

A Synthesis of Geometry and Light

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Master of Architecture

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Abstract

The poetics of an architecture of a moment is explored through design of a contemplative room (wherein the geometric transformation of a cubic base to a cone) demonstrates the rhythm and proportion of the construction of the room and the relative motion of the sun in the space. The relationship of the sun rays on the walls of the room passing through a reflecting pool are shown using demonstrative and constructive means of descriptive geometry as both the design generator and poetic expression. The composition of the buildings reveals the play of light on form.

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General Audience Abstract

An exploration to understand the relationship of architecture and the material sensible world. The work seeks to reveal that through the tangible architectural strategies of form, structure, material and light, the intangible qualities of architecture are defined.

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Introduction

“The Ultimate meaning of any building is beyond architecture; it directs our consciousness back to the world and towards our own sense of self and being” Juhani Pallasama.

When I started the thesis year, I wanted to explore the relationship of architecture and the material sensible world. I explored individual senses such as sight, sound and touch. The drawings are limited in doing that. Only the presence of a building can offer this. While at the Steger Center for International Scholarship in Riva San Vitale in Switzerland for the final semester, visits to buildings like Convent Sainte-Marie de la Tourette, Notre-Dame du Haut, in western France; Church of San Giovanni Battista in Mogno Switzerland; Basilica de la Sagrada Familia and Casa Mila in Barcelona helped me realize that I have to experience it first hand.

“A great building must begin with the unmeasurable, must go through the measurable means when it is being designed and in the end must be unmeasurable.” Louis Kahn.

The work seeks to reveal that through the tangible architectural strategies of form, structure, material and light, the intangible qualities of architecture are defined.

The poetics of an architecture of a moment is explored through design of a contemplative room (wherein the geometric transformation of a cubic base to a cone) demonstrates the rhythm and proportion of the construction of the room and the relative motion of the sun in the space. The relationship of the sun rays on the walls of the room passing through a reflecting pool are shown using demonstrative and constructive means of descriptive geometry as both the design generator and poetic expression.

The composition of the buildings reveals the play of light on form. The interplay of geometry and light occurs when walking down the ramp experiencing the transparent glass container wrapping the stone conoid and when light reveals the geometric transformation of the cubic base to a truncated cone in the contemplative room. The contemplative room reveals the more universal geometry of the sun's course throughout the seasons and throughout the day.



Figure 1

In the aerial view of the site, the universal geometry of the sun in its course setting at the end of the day is captured.

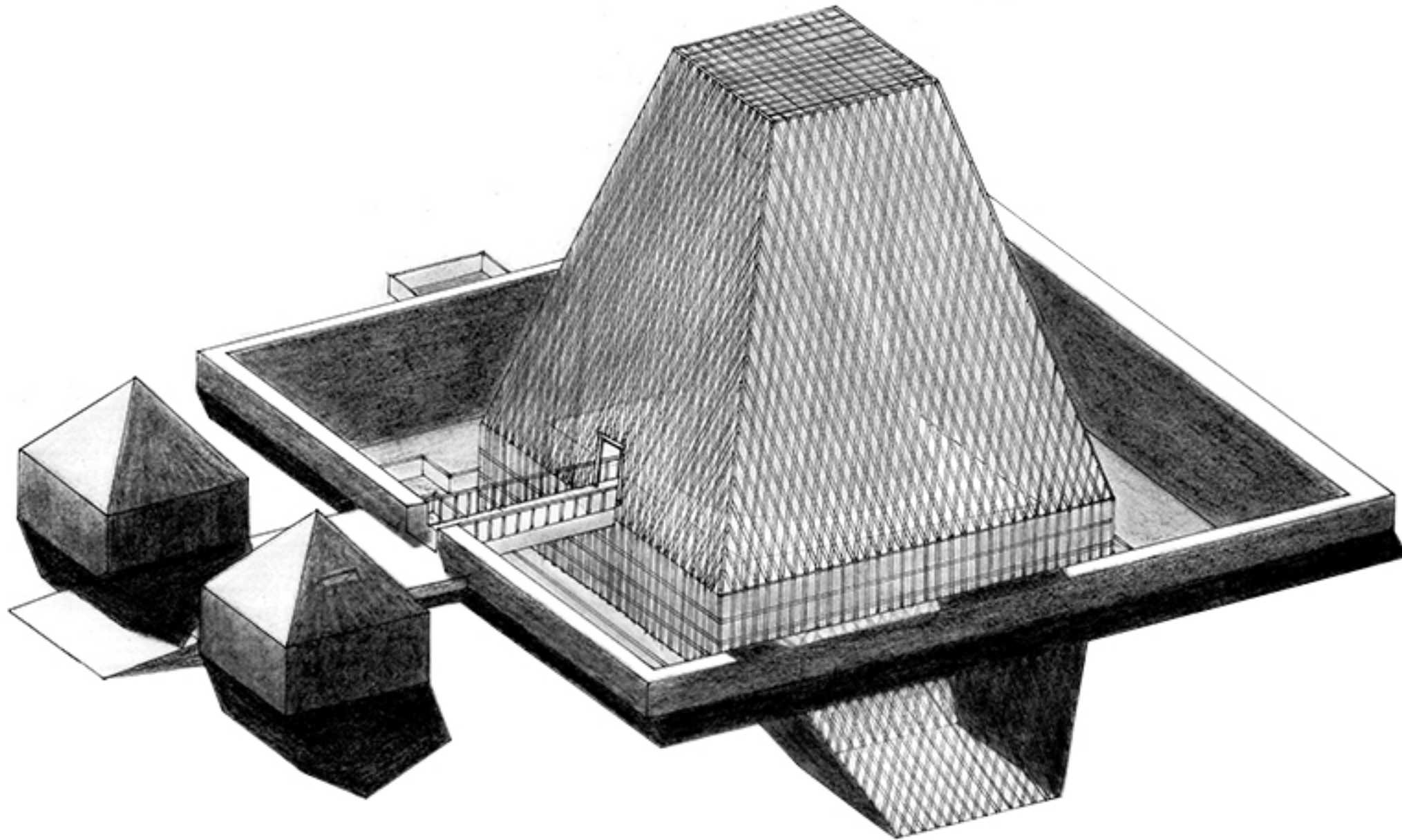


Figure 2

Architecture is the masterly, correct and magnificent play of masses brought together in light - Le Corbusier.

The architecture is perceived as a composition of geometric masses. The play of geometry as light interacts with it through light, shadow and contrast is going to reveal the geometry of the building. Descriptive geometry is instrumental to project the overall form: an earthly cubic base projects upward transforming into a conical form tending toward the spiritual realm.



