CROMELEQUE DOS ALMENDRES VISITOR CENTER

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TITLE PAGE

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ATTACHEMENTS
Appendix A
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ABSTRACT

This report presents the process of designing a visitor center for the megalithic complex Cromeleque dos Almendres, situated near Évora, Portugal. The visitor center addresses the problem concerning the lag of visitors to the site, even though the historical granite monoliths are in great condition and are surrounded by both a beautiful landscape of cork oaks and olive trees and a great view over Évora.

The design aims to add value to the surrounding area without creating a new landmark. A humble expression and focus on functionality and flexibility will give the visitors a place to experience different functions related to Cromeleque dos Almendres.

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INTRODUCTION

PROLOGUE

This is a master thesis project by group 27 from the 4th semester 2017 of Architecture at Architecture and Design, Aalborg University.
The report shows the entire design process of developing the visitor center located at the historical site Cromeleque dos Almendres, situated near Évora in Portugal.

The motivation of the project is based on the interest in how to make an old historical site gain more tourism than currently, through architecture that will complement the great history found in the old relics of the site. Creating interesting architecture that won't take over the site, but complement the existing qualities found at the site.
Évora is already today a city well visited by cultural and historical tourist, but by reasons yet unknown is Cromeleque dos Almendres not considered worth visiting by the tourist, even though being the biggest cromlech found in Europe.

GUIDE OF READING

This report contains the presentation of the final design proposal of a visitor center situated at the historical site of Cromeleque dos Almendres.
In this section, the motivation and basic information about the project is presented. Next section is presenting different focus points and two themes used throughout the project. The outline of the project is presented, describing the competition brief, historical information and potentials for the projects influence. This leads to the problem statement, describing why the visitor center is needed for this location.

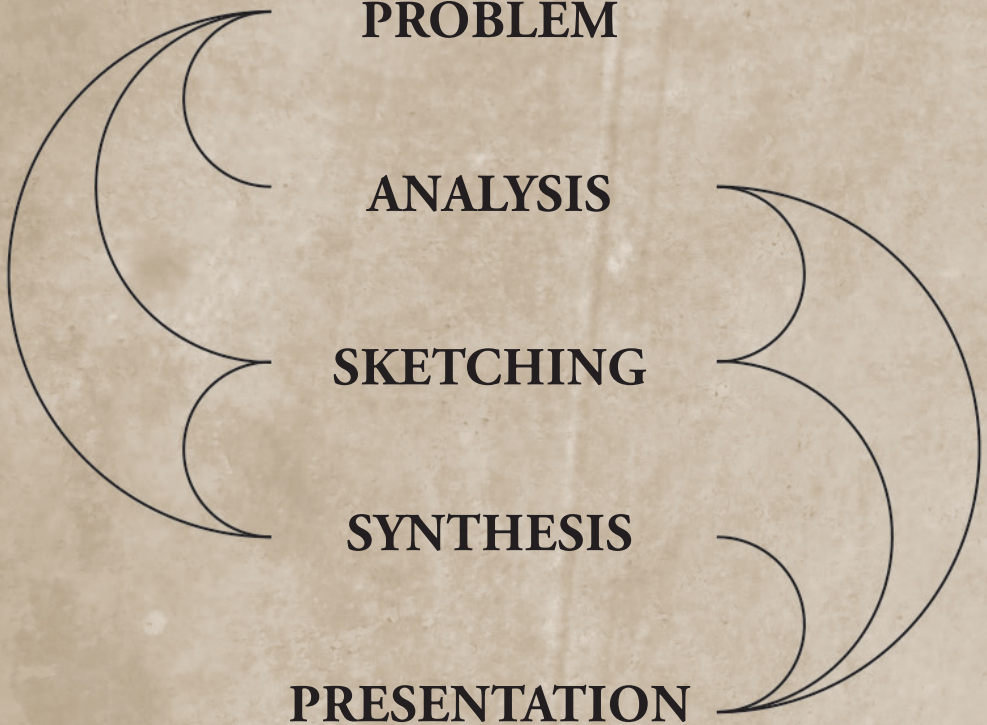
Next section presented in the report is the program. Here information about the target group and spatial program for the visitor center is presented. This is followed up by case studies of different visitor centers having the same approach as wanted for this visitor center. Next up is the site analysis which was used to achieve the information needed about the area designing in.

Following section is the concept and the presentation of the final project followed by the design process. The report ends with the reflections upon the work and process, and the appendix with the technical drawings and calculations.

OBJECTIVES

The main objective of this project is to create a building that will have the possibility to influence the tourism flow and acknowledge of the historical site of Cromeleque dos Almendres, which today is nearly not visited by tourists or locals. A visitor center in strong connection with the Cromeleque dos Almendres will be able to make the site more than just a historical site, but an area providing space for learning and experience for both tourists and locals.
To make a visitor center that provides more than just information, the building most include more features for the visitors, to invite for a longer stay in the area.

Through the project the already gain knowledge, through five years of education at Aalborg University and experience from working at architectural firms, is wanted to be used to achieve the best design solution possible. The main theme of the project is tectonics, the mix of architecture and engineering. This will be shown through the timber structure, which is going to be a vital part of the final design. Another theme chosen for the project is territory, beauty and monument, which covers how to design a building close to a historical, sacral site as the Cromeleque dos Almendres.



Ill. 3 - The Integrated Design Process

METHODOLOGY

With the architectural task of designing a building with such complexity as a visitor center, an approach where general intuition and technical research combined is needed. To achieve this holistic approach, the base of the project has been built upon The Integrated Design Process. *(Hansen & Knudstrup)* This method ensures an academic approach to the project, by merging aesthetic, functional and technical aspects together.

The *Integrated Design* Process's aim is to generate a systematic problem-solving to the problem asked. This is done through the five phases of the process. The different phases overlay each other, and are approaching closer to each other towards the finale design. This process is not chronological, but consists of several loops back and forth, between the phases. This ensures a constant knowledge sharing between the phases, making sure that all aspects are covered and has the ability to influence the finale design proposal, strengthen by the merge of both the architectural and engineering field. This should utterly generate a design, which will be a combination of aesthetic and technical parameters.

The first phase is the *Problem Phase*, this is the phase where the problem statement is formulated based on research and studies regarding the theme. This will form the foundation and focus for the design process.

The second phase of the process it the *Analysis Phase*, which will be used as the basis of the condition designing in. Analyses of the site and the surroundings are made to be able to create the concept and start the initial development of the design. In this stage mappings, diagrams, 3D and physical modelling will be used to obtain the information needed.

Third phase is the *Sketching Phase*. Here different proposals are sketched and tested regarding the concept. The early stage of the phase consists mostly of many sketched iterations and physical models, but further into the process, 3D programs are used to visualize the volumes and spaces in other scales. All information obtain in previous phase is used to develop through this phase.

The fourth phases I called the *Synthesis Phase*, which is the phase where all material created during the design process is gathered and merged into a more fixed design, using all the important aspects investigated and covered in the previous phases. The focus is put more into the detailing and refining of current design to ensure aesthetics, functionality and engineering aspects at a high level.

The final phases, the fifth phase, called the *Presentation Phase* is the part where the final material is produced for the presentation of the project. This phase is the end product of the previous four phases, and is important for the understanding of the process from problem statement to the final design.

FOCUS

The following section is a description of the focal points of the project. The aspects that is important will be revealed, and will be used as the base of the further design process.
Furthermore, the section contains detailed descriptions of the two main themes of the project.

FOCUS POINTS

CONCEPT

During the design process, it will be important to finding the idea that is simple and self-explaining, yet still able to accommodate the complex needs of a visitor center dealing with different types of visitors and their needs. By having one concept to use throughout the process, the finale project should signal one unity, where all details fit together and is not going in different directions.

LOCAL IDENTITY

The built should relate to the near context and the site. The new architecture added to the area should be able to tell and complement the history of the area surrounding Cromeleque dos Almendres. A visitor center is a parasitical building, and therefor can't overtake the focus of the area. To achieve this, the new building added to the area must respect the atmosphere and hierarchy of the existing historical site.

To achieve this, analysis of the surroundings will be used to find out what architecture will fit the area best. Also, the choice of materials will be important, where choosing local materials will make the building not seem aliens for the area.

USABILITY

The architecture is nothing without its users. It's the user that by its interaction with the building makes it into great architecture.
A tactile approach will create a building that will be able to influence all senses of the human body, making it easy for the visitor to relate to the new building.

Functionality is important if the building should invite the visitors to interact with the building, therefor simple design solutions is important, to give the visitors the best experience visiting the new visitor center.

Ill. 4 - Cromeleque dos Almendres

ATMOSPHERE

It is important that the atmosphere inside the visitor center is casual. This will help inviting the visitors to use the building without being afraid of doing stuff they're not allowed to do. At the same time, the visitor center has to project seriousness to respect the historical and sacral feeling of the Cromeleque dos Almendres.

The visitor center includes functions as exhibitions space, education space and a wine bar. Therefor is must function as both informal and at the same time entertaining. This makes the placement of the functions really important, since different atmosphere mixed together will ruin the experience for the visitors.

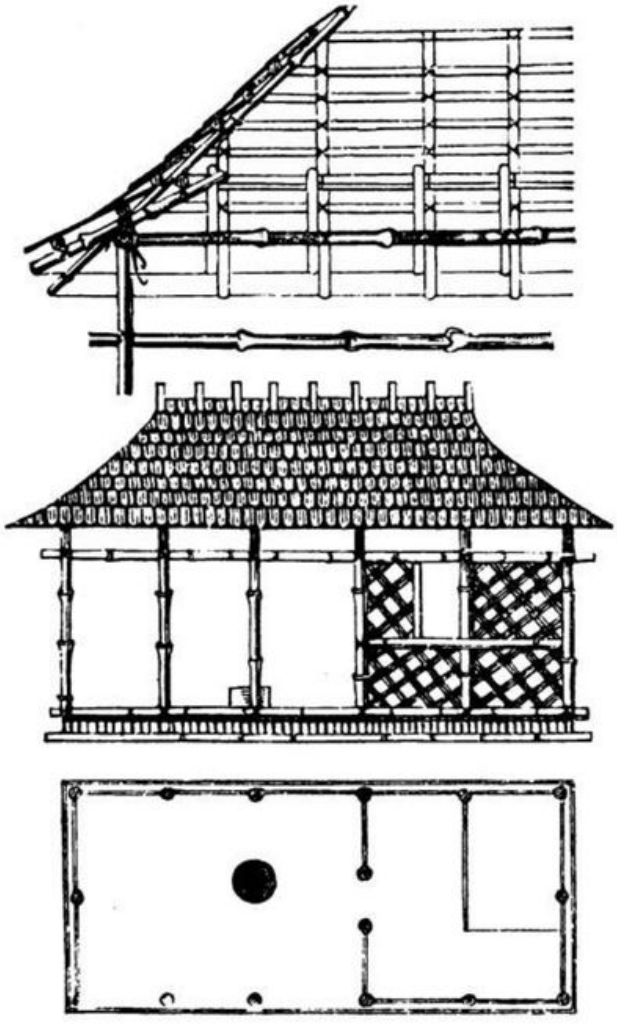
TECTONICS

The building should clearly be able to communicate the structural concept to the visitor. This will be possible by integrating the structural elements into the architectural expression, instead of hidden the loadbearing structure behind different kinds of cladding. By using this concept, the visitors will be able to read how the structural elements are working.

SUSTAINABILITY

Sustainability is an important factor of today's architectural design. Therefor sustainable principle will be used throughout the design process, making sure that the final design will give the users the best possible experience. For the project, passive strategies will be applied, this includes sun screening, cross ventilation and passive cooling of the new building.

To keep the CO_2 emission of the materials low, local materials will be chosen with advantage of other materials. This will keep the distance of transportation short and emission low.



Ill. 5 - Caribbean hut

TECTONICS

In architecture, tectonic is defined as being the art of construction, both related to the fundamental usage of architecture and the artistic extravagant design of architecture. Tectonic is concerning the modeling of materials, bringing the material to life, chancing it's a static element to a part of the finale architectural expression.
The theory of tectonic and architecture are inseparable linked together, which is demonstrated in the origins of the two words.

In Greek, the term tectonics roots back to its Greek form tektonikos, which refers to building, and tekton is referring to a carpenter or a builder. From this origins the Latin word architectus, which is divided into archi, meaning a person of authority, and the Greek word tekton. In present-day words does architectus means architect. *(Maulden)*

SEMPER

The first appearance of the modern understanding of tectonics origins back to Gottfried Semper's book Die vier Elemente der Baukunst.
Semper describes how certain elements, which are fundamental to architecture, have their own logic in terms of choice of materials and construction techniques.
On basis of a Caribbean hut, Semper traces the building cultures back to modern times, and states that architecture can be divided into four primary elements: the earthwork, the hearth, the framework/roof and the lightweight enclosing membrane.
On the base of the four elements, he categorized the building skills into two different classes: the tectonics of the frame, on which the lightweight linear components are assembled onto, and the stereotomics of the earthwork, expressing mass and volume by the repetitive stacking of heavyweight materials. *(UK Essays)*

What is useful in modern-day architecture is not the composition of the four elements, but it's the idea of having architecture that, viewed at, easily can be divided into identifiable elements. *(Pedersen)*

FRAMPTON

Kenneth Frampton claims a difference in Semper's four elements of architecture and the Vitrivian triad of ultilitas, firmitas and venustas. Frampton states that Vitruvius describes architecture through adjectives, while still the value

Ill. 6 - Taliesin West

of the architecture, where Semper draw the attention to the properties of the physical elements carrying cultural meaning or functional reason. This means that architectural elements aren't just a result of architectural abstractions or visions, concerning looks, but is a result of the constant development technology, resources available and materials capabilities.

In the publication Studies in Tectonic Culture, Frampton criticize the concept of space, which during the 19th and 20th century had a main role in the further development architecture, at the sacrifice of the tectonic thinking. Frampton argues the concept of space, and states that a reconsideration of structure and construction in architecture is needed. Structure and construction should not be chosen in favor of space, but should be central factors in the creation of space.

To support his statement, Frampton investigates the nature of building by analyzing both Semper's and Bötticher's theories about tectonics. Afterwards Frampton analyses works, where tectonics has been used in order to create space, by architects like Frank Lloyd Wright, Louis Kahn, Jørn Utzon, Carlo Scarpa and many more. Frampton argues that these architects works succeed in connection the design of the buildings to the fundamental parts of architecture.

Frank Lloyd Wright's Taliesin West is a project that illustrates Frampton's thoughts, where the building originated in a reading of site's nature, topography and materiality.

The low and long lines of the in-situ casted concrete walls suit the landscape and respect the casting technique. The relationship between the surrounding and the building is emphasized by the addition of local sand and stone into the concrete mix, making the tones of the building fit the surroundings. *(Pedersen)*

"Structures are tectonic when the material and technique have a significant impact on the initial idea about form, in such a way that the final structure can be said to be a consequence of material and technique."

Ole Eghold Pedersen

TERRITORY, BEAUTY AND MONUMENT

Every new building placed in the landscapes causes a transformation of the existing conditions in the area. Once the building is built, the new architectural object can influence and rearrange the existing hierarchies and balances of the site and its surroundings. But with the passage of time, the object will entirely become a part of the surroundings, and finally be recognized as an essential part of the area. In one way it can be argued, that the way symbolic, spatial and visual relationships between the architectural object and the landscape is perceived, simply is a function of time passing. Stonehenge is an example supporting this statement. Once the megalithic complex was erected, it was alien to the existing landscape, and changed the hierarchy of the surrounding area. Along the time passing by, the monoliths merged into the image of the landscape.
The architect has the choice of either following the structure and order of what existed prior the work, or actively choose to consider the project as a totally new architectural addition, with the power to drastically transform the experience and image of the area. *(Carta 22)*

Silvio Carta states:
"To a certain extent, a visitor center is a parasitical typology, owing its existence and relevance to an existing site of remarkable cultural importance or to a monument."

At a certain degree, a visitor center is categorized as a parasitical topology, meaning that it is owing it presence and relevance to an existing site of either a historical or cultural important landscape or monument. So, Carta follows up with the questions:
"So how should a "dependent" building, of which the main raison d'être is to offer an introduction to an important existing site, relate to its territory in order for this host-parasite symbiotic relationship to work properly? How can the new building play its introductory role without becoming more interesting or attractive than the site itself?"

The two quotations describe the essence of the relationship between territory, beauty and monument. The goal of a visitor center is to provide a building, which welcomes and informs the visitors about the nearby cultural and historical monument of the area. But at the same time, the visitor center should be able to keep

Ill. 7 - Cromeleque dos Almendres

the past of the monument placed at, and collect the studies and local stories about the surroundings. Both adding new attractions that appeals to the tourists, and respect the needs and desires of the locals. *(Carta 23)*

Used to discuss this topic, and further analyzed in the section *Case Studies*, are examples of two different visitor centers: *Giant's Causeway Visitor Center* and *Stonehenge Visitor Center*.
These are two visitor centers placed near unusual monuments of beauty, which is situated in tremendously beautiful and multifaceted landscapes.

GIANT'S CAUSEWAY VISITOR CENTER

Placed in the enormous and far-vanishing landscape of Giant's Causeway, the visitor center questions how to relate to the landscape of the surrounding area placed in.
In an attempt to counter the vastness and unpredictable shapes of the terrain, the building has been visibly geometrized. The straight lines of the of the facility generates long sightlines, directing the visitors' attention to specific focus points in the landscape.
The result of this approach is new shapes carefully placed into the existing, to add to the overall quality and experience of the site. The shaping and placing of the building makes both visible and invisible depending on what side approaching the visitor center from.

STONEHENGE VISITOR CENTER

The visitor center at Stonehenge is opposite Giant's Causeway Visitor Center placed far away from the ancient monument attached to. Showing its respect to what was prior by not interfering with the image of the area around Stonehenge.
Additionally, are the visitor center instead symbolizing the relation by expressing a clear contrast to the ancient monument of Stonehenge. An example on this is the canopy hovering above the visitor center, mimicking the hilly landscape under Stonehenge, flipping the overall composition upside-down.

OUTLINE

This section presents the first analyses and research done, which have been made to set the base for the further development of the project. Knowledge about history and culture of the surroundings of Évora are gathered and combined, and used as the prophase for the problem statement.

Ill. 8 - Cromeleque dos Almendres

COMPETITION BRIEF

The project of a visitor center at Cromeleque dos Almendres is based on a competition brief, made by Ark x Site for young architects and student during spring 2016. It's asked for the competitors to design a contemporary visitor center, located near the Cromeleque dos Almendres.

The megalithic complex Cromeleque dos Almendres is described as "*a significant landmark on a prominent landscape, a place of great cultural heritage and historical significance with characteristics that must be fully preserved.*". *(Ark x Site 3)*

It's stated that the final design proposal must meet following criteria: "*When generating a vision for an intervention located within such a spectacular place, it is essential that each proposal emphasizes, respects and celebrates the site, while providing visitors with a unique experience.*". *(Ark x Site 3)*

The new visitor center must be able to promote the unique experience, given by both the historical site and the remarkable landscape unfolding beneath the megalithic complex. The visitor center should provide the visitors with new and interesting ways to engage with the sacral place of the Cromeleque dos Almendres. Also, the new architecture added to the area must be humble to the already existing structure and atmosphere of the Cromeleque dos Almendres.

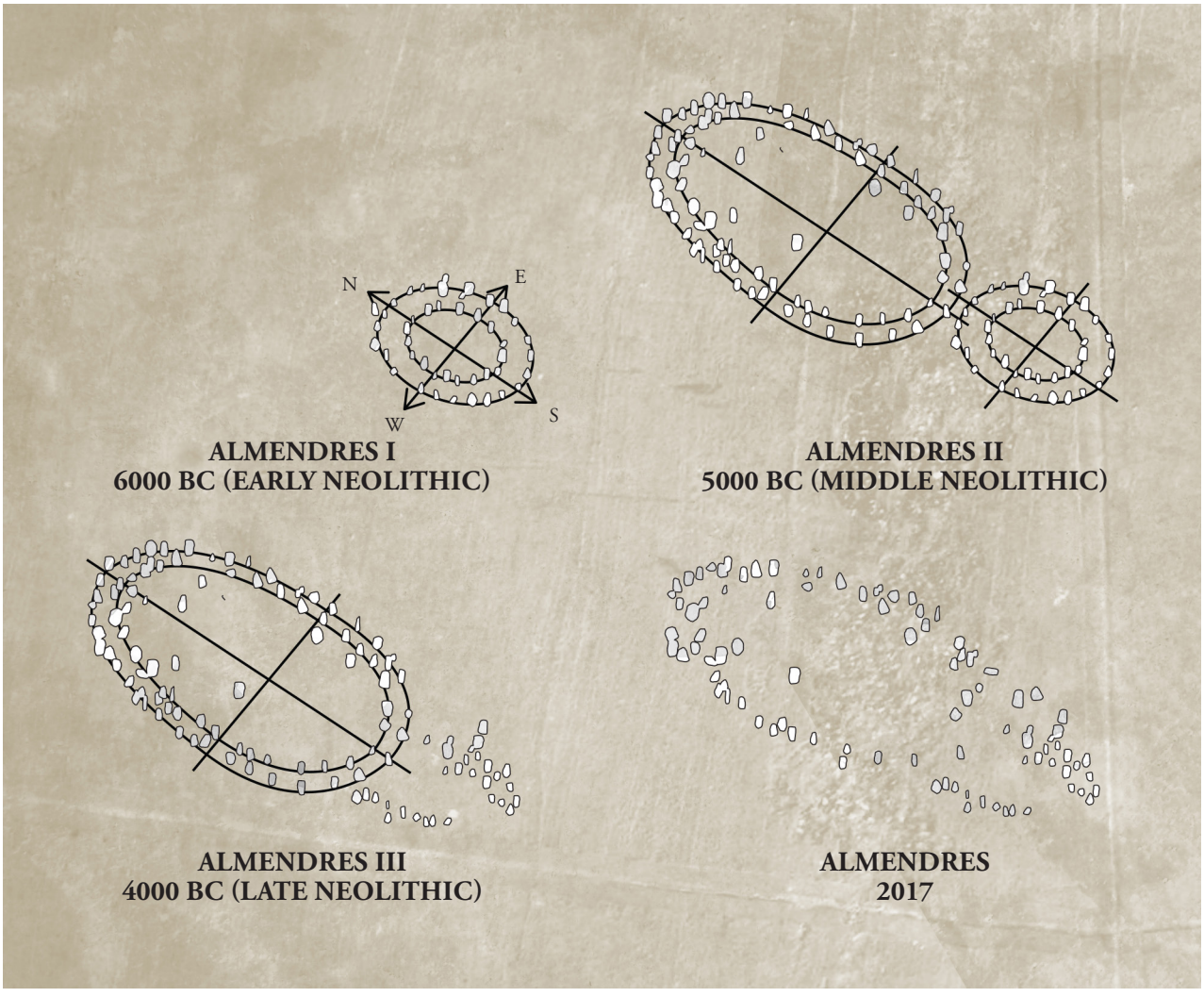
The brief states which functions that must be included in the new visitor center. This includes, besides the service functions, a reception area with a lobby, gift shop and restrooms, an administration area with offices and meeting rooms, and a cultural area containing exhibition space, gallery space, education space and lastly a wine bar for the locals to promote local produced wine and brewage.

Ill. 9 - Giraldo Square, Évora

ÉVORA

Évora is a city located in Portugal in the municipality also named Évora. The population is approximately 57.000 inhabitants and the area of the city is close to 1310km^2. *(Wikipedia Évora)*

The history of Évora dates more than 5.000 years back, where the city was known as Ebora rulled by the tribe of Celtici, which is known to have been inhabiting the southcentral part of Portugal and the western part of Spain.
Julius Caesar conquered the town in 57 BC and walled of the entire city. Relics from this period can still today be found all around Évora, and is today what gives Évora its historical appearance.
During the years Evora has been conquered and reconquered by many different factions, but as seen in the townscape, the Roman building still stand.
From the 15th century the Portuguese kings started living in Évora more often, which made Évora grow into its golden age. In this span of time royal buildings and abbeys sprung up all over the city. The numerous churches are remarkable monuments of the past, that where either new buildings or transformation of old roman monuments.
During the great earthquake of 1755 a lot of cities got damaged, but Évora remained undamaged. Therefore, after the destruction of Lisbon, Évora became the finest example of a city from the golden age of Portugal, which in 1985 made UNESCO choose the Historic Center of Évora to be a part of the UNESCO World Heritage program. *(UNESCO)*
Because of the great number of historical sites and monuments scattered around Évora and its surroundings, Évora is a well visited city by tourists with interest in history from different eras. Because of the vast diversity in historical attractions inside and outside city borders both city-tourists and nature-tourists are traveling to the city of Évora. *(Évora-Portugal)*



Ill. 10 - Stages of Cromeleque dos Almendres

CROMELEQUE DOS ALMENDRES

Cromeleque dos Almendres is one of the largest megalithic complex found in Europe. The complex is located approximately 15km west of Évora. The historical site of Cromeleque dos Almendres is located on the east sloping site of the mountain Serra de Monfurado, facing the sun rise and completely isolated from the local community, and is reached by a pedestrian path made by the local municipality. *(Sistema)*

EVOLUTION

The complex is made of two circular shapes tangent to each other, marked with 95 granite monoliths.
As shown on illustration 10 Cromeleque dos Almendres has gone through many steps for until it reached the state of today.
In the Early Neolithic, 6000 BC, the small circle towards east was created, consisting of two circles of monoliths. During the Middle Neolithic, 5000 BC, the big ellipse towards west was added to the complex.
Finally, in the Late Neolithic, 4000 BC, the complex went through modifications, where many of the stone were repositioned to line up with the sun, moon and stars. This makes archaeologists believe that the com-plex from the Late Neolithic has been used for either social or religious rituals.
Today the complex stands as it was reconstructed back in 1960, which makes it possible for visitors to roam freely in between the sacral monoliths of the past. *(Évora-Portugal)*

MENIR DOS ALMENDRES

Northeast of the complex the Menir dos Almendres, a 4m high monolith, is found. It is believed that this monolith is closely connected to the complex, since it together with Cromeleque dos Almendres is aligned with the sunrise on the winter solstice. *(Sacred)*

TOURISM

Even though the complex is situated close to the Historical Center of Évora, the transport from the city to the complex is too difficult, which makes the site unpopular amongst new tourists of the area. Because of the lack of visitors, the site remains completely open with no fence or ropes surrounding the complex. *(Ancient)*

Ill. 11 - Neolithic community

NEOLITHIC COMMUNITY

The Neolithic Era began around 10.200 BC and is estimated to end in 2000 BC. The development of the human technology influenced this period, which includes tools for agriculture, pottery, jewelry and weaving. The Neolithic Era is also known as the New Stone Age. *(Wikipedia Neolithic)*

NEOLITHIC SOCIETY

In first Neolithic communities, in the Early Neolithic, lived in densely built settlements with a number from 50 to 100 inhabitants.
During the Early and Middle Neolithic, the communities were based on a society of either allied clans or closely related families, consisting of both grandparents, parents and children.
The inhabitants of the communities lived in neighboring houses, creating households that could share hearths and ovens, placed in the in the common areas found in between the households.
During these periods of the Neolithic, the communities practiced a farming and stock-rearing economy, ensuring economic equality throughout the entire settlements inhabitants.

As the Late Neolithic period started, changes happened to the communities. An increase in population happened, which led to numerous changes in both the organization and economy situation of the communities.
The communities also went through changes architectural wise. Instead of small houses, bigger and more rectangular buildings were built, now able to house multiple families. This changes the common use of hearths and ovens, which now was built inside the houses, instead of in the outdoor common spaces.

BURIAL RITUALS

During the progress through the Neolithic period, the mind towards dead members of the communities changed. Instead of considering death as a simple form of sleep, the community believed the dead members continued the life inside the family's household. The burial of dead members now reflected this new view on death, and offerings were brought to the dead members in the belief of life after death. This made the communities start building sacral complexes like Cromeleque dos Almendres, where offering to the dead members could be done in respect of the lost members. *(Foundation)*

Ill. 12 - View towards Évora

QUALITIES OF SITE

Since the geologist, Henrique Leonor Pina, during fieldwork rediscovered the complex, the granite monoliths have been rearranged into their original positions, and the complex has stayed untouched since the 1960s. This means that there are no fences, ropes or any contemporary structures surrounding the complex. Only nature consisting of the native cork oaks, olive trees and bushes are surrounding the site, emphasizing the sacral feeling of the complex. *(EZPortugal)*

ATMOSPHERE

Walking in between the monoliths, the visitors are able go on adventure in the old engravings which is differ-ent from every 95 granite monoliths. It is unsure what the engravings means, but this gives the visitor the ability to interpret their own story of the historical complex. *(Ancient)*

As the exact function of the complex is still being discussed by archaeologists, the indications are pointing in the direction of either being a religious monument or astronomical observation point, especially after the rearranging of the monoliths, to align with, sun, moon and stars.

For some locals, the site is no matter what considered religious, since they at special occasions still this day today are practicing religious rituals in between the granite monoliths. *(Page)*

VIEW

As the complex is situated near the summit, an incredible view over the landscape below and the city of Évora is possible when standing in between the granite monoliths. The landscape unfolding beneath the com-plex is a gradient of untouched nature consisting of cork oaks, and the grid patterned farmland consisting olive trees. Closes to the complex is the raw nature, but as moving closer to Évora, the land changes into the grid pattern of the farmland, generating an interesting mixture of nature and manmade patterns. *(Visit Portugal)*

Ill. 13 - Tourists at Cromeleque dos Almendres

POTENTIAL OF TOURISM

Looking at the information written about in the previous sections, it is clear, that Cromeleque dos Almendres has a huge unused potential regarding tourism. Especially since Évora is a city already attracting tourists interested in ancient history. The site of the Cromeleque dos Almendres is unique, since visitors can both walk in between and touch the granite monolith, and at the same time enjoy the incredible view over the landscape of Évora municipality.

ARCHITECTURE

Adding new architecture to the site of the megalithic complex, will be able to generate more interest for the area, and thereby raise the popularity amongst both locals and tourists. A visitor center will be able to add more value to the stay at the Cromeleque dos Almendres, where visitors will be able to both interact with the complex and the new added functions from the visitor center.
The addition of functions as a gallery and a wine bar, gives the local artists and brewers the possibility to promote local products for the tourists, which can generate more interest for the area, attracting more tourists, that's not only interested in old relics of the past.

EXISTING QUALITIES

A visitor center will have the function to indorse the exceptional experience of the remarkable landscape and offer space for the visitors to engage with the historical complex in other ways, then currently accessible. This will maybe make the municipality of Évora consider making it easier for the tourists and locals in Évora to travel out to the sacral place of Cromeleque dos Almendres.

INFRASTRUCTURE

Adding better ways to commute to the complex will make it easier for example for local school classes, where the teachers will be able to take the classes to the education spaces, where teaching about the nature and history will be able to be a direct merge of theory and practice, since the lessons are given just next to the topic examined.

PROBLEM STATEMENT

The next sections wrap up the information gathered from the previous section. Conclusions and reflections are based on the outline analyses and ends up forming a problem statement, which will describe the main direction of the project.

Ill. 14 - Cromeleque dos Almendres

WHY A VISITOR CENTER?

QUALITIES OF THE SITE

Cromeleque dos Almendres is an important megalithic structure. This is one of the largest existing cromlech found in Europe and one of the oldest in the world. The site is well preserved and the visitors can walk between the 95 granite stones and feel the sacred history of the 7000 years old megalithic structure placed in the middle of olive and cork trees.
Since the site is on a hillside, a view over Cromeleque dos Almendres also gives a wonderful view over Évora and a little glimpse of the Vauban styled historic city center, which is considered world heritage by UNESCO.

POTENTIAL FOR TOURISM

Today as a UNESCO world heritage Évora, an old Roman settlement, is attracting a lot of historical and cultural interested tourists. By giving the site of Cromeleque dos Almendres a well-designed visitor center and connecting the site to the historic city center, the cromlech will be a part of the historical tour of Évora, instead of just being a part of the surroundings that only few knows about.
Compared to other identical historical monuments, Cromeleque dos Almendres is not cordoned or fenced off, which make the visitors able to roam freely around the area without having to pay any sort of entrance fee.

POSSIBILITIES FOR GROWTH

A visitor center will provide the tourists with information not only about the history of Cromeleque dos Almendres, but will also provide history and an overview of the entire region of Évora containing other cromlechs such as Almendres Menhir, Anta Grande do Zambujerio, Alto de São Bento and Megalithica Ebora.
Exhibition and gallery space with permanent and temporary exhibitions will educate visitors about the history of the region of Évora. An education space will be used for diverse education activities such as seminars and lectures for both the local community and visitors. The wine bar could be a showroom for the local wine and beverage producers, where the visitors are able to taste the quality of the products made by local resources.
The visitor center can become a place where both locals and tourists meet and use the different facilities during the day.

INFRASTRUCTURE

As Cromeleque dos Almendres is situated 15km away from Évora, how to get to the site as a tourist is important. Tourists often don't have a car and are therefore relying on either public transport or shuttle busses driving to the new visitor center. Today's guides on how to get to the site is described by using a car. Therefore, a bus or sight-seeing stop either connected to the city center of Évora or the other cromlechs in the region will be able to positively affect the number of tourists visiting the site.

CONCLUSION

A visitor center will increase the acknowledge of the historical site and the cultural value hidden in the history of Cromeleque dos Almendres, which today is hidden or hard to find for both tourists and locals.
The visitor center will be able to greatly influence the number of visitors to Cromeleque dos Almendres, but the visitor center itself is not enough. The municipality of Évora has to make public transportation going from the historical city center and out to the new visitor center, otherwise tourists and locals will still not be able to get easy to the site.

Today the only thing at the site to see is the Cromeleque dos Almendres. Adding the visitor center to the experience of the site, will add value for the visitors, since they can stay at the facility and use the functions before and after visiting Cromeleque dos Almendres. The new functions added to the area will both favor the tourists as well as the locals.

PROGRAM

In this section, the fundamental frame for the building is established. A formulation of what a visitor center is, what group of visitors it targets and what functions is needed will be described.

