Nyctalopia

The RedSands Astronomy Center

MSc04_ARK_ARCHITECTURE AND DESIGN | 2015 | ALIKI SKIADA

This master thesis report is a personal product, developed during the 4th semester of the MSc program in Architecture and Design of Aalborg University.

Extended from February to May 2015, the report presents the outcome of methodic research and elaborated design and describes the procedure followed and knowledge acquired through out.

Project title
NYCTALOPIA|The RedSands Astronomy Center

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ABSTRACT

This master thesis is an attribute to the spatial practices of a public architecture that is however, withdrawn from the urban content and invites users to live a reclusive experience. It is a referential architecture to the science of stars and the sociocultural and historical importance of a former offshore military base. The project proposal lies on a competition brief by Rethinking team –initiative of Estudio Heliopausa-, a call towards young architects to develop an Astronomy Center at the Red Sands sea forts of United Kingdom located on the Thames estuary.

Referencing the organic timetable followed in such a program, a walkable tube complementing the bizarre army structures and going from light to dark is introduced. The astronomy center is self-sufficient and eco-friendly and invites amateur astronomers and "star-eaters" to enter an experience of materiality combining the natural and artificial and initiate in the research of the universe's mysteries and their relation to the whole.

The report flows from theories on tectonics to a methodology that reveals characteristics of natural phenomena and the human intervention and drives the theoretical notion to a practical stage. The process of this emerging architectural design is presented through a poetic and a technical approach praising that both are needed for the production of a meaningful spatial experience.

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01 PROLOGUE

METHODOLOGY

The project proposal is the outcome of an open dialogue between empirical observations, creative thinking and technical approach. This combination is introduced to ensure that knowledge of architecture and engineering is integrated already in the early stages of design, adding to the notion that designing and construction should be a multidisciplinary product.

It is the Integrated Design Process as described by Mary- Ann Knudstrup (Knudstrup 2004), combined with the Problem Based Learning module, that is used as guidelines to address the project. Divided into five different phases, this methodology describes the overall steps and considerations taken into account throughout the designing process.

The first issue to be addressed is the actual possibilities on the site that could undergo changes. Thus, focus is oriented towards initiating questions -as problems- through site analysis procedure, introduced as the second phase of the methodology followed.

Topics concerning rehabilitation and revival as opposed to a strong architectural image and a historical tradition are additionally reflected upon, while bouncing between the poetic approach and meeting the technical demands.

The analysis provides a solid background for the sketching phase to lie on, where possible design solutions begin to form. At this stage, new questions arouse, inviting for further analysis.

It is through the synthesis phase, that preliminary sketching begins to form in the details, the construction, the materials. The final design emerges when all parameters are optimized and add on to the story of the architectural whole.

The presentation is introduced as the 5th phase of the process and is essential to an overall understanding of the architectural design process.

The Integrated Design Process does not suggest a chronological approach of the above mentioned phases. Instead it indicates a non-linear thinking that points out withdrawal in case intentions are not met or proceeding when approved.

TECTONIC APPROACH

In the belief that landscape can inform architecture and develop a different interpretation of its content and perception, the tectonic studies focus on the relationship between the two and the meanings emerging by their union. By pointing out the two natural elements –the sky and sea- that come together through a specific architectural program, the principles and tools to approach the design become obvious.

In addition, a discussion about relations between form, structure and aesthetics, raises the design motivation question concerning the production of spatial experiences that stimulate all senses.

On *the Sublime and the Beautiful*, Edmund Burke associates the magnificent qualities of the starry heaven with the Sublime, while attributing the beautiful qualities of a landscape to its opposite, the Picturesque. In the Red Sands Forts, the coexistence of the Sublime and the Picturesque is exemplified by the sky and sea, a relationship amplified by utter darkness and an impossibly expansive landscape.

This relation indicates that these elements cannot work independently, but harmonically supplement one another. There is no possible way in nature to segregate the sky from the sea to articulate different landscape experiences. The tectonic theory that I am interested in somehow makes this fact a commensurable thinking on the communication between landscape and architecture. Kenneth Frampton, when introducing critical regionalism, described that the goal towards a meaningful architecture is the absorption of the peculiarities of a particular place (Frampton, 2001). Simultaneously, he claims that empathy must also be present in the building. To be tectonic architecture must provoke people's empathetic participation in the experience of it. In order for that to be achieved, expressing and revealing the true essence of the building is inevitable.

This statement declares the necessity to dive deeply into an understanding of the basic elements of construction, in order to create tectonic spatialities where fundamental disciplines inform one another. The honesty of construction would develop into a form and vice versa. According to Sekler tectonic is accomplished when a building can be described as neither structure nor construction alone, but both modes are representative (Semper, 1851).

Levitation over these theories and thoughts will eventually inform the design and generate a sensitive towards the landscape project, with a structure that is justifying its form.


IL. 1 site photo

02 DESIGN BRIEF

Participating in a student competition, turned seeking for a master thesis theme into a prerequisite. The rethinking team raised the issue of rehabilitation, restoration and revival of Red Sands military forts in the Maunsell Sea of England. An Astronomy Center, introduced as the proposal program, lies under the category of public building. Architecture of this kind has been a wish to work on, as "public" is a reference to the crowd, the diversity and multiculturalism and could be a challenge when trying to meet its demands, especially when the site given presents public access limitations. The competition brief itself, however, is calling for unlimited ideas.

"Think of the competition as a laboratory of ideas. A support where questions are raised without fear of regulatory BREACH, unleash a projective TOTAL FREEDOM."

Rethinking team (REDSANDS_RULES_EN, 2015)

reTH!NKING
ARCHITECTURE COMPETITIONS

IL. 2-3 competition logo

PROPOSAL

Motivated by the human curiosity towards natural phenomena and the lasting desire to explore, investigate and reflect upon the unreachable, rethinking has chosen a theme to project into space. This would preferably lead to an understanding that human is only a small unit compared to the infinite universe and to an extension beyond the proposal of an astronomy center. It is a wish to reestablish the human relation to the surroundings, shorting the current relationships to potential endless possibilities abandoned since the discovery (and construction) of artificial and virtual environment.

The project raises an opportunity to experiment on spatial possibilities, loss of visual references in landscape, the absence of walkable earth and fighting of claustrophobia and confinement of its inhabitants. It is an opportunity to propose alternatives to growth and territorial forms of consumption.

Since these former fortresses are distant from the dense urbanism and fulfill the experimental opportunities developed, it seems appropriate to implement a center studying the stars. The isolation of these fortifications makes the visibility of the night sky perfect.

PROGRAM PREREQUISITES

Prerequisites of the astronomy center program are an observatory, an agora, conference and workshop rooms and accommodation for between 30 to 50 people. Accommodation should be supplemented with a kitchen, dining room and common areas among the sleeping rooms and bathrooms and could be individual or collective.

Intervening in the existing structures or around them is a possibility, while considering them as part of the project.

PRINCIPAL CONCEPTS TO BE CONSIDERED

SCALE, ECOLOGY, MOBILITY

The Rethinking team is always proclaiming competitions under a certain philosophy of positivism and expansive theories. For this specific competition, they introduced three concepts to be addressed, scale, ecology and mobility.

They understand scale as a capacity to form relationships and are interested in configurations such as recursive phenomena of increase and development. They deal with ecology as a progressive concept of interaction with artificiality and nature. They see mobility as the means to overcome mono-functionality.

03 ANALYSIS

SITE OF INTEREST

LOCATION OF THE SITE

The Red Sands Sea Forts are located in the so-called Maunsell Sea, approximately 8 miles away from the nearest British coast, the Whitstable port. Whitstable is a seaside town located on the north coast of Kent and the first seaside town to the south of London, in south-east England.

Latitude: 51 ° 28'6.00 "N
Longitude: 0 ° 59'6.00 "E

ACCESS

To this day, the site is only accessible by boat. A local union by the name of Project Red Sands is organizing daily excursions for those interested to visit the structures, departing from the coast of Whitstable town.

IL. 4 location map

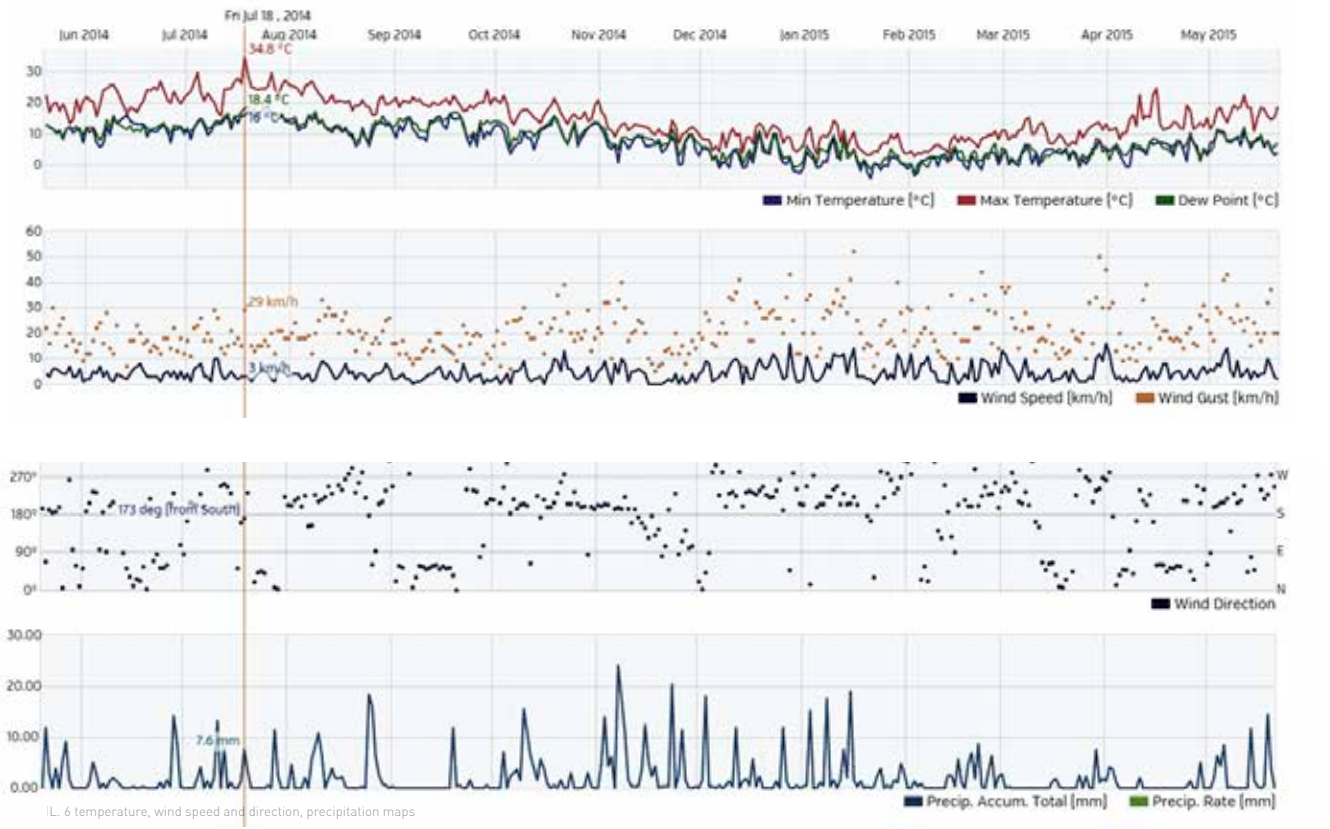
IL. 5 Whitstable beach

WHITSTABLE

It is a reasonable continuity of a former tradition, rather than a fortunate coincidence, the fact that boats visiting the Maunsell Forts begin their journey from Whitstable. Apart from being the nearest coast, many routes departed from Whitstable harbor, making it the second busiest of England during World War II. It was as well the first in Britain to have a railway link. As such, trains and ships navigating the Thames imported a large proportion of supplies to the UK, leaving Whitstable with the communicational operator tag.

Whitstable has also supported a successful boat building and repairing industry from its earliest days, while nowadays the industry is concentrated on leisure craft passing the torch of its maritime heritage to fishing activity.

Today, with a population of about 30,000, it is an attraction for tourists, due to the distinctive character of the town.



IL. 6 temperature, wind speed and direction, precipitation maps

CLIMATE

In Whitstable, the warmest time of the year is July and August, when maximum temperatures average around 21 °C (70 °F). The coolest time of the year is January and February, when minimum temperatures average around 1 °C (39 °F). The average maximum and minimum temperatures are around 1/2 °C higher than the national average (England 1971–2000 averages, 2007).

The average annual rainfall is about 728 mm (29 in), October to January being the wettest months. The national average annual rainfall is about 838 mm (33 in).

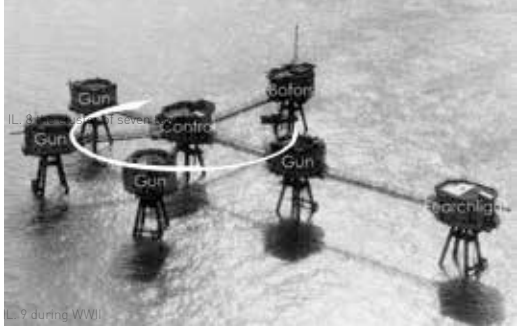
The presented data concern Whitstable coast, as there are no records saved for the specific site of the Forts, being far out in the sea.

IL. 7 Red Sands Army photo

THE STORY

The competition brief pointed the Red Sands sea forts as the site of intervention. As became clear while presenting tectonic theories of relating to landscape, it has been a goal to elaborate an idea that is respectful and sensitive towards the dignity of the towers and the surrounding environment.

Thus, in order to explore the potentials of these silhouettes it is necessary to gain knowledge over historical facts and information on their current condition as a starting point.



IL. 9 during WWII


IL. 10 the original catwalks

THE MAUNSELL ARMY FORTS


IL. 11 soldiers on tower rooftops


IL. 12 the towers in their original form and use

By the virtue of German aerial and naval attentions at the outbreak of World War II, an urgent need arose to protect London and other Thames settlements from the small naval aircrafts sowing magnetic mines. The initial response came from Guy Maunsell, a civil engineer -later known for innovations in concrete bridge design- who produced plans for offshore defenses.

As part of the Thames Estuary defense network, three sets of forts were constructed between May and December of 1943 to an identical design, in the South East coast of Whistable, town of England: the Nore forts, now demolished; the Red Sands and Shivering Sands forts, all three known as Army Maunsell Forts. They were sited on sand banks much closer to the mouth of the Thames and formed a west-east line of protection alongside the main shipping lanes. These nautical bastions were assembled after the main London Blitz, but were in place to hinder later attacks. They jointly shot down 22 enemy aircraft and 30 flying bombs, undoubtedly saving hundreds of lives.

DESIGN AND APPEARANCE

Each anti-aircraft fort is a cluster of seven stilted turrets -not identical as they served different functions-, arranged in a very distinct formation (IL.08).

The Searchlight Tower is set slightly apart from the cluster to succeed better visibility of the enemy proceeding. The Bofors Tower, armed with two 40mm Bofors guns, and four more Gun towers with 3.7" HHA guns circle the Control Tower housing predictors and radars. The towers provided not just operational rooms but also accommodation and storage areas (IL.11-12).

Tubular steel catwalks once spanned the gaps between each roost, but these have long-since removed for safety reasons (IL.10).

To access the cabins from the sea level, service members used vertical ladders still operational today. Rooms received natural light from windows and generators provided power (IL.14-15).

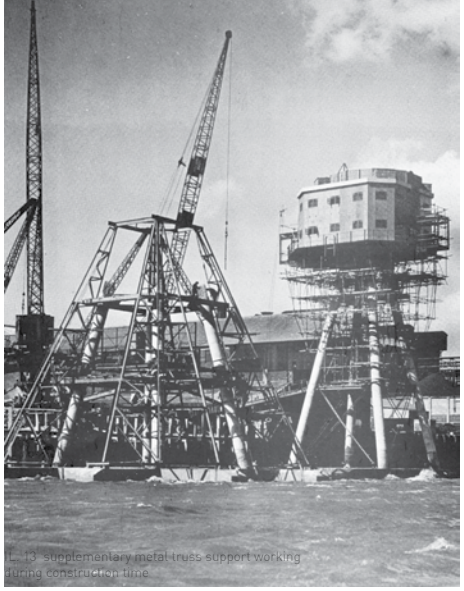
Each tower was built onshore, over a reinforced concrete base of 'Oxford picture frame' design, and towed out to sea where sunk onto the seabed (IL.17, 20).

Four hollow reinforced concrete legs of 80cm diameter, slender and angled, support the 11 x 11m two-story steel house ('fortress').

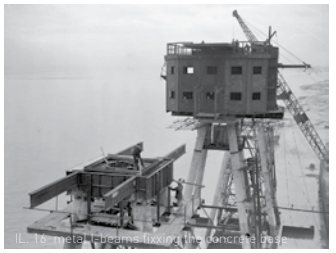
Girders balanced precariously on surprisingly small concrete platforms support the metal cabins (IL.15-16).

The roofs of the gun forts are equipped with flat cylindrical platforms on which the armaments were mounted.

Among the weaponry, shells were stored in solid metal cabinets affixed to the perimeter of the roof for safety reasons and protection against the estuary weather (IL.18).



IL. 13 supplementary metal truss support working during construction time



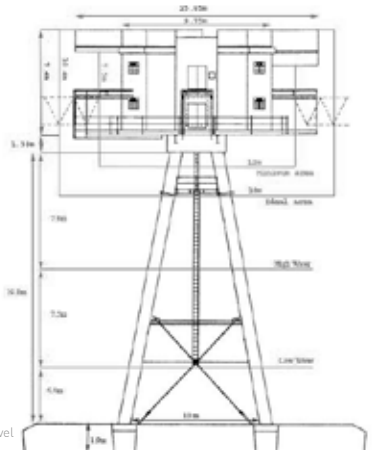
IL. 16 metal I beams fixing the concrete base

IL. 17 construction onshore, oxford concrete frame-base

IL. 14 vertical laders, access to the roosts

IL. 18 solid metal cabinets storing shells

IL. 15 concrete base supporting the metal houses



IL. 9 high and low water level

onstruction

IL. 21 Essex coast on the horizon

The harbor mouth of Whitstable is seven miles to the south, while the coastline of Essex is visible on the northern horizon. This suggests that the Bofors gun tower is oriented towards the west/ south west. Thus, the four gun towers surround the eastern side of the control tower and the searchlight takes up a position on the northern edge of the cluster - closest to the sea lanes (IL.21).

In this manner, enemy aircraft approaching the mouth of the Thames estuary from continental Europe would be confronted with an arc of gun emplacements backed by the bofors guns.

After their successful wartime career, the forts were decommissioned in the 1950s and fell into this rusty stasis not long after. In the 1960s and 70s, the remaining abandoned forts were famously taken over as pirate radio stations. All of the Army Forts are now abandoned and in varying states of decay, while attempting to enter them is probably ill-advised, if not illegal.

THE RED SANDS ARMY FORTS

The Red sands Forts were constructed between July and September 1943.
Crewed initially by 165 men, this figure was increased to 265 after June 1944 when the German Luftwafe started to use the V1 Flying Bomb (Doodlebug). These new weapons were much faster than aircraft of that period and it was necessary to have men at their gun positions to have a chance of hitting them.