Figure 3

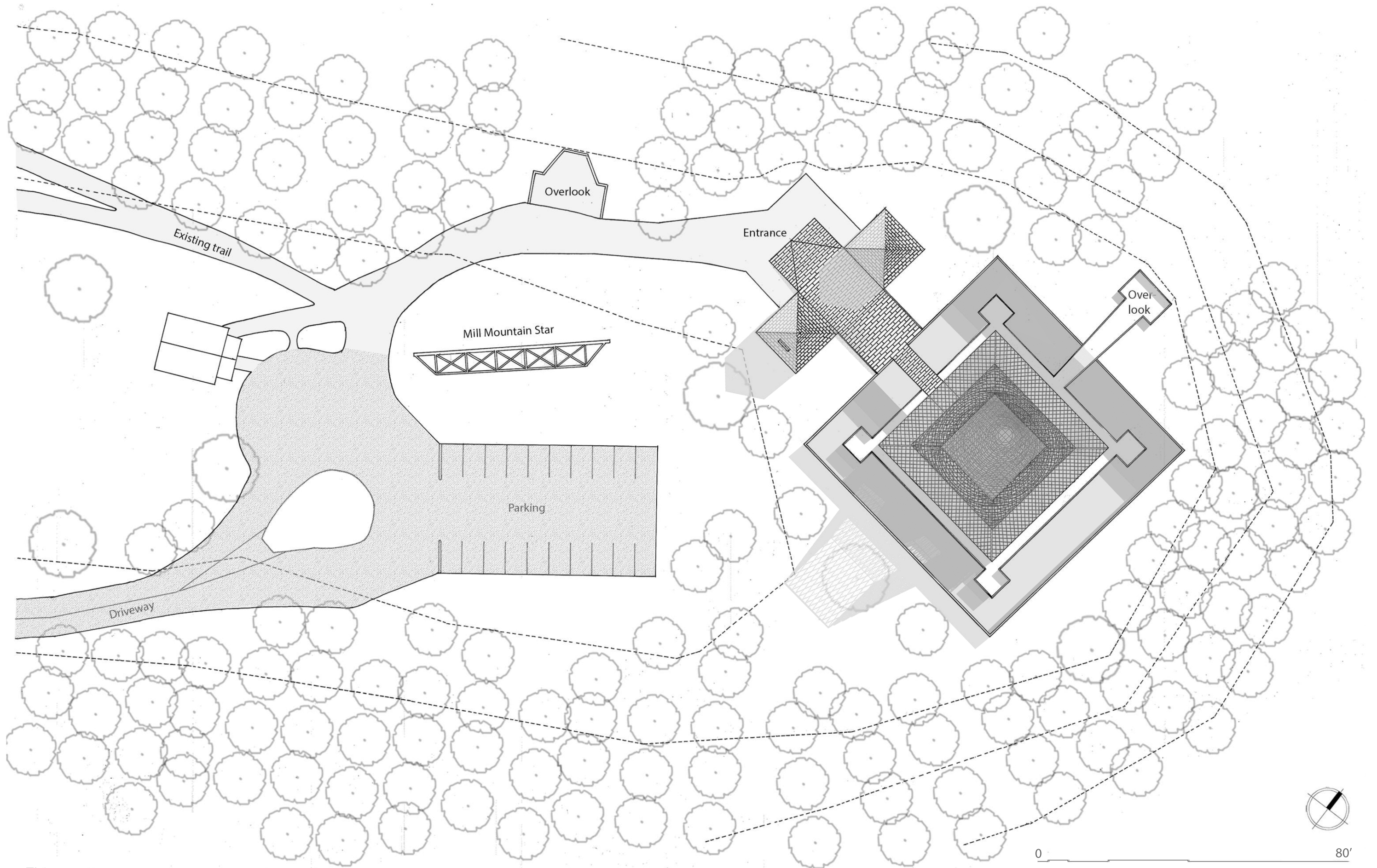


Figure 4

SITE PLAN

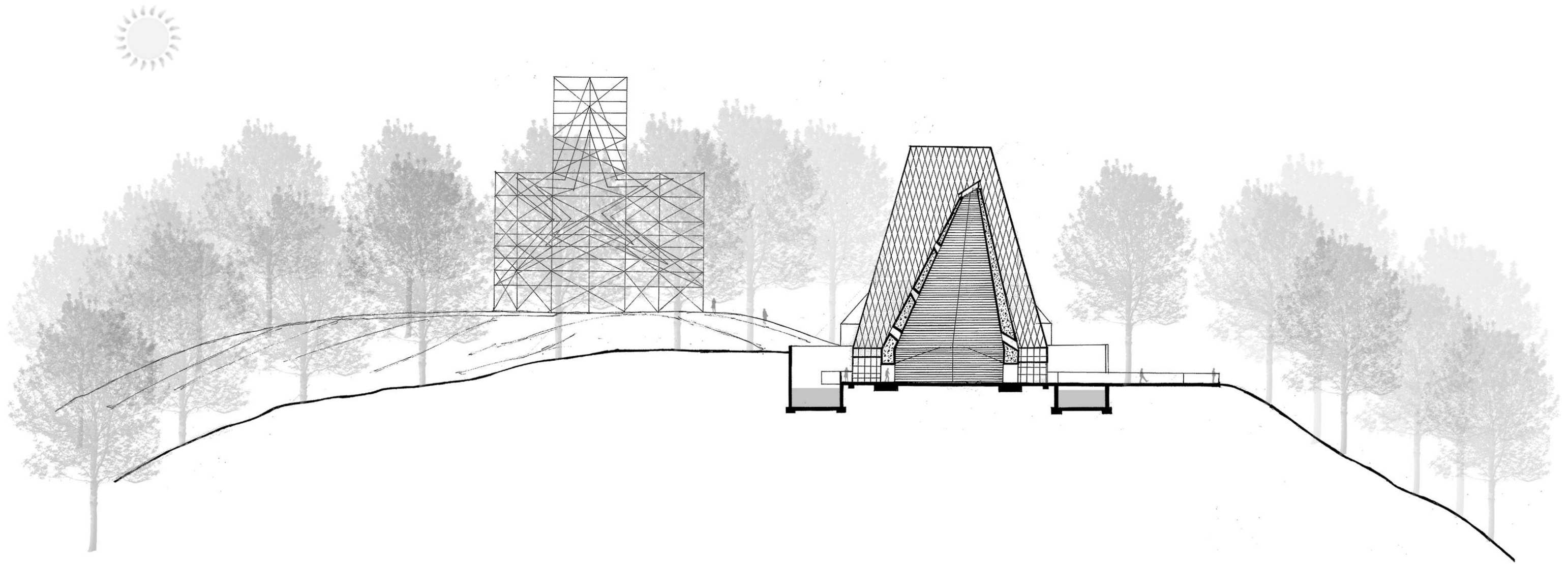
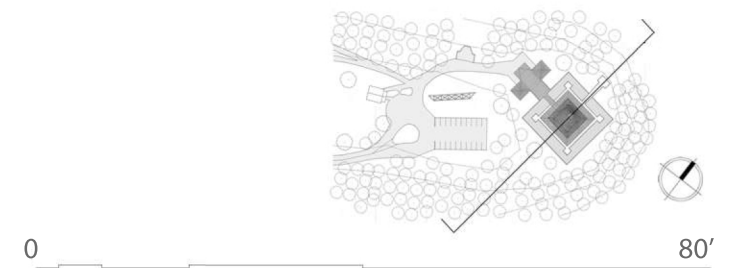


Figure 5

SITE SECTION



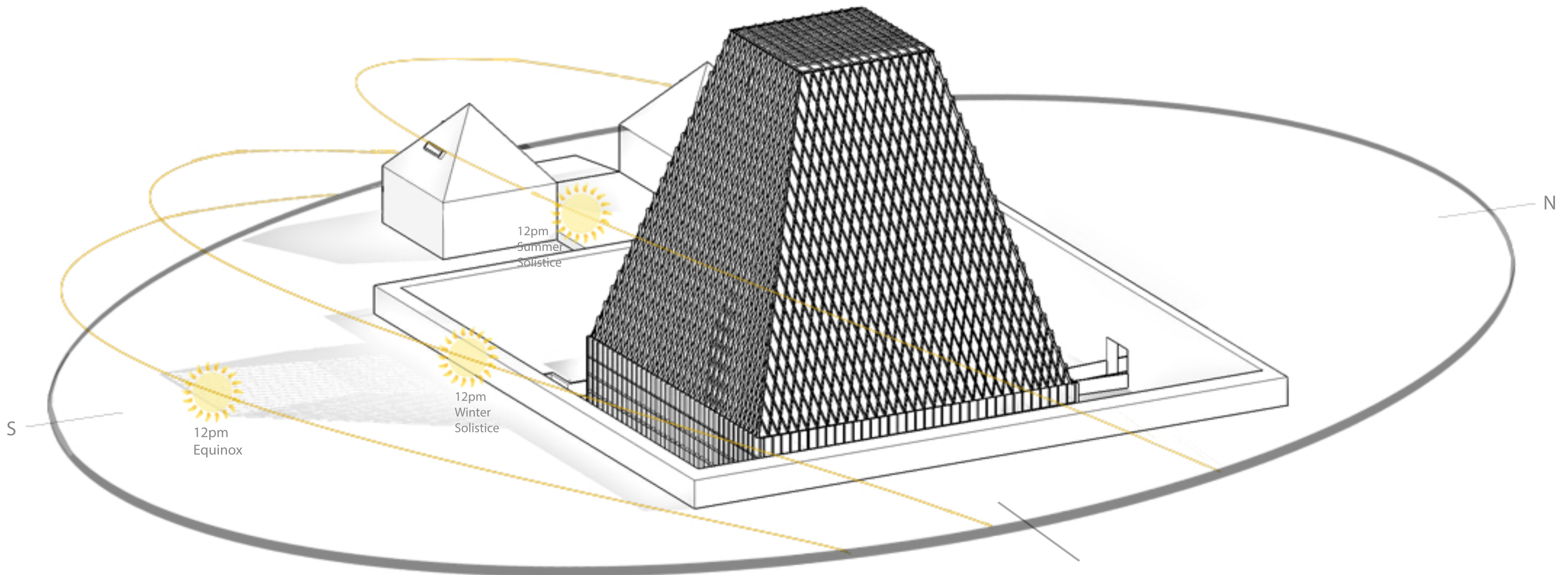


Figure 6

SUN PATH DIAGRAM

The sun in its course throughout the seasons and throughout the day form a universal sensible and intelligible pattern described through geometry giving a sense of a greater world beyond the immediate material world.

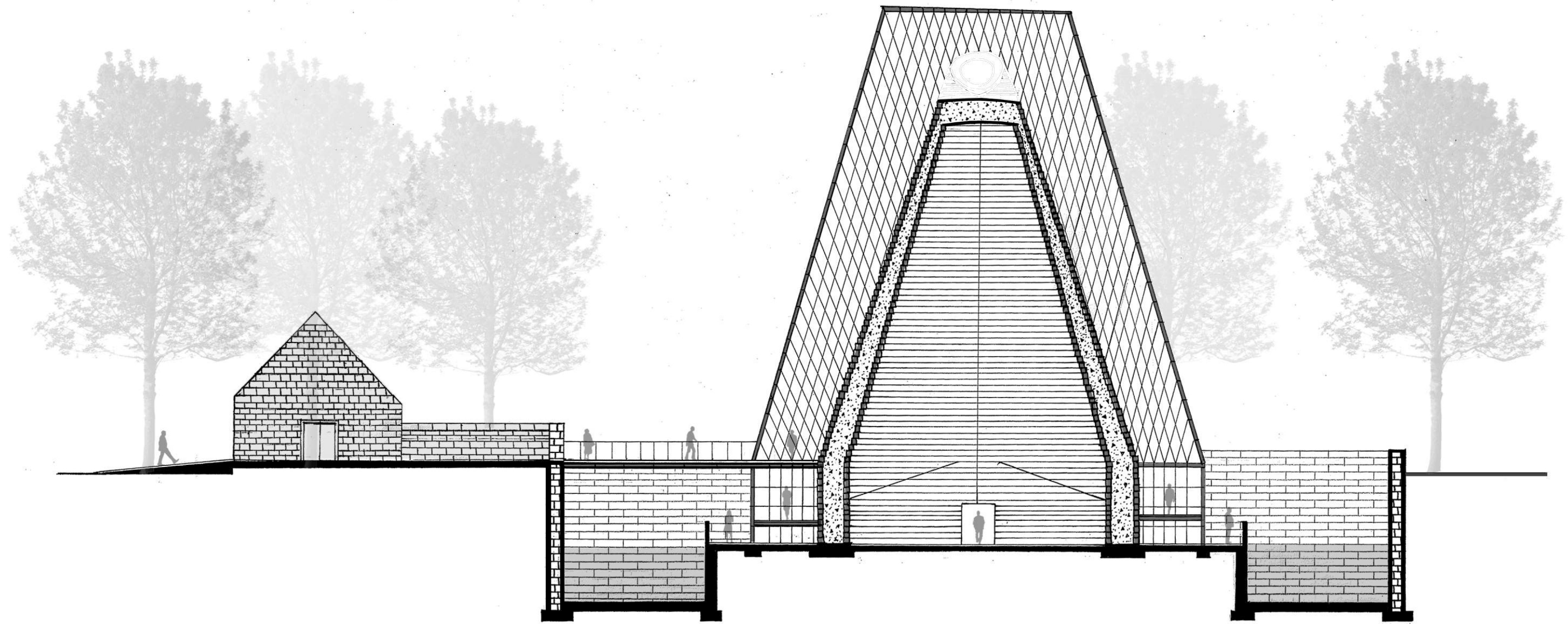
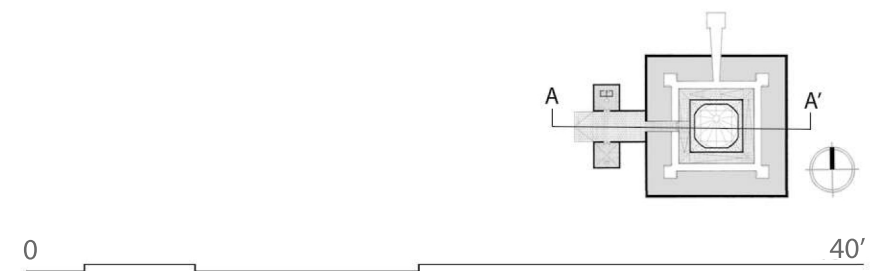


Figure 7

SECTION - AA'