WHAT IS A VISITOR CENTER?

INTRODUCTION

Over the last years, visitor centers have evolved more into an experience that helps brand the site, instead of only being a place for the tourist to find basic information. A visitor center can be described as the entrance to the site.

Since the visitor center isn't the main attraction of the area, it is important that the design is made with respect for what's already existing at the site, and thereby not overtakes the role as landmark of the area.

MULTI-FUNCTIONAL

Due to the evolving of the visitor center, more functions are now to be found in today's visitor centers. Therefore, the visitor centers have become multi-functional and not only providing basic information about the site. Today visitor centers are also providing spaces for exhibitions, restaurants, bars, administration and education, which can be used by both the locals and the tourists.

The new type of visitor centers is now becoming a place to meet for both locals and tourist, therefor it must be able to accommodate more functions being used at the same time. This is essential for the different functions to be able to work under the same roof.

MAIN FUNCTION

Even though todays visitor centers are multi-functional, the most important function is still to inform and guide the tourists. Therefore, the building must be able to easily provide basic information about the attraction to the visitors.

The visitor center should give the visitors preliminary experiences related to the main attraction, so the visitors have achieved additional knowledge, that will make the experience of the site better.

Ill. 15 - Rebildporten

EXPERIMENTAL EDUCATION

Adding an education space to the visitor center, theory and practice can be joined during the same class. Inside the building visitors and students can gather lots of theoretical knowledge concerning either history of the site, surrounding nature or cultural values of the region, and afterwards go out into the nature and investigate the newly achieved knowledge in practice. This will help diminishing the division between the theoretical and practical work, by making the physical distance between education space and practice smaller.

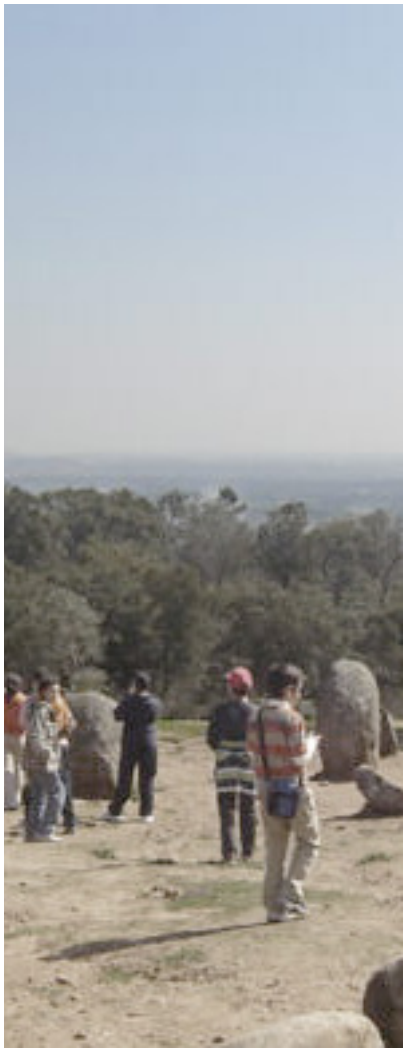
ARCHITECTURAL IMPACT

Adding new architecture to a historical site is always a fine balance. The architecture of the building should help branding the site, and add to the visitors' experience of the site, since the visitor center often will act as a showroom for the site. On the other hand, the architecture should not be so extravagant, that it takes the focus from the site, and become the new main attraction for the tourist to visit. The visitor center must respect its role as an addition to the site, and not a new attraction of the site, keeping it's parasitical typology, owing its existence to the existing site.

PRACTICAL REQUIREMENTS

A visitor center must be able to accommodate a large number of visitors, with different agendas, during peak hours. The visitor center should have proper division between interfering functions, so visitors don't disturb each other's visit.
The building should also incorporate sustainable principle, and set an example for the visitors how specific design choices can influence the quality of the building in a great way.

Ill. 16 - Signs


Ill. 17 - Target group

TARGET GROUP

SHORT STAY TOURISTS

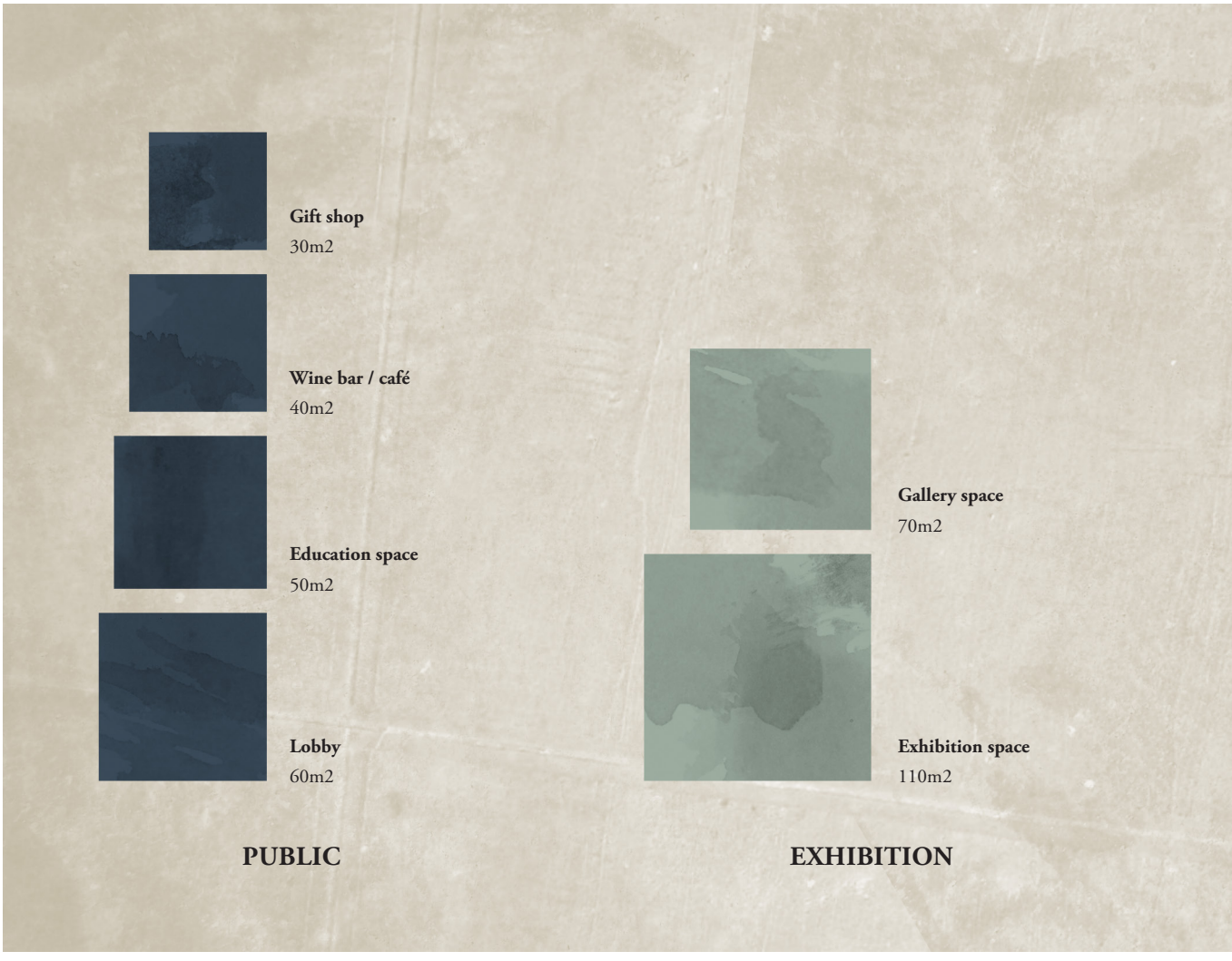
The main group of tourists expected to use the visitor center will be first time visiting tourists. They don't know the site and the main purpose of the visit is sightseeing.
For this group, the visitor center will serve the basic function, which is to provide the visitors with basic information to familiarize the visitors with the site, before starting the exploration outside the building.
The functions used by this group will mainly be the reception area, exhibition space, gallery space, wine bar, restrooms and the gift shop.

GROUPS AND STUDENTS

Another group that will be using the visitor center will be planned groups and students on study trips. During the whole year, different schools from the region will arrange study trips to the visitor center, to learn about the history and the history of the Neolithic Era, culture of Cromeleque dos Almendres and the surrounding landscape.
The main functions for this group will be the education space, where different activities will find place, such as lecture, seminars and workshops. Using the visitor center the distance between theory and practice will be minimized, making the teaching more interactive and experimental for the students.

LOCALS AND LONG STAY TOURISTS

The last group is the visitors that knows the visitor center and the main attractions. This group will use the visitor center more as a cultural center, where they will attend seminars, visit temporary exhibitions and participate in cultural events.
Functions used by this group will primarily be the education space, wine bar and the gallery space.



PROGRAM BREAK DOWN

INTRODUCTION

Through a disintegration of the program, a categorization and description of the functions are made to be able to make the right connections and arrangements when dealing with a multi-functional building. This will result in a holistic designed visitor center that will accommodate the different needs of the different functions.

PUBLIC

Entering the visitor center, the visitor will as the first thing enter the lobby. Here the general information is located and the visitors are distributed towards the different areas of the visitor center. Close to the lobby the gift shop will be located, where it's possible to by books and souvenirs. Near the main entrance the wine bar will be found with 16 indoor seats. Here local producers will serve wine and beverage for the visitors to taste and buy, while enjoying the view of the local farmlands.

EXHIBITION

A permanent exhibition will be found in the exhibition space. This exhibition will inform the visitors about the history of the Cromeleque dos Almendres, the essentials of megalithic complexes and the culture of Neolithic communities in the region.
In the gallery space, there will be temporary exhibitions and activities that will be related to the site. Because of the ever-chancing layout of this room, the flexibility of the room is very important to incorporate.

Ill. 18 - Program break down

EDUCATION

This area will be designated for educational activities such as video projections, classroom, seminars and lectures, which will be available for both locals, students and tourists. It should be a flexible area with space, that should accommodate for different arrangements of approximately 25 seats.

ADMINISTRATION

In the visitor center an area should be designated for the personnel in charge of the administration. This will include an office area and a meeting room, where internal meetings for the personnel and staff members can take place, without being disturbed by visitors using other functions of the visitor center.

SERVICE

Close to the lobby, public restrooms should be located. Next to the wine bar a dark room should be located, which will be used as a wine room for storage of wine bottles. Here temperature and humidity must be maintained by a climate cooling system.
Next to the exhibition and gallery spaces a general storage room should be placed. Here related materials can store, when not in use for the different exhibitions.
Lastly, a storage room and an equipment and mechanical room should be located within the building, these rooms will be used for the maintenance and running of the building.

CASE STUDIES

Case studies will be presented in the following section. The case studies are used as a supplement to the program, showcasing how other visitor centers with same problem has turned out different, but still answered the problem.

Ill. 19 - Giant's Causeway Visitor Center

CASE STUDIES

GIANT'S CAUSEWAY VISITOR CENTER

Architects: Heneghan & Peng
Location: Ireland
Area: 1.800m2
Completion year: 2012

SITE

The Giant's Causeway Visitor Center is situated in Northern Ireland, at the ridgeline of the North Antrim coast, designed as the gateway into the UNESCO World Heritage Site.
The site of Giant's Causeway is one of the only places in Europe, that can recall perspective of the history hidden in the Earth. The site was formed approximately 60 million years ago, when the two continents of Europe and North America started moving apart from each other, making lava flow out through the cracks, creating the basalt visible at the site today *(Carta 23)*

ARCHITECTURE

The visitor center designed by Heneghan & Peng Architects is merged into the landscape. The building consists of two folds in the landscape. One fold, that pulls up the landscape, revealing the building, and another fold, that pushes down into the ground forming the car park, that is intended to screen of the building, when arriving to the building from both the road and the coastal path. The facility is designed to be a part of the event, when moving along the route of the Giant's Causeway. The form of the building is formed into the landscape with a respect of the existing landscape, making the visitor center both visible and invisible at the same time. Invisible when walking along the cliffside, and easily identifiable when arriving from the land side. Inside the building, a series of stepping floors are representing the different functionalities of the facility. The different levels are linked together by a series of ramps and stairs, allowing the visitors to fluidly move through the building from the entrance to the exit, which leads the visitors onto the lower coastal path of the Giant's Causeway. *(Carta 28)*

Ill. 20 - Stonehenge Visitor Center

STONEHENGE VISITOR CENTER

Architects: Denton Corker Marshall
Location: England
Area: 2.510m2
Completion year: 2013

SITE

Stonehenge Visitor Center is placed just inside the UNESCO World Heritage Site of Stonehenge. The building is located 2,5km away from historical monument of Stonehenge, which puts the new building out of sight of the ancient monument.
The landscape around the site is rather flat and mainly farmlands, standing as a contrast to the site of Stonehenge, which is placed on top of a small hill. *(Carta 24)*

ARCHITECTURE

Opposite Giant's Causeway Visitor Center, the Stonehenge Visitor Center is not located at the historical site, but as far away from the site as possible. The distant locations form the ancient monument, has made the architects focus on the symbiotic connection instead of the visual connection. This is expressed through the clear contrast between the visitor center and Stonehenge in term of the expression.
Over the volumes of the visitor center is a large canopy hovering, mimicking the hilly landscape of the surroundings. The canopy is detached from the ground by thin columns, making it opposite the composition of Stonehenge, where the hill naturally is underneath the monoliths. *(Carta. 24)*

The visitor center is made of local, recyclable and renewable materials. The largest volume is cladded with locally grown sweet chestnut timber. The second largest volume is cladded in glass, and the last and by far the smallest volume is cladded with recycle zinc. The building is designed to have as little impact on the landscape as possible, which by the architects is called reversibility. This is done by building the facility on top of a concrete raft, which sits on top of the soil, reducing the cutting into the soil tremendously. To be able to build foundations with the minimal depth, lightweight structures and materials has been used throughout the entire building. *(Carta 39)*

Ill. 21 - Jianamani Visitor Center

JIANAMANI VISITOR CENTER

Architects: Atelier TeamMinus
Location: China
Area: 1.447m2
Completion year: 2012

SITE

Jianamani Visitor Center is located next to the Buddhist memorial, Jianamani, in Yushu, Tibet. Jianamani is the world's largest Tibetan Buddhist landmark, with a history stretching over more than 300 years. Jianamani bears over 250 million pieces of Mani stone, brought to the memorial by pilgrims. In 2010 Yushu was hit by an earthquake. After the earthquake Yushu-ers instantly started repairing Jianamani, even before repairing their own houses. More than 40% of the citizens live on carving Mani stones *(Carta 61)*

ARCHITECTURE

The Jianamani Visitor Center is designed to serve both locals and tourists. For the tourists, the building provides information about the history of the sacral place of Jianamani. For the locals, the facility provides a post office, clinic, public toilets and a research archive.
The visitor center is designed as a square building with a courtyard in the middle. Around the building is 11 observations decks placed, giving the visitors of the facility the possibility to observe the surroundings of Yushu.
The building is mainly built out of local Mani stones, carved out by the local stone masons, and constructed using local construction techniques . *(Carta 61)*

The facility is built upon the concept of giving the pilgrims a warm, welcoming and informative place in Yushu, when visiting the Buddhist memorial and experiencing the Mani stones.
Special for this project is, that the actual attraction, the Mani stones, is directly incorporated into the building of the visitor center. Here the horizontal lines are emphasized due to the stacking of the Mani stones, just as done at the Buddhist memorial. *(Carta 25)*

Ill. 22 - Tsing Tao Pearl Hill Visitor Center

TSING TAO PEARL HILL VISITOR CENTER

Architects: Bohlin Cywinski Jackson
Location: China
Area: 2.044m2
Completion year: 2012

SITE

Opposite the approach of Stonehenge Visitor Center, Tsing Tao Pearl Hill Visitor Center is placed right at the attraction. The visitor center is located right at the bottom of Pearl Hill, where it emerges with the surrounding landscape.
The surrounding landscape is mainly made of rocky hills, wild grass and thin trees. *(Carta 25)*

ARCHITECTURE

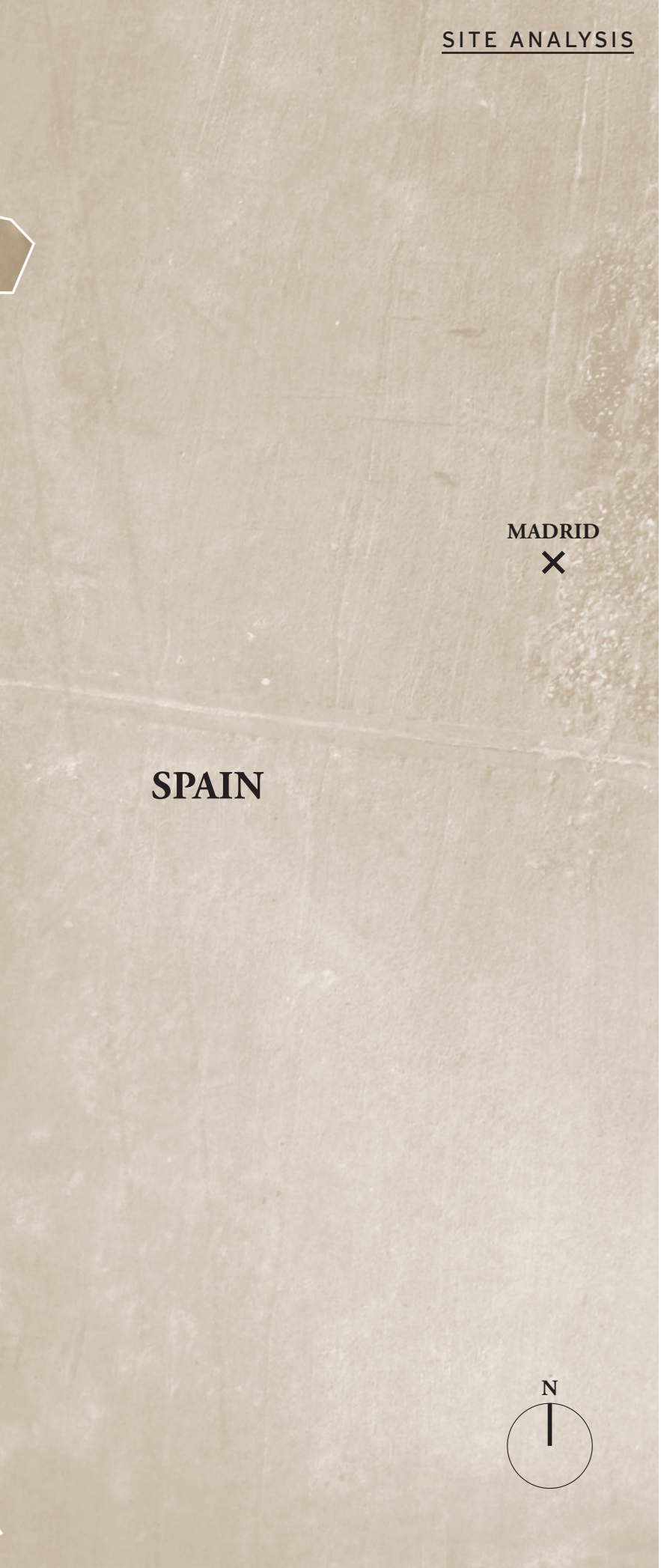
Similar as the approach of Stonehenge Visitor Center, the architects of this visitor center made a strong connection to the surrounding topography, where the canopy and roof is mimicking the hilly landscape of Pearl Hill.
As another connection to the surroundings, the architects have reintroduced the wooden construction in a new innovative way, representing the new Chinese architecture, with focus on traditional construction techniques and skills with new innovative materials.
By mimicking the traditional use of material and shapes, the new built will relate to the characteristics of the local houses and existing surroundings.
At the first glimpse building looks alien for the area, but at a closer look, the old constructional techniques and skills, learned from the locals, will be revealed and make the new architecture complement the old architecture characterizing the area, which it's known for. *(Carta 50)*

On the roof is found native vegetation taken from the surroundings. The vegetation make the building mimic the tactility and color of the surroundings, making the facility blend in with the landscape of Pearl Hill. As another nature reference, the forest of columns should remind the visitors of the bamboo groves near the entrance of the building. *(Carta 51)*

SITE ANALYSIS

This section will contain analyses made about the site, to achieve the need knowledge to be able to design in the surroundings of Cromeleque dos Almendres. The new understanding of the area will be utilizing to make a building that will respect the existing conditions.

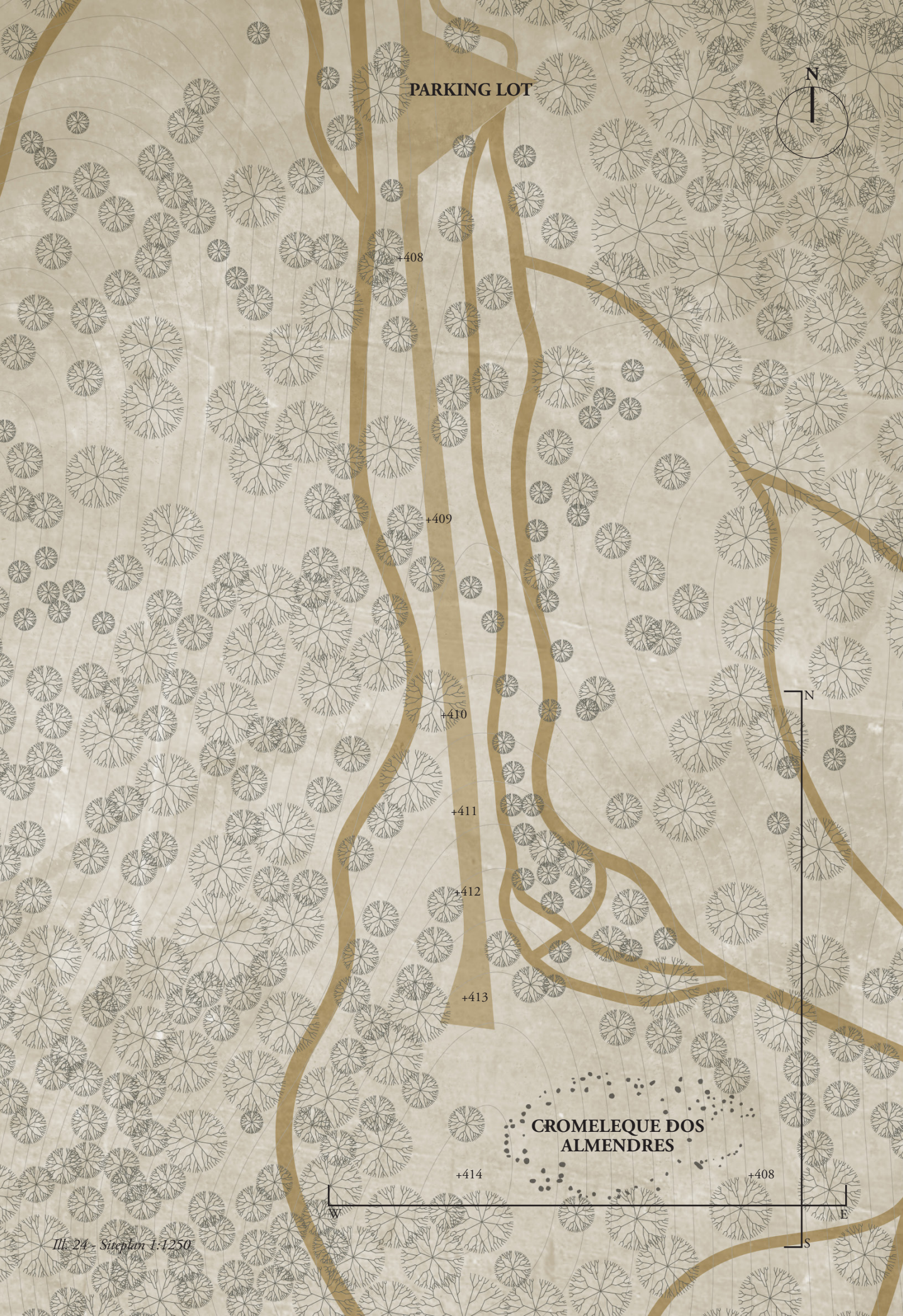
Ill. 23 - Portugal



LOCATION

Cromeleque dos Almendres is located close to Évora in the central part of Portugal, in the region named Alentejo.
Alentejo is both a historical and cultural region of Portugal, and is in Portuguese directly translated to "beyond". The region contains plenty of historical cities, including Évora as one of the most important once.

Évora is situated 140km east of the capital of Portugal, Lisbon, and 80km west of the Spanish city Badajoz located at the Spanish border.



Ill. 24 - Siteplan 1:1250

Ill. 25 - Section west-east 1:1000

Ill. 26 - Section south-north 1:1000

SURROUNDINGS

TOPOGRAPHY

The topography of the area of Cromoleque dos Almendres is dominated by granite hills, which is characteristic for this area of Portugal.

The site is located on the east side of the summit located 414m above sea-level. Placed on the east side of the summit gives a view over the terrain all the way to Évora. (Ill. 25)
When arriving to the site from the parking lot to the north, which is located 6m lower than Cromeleque dos Almendres. On path between the parking lot and Cromeleque dos Almendres a flat area is situated one-third of the way. (Ill. 26)

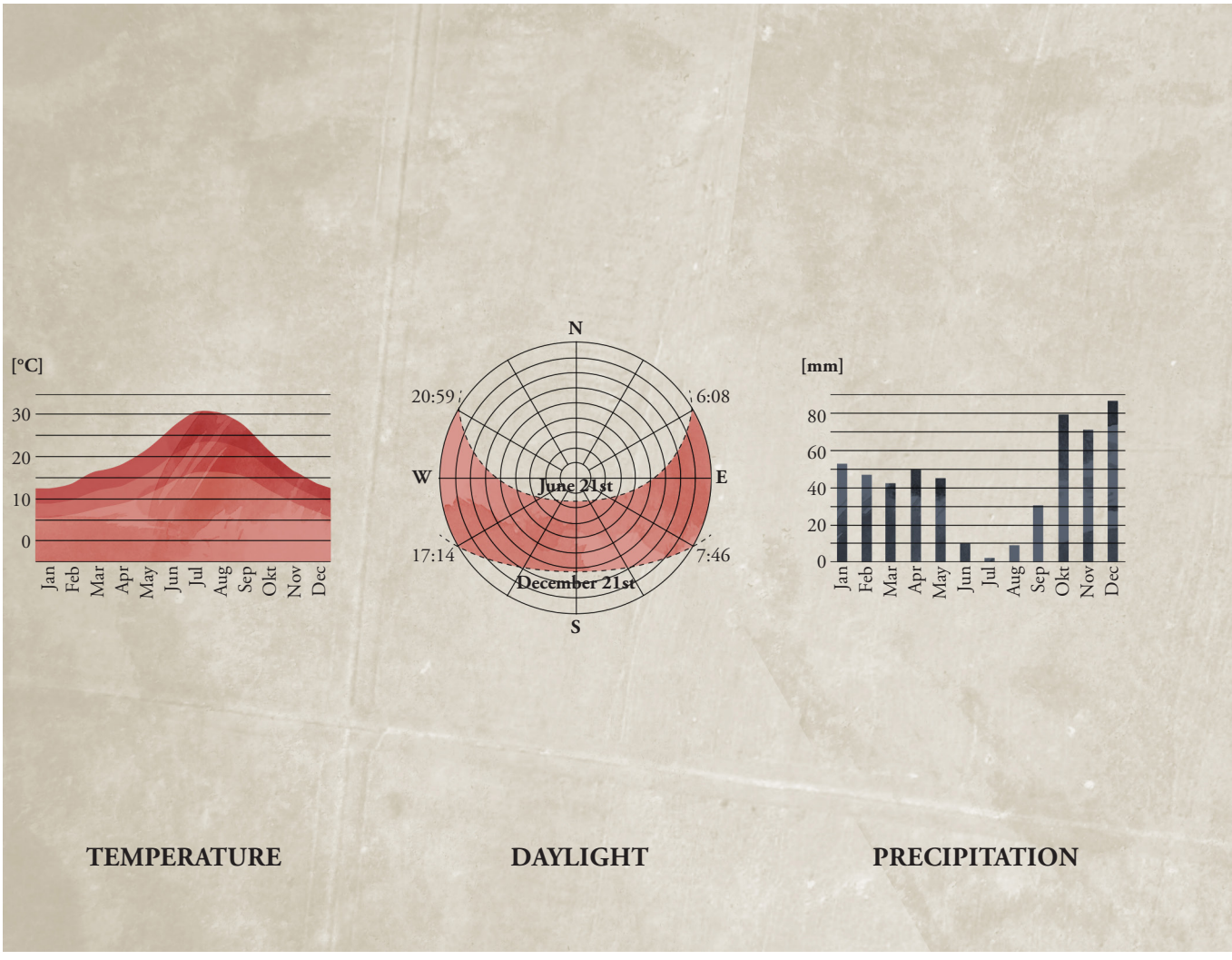
VEGETATION

The surroundings of the Cromeleque dos Almendres is mainly filled with a mixture of olive trees and cork oaks. The cork oaks are a native species of the area, where the olive trees are established by farmers, which from the air gives a grid pattern mixed in with the native cork oak pattern.

The density of the cork oaks and olive trees is high, which creates a natural barrier around the Cromeleque dos Almendres, helping to emphasis the sacral feeling of the site.

INFRASTRUCTURE

The only manmade way to the site is by the dirt path north of the site. This path goes to the town Almendras. From here the path continues to the town Guadalupe.
To go to Évora it's possible to go north, and take the main road N114, or go south and take the other main road N380, which both leads into Évora. This trip will take approximately 30 minutes by car.
There is currently no public transport to the site or near surroundings
It's possible to walk to the site from Évora. This journey will take 3 hours 30 minutes if done by following existing roads.



TEMPERATURE **DAYLIGHT** **PRECIPITATION**

CLIMATE

TEMPERATURE

Studying the temperature for the area, the average temperatures normally range between 5°C to 33°C. During the winter the temperature rarely drops below 1°C and during the summer the temperature rarely goes above 38°C.

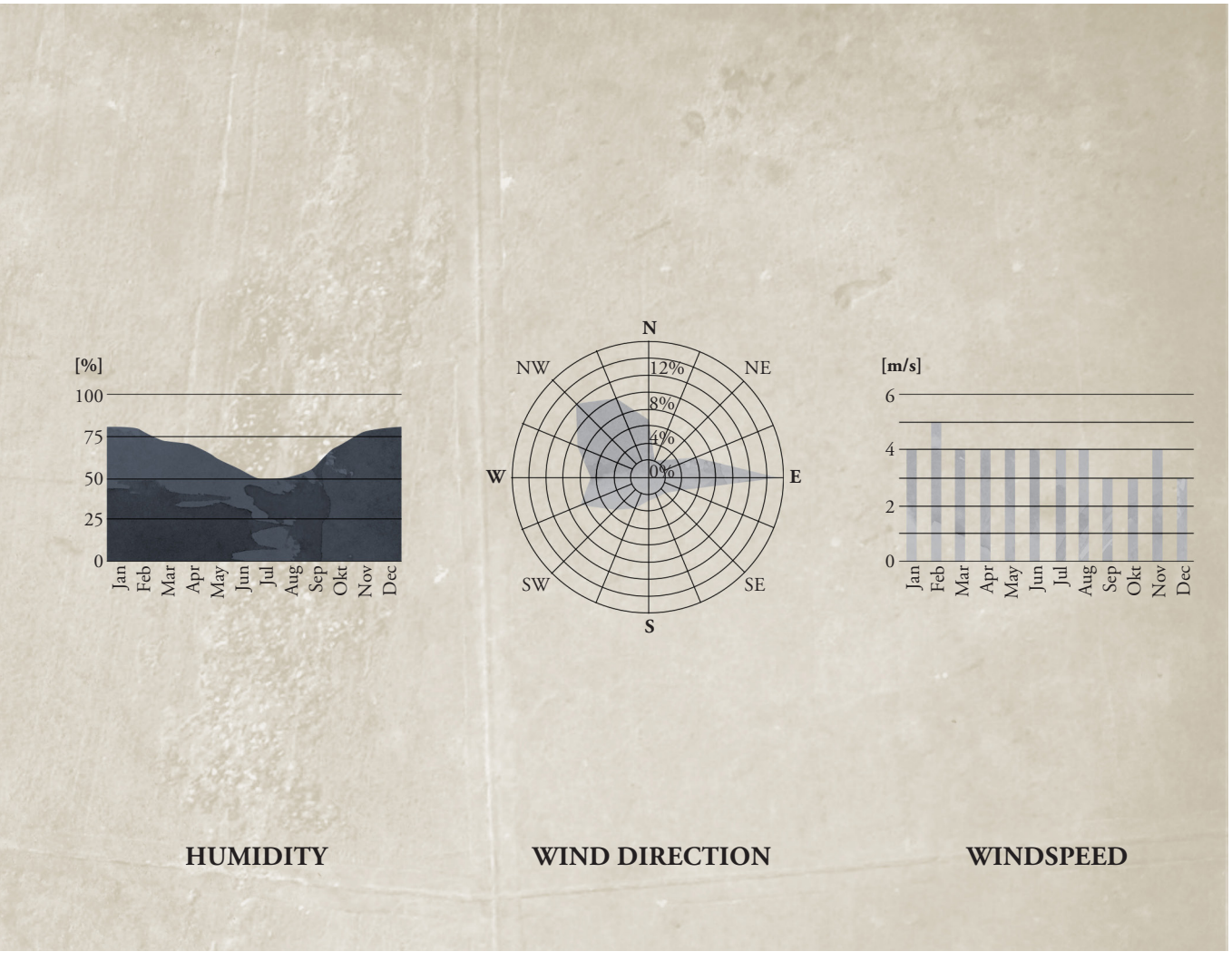
Illustration 27 shows the average temperature during the year. The hot season lasts from mid-June to mid-September, with an average daily peak temperature above 29°C. The hottest day is during mid-July, with an average peak temperature of 33°C. The cool season lasts from mid-November to early-March, where the average peak temperature is under 17°C. The coldest day is during mid-January, where the average low temperature of 5°C. *(Weatherspark)*

DAYLIGHT

The length of a day in the area of Évora changes a lot during the year. The shortest day is December 21st with an average length on approximately 9,5 hours of daylight. The longest day is June 21st with an average length with approximately 15 hours of daylight. The earliest sunrise is at 6:08 during mid-June, where the latest sunrise is at 7:46 during late-October. The earliest sunset is at 17:14 during early-December and the latest sunset is at 20:59 during late-June. *(Weatherspark)*

PRECIPITATION

Studying the precipitation of Évora, it's clear that there is a significant seasonal variation in the monthly rainfall. The rainy period lasts from early-September to mid-June, with an average of at least 13mm precipitation per month. The most rain falls during start-December with an average around 85mm precipitation during the month.
The rainless period lasts from mid-June to early-September. The least precipitation is during July with an average around 2mm. *(Weatherspark)*



Ill. 27 - Climate diagrams

HUMIDITY

As seen on illustration 27, the relative humidity varies a lot during the year. The relative humidity around Évora ranges from 50% to 80% during the year, with an average at 66%.
During the summer, the average relative humidity will stay under 60%. Where during the period of late-Autumn to early-Spring will have an average relative humidity above 70%.
(Climatemps)

WIND DIRECTION

The main wind direction throughout the year is from east. 7 months a year the dominant wind direction is from east, and the last 5 months the dominant wind direction is from northwest.
Because of the placement near the summit of the mountain, there will not be any significant cover from any directions of wind during the year.
(Windfinder)

WINDSPEED

The average windspeed during the year around Évora is 4m/s. With a peak in February with an average of 5m/s and lowest during September, October and December with an average of 3m/s.
Because of the placement near the summit, the windspeed can be expected to be higher than the readings from the weather station near Évora.
(Windfinder)

CONCEPT

Based on all the previous analyses and studies, a concept for the visitor center will be presented. The concept will be the guiding line for what direction to take the design, to ensure a final design that is working as one unit.