In 2003, the Project Redsands organization formed with the aim of protecting and possibly restoring the Redsands Forts chose those over Shivering Sands, due to their better state of preservation.

In 2005, the artist Stephen Turner occupied the Forts for 36 days; roughly, the same amount of time a WWII service-member would have spent at the fort. He described the project as an artistic exploration of isolation, investigating how one's experience of time and place changes in isolation, and what creative contemplation means in a twenty first century context. He kept a daily updated blog as notes to his later-on published book documenting his experience on the project. During his staying, the artist had an experience with stars and shares:

IL. 22 Capture of Cassiopeia from the tower (artist's blog)

"I discovered Cassiopeia in the boiler room today, rising over the firmament of a barren floor peppered with small illuminated holes leading to the void below. On closer inspection I saw through my error, and realized I was looking onto a series of five green and watery planets."

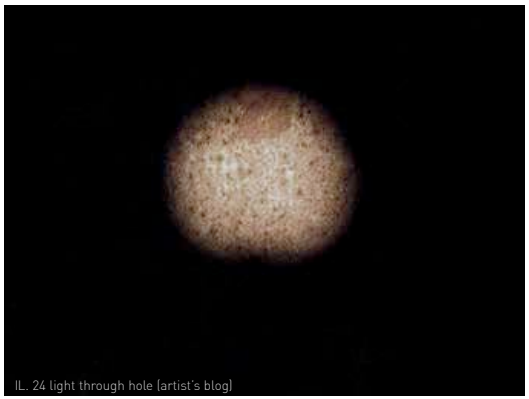
POSTED BY STEPHEN TURNER AT 7:49 PM
MONDAY, SEPTEMBER 05, 2005

IL. 23 sea through a hole on the rusty floor (artist's blog)

ARTIST'S LOG

Artist quotes

The listings presented here are part of the artist's blog that served my inspiration throughout the .whole project



IL. 24 light through hole (artist's blog)

These images and words shaped my idea of how would the stars look like when habituating the peculiar towers and informed my vision of an astronomy center that is more about an experience enabling all senses, rather than a place just sharing scientific knowledge.

MONDAY, SEPTEMBER 05, 2005

Cassiopeia

I discovered Cassiopeia in the boiler room today, rising over the firmament of a barren floor peppered with small illuminated holes leading to the void below. On closer inspection I saw through my error, and realised I was looking onto a series of

IL. 25 red moon emerging above towers (artist's blog)

Following the rhythm of the sun cycle is a desirable action for a program that is looking forward to the magic of the night. The organic timetable that the artist is talking about will eventually inform my interiority gestures and principle concept.

Artist quotes

The listings presented here are part of the artist's blog that served my inspiration throughout the

.five green and watery planets

POSTED BY STEPHEN TURNER AT 7:49 PM

WEDNESDAY, SEPTEMBER 07, 2005

IL. 26 green grows on the rooftops (artist's blog)

.hole in the outer wall

POSTED BY STEPHEN TURNER AT 9:49 PM

This image and words shaped my idea of how would the stars look like when habituating the peculiar towers and informed my vision of an astronomy center that is more about an experience enabling all senses than a place sharing just sci-.entific knowledge

IL. 27 plaster on interior wall of a tower (artist's blog)

The idea that something green could grow under such strong maritime conditions had not occurred to me before I read this blog. This sensitive approach made me hope for some greenery planting as part of a sustainable philosophy.

I find inspirational the meaning that just a plaster can obtain. Then materials are not soulless.

IL. 28 night sky view from the towers

VISION

When observing stars, one surrenders to the darkness of the night and the magical light of celestial systems. This bipolar notion produces an experience that affects body and mind. It is exploring a universe mystery and initiating into the human relation to the whole, while the body is exposed to external conditions. Initiation is a ritual, a path that guides one into deep thinking of what will occur. Imagine an architecture that exemplifies an experience of all senses and prepares human for reconnecting with the unreachable.

The Red Sands Astronomy Center is to be such an architecture. The bizarre structures, isolated and exposed, challenge for new ideas under the juxtaposition of a non-place that does have strong references to the past and a seductive beauty.

It has been a strong vision to preserve the uniqueness of the structures and site in all their integrity and compliment them with an architectural design that is strong and fresh enough to make distinction but integrate in the historical content of the hosting towers.

USER PROFILE

The Red Sands Astronomy Center is designed to respond to amateur astronomy and invites users to an informative journey over stars as the outset of their extraordinary hobby. It is oriented towards a more intuitive learning that involves observing stars through an experience of senses.

While presenting an educative system on engaging a knowledge-based relationship with the celestial universe, the level of proficiency is friendly to anyone interested in the stars even if not extremely informed on the topic, as opposed to a strictly scientific operation.

The spatial treatment as well as the equipment provided urge visitors to marvel at the magnificent universe and learn about its ingredients, while there are accommodation units for those in need to sleep on this new knowledge or engage in a full-time observation experience.

04 PRESENTATION

CONCEPT

The observation of the stars is an activity that involves a combination of senses. Since, the Red Sands Astronomy Center is addressing to amateur astronomers, it seemed essential to explore a step guide on how visitors could reach the best stargazing experience.

Step guide to stargazing

1. Nyctalopia is the difficulty to see in low light, as human eyes need time to adjust in the dark. An astronomy center purpose is the observation of the stars. Thus, one shall experience total exposure in the darkness of the night.

2. Stargazing is successful only in places where the sky is clear and there is minimum light interference.

3. Observing the stars requires looking up for quite some time, which could mean discomfort if one is not carefully positioned. The most comfortable way to stargaze is to lie back and watch the heavens unfold before you or to sit and stare up, increasing the distance of your eyes from the starry light source.

IL. 29-30 diagrams: step guide to stargazing and design notion

DESIGN NOTION

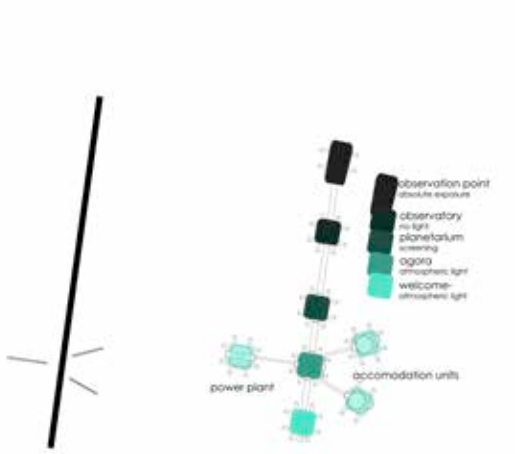
The concept is inspiring a design gesture -a path- that is in a continuous dialectic with the possibilities of program articulation and the orientation of the structures. In other words, gesture, program and orientation are design principles that inform one another.

As follows, a "gradient" path is guiding visitors from light to darker spaces, which gives their eyes time to adjust to the darkness before they even reach the observation point.
The program is now allocated according to this idea. Thus, one is guided from services that require a brave amount of artificial light to perform during the nighttime, towards those that demand total darkness for the best observation of the stars.

The orientation of the towers is pointing out the most privileged spot for the stars to be observed. The former Searchlight Tower, being set slightly apart from the cluster is more exposed to the open sea supporting a clear view of the cosmos, as opposed to the rest of the turrets that surround each other and frame the night sky.

To these principles, the linear path connects the towers on the long axis of the complex and the "path-towers" system carries the main program of the Astronomy Center (ticket and Info box, exhibition workshop and conference rooms, Agora-restaurant, planetarium, observatory).

The axis is accentuated in order to clearly state the division between the main and supplementary



uses (accommodation units, power production plant). It is thereby prolonged and strengthened, in comparison to the catwalks that connect the rest.
The distinction between main and supplementary to the program uses is based on the fact that the former has more of a public character that the private latter.

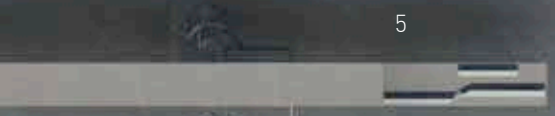

7
1
2
3
4
6
6
N
1. |welcome center|
2. |agora|
3. |planetarium|
4. |observatory|
5. |absolute exposure
6. |accommodation un
7. |power production p
10 m
10 m

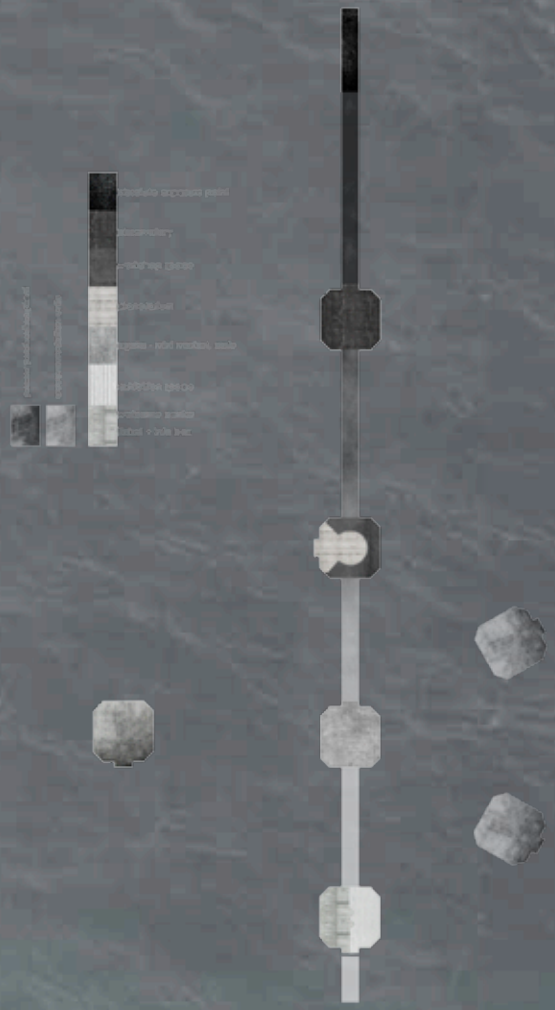
MASTERPLAN

Approaching the site only by boat, as currently occurs, is a conscious decision. Any other consideration would have intruded the sensitivity and sustainable awareness cared to maintain throughout the project.

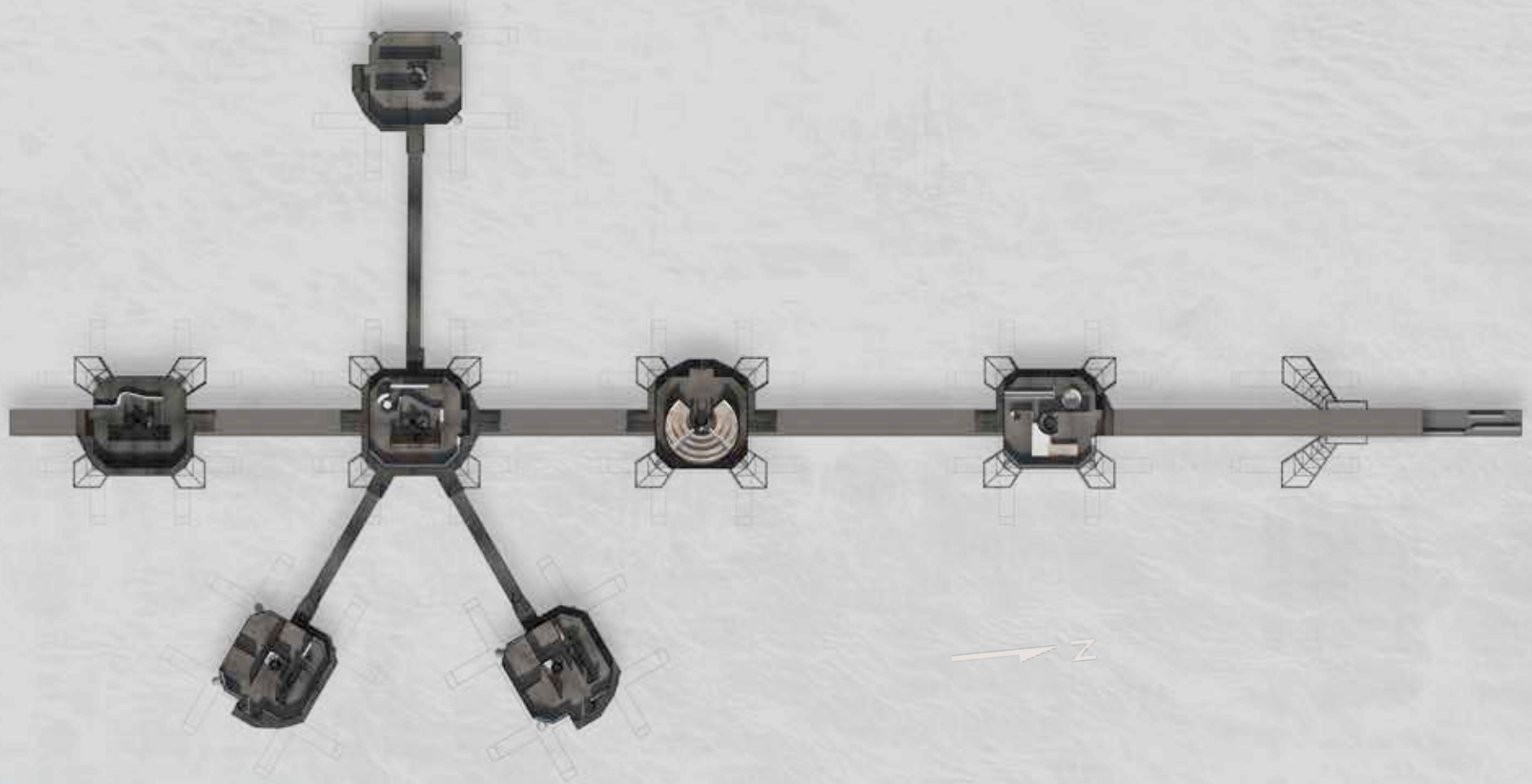
To this extend, the tower that is first approached by boat from the coast of Whitstable hosts the Welcoming Center.
When entering the path, the visitor is immediately introduced to another experience, leaving the earth behind and beginning a journey into the domain of the stars.
The Agora follows as the central hearth of the cluster and then the visitor approaches the planetarium and observatory to end his journey at an exposed area, where the view of the stars is purely undisturbed.
Circling the Agora, are the accommodation units and the Tower preserved for energy production. Their position is withdrawn from the neat public sector.

Apart from the orientation and articulation of the new project, the master plan describes the treatment of rooftops that are selectively changed, in order to provide the tower with extra daylight where required. A milky glass is covering the new openings that are designed under the architectural language that will be soon described, while referencing the original geometries.

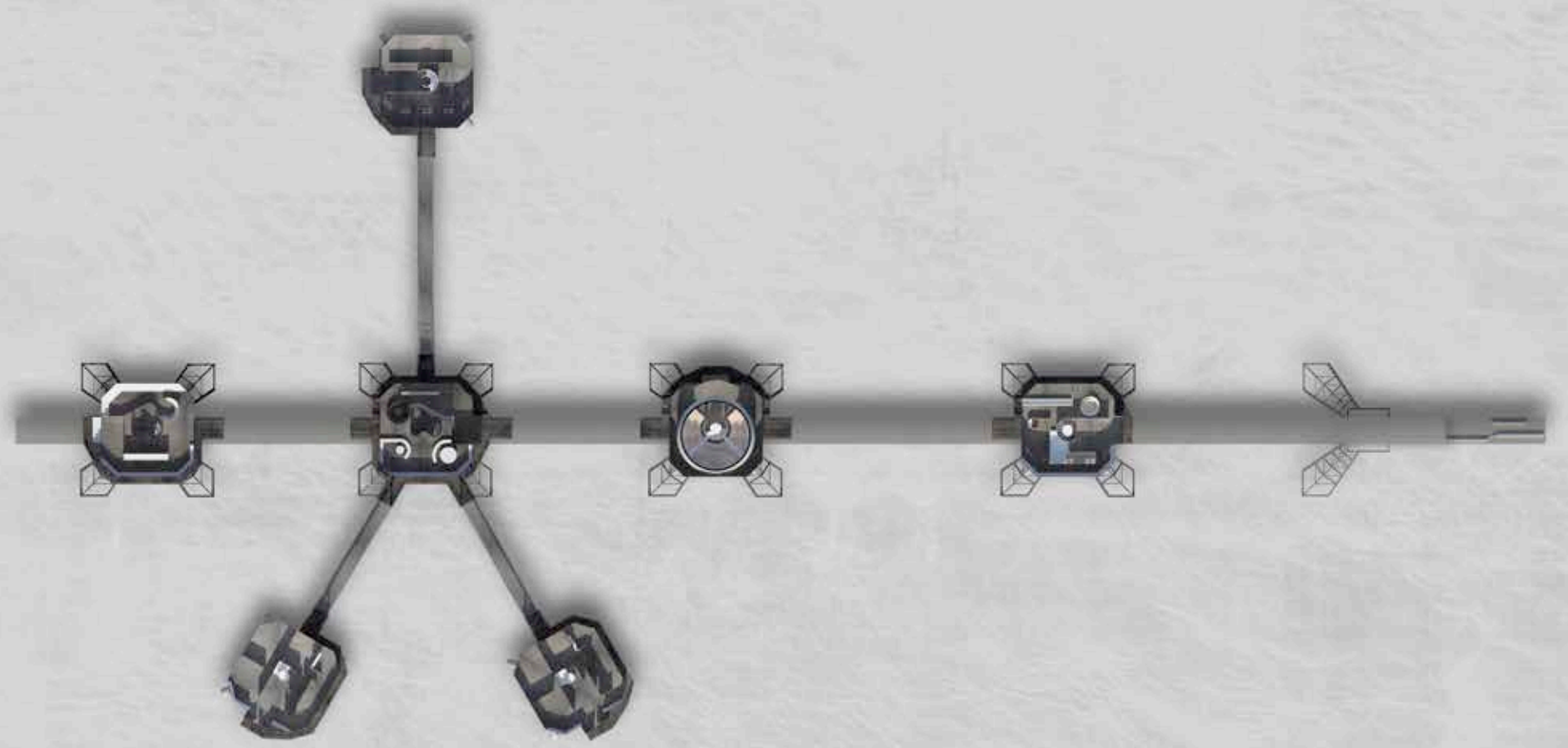




IL. 31 masterplan
IL. 32 program distribution diagram



IL. 32 floor plan



IL. 32 second floor plan

INTERIORITY

Before we move further onto the detailed presentation of each tower, it is essential to analyze the gestures of interiority proposed, in order to acquire a better understanding of the architectural intention.