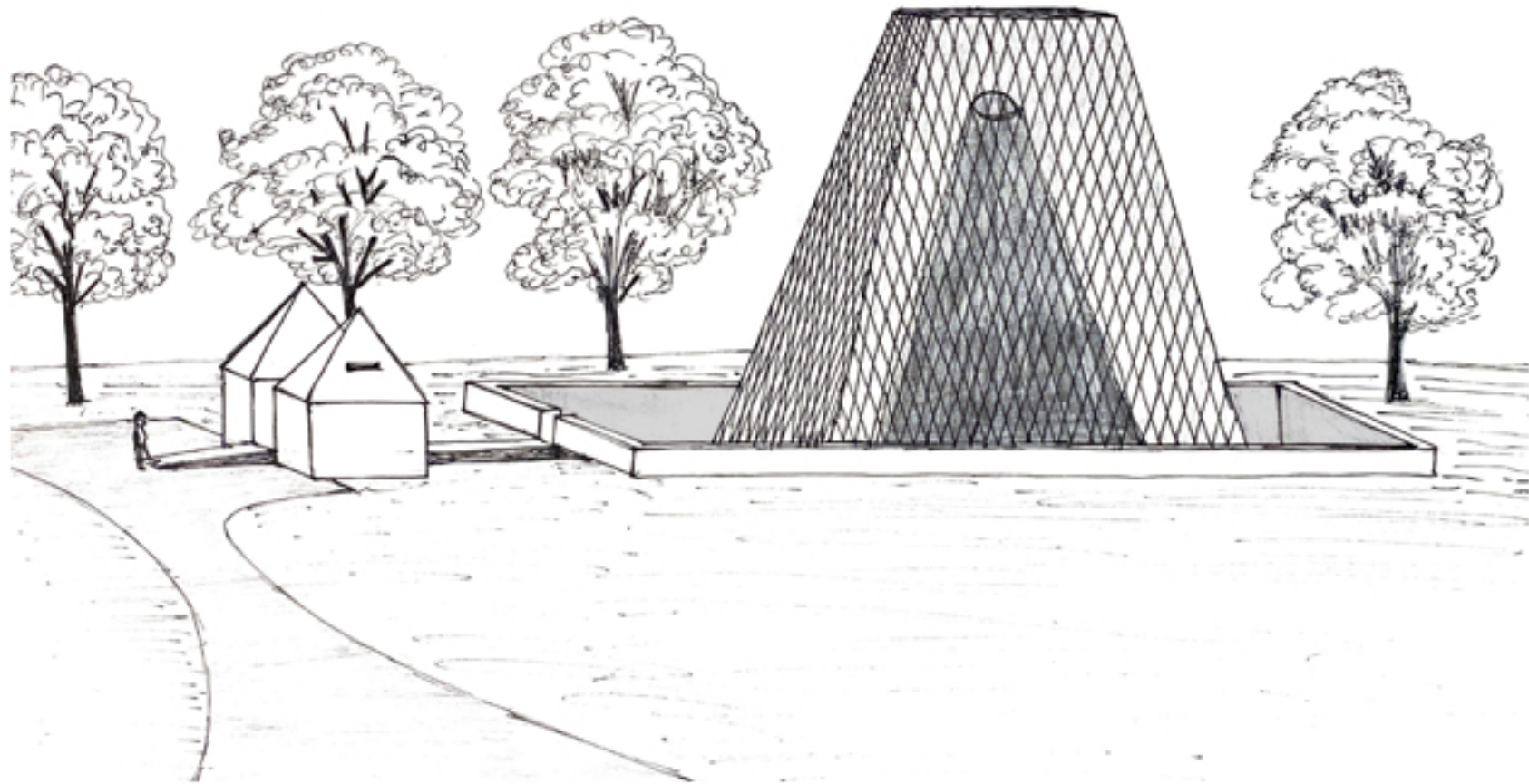


Figure 8

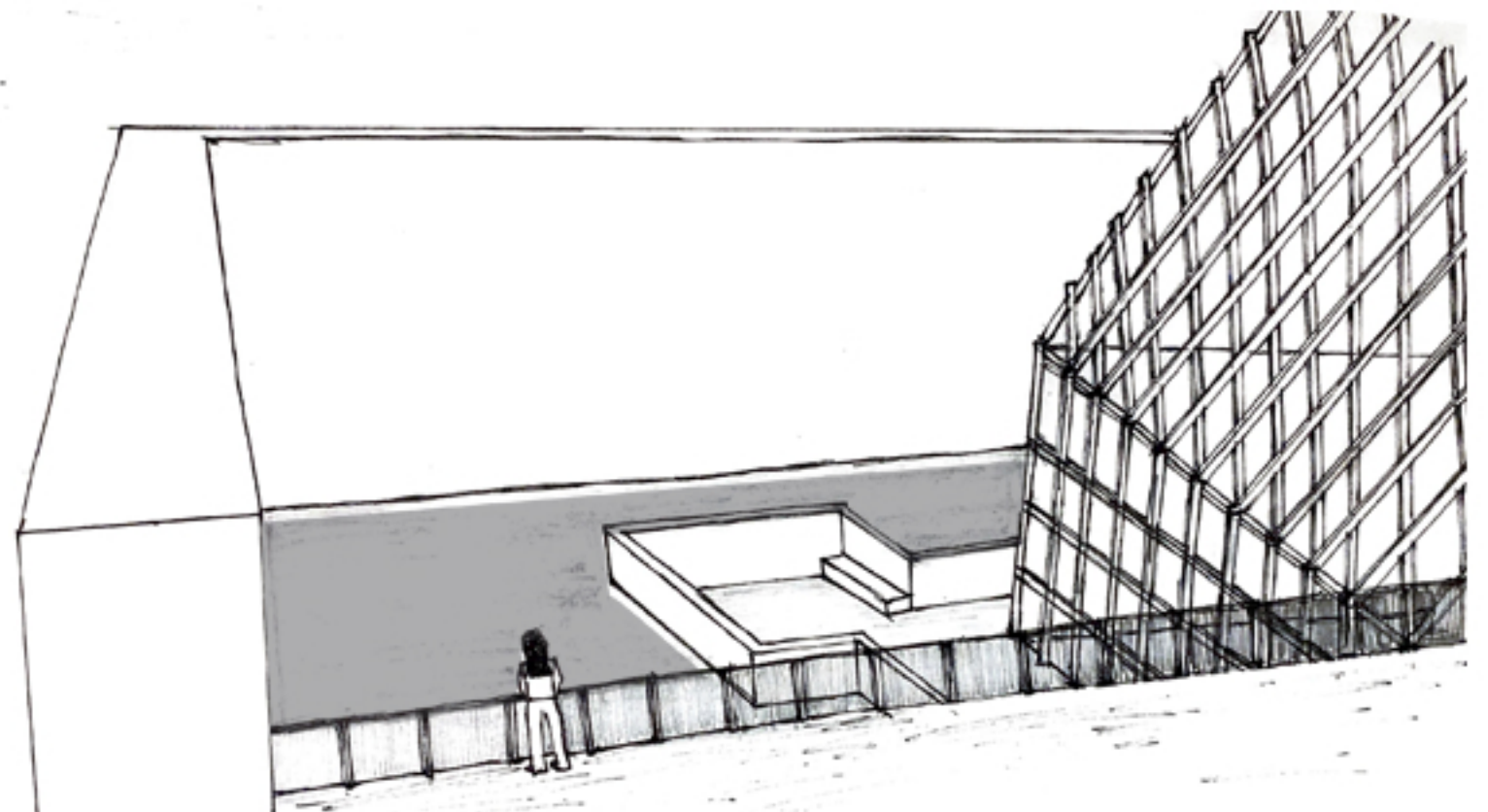


Figure 9



Figure 10

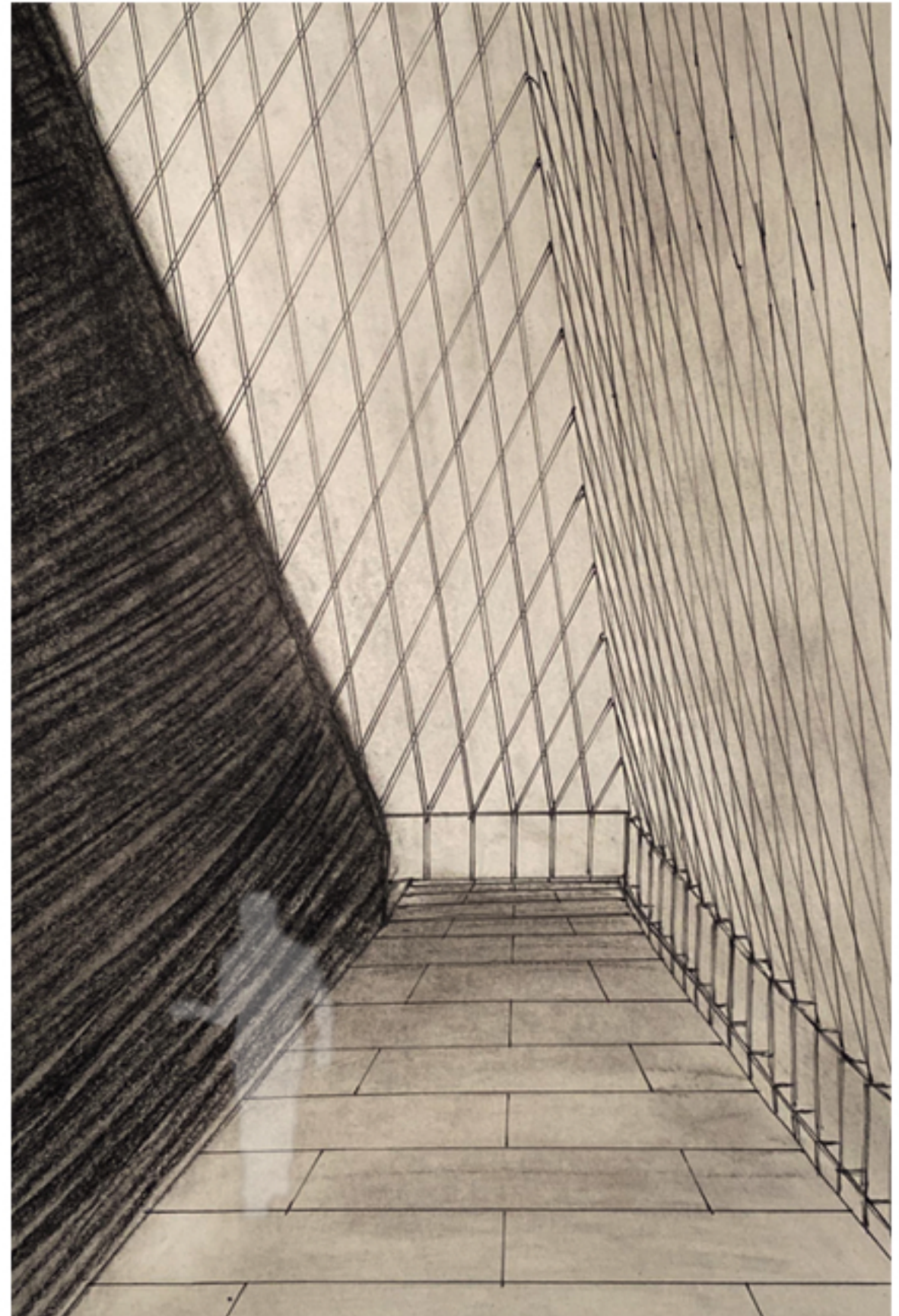
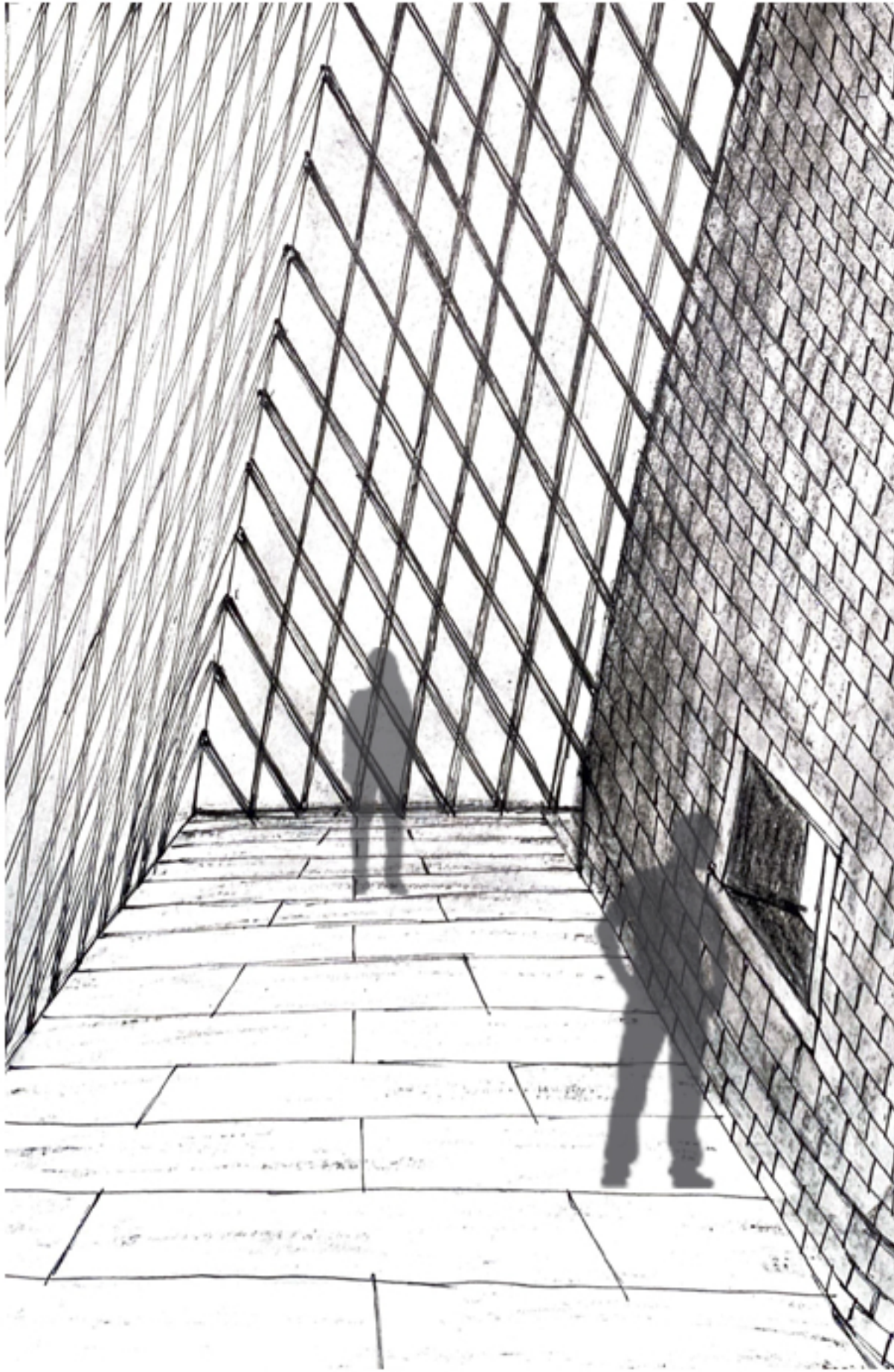