VISITOR COMMUNITY

NEOLITHIC COMMUNITY

In the Early Neolithic, were communities made of lots of small households placed in clusters, where it was possible to share hearts and ovens in outdoor common spaces. Due to the way communities were built at that time, the households only contain the bare minimal functions.

Because of the structure of the communities, every household was equally important and valued for the community. This approach towards the community ensured a fellowship between citizens, let them be fishers, tailors or farmers, which made the communities grow as one joint unity.

VISITOR CENTER

The main function of a visitor center is to provide information to the visitors. This is normally done through a permanent exhibition, making the visitor center only serving as one function.

Through the evolution of the visitor center, more functions are now added to the facility. For example, leisure such as restaurant, café, bars and gift shops are now becoming a part of the experience, which helps branding local quality products, produced by local citizens.
In addition to leisure, functions such as galleries and education spaces are also added to the visitor centers. This is transforming visitor centers into multi-functional facilities, that must be able to accommodate the different needs from the different functions.

As seen in Jianamani Visitor Center and Tsing Tao Pearl Hill Visitor Center, the new visitor centers start focusing on adding value to the area built in. Public functions such as research archives, public toilets, post offices and even clinics, which can be used by the locals, adding more than just value regarding tourism for the area.
Also, as seen in Stonehenge Visitor Center and Giant's Causeway Visitor Center, the facilities are also designed to show the visitors what's possible regarding sustainability. It is possible to do great architecture, while still using local resources and ensuring that the building can be passively cooled.

Ill. 28 - Concept diagram

VISITOR COMMUNITY

The concept of the Visitor Community is to unite the best from the historical Neolithic communities and the modern-day visitor centers. Taking from the Neolithic communities are the unity, respect and equality between functions together with common outdoor spaces, for every citizen of the community. And taking from the visitor centers are ability to have one big facility, providing functions for different people with different agendas, creating a building that is designed to be used for different purposes.

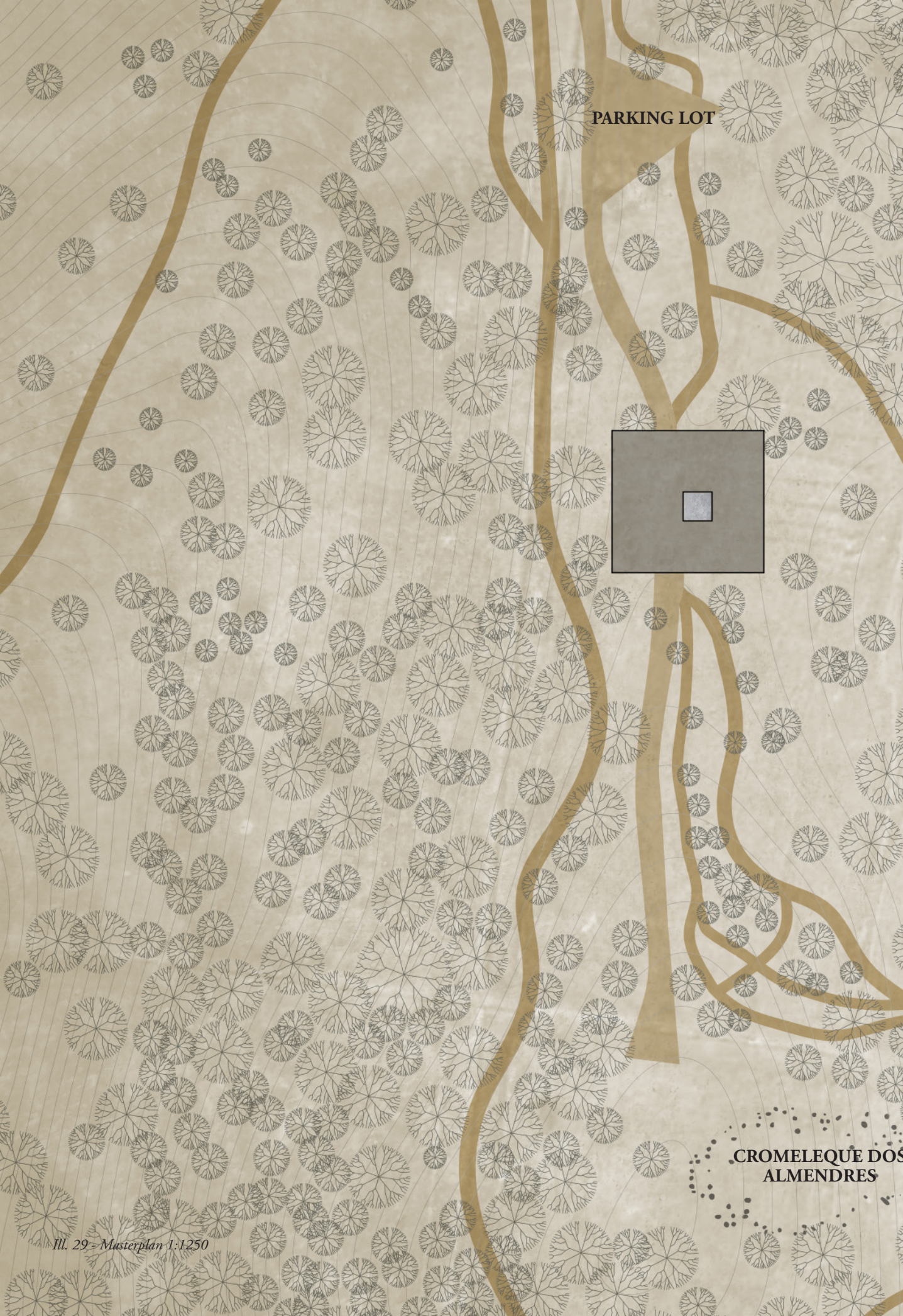
In a Visitor Community, there will be no hallways connecting the different functions. All functions will be connected through the outdoor common spaces, created by the different volumes and shapes of the building. Here the different types of visitors will meet during their stay at the Visitor Community, let it be students, tourists or locals.

A Visitor Community is a facility, that can house different functions, which are being used at the same time, by different types of visitors. The student can attend a lecture in the education space, the employee can work in the office space, the tourist can explore the exhibition space, while the local can sit in the wine bar, enjoying a glass of wine from the local farmers.
This will be possible, if the functions are arranging with attention to how they are going to work during the opening hours, and which functions are able to complement each other and which ones has to be separated.

Ensuring these features into the facility, the visitors of the Visitor Community will feel part of a bigger community, where different interests can meet and work under the same roof, without necessary have to interfere and disturb each other.

PRESENTATION

The next section shows the final design proposal of Cromeleque dos Almendres Visitor Center. It contains both interior and exterior visualizations, masterplan, facades, plans, sections and detailed drawings, all used to describe the project.

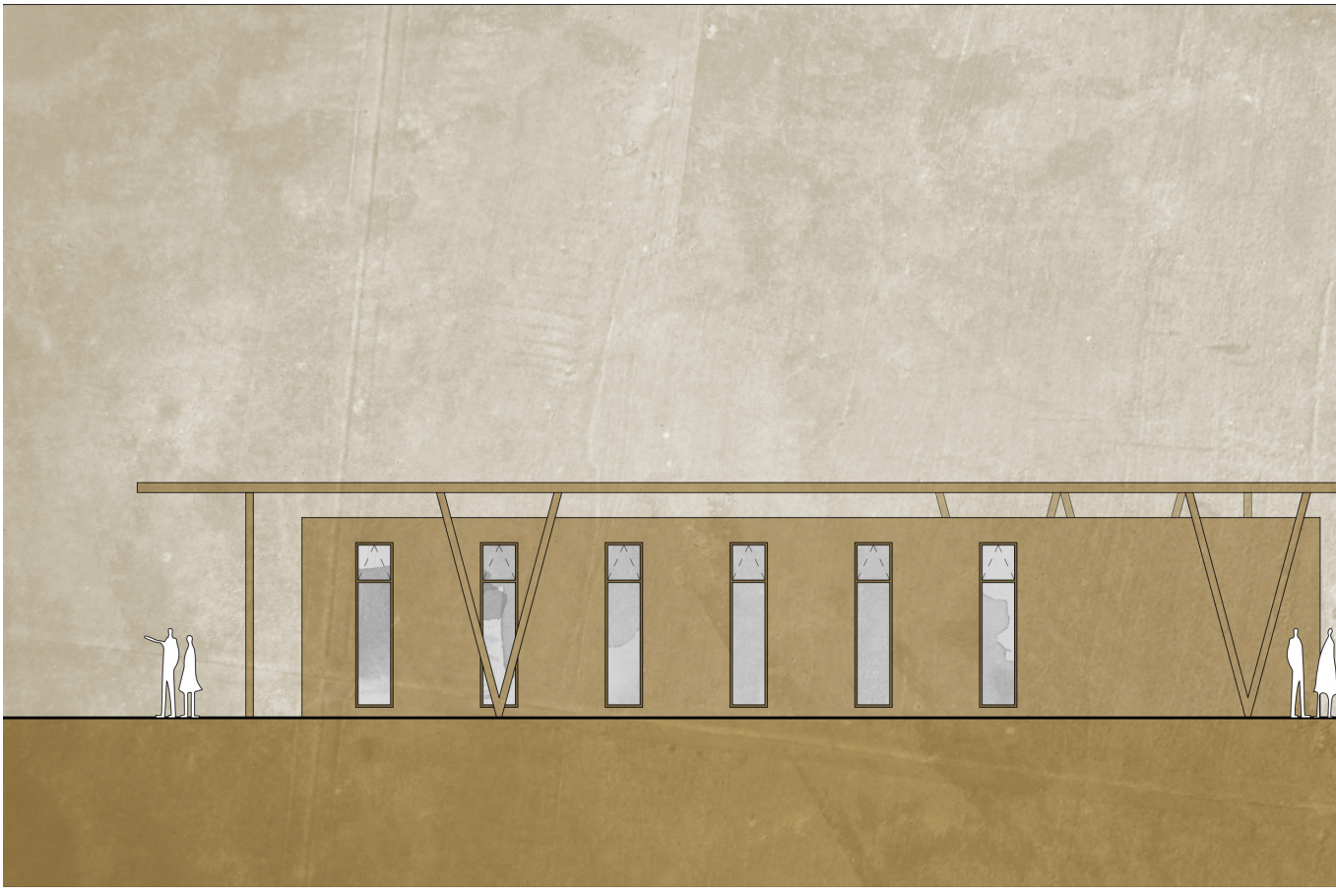


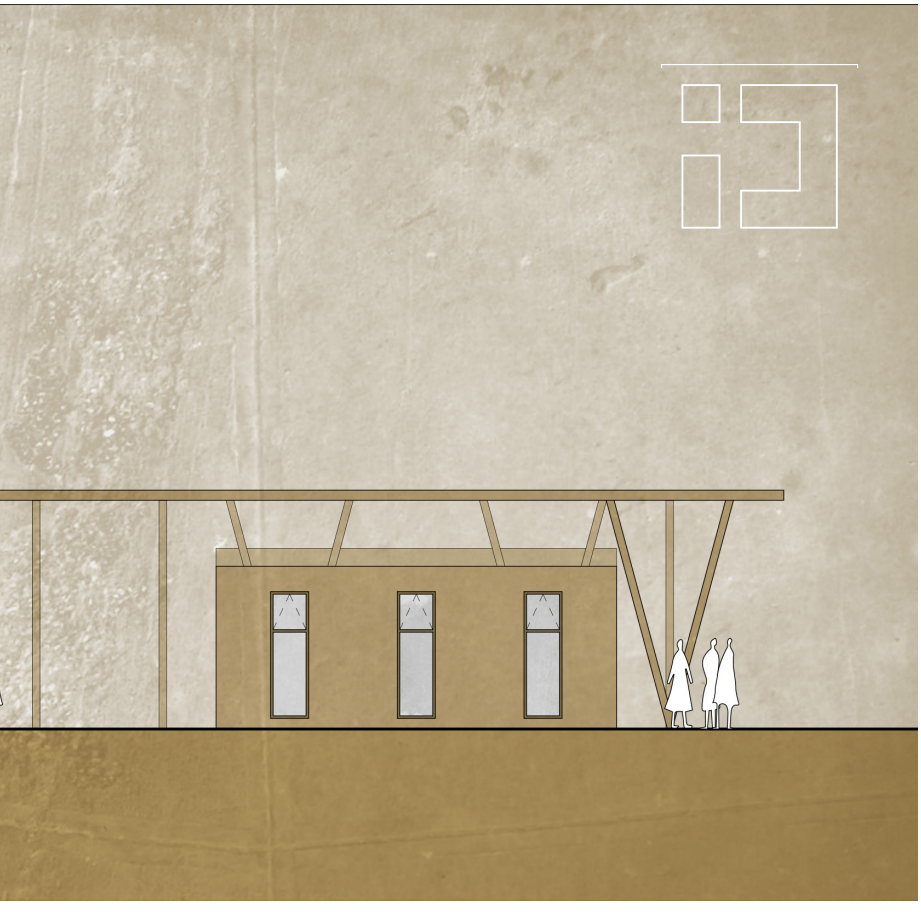
Ill. 29 - Masterplan 1:1250

MASTERPLAN

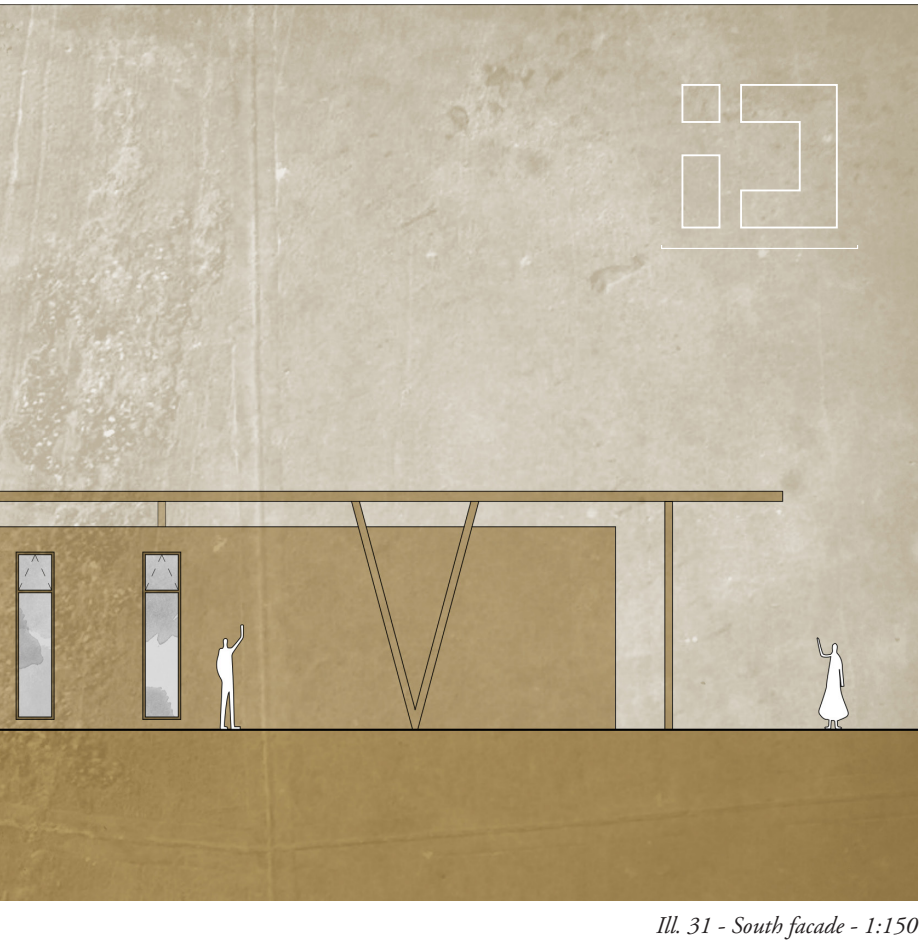
Surrounded by cork oaks and olive trees, the Cromeleque dos Almendres Visitor Center is situated on the path uphill toward the sacral site of the Cromeleque dos Almendres, found at the summit of Serra de Monfurado hidden between the densely vegetation.

The building is situated at the flat area between the parking lot and Cromeleque dos Almendres, acting as the natural spot for a break, where visitors will take a break and enjoy the sight of the surroundings, before advancing the last part of the walk towards the historical megalithic complex at the summit. The Visitor Center invites the visitors inside to interact with the numerous functions of the building.





Ill. 30 - North facade - 1:150

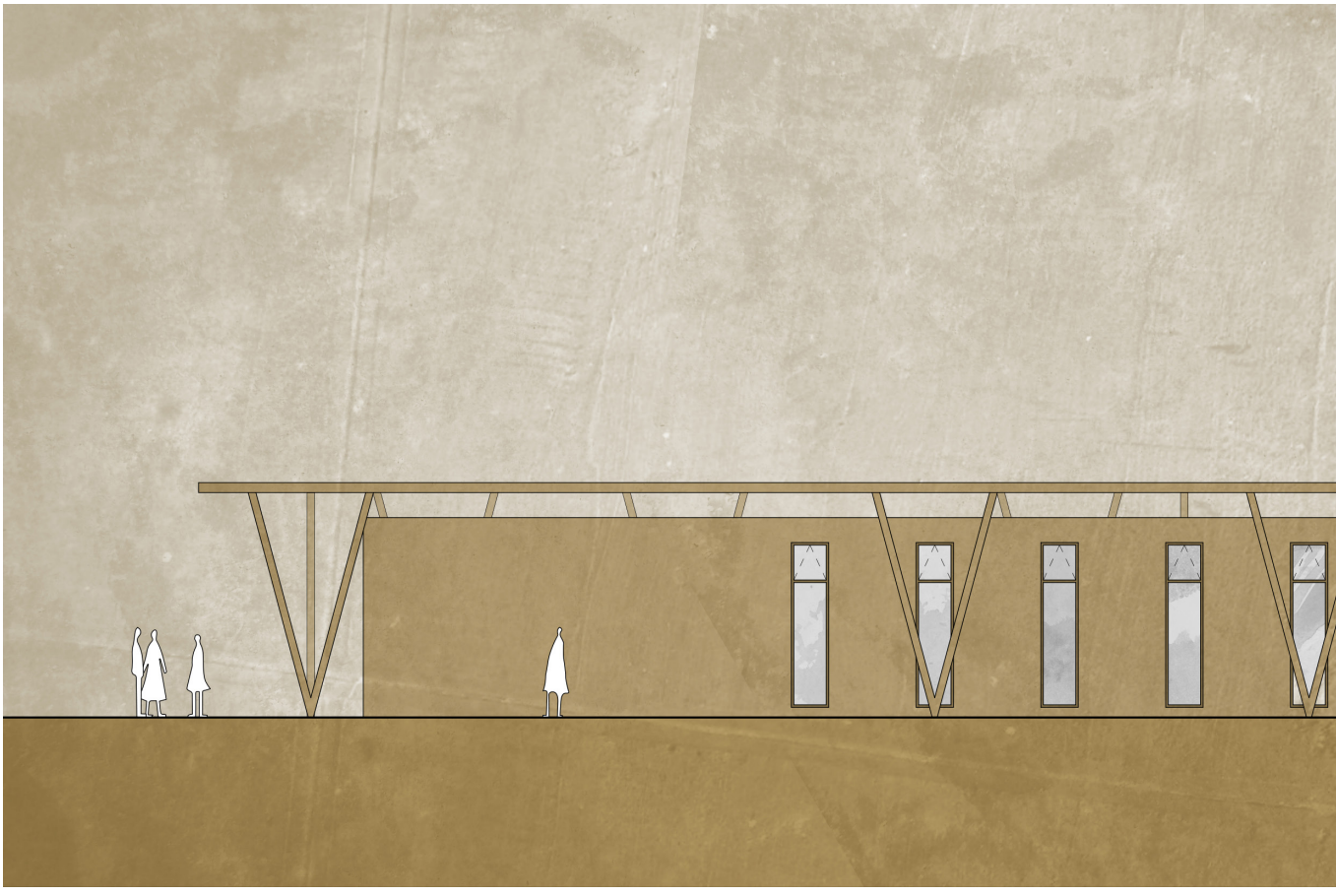


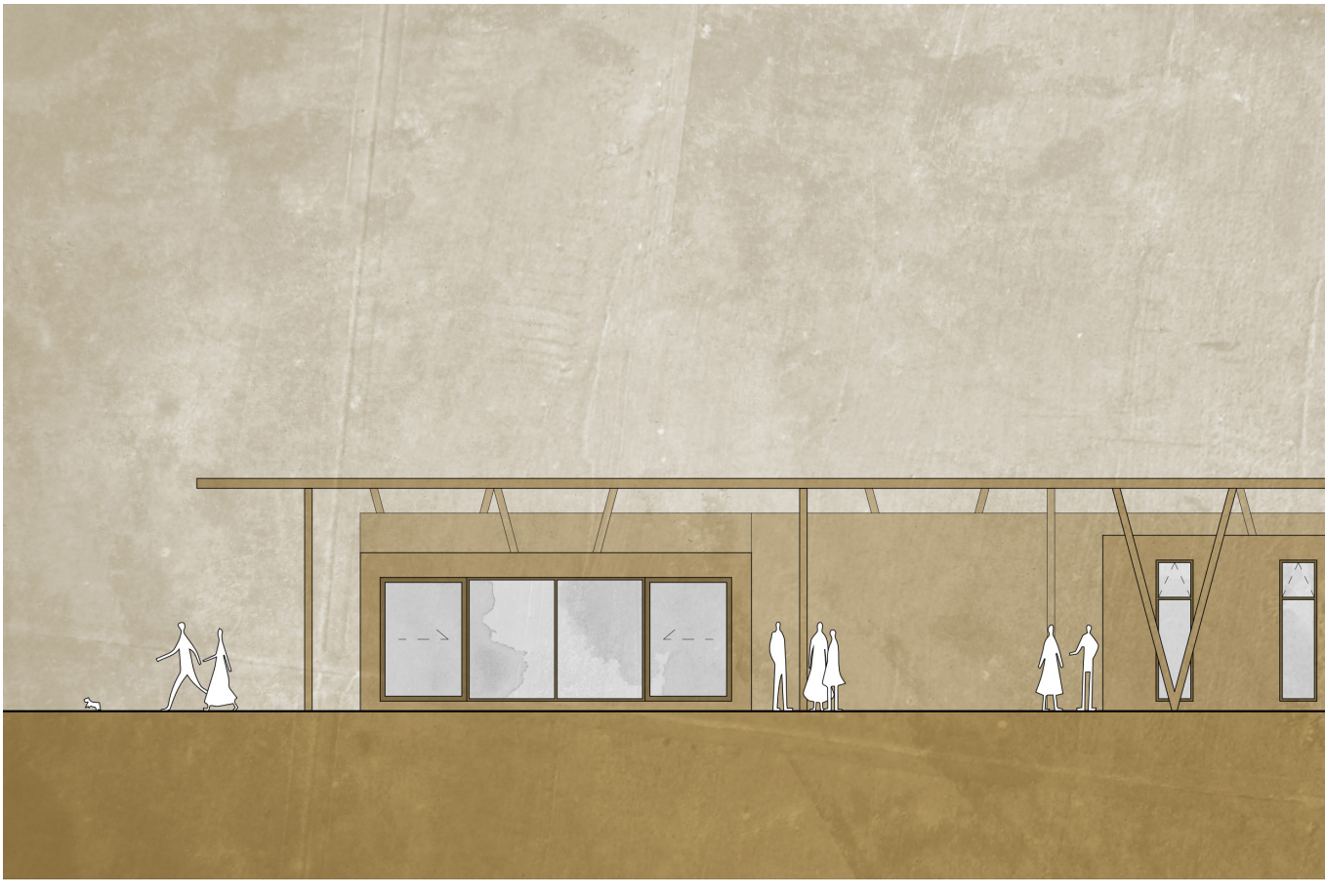
Ill. 31 - South facade - 1:150

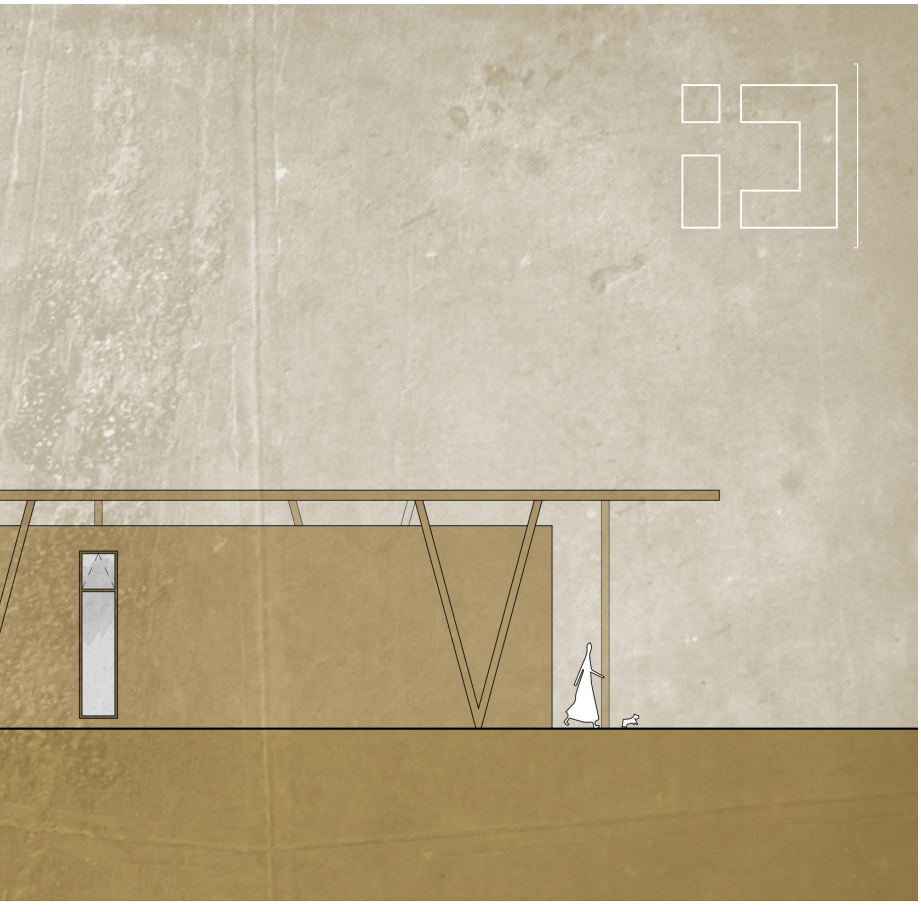
ELEVATIONS

Arriving to the Visitor Center from either north or south, the hierarchy of the volumes becomes clear, while walking towards the path leading into the courtyard of the building. The visitors get the choice of either walking through the path towards the Cromeleque dos Almendres or take a break at the building, when entering the inside of the complex.

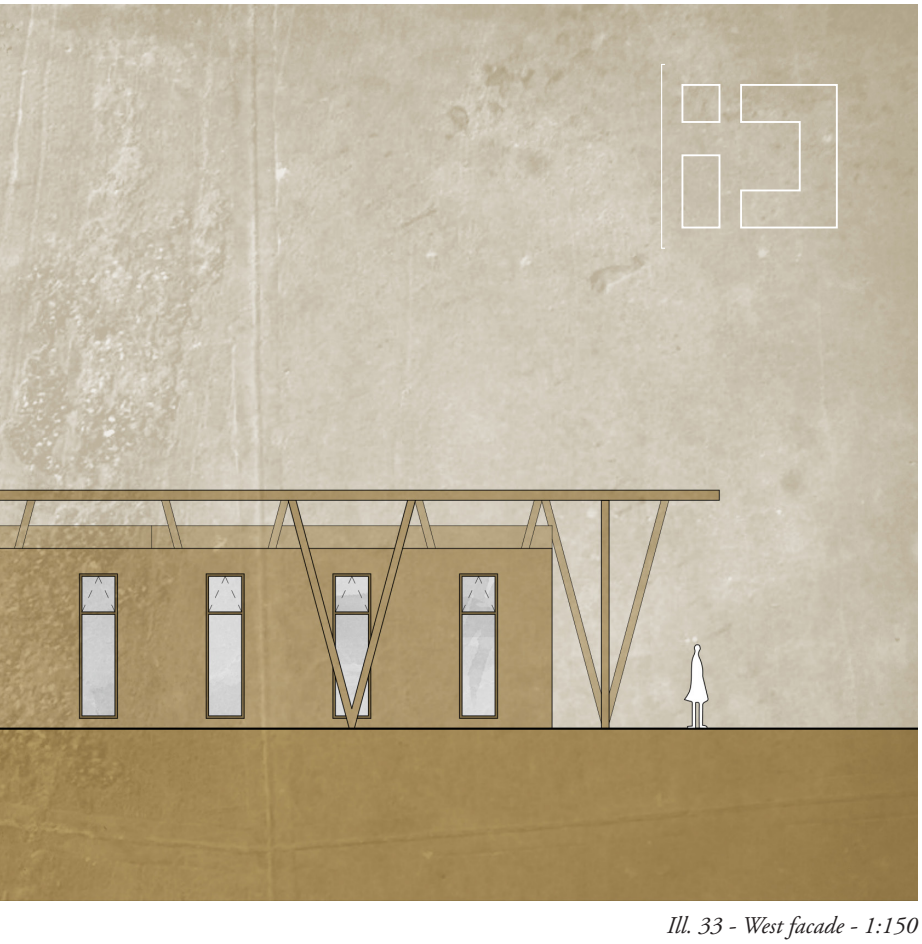
The large windows placed on the south façade, gives the employees of the administration a great view to the path leading to the Cromeleque dos Almendres, making them able to follow the flow of visitors of the historical site.