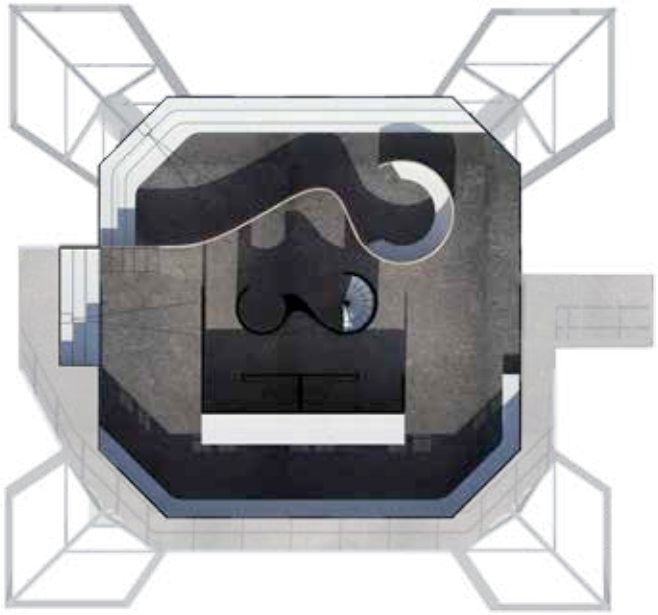
Each floor and every tower has a unique characteristic for the visitor to sense when it comes to interior environment. The geometries proposed are part of an exploration on how one perceives an unknown space, while guiding him through rooms of the same dimension. They are product of inspirational stimuli and architectural geometries on the existing structures.

To be more specific, the square concrete volume that supports the metal cabins has a circular opening in the center –symmetrically positioned- which used to be the vertical entrance to the roost (IL.14-16). Referencing the clean geometry of this component and its use, the architectural language formed introduces curves, pure circles or semicircular patterns.
The liquid forms are juxtaposed with strictly regular cores that usually host secondary uses or wet areas.

Thereby, the circular opening becomes a circular elevation tube, embraced by a circular staircase or it is transformed into an organic core of the same uses, creating an interesting experience for the visitors.

IL. 33 interior detail: access to the towers from the path

WELCOME TOWER

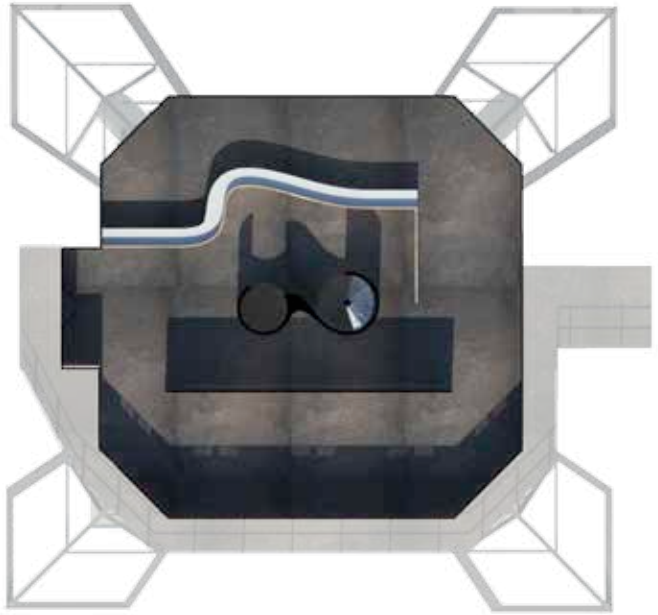


SCALE 1:200

Visitors are introduced to an organic space, where an info and ticket bureau welcomes them to the Astronomy center.

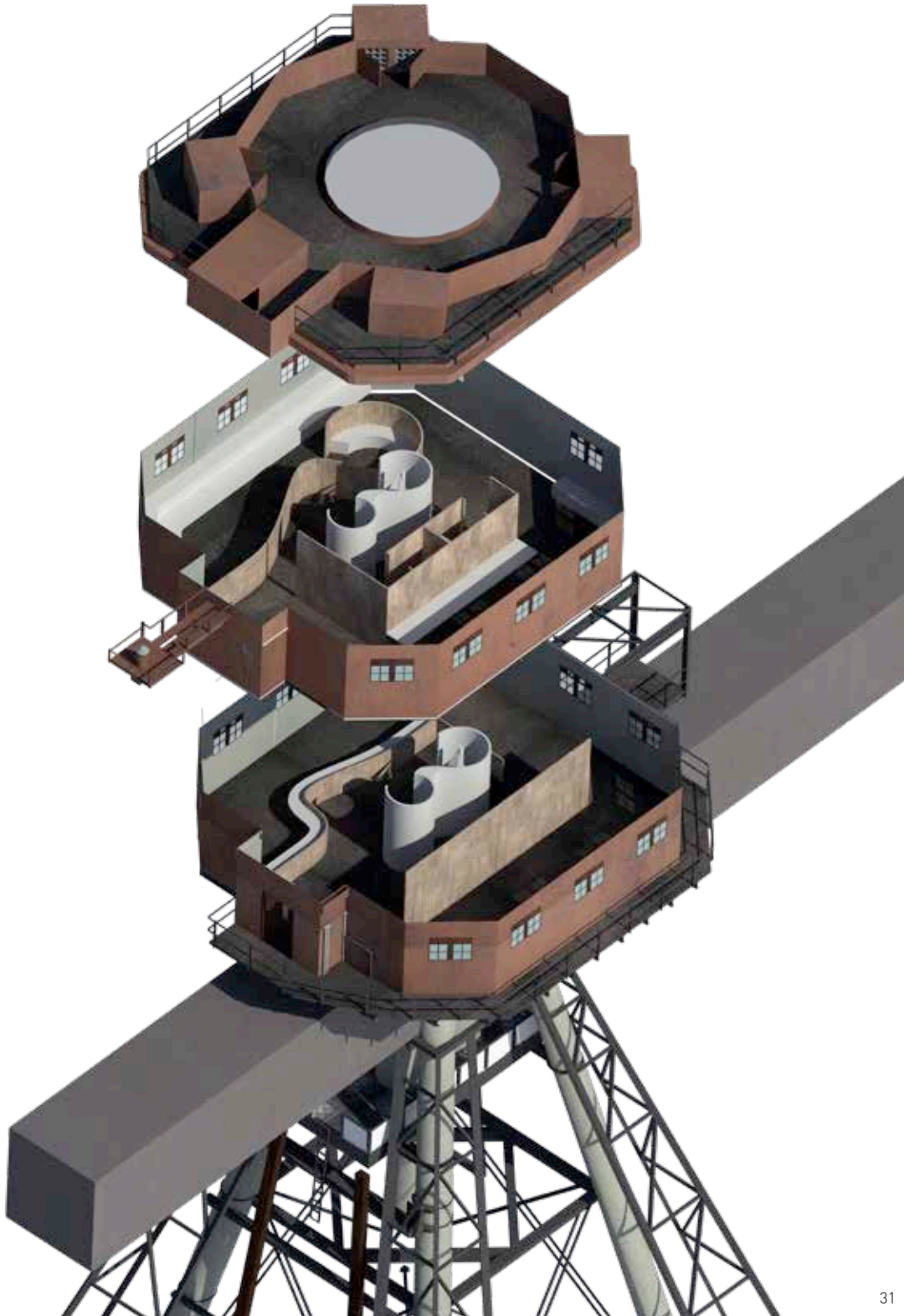
The wooden furniture guides them around the rest of the floor, divided by a single linear wall. Two areas of different quality are emerging, both running educative exhibitions.

When moving on to the second floor, one can find corners for studying and group areas for socialization and meetings, accompanied with a dark mini auditorium for requested projections and a conference room.



IL. 33 welcome center floor and 2nd floor plan

IL.34 3D representation of the spaces and services available



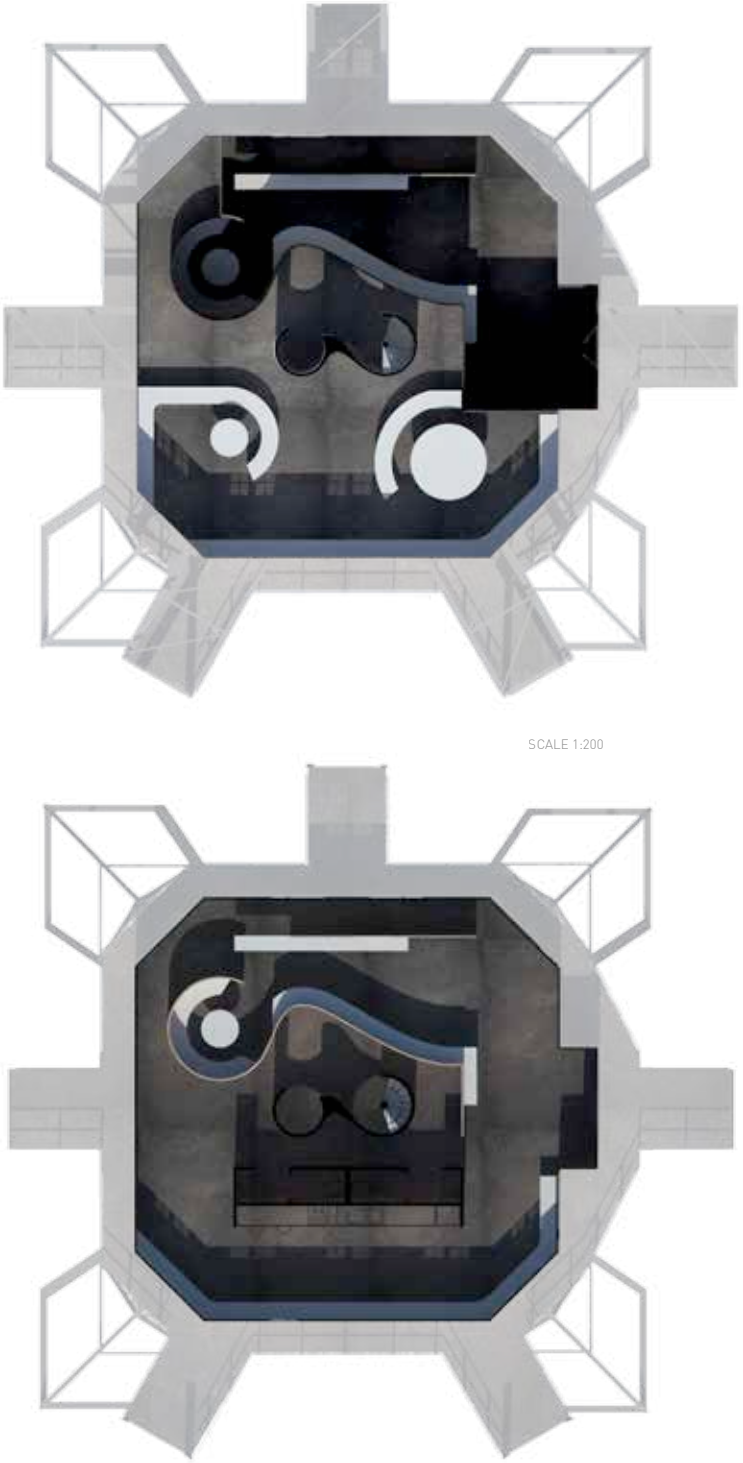
IL. 35 expanded view of the 2-story interior

AGORA

Agora is a Greek origin word used to describe a central spot in a city-like system. It is normally the market, the gathering place.

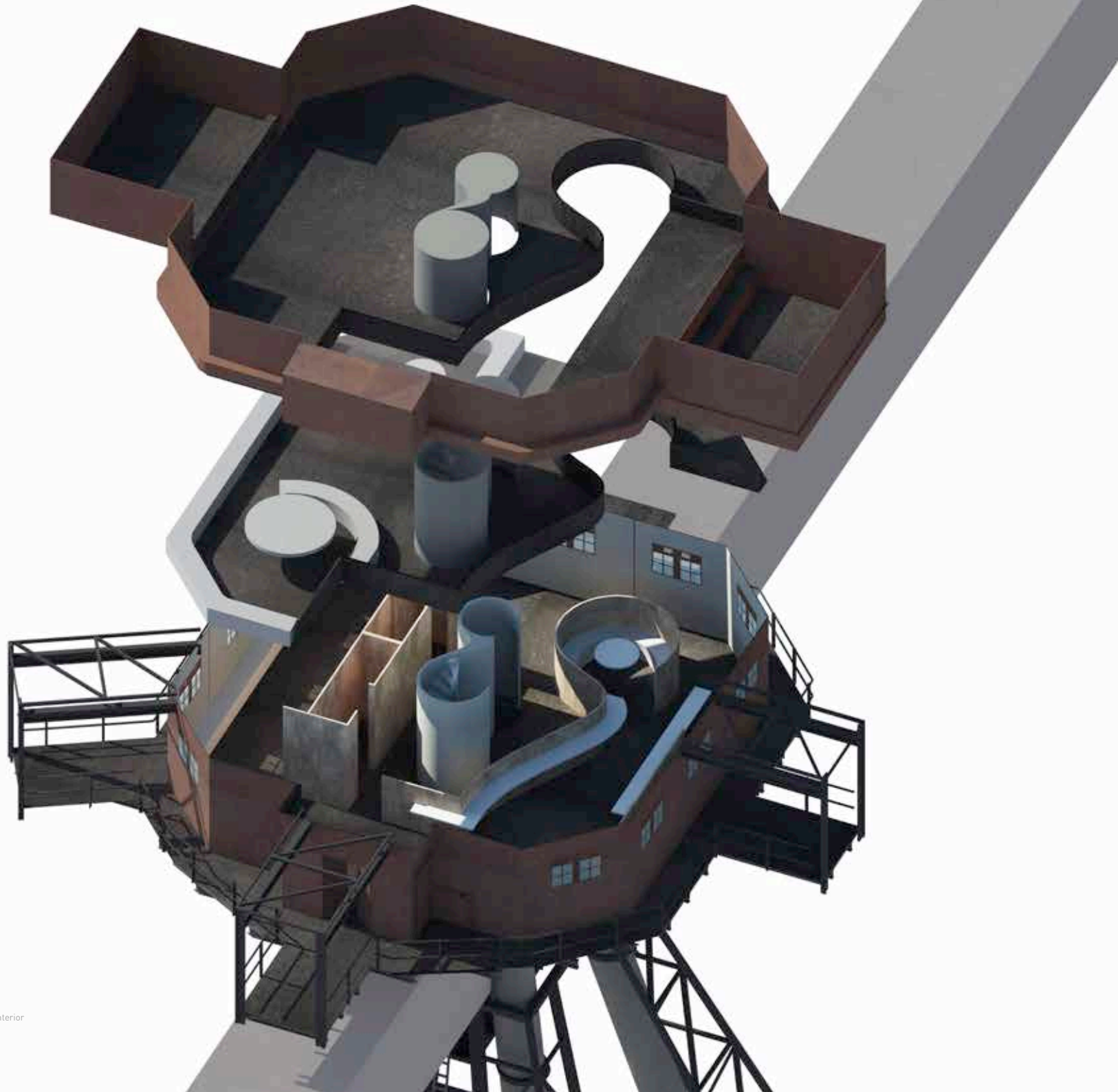
Being a competition parameter, an agora is introduced in the Astronomy complex as the central tower that connects the primary program to the supplementary one.

The Agora accommodates a two-story restaurant with an atrium and a small market to cover basic needs of those spending the night.



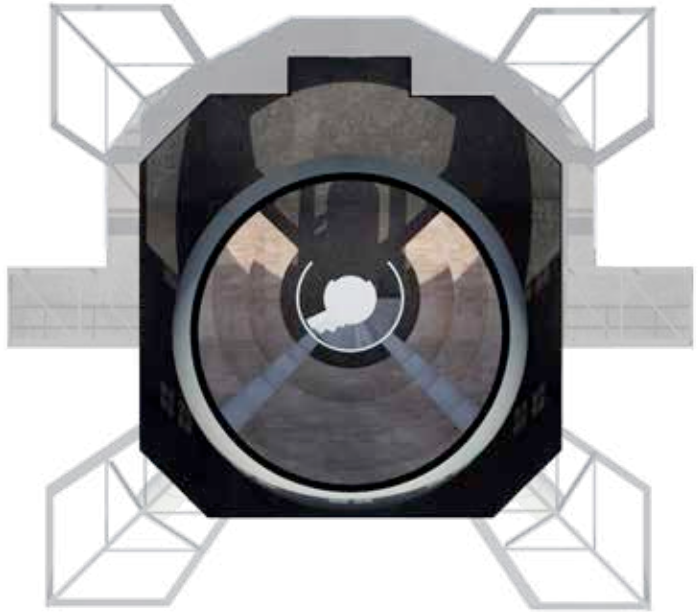
SCALE 1:200

IL. 36 agora floor and 2nd floor plan

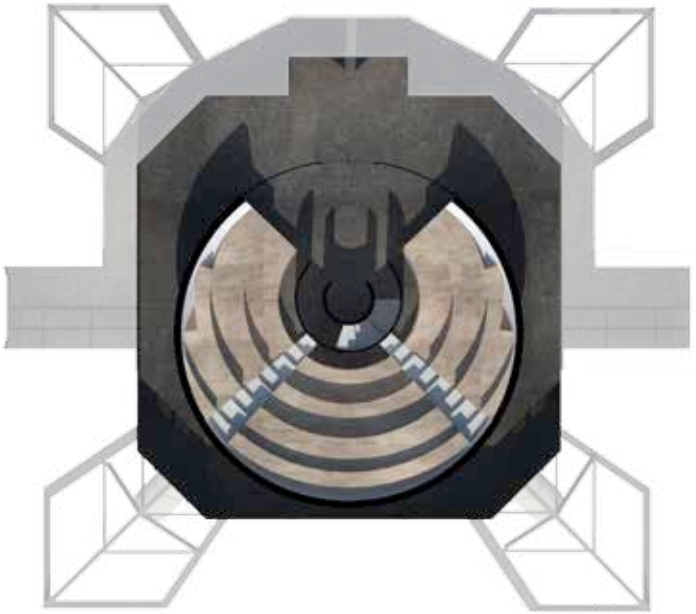


IL. 37 expanded view, detailed interior

PLANETARIUM



SCALE 1:200



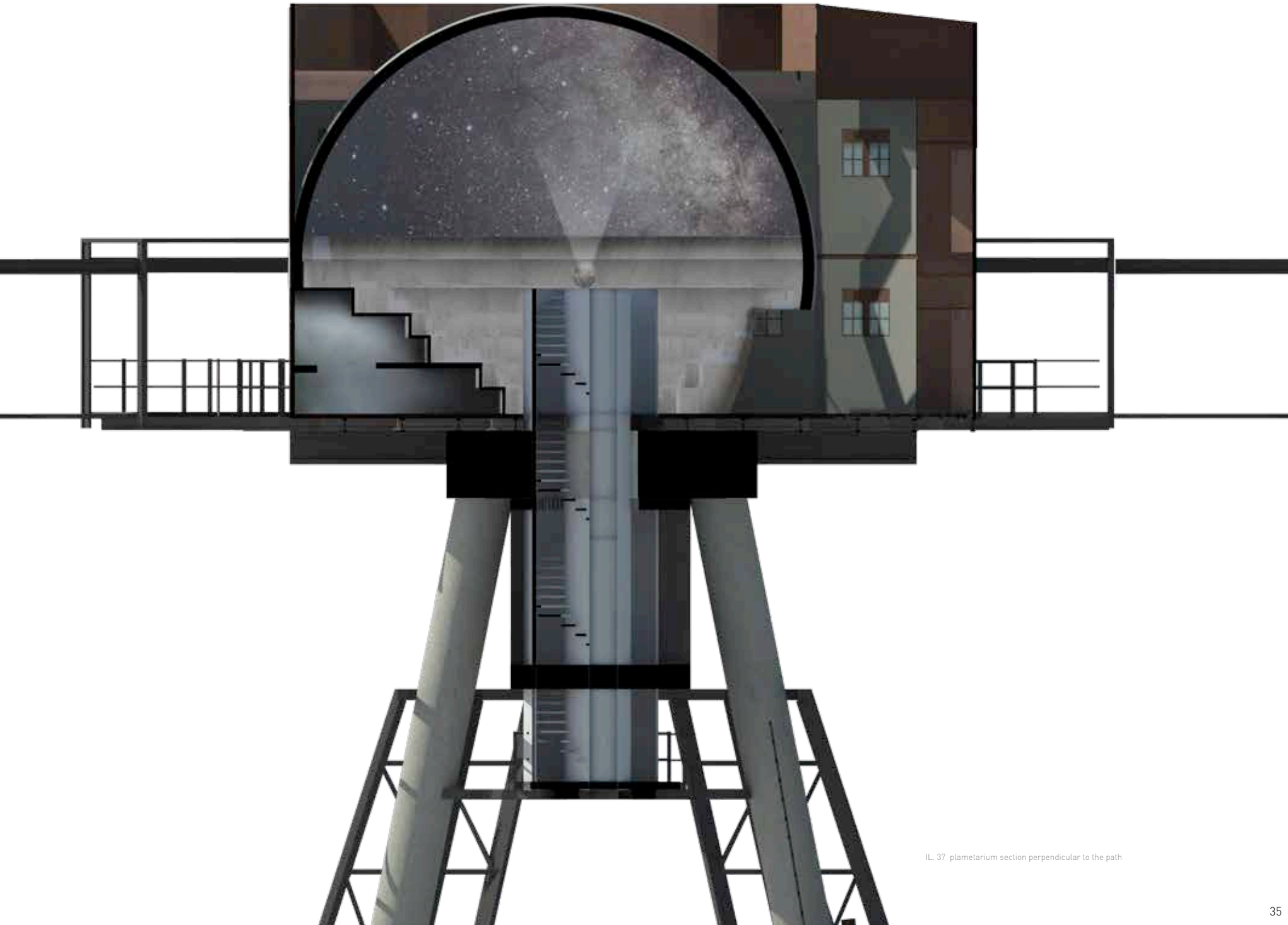
The most important feature of the planetarium is the hemispherical dome, which serves as a projection screen, while the heart of it is the star projector placed on top of the elevator.