Figure 11

The texture of the surface of the stone is experienced walking along the ramp. The roughness of the granite contrasts with the transparent and smooth surface of the steel & glass pyramidal enclosure.



While walking along the ramp, a person can look into the conoid and experience the contrasting condition of the light steel and glass enclosure he stands in and the thick dark contemplative room that he is about to enter.

Figure 12

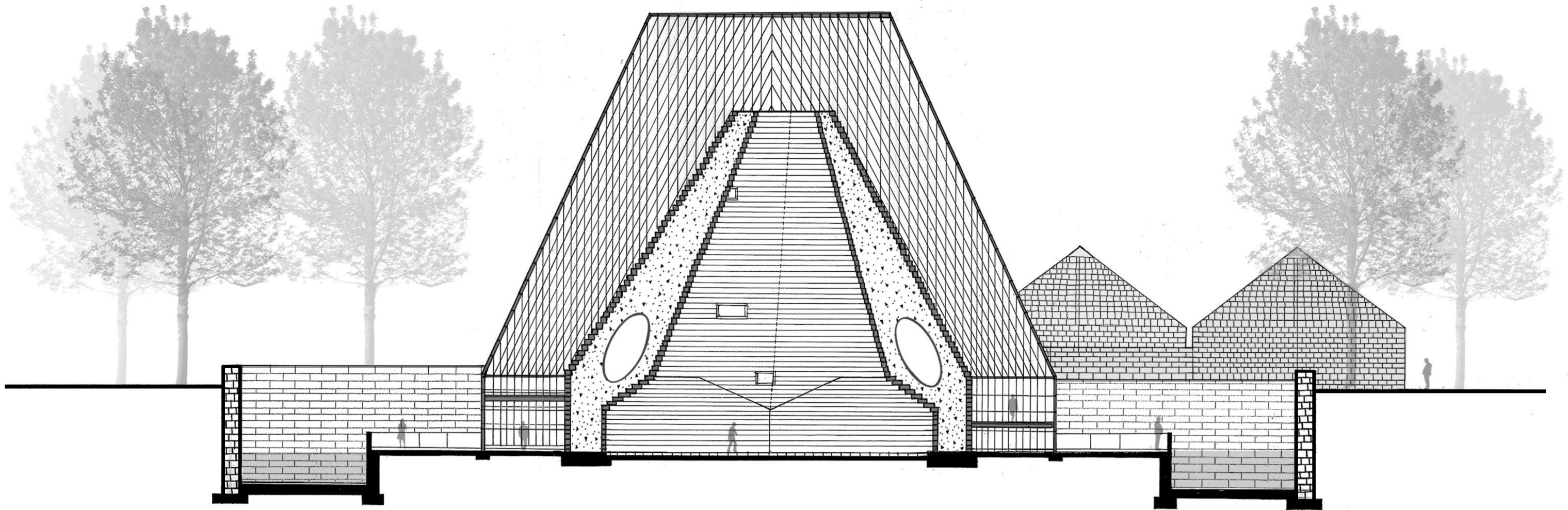
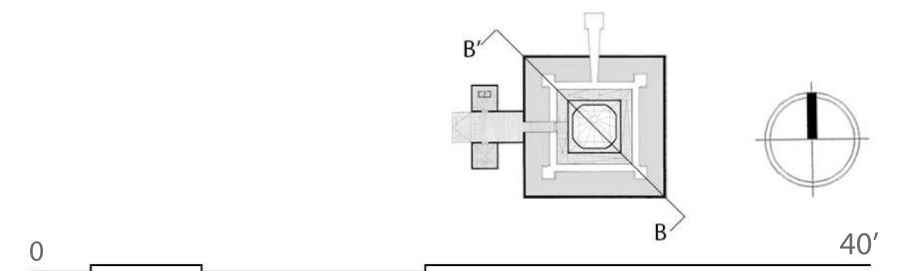


Figure 13

SECTION - BB'



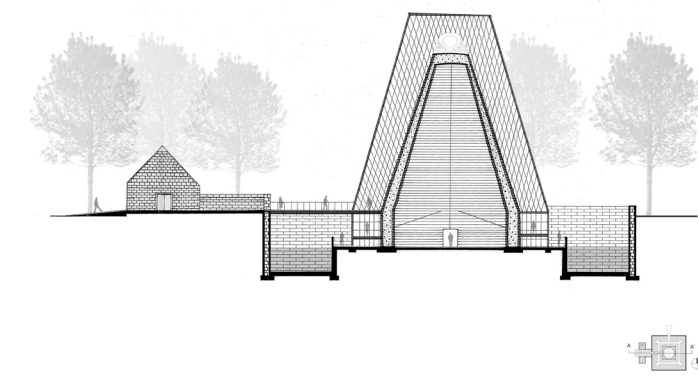
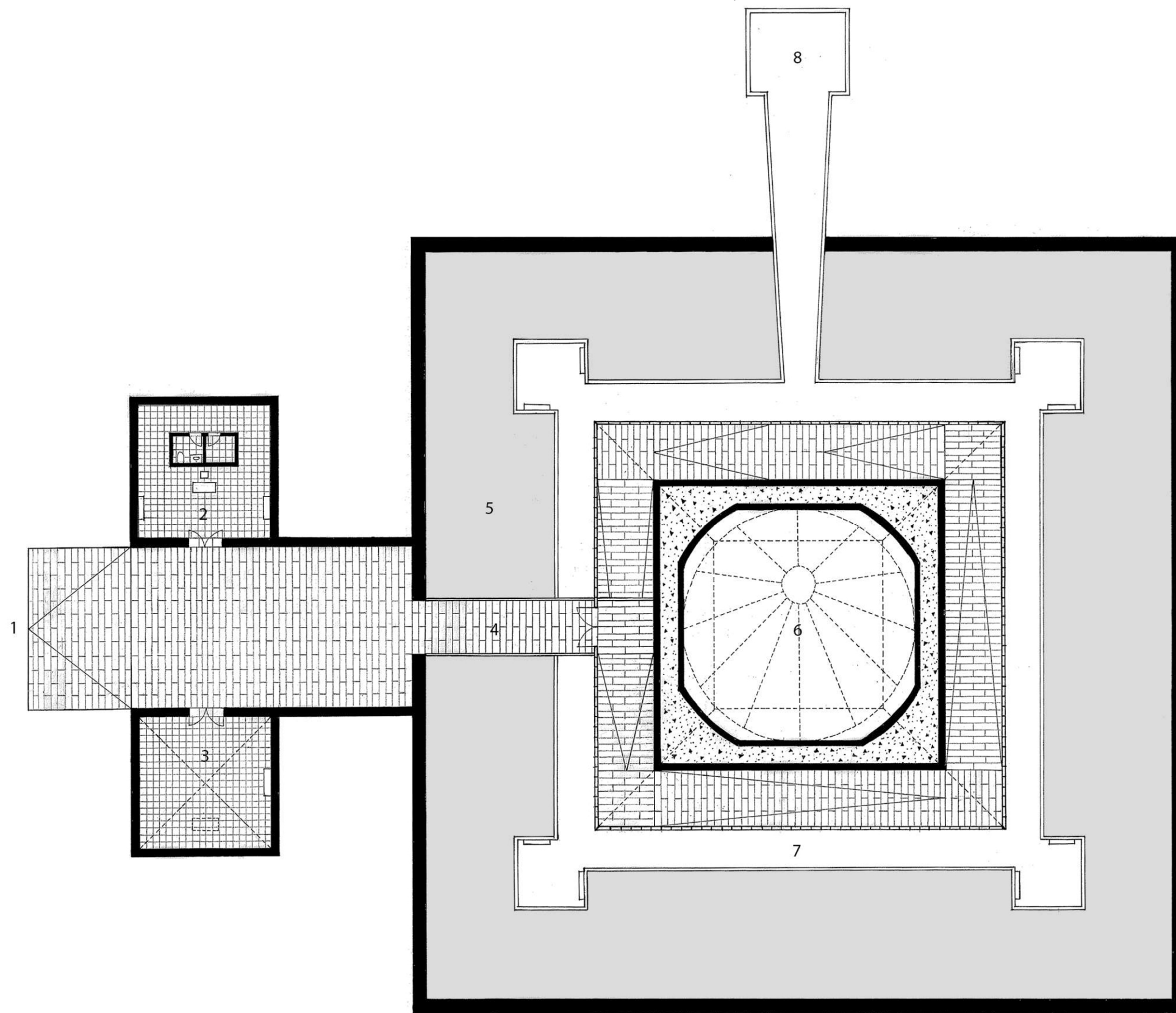
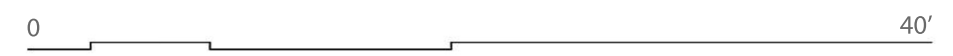


Figure 14

- 1 Entrance
- 2 Reception
- 3 Reflection room
- 4 Bridge
- 5 Reflective pool
- 6 Main Reflection room
- 7 Walkway
- 8 Overlook

