportion of the external wind pressure is able to leak through the cladding to act directly on the building wall, relieving the loads on the cladding.



External Corners

External corners are one of the most vulnerable areas to wind. As well as the wind pulling the panel from the outside, the back of the panel can be also subjected to pushing from the cavity. To counteract this, a continuous vertical cavity closer can be introduced so that the wind pressures are separated. Another solution is to use additional fasteners and fix extra supports on both sides of the corners of the facade.

Building Shape

The shape of the building has an effect on how the wind pressures are distributed. Recesses, overhanging areas, roof gardens and terraces will have a local effect on wind pressures.

Effects of Building height

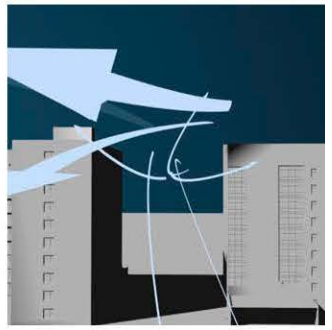
Wind speed increases with height above ground, it follows therefore that the taller the building the greater the wind speeds acting on it. Of course if the building is surrounded by similar tall buildings the wind effect may not be as great. A low rise building on an open flat site may have as many design considerations as a tall building.

Interaction between buildings

Should a tall building have a lower building upwind from it, then, depending on their relative dimensions and separation distance, the ground level wind speeds in front of the tall building can be magnified. Where a tall building is surrounded by closely spaced low rise buildings the windward vortex can still cause high wind speeds around the lower building.

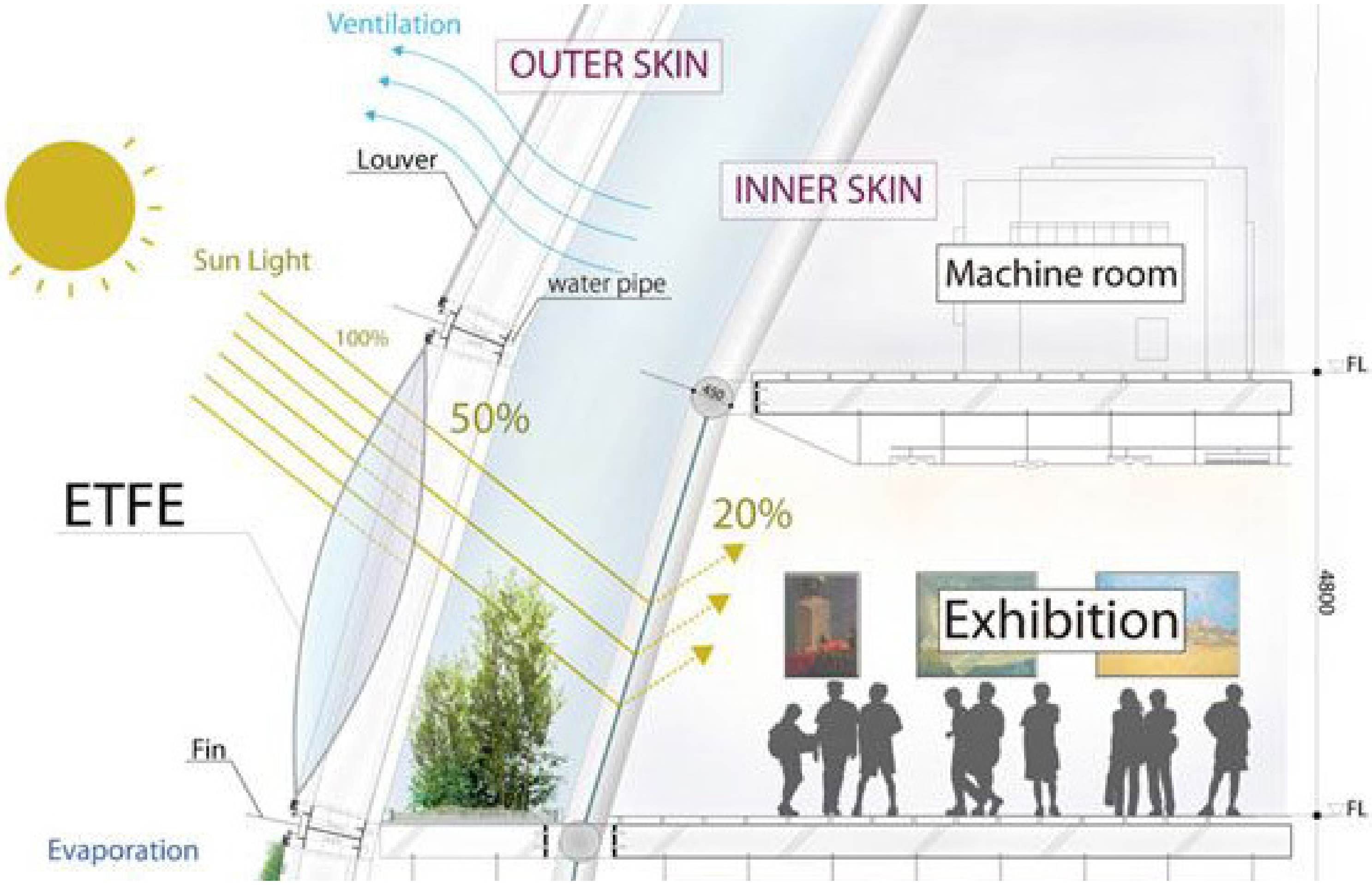
Funnelling

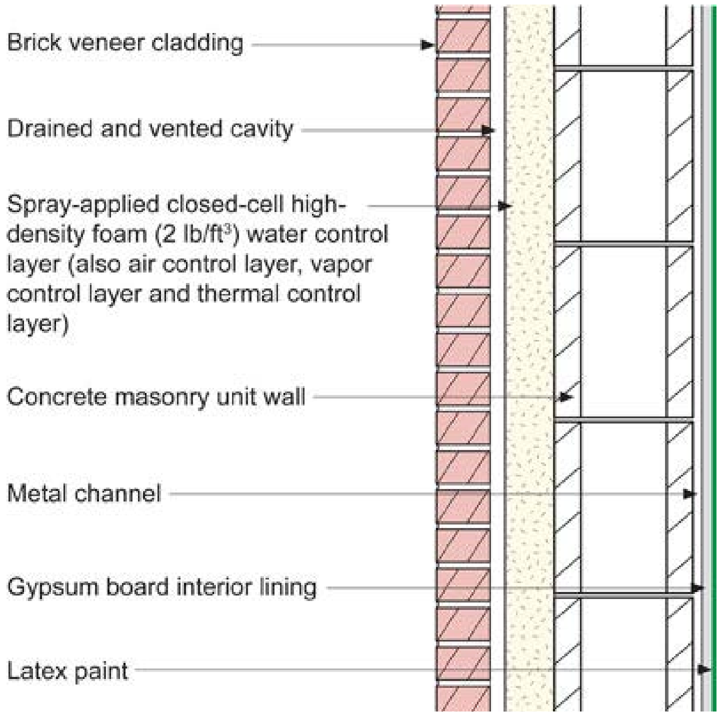
Wind funnelling and flow acceleration can occur when there are gaps between the buildings. The distance between the building facades is a factor in determining the increased speed and pressure.



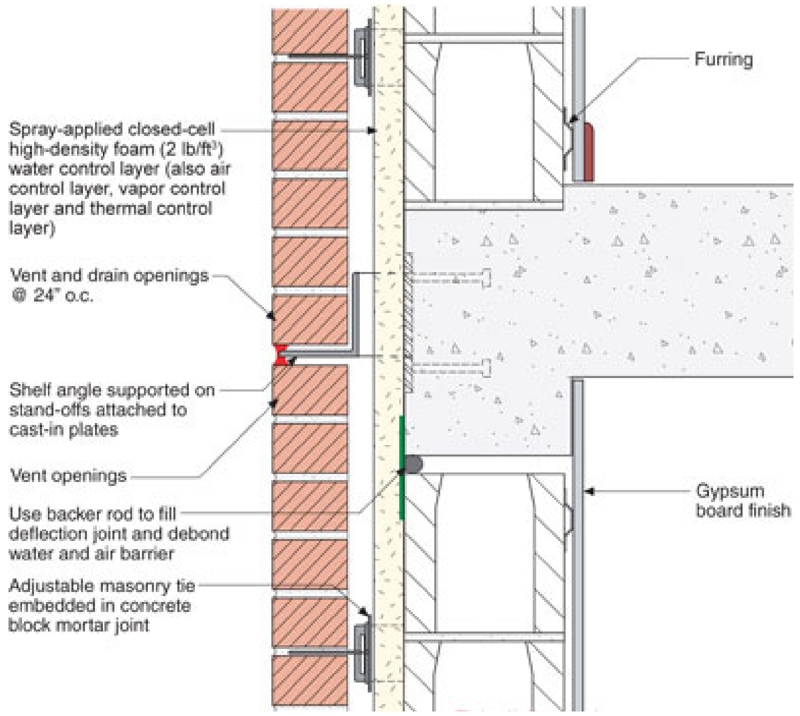
Aircraft vortices

Cladding near airports can experience higher local wind load forces due to air vortices being created by certain aircraft when taking off and landing, which may be greater than the normal calculated values. These forces need to be considered in any calculation.

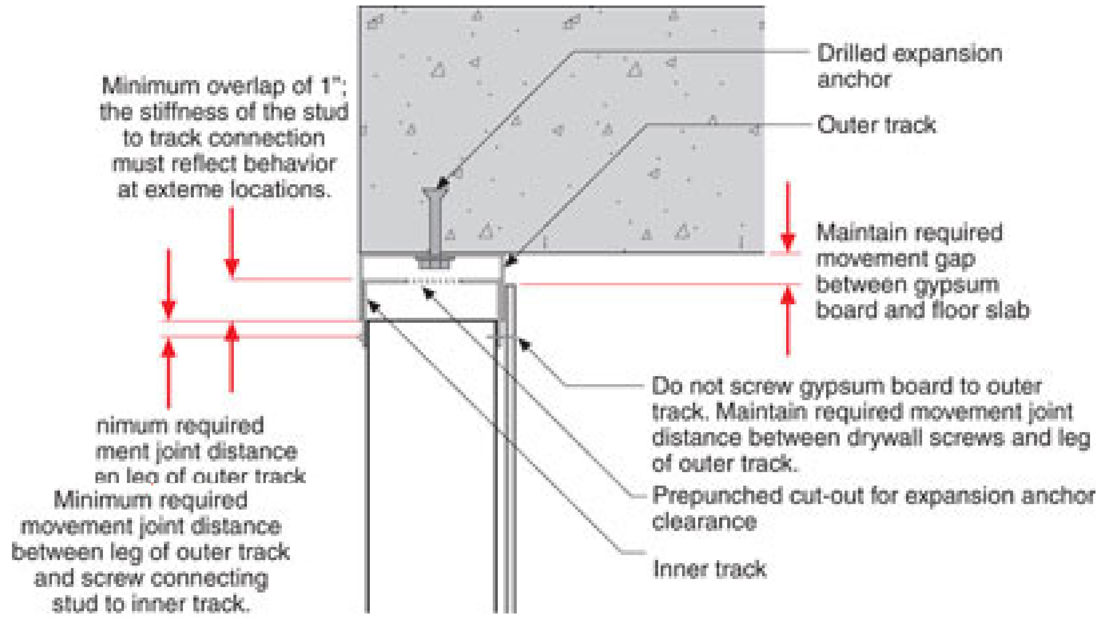




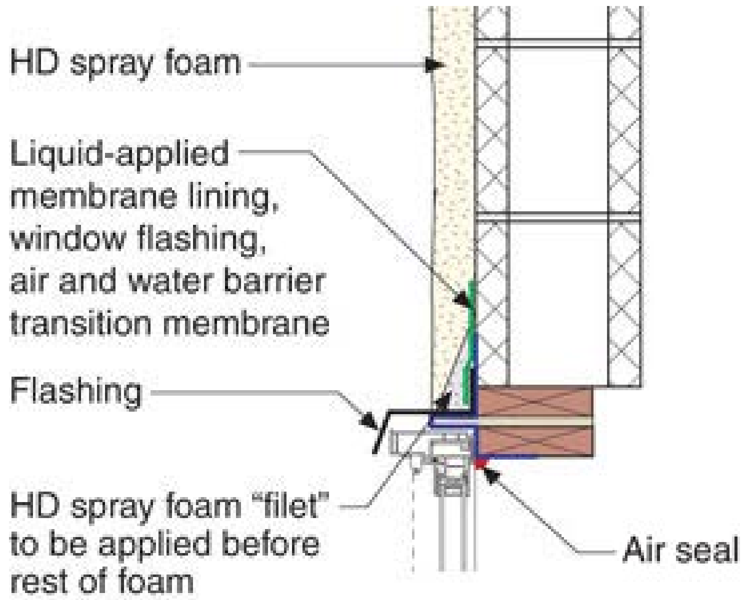
Brick veneer cladding
Drained and vented cavity
Spray-applied closed-cell high-density foam (2 lb/ft³) water control layer (also air control layer, vapor control layer and thermal control layer)
Concrete masonry unit wall
Metal channel
Gypsum board interior lining
Latex paint



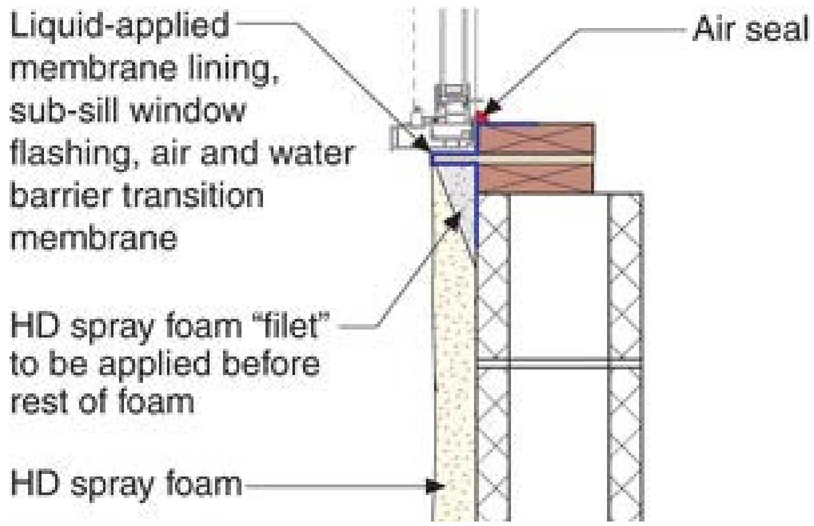
Furring
Spray-applied closed-cell high-density foam (2 lb/ft³) water control layer (also air control layer, vapor control layer and thermal control layer)
Vent and drain openings @ 24" o.c.
Shelf angle supported on stand-offs attached to cast-in plates
Vent openings
Use backer rod to fill deflection joint and debond water and air barrier
Adjustable masonry tie embedded in concrete block mortar joint
Gypsum board finish



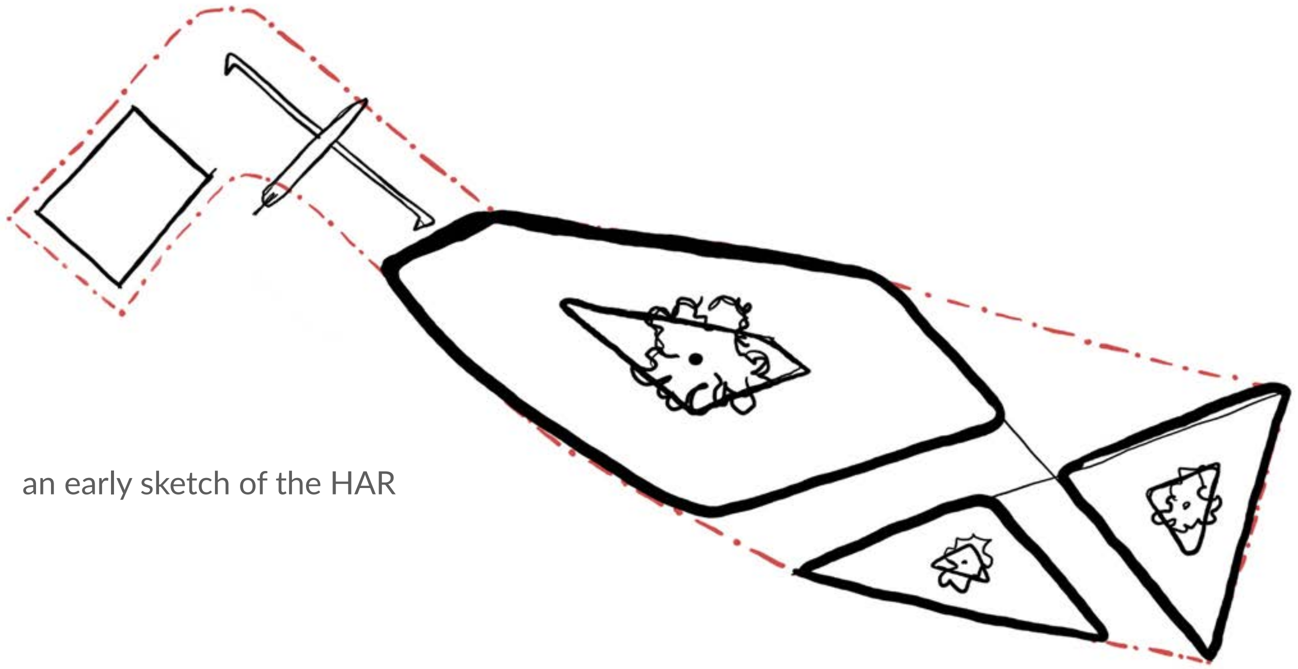
Minimum overlap of 1"; the stiffness of the stud to track connection must reflect behavior at exteme locations.
Drilled expansion anchor
Outer track
Maintain required movement gap between gypsum board and floor slab
Do not screw gypsum board to outer track. Maintain required movement joint distance between drywall screws and leg of outer track.
Prepunched cut-out for expansion anchor clearance
Inner track
Minimum required movement joint distance between leg of outer track and screw connecting stud to inner track.