The elevator and staircase bring the user up to an outlet space that reveals the amphitheatric auditorium.

Apart from the obvious movies concerning stars and celestial entities, this hall is used for lectures and public presentations with seating capacity of 90 people.

Underneath the auditorium, there is space for workshops with desks and seating that receive light from the openings of the roof circling the planetarium dome and the windows.

IL. 36 plametarium floor and 2nd floor plan



IL. 37 plametarium section perpendicular to the path

OBSERVATORY

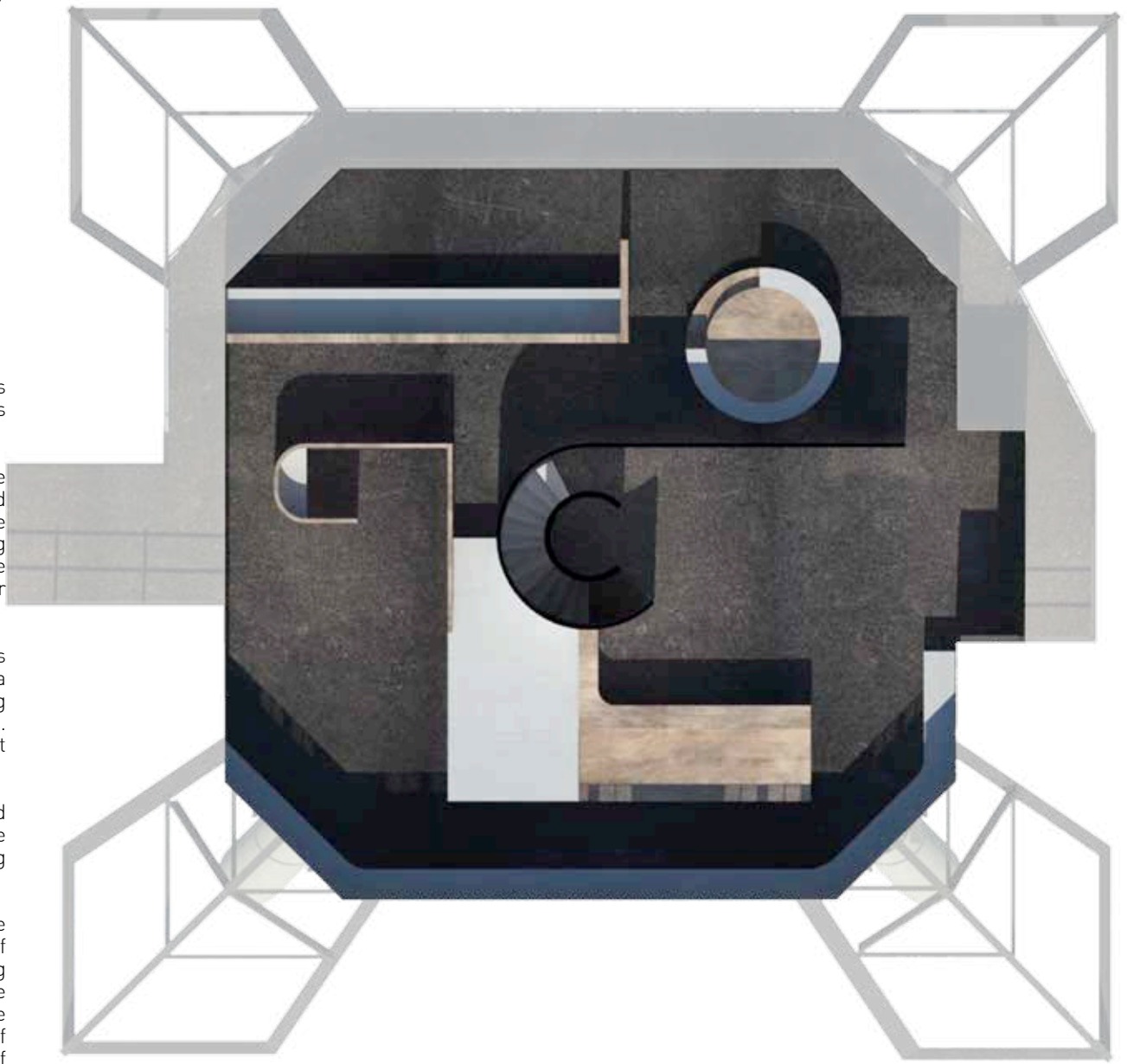
My personal interpretation of an observatory is more of an open shelter that accommodates versatility and fulfills different moods.

Handling the comfort concept as a tool to shape tectonic practices, different levels are introduced as part of the furnishing gestures. Thinking of the best stargazing experience, geometries taking into consideration an anthropometric scale modulor generate different spatial qualities (for lying down, sitting, bending).

These levels are as well reestablishing the user's visual contact with the sky, as each position is a distinctive frame of the view, with the big opening on the roof being the ultimate skyward frame. During daytime, the roof provides sufficient daylight and can be closed when in need.

To this context, the geometries are designed to enable public interaction but also provide "corners" of isolation and contemplation, along with the view of the stars.

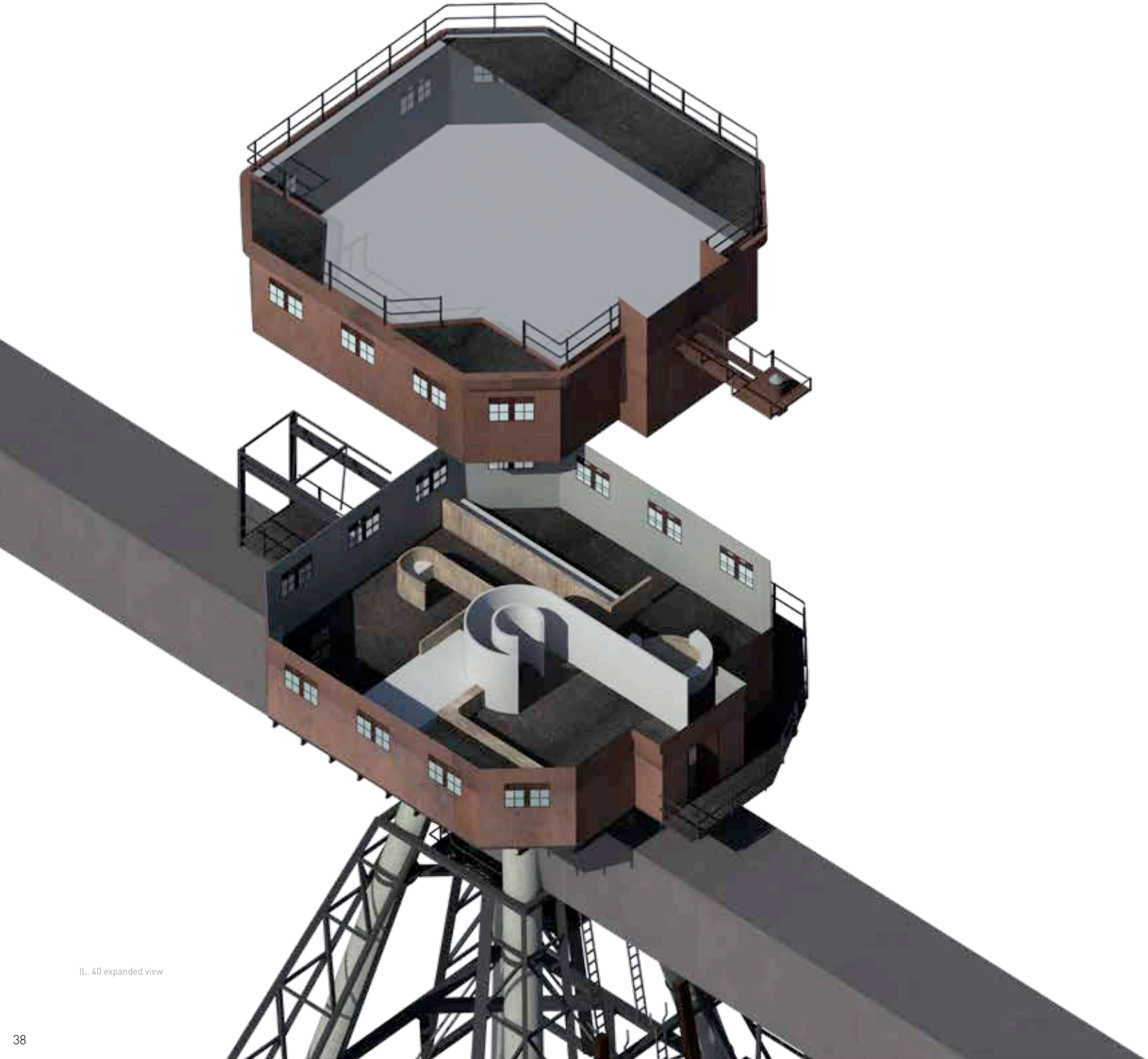
The curved elements and metal walls are eliminating distractions, in favor of a pure view of the cosmos. They exclude then enclose, allowing people to experience the richness of the space within the geometry, admitting light, wind, and the passing visitor, who leaves behind the disorder of everyday existence to be sheltered in a realm of stillness.



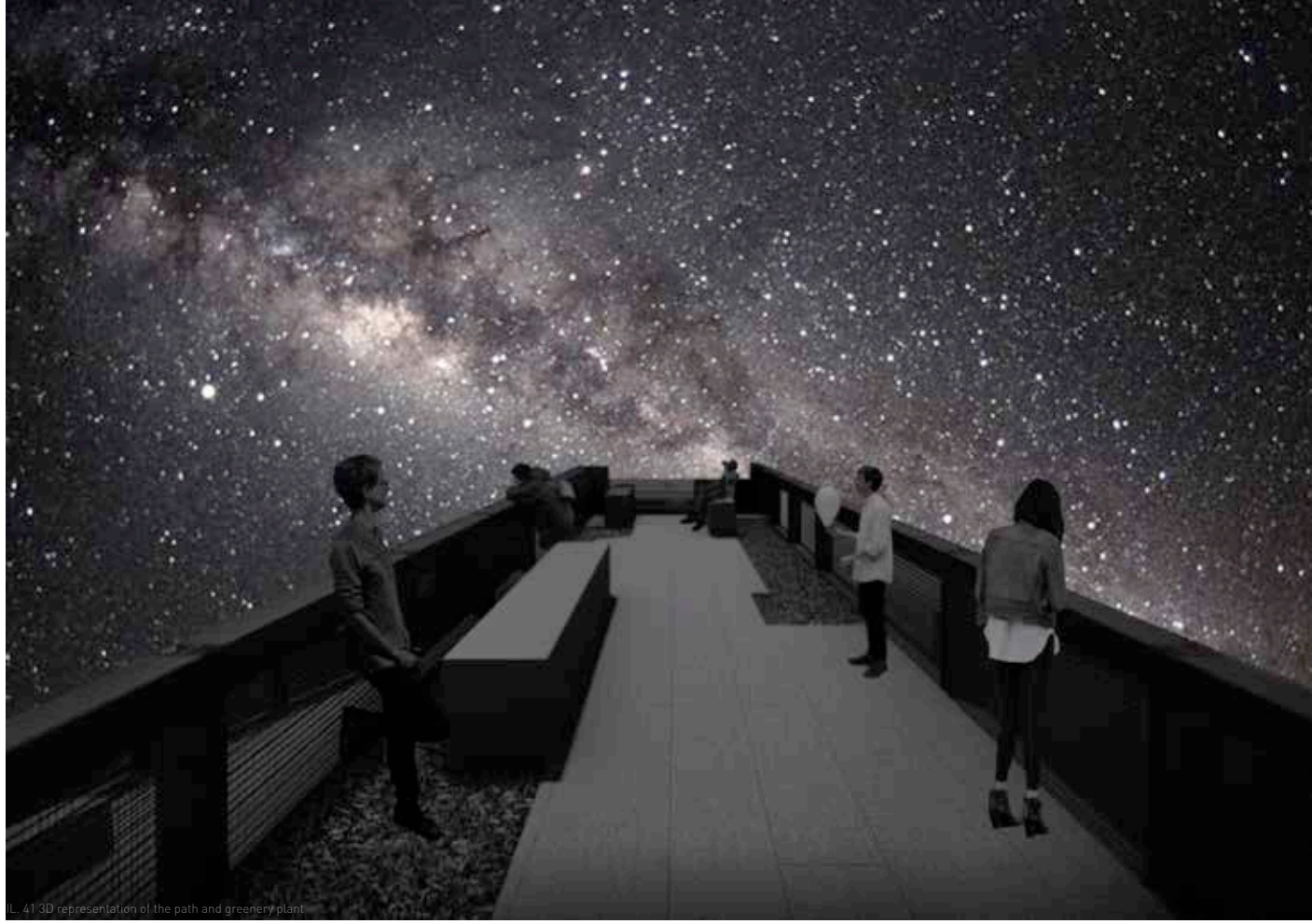
SCALE 1:100

IL. 38 observatory floor plan

IL. 39 cetral framed view of the sky



IL. 40 expanded view



IL. 41 3D representation of the path and greenery plant

ABSOLUTE EXPOSURE

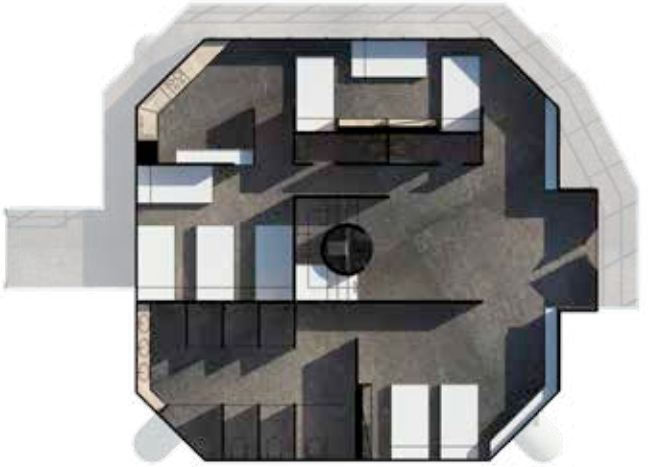
The path is reaching a dramatic end. It is a manifestation of the ultimate stargazing experience.

An area totally exposed in the night air and the natural darkness forces the user to endure nature's occasional hardships. The body is now exposed to the temperature of the night, the gentle touch of a wind breeze and the moisture of the waves, the smell of seawater, the darkness and lights of the starry sky and the roughness of the bare concrete under it.

The visitor finally experiences all notions that transcend the usual limits of architecture by focusing on visual and tactile sensations.

From a phenomenological perspective, a return to the body and its sensorial attributes makes us aware of our own presence. In that sense, the path and the "absolute exposure point " are spatial practices where not only passages occur but also pausing of movement in order to experience, observe, reflect.