GROUND FLOOR PLAN



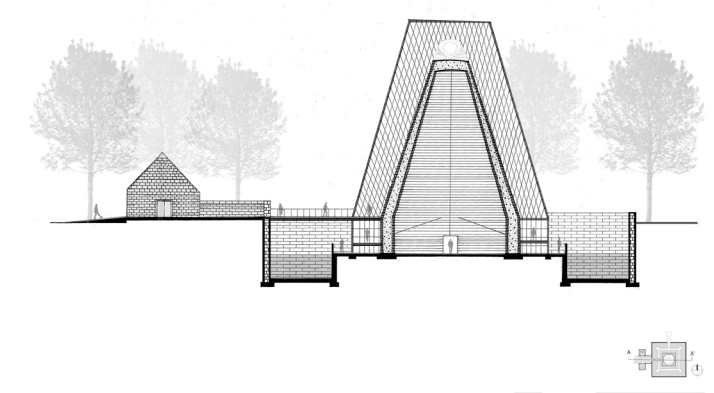
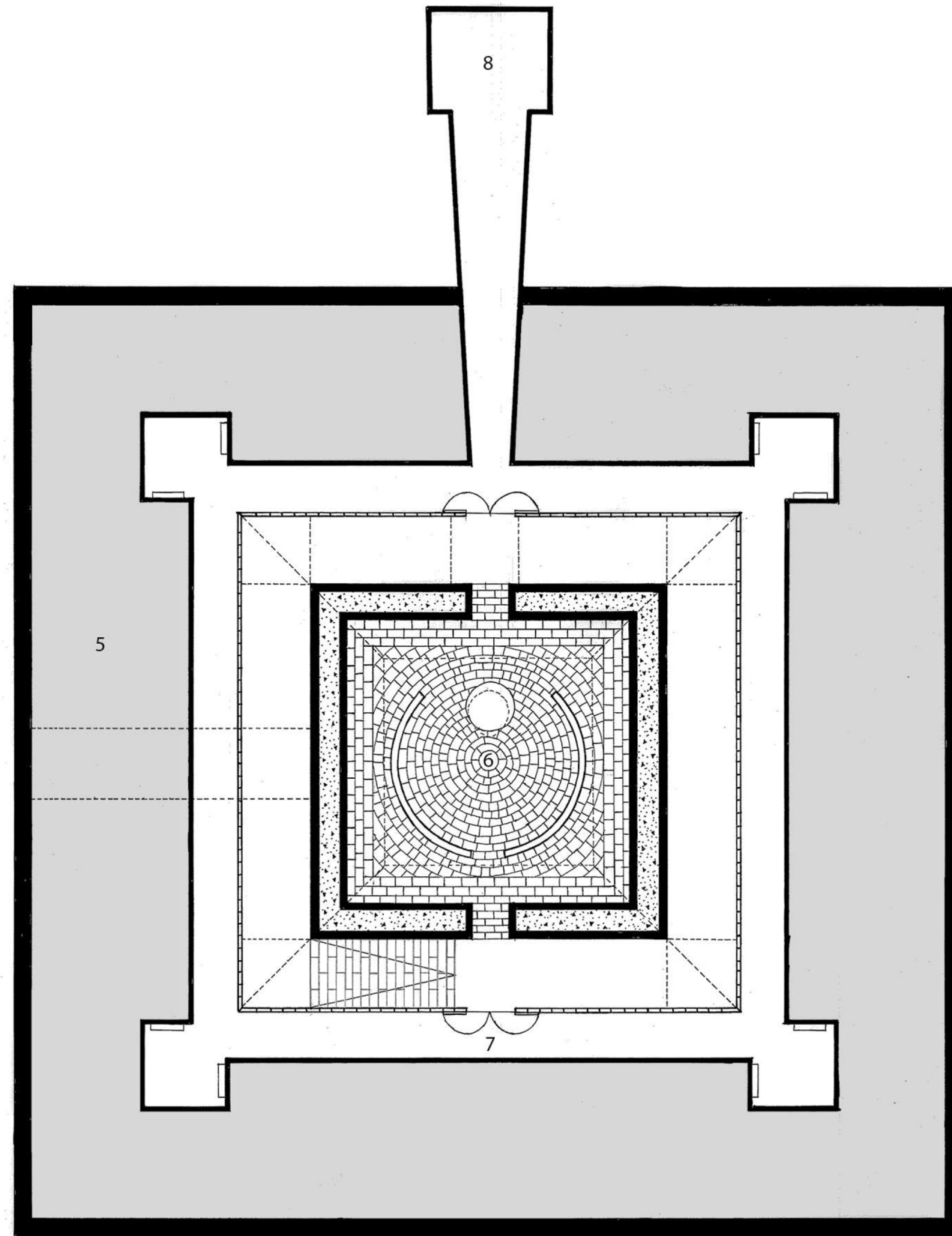
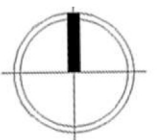


Figure 15

- 5 Reflective pool
- 6 Main Reflection room
- 7 Walkway
- 8 Overlook

BASEMENT FLOOR PLAN



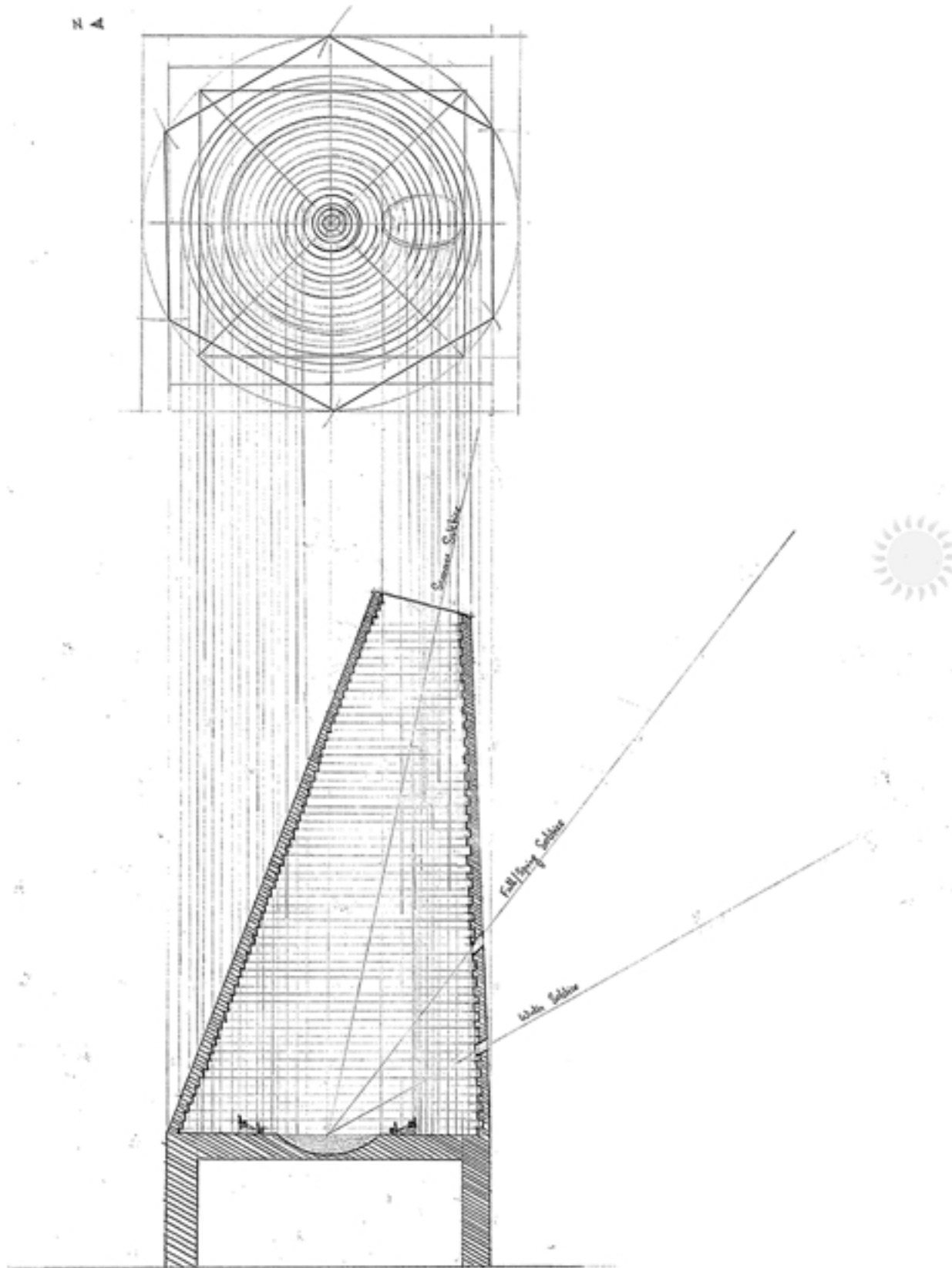


Figure 16

Working with the cubical base and truncated conoid, the conoid is inclined to bring in sun at solar noon on the summer solstice, spring/fall equinoxes and winter solstice respectively which passes through the apertures on the south wall of the cone and reflects off the pool of water in the room.

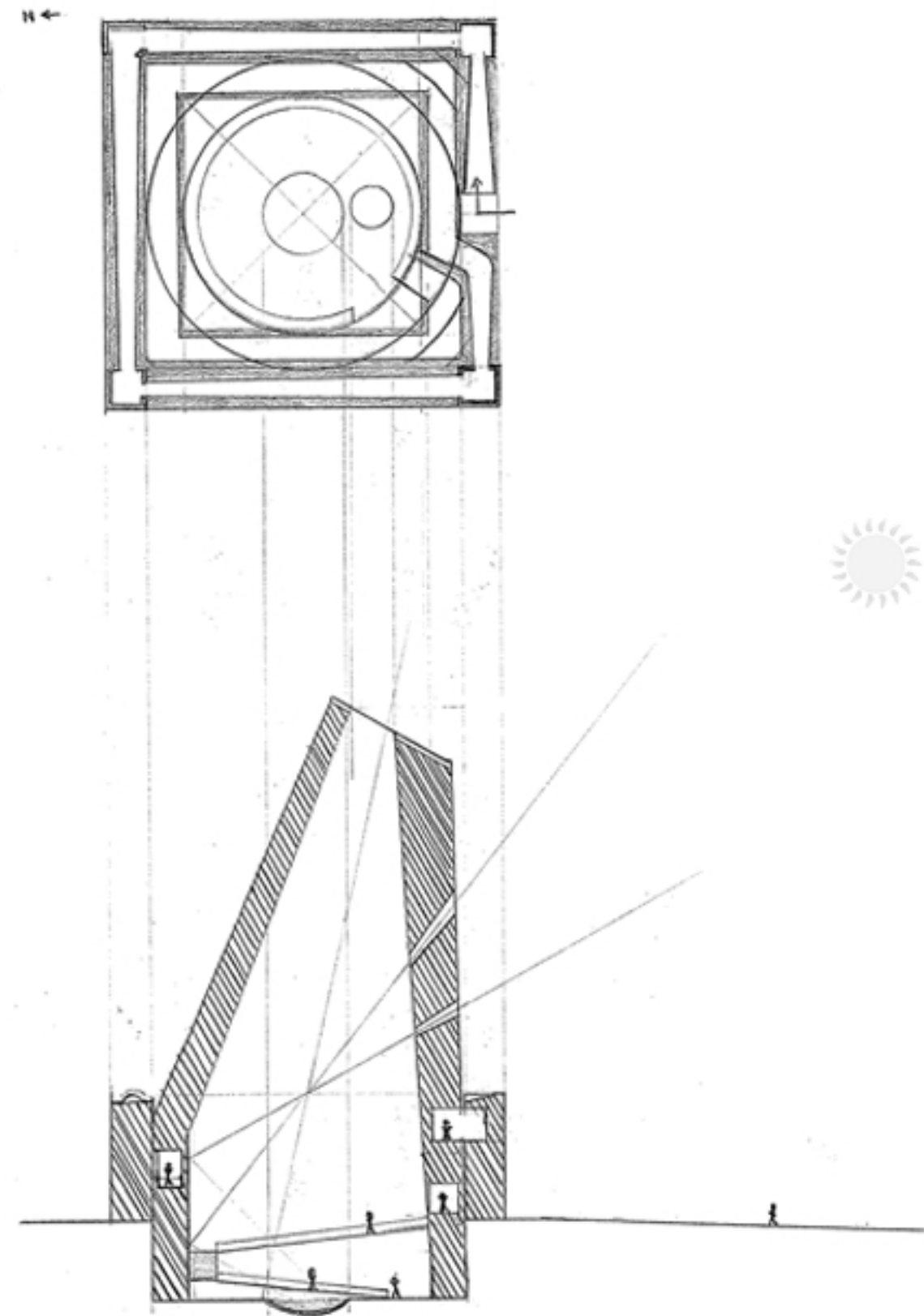


Figure 17

Here, the thickness of the enclosure is used to accommodate a ramp that would lead to the base of the contemplative room.