HD spray foam
Liquid-applied membrane lining, window flashing, air and water barrier transition membrane
Flashing
HD spray foam "filet" to be applied before rest of foam
Air seal



Liquid-applied membrane lining, sub-sill window flashing, air and water barrier transition membrane
Air seal
HD spray foam "filet" to be applied before rest of foam
HD spray foam

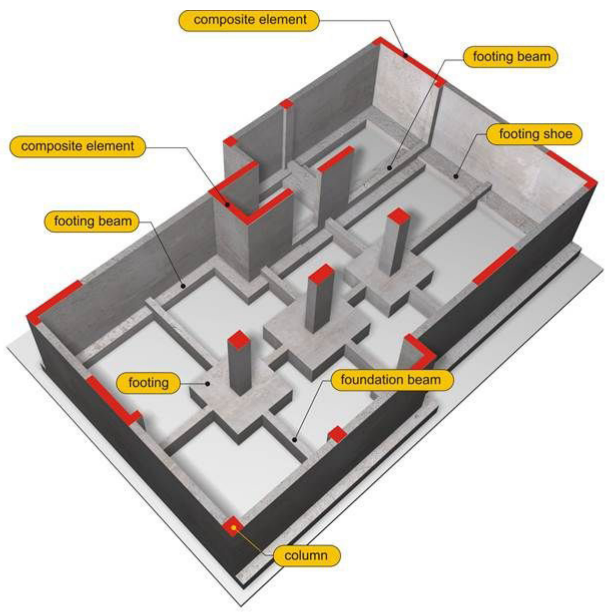


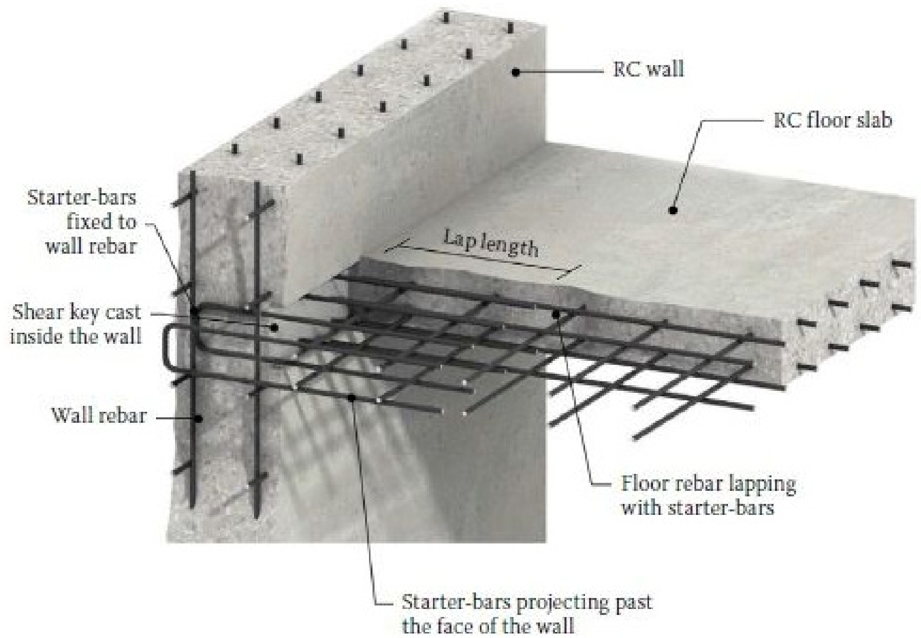
an early sketch of the HAR

STRUCTURAL POSSIBILITIES

The HAR project is to be proposed with a combined structure of Reinforced Concrete Frame + Reinforced Concrete Shear Walls for bracing, both acting as the main load bearing systems of the project, along with a Reinforced Concrete Slab.

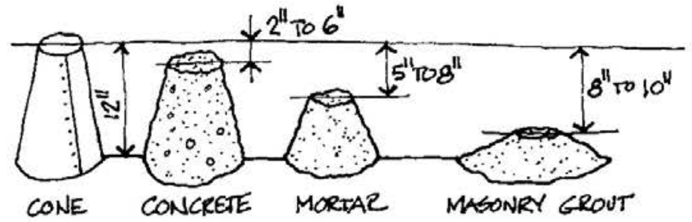
STRUCTURAL PRECEDANT STUDIES





___ 1. General Cast-in-Place Costs
- ___ ***a.* Substructure: $150 to $400/CY (40%M and 60%L)**
- ___ ***b.* Superstructure: $500 to $1100/CY (30%M and 70%L)**

___ 2. Concrete: Consists of (using the general 1-2-3 mix, 1 part cement, 2 parts sand, and 3 parts rock, plus water):
- ___ *a.* Portland cement
  - ___ (1) Type I: Normal for general construction.
  - ___ (2) Type II: Modified for a lower heat of hydration, for large structures or warm weather.
  - ___ (3) Type III: Modified for high, early strength, where forms must be removed as soon as possible, such as high-rise construction or cold weather.
  - ___ (4) Type IV: Modified for low heat for very large structures.
  - ___ (5) Type V: Modified for sulfate resistance.
  - ___ (6) Types IA, IIA, or IIIA: Air-entrained to resist frost.
- ___ *b.* Fine aggregate (sand): ¼″ or smaller.
- ___ *c.* Course aggregate (rock and gravel): ¼″ to 2″.
- ___ *d.* Clean water: Just enough to permit ready working of mix into forms. Mix should not slide or run off a shovel. Major factor effecting strength and durability is the *water-cement ratio,* expressed as gallons of water per sack of cement (usually ranging from 5 to 8). Slump is a measure of this:



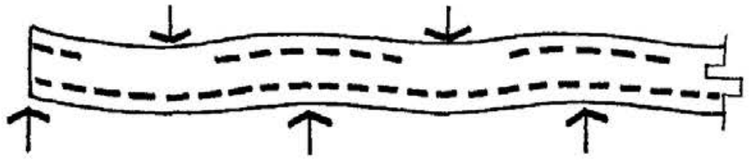
___ 3. Structural Characteristics (Primer)
- ___ *a.* Strength

AVERAGE PHYSICAL PROPERTIES

MATERIAL	ELASTIC LIMIT (PSI)		ULTIMATE STRENGTH (PSI)			ALLOWABLE WORKING UNIT STRESS (PSI)				MODULE OF ELAST. (PSI)	WEIGHT (LB./C.F.)
	TENSION	COMPRESS.	TENSION	COMPRESS.	SHEAR	TENSION	COMPRESS.	SHEAR	EXTR. FIBER BEND		
CONCRETE				2500			1125	75		3000M	150

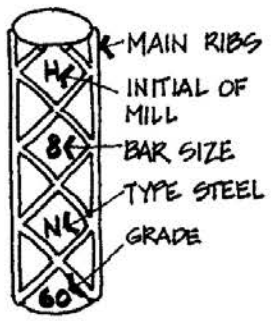
___ *b.* Bending

___ (1) Concrete is strong in compression but has little dependable tensile strength. Steel is strong in tension. When they are combined in a reinforced concrete bending member, such as a beam or slab, the concrete resists compression and the steel resists the tension. Thus, the reinforcing must be located at the tension face of the member.



Reinforcing splices in continuous-top reinforcing are usually located at midspan. Splices at bottom reinforcing are usually located over supports.

___ (2) Reinforcing: Steel bars start at #2s, which are ¼″ dia. Sizes go up to #11s, with each size an added ⅛″. All bars are deformed except #2s. A common problem is trying to cram too many bars into too small a section.

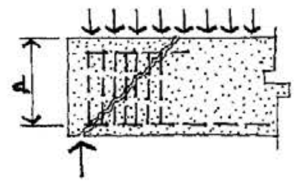


REINFORCING BARS: GRADES & SIZES

	ENGLISH		METRIC	
GRADES:	40 60 75		300 420 520	
SIZES:	SIZE	DIAMETER (IN)	SIZE	DIAMETER (MM)
	#3	0.375	#10	9.5
	#4	0.500	#13	12.7
	#5	0.625	#16	15.9
	#6	0.750	#19	19.1
	#7	0.875	#22	22.2
	#8	1.000	#25	25.4
	#9	1.128	#29	28.7
	#10	1.270	#32	32.3
	#11	1.410	#36	35.8
	#14	1.693	#43	43.0
	#18	2.257	#57	57.3

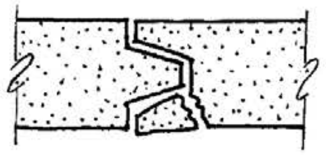
___ (3) Shear

___ (*a*) When concrete fails in shear it is generally due to a tension failure along a diagonal line.

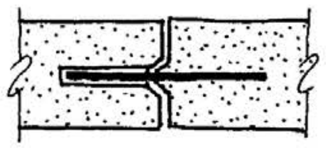


Vertical steel "stirrups" or diagonal bars are often used to tie the top and bottom parts together across the potential crack and prevent failure. This steel must be placed accurately in the field.

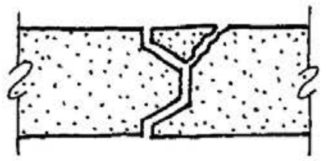
___ (*b*) The weakness of concrete in diagonal tension leads to problems with keys and construction joints.



SPALLED KEY



BETTER



SPALLED KEY

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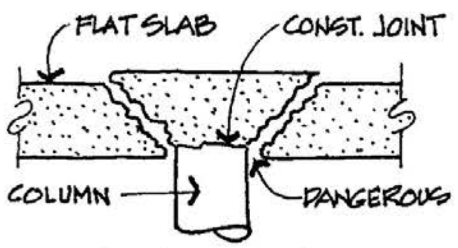
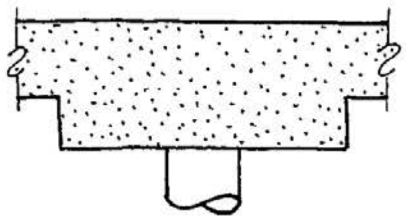


CONSTRUCTION JOINT IN COLUMN POURED TOO HIGH



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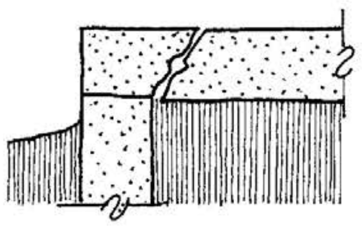
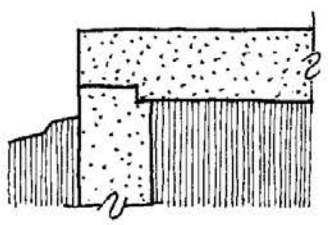
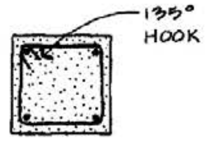
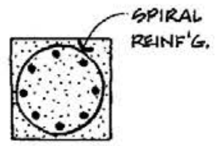
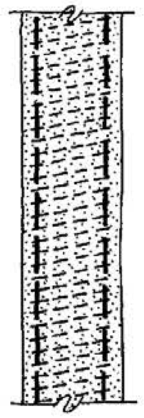


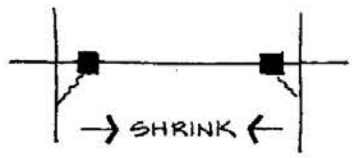


___ (4) Bond: Reinforcing lap splices need to be long enough to bond with the concrete. These splices close to the surface are weak, so reinforcing needs to be centered or kept clear of surfaces. In general, bars should not be lap-spliced at points of maximum stress.









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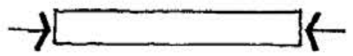
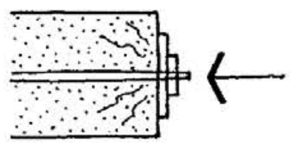




___ (5) Columns

___ (*a*) In columns, both the concrete and the steel can work in compression.

___ (*b*) Bars need steel ties to keep them from buckling outward. Also, closely spaced ties help confine the concrete against breaking apart.

___ (*c*) 90° hooks are often used, but should *not* be used in seismic areas. The best anchor for the end of a tie is a 135° hook around the rebar and back into the concrete.

___ (*d*) The ultimate in tying bars against outward buckling and confining concrete against breaking apart is the spirally reinforced column.

___ (*e*) Reinforcing is often lap-spliced at floor levels.

___ (6) Concrete shrinks: Details must allow for this. Try to avoid locking fresh concrete between two immovable objects. Pouring sequences should consider this problem.

___ (7) Prestressed Concrete:

___ (*a*) Differs from ordinary, reinforced concrete in that prestressing steel is under a very high tension, compressing the concrete together, before any load is placed on the member. This strengthens the concrete in shear as well as bending. This requires very high-strength steel which is impractical in ordinary reinforced concrete but results in large steel savings.

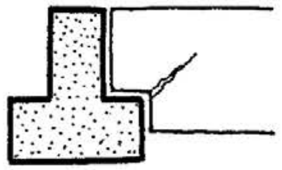
___ (*b*) *Posttensioning* involves tightening the rods or cables *after* the concrete is poured and cured. This concentrates a large stress at each end of the cables and requires special care (bearing plates, special hardware, reinforcing, etc.) to prevent failure at these points. If an end connection fails in unbonded posttensioning, there's no reinforcing strength left!

___ (*c*) *Pretensioning* has none of these "all the eggs in one basket" problems. Pretensioning lends itself to precast, plant-produced members, while posttensioning lends itself to work at the job site.

___ (*d*) Problems

___ 1. Continuing shrinkage is the most common problem with prestressed concrete. All details must consider long-term shrinkage.

___ 2. Notches in precast tees at bearing may cause problems. Use quality bearing pads.



___ 4. <u>Testing:</u> Typical design compressive strengths are f′c = 2500 to 3000 psi. To be sure of actual constructed strengths, compressive cylinder tests are made:

7-Day Break	28-Day Break
60 to 70% of final strength	Final strength

The UBC requires average of three tests to meet or exceed f′c. No test must fall below f′c by 500 or more psi.

___ 5. <u>Finishes:</u> Different wall finishes can be achieved by:

Type	Cost
___ *a*. Cast shapes and textures	**$3.30 to $6.00/SF**
___ *b*. Abrasive treatment (bush hammering, etc.)	**$1.50 to $5.00/SF**
___ *c*. Chemical retardation (exposed aggregate, etc.)	**$0.80/SF**

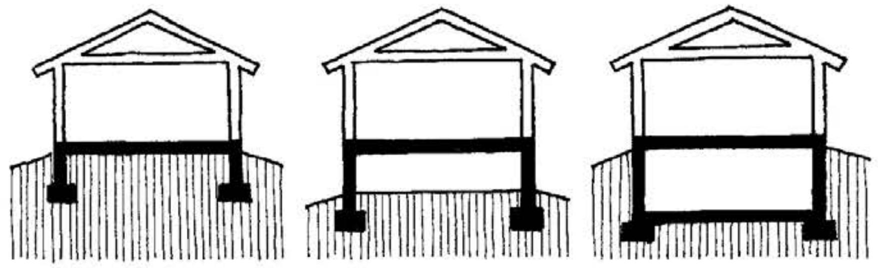
___ B. FOUNDATIONS

___ 1. <u>Functions</u>

___ *a.* Transfers building loads to ground
___ *b.* Anchors the building against wind and seismic loads
___ *c.* Isolates the building from frost heaving
___ *d.* Isolates building from expansive soils
___ *e.* Holds building above or from ground moisture
___ *f.* Retards heat flow to or from conditioned space
___ *g.* Provides storage space (basements)
___ *h.* Provides living space (basements)
___ *i.* Houses mechanical systems (basements)

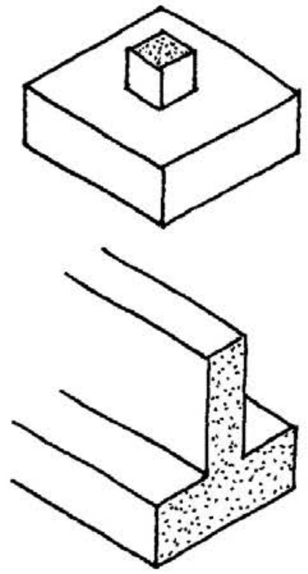
___ 2. <u>Types</u>

___ *a.* Slab-on-grade ___ *b.* Crawl space ___ *c.* Basement

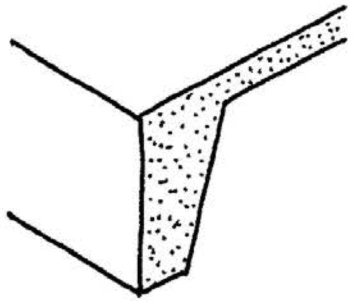


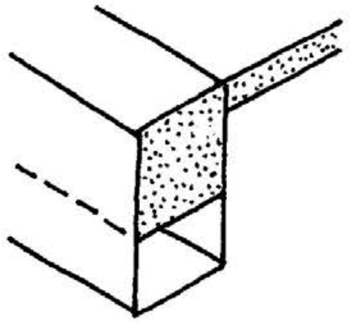
___ 3. <u>Types</u>

___ *a.* *Spread Footings:* Used for most buildings where the loads are light and/or there are strong, shallow soils. At columns, they are a single "spot" square directly bearing on the soils. Bearing walls have an elongation of the above. These are almost always of reinforced concrete.

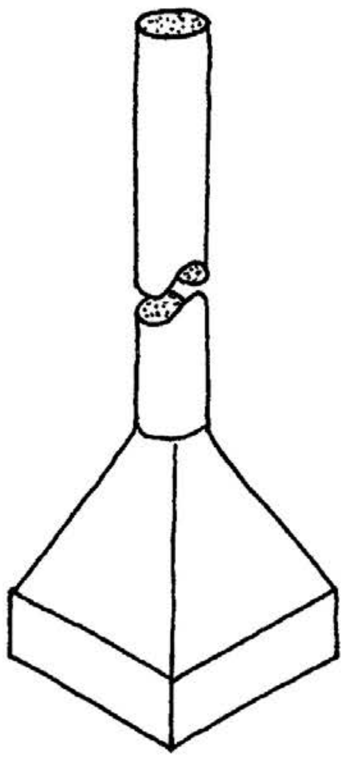


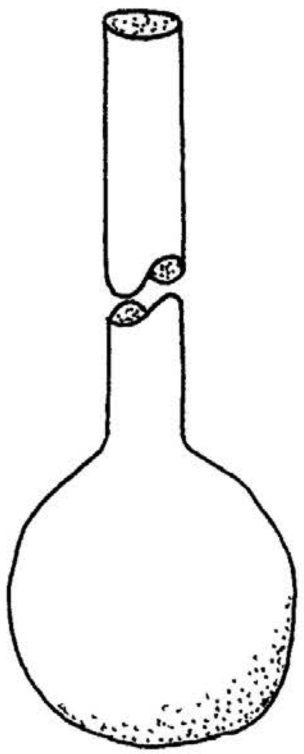
___ *b. Grade Beams:* These are used where upper soils are weak. They take wall loads and transfer them over to column foundations as if the beam were in the air. They are of reinforced concrete. Where soils are expansive, forms are sometimes hollow at the bottom to allow for soil heave without lifting the beam. This system is usually used with drilled piers at the columns.