ACCOMMODATION



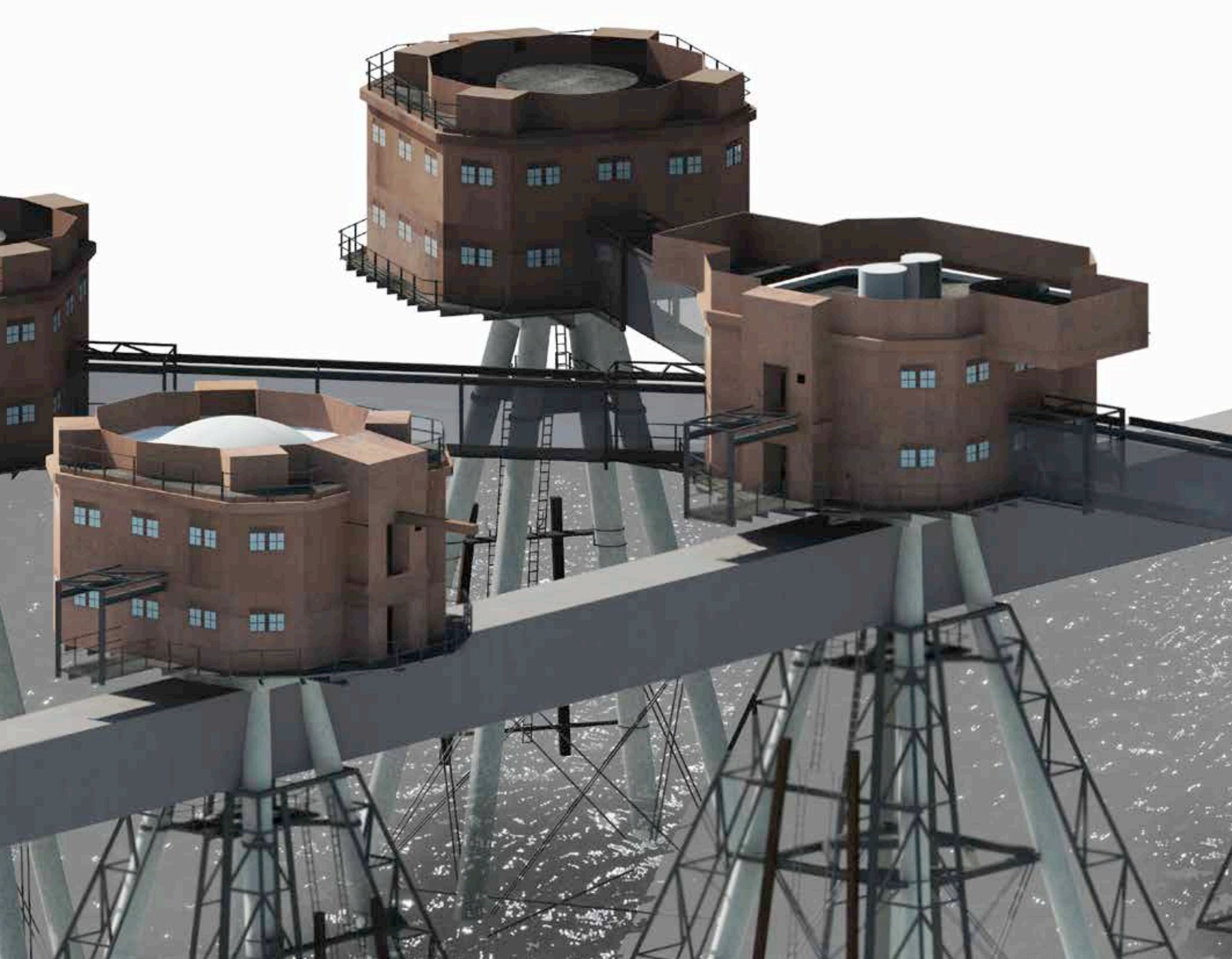
SCALE 1:200

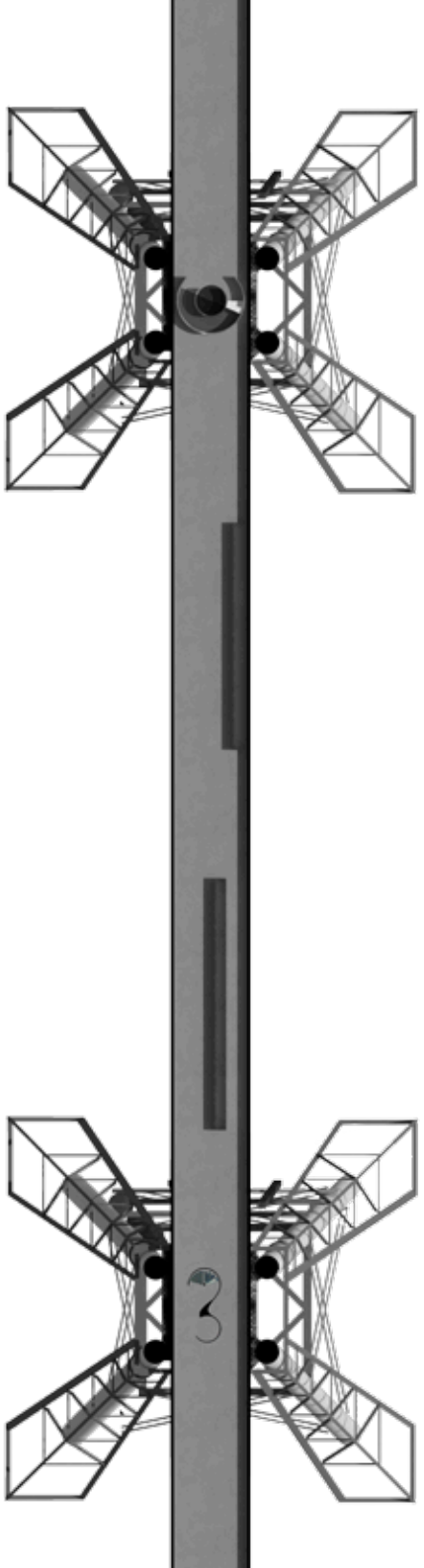
The accommodation towers are part of the supplementary program and communicate with the rest of the complex only by tubular bridges reminiscent of the past catwalks.

These two towers offer accommodation to 50 people.
There is provision for two and three bedroom rooms and larger dormitories, common areas and shared kitchen and dining room, collective bathrooms and individual toilets and storage units.

IL. 42-43 accommodation units floor and 2nd floor plan

IL. 44 expanded view





THE PATH

The path is independent, not only structurally but also emotionally. It is an autonomous entity of initiation into the science of stars, but it also provides access to the relevant services in the towers.

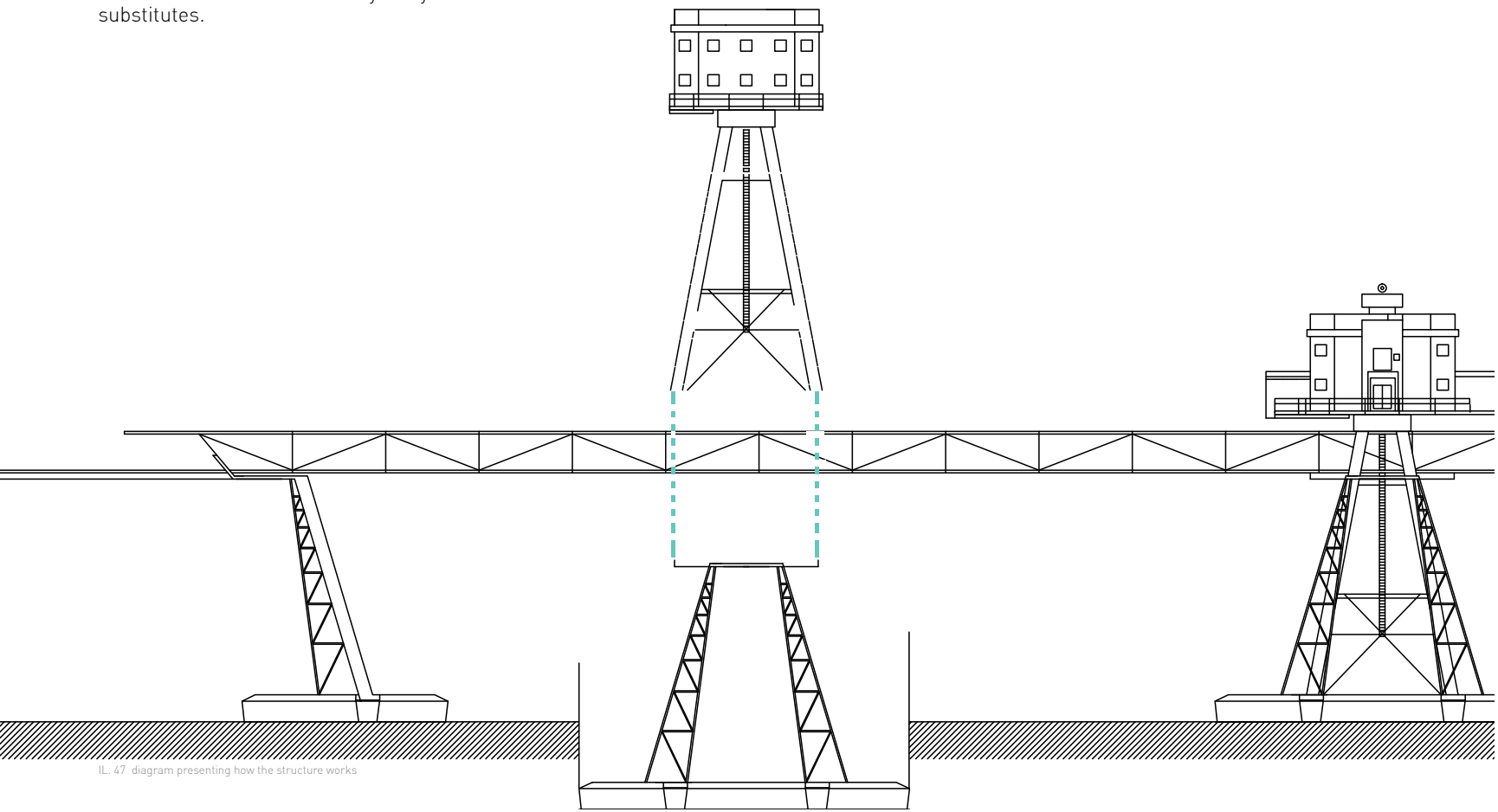
The alternation between solid volumes and a narrow sensation set the emotion of both experiences on a greater level. This way, a spatiality is achieved that stimulates the human spirit and awakens the sensitivity.

IL. 45 the new catwalks connecting the supplementary program to the main Tower, Agora

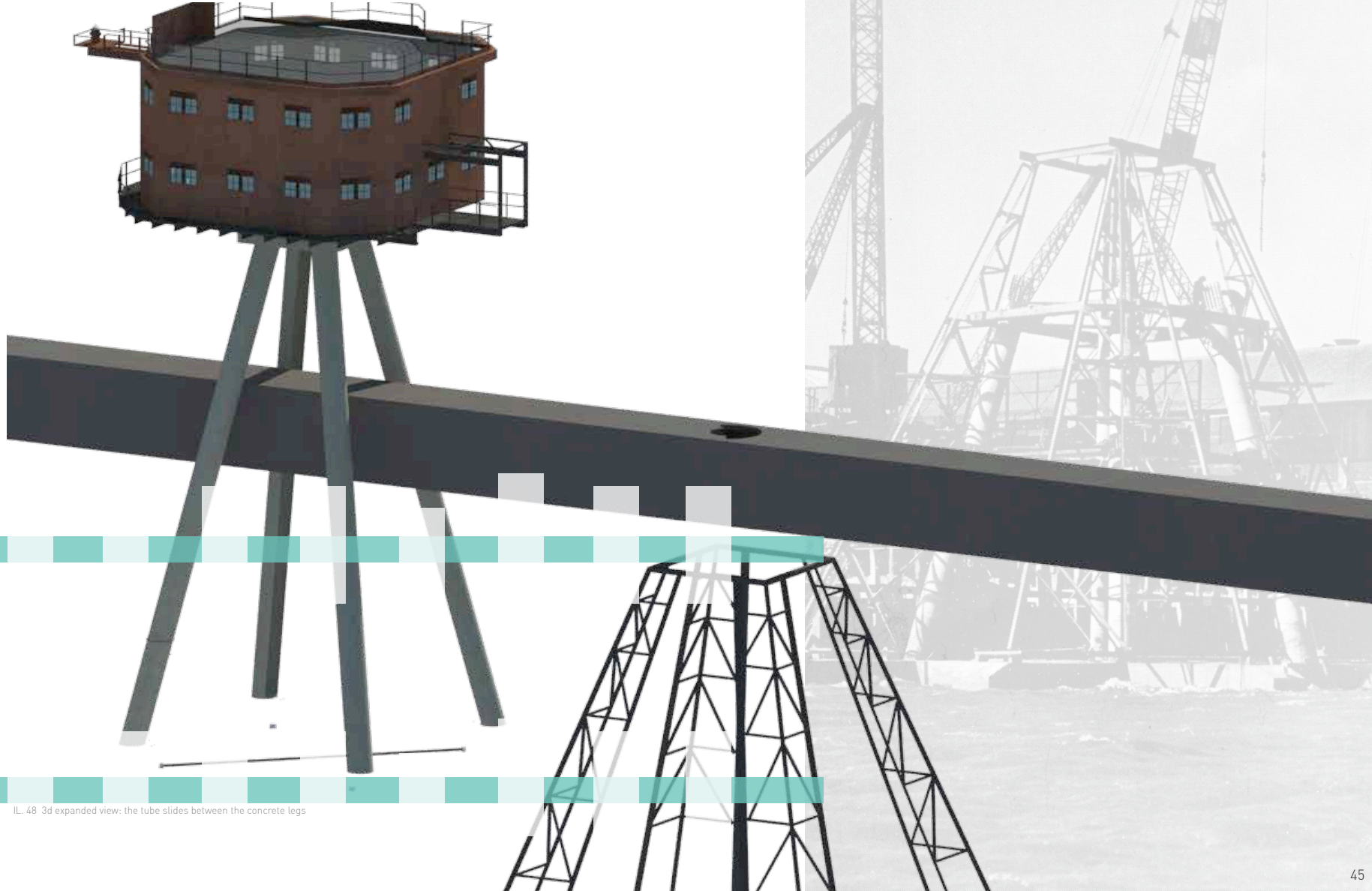
IL. 46 part of the tube in section 1:500

INDEPENDENT STRUCTURE

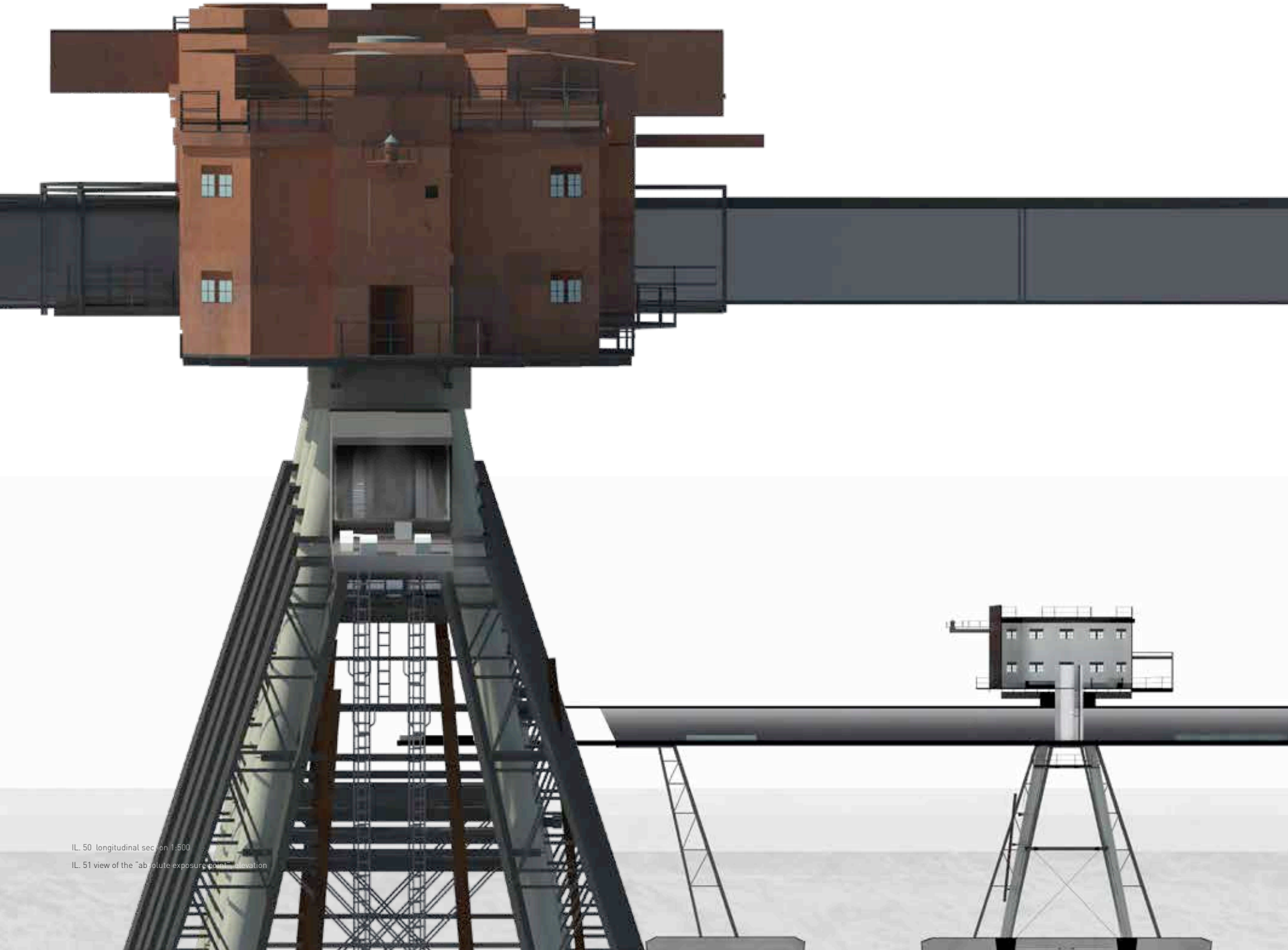
The path is 100% self-supported. The idea lies on the thought that the original forts are structures to be preserved and it would not be smart to add extra load on them.
Thus, the path is a metal truss and is supported by an adittional metal diagonal truss, referencing the structure used to build the forts, which also reinforces the existing stuctrure.
The tube practically passes in between the concrete "legs" of each fort and it is only connected with the latter by the vertical lifts and staircases.
The concrete planks that work as flooring inside the tube are prefabricated and extremely lighter as made out of eco-friendly recycled cement substitutes.



IL. 47 diagram presenting how the structure works



IL. 48 3d expanded view: the tube slides between the concrete legs



IL. 50 longitudinal section 1:500

IL. 51 view of the "absolute exposure point" elevation

05 DETAILING

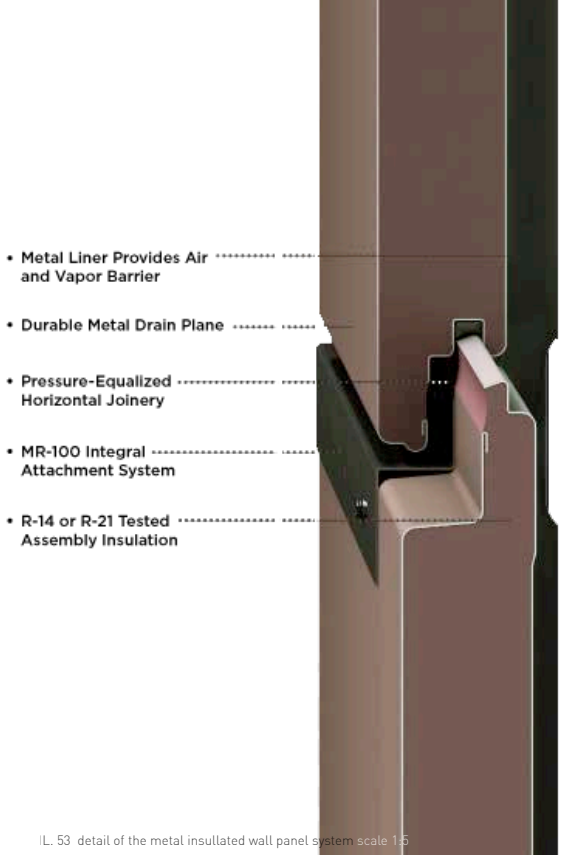
MATERIALITY

A restoration process requires a thorough observation and research on the existing materials. There is always a reason why they have been chosen to compliment the original structure, even if it is a mistaken one.

When it comes to the Red Sands towers the choice of materials is due to the maritime conditions that significantly affect the structures.

Concrete and metal are materials of high resistance against water and phenomena of corrosion that come along, which makes the choice quite successful.

IL. 52 material map, materials used in



IL. 53 detail of the metal insullated wall panel system scale 1:5

To this extend, in combination with my personal interest in preserving the structures with respect to their past glory, metal remains the basic reconstruction material for the fortresses.

An architectural metal insulated wall panel system, providing thermal efficiency and moisture control (supplementary to the material's natural properties), will be used for the "cabins".