Ill. 32 - East facade - 1:150

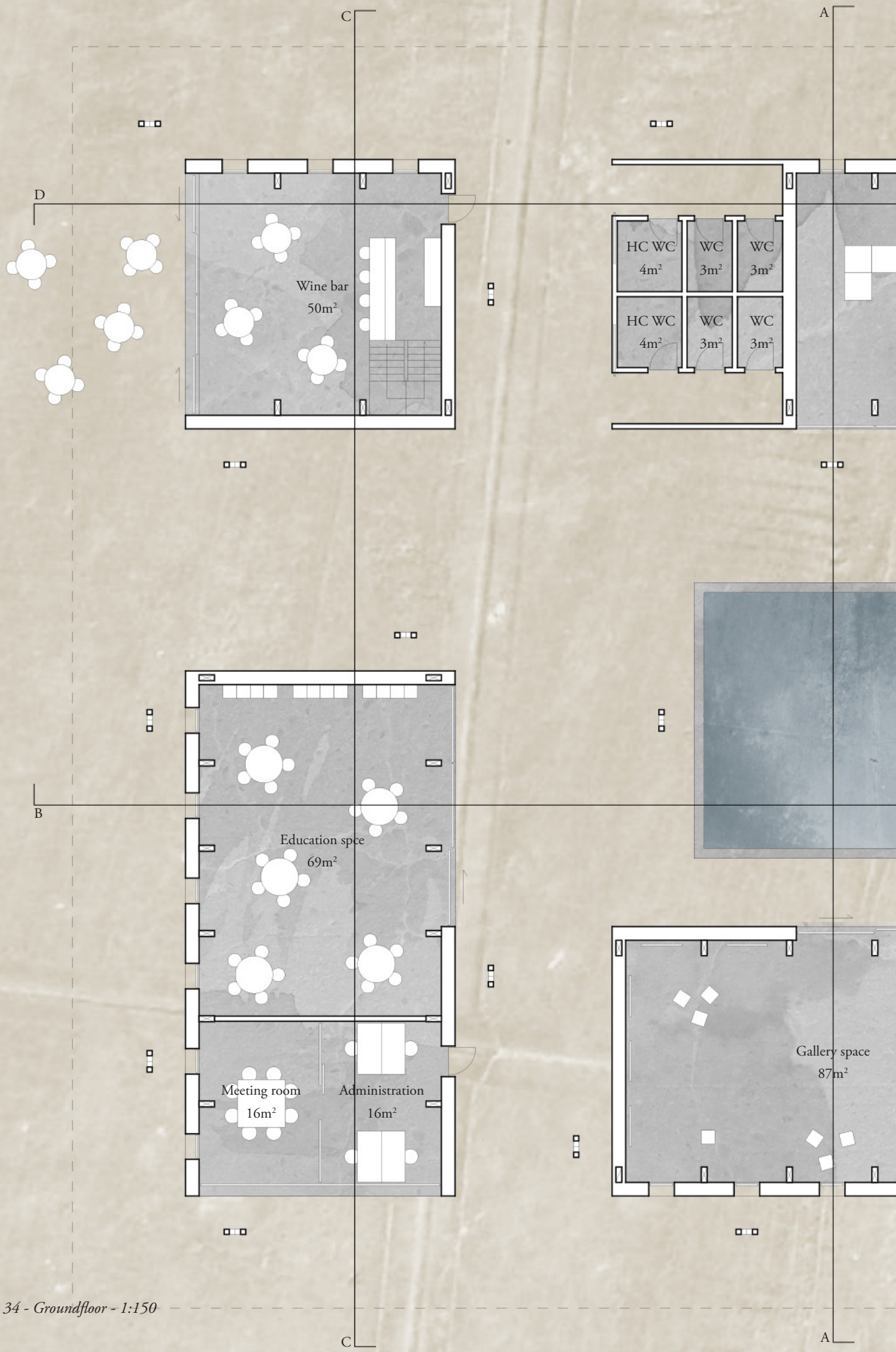


Ill. 33 - West facade - 1:150

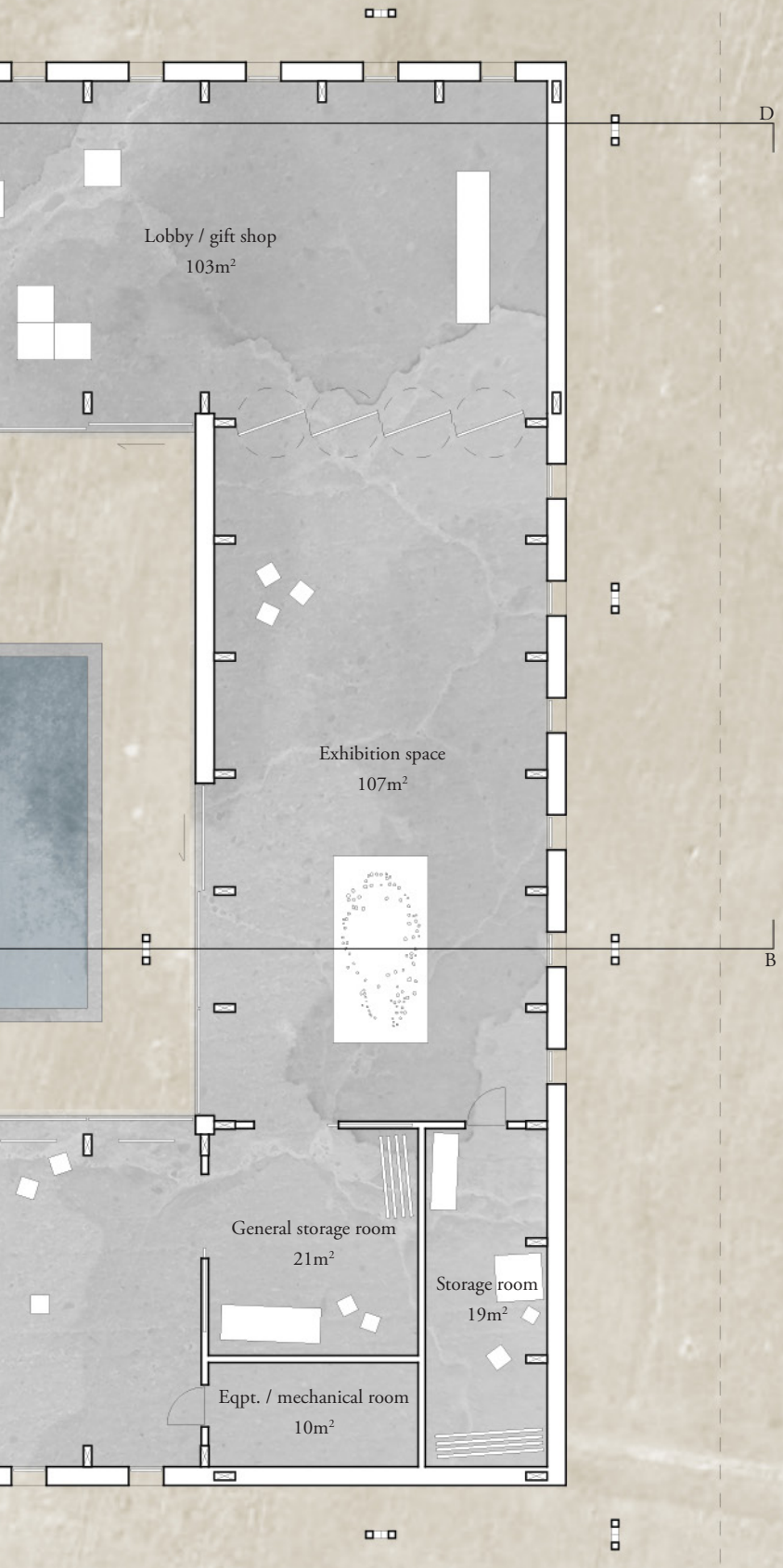
ELEVATIONS

The eastern façade is symmetrical, giving it a rather monumental expression. By adding the angled columns for the canopy hovering above the complex, gives the façade that little irregularity, that breaks with the horizontal and vertical lines and makes it just a bit unsymmetrical.

The western façade opens towards the landscape, where a wide path leads from the courtyard and out of the complex towards the hillside, sloping down towards west. Also, large windows are placed in the wine bar giving the visitors a view over the farmlands, where the products showcased in the bar are produced by local farmers.



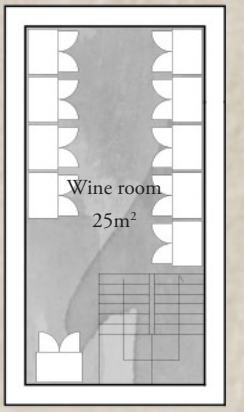
Ill. 34 - Groundfloor - 1:150

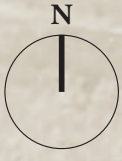


PLAN

Entering the Visitor Center, the visitors are led to the courtyard, acting as an outdoor common space. In the courtyard four big openings in the volumes are visible, inviting the visitors to either enter the lobby, exhibitions space, gallery space or education space. The openings are provided with a big sliding door, which make the transition between indoor and outdoor as minimal as possible. This strengthen the connections in between the functions connected to the courtyard, making the complex feel like one unity.

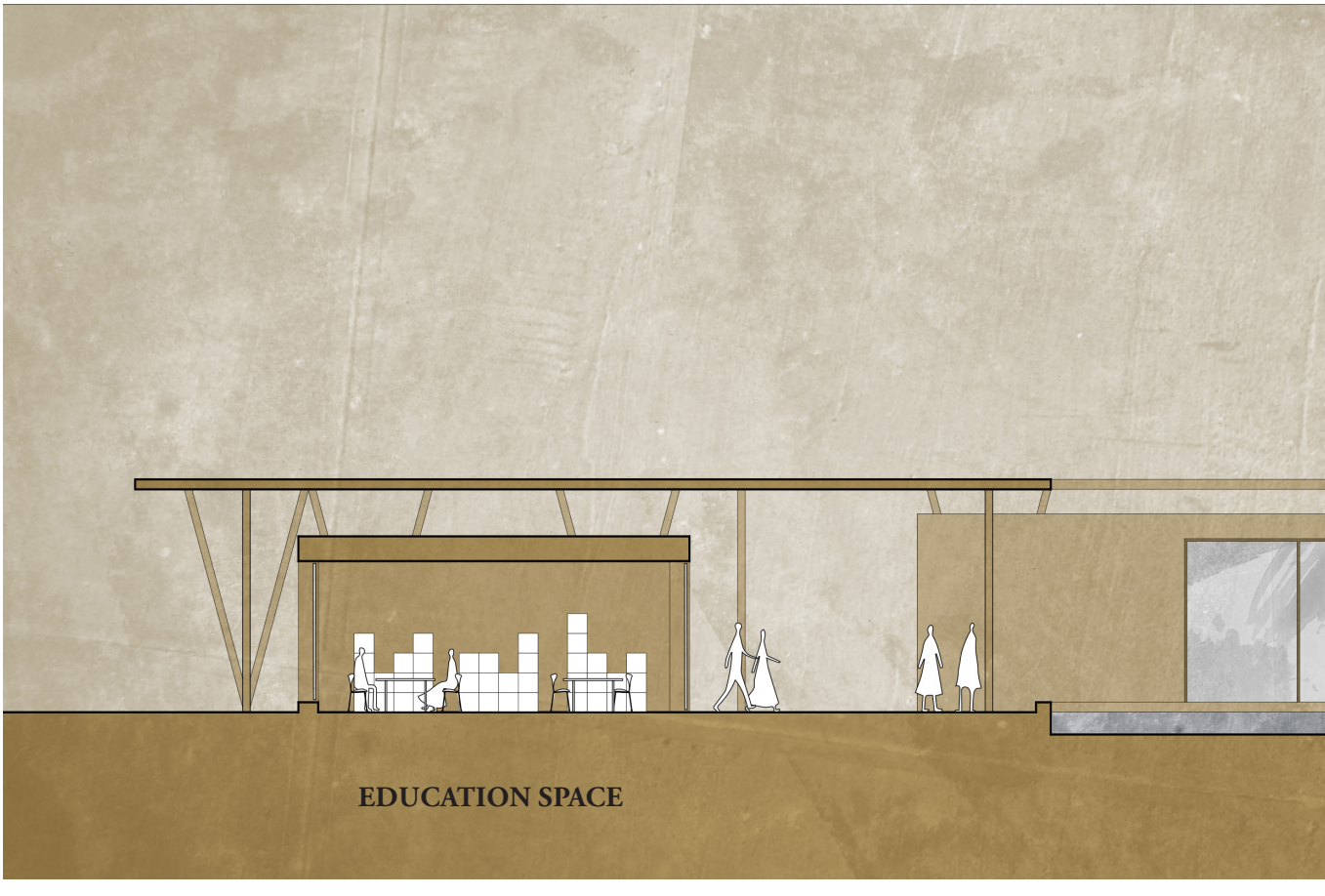
The wine bar is placed in the northwestern corner, to be easy for visitors to find when arriving. This placement make it possible to arrange events with no relation to the rest of the functions, without disturbing the atmosphere in the rest of the complex.

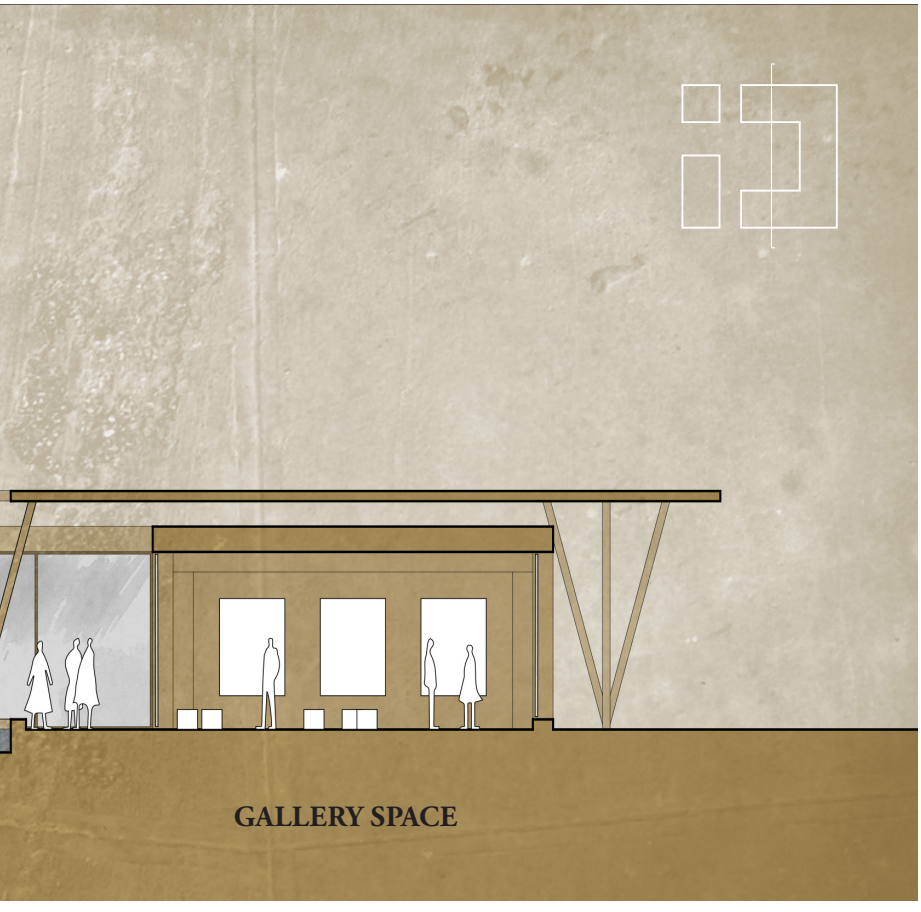




Ill. 35 - Basement - 1:150


LOBBY / GIFT SHOP


EDUCATION SPACE



Ill. 36 - Section AA - 1:150

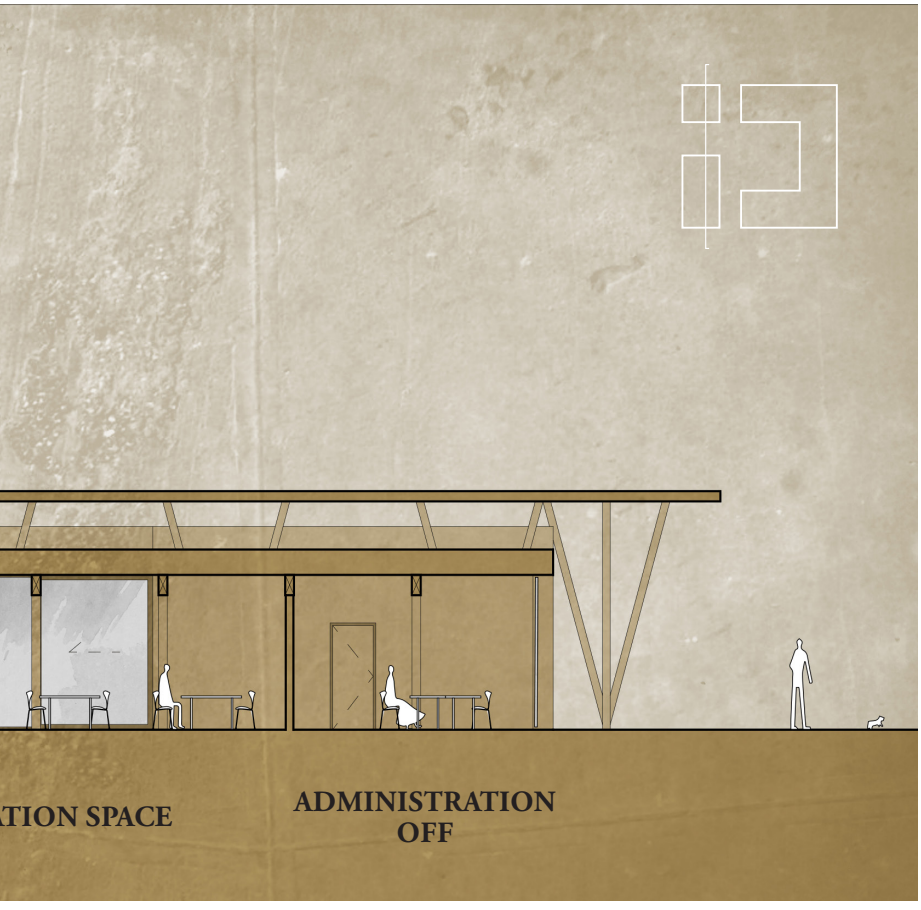
Ill. 37 - Section BB - 1:150

SECTIONS

The courtyard is the center of the visitor center, connecting the four main functions: The lobby, exhibition space, gallery space and education space. The courtyard is the shared outdoor space, where the different groups of visitors will meet each other. To emphasis the unity between the functions, are the openings placed opposite each other, creating a strong visual connection crossing the courtyard.


WINE BAR
EDUCA


LOBBY / GIFT SHOP
TOILETS



Ill. 38 - Section CC - 1:150

Ill. 39 - Section DD - 1:150

SECTIONS

To enter the visitor center, the visitors must enter through the openings of the courtyard. The path coming from north to south is narrow, which highlighting the opening of the courtyard in the middle of the volume.
Towards west is a bigger opening in the volume, this invites the visitors to walk out through the path and look over the hilly nature unfolding underneath.

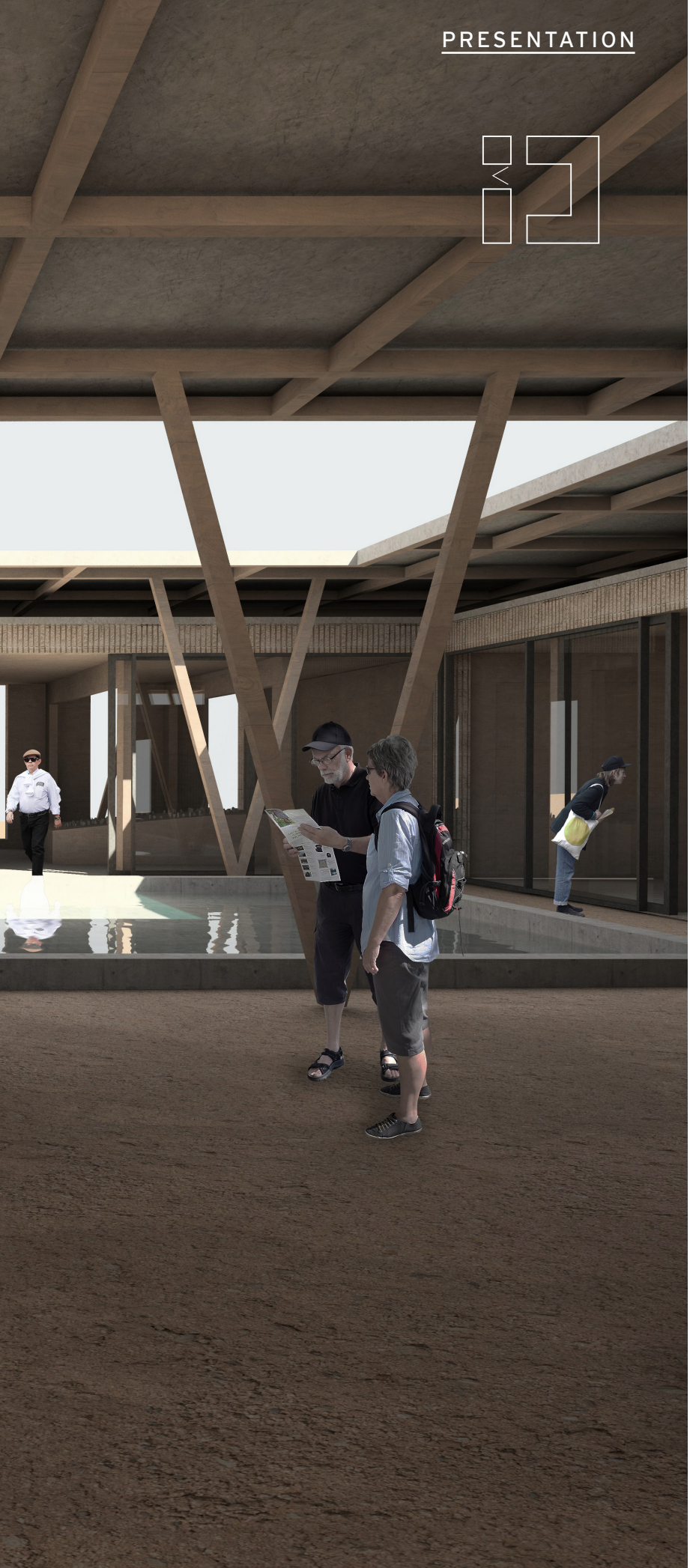
Ill. 40 - Arrival

ARRIVAL

When arriving to the visitor center, the visitors are walking along an uphill path, with dense vegetation of both cork oaks and olive trees. Due to the proportions of the building, it won't reach above the treetops, and will first be in sight when the visitors are close to the building.

The opening underneath the canopy emphasize the buildings effect at a gateway into the site of Cromeleque dos Almendres, staging the calm atmosphere of the granite monument.

Ill. 41 - Courtyard



COURTYARD

The courtyard is the gathering spot for visitors. All flow in the building will go through this area. To ensure that this shared outdoor area is comfortable, shading from the canopy is provide, and a basin in the middle of the courtyard will cool the surrounding air.

Ill. 42 - Lobby and exhibitions space

LOBBY AND EXHIBITION SPACE

The lobby and exhibition space is made with only a retractable glass wall dividing the two functions. This makes the transition between the two functions during the open hours natural, since they will merge into the same room.

In the beginning of the exhibition space is there an open space, which is designated to temporary exhibitions related to Cromeleque dos Almendres, which is made in a 1:20 model I the far end of the room. The model will provide visitors with an aerial view and additional information about the megalithic complex.

Ill. 43 - Gallery space

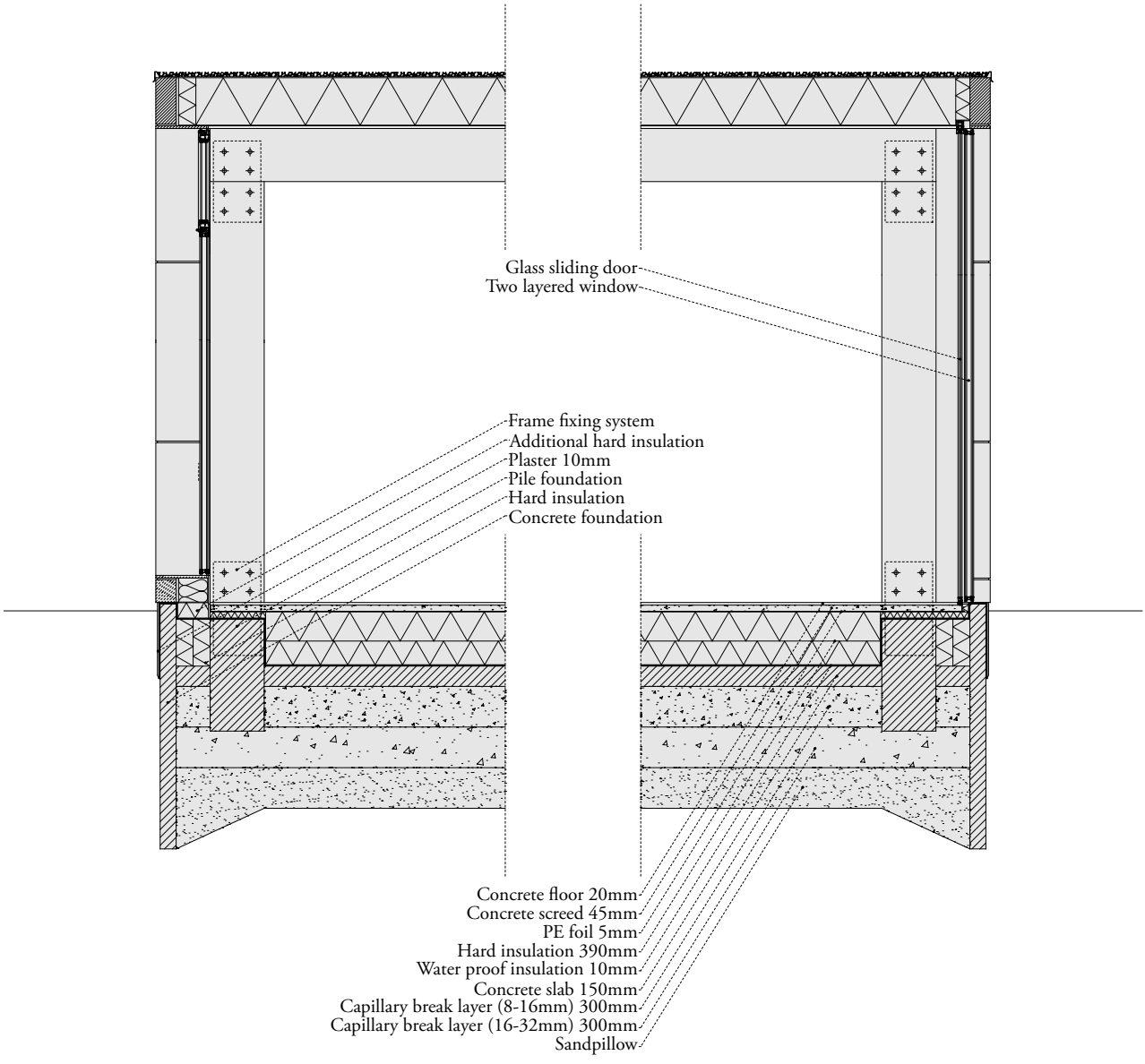
GALLERY SPACE

The Gallery space is an open space, giving the possibility to arrange new installations the way that fits the current exhibition best. Having the wooden frames make sure that the exhibition team has as much freedom to arrange the exhibition as possible within the area of the room.

Ill. 44 - Education space

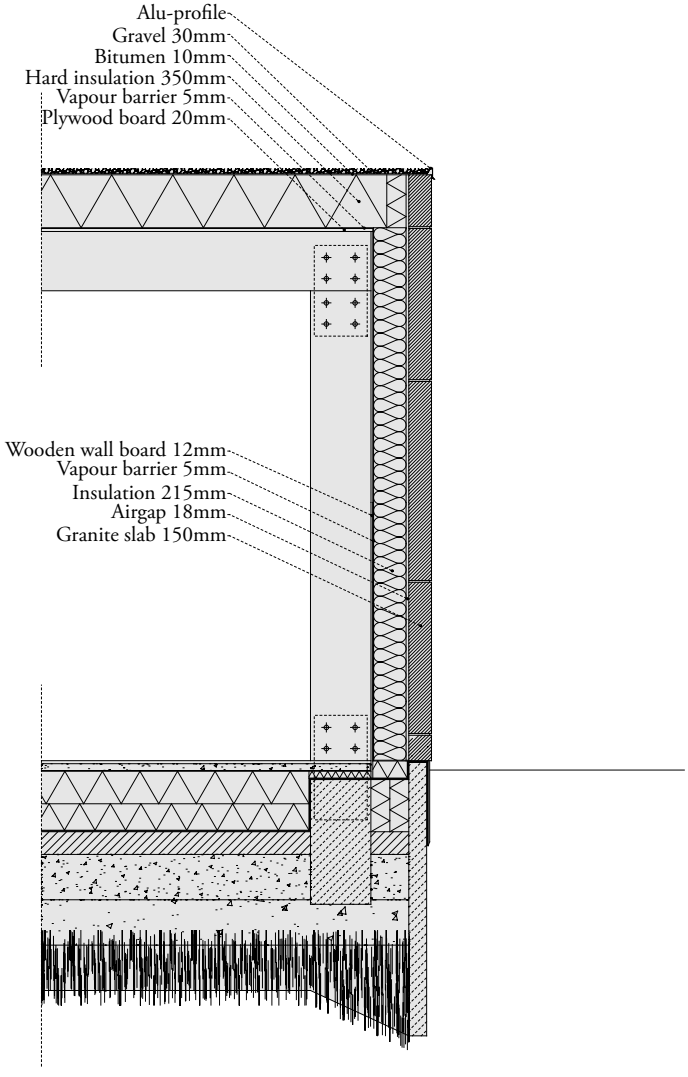
EDUCATION SPACE

As for the gallery space, the main feature of the room is that it freely can be arranged to accommodate the situation for the given day. The teachers and students has the freedom to arrange the tables to fit workshops in groups, lectures for the entire class or watching video material on the video projector.



Ill. 45 - Section 1:50

DETAILS



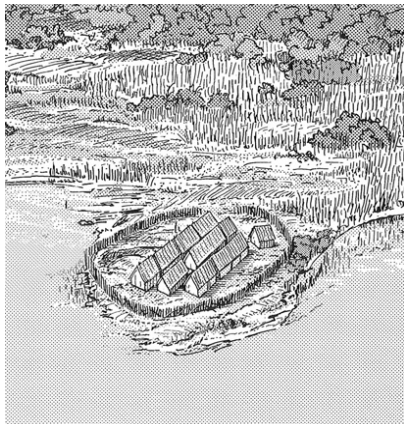
The structure of the building is made from a set of wooden frames, made by maritime pine. The material has been chosen due to its strength and it's a common wood species in Portugal. The roughness of the maritime wood elements is contrasted by the wooden wall boards made from olive wood, as a reference to the surrounding trees. The floor is made of concrete, because of its though durability against wear from moving objects around, when arranging for the various scenarios. The façade is made of stacked granite slabs, as a reference to the granite monoliths. From the outside the volume seems massive, with only few hole in it, giving it a heavy look, contrasted by the light canopy hovering above.

Ill. 46 - Section 1:50

DESIGN PROCESS

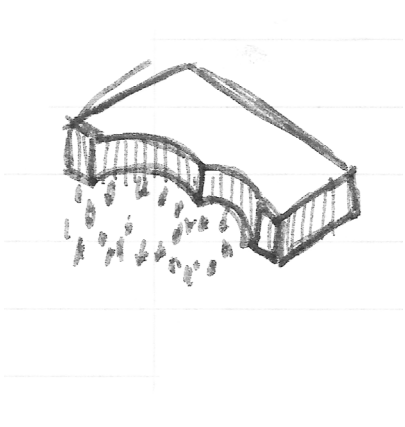
This sections shows the design process of the final project. The design development is divided into topics to make the process from start to the end stand out clearer.

Ill. 47 - Neolithic longhouse

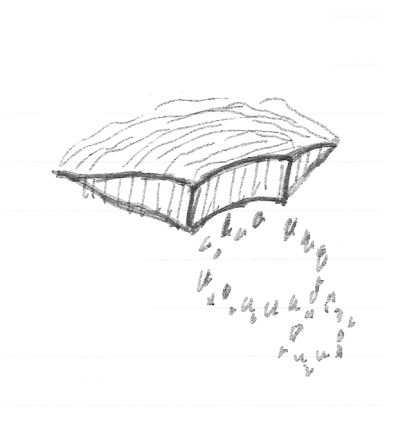


Ill. 48 - Neolithic community

Ill. 49 - Neolitich community

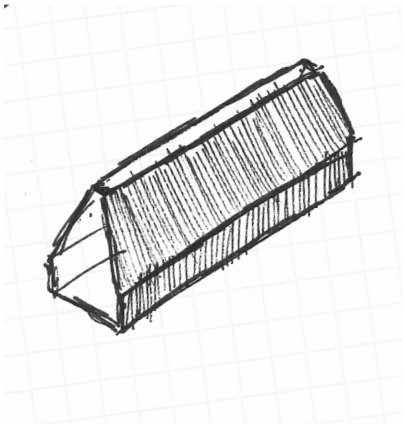


Ill. 51 - The cuts

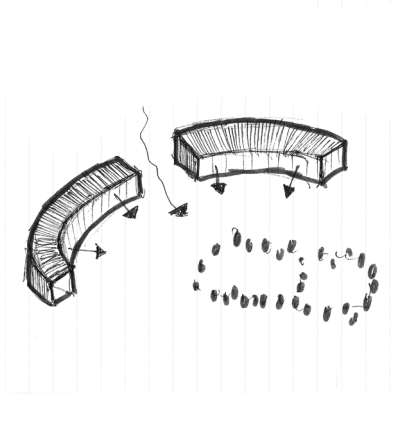


Ill. 52 - The hill

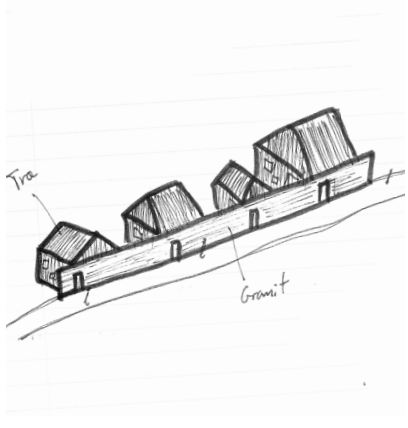
Ill. 53 - The third circle



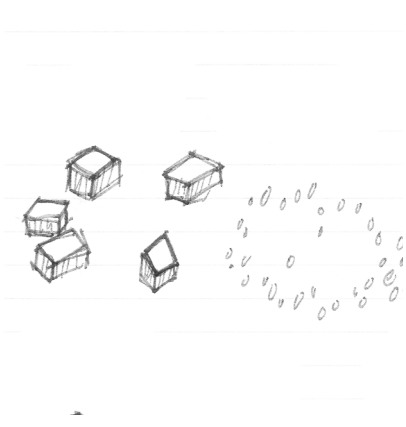
Ill. 55 - The longhouse



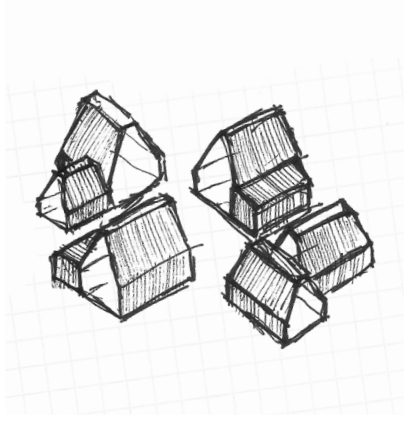
Ill. 56 - The barrier



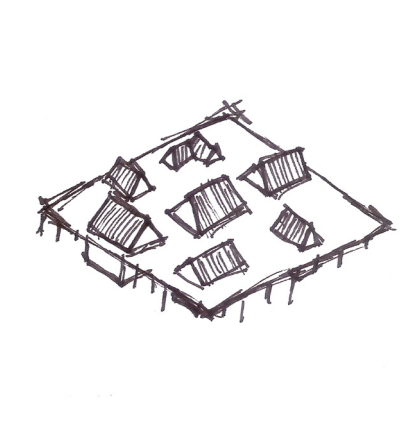
Ill. 57 - Wall of houses



Ill. 59 - New monoliths



Ill. 60 - Pitched roofs



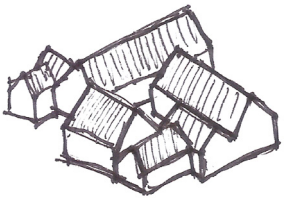
Ill. 61 - Village under the roof

Ill. 50 - Rooftops of Évora

INITIAL FORM STUDIES

INSPIRATION

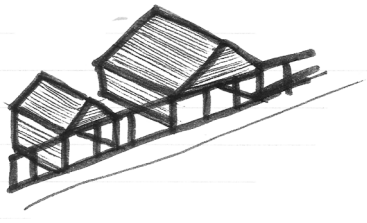
Before starting the initial form studies, inspirations were found, which some of them is shown at illustration 47-50. The inspiration was found in the historical Neolithic community, which is characterized by the cluster and grouping of houses inside the community walls. As shown on illustration 47, were the Neolithic longhouse also used as inspiration, which is characterized by the ration between wall and roof height. Lastly inspiration was drawn from the townscape of Évora.