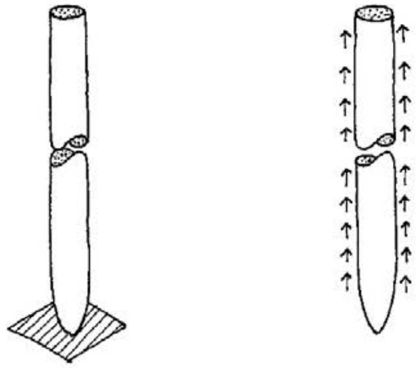


___ *c. Drilled Piers or Caissons:* These are used for heavy loads and/or where the soil is weak down to a stronger depth. These are almost always of reinforced concrete.

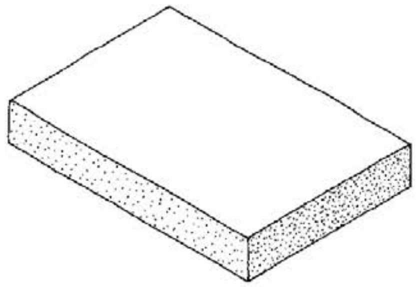




___ *d. Piles:* These are used for heavy loads and/or where deep soils are weak. End bearing piles are driven down to a deep bearing stratum. Friction piles are used where there is no reasonable bearing stratum and they are driven until a certain amount of resistance (from skin friction against the soil) is obtained to counteract the column load. Piles can be timber, reinforced concrete, or steel (with concrete fill).



___ *e. Rafts or Mats:* Reinforced concrete rafts or mats can be used for small, light-load buildings on very weak and expansive clays. These are often post-tensioned concrete. They can also be used at the bottom of subbasements of very large buildings where there are deep mushy soils. Either way, they allow the building to "float" on or in the soil, like a raft or ship.

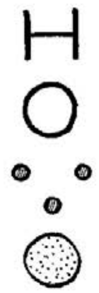


___ 4. **Depths** (spread footings) should be at or below frost line (see App. B, item C):

- ___ *a.* No Freeze 1′–6″
- ___ *b.* +20°F 2′–6″
- ___ *c.* +10°F 3′–0″
- ___ *d.* 0°F 3′–6″
- ___ *e.* –10°F 4′–0″
- ___ *f.* –20°F 4′–6″

___ 5. **Differential Settlement:** ¼″ to ½″

___ Steel H Piles, end-bearing, 100k, 50′ long, $1285/ea.
___ Steel-step tapered, end-bearing, 50k, 50′ long, $735/ea.
___ Treated wood pile, 3 ea. in cluster, end-bearing, 50k, 25′ long, $1620/ea. group.
___ Pressure-injected footings, end-bearing, 50k, 50′ long, $1550/ea.



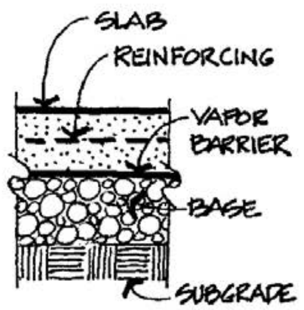
___ (3) <u>*Mat foundations:*</u> For poor soil conditions and tall buildings (10 to 20 stories) with their overturning moments, a mat foundation is required. A mat foundation is a large mass of concrete laid under the entire building. Mat foundations range from 4′ to 8′ thick.

Approximate cost: **See p. 285.**

___ 2. <u>Concrete Superstructure</u>

___ *a.* <u>*Concrete slabs*</u>

___ (1) <u>*Slab-on-grade:*</u> General rule on paving slabs is that depth should be ½ to ⅓ of average annual frost penetration.



Typical thickness:

Floors	4″
Garage Floors	5″
Terraces	5″
Driveways	6″ to 8″
Sidewalks	4″ to 6″

Approximate cost of 4″ reinforced slab is $2.50 to $3.00/SF.
For rock base see p. 277.
For vapor barrier see p. 377.
For compacted subgrade see p. 250.
For termite treatment see p. 268.

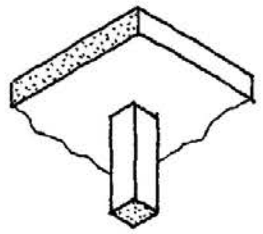
___ (2) <u>*Reinforced concrete slabs in the air:*</u> For general span-to-depth ratios, see p. 180.

___ (*a*) *One-way slab*

___ Usual spans: 6′ to 20′

___ Typical SDR:
20 for simple spans
28 for continuous spans

___ (*b*) *Two-way flat plate slabs*



___ Flat plate

___ Usual spans of 20′ to 30′.

___ Usual thickness: 6″ to 12″

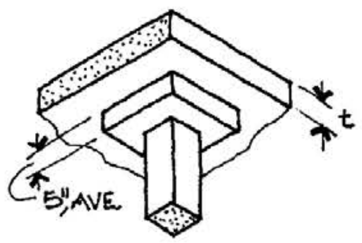
___ Usual maximum ratio of long to short side of bay: 1.33.

___ Typical ratio of span to depth: 30.

___ Another common rule is to allow 1″ thickness for each 3′ of span.

Approximate costs of $8.80/SF (15′ bays, 40 psf) to $10.80/SF (25′ bays, 125 psf). 25%M and 75%L.

___ (*c*) *Flat slab with drop panels*



___ Usual spans: 25′ to 36′

___ Usual thickness: 6″ to 12″

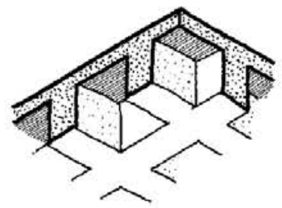
___ Usual maximum ratio of long to short side of bay: 1.33

___ Side of drop panels: +/– ⅓ span

___ Typical ratios of span to depth 24 to 30

Approximate costs of $9.25/SF (15′ bays, 40 psf) to $14/SF (35′ bays, 125 psf). 35%M & 65%L.

___ (*d*) *Two-way waffle slabs*



___ Longer 2-way spans and heavier load capacity.

___ Usual spans: 25′ to 40′.

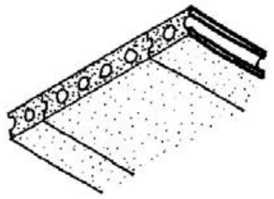
___ Standard pan sizes: 20″ to 30″ square with other sizes available. Standard pan depths 8″ to 20″ in 2″ increments.

___ Usual maximum ratio of long to short side of bay is 1.33.

___ Typical ratio of span to depth: 25–30.

Approximate cost of $13/SF (20′ bays, 40 psf) to $16.30/SF (40′ bays, 125 psf). 40%M and 60%L.

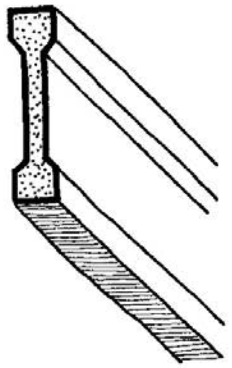
___ (*e*) *Precast, prestressed concrete planks*



___ Thickness of 6″ to 12″ in 2″ increments.
___ Spans of 8′ to 36′.
___ Span-to-depth ratio of approximately 30 to 40.
___ 1½″ to 2″ conc. topping often used for floors.

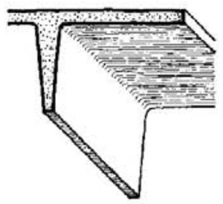
Approximate cost of $7.20/SF for 6″ thick (85% M and 15% L) with 35% variation higher or lower. Add $0.20 for each added 2″. Add $2.00/SF for topping.

___ *b.* Concrete beams and joists



___ (1) Precast concrete I beams (prestressed)
___ (*a*) Typical beam thickness of 12″ to 16″.
___ (*b*) Spans range from 20′ to 100′.
___ (*c*) Approximate ratios of span to depth of 15 to 25.

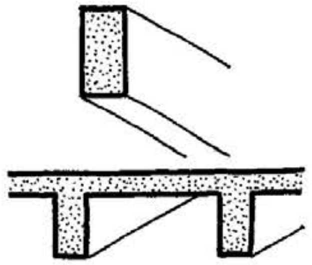
Approximate cost of $54.75/LF for 15′ span and $240/LF for 55′ span (90% M and 10% L) with variations of 20% higher or lower.



___ (2) Prestressed T beams (single and double tees)
___ (*a*) Typical flange widths of ½ to ⅓ the effective depth (8′ to 10′).
___ (*b*) Usual spans of 20′ to 120′.
___ (*c*) Approximate ratio of span-to-depth ratio: 24 to 32.
___ (*d*) Usually has 1½″ to 2″ concrete topping for floors.

Approximate cost of double tee 2′ deep × 8′ wide with 35′ to 80′ span is $5.25 to $6.75/SF (90% M and 10% L) with variation of 10% higher or lower.

___ (3) Concrete beams and joists.
SDR:

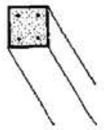


simply supported	=	16
one end continuous	=	18.5
both ends continuous	=	21
cantilever	=	8

Width should be ½ to ¼ the total depth.

Approximate cost of P.C. beam, 20′ span is $60.00/LF (70% M and 30% L). Cost can go 3 times higher with 45′ spans and heavy loads.

___ *c.* Concrete columns
___ (1) Round columns usually 12″ minimum.
___ (2) Rectangular: 12 in sq. minimum.
___ (3) Usual minimum rectangular tied columns 10″ × 12″.



___ (4) Square or round spiral columns: 14″; add 2″ for each story.
___ (5) Most columns are "short": maximum height *10* times least cross-section dimension. Typical column height is 12.5′ for multistory building.
___ (6) Maximum unbraced height for "engineered" long columns: *20* times least cross-section dimension.

Approximate cost of $45 to $85/LF (30% M and 70% L). Use lower number for single-story, min. loads, and min. reinforcing.

___ *d.* Concrete walls
___ (1) Wall Thickness
___ (*a*) Multistory: 8″ top 15′, add 1″ for each successive 25′ down.
___ (*b*) Basements: 8″ minimum.

___ (*c*) Nonbearing: Minimum thickness 6″. Maximum ratio of unsupported height: 25 to 30.
___ (*d*) Precast wall panels:
Minimum thickness: 5½″.
Maximum ratio of unbraced length to thickness: 45.

Approximate cost of $15.35/SF for 6″, reinf. wall (65% M and 35% L) with variation of 35% higher for special finishes. Add $.85 per each added inch thickness.

___ (2) <u>“Tilt-up”</u> (on site precast)
- ___ (*a*) Height-to-thickness ratio: 40 to 50.
- ___ (*b*) Typical heights: 22′ to 35′.
- ___ (c) Typical thickness: 5½″ to 8″.
- ___ (*d*) Typical use: Favorable climate, 20,000 SF size building or larger. Time and material savings can cut cost ≈ ⅓, depending on height and area, compared to masonry.

Costs: $7 to $12/SF (45% M and 55% L), costs can double for special finishes. Add ≈ 30% for concrete columns.

A. <u>SIZE</u>

1. WAFFLE SLAB (P.300)
   SDR: 25 TO 30 FOR 30′ SPAN = 1.2′ to 1.0′, SAY <u>14″ DEEP</u>

2. BEAM (P.301)
   SDR: 18 FOR 30′ SPAN = 1.67′ DEEP   SAY <u>12″W</u>
   WIDTH: ½ TO ¾ DEPTH = .83′ TO 1.25′   <u>× 1′-8″ D</u>

3. COLUMN (P.302)
   WIDTH: HEIGHT ÷ 10 = 1.8′   SAY <u>1′-10″ SQ.</u>

B. <u>COST</u>

1. WAFFLE SLAB: (½ BETW'N $13 & $16) ≈ $ 14.50/SF
2. BEAM: SAY $65/LF × (30′ × 4) ÷ (30′²) ≈ $ 8.65/SF
3. COLUMNS: SAY $65/LF × (18′ × 4) ÷ (30′²) ≈ $ 5.20/SF

$ 29.35/SF

___ A. MASONRY MATERIALS

___ 1. <u>General:</u> Masonry consists of:
- ___ *a.* Brick
  - ___ (1) Fired
  - ___ (2) Unfired (“adobe”)
- ___ *b.* Concrete block (concrete masonry units or CMU)
- ___ *c.* Stone
- ___ *d.* Glass block

___ 2. <u>Structural Characteristics</u>
- ___ *a.* Strength

AVERAGE PHYSICAL PROPERTIES

MATERIAL	ELASTIC LIMIT (PSI)		ULTIMATE STRENGTH (PSI)			ALLOWABLE WORKING UNIT STRESS (PSI)				MODULE OF ELAST. (PSI)	WEIGHT (LB./C.F.)
	TENSION	COMPRESS.	TENSION	COMPRESS.	SHEAR	TENSION	COMPRESS.	SHEAR	EXTR. FIBER BEND.		
ADOBE				300-500			30	8			110
BRICK				2800		800	100-250	50	2500M		120
C.M.U.				1500		500	300	38	1900M		145
STONE				2500			200-400	8			145

- ___ *b.* Load centers on masonry must lie within the center ⅓ of its width.
- ___ *c.* Reinforcing: Like concrete, masonry is strong in compression, but weak in tension. Therefore, steel reinforcement must usually be added to walls to simulate columns and beams.
  - ___ (1) Like *columns:* Vertical bars @ 2′ to 4′ oc.
  - ___ (2) Like *beams:* “Bond Beams” @ 4′ to 8′ oc.
  - ___ (3) Also, added *horizontal wire reinforcement* (ladder or truss type) @ 16″ oc. vertically, to help resist lateral forces and cracking.

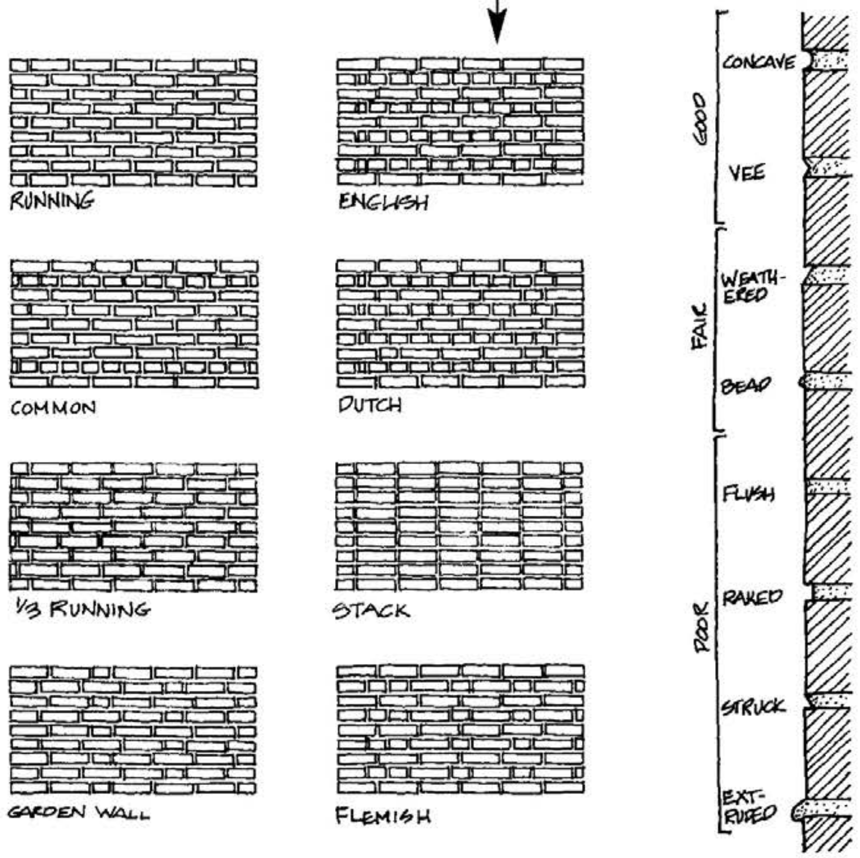
___ 3. <u>Bonds</u>
- ___ *a.* Structural (method of laying units together):
  - ___ (1) Overlapping units.
  - ___ (2) *Metal ties* (should be galvanized with zinc coating of 2 oz/SF, or stainless steel). Wire ties usually @ every 3 SF, or . . .
    Metal anchors, usually at 16″ oc, vertical and 24″ oc, horizontal.
  - ___ (3) Grout and mortar:
    - ___ (*a*) *Grout:* A “soup” of sand, cement, water, and often pea gravel that

encases reinforcing bars. Usually 2000 psi comp. strength. Always poured in cavities with high slump. Except for adobe brick, the mortar is considerably weaker than the bricks or blocks. The mortar is more elastic amd its joints shrink more. See p. 285.

___ (*b*) *Mortar:* Stiffer mix of sand, cement, lime, and water, to bond units together by trowel work. Types:
- ___ N General purpose, medium strength, for above grade.
- ___ M High strength, for high compression, above-grade.
- ___ S High strength, for compression and tension.
- ___ O High lime, low strength, easily workable for veneers not subject to freezing.
- ___ K Low strength, for interiors.

___ (4) Bond joints

___ (5) Bond patterns



___ **4. Control and Expansion Joints**

___ *a.* Width
- ___ (1) Thermal movement. See p. 394. = ___
  Plus,
- ___ (2) Movement due to moisture: = ___
  - ___ (*a*) Bricks expand; should be laid wet.
  - ___ (*b*) Concrete blocks shrink like concrete; should be laid dry.
  Plus,
- ___ (3) Construction tolerance. = ___
  Total width = ___

___ *b.* Locations
- ___ (1) Corners
- ___ (2) Length of walls: 20′ to 25′ oc.
- ___ (3) Offsets, returns, and intersections.
- ___ (4) Openings:
  - ___ (*a*) One side of opening, less than 6′ wide.
  - ___ (*b*) Two sides of opening, greater than 6′ wide.
- ___ (5) Against other materials.

___ **5. Embedments:** The best metal today for embedment in concrete or masonry is stainless steel, followed by bronze, then brass; however, most structural embedments remain galvanized steel.