While such a material would reinforce the turrets exposed to seawater and seal the interior as a habitable environment, the tactile and visual experience for the user will be quite different to the existing one. The sense of old and abandoned somehow raised the seductiveness of the place as well as the referential attribute to its historical importance.
Thus, there is an extra technique of copper veneering on the metal sheet applied, that forms a rough finishing without affecting the quality of the material. In this way, the oxidized like metal has stronger references to its original state and complement the industrial uncanny feeling of the distant silhouettes, while retrieving the unsafe feeling of a corroded structure.

A congruent texture of rugged and rustic is again a choice when it comes to interiority.

Wood and concrete are selected to accompany metal -now used as flooring- and a roughcast of lighter colour as finishing on the walls when relevant.
Using contrast materials like soft wood and bare concrete for the refurbishment underlines the roughness but habitability of the interior, but also adds on the tactility.

The path is a metal truss, where galvanized perforated metal panels are supported.
The façade is a reference to a celestial image. The almost random openings on the texture are simulating a starry sky, gradually fading into darkness (openings become less and less and the metal is now solid).

Perforation is elaborated to strengthen the concept of discovering the absolute darkness through light (the openings become less and smaller while moving towards the dark spaces).

During daytime, the path becomes an interesting walkaway. The light that runs through the small and bigger openings introduces an exploration of materiality. During nightime, interior lighting is lessened as the user approaches the exposure point in the natural dark nightlight. The metal panels that gradually lose all their openings form an isolated from any light source tube that prepares the human eye for what is to follow. Either hours, the path invites visitors to an experience of senses.

The combination of different textures of steel introduces the element of surprise in the complex, giving justice to the vision of a strong architectural composition that is fresh enough but integrated into the rusty hulking towers.

SUSTAINABILITY

The competition introduced ecology as part of the concepts to be addressed. Ecology is being respectful towards the environment and comprehend the results of maltreating the life surrounding. To this extend, a sustainable thinking is embraced throughout the whole project, recognized in actions of large and detailed scale.

The clearest evidence has been the choice to preserve the Bofors Tower as "power production plant", in order for the whole complex to meet the energy demands and balance out the amount consumed daily and yearly.

The structures being offshore, in a distance from the coast that is quite uncomfortable for cable power transfer, require other ways to provide electricity for a livable environment. As opposed to the unsustainable solution of just placing generators inside the towers, it is a choice to use some only as a backup plan and balance the requirements by through wind and tidal energy.

A wind turbines farm located close to the site is an excellent energy production source to take advantage of, considering the windy conditions presented. By installing converters of wind energy into power inside the tower, the purpose is served.

At the same time, the weather conditions being severe for quite some time during the year produce waves that can be exploited for energy reasons. Thus, propellers are installed in the supporting concrete structure of each tower that save tidal energy and after converting it, they feed it into the rest of the power grid.

Any excess electricity produced is saved in storage panels to be used when the conditions do not allow energy production, along with the generators.

IL. 54 wind farm in the Maunsell sea

WATER AND WASTE MANAGEMENT

Such a complex now requires fresh water and waste management actions to assure a habitable environment for the visitors.

In the sustainable context, rainwater recovery systems are integrated into the design that channel savings in biological filters, ensuring the water is ready for hygiene use and consumption.

An aerobic processing system that manages decomposition of human excreta is installed (composting toilets), while storage units are used to collect the compost product, ultimately delivered to special management units onshore.
This system, used in conjunction with an on-site greywater treatment system, can reduce the environmental footprint. They require little to no water and their product can also be reused for horticultural or agricultural soil enrichment if the local regulations allow this, adding to the sustainable cycle.

GENERALLY

Finally, in an attempt to promote financial sustainability, some of the materials chosen for the rehabilitation of the existing structure and the construction of the new one are locally sourced and often prefabricated.

At the same time, the techniques apllied on the metal sheets can reuse the old rusty materials that are no longer convinient in their original form.

Inspired by the artists quote concerning the plants growing on top of the fortresses, the idea of preserving space for greenery and mini agriculture is introduced. Hoping that some products could be grown on-site and consumed by the users, enabling an ongoing cycle of ecological treatment, is a positive thought on small scale sustainable actions.
The astronomy center is self-sufficient and eco-friendly

STRUCTURE

The Integrated Design Process, the basic methodology followed in this project, suggests a multidisciplinary approach to enable an understanding between form exploration and structural performance evaluation. It is crucial to investigate the way the additional to the existing towers design works, as its technical demands will influence the architectural aesthetics and vice versa.

For this reason, Grasshopper plug-in is used to parametrically build the overall structure and Karamba to specify the dimensions, materials, loads and supports and speculate how the structure reacts over an assigned preliminary load when changing parameters.
The final inquiry is achieved in Robot software where load cases and specified data of the structure along with the applied changes are presented. The loads applied are also calculated by hand in order to cross-examine results.

L. 55 ratio map (robot export) green indicates the beam members that perform well

ANSI/AISC 360-10 - Member Verification (SLS ; ULS) 1to25 42to49

Results | Messages

Member	Section	Material	Lay	Laz	Ratio	Case
1	OK HEA 160	S 235	79.92	131.76	0.54	4 COMB1
2	OK HEA 160	S 235	79.92	131.76	0.33	4 COMB1
3	OK HEA 160	S 235	79.92	131.76	0.41	4 COMB1
4	OK HEA 160	S 235	79.92	131.76	0.43	4 COMB1
5	OK HEA 160	S 235	79.92	131.76	0.46	4 COMB1
6	OK HEA 160	S 235	79.92	131.76	0.45	4 COMB1
7	OK HEA 160	S 235	79.92	131.76	0.36	4 COMB1
8	OK HEA 160	S 235	79.92	131.76	0.51	4 COMB1
9	OK HEA 200	S 235	63.39	105.40	0.77	4 COMB1
10	OK HEA 200	S 235	63.39	105.40	0.61	4 COMB1
11	OK HEA 200	S 235	63.39	105.40	0.50	4 COMB1
12	OK HEA 200	S 235	63.39	105.40	0.54	4 COMB1
13	OK HEA 200	S 235	63.39	105.40	0.54	4 COMB1
14	OK HEA 200	S 235	63.39	105.40	0.50	4 COMB1
15	OK HEA 200	S 235	63.39	105.40	0.61	4 COMB1
16	OK HEA 200	S 235	63.39	105.40	0.77	4 COMB1
17	OK HEA 160	S 235	53.28	87.84	0.54	4 COMB1
18	OK HEA 120	S 235	71.56	115.94	0.62	4 COMB1
19	OK HEA 120	S 235	71.56	115.94	0.61	4 COMB1
20	OK HEA 120	S 235	71.56	115.94	0.50	4 COMB1
21	OK HEA 120	S 235	71.56	115.94	0.54	4 COMB1
22	OK HEA 120	S 235	71.56	115.94	0.77	4 COMB1
23	OK HEA 120	S 235	71.56	115.94	0.62	4 COMB1
24	OK HEA 120	S 235	71.56	115.94	0.78	4 COMB1
25	OK HEA 160	S 235	53.28	87.84	0.54	4 COMB1
42	OK HEA 120	S 235	129.00	209.01	0.62	4 COMB1
43	OK HEA 120	S 235	129.00	209.01	0.62	4 COMB1
44	OK HEA 120	S 235	129.00	209.01	0.50	4 COMB1
45	OK HEA 120	S 235	129.00	209.01	0.50	4 COMB1
46	OK HEA 120	S 235	129.00	209.01	0.43	4 COMB1
47	OK HEA 120	S 235	129.00	209.01	0.46	4 COMB1
48	OK HEA 120	S 235	129.00	209.01	0.45	4 COMB1
49	OK HEA 120	S 235	129.00	209.01	0.36	4 COMB1

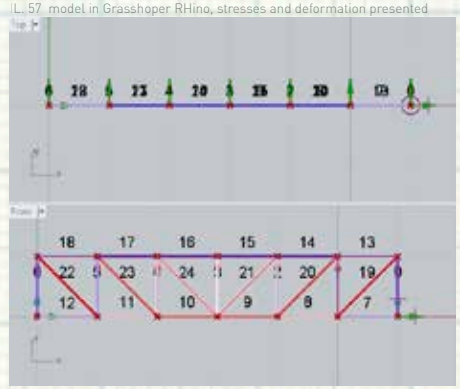
Calc. Note | Close | Help

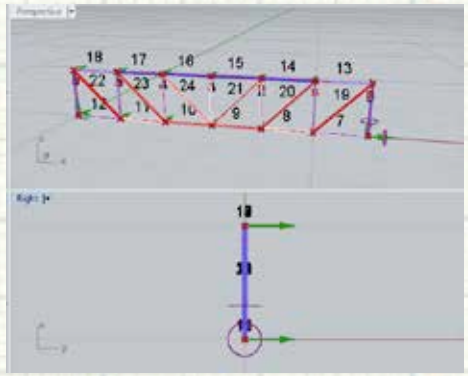
Ratio: Analysis | Map

Calculation points
Division: n = 2
Extremes: none
Additional: none

L. 56 member verification map

L. 57 model in Grasshoper RHino, stresses and deformation presented





06 DESIGN PROCESS

In the process of designing, challenges present.

In order to reach a point where the form, the structure, functionality and the approach towards the user is satisfactory, further examination is required.

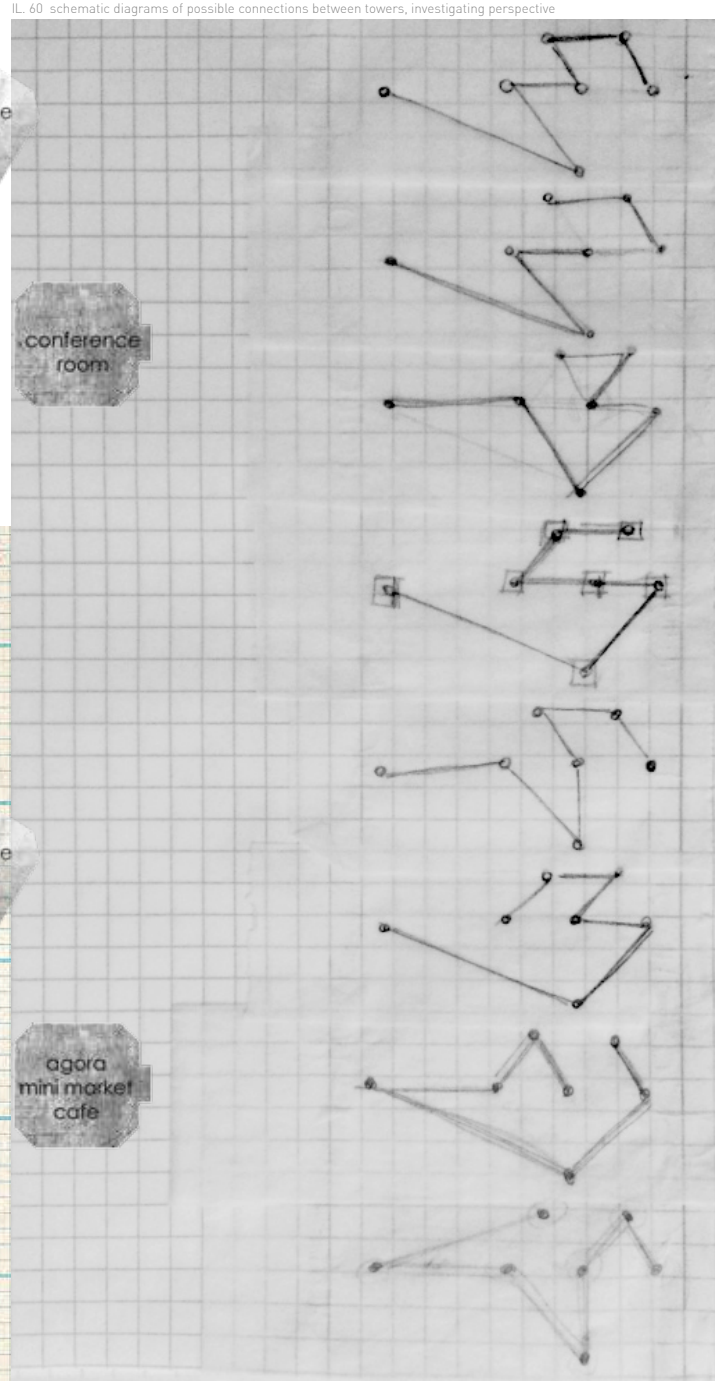
1. Function distribution
The articulation of the program is one of the most important aspects of the project, as it has to serve the concept and be functional as well.

2. In the same context, the program suggests the connections between each service and influence the circulation, access to the towers and of course their form. The illustrations present an investigation of the possible connections between the towers and experiments on their dimensions and form.

3. The path is has undergone changes on the length in an effort to achieve a dramatic appearance, while this gesture immediately affected the structure behind it and the one supporting it.

4. Finally, the human factor is under the microscope. Experimentation on the position of the body and the view-angles each position generates in combination with the corresponding treatment of the roof and the space is presented below. In addition, the notions of solidarity and gathering are assessed, thinking of the contemplation possibility when one observes stars in a public space.

IL. 60 schematic diagrams of possible connections between towers, investigating perspective



planetarium

welcome center

observatory

workshop space

agora mini market cafe

conference room

IL. 58-59 diagrams of function distribution

FUNCTION DISTRIBUTION

accommodation units

CONNECTION ARTICULATION INVESTIGATION

conference room

welcome center

observatory

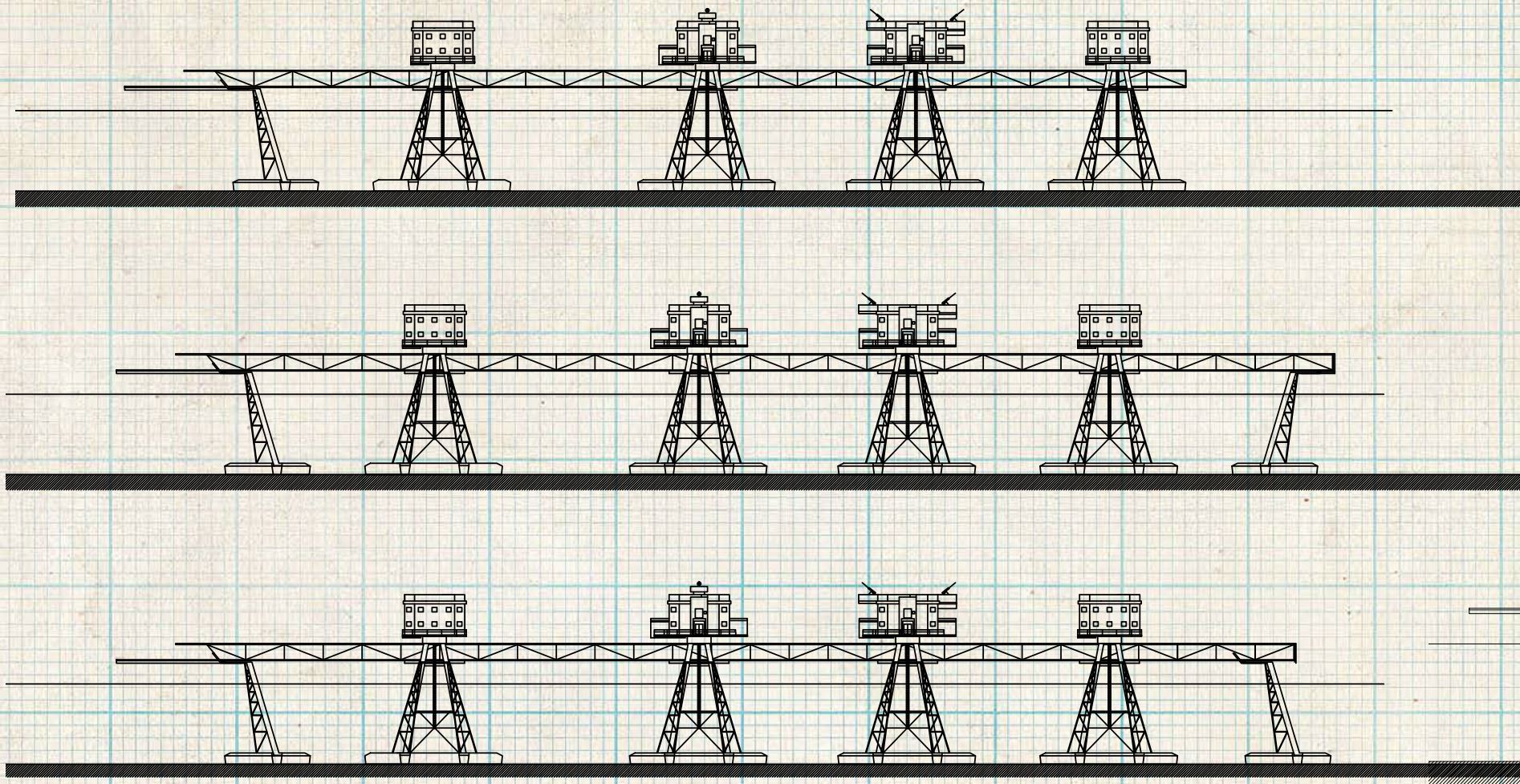
planetarium

workshop space

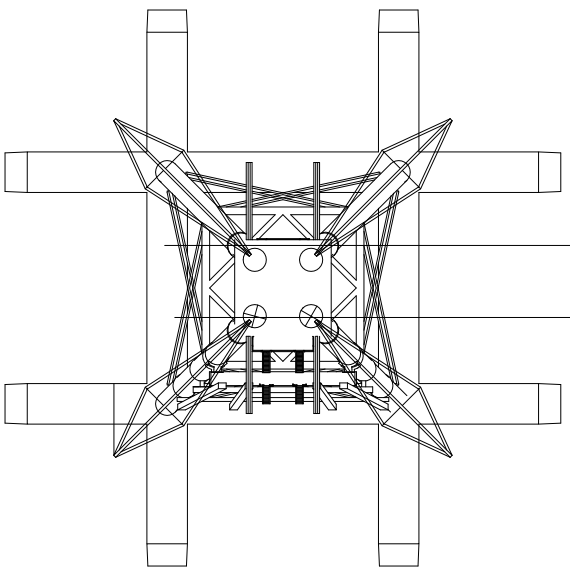
agora mini market cafe

accommodation units

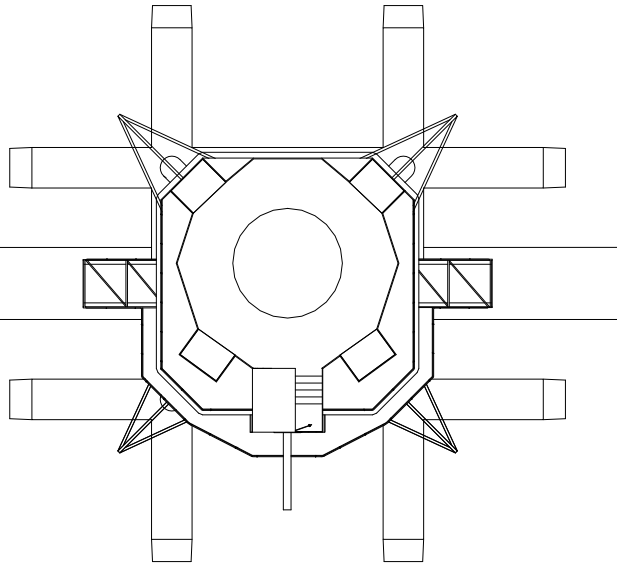
INVESTIGATION OF THE PATH



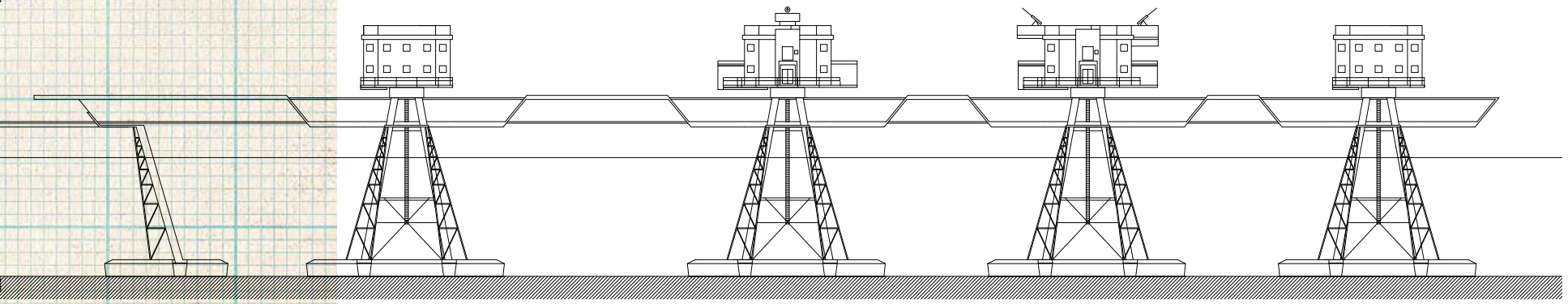
IL. 60-61 technical drawings, elevations showing experimentation on the size of the path and the structure supporting it