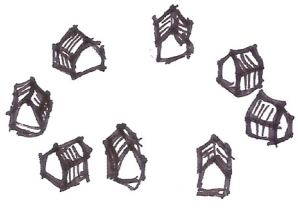
Ill. 54 - Cluster of houses

COMPACT VOLUME

The first form studies were made with the focus of having only one volume, as normally seen in today's visitor centers. The first iteration was concerned about working with the shapes of the Cromeleque dos Almendres, seen on illustration 51 where it is tried to merge the basic box with the shape of the megalithic complex, cutting outs shapes of the box, and on illustration 53, the round shapes of the complex are used to design a third circle, containing the visitor center.
Illustration 52 is a variation of how to use the building as an extension of the landscape, and that way hide the building, keeping the visitors' main attention on the site, instead of the building.
The last variation for this category shown is illustration 54, here the idea of small houses from the Neolithic community is clustered together, to make on big volume that's divided into smaller volumes decided by the size of the function underneath the roof.



Ill. 58 - Transparant wall



Ill. 62 - Camp of houses

STRETCHED VOLUME

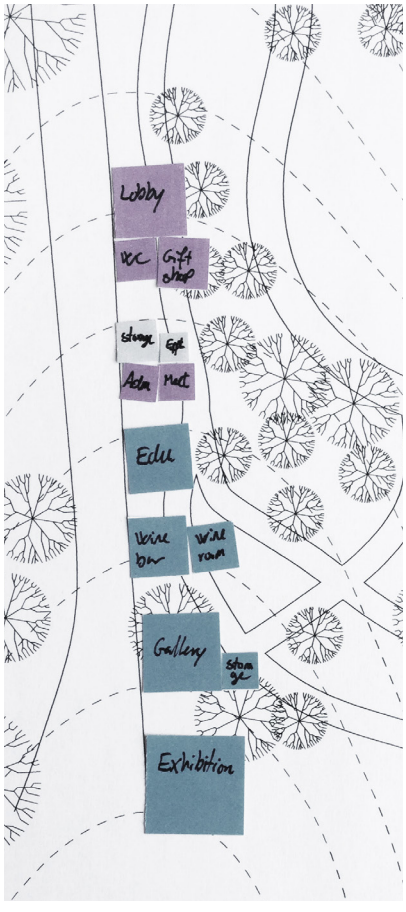
In the search of finding shapes, which won't be too deep, and potentially causing daylight problems for the finale design, stretched volumes were tested, which is clearly seen on illustration 55, which is inspired from the Neolithic longhouse, with lower walls and a high roof.
On illustration 56 a stretched volume is shown, which has been bended, to embrace the megalithic complex. The two quarter circles are thought as only opened on the side pointing toward the complex, making is look heavy on the outside and light on the inside, where people will be stay during the visit.
Illustration 57 and 58 shows two variations of having a long wall, with houses on the other side, symbolizing walking along the wall of at Neolithic community with the roof tops poking above the outer walls.

SCATTERED VOLUMES

Inspired by the cluster shown at illustration 54 and the Neolithic community, scattered volumes were tested.
Illustration 59 and 62 shows small volumes scattered either symbolizing granite monoliths or small huts from the community.
On illustration 60 is small houses arranged with views towards a share courtyard, creating a natural meeting point.
The last sketch, illustration 61, shown a combination of having smaller volumes scattered, but still gathered under one roof. Here it's done by having a canopy over the outdoor spaces, making all hallways outdoor, and only having functions indoor.

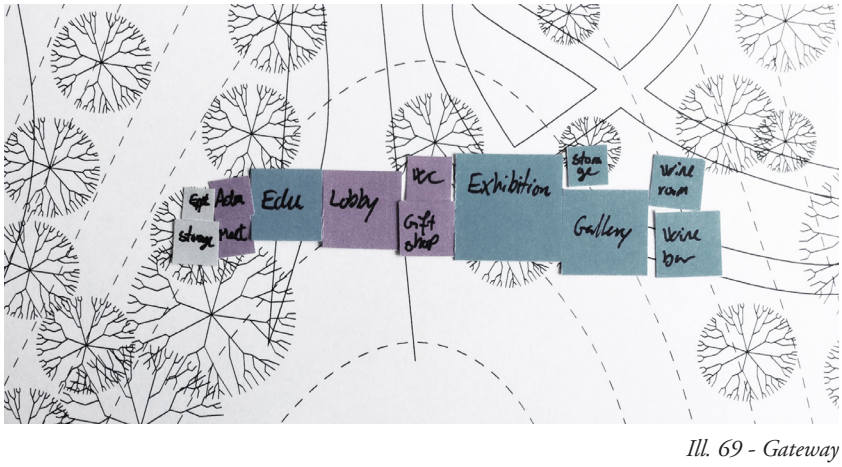
Ill. 63 - Community

Ill. 64 - Cluster

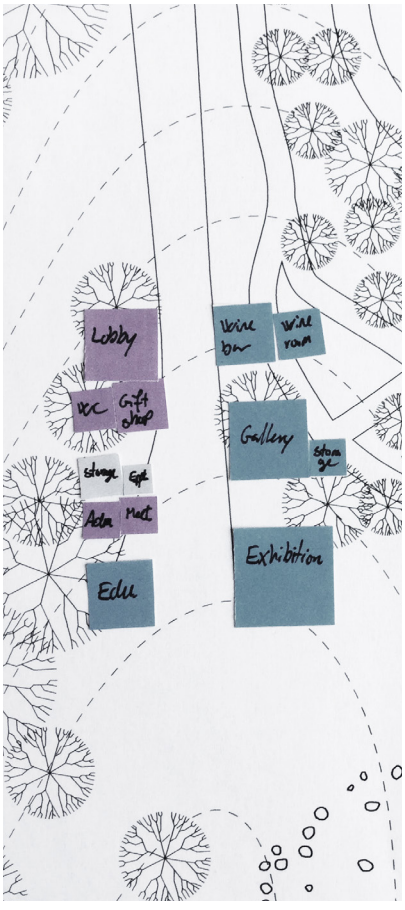


Ill. 65 - Wall

Ill. 67 - Ring

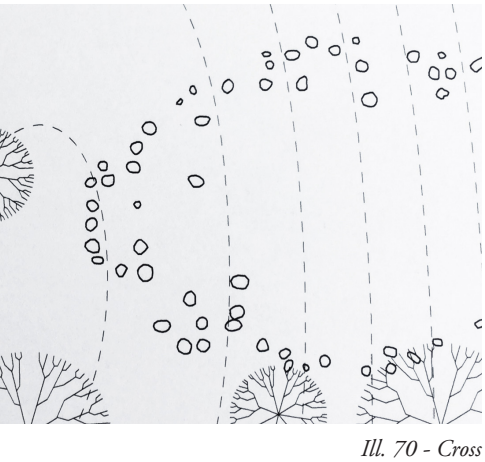


Ill. 69 - Gateway



Ill. 66 - Two walls

Ill. 68 - Flag



Ill. 70 - Cross

INITIAL PLAN STUDIES

With the form studies in mind, the initial plan studies were commenced. Here the functions were made in scale, to give a more realistic view of the size of the facility.

THE COMMUNITY

First off is illustration 63, showing an iteration of small scattered volumes. Here the focus was to make a courtyard in the middle, with multiple paths leading into it, making the visitors walk through the visitor center, even during hours the facility is closed.

THE CLUSTER

Illustration 64 is a variation of how to arrange the functions in one big cluster. The service functions are placed in the center, and otherwise are functions with the same type of visitors placed next to each other.

THE WALL

This design, illustration 65, is based on the idea shown on illustration 55 from previous section. The functions are scattered along the path leading from the parking lot to the Cromeleque dos Almendres. Visitors will enter the door for the function wanted to visit.

THE TWO WALLS

Illustration 66 is a variation of previous idea, but trying to link the functions better together, by having a "wall" on both sides of the path, making the built more compact in look.

THE RING

With inspiration from The community, illustration 67 was made. The shared courtyard is still in focus, but the functions are now divided along a circle, enclosing the courtyard, making it private for the visitors inside the facility, instead of at place people just walk through.

THE FLAG

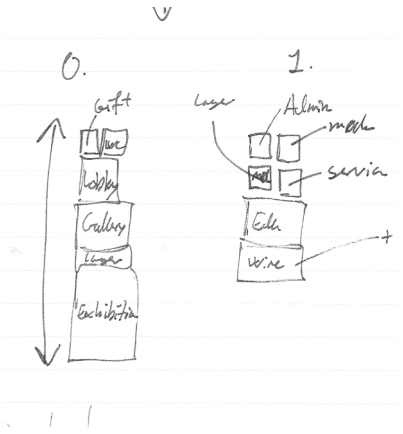
The flag, illustration 68, is inspired by the The cluster, but made with an attempt of opening up the middle of building. This way the middle of the facility will achieve more daylight, adding more quality to the indoor spaces. The cuts create small paths inside the area of the facility.

THE GATEWAY

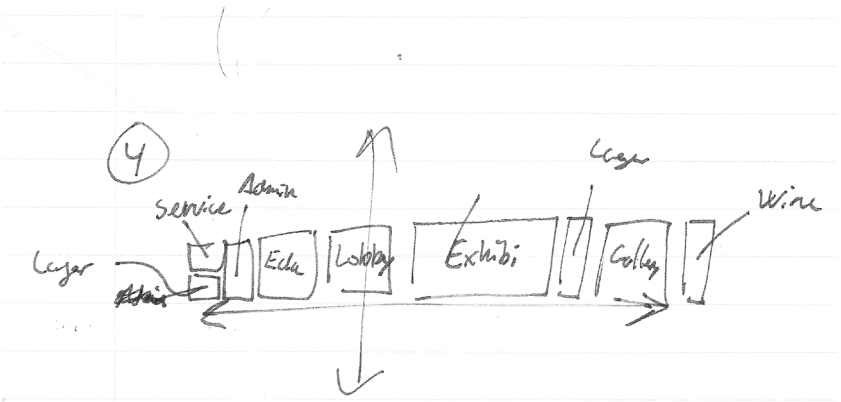
Illustration 69 shows the idea of having the visitor center literally as a gateway into the site of Cromeleque dos Almendres. The lobby will serve as the gateway, where the visitor either can continue to the megalithic complex, visit the exhibition, gallery and wine bar or attend a lecture in the education space.

THE CROSS

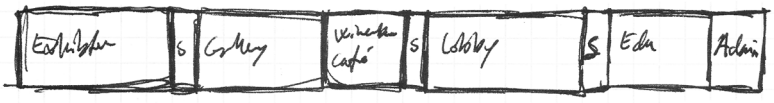
The cross, illustration 70, is inspired by the axial directions found in the Cromeleque dos Almendres. The lobby is placed in the middle, giving the visitors the possibility to move in the direction towards the desired function of the facility.

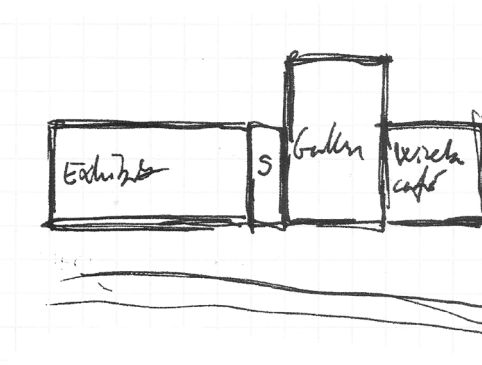


Ill. 71 - Wall , two-storey

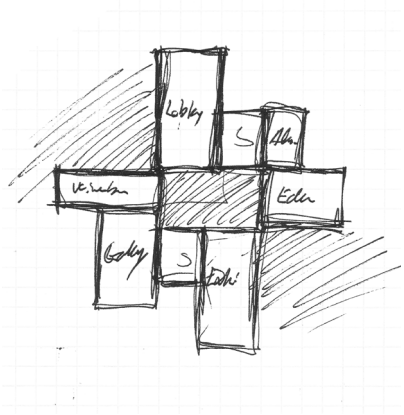


Ill. 72 - Gateway

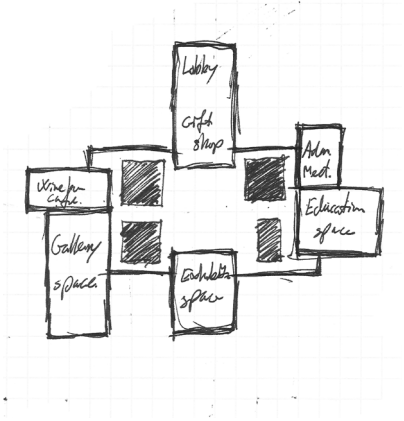




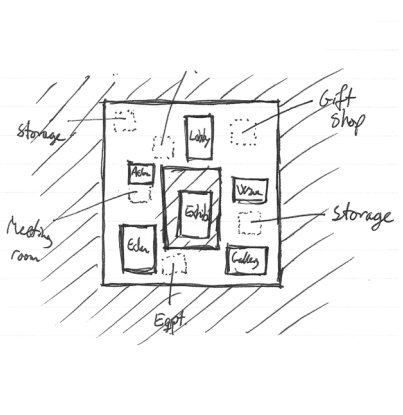
Ill. 74 - Straight wall



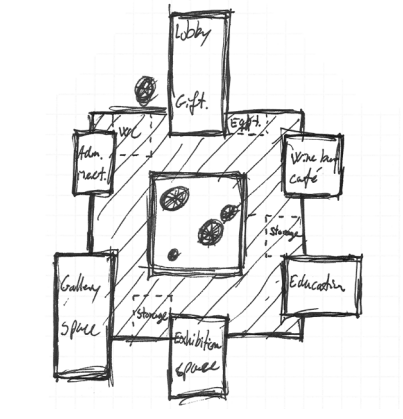
Ill. 76 - Cluster with courtyard



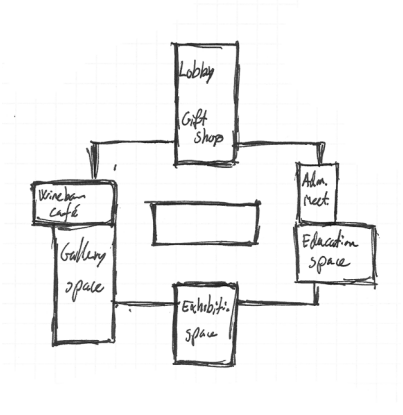
Ill. 77 - Canopy with surrounding buildings



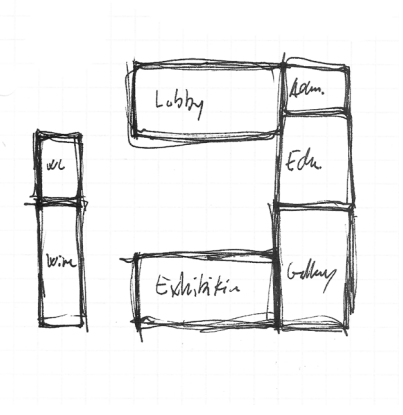
Ill. 78 - Building in courtyard



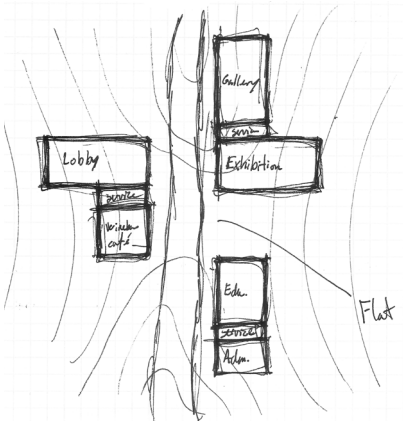
Ill. 80 - Squared courtyard



Ill. 81 - Narrow courtyard



Ill. 82 - Ring, open in top



Ill. 73 - Three houses

FURTHER PLAN STUDIES

For the further plan studies, four of previous ideas are chosen to be sketched further on. It's The wall, The gateway, The community and The ring.

THE WALL

Illustration 71, 74 and 75 are some of the iteration for this concept. Illustration 71 shows a two-story variation where all functions regarding the Cromeleque dos Almendres is situated on the ground floor, and wine bar and working areas, the education space and administration offices, are placed on the first floor, giving these functions more calmness around them. Illustration 74 and 75 shows how the arrangement of the functions will be in a one-story design. The lobby will be placed in the middle, where it's possible to go to the calm area, education space and administration offices, or go the more dynamic area of the exhibition space, gallery space and wine bar.

THE GATEWAY

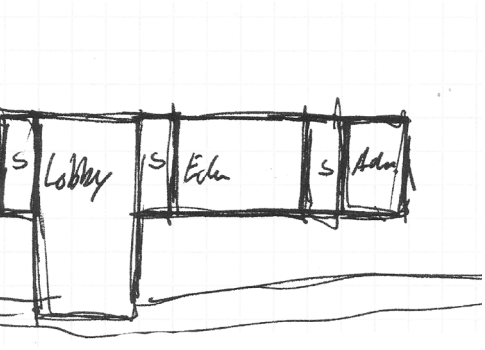
The layout, shown on illustration 73, is like previous design, which dynamic functions on one side of the lobby and calm functions on the opposite side. As thought in the initial plan studies, the lobby will function as the gateway, where the visitor can either continue through the building or walk along one of the hallways inside the facility. Trying to break up the volume, the sketch of illustration 73 was made. Here the functions are placed beside the path, the gateway will now symbolic be between the volumes, when walking toward the Cromeleque dos Almendres.

THE COMMUNITY

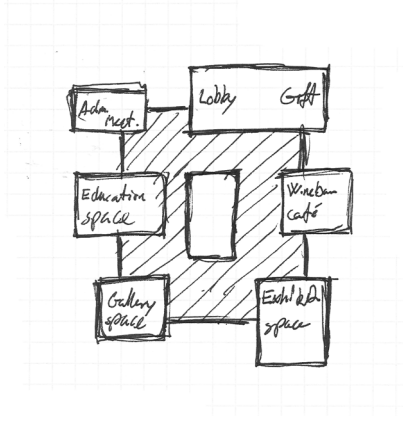
Illustration 76 - 81 shows some different iterations made on the concept from The community, all with a main flow from entering the lobby, through the courtyard, into the exhibition space and exiting towards Cromeleque dos Almendres.
Illustration 76 has a closed courtyard, working as the connection point for the facility. If the visitor want to go from one function to another, they must walk through the courtyard.
Illustration 78 - 81 shows different iterations of having a canopy connection the functions, giving shade to the visitors while moving between functions of the facility. Underneath the canopy will there be placed different service functions. The sketch on illustration 78 shows that a function can be placed inside the courtyard, acting as the main function of the facility.
Lastly is illustration 77 a version, where the canopy totally covers the courtyard, shading off the middle of the facility, even though it's outdoor.

THE RING

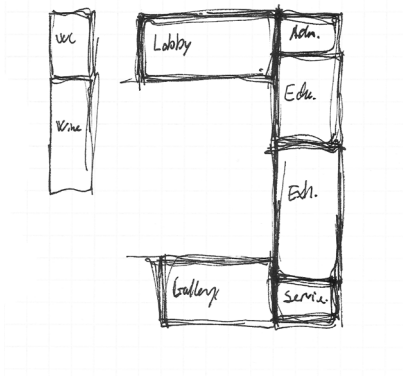
Illustration 82 and 83 shows two iterations of The ring from previous section. Here the ring is punctuated at two places, making it possible for the visitors to walk through the facility, without entering the building.
This makes the surrounding functions connect to the courtyard in one side, and makes a path for passersby walking towards Cromeleque dos Almendres.
This separation allows a division between the functions, which can be done accordingly to type of visitors.



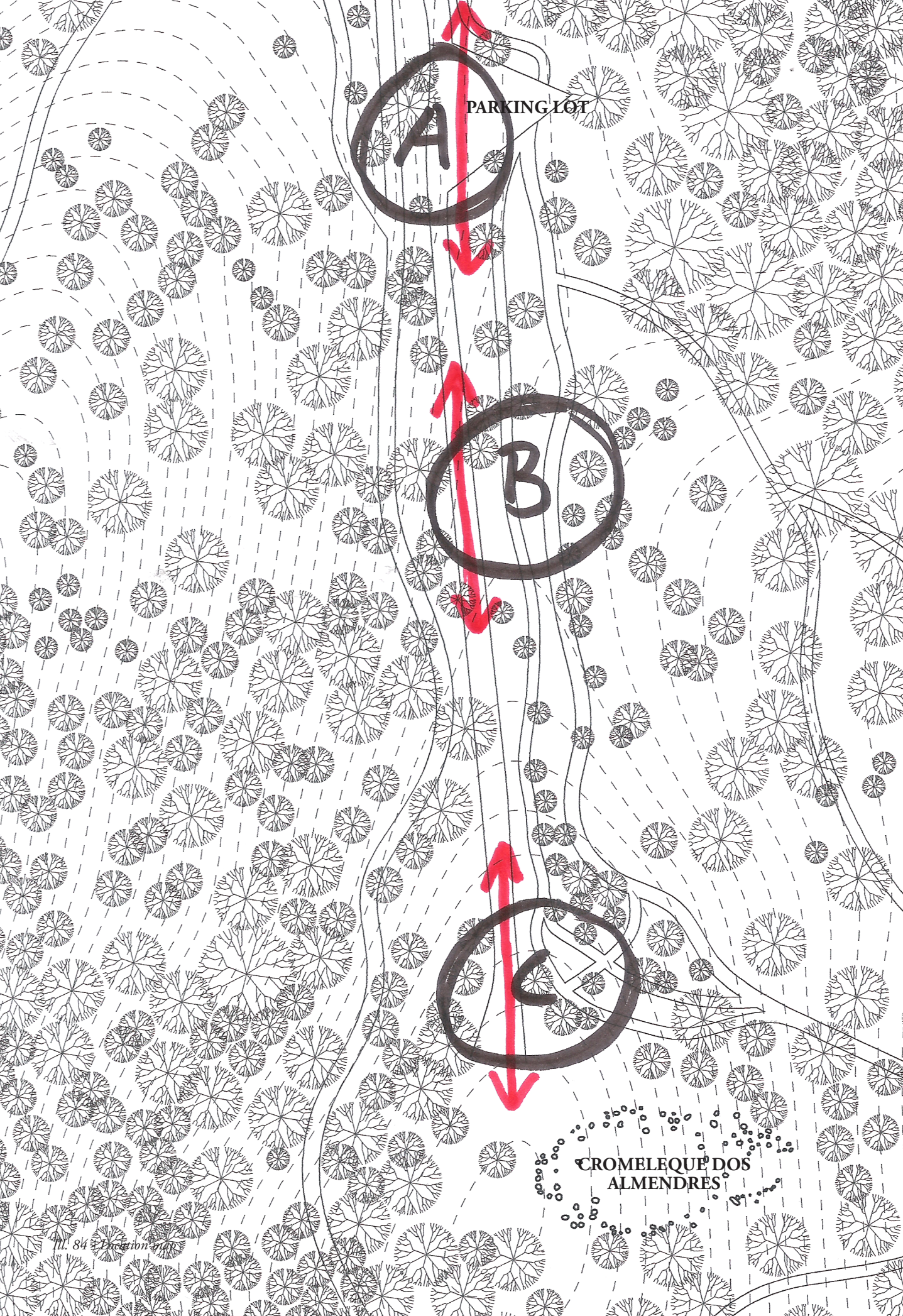
Ill. 75 - Wall with peg outs



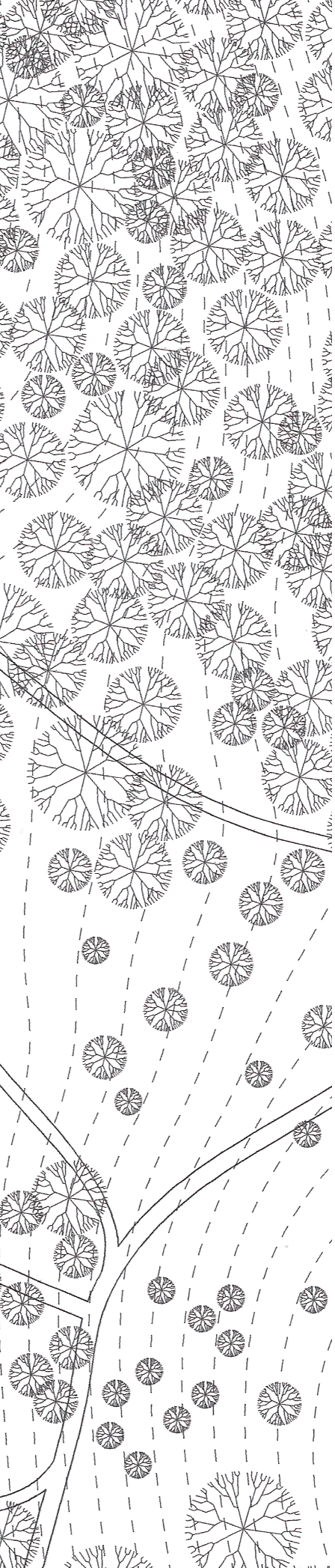
Ill. 79 - Ring with courtyard



Ill. 83 - Ring, open in bottom



Il. 84 - Location map.



LOCATION STUDIES

LOCATION A

This location is at the parking lot for Cromeleque dos Almendres. Building the Visitor Center at this location, will make the building work as the obvious entrance to the site. The visitors will drop of their cars or arrive with the busses, and then immediately know where to go to find the information about the site.
The distance between Cromeleque dos Almendres and location A is around 250m, clearly making a separation between the historical site and the new building, marked with lots of native cork oaks and olive trees.

LOCATION B

Location B is situated approximately in the middle between the parking lot and Cromeleque dos Almendres. The special about this location is, it's the only flat part on the mountain, making it a good location for a building with a big footprint.
The existing path is just cutting through the westside of the site, making it ideal for a building, where the path can be integrated as a part of the new visitor center.
Placing the visitor center here, the historical complex will still be respected by the separation, but the facility will be closer and better connected to the megalithic complex.

LOCATION C

This location at the end of the path leading to Cromeleque dos Almendres. Here the path transform into an open area surrounded with trees, and with a great view over Cromeleque dos Almendres.
Placing the visitor center here, will make it nearly stand just beside Cromeleque dos Almendres. Designing a building here, should be done with a huge though on the atmosphere of the already existing site, which is influence by the historical feeling the granite monoliths.
The path goes directly through the middle of the site, making it important to incorporate how the visitors will pass the building doing the opening hours, but especially also during the closing hours, where tourists and locals still should be able to visit Cromeleque dos Almendres.

CONCLUSION

For the further progress of the design, the chosen location is location B.
This location is going to make the visitor center be placed right between the parking lot and Cromeleque dos Almendres, working as a midpoint, on the walk to Cromeleque dos Almendres. This also work together with the idea of that a visitor center is a parasitical topology, respecting Cromeleque dos Almendres as the main attraction and landmark of the area.

Choosing this location makes two of the previous plans more interesting to continue with for the further progress of the design. Therefor the two plans called The community and The ring will be used in the further process towards the finale design of the visitor center.

Ill. 85 - v1 Northwest

Ill. 86 - v1 East

Ill. 87 - v2 Northwest

Ill. 89 - v3 Northwest

Ill. 90 - v3 East

Ill. 91 - v4 Northwest

Ill. 93 - v6 Northwest

Ill. 94 - v6 East

Ill. 95 - v7 Northwest

Ill. 97 - v9 Northwest

Ill. 98 - v9 East

Ill. 99 - v10 Northwest

Ill. 88 - v2 East

WIND STUDIES

For the further progress towards the finale plan design, Autodesk's program Flow Design is used together with Rhino, to investigate how the courtyard can achieve the best condition in the two most common wind directions happening around Évora, 5m/s from northwest and east.

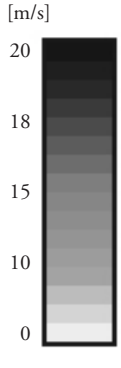
THE COMMUNITY

First wind study made, was for the plan of the community, shown with northwestern wind on illustration 85 and eastern wind on illustration 86. The studies clearly show that the open corners of this plan layout makes the wind blow directly through the middle of the courtyard, even with higher velocity than outside the courtyard, due to turbulence effect.
Because of this, the further process on this type of plan layout was stopped in favor for The ring layout.

Ill. 92 - v4 East

Ill. 96 - v7 East

Ill. 100 - v10 East



VELOCITY

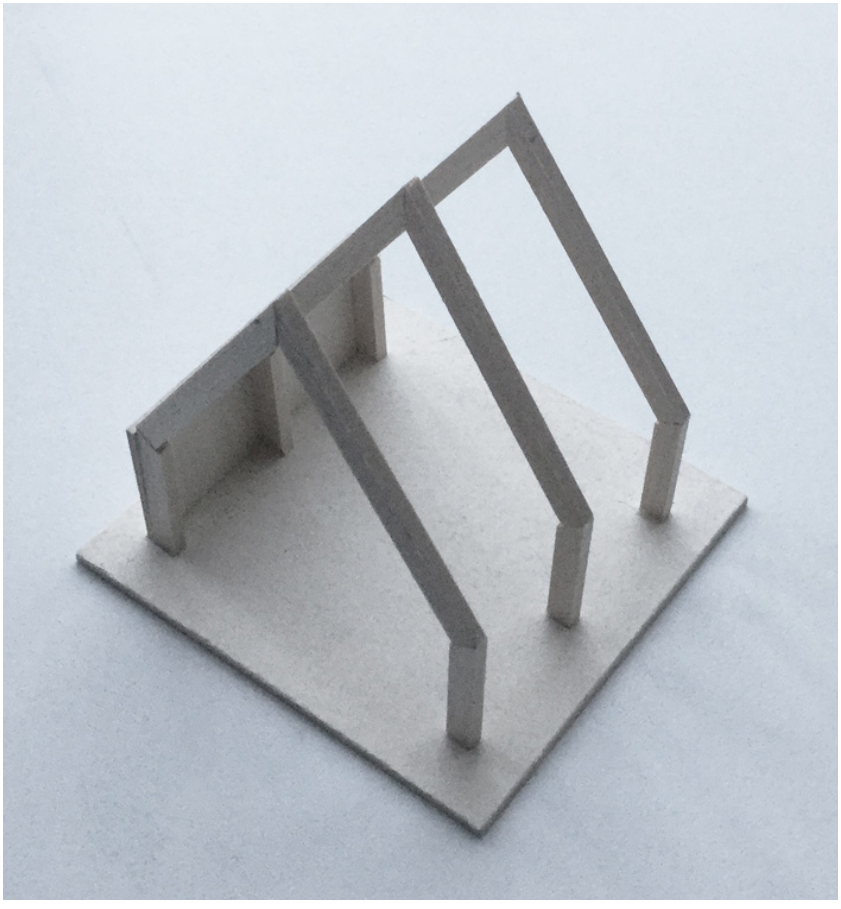
Ill. 101 - Velocity scale

THE L'S

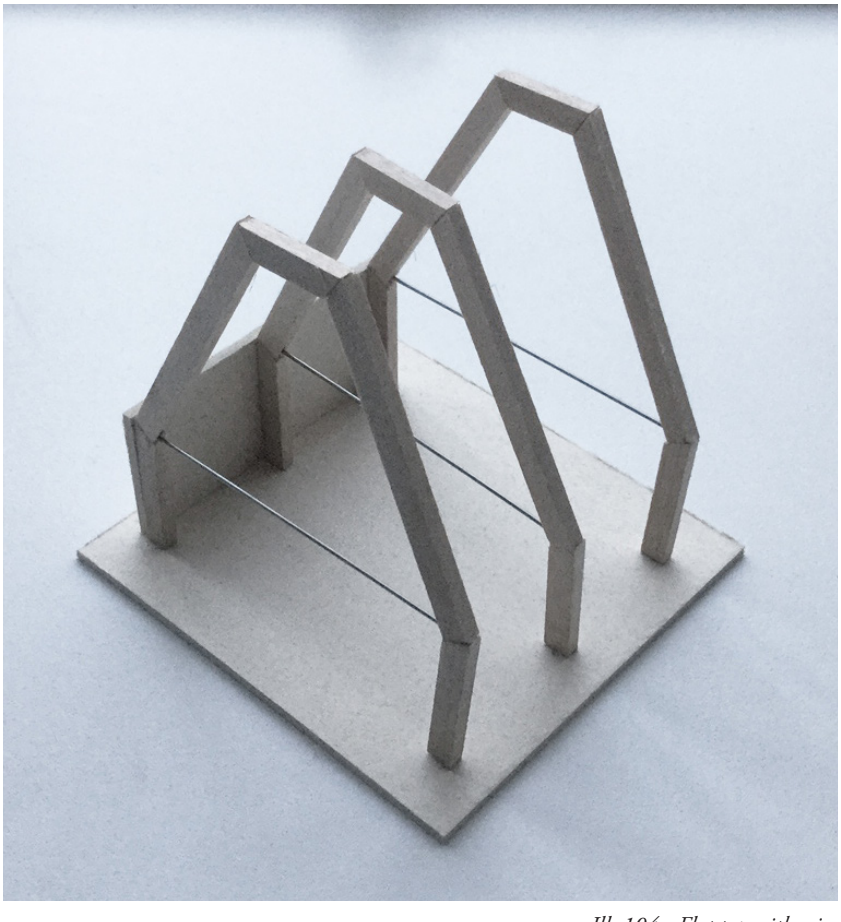
With the knowledge from previous studies, two L's where used to create a ring around the courtyard, shown on illustration 87 - 90. Due to the desire of having the path go through the courtyard, an opening towards north and south is necessary. The eastern building blocks the eastern wind from entering the courtyard, but the openings in the northern façade makes the wind blow directly through the middle of the courtyard, with nearly three times as high velocity than outside the building.