___ **6. Coatings:** Must be (see p. 436)
- ___ (1) "Bridgeable" (seal cracks)
- ___ (2) Breathable (do not trap vapor)

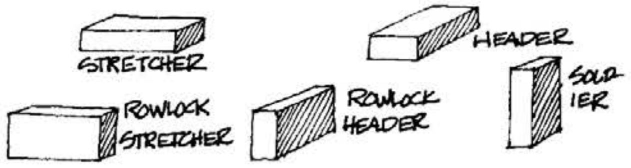
___ **7. Brick**

___ *a.* Types
- ___ (1) Common (building)
- ___ (2) Face
  - ___ (*a*) FBX Select
  - ___ (*b*) FBS Standard
  - ___ (*c*) FBA Architectural
- ___ (3) Clinker
- ___ (4) Glazed
- ___ (5) Fire
- ___ (6) Cored
- ___ (7) Sand-lime (white, yellow)
- ___ (8) Pavers

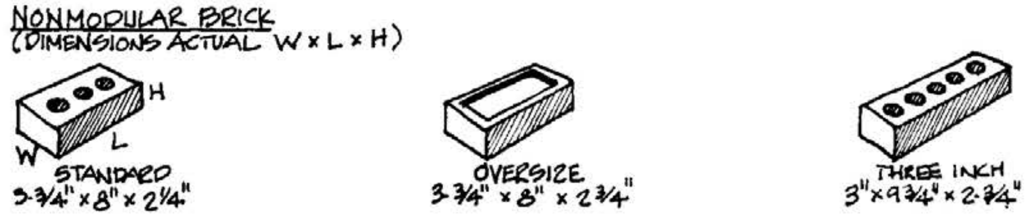
___ *b.* Weatherability
- ___ (1) NW Negligible weathering; for indoor or sheltered locations and warm climates.
- ___ (2) MW Moderate weather locations.

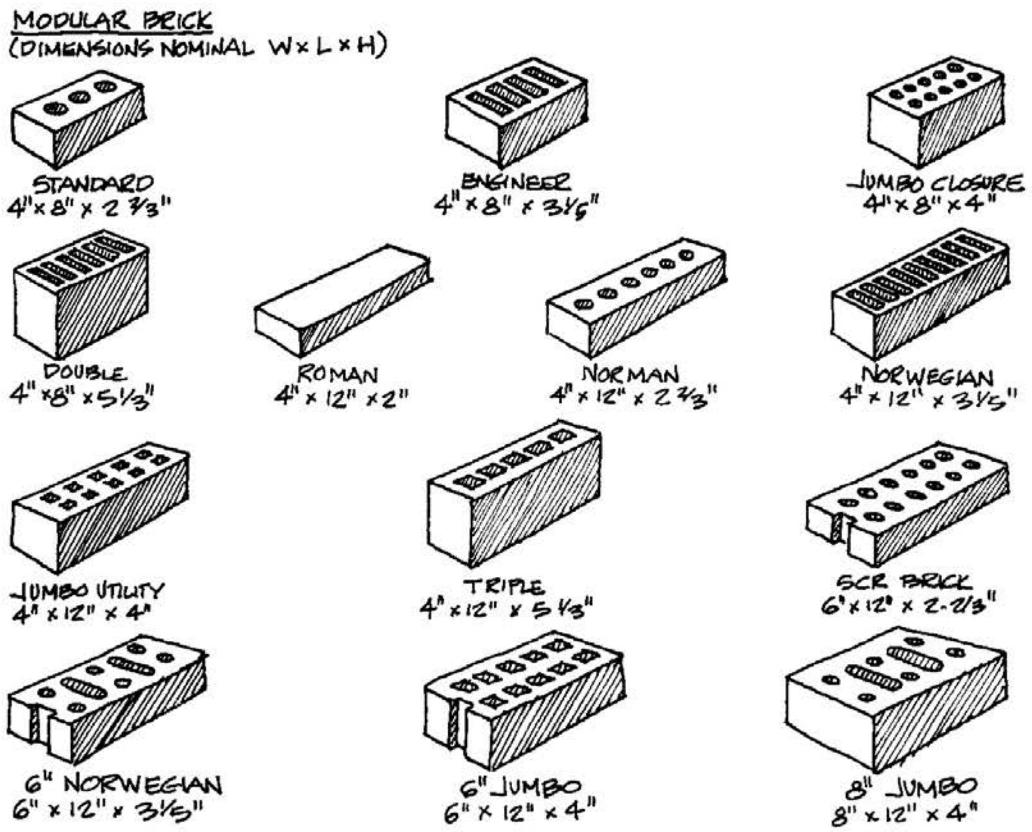
___ (3) SW Severe weather locations and/or earth contact as well as cold, wet climates.

___ *c.* Positions



___ *d.* Sizes:
(modular brick based on 4″ module with ⅜″ jt.)





___ *e.* Coursing: See p. 313.

___ 8. Concrete Block (CMU)

___ *a.* Types: Plain (gray), colored, pavers, special shapes (such as "slump"), and special surfaces (split faced, scored, etc.).

___ *b.* Size: See p. 314.

___ *c.* Coursing: See p. 315.

BRICK COURSING

COURSE	NONMODULAR						MODULAR				
	2 1/4" THICK BRICKS		2 5/8" THICK BRICKS		2 3/4" THICK BRICKS		NOMINAL THICKNESS (HEIGHT) OF BRICK				
	3/8" JOINT	1/2" JOINTS	3/8" JOINT	1/2" JOINT	3/8" JOINT	1/2" JOINT	2"	2 2/3"	3 1/5"	4"	5 1/3"
1	2 5/8"	2 3/4"	3"	3 1/8"	3 1/8"	3 1/4"	2"	2 11/16"	3 3/16"	4"	5 5/16"
2	5 1/4"	5 1/2"	6"	6 1/4"	6 1/4"	6 1/2"	4"	5 5/16"	6 3/8"	8"	10 11/16"
3	7 7/8"	8 1/4"	9"	9 3/8"	9 3/8"	9 3/4"	6"	8"	9 5/8"	1'-0"	1'-4"
4	10 1/2"	11"	1'-0"	1'-0 1/2"	1'-0 1/2"	1'-1"	8"	10 11/16"	1'-0 13/16"	1'-4"	1'-9 5/16"
5	1'-1 1/8"	1'-1 3/4"	1'-3"	1'-3 5/8"	1'-3 5/8"	1'-4 1/4"	10"	1'-1 5/16"	1'-4"	1'-8"	2'-2 11/16"
6	1'-3 3/4"	1'-4 1/2"	1'-6"	1'-6 3/4"	1'-6 3/4"	1'-7 1/2"	1'-0"	1'-4"	1'-7 3/16"	2'-0"	2'-8"
7	1'-6 3/8"	1'-7 1/4"	1'-9"	1'-9 7/8"	1'-9 7/8"	1'-10 3/4"	1'-2"	1'-6 11/16"	1'-10 3/8"	2'-4"	3'-1 5/16"
8	1'-9"	1'-10"	2'-0"	2'-1"	2'-1"	2'-2"	1'-4"	1'-9 5/16"	2'-1 5/8"	2'-8"	3'-6 11/16"
9	1'-11 5/8"	2'-0 3/4"	2'-3"	2'-4 1/8"	2'-4 1/8"	2'-5 1/4"	1'-6"	2'-0"	2'-4 13/16"	3'-0"	4'-0"
10	2'-2 1/4"	2'-3 1/2"	2'-6"	2'-7 1/4"	2'-7 1/4"	2'-8 1/2"	1'-8"	2'-2 11/16"	2'-8"	3'-4"	4'-5 5/16"
11	2'-4 7/8"	2'-6 1/4"	2'-9"	2'-10 3/8"	2'-10 3/8"	2'-11 3/4"	1'-10"	2'-5 5/16"	2'-11 3/16"	3'-8"	4'-10 11/16"
12	2'-7 1/2"	2'-9"	3'-0"	3'-1 1/2"	3'-1 1/2"	3'-3"	2'-0"	2'-8"	3'-2 3/8"	4'-0"	5'-4"
13	2'-10 1/8"	2'-11 3/4"	3'-3"	3'-4 5/8"	3'-4 5/8"	3'-6 1/4"	2'-2"	2'-10 11/16"	3'-5 5/8"	4'-4"	5'-9 5/16"
14	3'-0 3/4"	3'-2 1/2"	3'-6"	3'-7 3/4"	3'-7 3/4"	3'-9 1/2"	2'-4"	3'-1 5/16"	3'-8 13/16"	4'-8"	6'-2 11/16"
15	3'-3 3/8"	3'-5 1/4"	3'-9"	3'-10 7/8"	3'-10 7/8"	4'-0 3/4"	2'-6"	3'-4"	4'-0"	5'-0"	6'-8"
16	3'-6"	3'-8"	4'-0"	4'-2"	4'-2"	4'-4"	2'-8"	3'-6 11/16"	4'-4 3/16"	5'-4"	7'-1 5/16"
17	3'-8 5/8"	3'-10 3/4"	4'-3"	4'-5 1/8"	4'-5 1/8"	4'-7 1/4"	2'-10"	3'-9 5/16"	4'-6 3/8"	5'-8"	7'-6 11/16"
18	3'-11 1/4"	4'-1 1/2"	4'-6"	4'-8 1/4"	4'-8 1/4"	4'-10 1/2"	3'-0"	4'-0"	4'-9 5/8"	6'-0"	8'-0"
19	4'-1 7/8"	4'-4 1/4"	4'-9"	4'-11 3/8"	4'-11 3/8"	5'-1 3/4"	3'-2"	4'-2 11/16"	5'-0 13/16"	6'-4"	8'-5 5/16"
20	4'-4 1/2"	4'-7"	5'-0"	5'-2 1/2"	5'-2 1/2"	5'-5"	3'-4"	4'-5 5/16"	5'-4"	6'-8"	8'-10 11/16"
21	4'-7 1/8"	4'-9 3/4"	5'-3"	5'-5 5/8"	5'-5 5/8"	5'-8 1/4"	3'-6"	4'-8"	5'-7 3/16"	7'-0"	9'-4"
22	4'-9 3/4"	5'-0 1/2"	5'-6"	5'-8 3/4"	5'-8 3/4"	5'-11 1/2"	3'-8"	4'-10 11/16"	5'-10 3/8"	7'-4"	9'-9 5/16"
23	5'-0 3/8"	5'-3 1/4"	5'-9"	5'-11 7/8"	5'-11 7/8"	6'-2 3/4"	3'-10"	5'-1 5/16"	6'-1 5/8"	7'-8"	10'-2 11/16"
24	5'-3"	5'-6"	6'-0"	6'-3"	6'-3"	6'-6"	4'-0"	5'-4"	6'-4 13/16"	8'-0"	10'-8"

___ C. VAPOR BARRIERS (5)

___ 1. General

___ *a.* Vapor can penetrate walls and roof by:

___ (1) Diffusion—vapor passes through materials due to:

___ (*a*) Difference in vapor pressure between inside and outside.

___ (*b*) Permeability of construction materials.

___ (2) Air leakage by:

___ (*a*) Stack effect

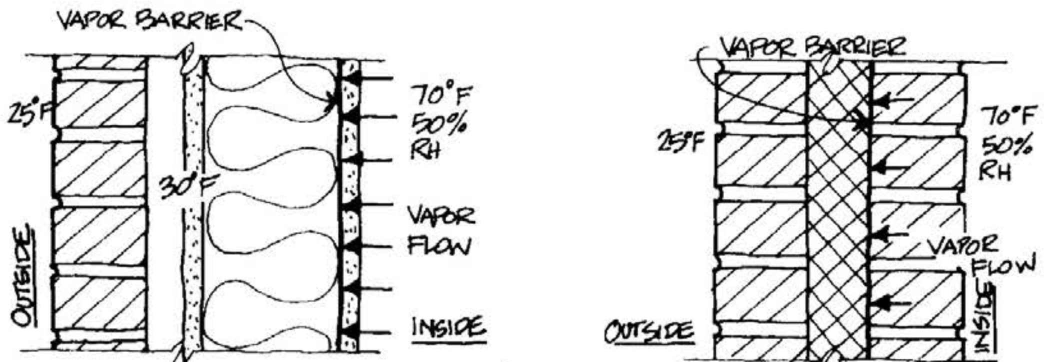
___ (*b*) Wind pressure

___ (*c*) Building pressure

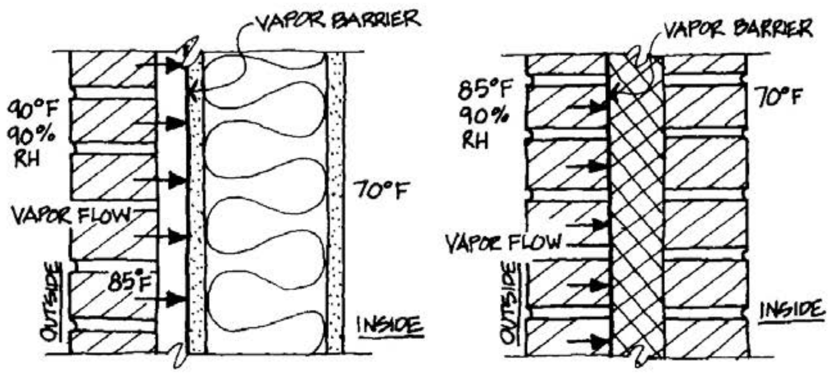
___ *b.* Vapor is not a problem until it reaches its *dew point* and condenses into moisture, causing deterioration in the building materials of wall, roof, and floor assemblies.

___ 2. Vapor Barriers: Should be placed on the warm or humid side of the assembly. For *cold* climates this will be toward the inside. For warm, humid climates, this will be toward the outside. Barriers are also often put under slabs-on-grade to protect flooring from ground moisture.

Vapor barriers are measured by *perms* (grains/SF/hr/inch mercury vapor pressure difference). One grain equals about one drop of water. For a material to qualify as a vapor barrier, its perm rate must be *1.0* or less. A good perm rate for foil laminates, polyethylene sheets, etc. equals *0.1* or less (avoid aluminum foil against mortar). See p. 381 for perms of various materials. Care must be taken against puncturing the barrier.



COLD CLIMATE



HOT HUMID CLIMATE

Other methods are elastomeric coatings on interior wallboard in cold climates and at exterior masonry or stucco walls in hot, wet climates. See p. 436 for coatings. Care must be taken to caulk all joints and cracks (see p. 394).

___ 3. Roof Vapor Retarders

___ *a.* As a general guide, vapor retarders should be considered for use when:

___ (1) The outside, mean, average January temperature is below 40°F.

___ (2) The expected winter, interior, RH is 45% or greater.

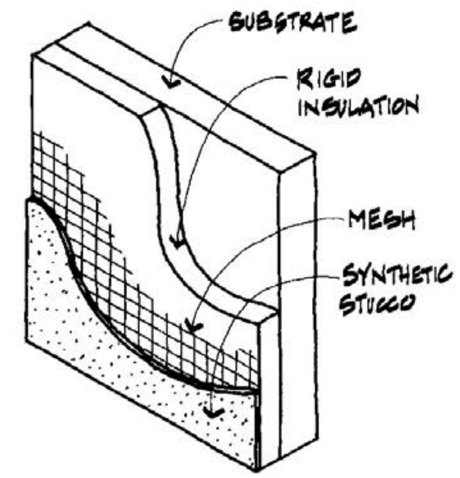
___ *b.* Vapor retarders generally fall into two classes:

___ (1) Bituminous membranes: A typical 2-ply installation using 3 moppings of steep asphalt rates at less than .005 perms.

___ (2) Sheet systems, with sealed laps, such as PVC films, kraft paper, or alum. foil, with perm ratings ranging from 0.10 to 0.50.

___ *c.* When vapor is a concern in top of deck insulation, moisture relief vents (preferably one-way) at a min. of one per 1000 SF should be considered.

___ F. EXTERIOR INSULATION AND FINISHING SYSTEMS (EIFS)



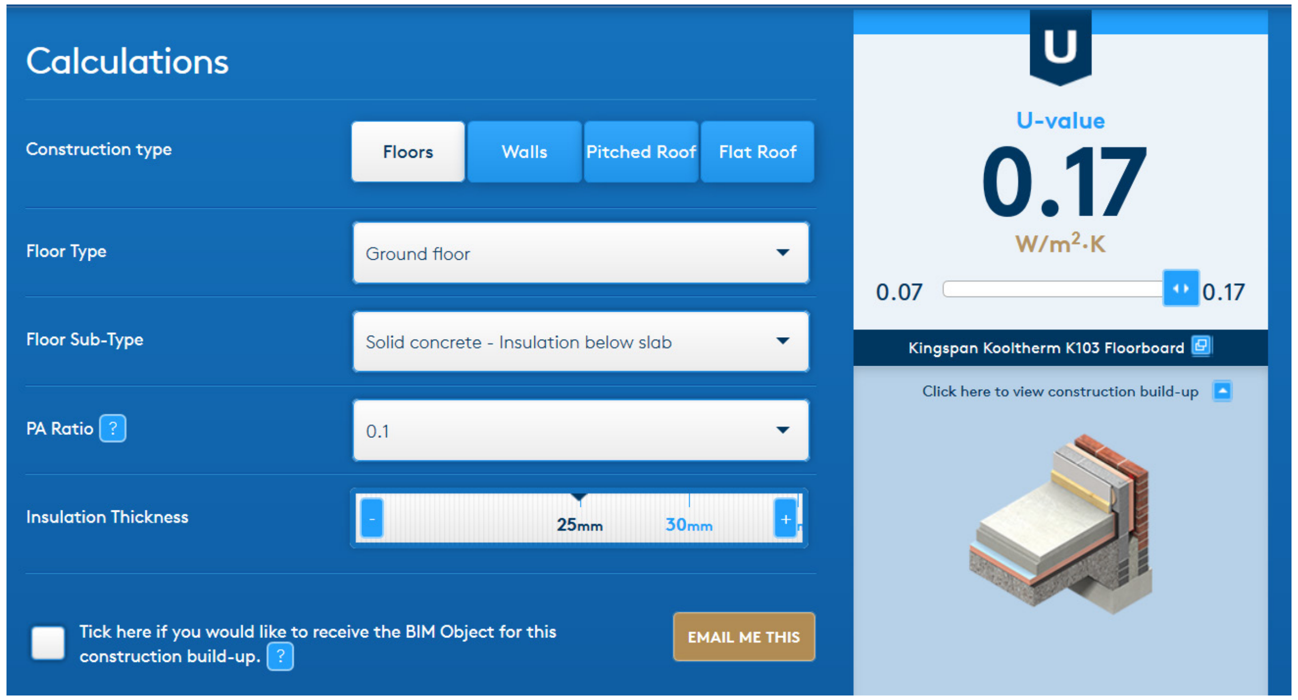
___ 1. Exterior Insulation and Finishing Systems (EIFS) provide a stucco appearance using exterior insulation. They involve a combination of exterior-applied synthetic stucco on rigid insulation on a substrate (see item 32 on p. 200). Substrate can be masonry, gypsum board, plywood, etc.