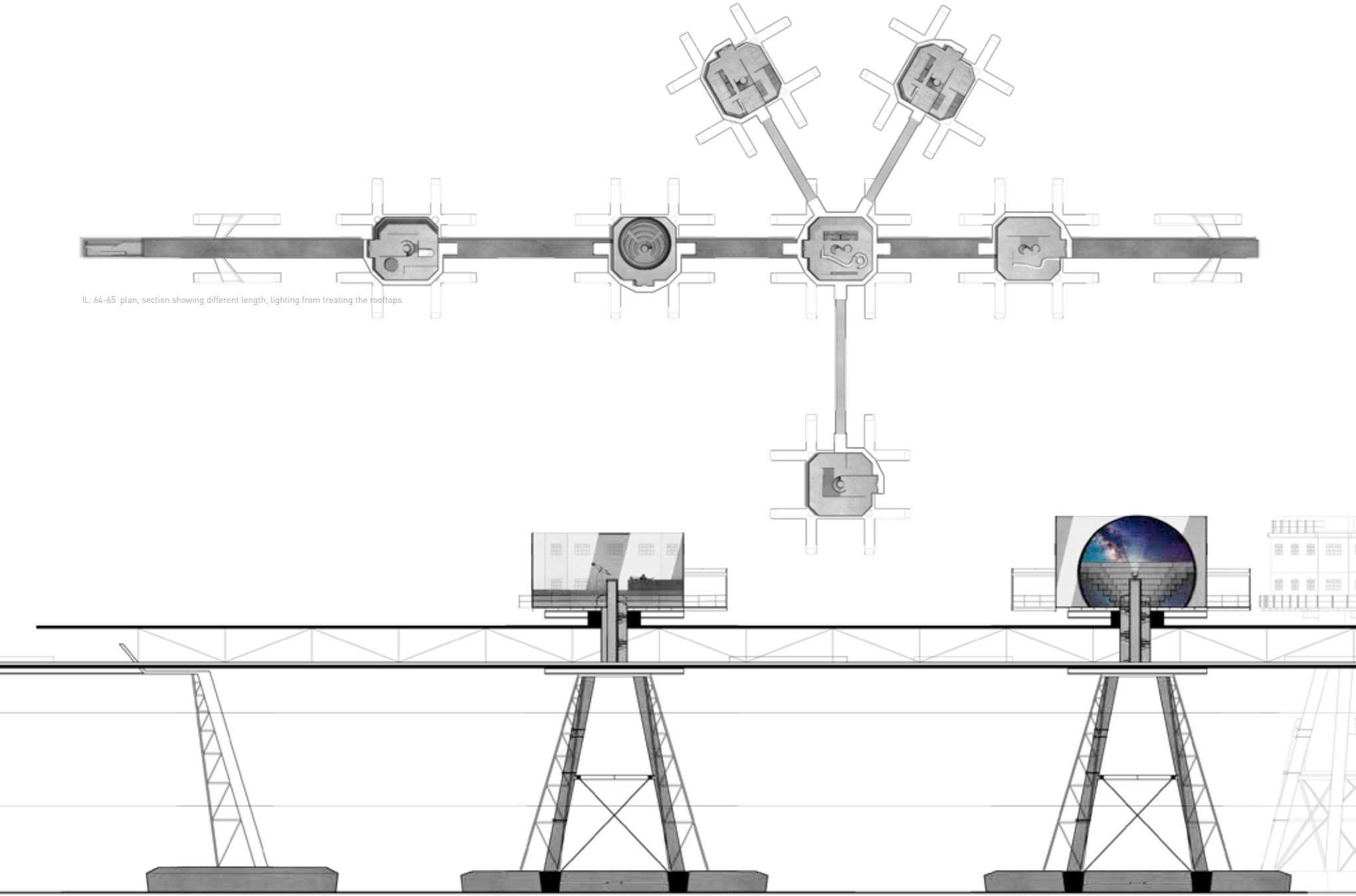


IL. 62 technical drawings, variation of the structural angles of support

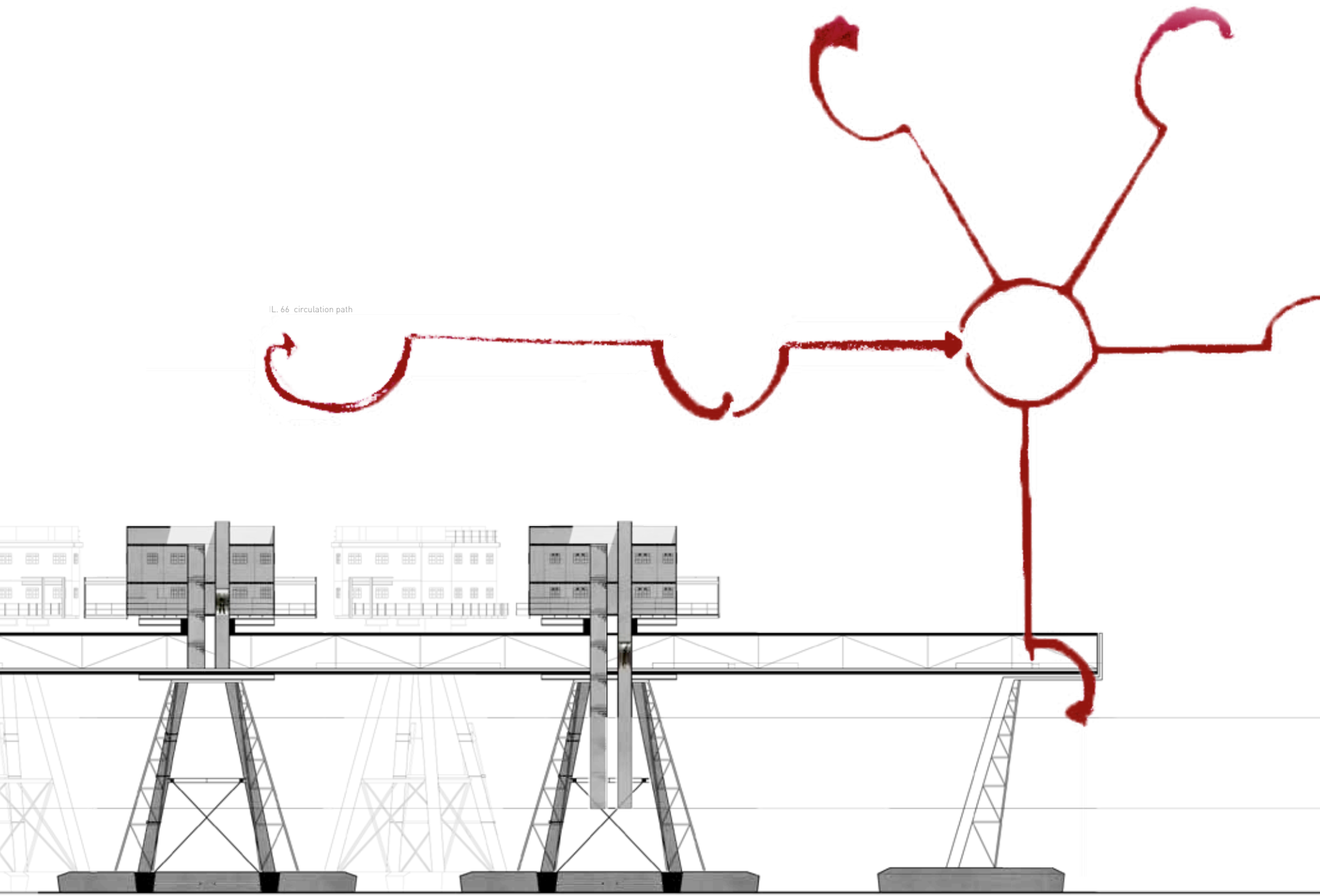


IL. 63 technical drawings, rooftop with support

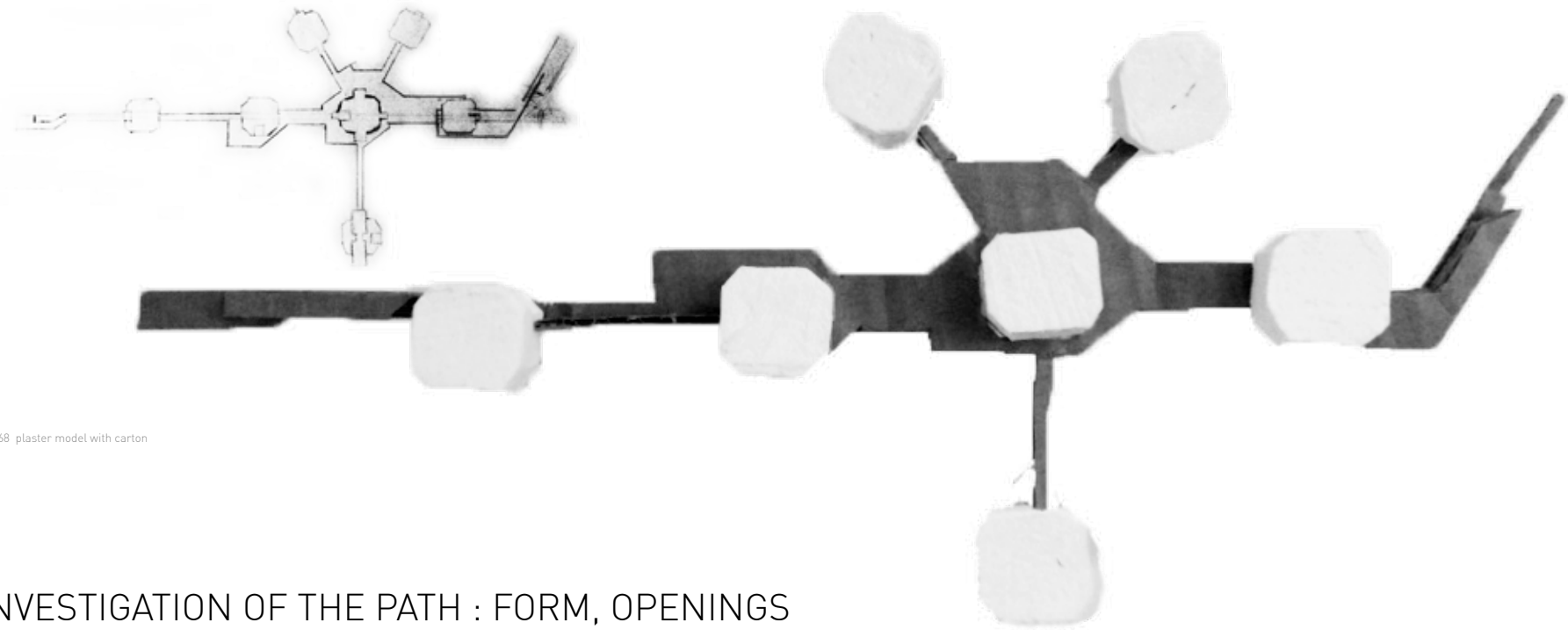




IL. 64-65 plan, section showing different length, lighting from treating the rooftops



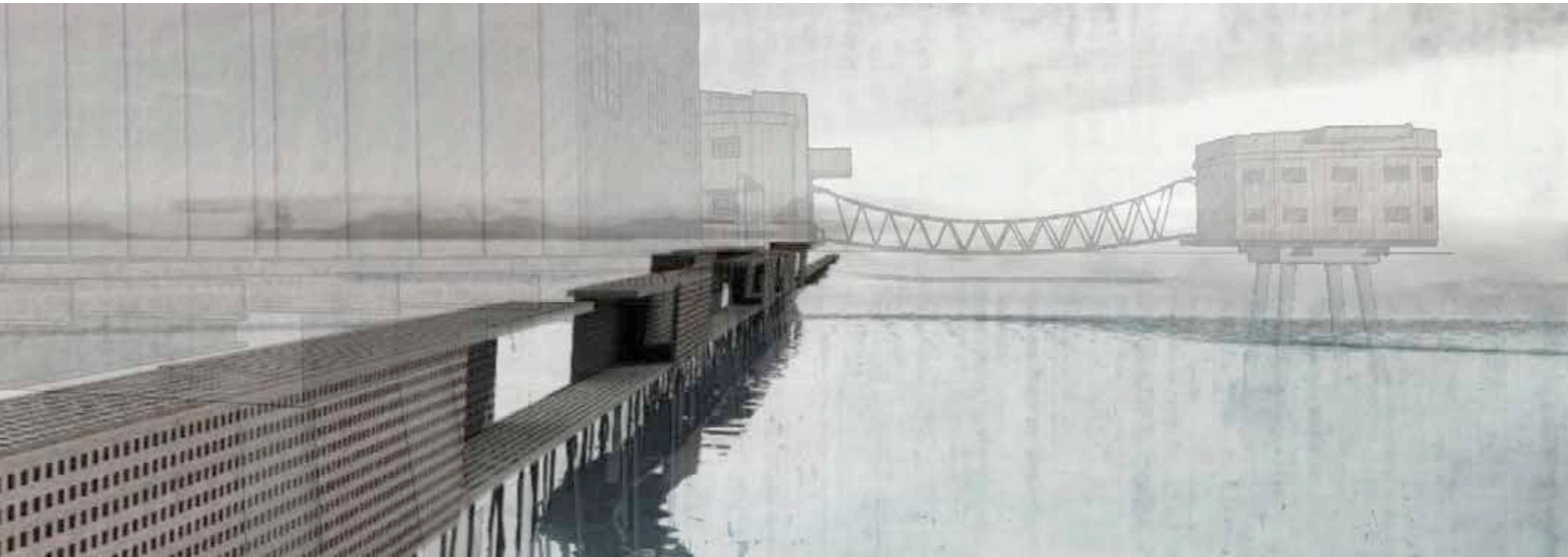
IL. 66 circulation path



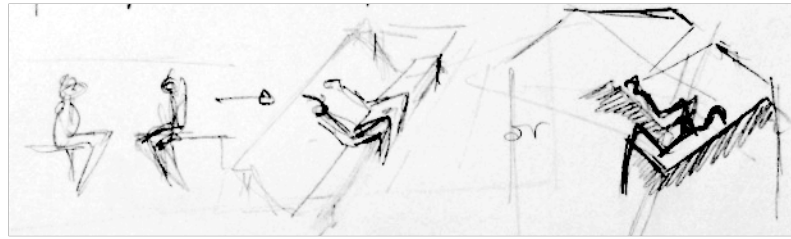
IL. 68 plaster model with carton

INVESTIGATION OF THE PATH : FORM, OPENINGS

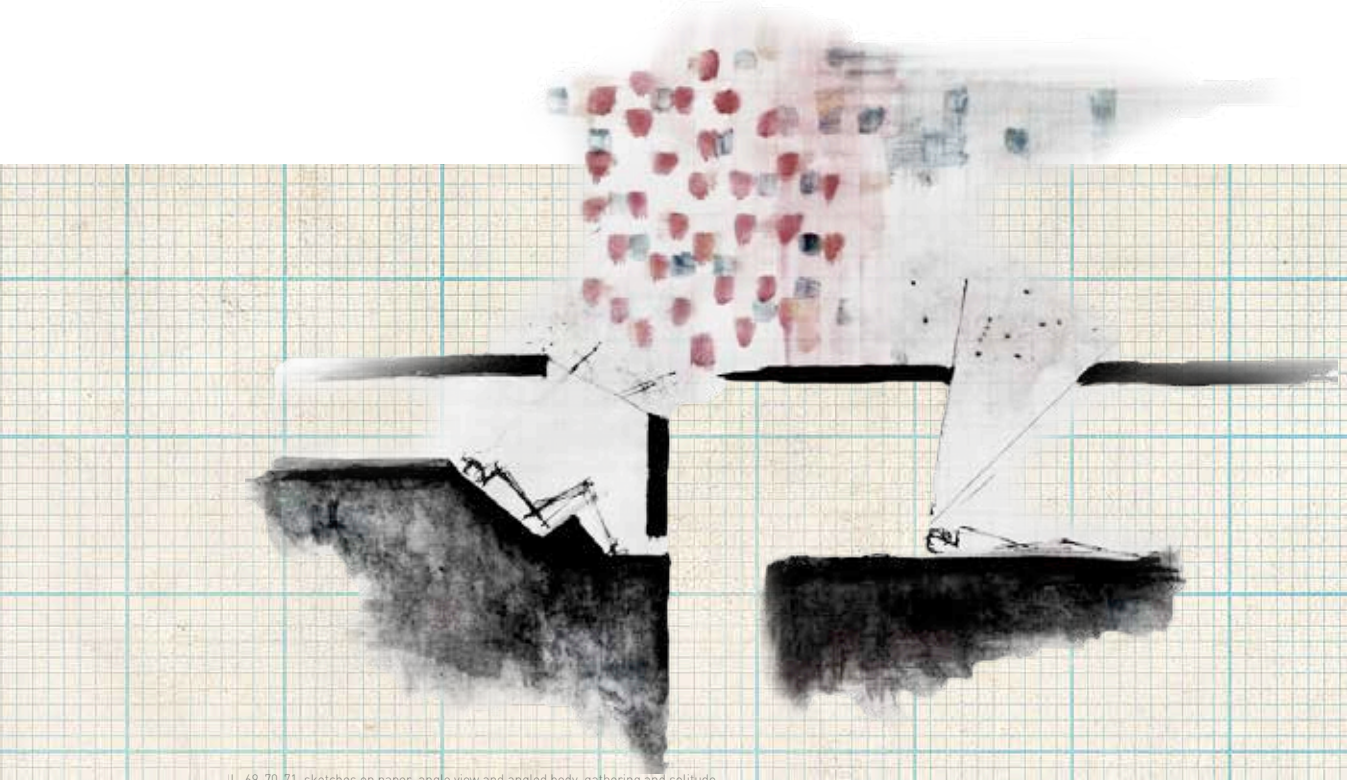
IL. 67 different materials, different openings, different form

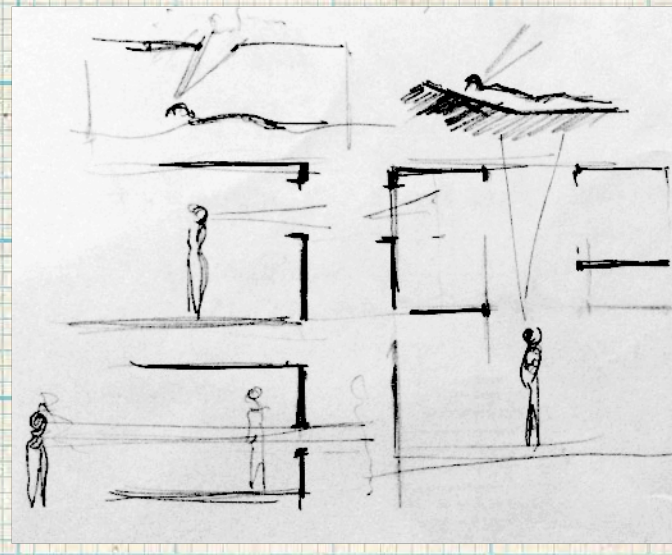


HUMAN BODY AND COMFORT
HUMAN RELATIONS



GATHERING AND SOLITUDE





IL. 69-70-71. sketches on paper, angle view and angled body, gathering and solitude

07 EPILOGUE

CONCLUSION

An Astronomy center that has claimed its presence into a site of great historical importance and seductive beauty raised one main motivational question, eventually approached through the principles of scale, ecology and mobility.