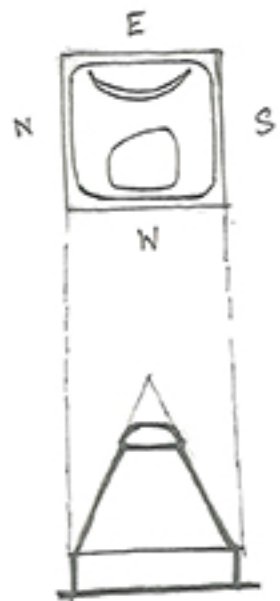
Figure 18



Figure 20

Church at Firminy
Le Corbusier

Feb 20, 2020



BAPTISTRY OF PISA, ITALY

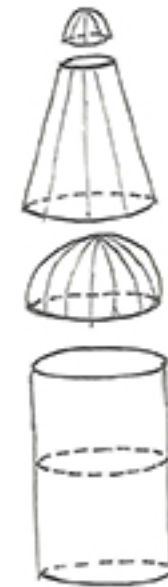
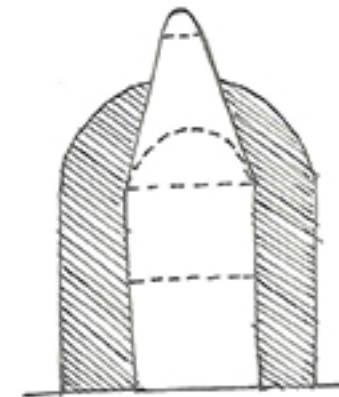