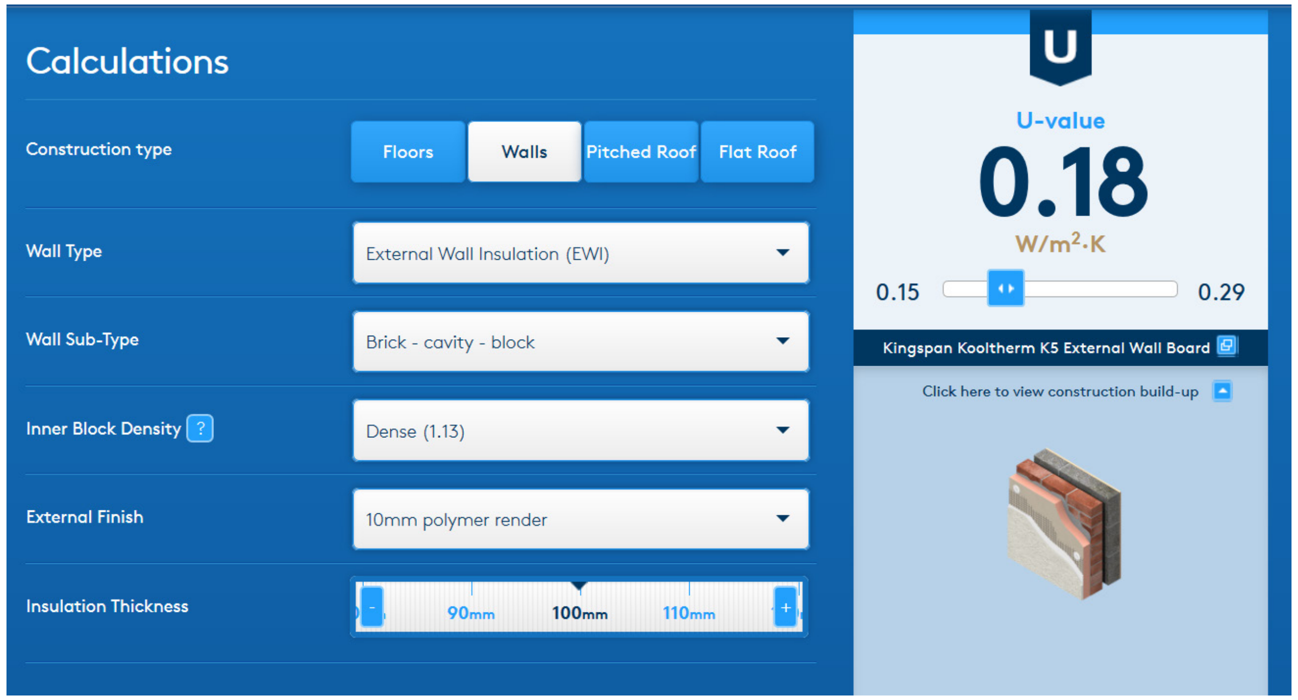
___ 2. Rigid insulation is typically expanded polystyrene (R/in. = 4.17) of 1″ up to 4″ thickness, and is usually applied by adhesive.

___ 3. Synthetic stucco is applied after a fiber mesh is embedded in an adhesive.

Costs: For 1″ board $8.00/SF (30% M and 70% L), + 30% variation. Add $0.20/SF for each added 1″ of insulation.

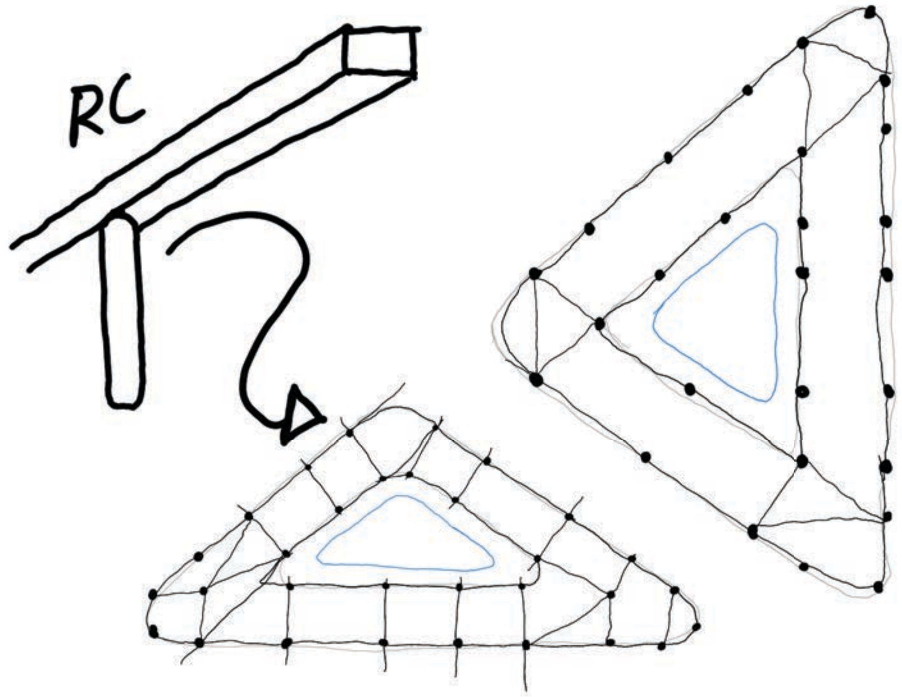
U VALUE CALCULATION



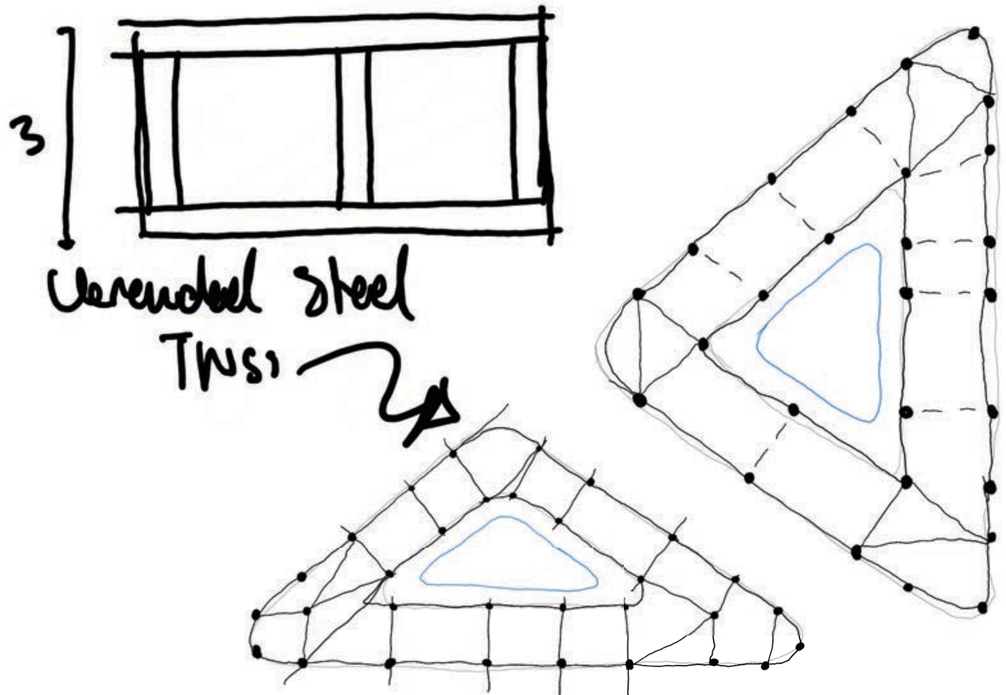


ANNEX C STRUCTURE DPT. STUDY BREIF

After the analysis of similar examples and precedant studies, HAR initiated five structural concept after which, the most effecient structure would be chosen to proceed.

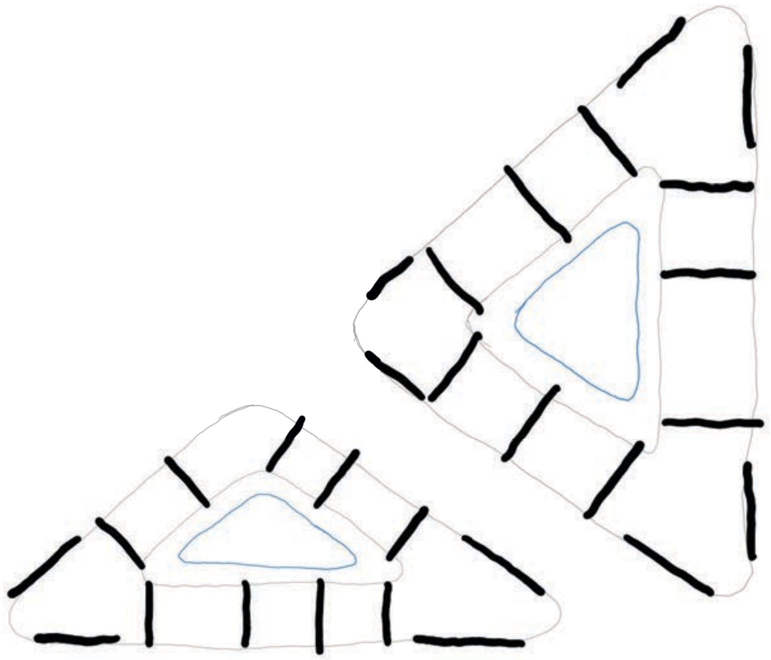


1. RC SKELETON FRAME



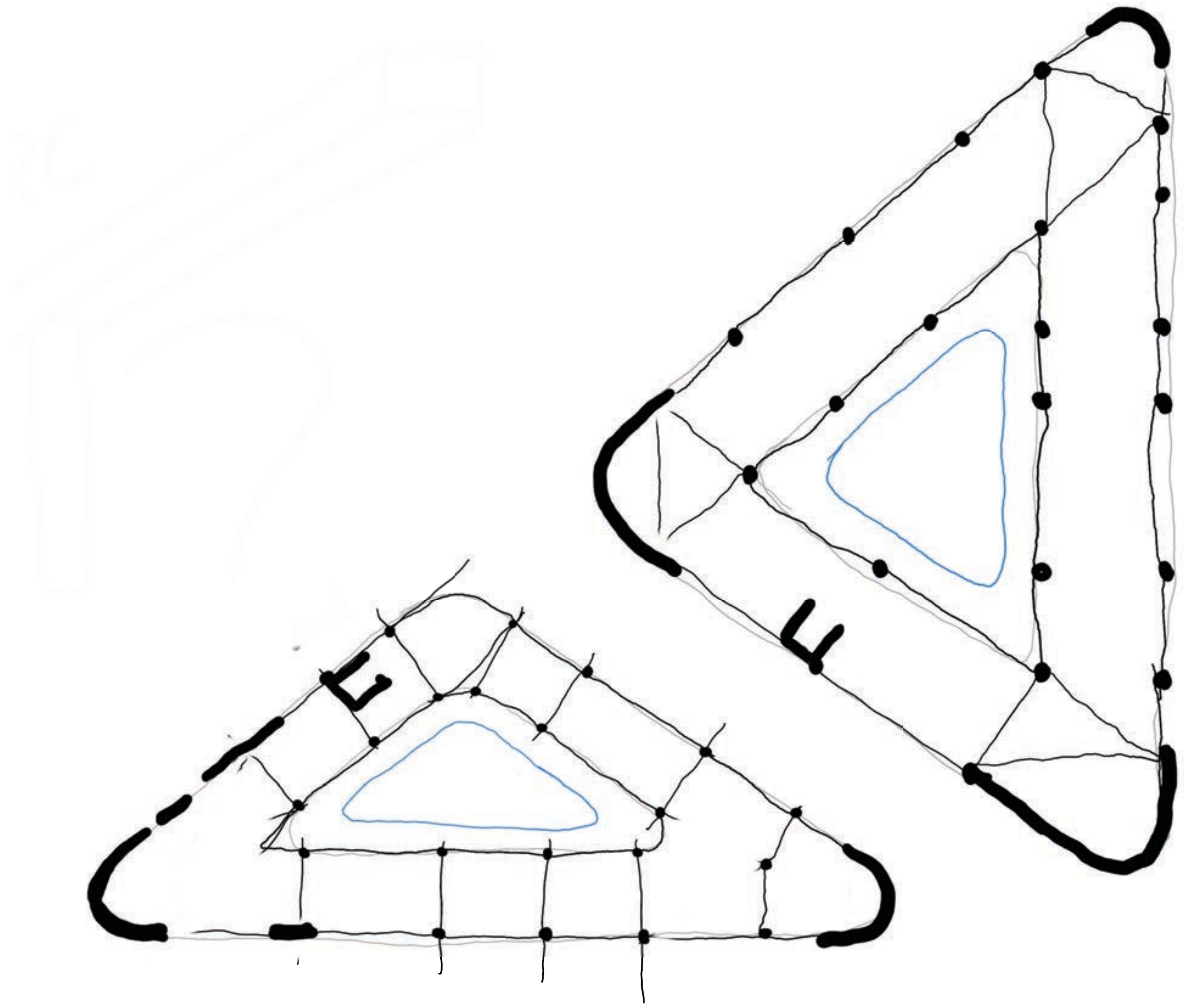
2. VERENDEEL STEEL TRUSS

3. PERPENDICULAR SHEAR WALLS



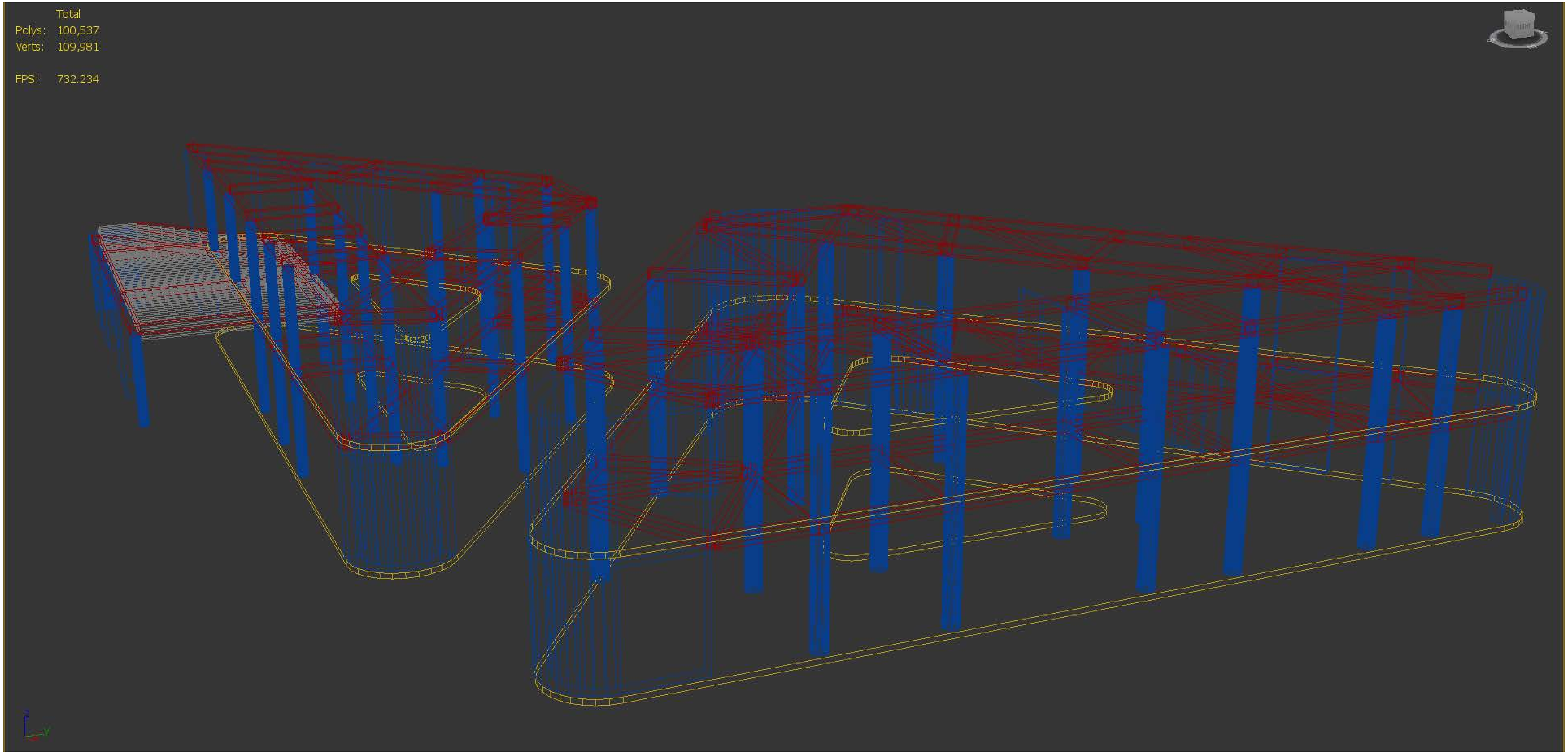
4. PEREMETRIC RC SHEAR WALLS

5. HYBRID SYSTEM OF SKELETON FRAME AND SHEEAR WALLS

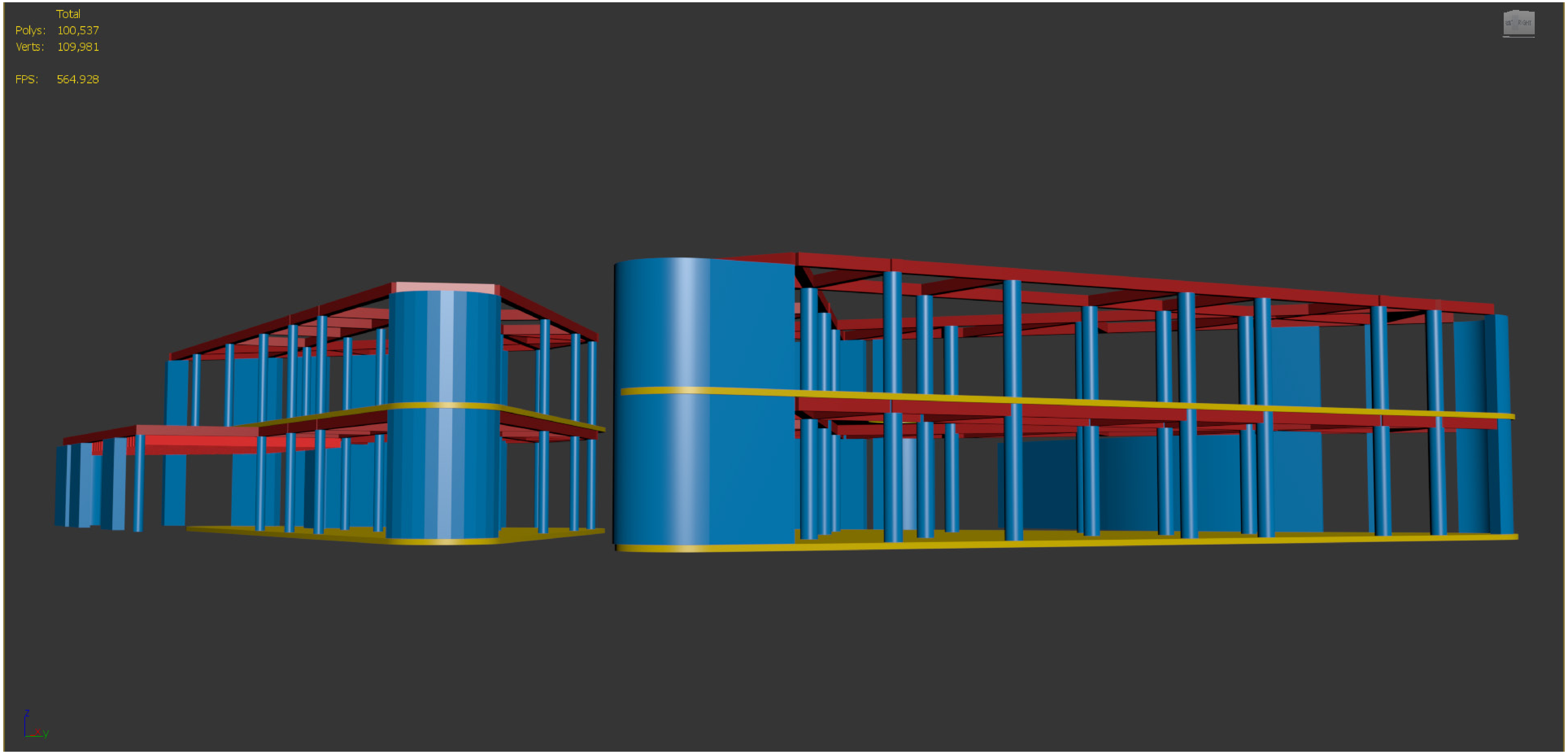


The fifth alternative was selected to be the structural framework of the HAR project, for Building C + Buildling D, the system is a hybrid of two RC elements, a skeleton frame, and shear walls. This system was selected due to its efficiency for this project when compared to the other alternatives, as it provides the flexibility within the inner spaces that the skeleton fram offers, and also the good bracing that the shear walls suggest. This option would be optimum for the HAR function.