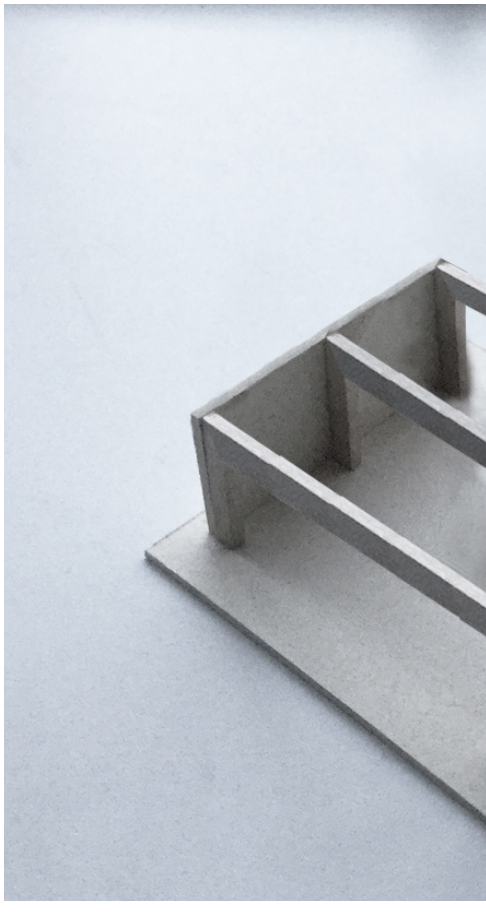
THE RING

After plenty of variations where the opening on the northern façade is opposite the opening on the southern façade, both openings were moved to the western side of the facades, as seen on illustration 93 - 100, since the path still should go through the courtyard from north to south. This made the volume towards east shaped as a mirrored 95, blocking the wind from east. Now the wind is only passing through the one side of the courtyard, but still with a high velocity, as seen on illustration A. Since the wind from northwest can't be blocked, it was necessary to make a bigger opening for the wind to pass, with a lower velocity, countering the turbulence effect. Therefor an opening in the western façade were made, as seen on illustration 95.
Through numerous iterations of size and placement of the opening on the western façade, the finale design ended up as shown on illustration 99 and 100, where even with northwestern wind, the velocity inside the courtyard is kept comfortable.



Ill. 102 - Pitched roof





Ill. 104 - Flat top with wire

Ill. 103 - Pitched roof flat top

Ill. 105 - Flat roof

STRUCTURAL STUDIES

Since many of the functions in the visitor center should be designed as multi-purpose rooms, open floorplans are important for the flexibility of the layout. Therefor is it important that the loadbearing structure, don't need columns, that are placed away from the outer walls.
This leads to a structural system consisting of frames spanning 7,5m from one wall to the other.

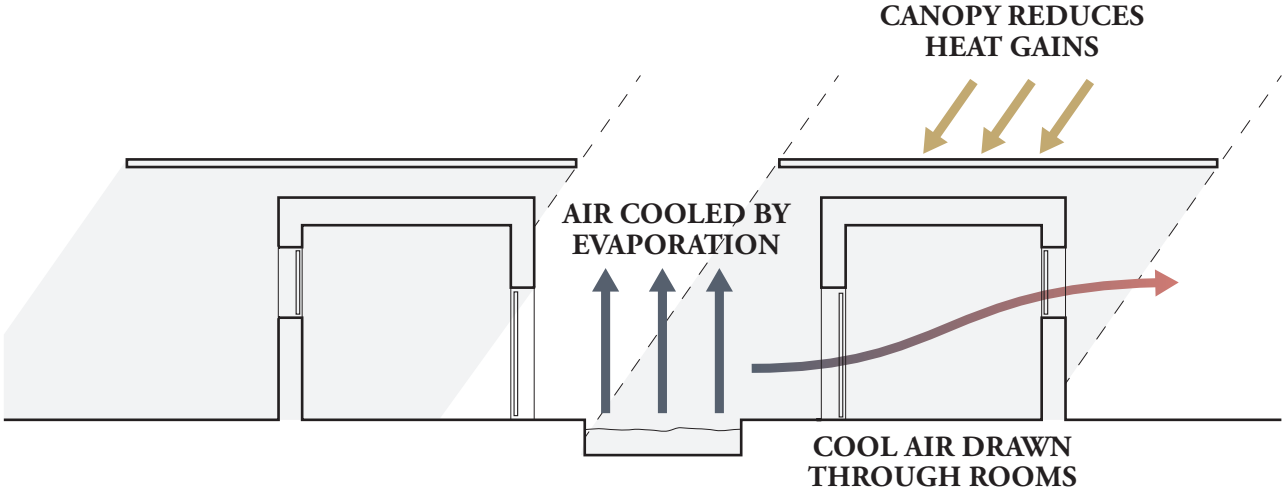
PITCHED ROOF

For a long time during the design process, the visitor center was designed to have a pitched roof, as shown on illustration 102, 103 and 104. To emphasize the pitch, the angle of the roof was 55° related to horizontal.
Through studies in the Grasshopper plugin Karamba, which can analyze stress and displacement in the structure designed, the displacement of this structure was analyzed to be 0,63m, due to the long, angled beams.
To counter the problem, the top was cut off, and a horizontal element was added at the top, as shown on illustration 103. By doing this the displacement change to 0,54m, since the longest beams were shortened. But the displacement was still too high, which was due to the forces pushing out the columns.
The solution to this problem was to add a steel wire spanning between the top of the columns. This reduced the displacement down to 0,05m. Adding the wires helped, because steel works best against tension, in comparison to wood, which works best against pressure. This way the forces pushing the columns outwards, was countered by the strength of the steel wires, keeping the columns together and making the forces from the beams continue down through to the supports.

FLAT ROOF

During the further progress of the design, sustainable principle was added to the design, making the expression of the building change, which made the roof going from being pitched to be flat. Therefore, was the frames changed as well, shown on illustration 105.
This structure was constructed in Rhinoceros and afterwards imported into Autodesk's program called Robot Structural Analysis. Here the Ultimate Limit State, ULS, was calculated to find the most efficient spacing and dimensioning of the wooden frames. The calculations concerned the dead load of the entire building envelope and the two dominant wind loads from both east and northwest. The calculations and ratio table can be found in Appendix A.

The finale dimension of the cross-section of the beams and columns is 175mm x 400mm with the highest ratio of 0,79.



Ill. 106 - Passive strategies

Ill. 107 - Maritime pine trees

Ill. 108 - Olive tree

Ill. 109 - Granite

SUSTAINABLE PRINCIPLES

Since the temperature during the year is high and the humidity comfort is categorized as dry during 75% of the year, sun screening and comfortable temperature is important for the building. Therefor passive cooling strategies are incorporated into the design of the finale visitor center.

PASSIVE SHADING

As shown on illustration 106, multiple strategies have been added to the finale design. First, the canopy hovering above the building is made with eaves, which passively shades for the sun, reducing the heat gain from direct sun on both walls and windows.
In addition to the passively shading of the windows, all windows on the outer façade is moved deep into the walls, adding to the shading from the direct sun.
Besides shading for the building envelope, the canopy is also shading outdoor areas inside the courtyard, making sure to give visitors comfortable outdoor places to stay, during the visit at the Cromeleque dos Almendres.

PASSIVE COOLING

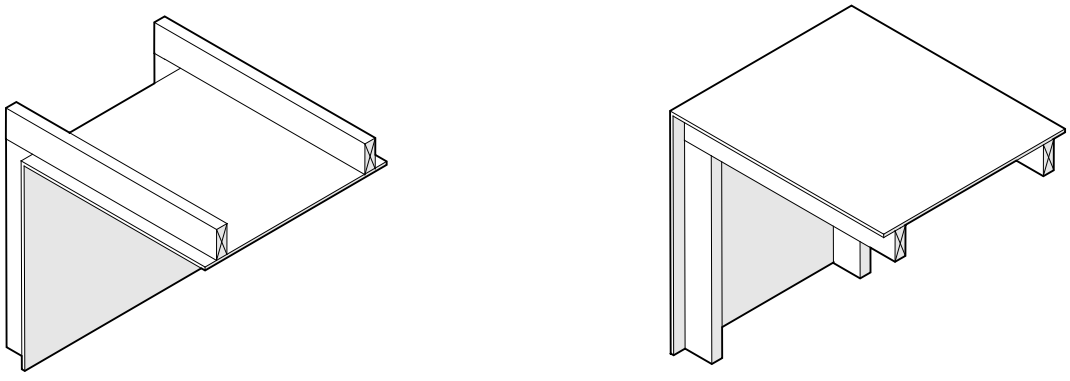
In the middle of the courtyard a basin is placed, which functions as passive cooling for both the courtyard and building. When the water in the basin evaporates during the day, the air around the basin will be cooled down, making sure that the temperature in the courtyard stays low and comfortable.

PASSIVE VENTILATION

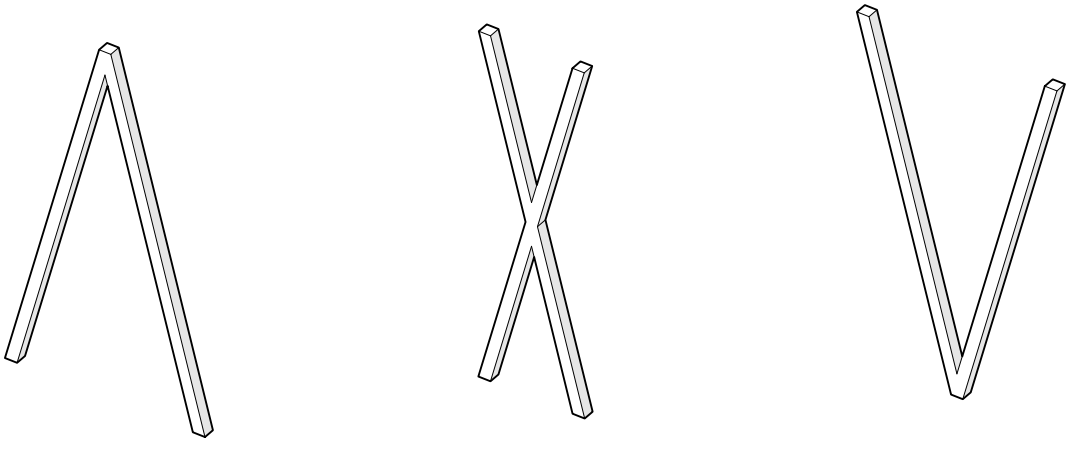
By adding low-level openings in the walls towards the courtyard and high-level openings on the outer walls, the cooled air from the courtyard enters the building low, gets warm up inside the room and leaves the building through the outer walls' windows. This process of sending cool air into the room and make it leave the room when heated, ensure a flow of air through the room, which is called cross-ventilation, where air is entering in one side of the room and exits at the opposite side.

LOCAL RESOURCES

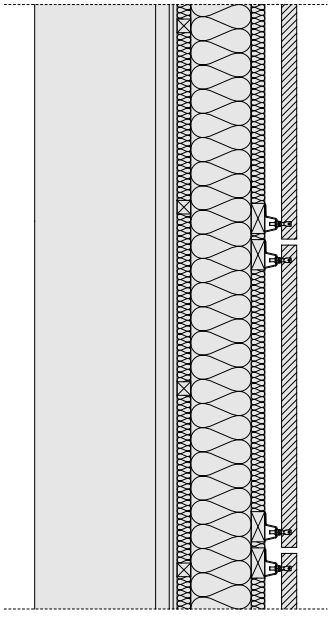
To ensure the environmental sustainability in the construction of the building, local materials are chosen in favor of other materials. Therefor are the outside of the building envelope made of granite, which is locally produced in Portugal.
Inside, the wooden loadbearing structure is made by maritime pine, which is one of the most common woods species used for wooden construction elements in Portugal. Maritime pine is grown in Portugal, making sure the emission from transporting the wood is kept at a minimum.
For the interior walls, olive wood planks are used. The olive trees are produced in the area of Évora, making the transportation short and sustainable, and makes sure to support the local farmers' production.



Ill. 110 - Visible structure



Ill. 111 - Columns for the canopy



DETAILING

VISIBLE STRUCTURE

Because of the tectonic approach of the project, the presentation of the load bearing structure has had a big part of the design process. How it should be designed, and how it should be shown to the visitors of the visitor center.

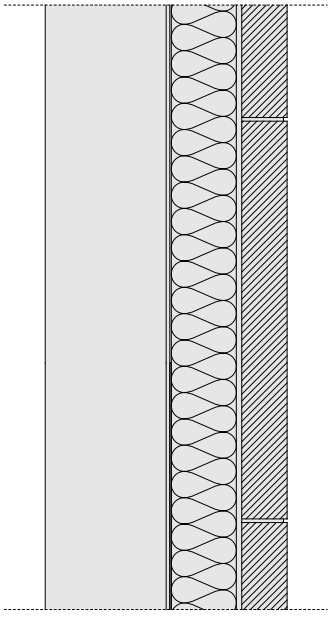
During the detailing of the technical drawings, it was considered on which side of the wood frame to place the interior cladding. As shown on illustration 110, it was considered to either put it on the inside of the frame or on the outside of the frame. Through studies of the space, it was finally chosen to go with the wooden frame visible, by attaching the interior cladding to the outside of the wooden frame.

COLUMNS

The columns for the canopy is made by two elements angled in two different directions. During the process of the columns, different variations has been tried out, as shown on illustration 111.

As seen in the Presentation section of the report, the columns are aligned in two directions, orientated north-south and east-west. Together with the two directions of the columns, the canopy will be structural stable for wind coming for every direction.

In the finale design the columns shaped as a “V” was chosen, because of the lighter look, when only touching the ground in one point, instead of in two points.



GRANITE FAÇADE

During the process of the detailing the outer side of the building envelope, granite was chosen. The tactility of the rough granite surface, associates with the granite monoliths at Cromeleque dos Almendres and therefor with the earth toned colored fits well into the context placed in.

At first, as shown on illustration 112, the granite was thought as thin sheets of granite, hang onto a wooden structure. But because of tectonic thoughts, this wasn’t the natural way of experience granite. Granite is found massive in the earth, and therefore the façade was changed to a thicker stacked wall of granite slabs. This makes sure, that if feeling the wall, the robustness of the granite will still be intact.

Ill. 112 - Granite facade - 1:20

EPILOGUE

The epilogue is the concluding section of the report. Reflections are made upon the design process and the choices made during the process, and concludes on the final design proposal for Cromeleque dos Almendres Visitor Center.

CONCLUSION

The project of Cromeleque dos Almendres Visitor Center is a humble addition to the ancient monument of Cromeleque dos Almendres. The visitor center is based on the origin of the ancient monument, the Neolithic community. The focus of the project has been to create a place for both locals and tourists to stay. A common place where both types of visitors can interact with each other. The courtyard is the base of the complex, working as a shared common space, which relates and connects to all functions of the facility, making sure visitors are not utterly divided depending on their purpose at the visitor center.

For high flexibility of the functions and future-proofing of the facility, open floorplans are used throughout the plan layout. This makes it easy to arrange the rooms accordingly to what's currently needed. The education space can one day be an auditorium and the other day host a workshop. The flexibility in both the exhibition and gallery space, makes it possible to host a large variety of exhibitions, inviting locals to revisit the visitor center to experience new art pieces.

In relation to Cromeleque dos Almendres, is the new visitor center placed out of sight, to respect the historical site and what was prior the new addition to the area. The facility accepts its role as a parasitic topology, which owes its existence to the ancient monument.
The aim of the visitor center is to be an addition to the area, not being a new landmark. It provides information about the megalithic complex and its relation to other complexes scattered around the area of Évora.

The tectonic approach is visible through the placement and materiality of the visitor center. The site's nature, topography and materiality have been analyzed in order to find the most optimal placement for the new visitor center. The tactility of the monument and its surrounding has been examined to be able to choose materials, that will be able to complement the existing condition.
Looking at the structure, the tectonic approach is visible in the final design. Design and detailing is a consequence of the materials and building techniques chosen.

REFLECTION

Designing a visitor center or any kind of architecture at such a remote place, provides at the first sight a lot of freedom regarding the architectural expression. There are no surrounding buildings to respect or try to fit in with. The same regards regulations, that since its isolated location, isn't included in the municipal plan.
But with a lot of freedom follows a lot of responsibility regarding what the architect ends up adding to the surrounding landscapes atmosphere. It's easy to be dragged into a process of designing a new landmark for the area in order to attract more visitors, but that won't fit the context. The area is characterized of being an ancient monument, with an atmosphere that is characterized by the sacral feeling of the historical grave monument.
For a long time during the process, a desire for pitched roof influenced the design of the visitor center, but late in the process, reflections concerning the respect and coherence with the surroundings made the project change drastically, with a design that instead of focusing on the architectural expression as the main target, focused on how to make great functionality and unity to the complex.

Choosing a site with such a remote location to design at is difficult, especially if there is no intention in visiting the site. Today it's nearly possible to get at street view of any location close to any city in the world, due to services like Google Earth. The lack of this type of information has made the analyses difficult, and a lot of time has been used on finding all relevant information possible. In addition to the lack of information from services, the lack of tourists visiting the site also affect the amount of information available, making it difficult to find good references and descriptions of tourists' experience of the site. This really highlight how important a site visit is, especially in the early phases of the process.

During the process of designing the visitor center, it became increasingly clearer, that the problem this project should answer, is more than just adding a new architectural object. The problem is that not enough tourists or locals visit the site, which one of the reasons could be that they simply don't find the area interesting enough. In that case, it makes sense to add new architecture to the area to attract more visitors. But another problem found during the analyses was, that it's nearly impossible to get to the site, if not having a car at deposal. This means that in case to attract more visitors, the municipality actively has to make it possible to go by public transport.

REFERENCES

Ancient Origins, 2015. *Almendres Cromlech: The Twin Megalithic Stone Circles of Portugal.* Available from: http://www.ancient-origins.net/ancient-places-europe/almendres-cromlech-twin-megalithic-stone-circles-portugal-003329, Accessed on: 30th of March 2017

Ark x Site. *Site Visitor Center International Architecture Competition (2016):* 1-14. Print.

Carta, Silvio. *Territory, Beauty And Monument : Visitor Centres.* 1st ed. C3, 2013. Print.

Climatemps, 2017. *Relative Humidity in Evora, Portugal*. Available from: http://www.evora.climatemps.com/humidity.php, Accessed on: 15th of March 2017

Évora-Portugal, 2017. *Évora Portugal Tourism and holiday Guide.* Available from: http://www.evora-portugal.com/index.html, Accessed on: 4th of April 2017

EZPortugal, 2015. *Almendres Cromlech*. Available from: http://www.ezportugal.com/evora-portugal/attractions-evora-portugal/almendres-cromlech-evora, Accessed on: 18th of March 2017

Foundation of the Hellenic World, 2017. *Indications of political organization*. Available from: http://www.fhw.gr/chronos/01/en/nl/politics/index.html, Accessed on: 17th of April 2017

Hansen & Knudstrup, H&K, 2005. *The Integrated Design Process (IDP) – a more holistic approach to sustainable architecture*. Available from: http://vbn.aau.dk/files/1624830/The_Integrated_Design_Process__IDP____A_more_holistic_approach_to_sustainable_architecture, Accessed on: 10th of March 2017

Maulden, Robert, 1986. *Tectonics in architecture : from the physical to the meta-physical*. Available from: http://hdl.handle.net/1721.1/78804, Accessed on: 20th April 2017

Page, Helen, 2016. *The Mysterious Cromlech of Almendres*. Available from: http://www.travelsignposts.com/Portugal/featured/cromlech-almendres-megaliths, Accessed on: 3rd of May 2017

Pedersen, Ole Egholm, 2013. *The tectonic potentials of concrete*. Available from: http://www.re-ad.dk/ws/files/41214970/TectonicPotentialsOfConcrete_OEP.pdf, Accessed on: 11th of April 2017

Sacred Destinations, 2010. *Almendres Menhir, Portugal*. Available from: http://www.sacred-destinations.com/portugal/almendres-menhir, Accessed on: 18th of March 2017

Sistema de Informação para o Património Arquitetónico, 2011. *Cromeleque dos Almendres*. Available from: http://www.monumentos.pt/Site/APP_PagesUser/SIPA.aspx?id=3946, Accessed on: 18th of March 2017

UK Essays, 2015. *A Key Design Role In Tectonic Architecture History Essay*. Available from: https://www.ukessays.com/essays/history/a-key-design-role-in-tectonic-architecture-history-essay.php, Accessed on: 2nd of May 2017

UNESCO, 2014. *Historic Centre of Évora*. Available from: http://whc.unesco.org/en/list/361, Accessed on: 4th of April 2017

Visit Portugal, 2015. *Alentejo*. Available from: https://www.visitportugal.com/en/destinos/alentejo, Accessed on: 4th of April 2017

Weatherspark, 2017. *Average Weather in Évora*. Available from: https://weatherspark.com/y/32806/Average-Weather-in-%C3%89vora-Portugal, Accessed on: 15th of March 2017

Wikipedia, Évora, 2017. *Évora*. Available from: https://en.wikipedia.org/wiki/%C3%89vora, Accessed on: 18th of March 2017

Wikipedia, Neolithic, 2017. *Évora*. Available from: https://en.wikipedia.org/wiki/Neolithic, Accessed on: 13th of March 2017

Windfinder, 2017. *Évora*. Available from: https://www.windfinder.com/windstatistics/evora, Accessed on: 15th of March 2017

ILLUSTRATION LIST

Ill. 1-2 – Far Off Place Blog, 2014. *Uma Viagem Ao Portugal Mágico E Assombrado*. Available from: https://faroffplacesblog.wordpress.com/2014/10/31/uma-viagem-ao-portugal-magico-e-assombrado/, Accessed on: 13th of February 2017

Ill. 3 – Own illustration

Ill. 4 – Wikimedia Commons, 2006, *Cromaleque dos Almendres, Alentejo, Portugal, September 2005.* Available from: https://commons.wikimedia.org/wiki/File:Cromaleque_dos_Almendres,_Alentejo,_Portugal,_September_2005.jpg, Accessed on: 13th of February 2017

Ill. 5 – Pinterest, 2017, *Caribbean Hut*. Available from: https://dk.pinterest.com/pin/291467407108068679/, Accessed on: 12th of May 2017

Ill. 6 – Archdaily, 2011, *AD Classics: Taliesin West / Frank Lloyd Wright*. Available from: http://www.archdaily.com/123117/ad-classics-taliesin-west-frank-lloyd-wright, Accessed on: 7th of May 2017

Ill. 7 – Footsteps across Europe, 2015, *The Cromeleque dos Almendres.* Available from: https://footstepsacrosseurope.blogspot.dk/2015/08/blog-post.html, Accessed on: 15th of February 2017

Ill. 8 - Locais De Origem Religiosa, 2010, *Almendres*. Available from: http://locaissagrados.blogs.sapo.pt/2010/09/19/, Accessed on: 18th of February 2017

Ill. 9 – Travel Quality, 2016, *Èvora*. Available from: http://www.tqviagens.com/en/product/hoteis-evora-2/evora-2/, Accessed on: 10th of March 2017

Ill. 10 – Own illustration

Ill. 11 – 1ZOOM, 2010, *Neolithic settlement*. Available from: http://www.1zoom.net/Miscellaneous/wallpaper/304652/z3453.4/, Accessed on: 17th of March 2017

Ill. 12 – Panoramio, 2009, *Nossa Senhora de Guadalupe - Cromeleque dos Almendres - Portugal.* Available from: http://www.panoramio.com/photo/27100035, Accessed on: 20th of February 2017

Ill. 13 – Travel Sign Posts, 2009, *The Mysterious Cromlech of Almendres*. Available from: http://www.travelsignposts.com/Portugal/featured/cromlech-almendres-megaliths#forward, Accessed on: 7th of May 2017

Ill. 14 – Wikimedia Commons, 2011, *Cromeleque dos almendres I.* Available from: https://commons.wikimedia.org/wiki/File:Cromeleque_dos_almendres_I.jpg, Accessed on: 13th of February

Ill. 15 – Archdaily, 2013, *Rebildporten / CEBRA*. Available from: http://www.archdaily.com/450890/rebildporten-cebra, Accessed on: 3rd of April 2017

Ill. 16-17 – Tripadvisor, 2015, *Almendres Cromlech*. Available from: https://www.tripadvisor.dk/LocationPhotoDirectLink-g189106-d1568926-i136068458-Almendres_Cromlech-Evora_Evora_District_Alentejo.html, Accessed on: 18th of April 2017

Ill. 18 – Own illustration

Ill. 19 – A as architecture, 2012, *Giant's Causeway Visitor Centre By Heneghan Peng Architects.* Available from: http://aasarchitecture.com/2012/10/giants-causeway-visitor-centre-by-heneghan-peng-architects.html, Accessed on: 23rd of February 2017

Ill. 20 – Archdaily, 2013, *Stonehenge Visitor Centre / Denton Corker Marshall.* Available from: http://www.archdaily.com/461242/stonehenge-visitor-centre-denton-corker-marshall, Accessed on: 23rd of February 2017

Ill. 21 – Archdaily, 2015, *Jianamani Visitor Center / TeamMinus*. Available from: http://www.archdaily.com/772575/jianamani-visitor-center-teaminus, Accessed on: 24th of February 2017

Ill. 22 – Chinese Architects, 2015, *Tsing Tao Pearl Hill Visitor Center*. Available from: https://www.chinese-architects.com/en/projects/50766_Tsingtao_Pearl_Visitor_Center, Accessed on: 24th of February 2017

Ill. 23-46 – Own illustration

Ill. 47-48 – Frontiers of Anthropology, 2012, *Rondel Settlements and Europe's Oldest Civilisations*. Available from: http://frontiers-of-anthropology.blogspot.dk/2012/02/rondel-settlements-and-europes-oldest.html, Accessed on: 19th of February 2017

Ill. 49 - 6th Grade Social Studies, 2010, *The Agricultural Revolution.* Available from: http://nsms6thgradesocialstudies.weebly.com/agricultural-revolution.html, Accessed on: 18th of February 2017

Ill. 50 – Planetware, 2017, *12 Top-Rated Tourist Attractions & Things to Do in Évora*. Available from: http://www.planetware.com/tourist-attractions-/evora-p-evor-evor.htm, Accessed on: 9th of March 2017

Ill. 51-106 – Own illustration

Ill. 107 – Pining, 2017. Available from: https://s-media-cache-ak0.pinimg.com/originals/86/2a/1f/862a1ff0d4819fb9946e6148787af8b3.jpg, Accessed on: 22nd April 2017

Ill. 108 – Before It's News, 2014, *ITALY: ALERT – Bacterium from the USA hits Italy's Olive Trees.* Available from: http://beforeitsnews.com/eu/2014/08/italy-alert-bacterium-from-the-usa-hits-italys-olive-trees-2567224.html, Accessed on: 22nd of April 2017

Ill. 109 – Quality Natural Stones, 2015, *Granite*. Available from: www.qualitynaturalstones.com, Accessed on: 22nd of April 2017

Ill. 110-112 – Own illustration

Ill. 113-114 – "DS/EN 1991-1-4 DK NA:2015". *Eurocode 1: Last på bygværker – Del 1-4: Generelle laster - Vindlast* (2015): n. pag. Print.

ILLUSTRATION LIST

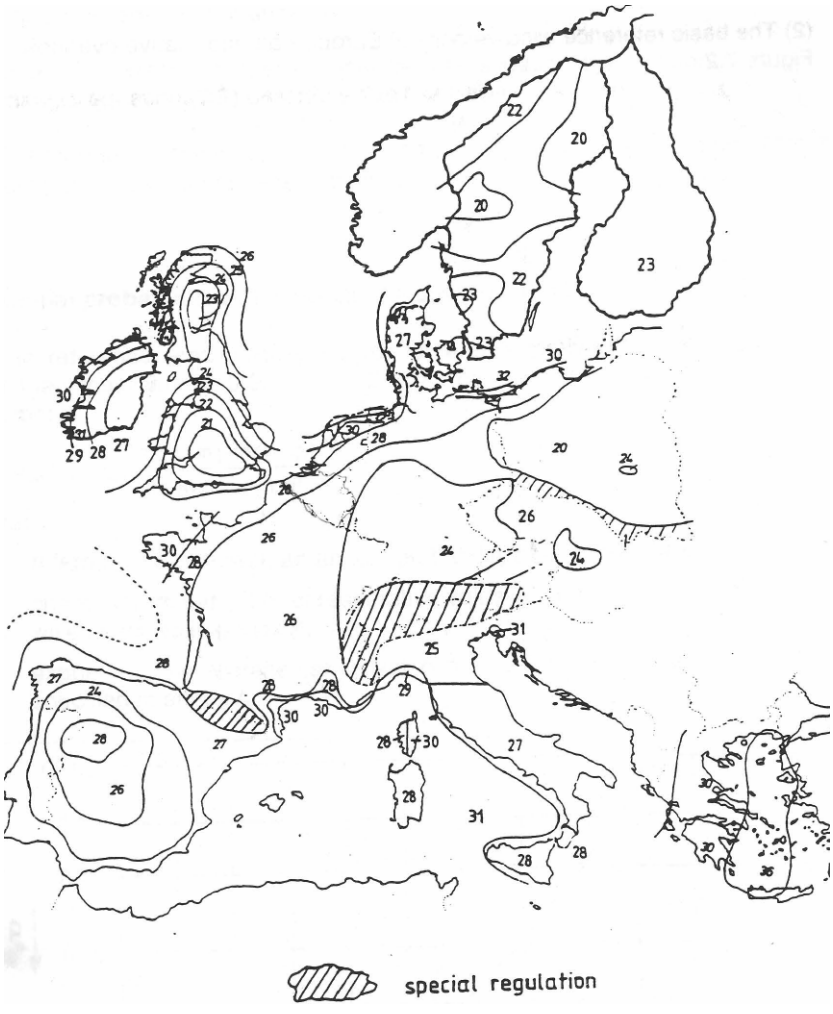
Ill. 115 – Own illustration

Ill. 116 – "DS/EN 1991-1-4 DK NA:2015". *Eurocode 1: Last på bygværker – Del 1-4: Generelle laster - Vindlast* (2015): n. pag. Print.

Ill. 117-128 – Own illustration

TABLE LIST

APPENDIX



Ill. 113 - Fundamental value of the basic wind velocity map

APPENDIX A STRUCTURAL ANALYSIS

To be able to dimension the structural elements correctly, load calculations has been made. In this appendix are calculations of a selected part of the construction, where the structure will be stressed the most, which will be done by using Autodesk's Robot Structural Analysis.
Afterwards a calculation for a basic beam will be calculated for the ULS.

WIND LOAD CALCULATIONS

For the dimensioning of the structural elements, the dominant wind load has been used. The wind load is calculated through following steps: main wind velocity, turbulence intensity, peak velocity pressure and the wind loads affecting the walls and roof.
The wind loads are calculated according to Eurocode 1.4 where the wind loads are calculated depended on the location and shape of the building. All formulas and factors are found in Eurocode 1.4.

BASIC WIND VELOCITY, v_b

$$v_b = c_{dir} * c_{season} * v_{b,0}$$

c_{dir}
Directional factor value: 1,0

c_{season}
Season factor value: 1,0

$v_{b,0}$
Fundamental value of the basic wind velocity: 27m/s

$$v_b = 1 * 1 * 27m/s$$
$$\boldsymbol{v_b = 27m/s}$$

MAIN WIND VELOCITY, $v_m(z)$

The main wind velocity depends on the terrain roughness and orography and the basic wind velocity.

$$v_m(z) = c_r(z) * c_o(z) * v_b$$

$c_r(z)$
Roughness factor

$c_o(z)$
Orography factor: 1,0

APPENDIX A

Terrain category		z_0 m	z_{min} m
0	Sea or coastal area exposed to the open sea	0,003	1
I	Lakes or flat and horizontal area with negligible vegetation and without obstacles	0,01	1
II	Area with low vegetation such as grass and isolated obstacles (trees, buildings) with separations of at least 20 obstacle heights	0,05	2
III	Area with regular cover of vegetation or buildings or with isolated obstacles with separations of maximum 20 obstacle heights (such as villages, suburban terrain, permanent forest)	0,3	5
IV	Area in which at least 15 % of the surface is covered with buildings and their average height exceeds 15 m	1,0	10
NOTE: The terrain categories are illustrated in A.1.			