Figure 19

Figure 21

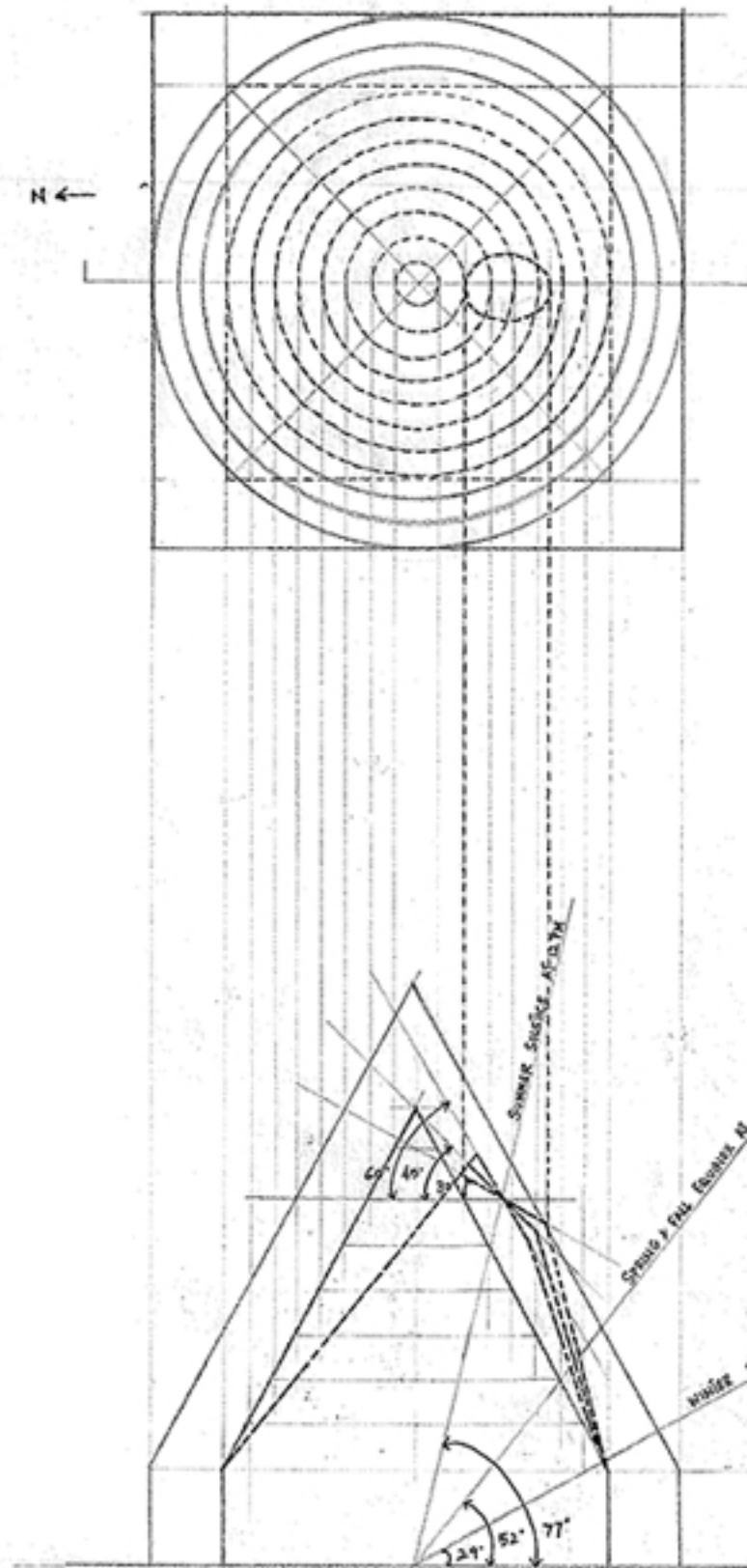


Figure 22

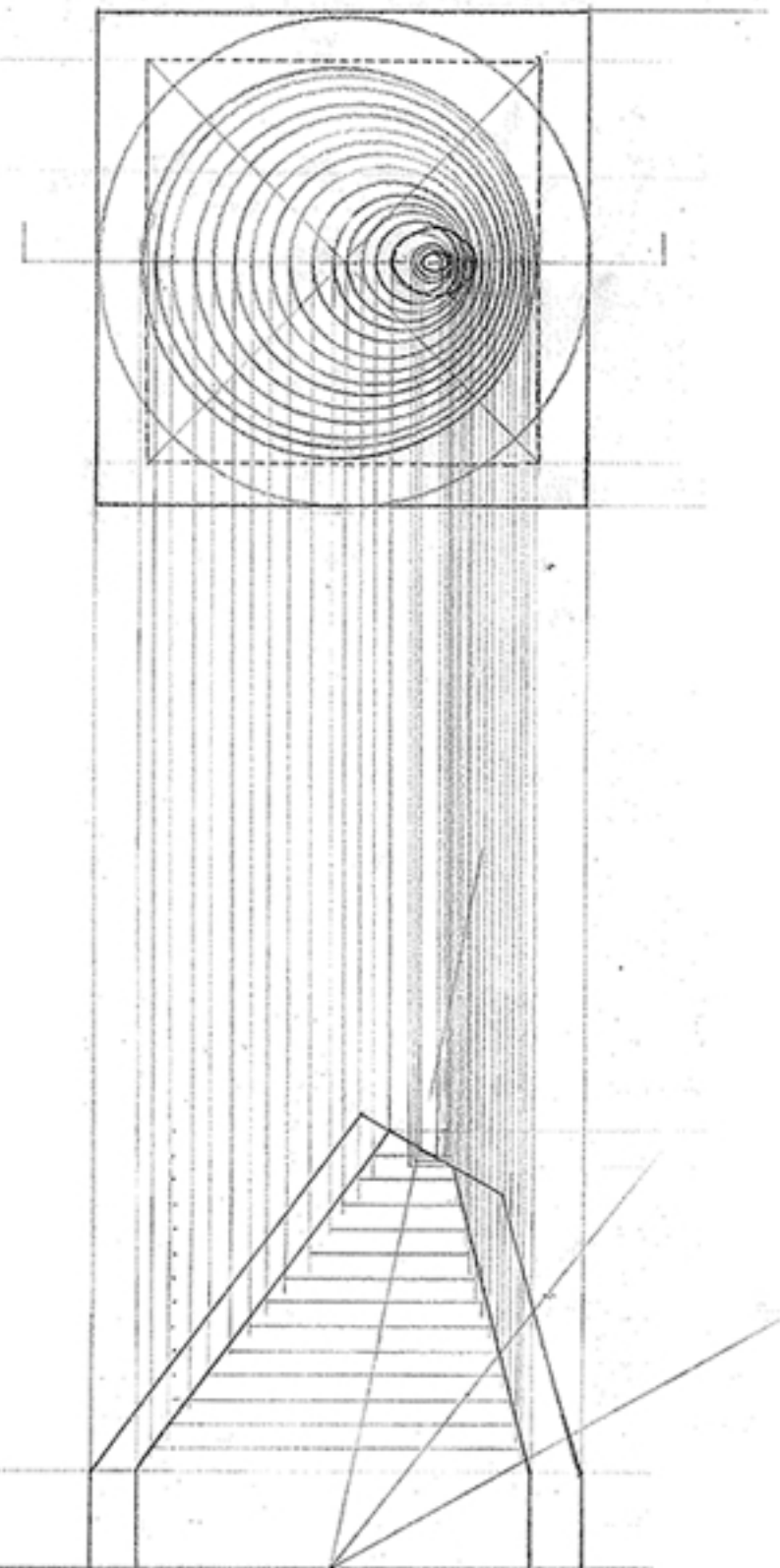


Figure 23

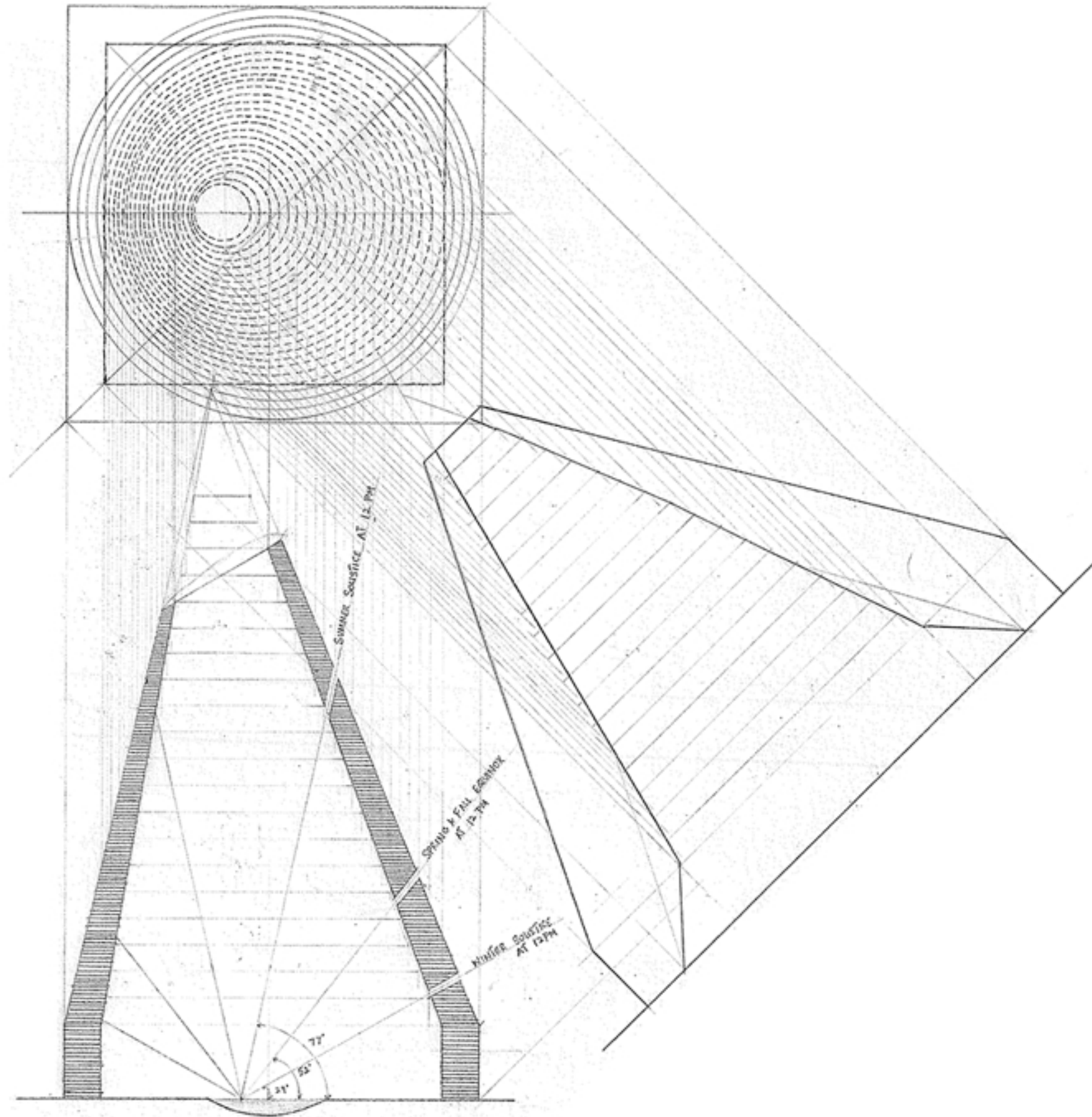


Figure 24

This attempt at the inclined cone with an angled oculus uses the same defining geometry, but accommodates the slits on the south wall and attempts to resolve the intersecting geometry between the cubical base and the conical top.

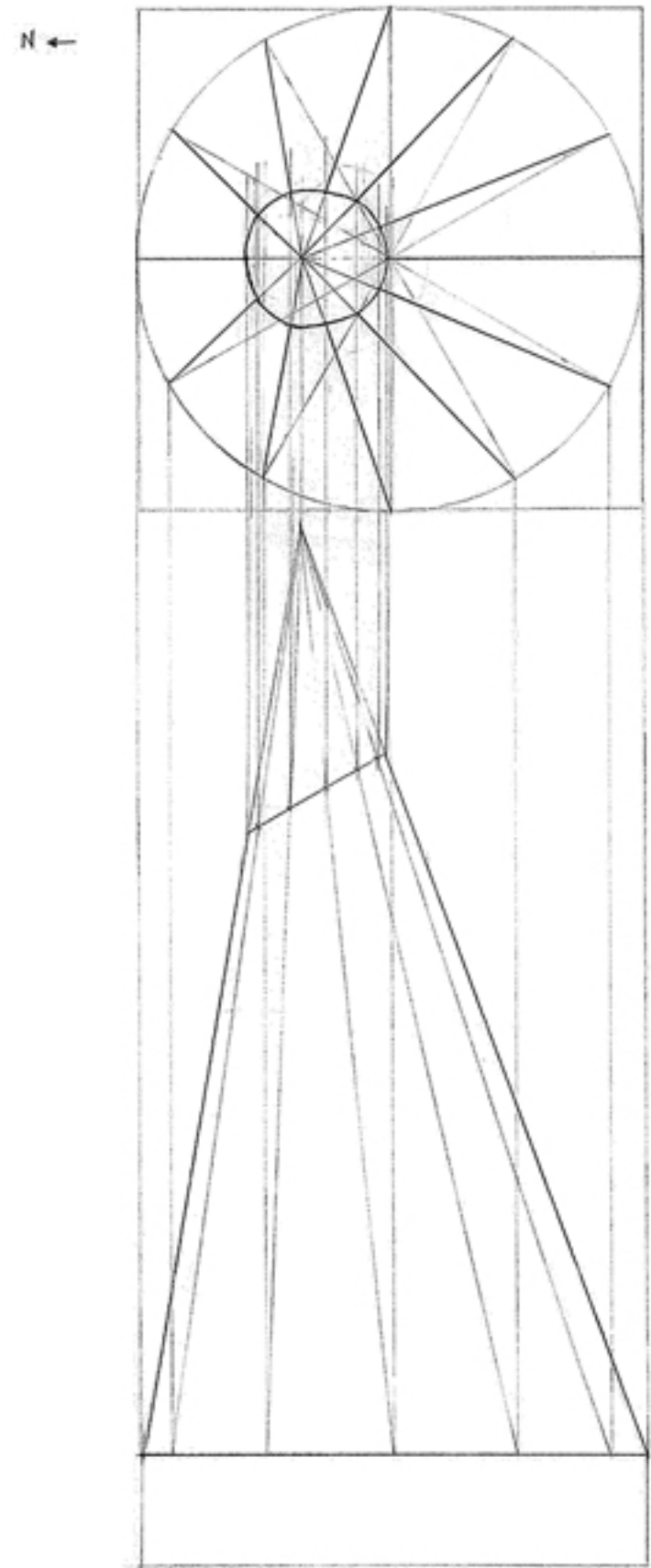


Figure 25

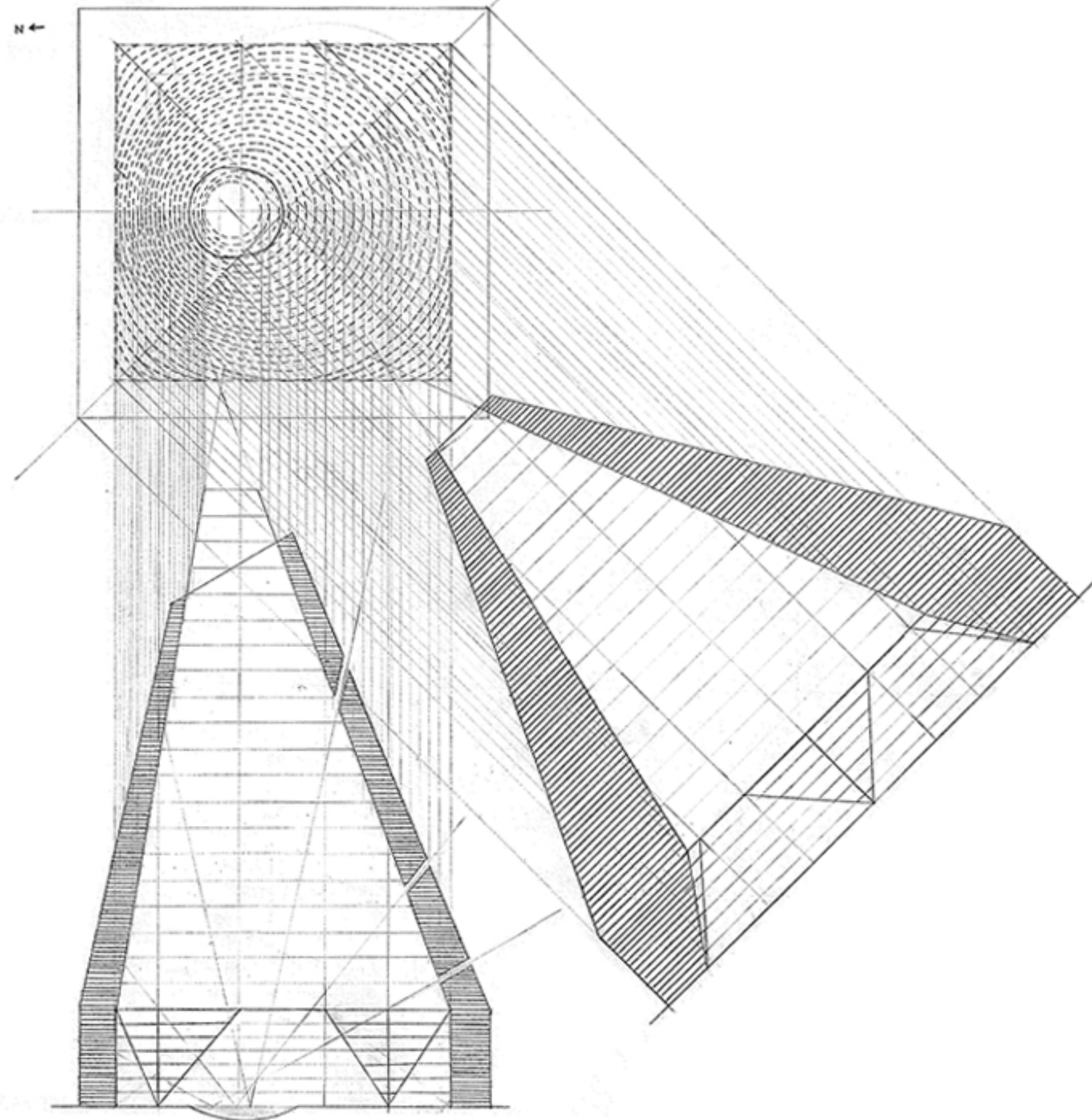
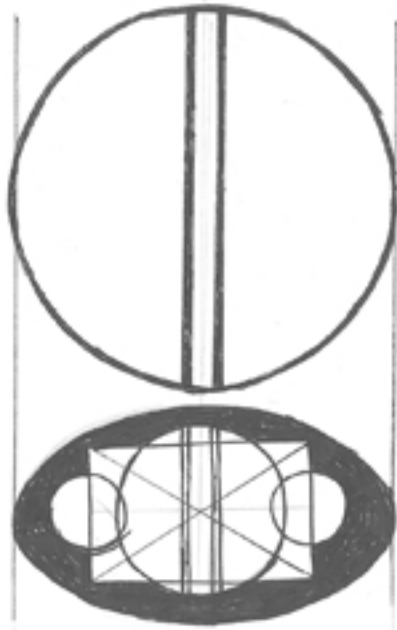


Figure 26

The demonstrative basis of these studies is the use of rectilinear logic through circular constructions. This drawing uses descriptive geometry to resolve issues discovered in the previous drawing. It resolves the intersecting geometry between the cubic base and the conoid.