How structures that are reminiscent of a glorious past could be reformed into something that excludes the negative associations, is powerful and fresh enough to make a statement, but still respects its surrounding landscape and original beauty.

SCALE

Scale as philosophy has been present along the design process in terms of exterior development and interiority.

The intention of reconnecting the towers automatically reestablishes relations. A tower that before was standing alone, although among others, is now communicating with the rest of the complex and even becomes a central node relating uses and users.

When it comes to interior design, the spatial details proposed become more than subordinate elements. They can be regarded as the minimal units of signification in the architectural production of meanings (Frascari 1984:1). A production of space through a functional detail that is so essential to the rest of the volumes suggests another perception of the relation between details and the architectural whole. Scale is set again as tectonic evidence, where relations between volumes produce also the meanings.

ECOLOGY

Ecology extends from environmental to energy and financial sustainability. It is proposed as a way of thinking and acting in elements that matter when singular or in collective articulation, in big or detailing scale. The outcome is a self-sufficient and eco-friendly architecture that transforms volumes into soulful organisms producing and consuming.

MOBILITY

Inviting life in a context of limited approach has been challenging but far more interesting. The project proposes local boats as the means to reach the site, which somehow reestablishes our vision of the current infrastructure system. It invites users to a concept of reorganizing the ground: reference bases, independent from edification working as a base for new activities over lands, defined in section from an intricate superposition of uses.

REFERENCES

1. Jellicoe, Geoffrey, Alan.1987. The landscape of man - Shaping the environment from prehistory to the present day. Thames and Hudson. London.

2. Burke, Edmund. 2005. On the Sublime and Beautiful. Vol. XXIV, Part 2. The Harvard Classics. New York: P.F. Collier & Son, Bartleby.com, New York.

3. Knudstrup, M. 2004. Integrated design Process in Problem-Based Learning, Aalborg University. Aalborg.

4. Lawson, B. 2005. How Designers Think The Design Process Demystified. Oxford: Architectural Press. Oxford.

5. Frampton, Kenneth. 2001. Studies in Tectonic Culture – The Poetics of Construction in Nineteenth and Twentieth Century Architecture. The MIT Press. Cambridge (Massachu-setts).

6. Frascari, Marco. 1984. The tell-the-tale detail. Via. no.7, pp.22-37

8. Hvejsel, Marie Frier. 2010, Interiority - a critical theory of domestic architecture. Aalborg University. Aalborg.

9. Semper, Gottfried. 1851. The four elements of architecture – A contribution to the comparative study of architecture. Cambridge University Press. New York.

10.Peter Cook, Archigram, Princeton Architectural Press, 1999, p.44

11. wikipedia.org (Online)

TECHNICAL DEMANDS

12. British Standards Institution (BSI), 2010. BS NA EN 1991-1-4: UK National Annex to Eurocode 1. Actions on structures. General actions. Wind actions

13. England 1971–2000 averages". Met Office. Retrieved 29 March 2007 http://www.yr.no/place/United_Kingdom/England/Whitstable/statistics.html

14.http://materialicious.com/2010/05/distressed-galvanized-and-copper-technique.html (online)

ILLUSTRATIONS

IL.1.www.rethinkingcompetitions.com/photo/competitonredsands (online)
IL.3.http://www.whitstablescene.co.uk/forts.htm
IL.5.http://www.simplywhitstable.com/mforts/mforts3.htm
IL.6-23.http://en.wikipedia.org/wiki/Maunsell_Forts
IL.53.http://designobserver.com/article.php?id=38774
IL.54.http://en.wikipedia.org/wiki/Maunsell_Forts#/media/File:Redsandsforts.jpg
IL.79.http://subterrain.org.uk/maunsell/
IL.2. personal product
IL.24-53. personal product
IL.57-73 personal product

APPENDIX

HAND CALCULATIONS
WIND AND SNOW LOAD

Basic data

- Total length: $b = 42$ m
- Spacing: $s = 5$ m
- Bay width: $d = 3,2$ m
- Height (max): $h = 3,5$ m (above ground)

1 Wind loads

Basic values

Fundamental value of the basic wind velocity (UK national ANEX eurocode 1 p.11):
$v_{b,0} = 23\ m/s$ (for England, east coast, Whitstable)

Determination of basic wind velocity:
$v_b = c_{dir} \times c_{season} \times v_{b,0}$
Where:

- v_b basic wind velocity
- c_{dir} directional factor
- c_{season} seasonal factor
- $v_{b,0}$ fundamental value of the basic wind velocity

$c_{dir} = c_{season} = 1,0 \Rightarrow v_b = v_{b,0} = 23\ m/s \times C_{alt}$

$$C_{alt} = 1 + 0,001 \cdot A \cdot \left(\frac{10}{z}\right)^{0,2}$$

Where: $A = 11,85m$
A is the altitude of the site in meters above mean sea level, $z = 0,003$m (BS EN 1991-1-4:2005).

$C_{alt} = 1,06 \Rightarrow \mathrm{v}_{b,0} = 23 \times 1,06 = 24,38m/s$

Terrain category I $\Rightarrow z_0 = 0,003$ m (sea or coastal area exposed to the open sea) and $z > z_{min}$

Basic velocity pressure:

$$q_b = \frac{1}{2} \times p_{air} \times \mathrm{v}_b^2$$

where $p_{air} = 1,226\ kg/m^3$ (air density UK)
$q_b = \frac{1}{2} \times 1,226 \times 24,38^2 = 364,35N/m$

Peak pressure:

$$q_p(z) = [1 + 7l_v(z)] \times \frac{1}{2} \times p \times \mathrm{v}_m(z)^2$$

Calculation of $\mathrm{v}_m(z)$:

$\mathrm{v}_m(z)$ mean wind velocity
$\mathrm{v}_m(z) = c_r(z) \times c_o(z) \times \mathrm{v}_b$

So:

$$q_p(z) = \underbrace{[1 + \frac{7K_I}{ln(\frac{3,5}{0,003})}]}_{\text{squared gust factor}} \times \underbrace{\frac{1}{2} \times p \times \mathrm{v}_b^2}_{\text{basic pressure}} \times \underbrace{(k_T \times ln\left(\frac{z}{z_0}\right)}_{\text{wind profile}}$$

where $k_T = 0,19 \times \left(\frac{z_0}{z_{0,I}}\right)^{0,07}$

$$q_p(3,5) = [1 + \frac{7}{ln(\frac{3,5}{0,003})}] \times \frac{1}{2} \times 1,226 \times (24,38)^2 \times \left(0,19\left(\frac{0,003}{0,003}\right)^{0,07} \times ln\left(\frac{3,5}{0,003}\right)\right)^2$$

$$= \left(1 + \frac{7}{7,0619}\right) \times 364,36 \times 0,19(1)^0,07 \times (7,0619)^2 = 1,3062\ \mathrm{kN/m^2}$$

1 Snow loads

Snow loads on the roof are determined as follows:

$s = \mu_i \times c_e \times c_z \times s_k$

where $c_e \simeq 1$ and $c_z \simeq 1$

Roof shape coefficient:

The roof shape coefficient depends on the roof angle.

$0° \leq \alpha \leq 30° \Rightarrow \mu_1 = 0,8$

Snow load on the ground:

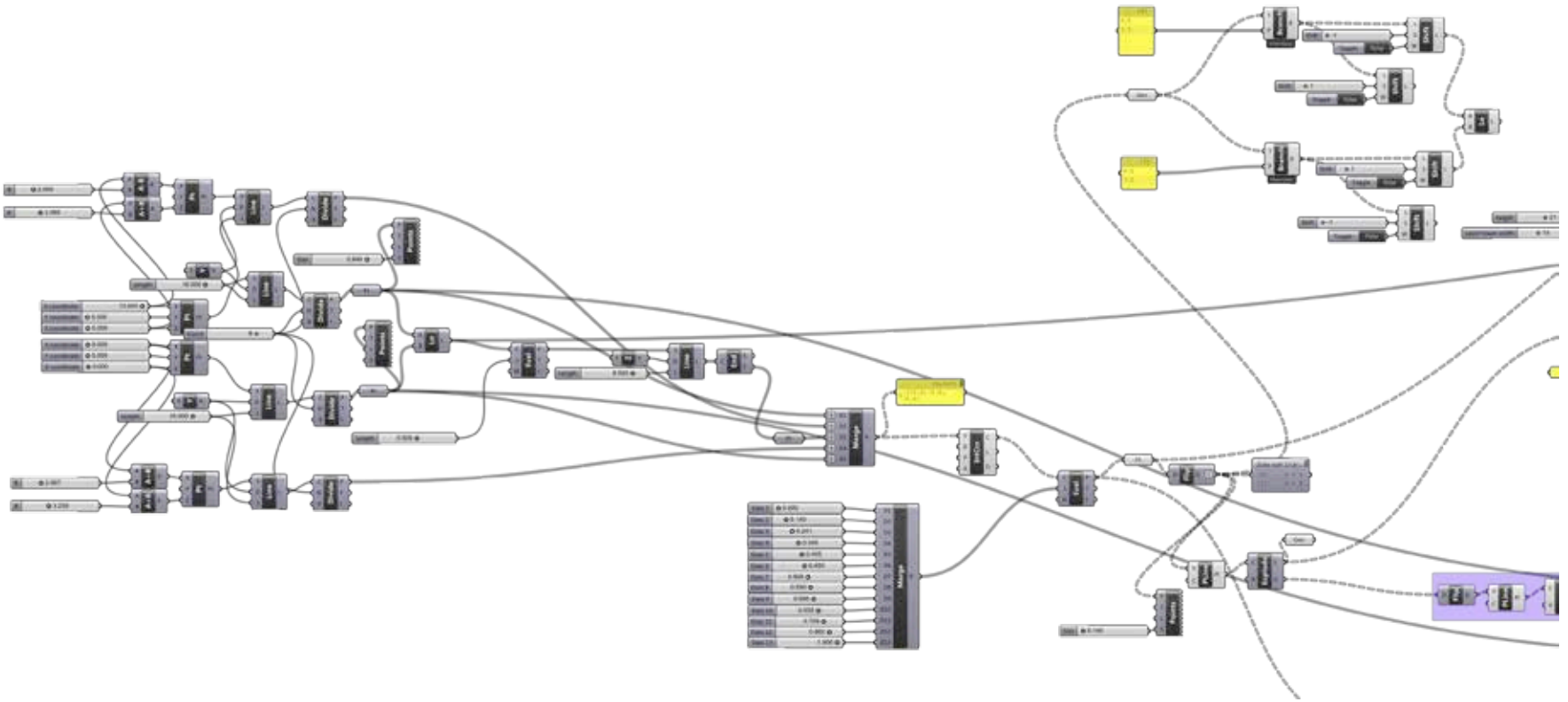
$$s_k = 0,14 \cdot z - 0,1 + \frac{A}{501}$$

where $z = 3$ (zone map ANEX C, England, Whitstable).

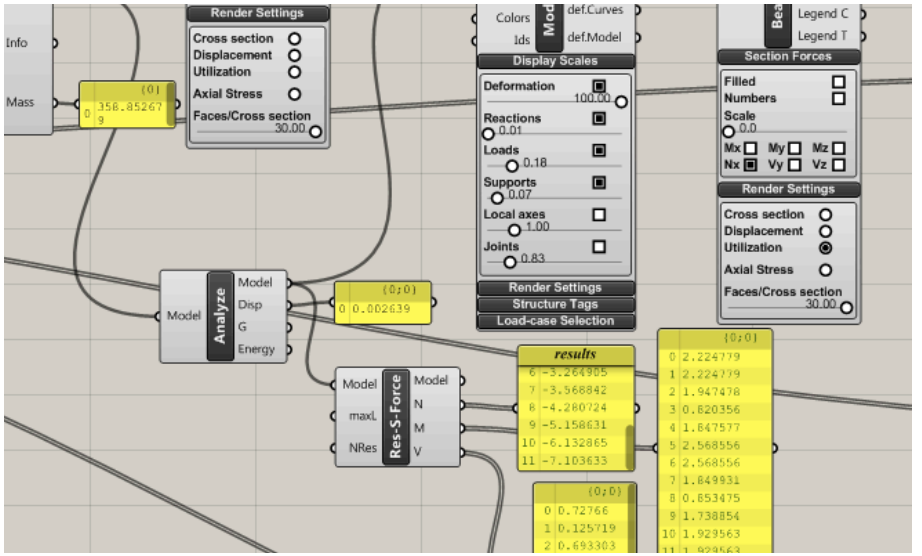
$$s_k = 0,14 \cdot 3 - 0,1 + \frac{11,85}{501} = 1,0237 \text{ kN/m}^2$$

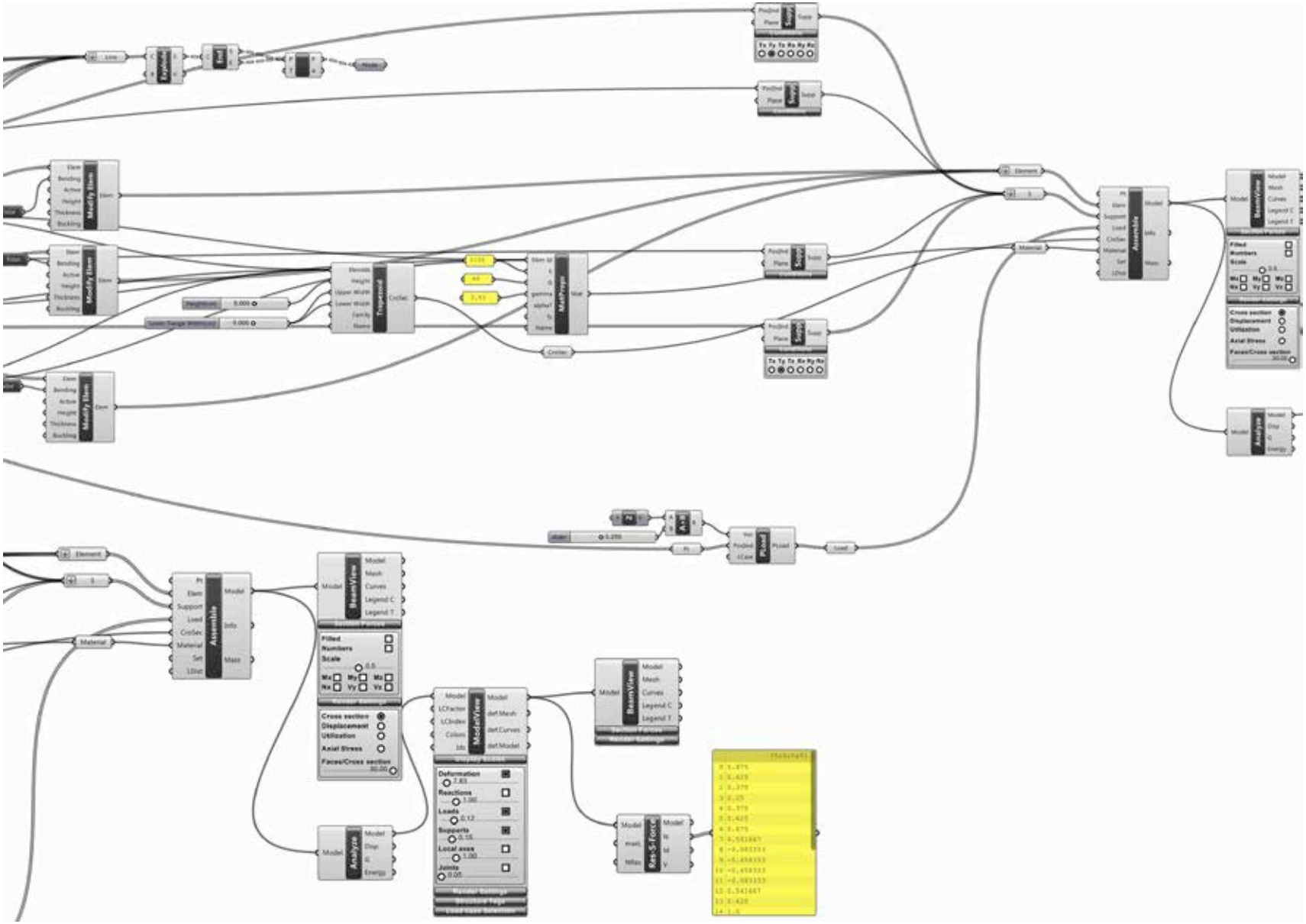
Snow load on the roof:

$s = 0,8 \times 1 \times 1 \times 1,0237 = 0,819 \text{ kN/m}^2 \Rightarrow$ for an internal frame: $s = 0,819 \times 5 = 4,095 \text{ kN/m}^2$



SCRIPTS FROM GRASSHOPER




Explode
End
Modify Elem
Modify Elem
Modify Elem
Trapezoid
CroSec
MatProps
Mat
Assemble
Model
Info
Mass
Element
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Material
Load
PLoad
BeamView
Model
Mesh
Curves
Legend C
Legend T
Filled
Numbers
Scale
Mx
My
Mz
Nx
Vy
Vz
Cross section
Displacement
Utilization
Axial Stress
Faces/Cross section
Analyze
Model
Disp
G
Energy
ModelView
Model
def Mesh
def Curves
def Model
Deformation
Reactions
Loads
Supports
Local axes
Joints
Res.S-Force
N
M
V