Table 1 - Terrain categories and terrain parameters

Roughness factor, $c_r(z)$

$$c_r(z) = k_r * \ln\left(\frac{z}{z_0}\right)$$

z
Average height of building: 4m

z_0
Roughness length. Table 1 category III: 0,3

k_r
Terrain factor depending on z_0

Terrain factor, k_r

$$k_r = 0{,}19 * \left(\frac{z_0}{z_{0,II}}\right)^{0{,}07}$$

$z_{0,II}$
Roughness length. Table 1 category II: 0,05

$$k_r = 0.19 * \left(\frac{0{,}3}{0{,}05}\right)^{0{,}07}$$
$$k_r = 0{,}22$$

Roughness factor

$$c_r(z) = 0{,}22 * \ln\left(\frac{4{,}5m}{0{,}3m}\right)$$
$$c_r(z) = 0{,}6$$

Main wind velocity

$$v_m(z) = c_r(z) * c_o(z) * v_b$$
$$v_m(z) = 0{,}6 * 1 * 27m/s$$
$$\boldsymbol{v_m(z) = 16{,}2m/s}$$

APPENDIX A

Zone	A		B		C		D		E	
h/d	$c_{pe,10}$	$c_{pe,1}$	$c_{pe,10}$	$c_{pe,1}$	$c_{pe,10}$	$c_{pe,1}$	$c_{pe,10}$	$c_{pe,1}$	$c_{pe,10}$	$c_{pe,1}$
5	-1,2	-1,4	-0,8	-1,1	-0,5		+0,8	+1,0	-0,7	
1	-1,2	-1,4	-0,8	-1,1	-0,5		+0,8	+1,0	-0,5	
≤ 0,25	-1,2	-1,4	-0,8	-1,1	-0,5		+0,7	+1,0	-0,3	

Table 2 - Pressure coefficients, walls

Roof type	Zone							
	F		G		H		I	
	$c_{pe,10}$	$c_{pe,1}$	$c_{pe,10}$	$c_{pe,1}$	$c_{pe,10}$	$c_{pe,1}$	$c_{pe,10}$	$c_{pe,1}$
Sharp eaves	-1,8	-2,5	-1,2	-2,0	-0,7	-1,2	+0,2	
							-0,2	

Table 3 - Pressure coefficients, roof

TURBULENCE INTENSITY, $l_v(z)$

$$l_v(z) = \frac{\sigma_v}{v_m(z)}$$

σ_v
Standard deviation of the turbulence

$$\sigma_v = k_r * v_b * k_l$$

k_l
Turbulence factor value: 1,0

$$\sigma_v = 0{,}22 * 27m/s * 1$$
$$\sigma_v = 5{,}94m/s$$

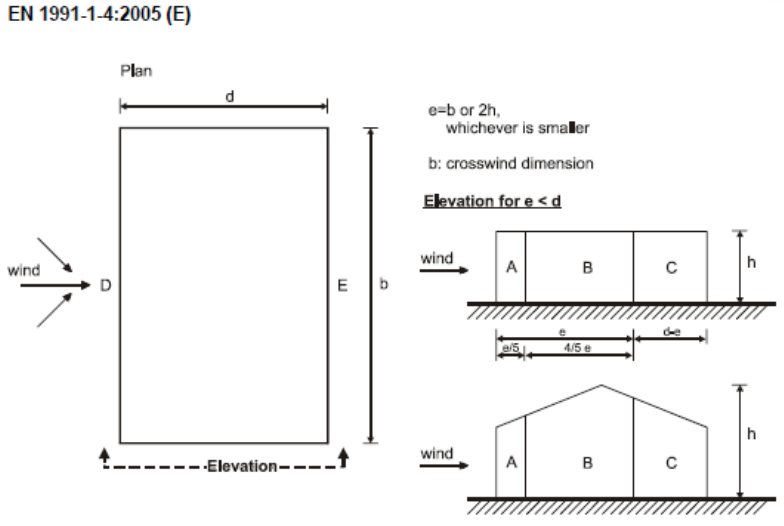
$$l_v(z) = \frac{5{,}94m/s}{16{,}2m/s}$$
$$\boldsymbol{l_v(z) = 0{,}37}$$

PEAK VELOCITY PRESSURE, $q_p(z)$

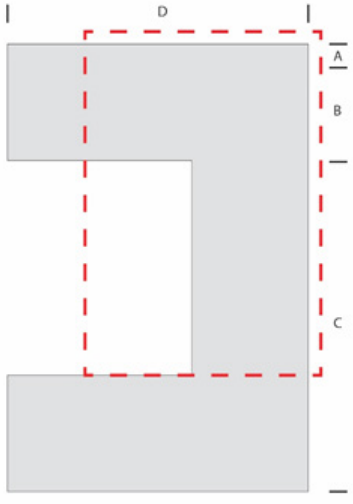
$$q_p(z) = \left(1 + 7 * I_v(z)\right) * \frac{1}{2} * \rho * v_m^2(z)$$

ρ
air density: 1,25kg/m3

$$q_p(z) = (1 + 7 * 0{,}37) * \frac{1}{2} * 1{,}25kg/m^3 * 16{,}2^2m/s$$
$$\boldsymbol{q_p(z) = 0{,}59kN/m^2}$$



Ill. 114 - Wind zone, wall



Ill. 115 - Section of structure, wall

WIND LOAD

From the site analysis, it's visible that the wind often comes from east or northwest. These directions have been used in the following calculations, starting with the situation where the wind is coming from northwest.
A part of the structure has been picked out, which is shown on illustration 115.
Eurocode EN 1991-1-4 has been used for the following formulas used for calculating the wind loads.

Wind pressure on surface

$$w_e = q_p(z) * c_{pe,10}$$

$q_p(z)$
Peak velocity pressure

$c_{pe,10}$
Pressure coefficient. Table 2

WIND LOAD NORTHWEST

Wall 1 Zone D

$w_e = 0{,}59kN/m^2 * 0{,}7$

$w_e = 0{,}41kN/m^2$

$A = 64{,}0m^2$

$p = 0{,}41kN/m^2 * 64{,}0m^2$

$p = 26{,}26kN$

Wall 2 Zone A

$w_e = 0{,}59kN/m^2 * (-1{,}2)$

$w_e = -0{,}71kN/m^2$

$A = 6{,}4m^2$

$p = -0{,}71kN/m^2 * 6{,}4m^2$

$p = -4{,}54kN$

Wall 2 Zone B

$w_e = 0{,}59kN/m^2 * (-0{,}8)$

$w_e = -0{,}47kN/m^2$

$A = 25{,}6m^2$

$p = -0{,}47kN/m^2 * 25{,}6m^2$

$p = -12{,}03kN$

Wall 2 Zone C

$w_e = 0{,}59kN/m^2 * (-0{,}5)$

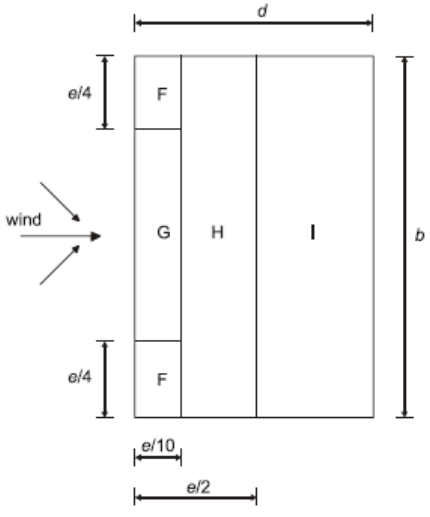
$w_e = -0{,}30kN/m^2$

$A = 61{,}4m^2$

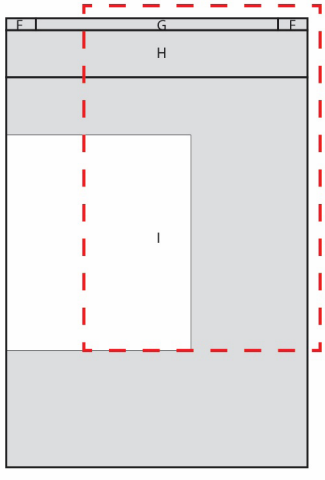
$p = -0{,}30kN/m^2 * 61{,}4m^2$

$p = -18{,}42kN$

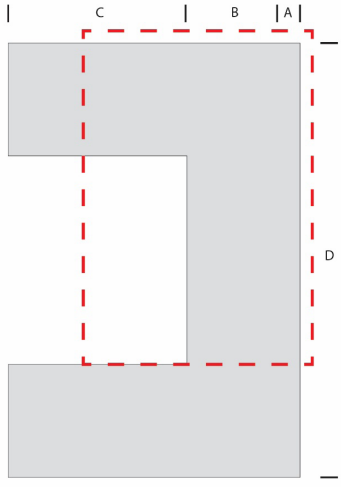
APPENDIX A



Ill. 116 - Wind zone, roof



Ill. 117 - Section of structure, roof



Ill. 118 - Section of structure, wall

Roof Zone F

$w_e = 0{,}59kN/m^2 * (-1{,}8)$

$w_e = -1.06kN/m^2$

$A = 1{,}6m^2$

$p = -1{,}06kN/m^2 * 1{,}6m^2$

$p = -1.70kN$

Roof zone G

$w_e = 0{,}59kN/m^2 * (-1{,}2)$

$w_e = -0{,}71kN/m^2$

$A = 11.2m^2$

$p = -0{,}71kN/m^2 * 11{,}2m^2$

$p = -7.95kN$

Roof Zone H

$w_e = 0{,}59kN/m^2 * (-0{,}7)$

$w_e = -0{,}41kN/m^2$

$A = 51{,}2m^2$

$p = -0{,}41kN/m^2 * 51{,}2m^2$

$p = -20{,}99kN$

Roof Zone I $\pm$

$w_e = 0{,}59kN/m^2 * (\pm 0{,}2)$

$w_e = \pm 0{,}12kN/m^2$

$A = 167{,}0m^2$

$p = \pm 0{,}12kN/m^2 * 167{,}0m^2$

$p = \pm 20{,}04kN$

WIND LOAD EAST

Wall 1 Zone D

$w_e = 0{,}59kN/m^2 * 0{,}7$

$w_e = 0{,}41kN/m^2$

$A = 93{,}4m^2$

$p = 0{,}41kN/m^2 * 93{,}4m^2$

$p = 38{,}29kN$

Wall 2 Zone A

$w_e = 0{,}59kN/m^2 * (-1{,}2)$

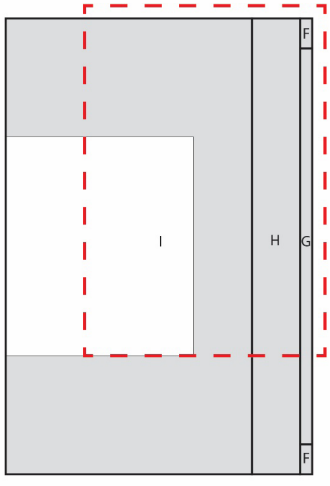
$w_e = -0{,}71kN/m^2$

$A = 6{,}4m^2$

$p = -0{,}71kN/m^2 * 6{,}4m^2$

$p = -4{,}54kN$

APPENDIX A



Ill. 119 - Section of structure, roof

Wall 2 Zone B

$w_e = 0{,}59kN/m^2 * (-0{,}8)$

$w_e = -0{,}47kN/m^2$

$A = 25{,}6m^2$

$p = -0{,}47kN/m^2 * 25{,}6m^2$

$p = -12{,}03kN$

Wall 2 Zone C

$w_e = 0{,}59kN/m^2 * (-0{,}5)$

$w_e = -0{,}30kN/m^2$

$A = 32{,}0m^2$

$p = -0{,}30kN/m^2 * 32{,}0m^2$

$p = -9{,}60kN$

Roof Zone F

$w_e = 0{,}59kN/m^2 * (-1{,}8)$

$w_e = -1.06kN/m^2$

$A = 1{,}6m^2$

$p = -1{,}06kN/m^2 * 1{,}6m^2$

$p = -1.70kN$

Roof zone G

$w_e = 0{,}59kN/m^2 * (-1{,}2)$

$w_e = -0{,}71kN/m^2$

$A = 17.1m^2$

$p = -0{,}71kN/m^2 * 17{,}1m^2$

$p = -12{,}13kN$

Roof Zone H

$w_e = 0{,}59kN/m^2 * (-0{,}7)$

$w_e = -0{,}41kN/m^2$

$A = 74{,}7m^2$

$p = -0{,}41kN/m^2 * 74{,}7m^2$

$p = -30{,}64kN$

Roof Zone I $\pm$

$w_e = 0{,}59kN/m^2 * (\pm 0{,}2)$

$w_e = \pm 0{,}12kN/m^2$

$A = 137{,}6m^2$

$p = \pm 0{,}12kN/m^2 * 137{,}6m^2$

$p = \pm 16{,}52kN$

APPENDIX A

DEAD LOAD CALCULATIONS

Dead load consists of two different loads. The structure itself and the weight of the roof layers above. The load of the structure itself is calculated automatically in Autodesk Robot.

For the simplicity, every beam is calculated to support a roof area of 2,5m x 7,9m, which is the max area the beams are supporting, though some of the beams are carrying less.

ROOF LAYERS

Gravel - 0,03m

$$V = 2{,}5m * 7{,}9m * 0{,}03m$$
$$V = 0{,}59m^3$$

$$\rho = 1201kg/m^3$$
$$\rho = 1201kg/m^3 * 9{,}8m/s^2$$
$$\rho = 11{,}78kN/m^3$$

$$p = 11{,}78kN/m^3 * 0{,}59m^3$$
$$\boldsymbol{p = 6{,}95kN}$$

Bitumen - 0,01m

$$V = 2{,}5m * 7{,}9m * 0{,}01m$$
$$V = 0{,}19m^3$$

$$\rho = 1104kg/m^3$$
$$\rho = 1104kg/m^3 * 9{,}8m/s^2$$
$$\rho = 10{,}82kN/m^3$$

$$p = 10{,}82kN/m^3 * 0{,}19m^3$$
$$\boldsymbol{p = 2{,}06kN}$$

Hard insulation - 0,48m

$$V = 2{,}5m * 7{,}9m * 0{,}48m$$
$$V = 9{,}48m^3$$

$$\rho = 23kg/m^3$$
$$\rho = 23kg/m^3 * 9{,}8m/s^2$$
$$\rho = 0{,}23kN/m^3$$

$$p = 0{,}23kN/m^3 * 9{,}48m^3$$
$$\boldsymbol{p = 2{,}18kN}$$

Plywood - 0,02m

$$V = 2{,}5m * 7{,}9m * 0{,}02m$$
$$V = 0{,}40m^3$$

$$\rho = 295kg/m^3$$
$$\rho = 295kg/m^3 * 9{,}8m/s^2$$
$$\rho = 2{,}89kN/m^3$$

$$p = 2{,}89kN/m^3 * 0{,}40m^3$$
$$\boldsymbol{p = 1{,}16kN}$$

APPENDIX A

Persistent and transient design situations	Permanent actions		Leading variable action (*)	Accompanying variable actions	
	Unfavourable	Favourable		Main (if any)	Others
(Eq. 6.10)	$\gamma_{Gj,sup} G_{kj,sup}$	$\gamma_{Gj,inf} G_{kj,inf}$	$\gamma_{Q,1}\ Q_{k,1}$		$\gamma_{Q,i} \psi_{0,i} Q_{k,i}$

(*) Variable actions are those considered in Table A1.1

NOTE 1 The γ values may be set by the National annex. The recommended set of values for γ are :
$\gamma_{Gj,sup} = 1,10$
$\gamma_{Gj,inf} = 0,90$
$\gamma_{Q,1} = 1,50$ where unfavourable (0 where favourable)
$\gamma_{Q,i} = 1,50$ where unfavourable (0 where favourable)

NOTE 2 In cases where the verification of static equilibrium also involves the resistance of structural members, as an alternative to two separate verifications based on Tables A1.2(A) and A1.2(B), a combined verification, based on Table A1.2(A), may be adopted, if allowed by the National annex, with the following set of recommended values. The recommended values may be altered by the National annex.
$\gamma_{Gj,sup} = 1,35$
$\gamma_{Gj,inf} = 1,15$
$\gamma_{Q,1} = 1,50$ where unfavourable (0 where favourable)
$\gamma_{Q,i} = 1,50$ where unfavourable (0 where favourable)
provided that applying $\gamma_{Gj,inf} = 1,00$ both to the favourable part and to the unfavourable part of permanent actions does not give a more unfavourable effect.

Table 3 - Partial factors

Total dead load
$p = 6{,}95kN + 2{,}06kN + 2{,}18kN + 1{,}16kN$
$\boldsymbol{p = 12{,}35kN}$

ULTIMATE LIMIT STATE

$$\sum_{j\geq 1} \gamma_{G,j} * G_{k,j} + \gamma_p * P + \gamma_{Q,1} * Q_{k,1} + \sum_{i>1} \gamma_{Q,i} * \psi_{0,i} * Q_{k,i}$$

Since there's only one variable load, the equation ends up like this:

$$\gamma_{G,j} * G_{k,j} + \gamma_{Q,1} * Q_{k,1}$$

γ
Partial factor

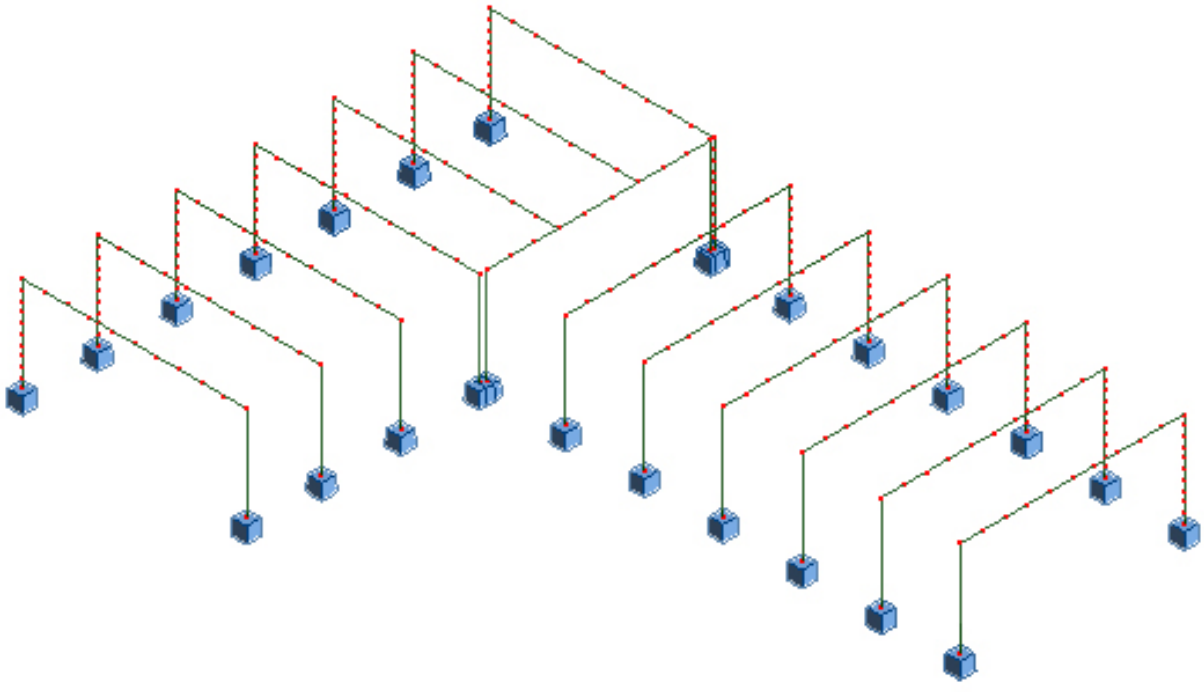
$G_{k,j}$
Permanent action

$Q_{k,1}$
Leading variable action

The partail factors are found in table 3.

Partial factor for permanent load
$$\gamma_{G,j} = 1{,}35$$

Partial factor for variable load
$$\gamma_{Q,1} = 1{,}50$$



Ill. 120 - Structural system

STRUCTURAL ANALYSIS

With all loads needed, the calculation of the structure in Robot Structural Analysis was done. The goal with the analysis was to find the size of the structural elements, which are not over- or undersized, making it as efficient as possible.
Since the structure calculated is only walls and roof elements, only ULS was calculated, making sure the elements can withstand the load combinations.

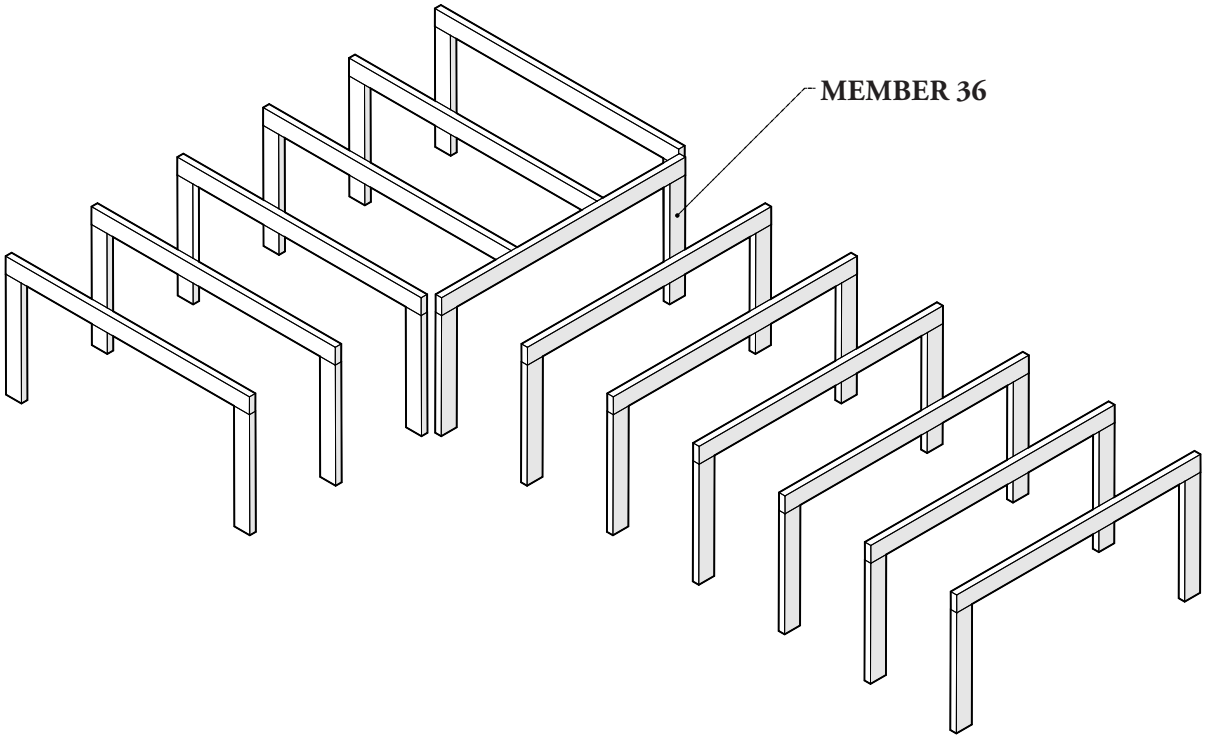
For the calculations only a part of the calculation is chosen, this is the structural elements in the lobby and exhibition space. The finale structure and dimensioning is shown on illustration 120 above.

In the beginning of the calculations, structural elements with the dimensions 700mm x 300mm was chosen only because of looks. The analysis showed that these elements was far oversized, with a max ratio at 0,16, as shown in table 4.

From here different iterations was made, where the elements were both over- and undersized. The dimensions tried was chosen from the desire of wanting the elements to look deeper than wide, this was ensured by having a maximum ratio between depth and width at 1:0,5.

The finale dimensions for the elements was 400mm x 175mm, with a max ratio of 0,79 using the load combination with dominant wind load from northwest.

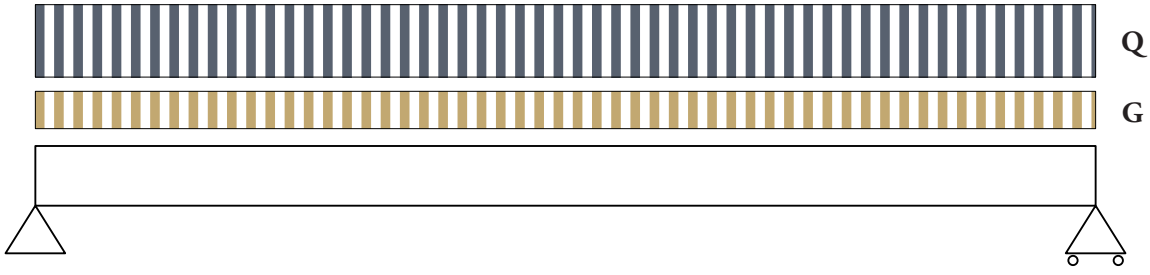
APPENDIX A



Ill. 121 - Structural system

Dimensions [mm]	Ratio	Member	Case	Conclusion
700 x 300	0,16	36	ULS NW	Oversize
500 x 300	0,22	36	ULS NW	Oversize
400 x 150	1,08	36	ULS NW	Undersize
400 x 200	0,61	36	ULS NW	Oversize
400 x 175	0,79	36	ULS NW	OK

Table 4 - Ratio table



Ill. 122 - Load diagram

MAXIMUM BEAM DEFLECTION

A calculation is made for a beam to find the exact deflection. The situation chosen is with dominant wind from northwest, and the beam is in the roof zone I.
The beam's length is 7100mm and as just shown in table 4, is the width 175mm and the height 400mm.

From DS EN 1990 is it stated that for a roof the maximal deflection allowed is found by following formula:

$$u_{max} = \frac{L}{200}$$
$$u_{max} = \frac{7100mm}{200}$$
$$\boldsymbol{u_{max} = 35,5mm}$$

To find the deflection the following formula is used:

$$u = \frac{5}{384} * \frac{q * L^4}{E * I}$$

q
Uniformly distributed load

E
Elasticity module
$17,77 * 10^3 N/mm^2$

I
Moment of inertia

Uniformly distributed load, q

$$\gamma_{G,j} * G_{k,j} + \gamma_{Q,1} * Q_{k,1}$$

Zone I+
$q = 12.35kN * 1.35 + 20.04 * 1.5$
$q = 46.73kN$
$q = \frac{46.73kN}{7100mm}$
$q = 6.58N/mm$

Zone I-
$q = 12.35kN * 1.35 - 20,04kN * 1,5$
$q = -13,39kN$
$q = \frac{-13,39kN}{7100mm}$
$q = -1,89N/mm$

APPENDIX A

Moment of inertia, I

$$I = \frac{1}{12} * b * h^3$$

$$I = \frac{1}{12} * 175mm * 400mm^3$$

$$I = 933{,}33 * 10^6 mm^4$$

Deflection Zone I+

$$u = \frac{5}{384} * \frac{6{,}58N/mm * 7100mm^4}{17{,}77 * 10^3 N/mm^2 * 933{,}33 * 10^6 mm^4}$$

$$u = 13{,}1mm$$

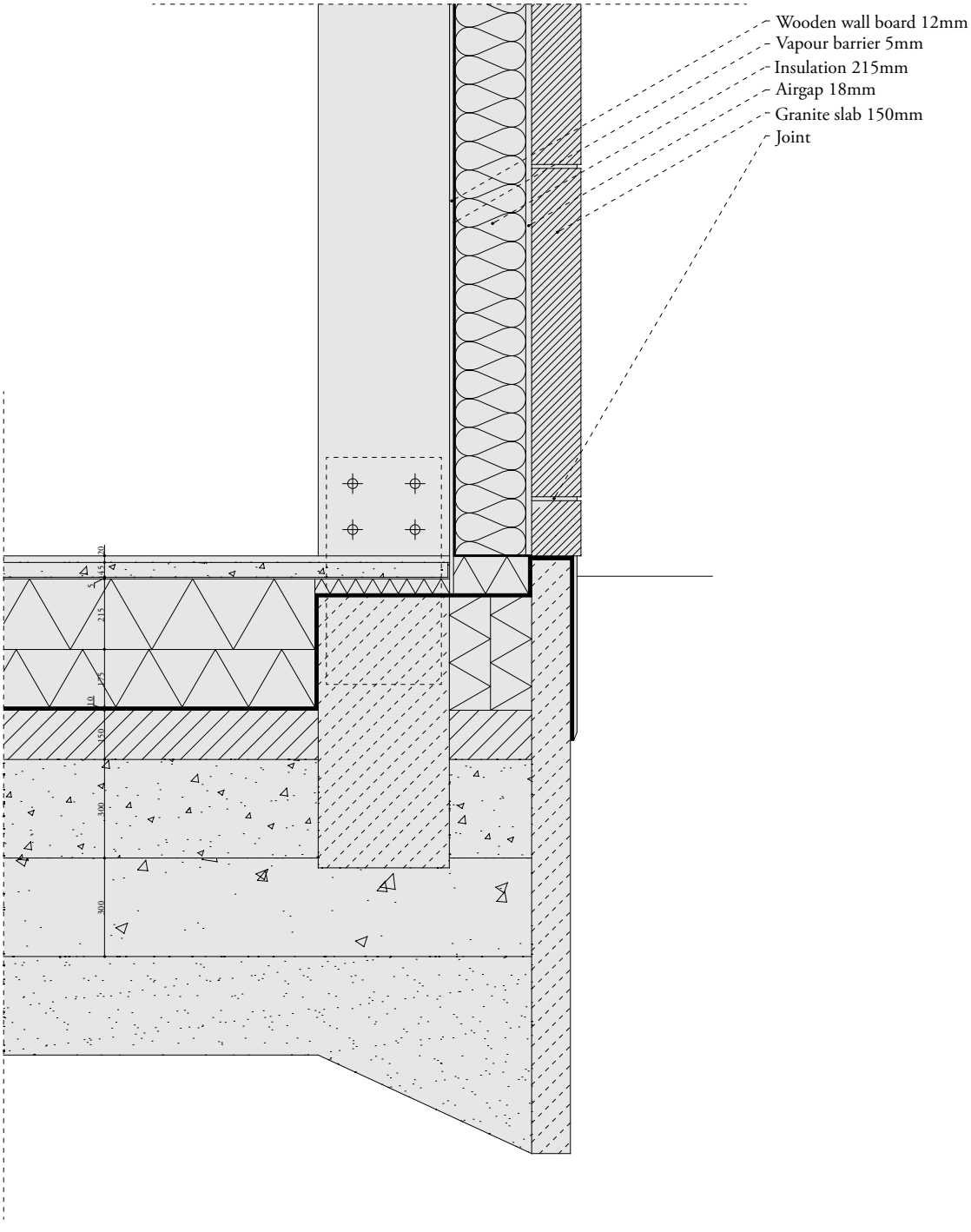
Deflection Zone I-

$$u = \frac{5}{384} * \frac{-1.89N/mm * 7100mm^4}{17{,}77 * 10^3 N/mm^2 * 933{,}33 * 10^6 mm^4}$$

$$u = -3{,}8mm$$

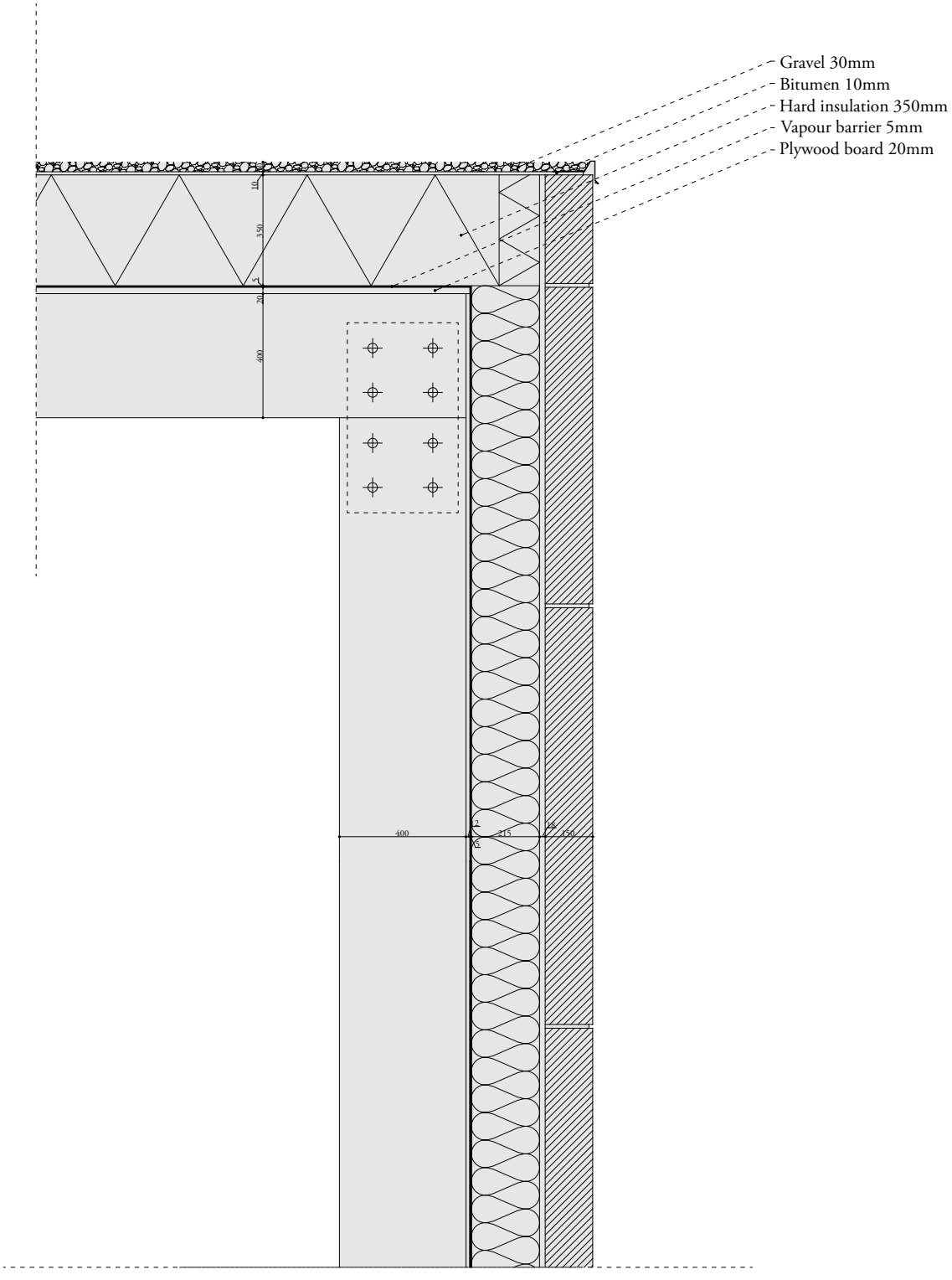
The deflection of the beam is below the maximum deflection allowed. In the case, where the force from the wind is negative, shows a situation, where the construction will be lifted by the low pressure generated by the wind, like the case is for an airplane wing.