STRUCTURAL ANALYSIS

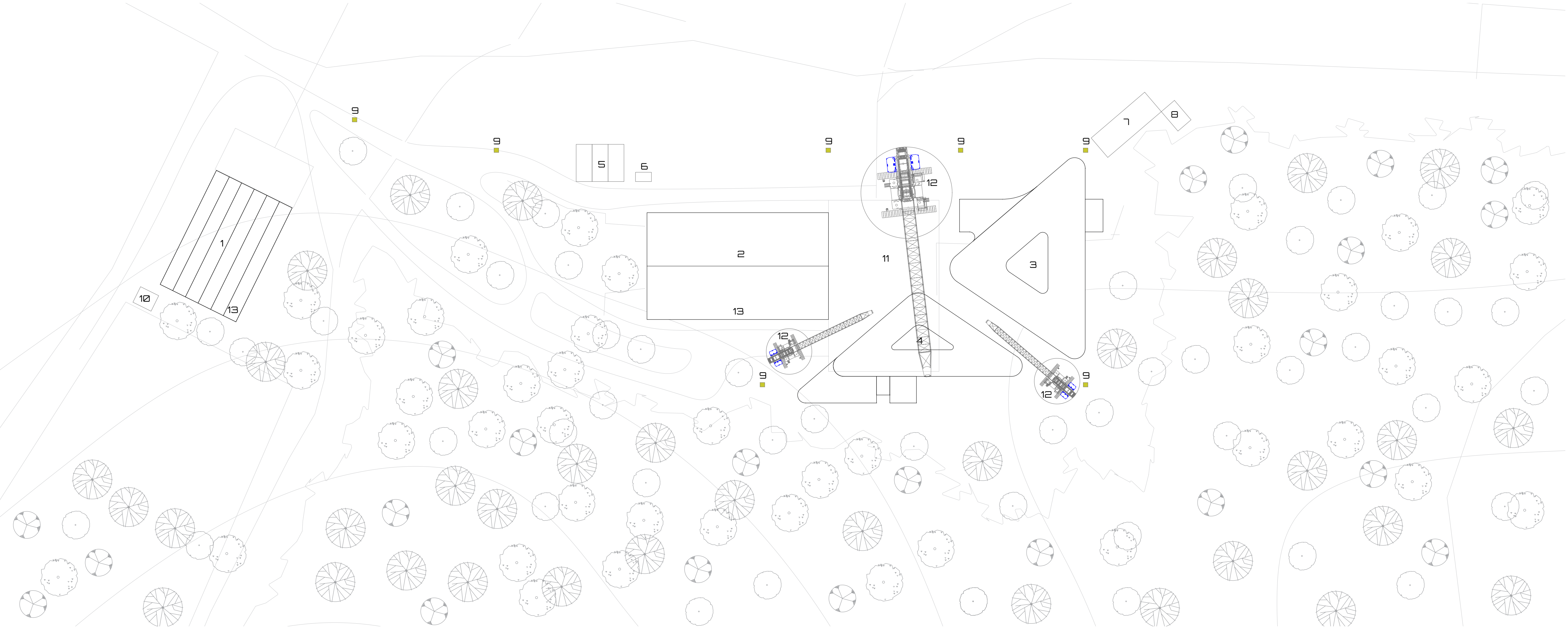


STRUCTURAL ANALYSIS

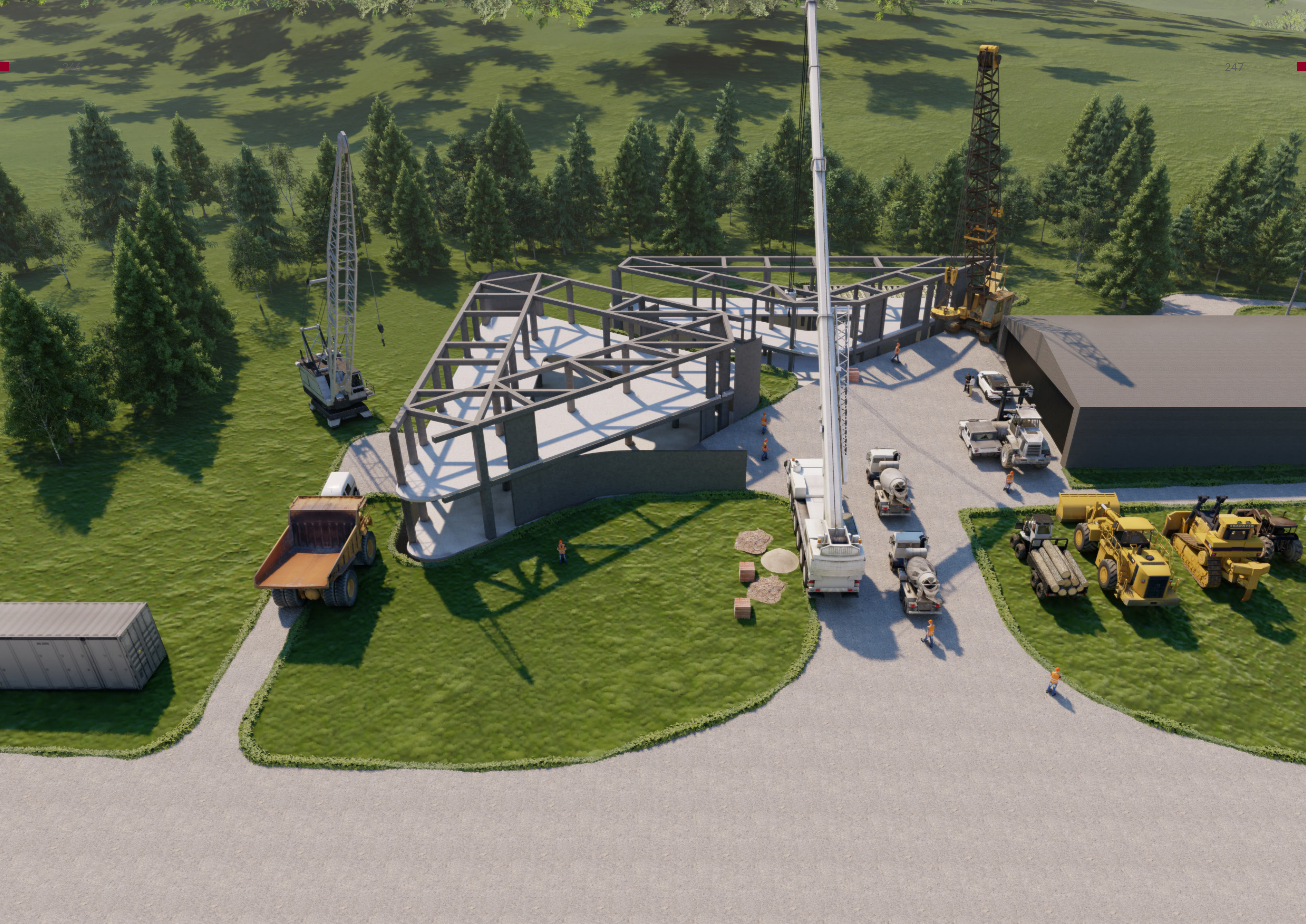


ANNEX D PROJECT MANAGEMENT STUDY BREIF

1. BUILDING A
2. BUILDING B
3. BUILDING C
4. BUILDING D
5. VEHICLE + HEAVY MACHINERY PARKING
6. GENERATOR
7. STAFF OFFICES/RESTING AREA
8. STAFF TOILETS
9. BENCHMARK / STATIONS
10. GUARD ROOM
11. ON-SITE CONSTRUCTION WORKSHOP AREA
12. CRANE
13. STORAGE (the existing hangar will be used as a storage during the process of construction)

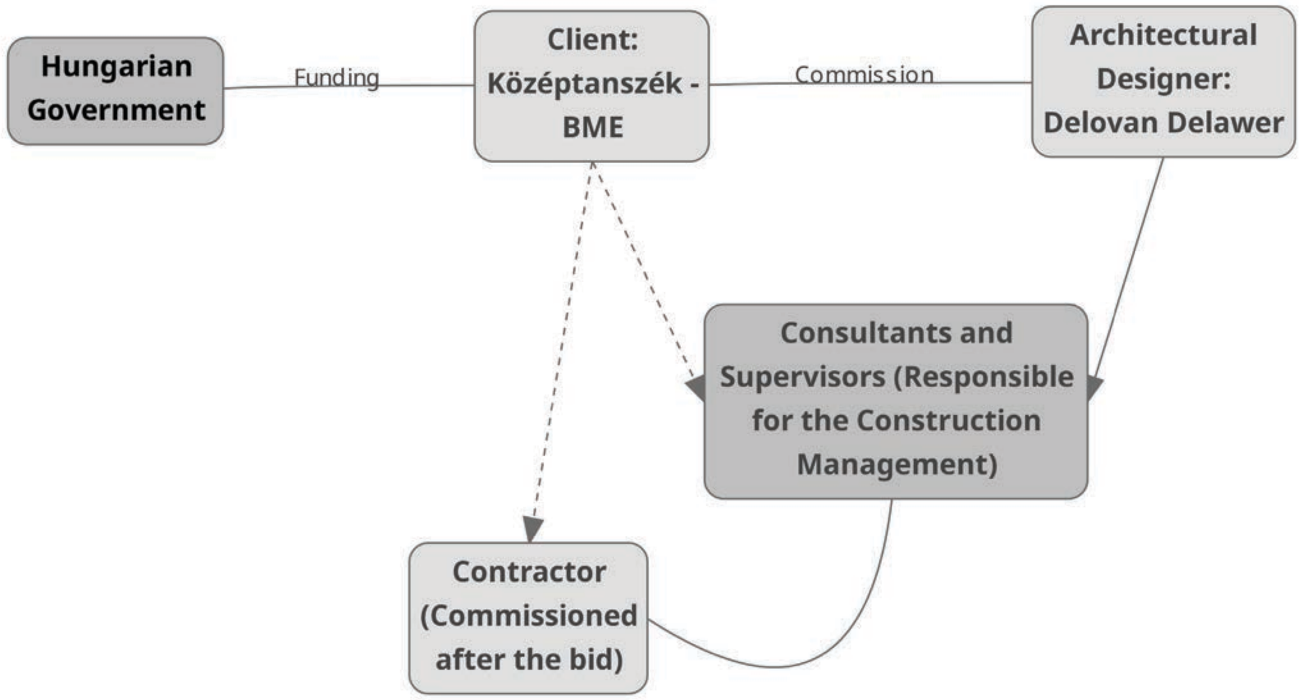


Construction Site Plan



PARTICIPANTS IN THE CONSTRUCTION OF HAR COMPLEX

A



Architectural Designer
Delovan Delawer

Location
Budapest, 1037, Hungary

Client
Középtanszék - BME

Consultant
Dr. Schrammel Zoltan

Construction Technology and Management Consultant
Mr. Zoltán Rostás

Building Energetics and Plumbing Consultant
Mr. Zoltán Magyar

Mechanics, Materials and Structures Consultant
Dr. Sajtos István

Building Construction Consultant
Dr. Fülöp Zsuzsanna

PM and Supervisors
To be Hired based on their proposals of schedules and exposure to such projects
Contractor
Selected after a winning bid they submit

GOALS OF CONSTRUCTION OF HAR COMPLEX

The building aims to achieve multiple goals among which political goals which are to stronger bonds withing the European Union, as the project aims to host the activities EGU (the European Gliding Union). The project does also aim to attract more users to this beautiful natural feature in the city of Budapest, there comes the economic goal, which is actually a main goal, since the building offers services to the public which is around 80% of the people visiting the site, and also the 15% of the users that are employees which means it is providing their families a living. One of the main target user group of HAR Complex is the customers, discussed in the second part of the previous chapter in the user types, as Clerks that form 15% of the user types, the Customers, that make up around 50% (the 60% of the the Public Users in the whole project's ration).

The operational time and working hours are as following:
8:00 AM - 6:00 PM working hours and the building is open (indoor)
7:00 PM - 11:59 PM the landscape of the building will be open to the public as public space or/ park.

COSTS OF THE WHOLE CONSTRUCTION PROJECT

C

The HAR Complex overall construction cost is to be estimated around 6,303,329 Euro which equivalent to 2,051,368,211 HUF, The 7500 sqm plot in District II is roughly estimated to be worth of 779,793 Euro would be provided by the Ministry of Planning in Hungary (Hungarian Goverment).

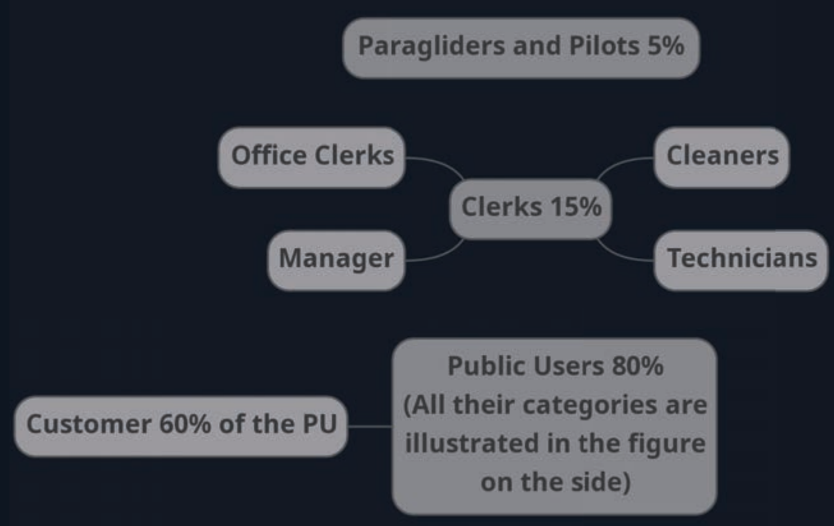
Although the cost of construction is mostly dependent on the quality of the materials used for the construction and their originating location, and as discussed before, for the project to succeed it is better to consume locally available materials and assign local experienced labor. The Structure of the project, on the other side, the skeleton frame and structural shering walls would form the highest concern in the cost estimation process. Not to mention that the preparation period would not cost a lot of money, since it was a competition held by BME. Therefore, there are not a lot of cost measures to be taken into consideration in an extra manner.

USER GROUPS OF THE HAR COMPLEX

1. Clerks:
Those who run the building and the main functions ofthe building residing in the offices. + the technicians that keep the building maintened. They make up to 15% of the user types. This category includes the officers at the control room/tower at Building D. This category subcategorize into the Office Clerks, Technicians, Cleaners and a Manager, and Janitors.

2. Paragliders and Pilots:
This user group are those who put the Airfield port and the paragliding decks to their use, they make up to 5% of the total user types count of the HAR complex. The Pilots tend to use the two Hangars, Building A and B. Though the paragliders do not tend to use the buildings directly unless they are using the public facilities like everyone else. such as those in Building C and D.

3. Public Users:
Are those who may come to the building to enjoy the public facilities within the landscape + cafe + Spa and entertainment activities at Building C and D. The make up the majority of the user types, up to 80%. Off this percentage, up to 60% would be benifiting and bringing benifits to the commercial zones within HAR.



SCHEDULE OF CONSTRUCTION OF HAR COMPLEX D

The schedule of the HAR Complex is to be set into two main phases that is broken down in Annex D, the Gantt Chart, the two main stages are composed: Phase One, which is the Planning Phase of which, the preparation for, must begin on January 10, 2020, and that in turn breaks down into two sub-categories, a) Research Phase, and b) Design Development. In which both sub-phases would take around around a year and a half. The second phase would be the Contracting and Construction which must start at the end of the first phases which ends in July 30 2021, which would last at least a good 450 days. So its fair to say that the schedule consists of two main milestones having to start with the planning phase and getting the necessary funds, so the construction could start which marks the second milestone of the project until the skeleton frame is erected which in turn allows other activities to be started, the second milestone fades as the construction process comes to an end. The factors that could affect the time estimation the most is just as any other project, the comitment of the contractors and supervisors within the construction phase, through transporting the materials to the site and carrying out other activities could be said to be the most challenging aspect in the time estimation, let alone the weather conditions and other typical project delaying factors, that must be taken into account

CIRCUMSTANCES OF THE CONSTRUCTION PROJECT E

As the project was through a held competition (which is the way how most of big projects are done in Hungary) the whole process was very clear at most of the times, and the guide of the consultants and people in charge was mostly technical and precised, especially that it had many goals to acheive.

If we skip that part and talk merely as if what could have happened if the project would be constructed, we would talk about the poor infrastructure and how to connect that into the selected site to build, as mentioned before multiple times, the suburban district of Pirzin is not so richly planned. As believed this would be the biggest challenge, from getting all the governmental approvals and the funds that would only be spent on providing services that must have been already there, from electricity, sanitation to other necessary services. Another problem that the project might face is the unreasonable delays in schedule that might happen because of delayed paperwork or lag in the funding procedure, which happens usually due to the economic crisis, that leaves most of the projects on pause for an unknown notice.

FINISHING MATERIAL LIST (FACADE + ROOF)

1. Hangar (RED BRICK + OXIDIZED STEEL ROOFING)
2. Interactive Hangar (RED BRICK + CERAMIC TILE ROOFING)
3. Administrative + Education Mass
   (BLACK BRICK CLADDING + CERAMIC TILE ROOFING)
4. Entertainment + Relaxing Mass
   (BLACK BRICK CLADDING + CERAMIC TILE ROOFING)

CREATE PM OFFICE

Create an office for the PM on construction site.

EXISTING BARRACKS

Integrate the existing barrack into the two new structures and merge them with the same finishing cladding

ON-SITE WORKSHOP

Create on-site construction and fabrication workshop area.

STAFF ROOMS

Having staff rooms, dedicated Waterclosets and a gaurd room on construction site.

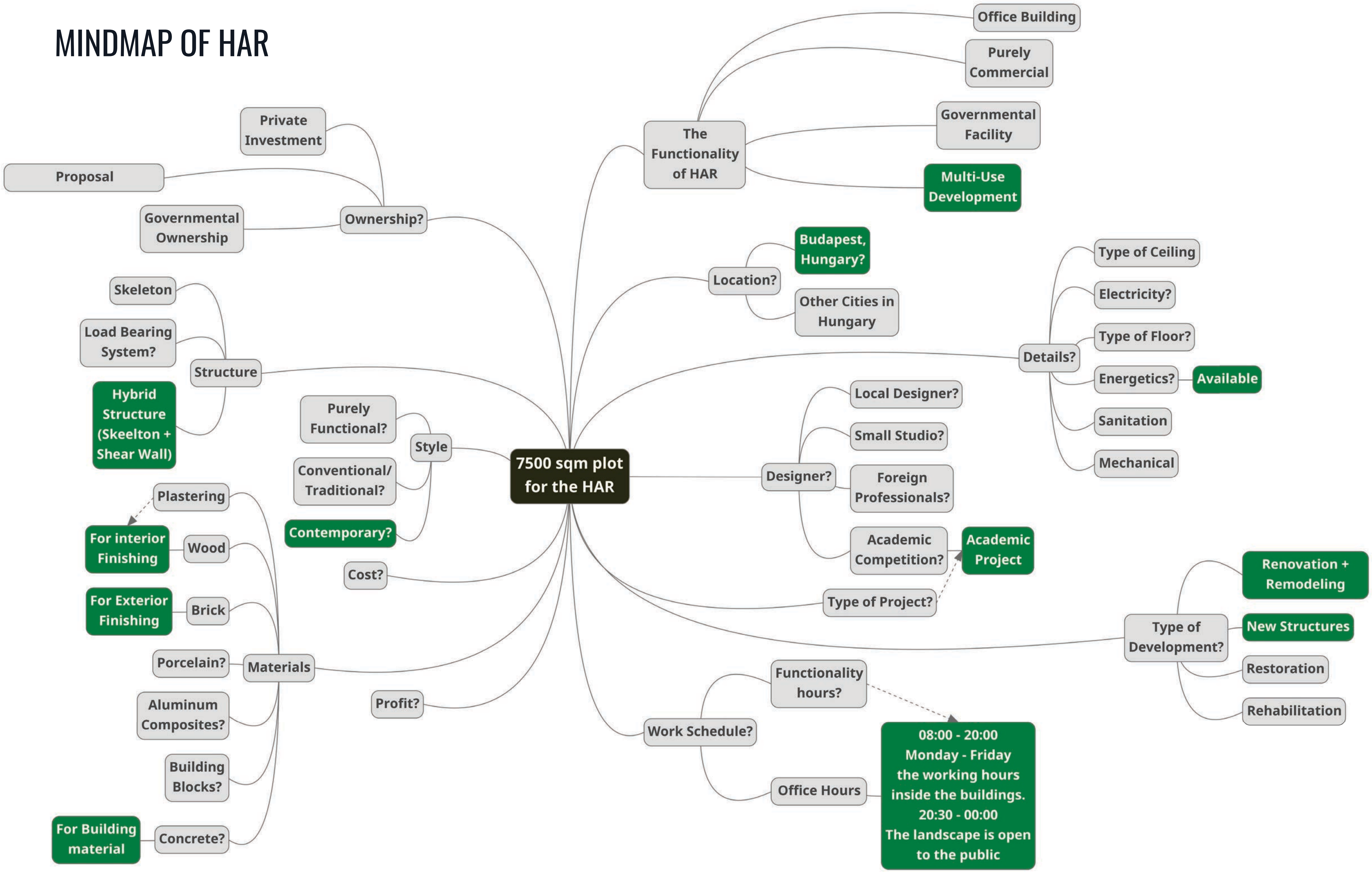
MACHINERY PARKING

Having on-construction-site parking for the construction machinery and vehicles.

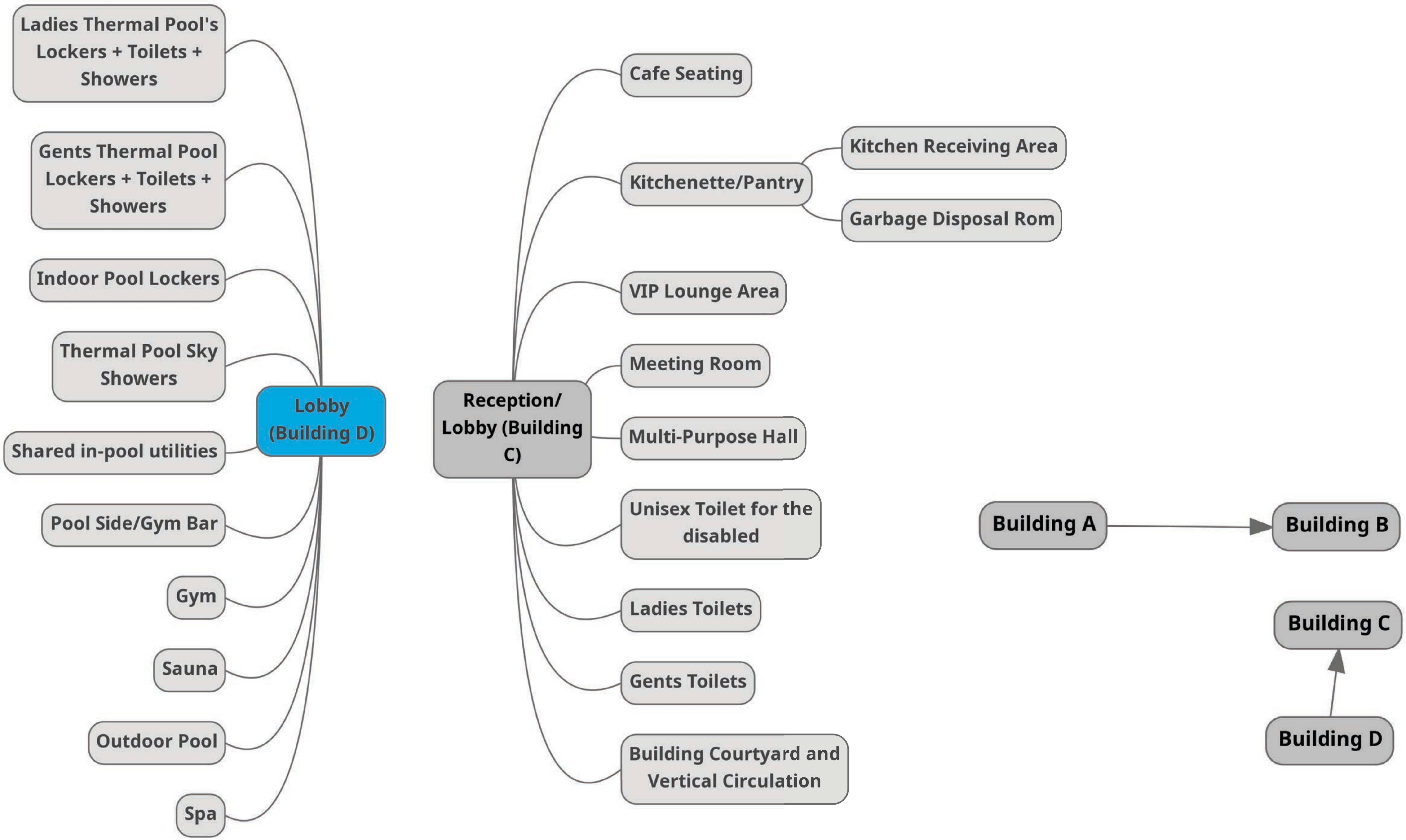
HANGARS' RENOVATION + RE-MODELLING

Renovate the both Hangars and rebuild the roof of Building A. And remodel both Hangars' facades.

MINDMAP OF HAR



FUNCTIONAL SCHEMA



COST ESTIMATION

Investment cost

194%

	Cost Groups	Estimated Cost (EUR)	Estimated Percentage
100	Plot	€ 779,793.36	24%
200	Infrastructure	€ 324,913.90	10%
300	Building Construction	€ 3,249,139.00	100%
400	Building Installations (Power + Sanitation)		
500	Outdoor Constructions (Landscaping)	€ 1,137,198.65	35%
600	Installations and Furnishing	€ 324,913.90	10%
700	Additional Expenses	€ 487,370.85	15%
	Total Amount	€ 6,303,329.66	194%

Building Construction + Installation cost

100%

Building A Floor Area Average	400	Price	€ 500.00
Building A Total Area	400	Total Amount	€ 200,000.00
Building A Floor Count	1		

Building B Floor Area Average	690	Price	€ 500.00
Building B Total Area	690	Total Amount	€ 345,000.00
Building B Floor Count	1		

Building C Floor Area Average	500	Price	€ 872.30
Building C Total Area	1000	Total Amount	€ 872,300.00
Building C Floor Count	2		

Building D Floor Area Average	700	Price	€ 872.30
Building D Total Area	2100	Total Amount	€ 1,831,830.00
Building D Floor Count	3		

Building Installations	€ 909,758.92	28%
Building Construction	€ 2,339,380.08	72%

Construction Costs (Group 300)

72%

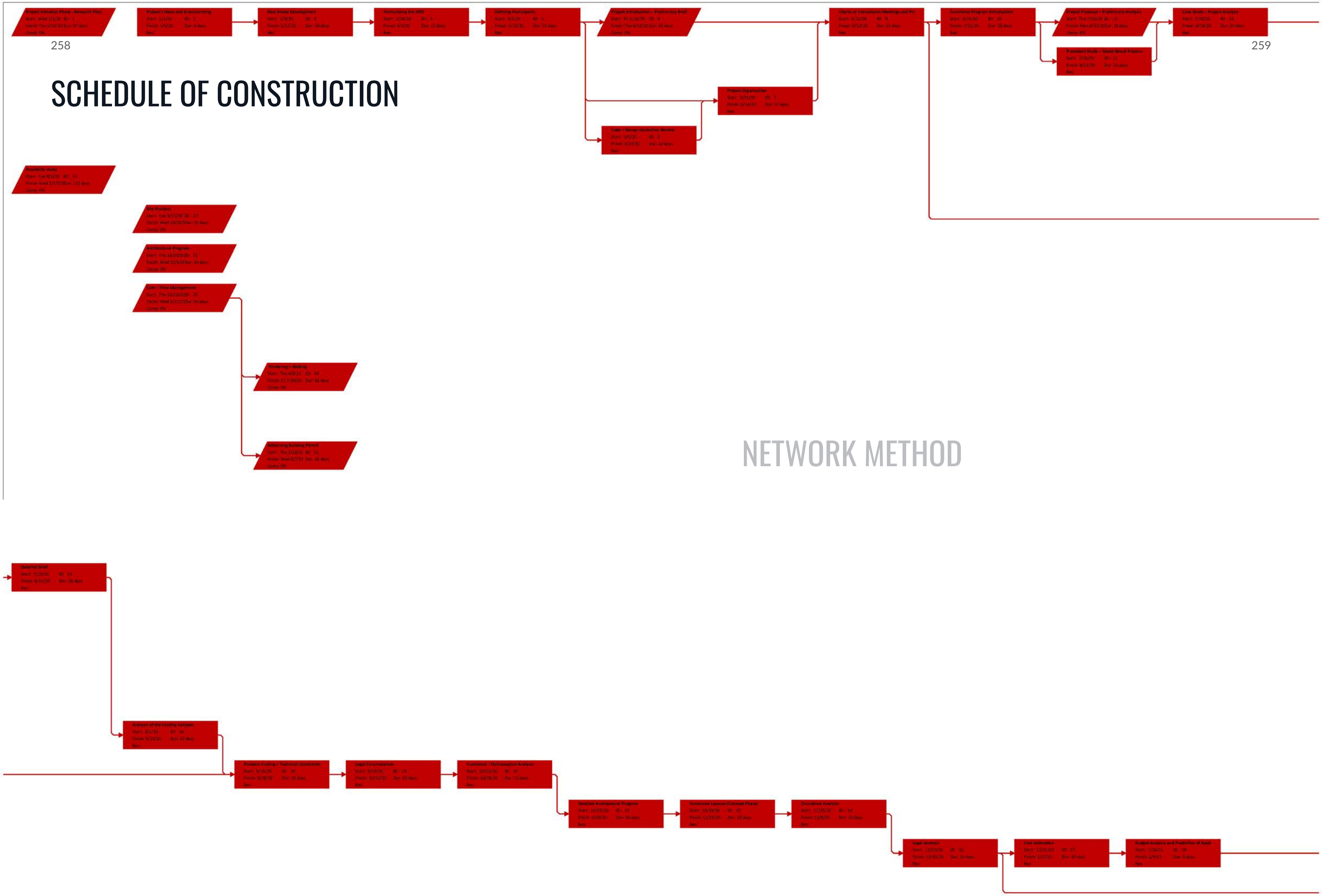
	Cost Groups	Estimated Cost (EUR)	Estimated Percentage
310	Earthwork	€ 70,181.40	3%
320	Foundation	€ 327,513.21	14%
330	External walls	€ 397,694.61	17%
340	Interior walls	€ 116,969.00	5%
350	Roof	€ 304,119.41	13%
360	Floors (slabs)	€ 233,938.01	10%
370	Built-in appliances	€ 140,362.80	6%
380	Other	€ 93,575.20	4%
	Total Amount	€ 2,339,380.08	72%

Construction Costs (Group 400)

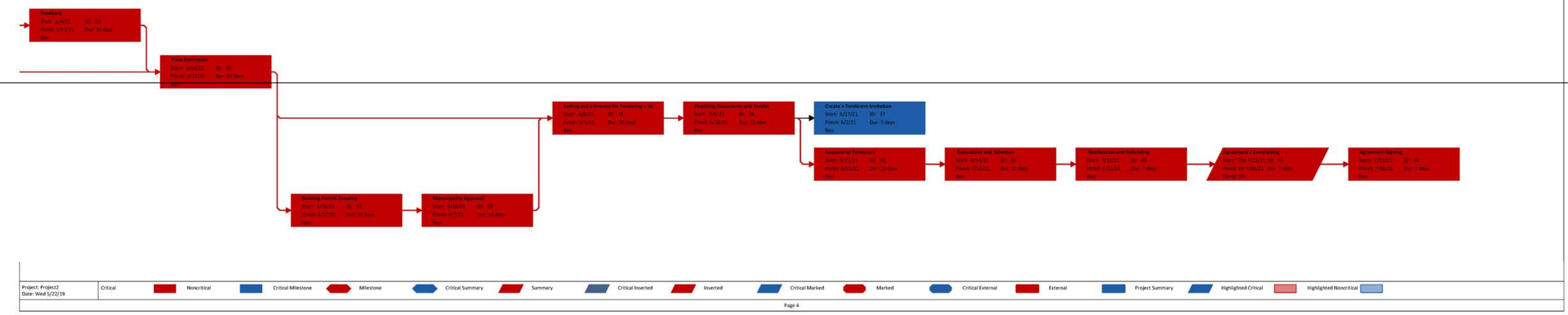
28%

	Cost Groups	Estimated Cost (EUR)	Estimated Percentage
410	Water, Sewage, Gas	€ 27,292.77	3%
420	HVAC	€ 72,780.71	8%
430	Electricity	€ 45,487.95	5%
440	Telecommunication and Information Technology	€ 25,473.25	3%
450	Transportation equipment	€ 18,195.18	2%
460	Technology equipment	€ 27,292.77	3%
470	Integrated building management and service management	€ 29,112.29	3%
490	Other	€ 9,097.59	1%
	Total Cost	€ 909,758.92	28%