APPENDIX B
DETAILED DRAWINGS

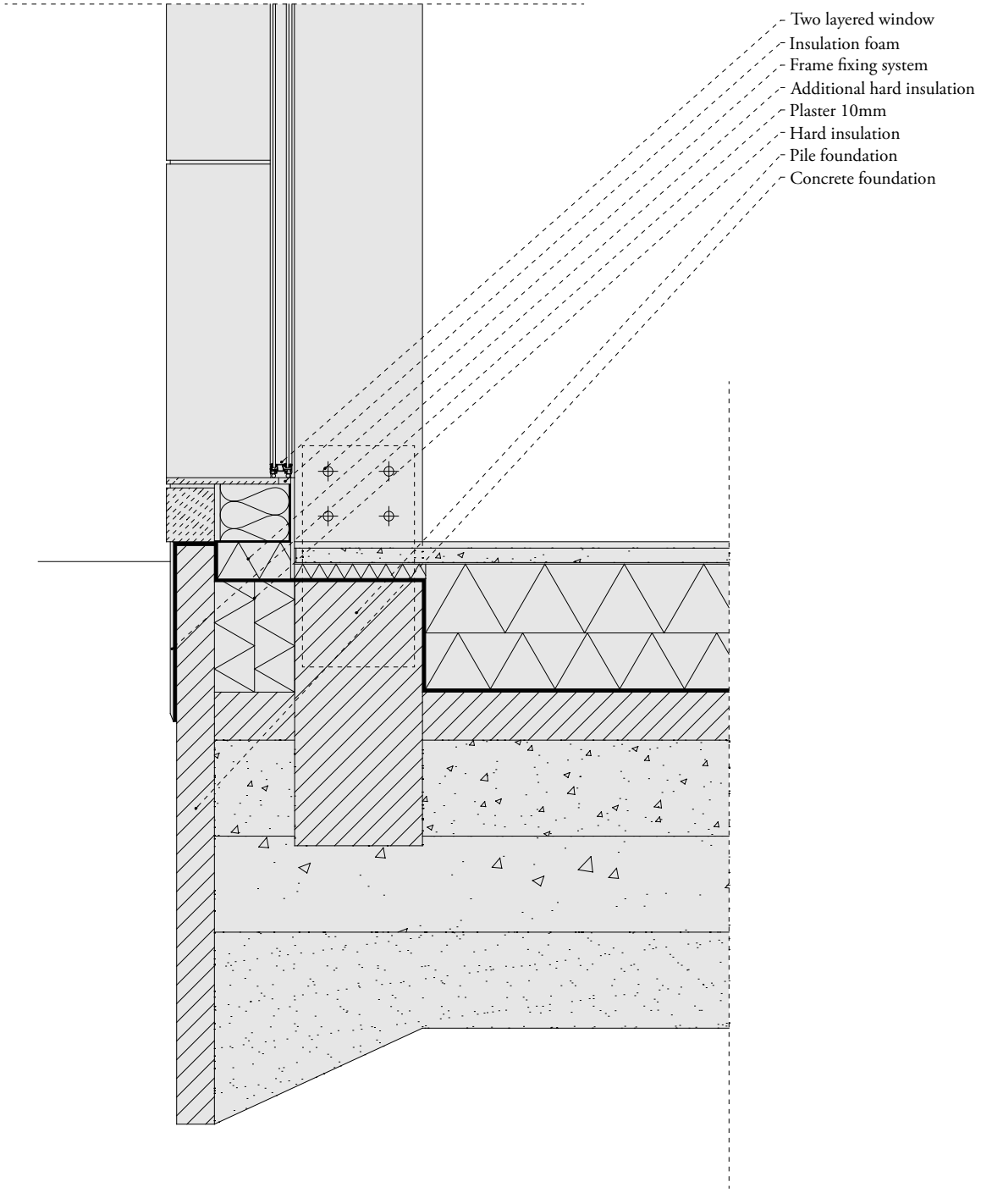


Ill. 123 - Detail 1 - 1:20

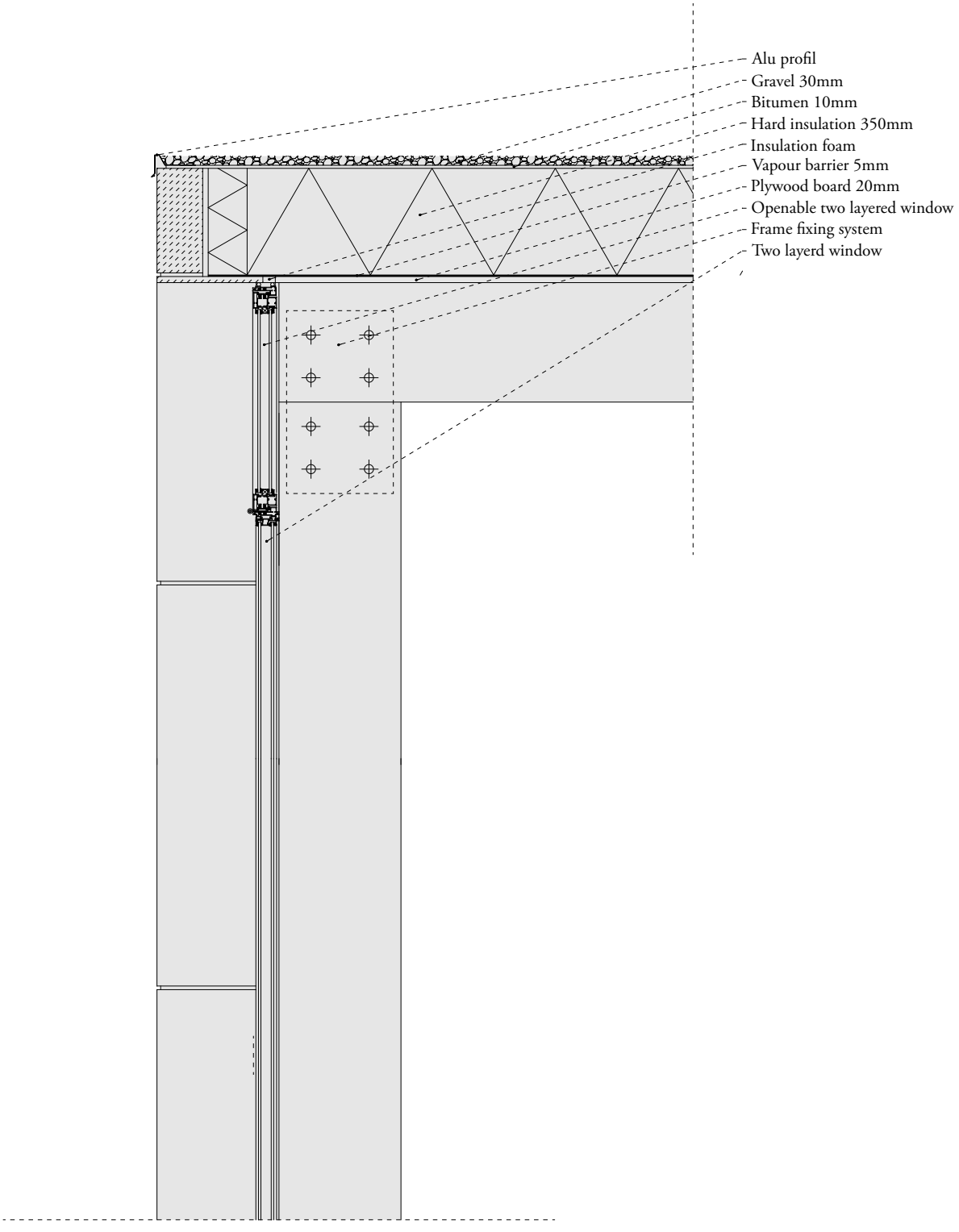
APPENDIX B



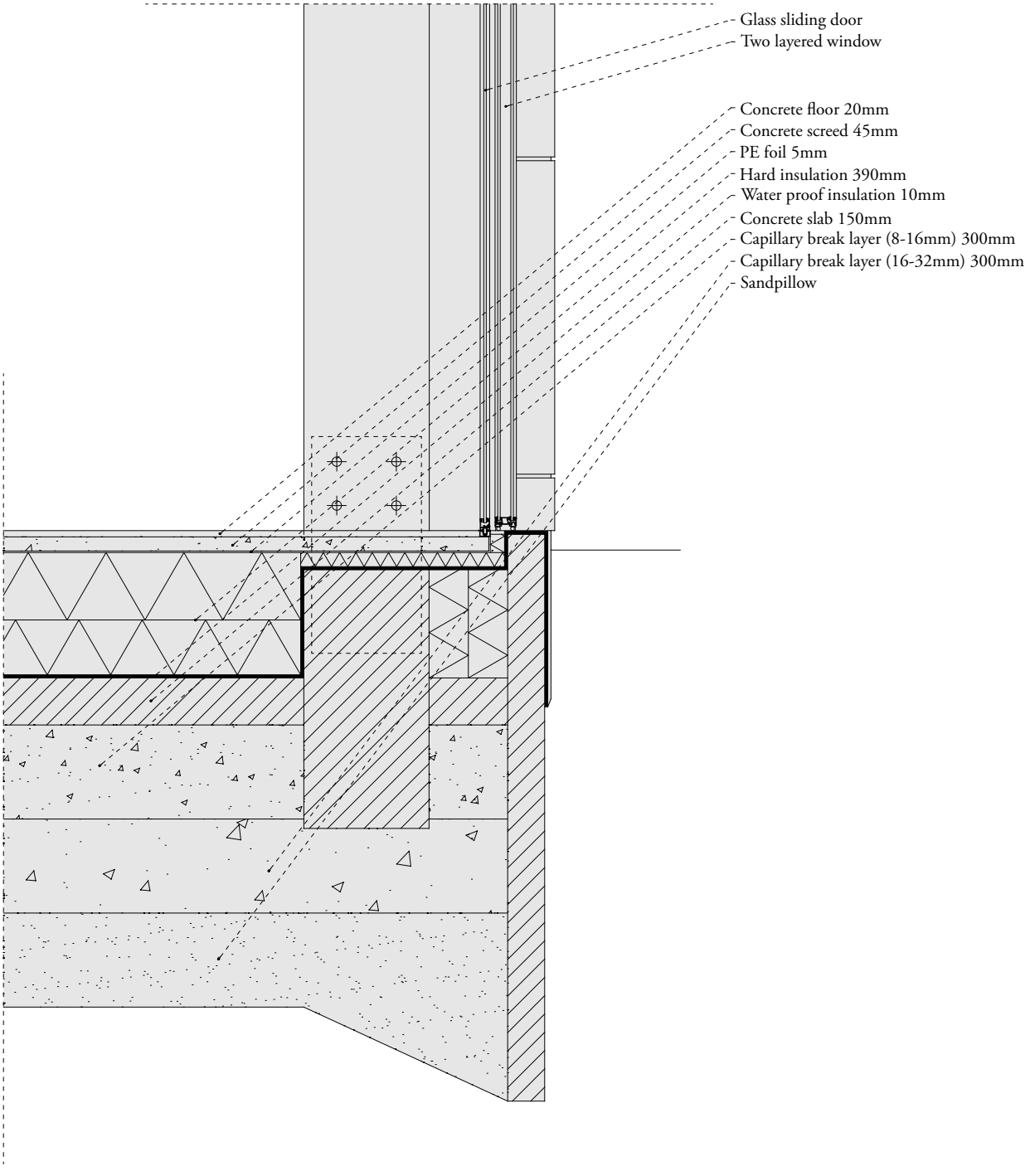
Ill. 124 - Detail 2 - 1:20



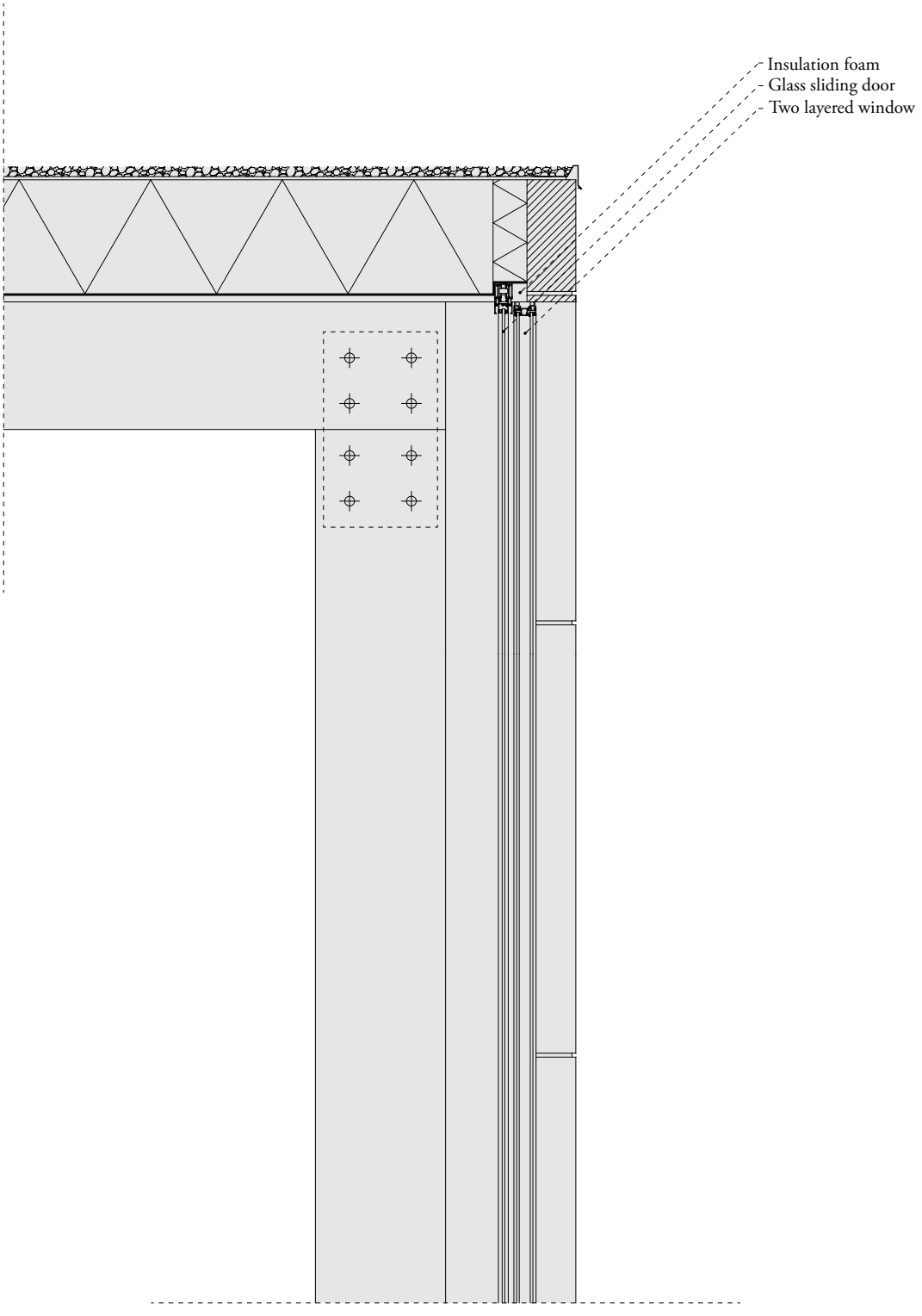
Ill. 125 - Detail 3 - 1:20



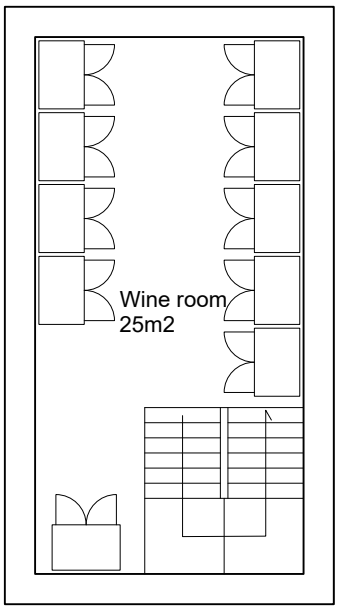
Ill. 126 - Detail 4 - 1:20



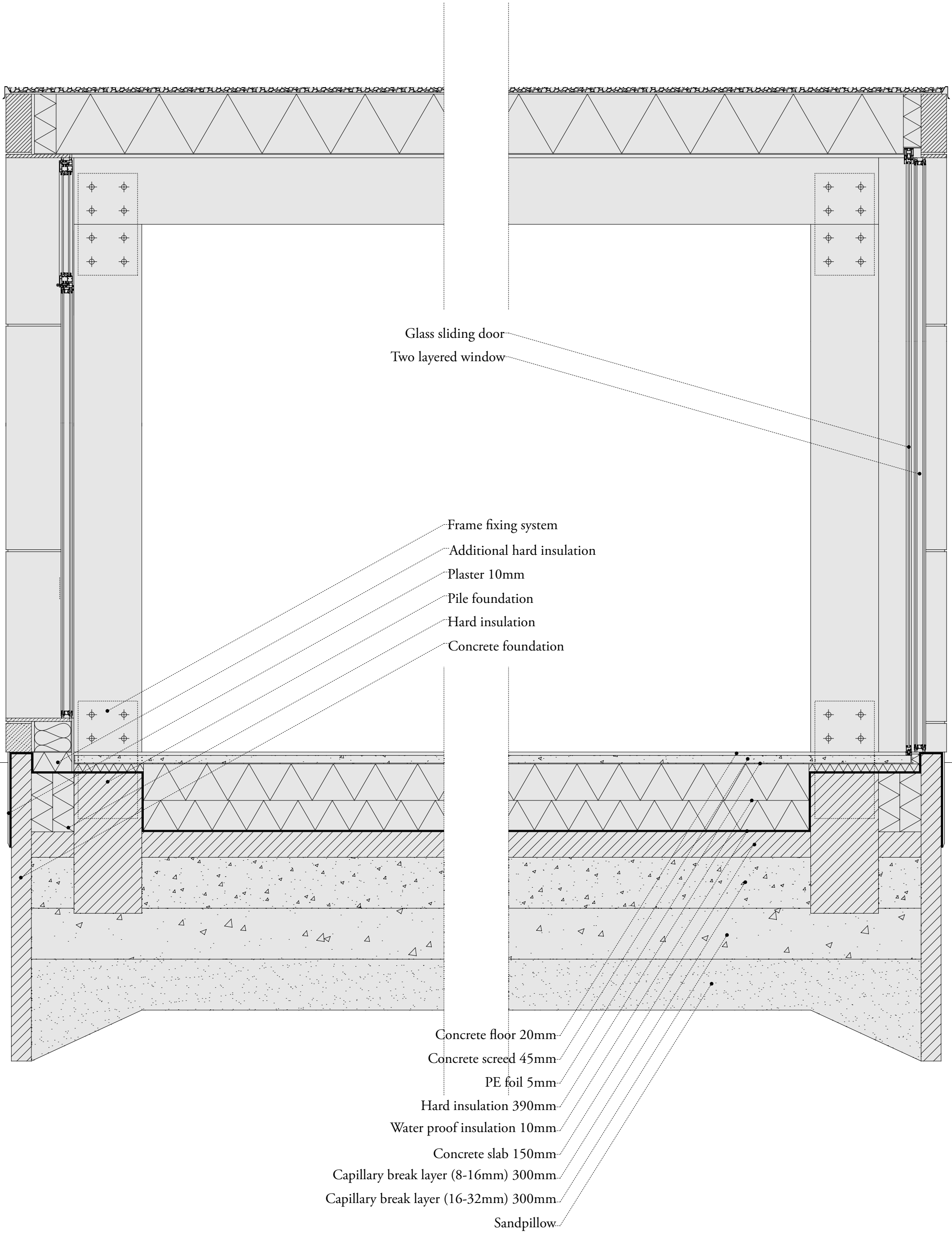
Ill. 127 - Detail 5 - 1:20



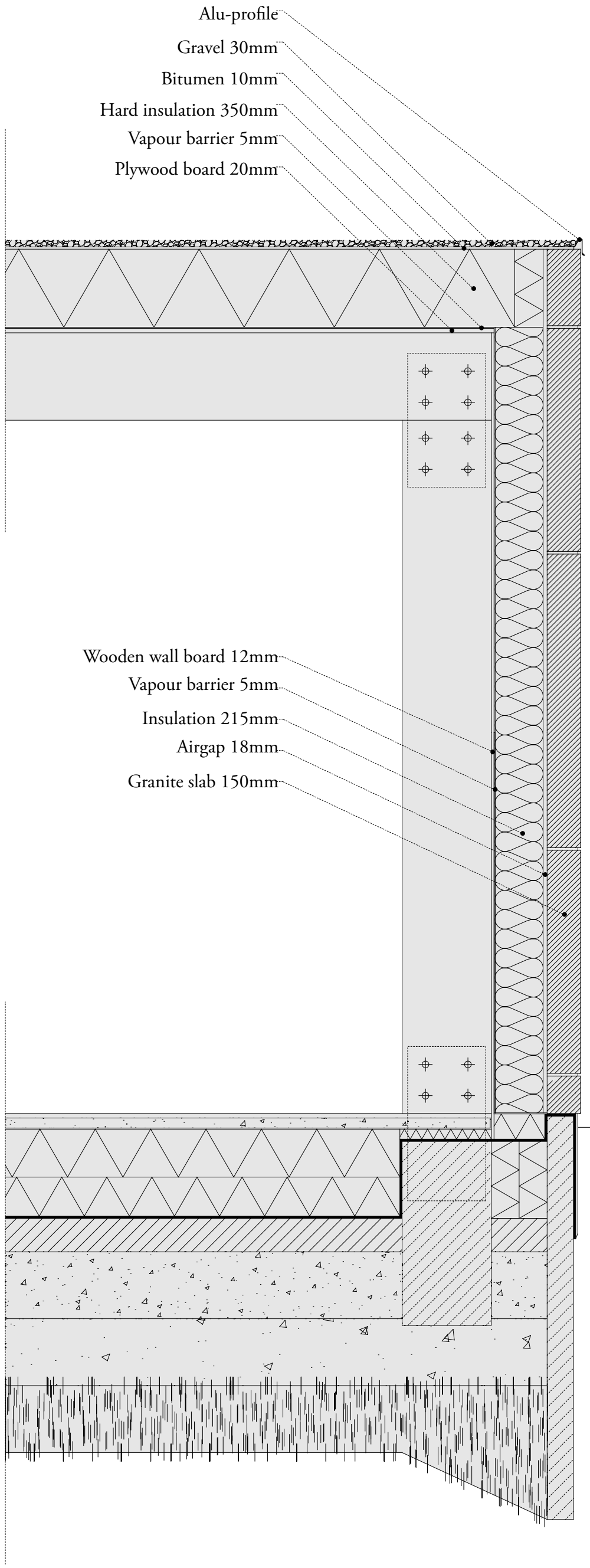
Ill. 128 - Detail 6 - 1:20



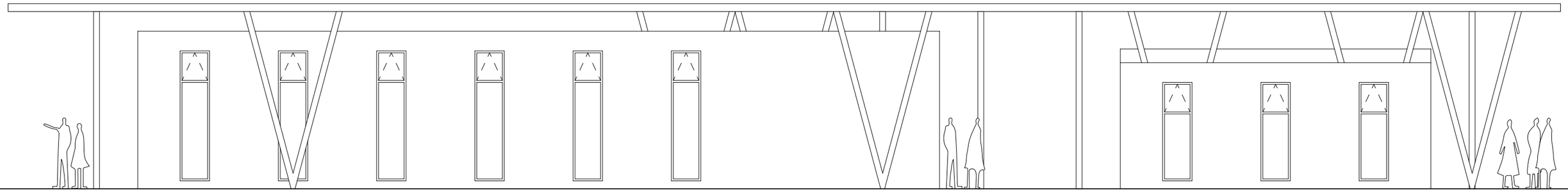
Architecture & Design Aalborg University	Cromeleque dos Almendres Visitor Center	Basement	
		Part 7 - 13	Made by: Group 27
		Date 18/5 2017	Scale 1:100



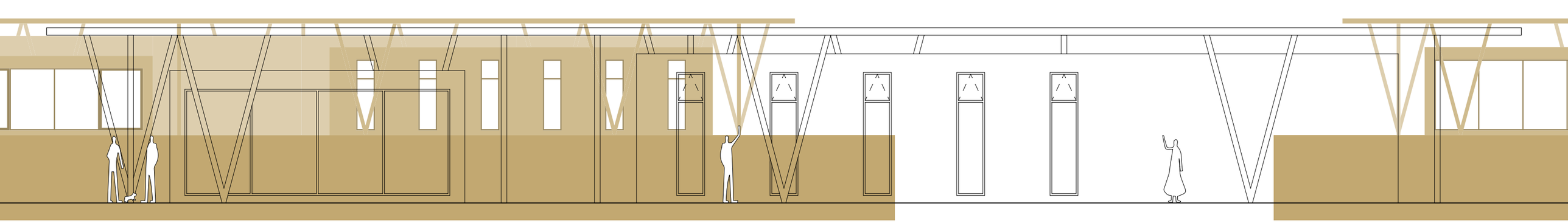
Architecture & Design Aalborg University	Cromeleque dos Almendres Visitor Center	Details 1	
		Part 12 - 13	Made by: Group 27
		Date 18/5 2017	Scale 1:20



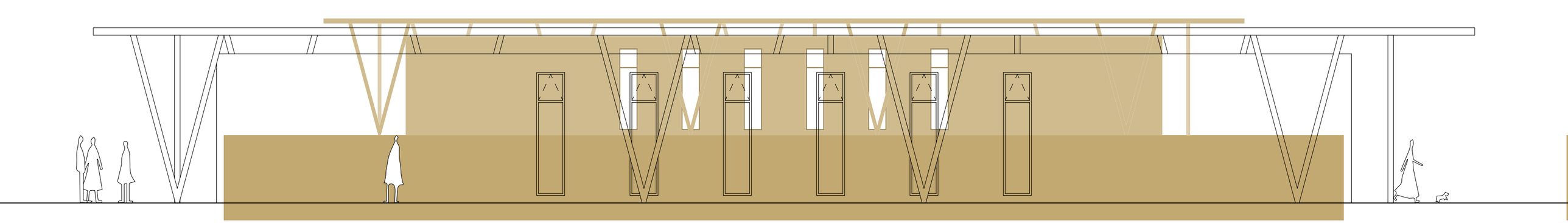
Architecture & Design Aalborg University	Cromeleque dos Almendres Visitor Center	Details 2	
		Part 13 - 13	Made by: Group 27
		Date 18/5 2017	Scale 1:20



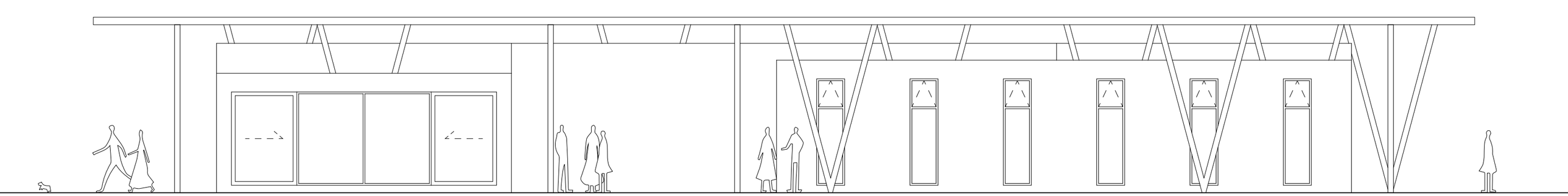
Architecture & Design Aalborg University	Cromeleque dos Almendres Visitor Center	North facade			
		Part	2 - 13	Made by:	Group 27
		Date	18/5 2017	Scale	1:100



Architecture & Design Aalborg University	Cromeleque dos Almendres Visitor Center	South facade		
		Part	3 - 13	Made by: Group 27
		Date	18/5 2017	Scale 1:100



Architecture & Design	Cromeleque dos Almendres Visitor Center	East facade			
Aalborg University		Part	4 - 13	Made by:	Group 27
		Date	18/5 2017	Scale	1:100



Architecture & Design Aalborg University	Cromeleque dos Almendres Visitor Center	West facade		
		Part	5 - 13	Made by: Group 27
		Date	18/5 2017	Scale 1:100

C

A

D

D

B

B

Wine bar / café
50m2

HC WC
4m2

WC
3m2

WC
3m2

HC WC
4m2

WC
3m2

WC
3m2

Lobby / gift shop
103m2

Education space
69m2

Exhibiton space
107m2

1:20 model

Meeting room
16m2

Administration office
16m2

Gallery space
87m2

General storage room
21m2

Storage room
19m2

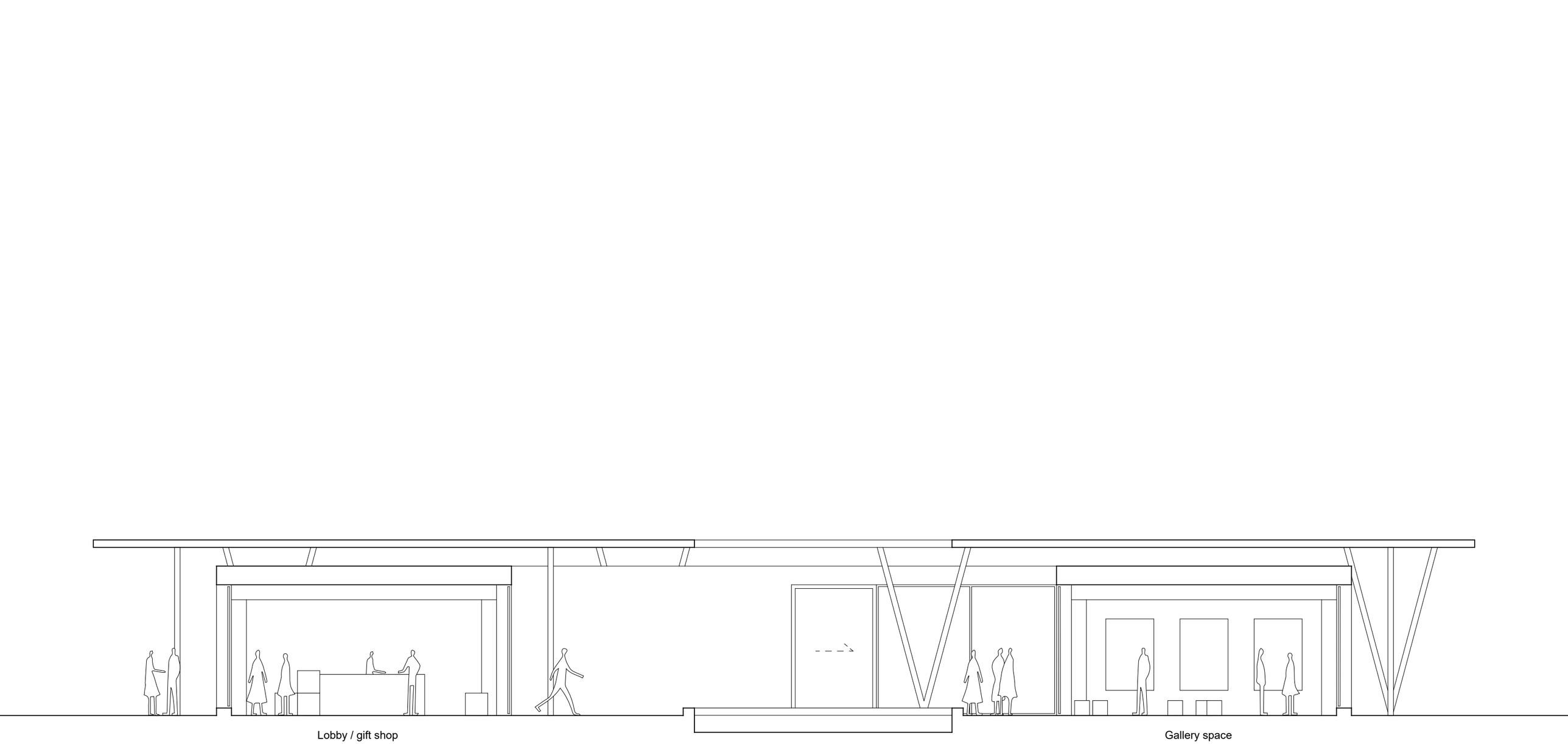
Equipment and mechanical room
10m2

C

A

Architecture & Design Aalborg University	Cromeleque dos Almendres Visitor Center	Groundfloor	
		Part 6 - 13	Made by: Group 27
		Date 18/5 2017	Scale 1:100

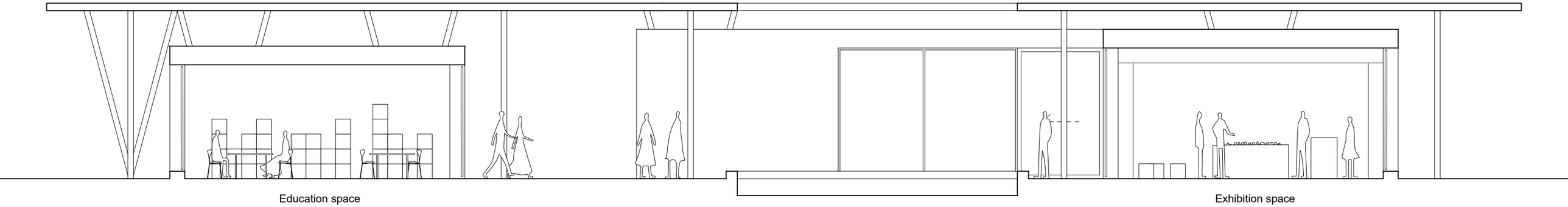
Architecture & Design Aalborg University	Cromeleque dos Almendres Visitor Center	Masterplan	
		Part 1 - 13	Made by: Group 27
		Date 18/5 2017	Scale 1:500



Lobby / gift shop

Gallery space

Architecture & Design Aalborg University	Cromeleque dos Almendres Visitor Center	Section AA	
		Part 8 -13	Made by: Group 27
		Date 18/5 2017	Scale 1:100



Architecture & Design	Cromeleque dos Almendres Visitor Center	Section BB			
Aalborg University		Part	9 -13	Made by:	Group 27
		Date	18/5 2017	Scale	1:100

Architecture & Design Aalborg University	Cromeleque dos Almendres Visitor Center	Section CC	
		Part 10 - 13	Made by: Group 27
		Date 18/5 2017	Scale 1:100

Architecture & Design Aalborg University	Cromeleque dos Almendres Visitor Center	Section DD	
		Part 11 -13	Made by: Group 27
		Date 18/5 2017	Scale 1:100