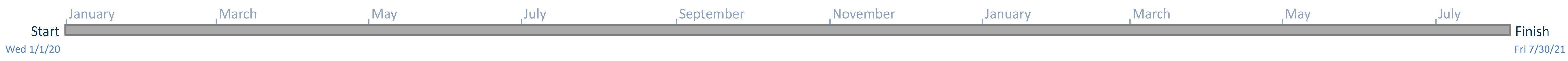
SCHEDULE OF CONSTRUCTION



NETWORK METHOD

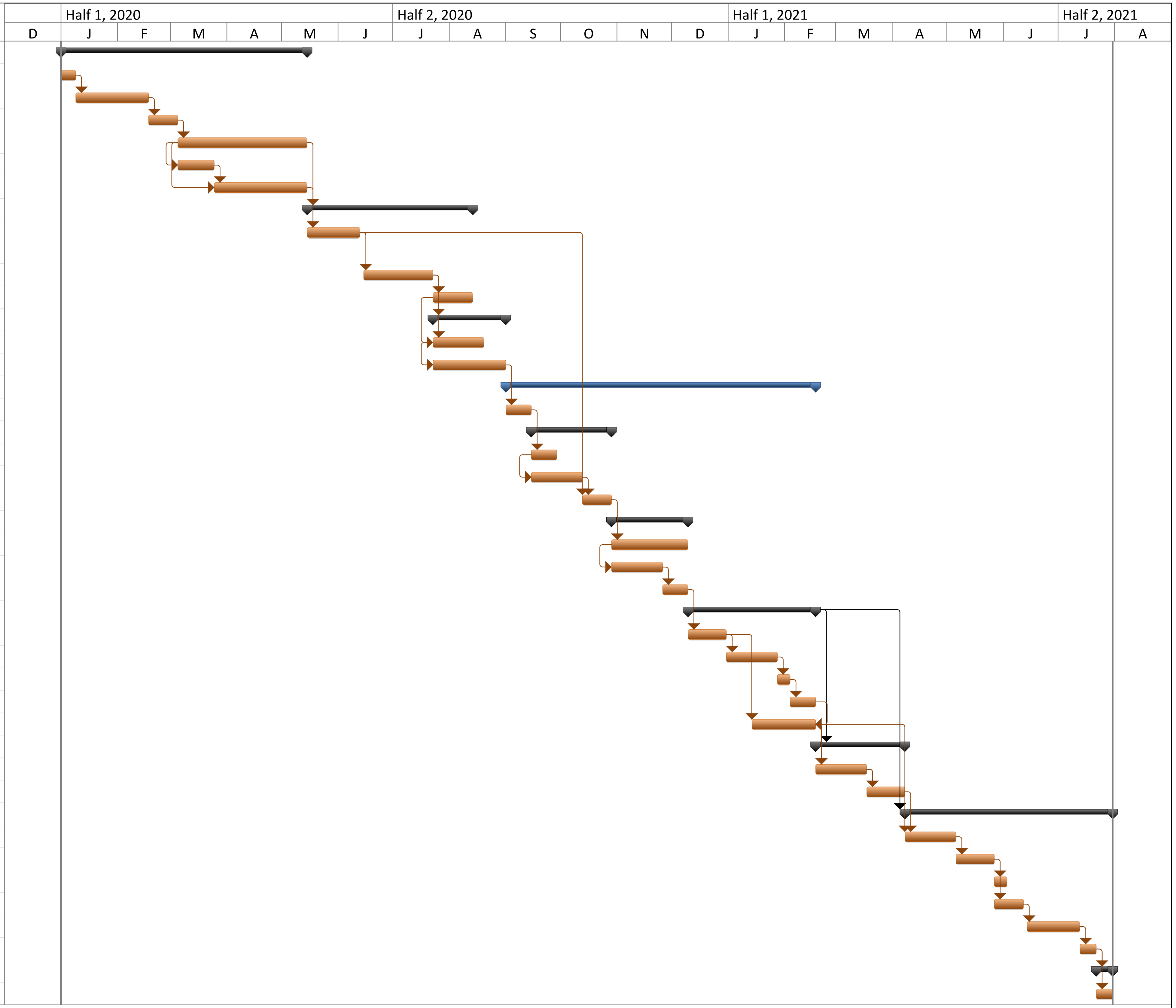


TIMELINE METHOD



GANTT CHART OF THE DETAILED ACTIVITIES

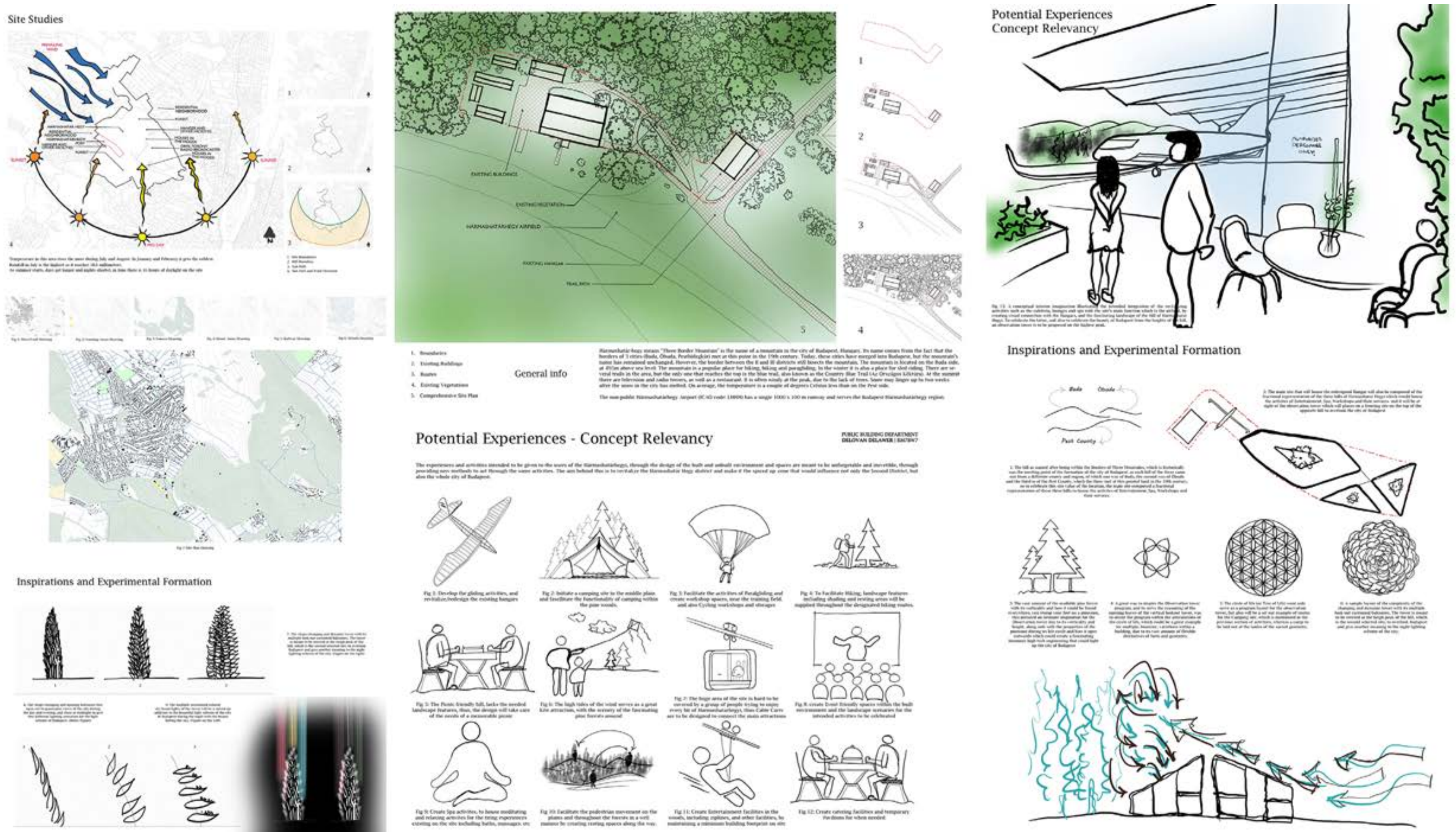
ID	Task Name	Duration	Start	Finish
1	**Project Initiation Phase - Research Phase**	**97 days**	**Wed 1/1/20**	**Thu 5/14/20**
2	Project's Ideas and Brainstorming	6 days	Wed 1/1/20	Wed 1/8/20
3	Real Estate Development	28 days	Thu 1/9/20	Mon 2/17/20
4	Formulating the AIM	12 days	Tue 2/18/20	Wed 3/4/20
5	Defining Participants	51 days	Thu 3/5/20	Thu 5/14/20
6	Code + Design Guidelines Review	10 days	Thu 3/5/20	Tue 3/24/20
7	Project Organisation	37 days	Wed 3/25/20	Thu 5/14/20
8	**Project Introduction + Preliminary Breif**	**65 days**	**Fri 5/15/20**	**Thu 8/13/20**
9	Clients or Consultants Meetings and Project Introduction	21 days	Fri 5/15/20	Fri 6/12/20
10	Functional Program Introduction	28 days	Mon 6/15/20	Wed 7/22/20
11	Precedent Study + Mood Board Preparation	14 days	Thu 7/23/20	Thu 8/13/20
12	**Project Proposal + Preliminary Analysis**	**28 days**	**Thu 7/23/20**	**Mon 8/31/20**
13	Case Study + Project Analysis	**20 days**	**Thu 7/23/20**	Wed 8/19/20
14	Detailed Brief	**28 days**	**Thu 7/23/20**	Mon 8/31/20
15	**Feasibility study**	**122 days**	**Tue 9/1/20**	**Wed 2/17/21**
16	Analysis of the Existing Samples	10 days	**Tue 9/1/20**	Mon 9/14/20
17	**Site Analysis**	**32 days**	**Tue 9/15/20**	**Wed 10/28/20**
18	Problem Finding + Technical Constraints	10 days	**Tue 9/15/20**	Mon 9/28/20
19	Legal Circumstances	20 days	Tue 9/15/20	Mon 10/12/20
20	Functional - Technological Analysis	12 days	Tue 10/13/20	Wed 10/28/20
21	**Architectural Program**	**30 days**	**Thu 10/29/20**	**Wed 12/9/20**
22	Detailed Architectural Program	30 days	Thu 10/29/20	Wed 12/9/20
23	Functional Layouts (Concept Phase)	20 days	Thu 10/29/20	Wed 11/25/20
24	Circulation Analysis	10 days	Thu 11/26/20	Wed 12/9/20
25	**Cost + Time Management**	**50 days**	Thu 12/10/20	**Wed 2/17/21**
26	Legal Analysis	15 days	Thu 12/10/20	Wed 12/30/20
27	Cost estimation	20 days	Thu 12/31/20	Wed 1/27/21
28	Budget Analysis and Prediction of Applicability	5 days	Thu 1/28/21	Wed 2/3/21
29	Feedback	10 days	Thu 2/4/21	Wed 2/17/21
30	Time Estimation	25 days	Thu 1/14/21	Wed 2/17/21
31	**Attainning Building Permit**	**35 days**	Thu 2/18/21	**Wed 4/7/21**
32	Building Permit Drawing	20 days	Thu 2/18/21	Wed 3/17/21
33	Manucipality Approval	15 days	Thu 3/18/21	Wed 4/7/21
34	**Tendering + Bidding**	**82 days**	Thu 4/8/21	**Fri 7/30/21**
35	Setting out a Process for Tendering + Bidding	20 days	Thu 4/8/21	Wed 5/5/21
36	Finalizing Documents and Tender	15 days	Thu 5/6/21	Wed 5/26/21
37	Create a Tenderers-Invitation	5 days	Thu 5/27/21	Wed 6/2/21
38	Respond to Tenderers	12 days	Thu 5/27/21	Fri 6/11/21
39	Evaluatiion and Selection	21 days	Mon 6/14/21	Mon 7/12/21
40	Notification and Debriefing	7 days	Tue 7/13/21	Wed 7/21/21
41	Agreement / Contracting	**7 days**	Thu 7/22/21	**Fri 7/30/21**
42	Agreement Signing	7 days	Thu 7/22/21	Fri 7/30/21



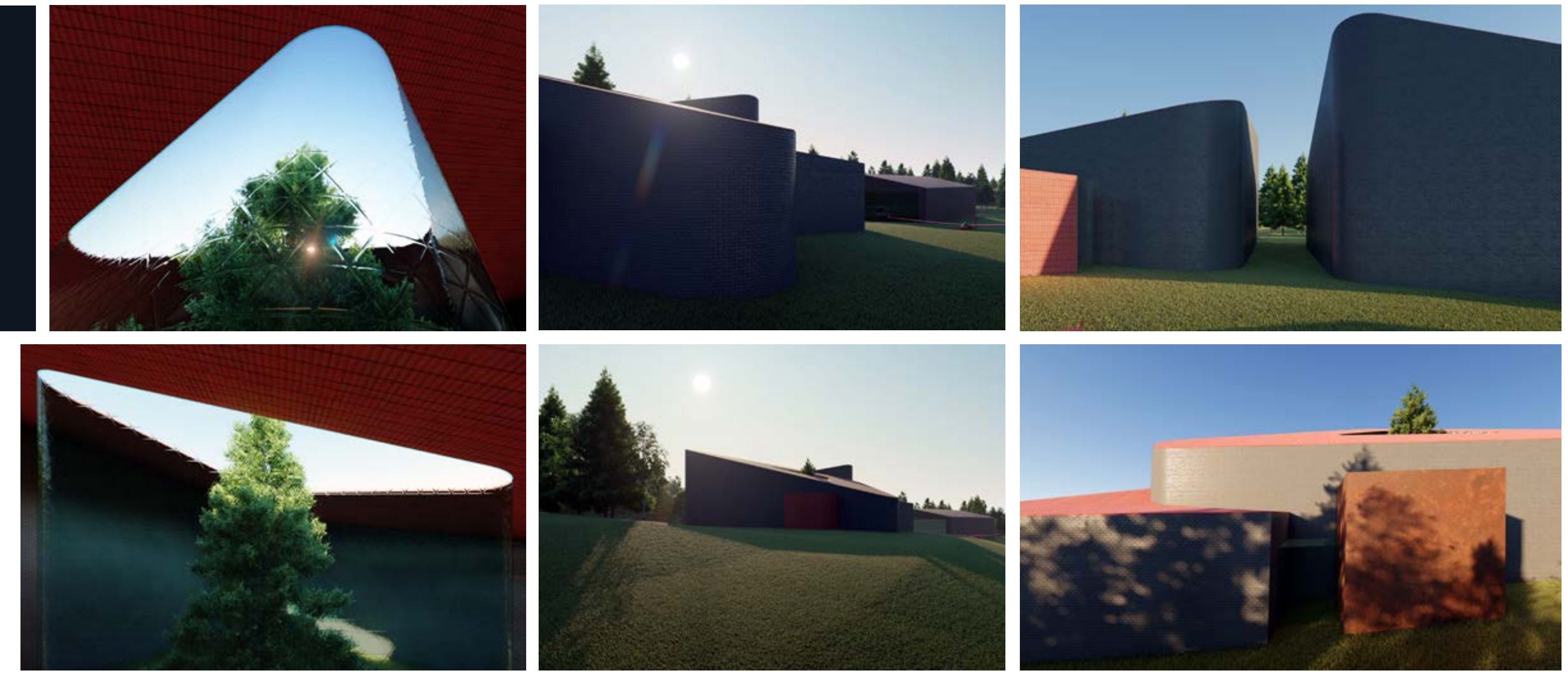
Project: Project2
Date: Wed 5/22/19

Task | Split | Milestone | Summary | Project Summary
External Tasks | External Milestone | Inactive Task | Inactive Milestone | Inactive Summary
Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only
Finish-only | Deadline | Baseline | Baseline Milestone | Baseline Summary
Progress | Slippage

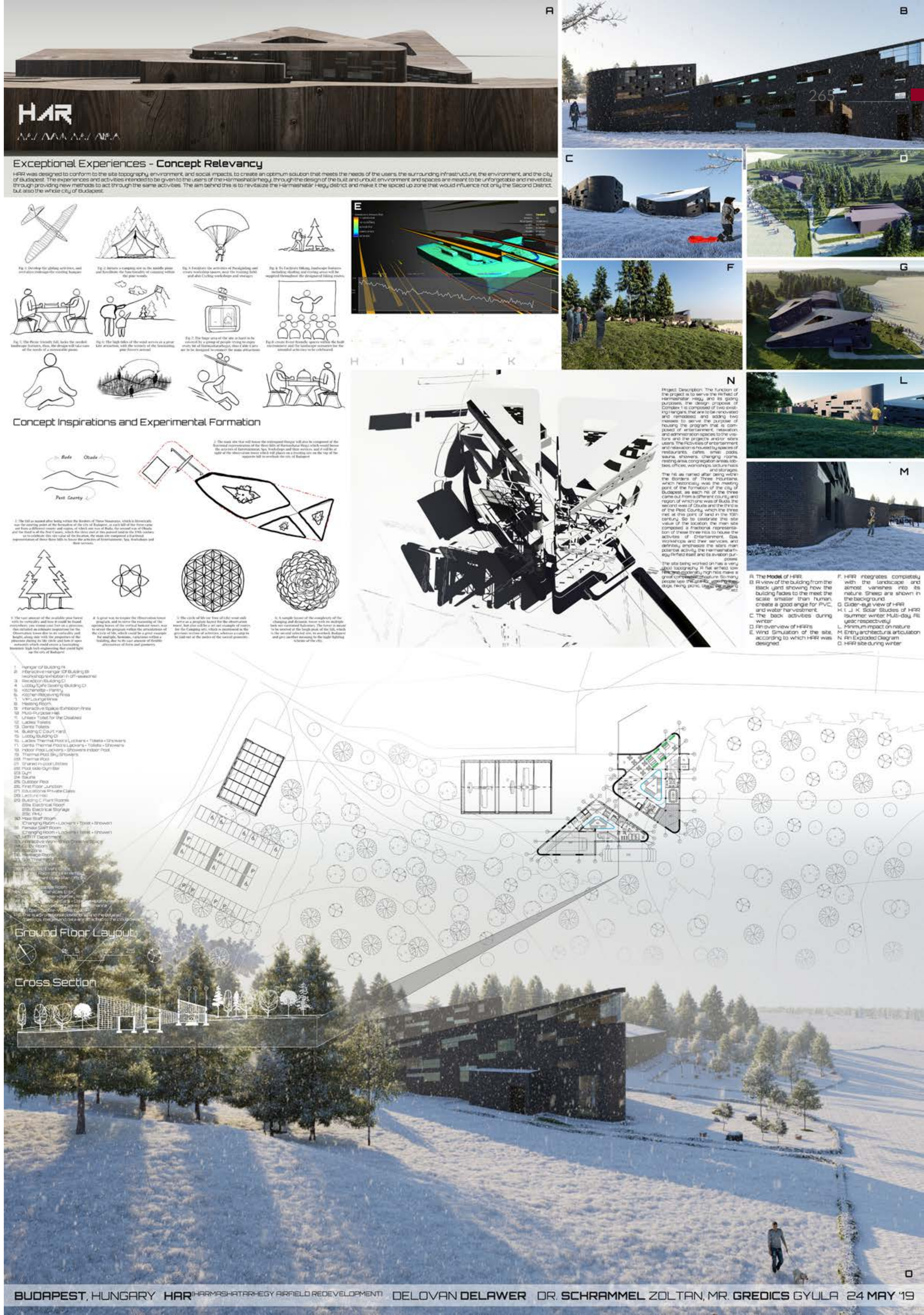
ANNEX E HAR SUBMISSIONS THROUGHOUT THE 2019 WINTER SEMESTER AT BME



March, 4, 2019, Concept Submission



April, 15, 2019, Preliminary Submission (Above) May, 23, 2019 Final Submission (Right)



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END

QUESTIONS?

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