Church of San Giovanni Battista (1966-1996) Megève, Switzerland
 Mario Botta

March 9, 2020



Transformation of geometry → ellipse - rectangular - circle
 (form) - (floor) (roof)

- cylindrical form of the church rises above the surrounding village → the vertical axis expresses the spiritual axis.
- The interior walls demonstrate the transformation of geometry of the building form :-
 * a rectangle inscribed within an external ellipse that ultimately changes into a circle at roof level *

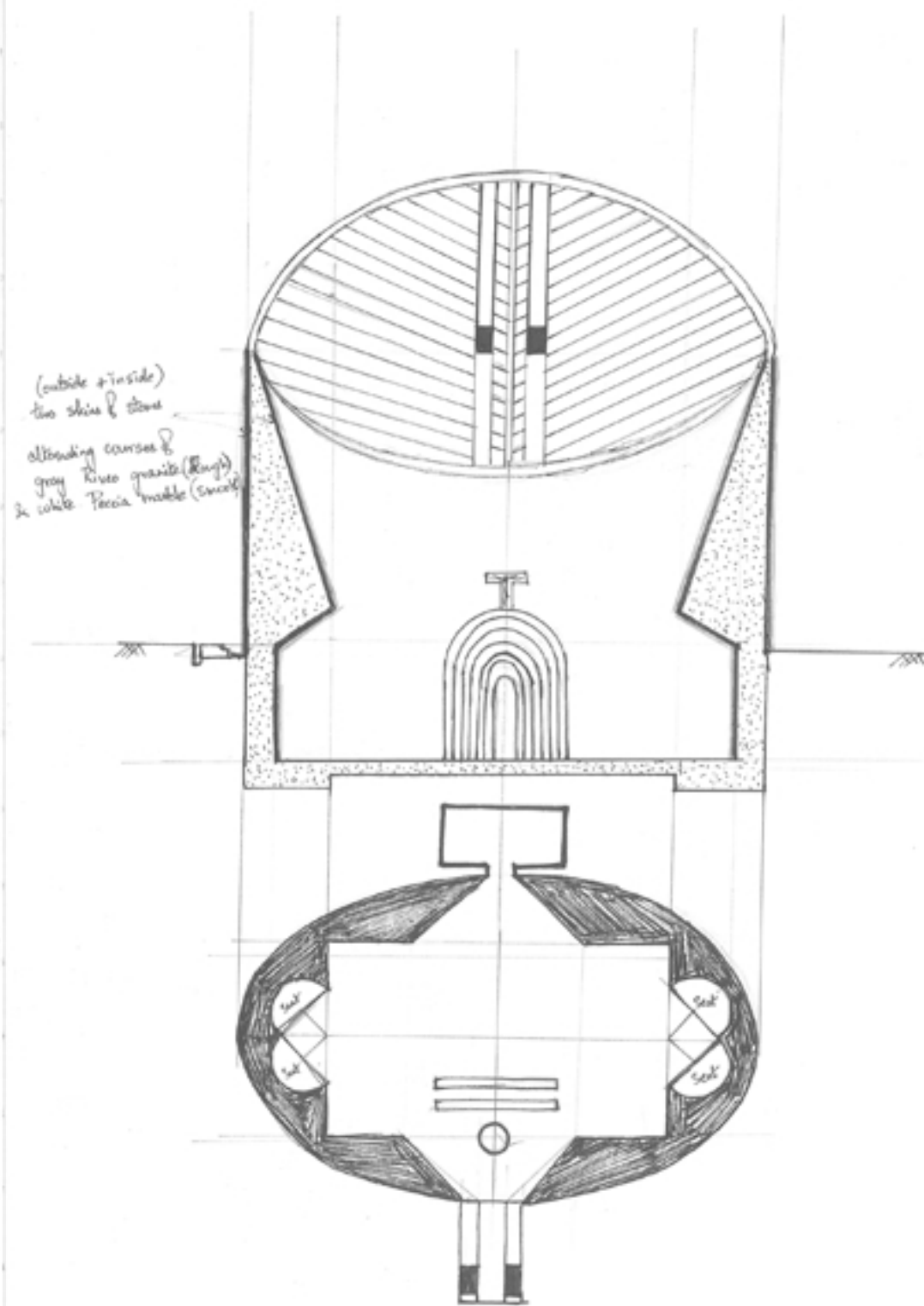
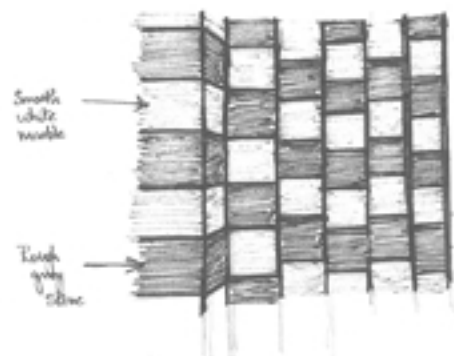


Figure 27

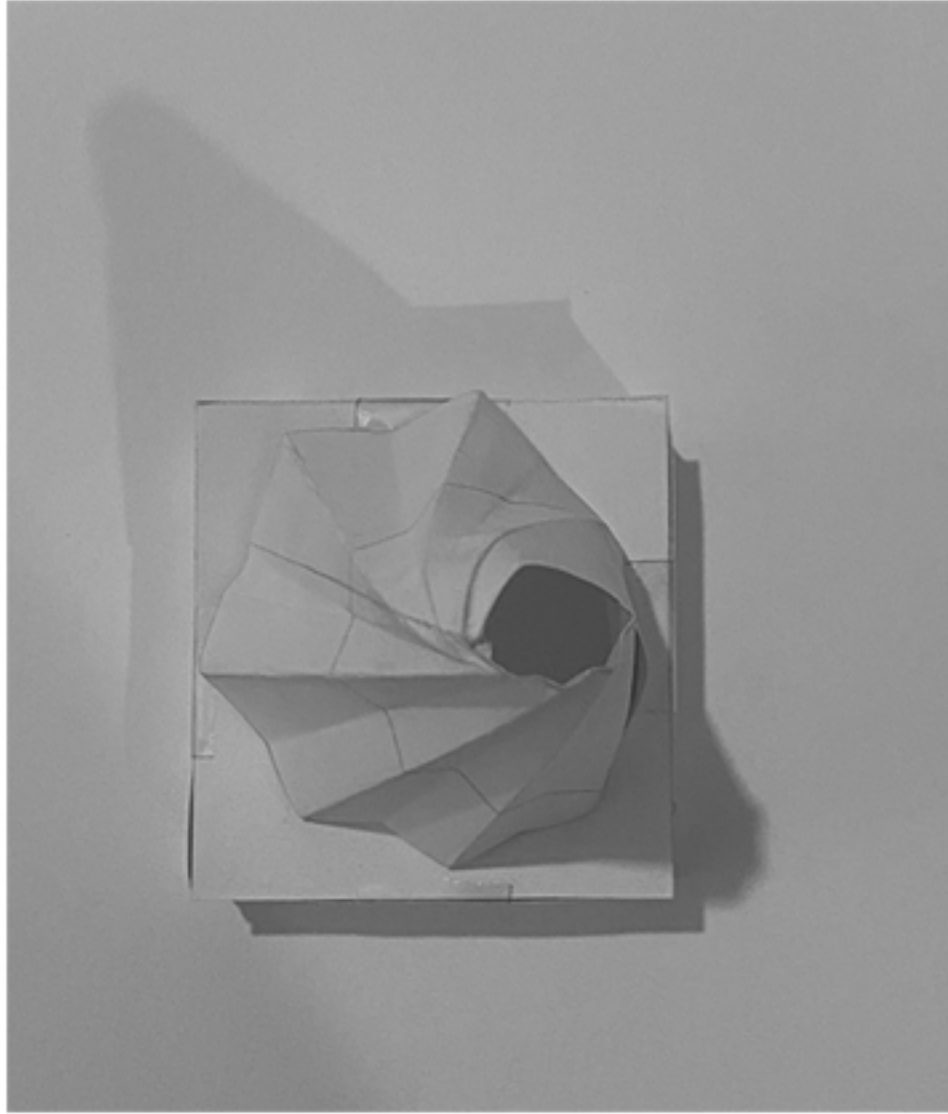


Figure 28

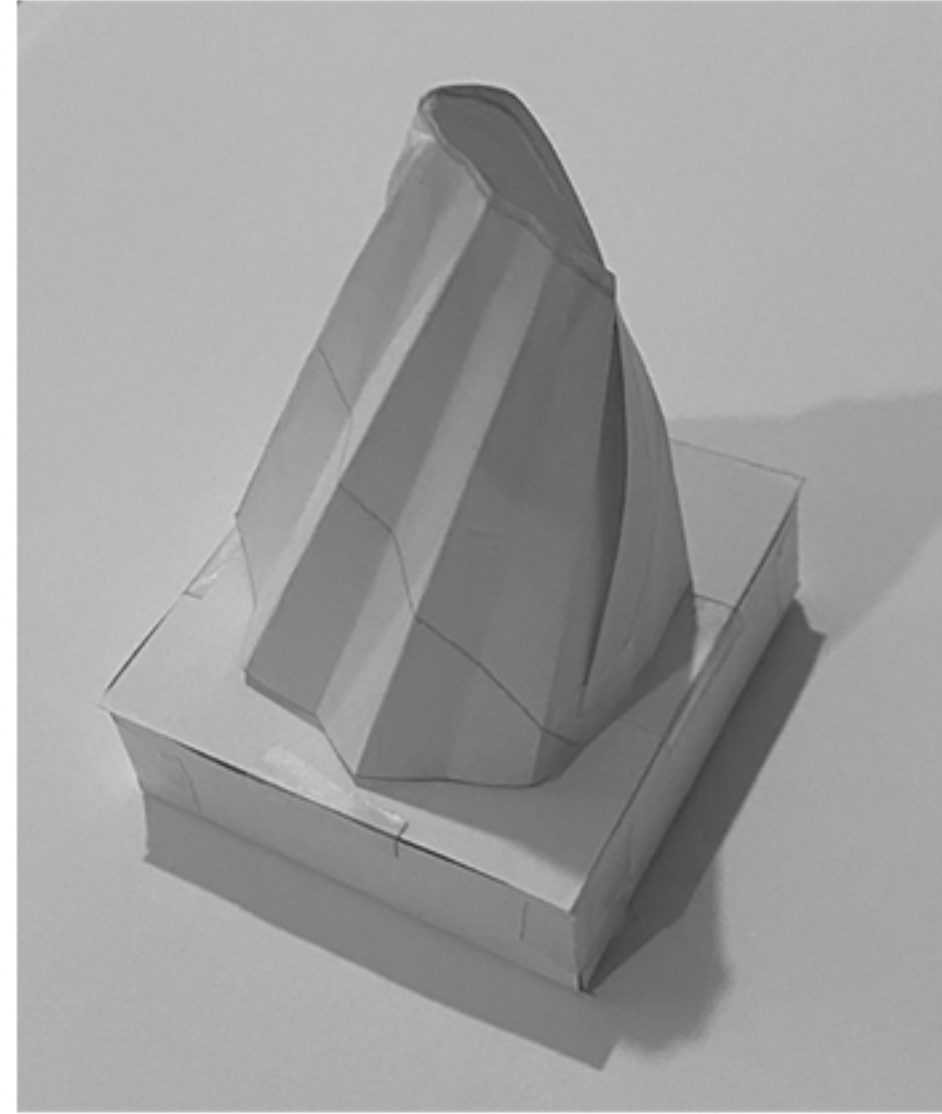


Figure 29



Figure 30

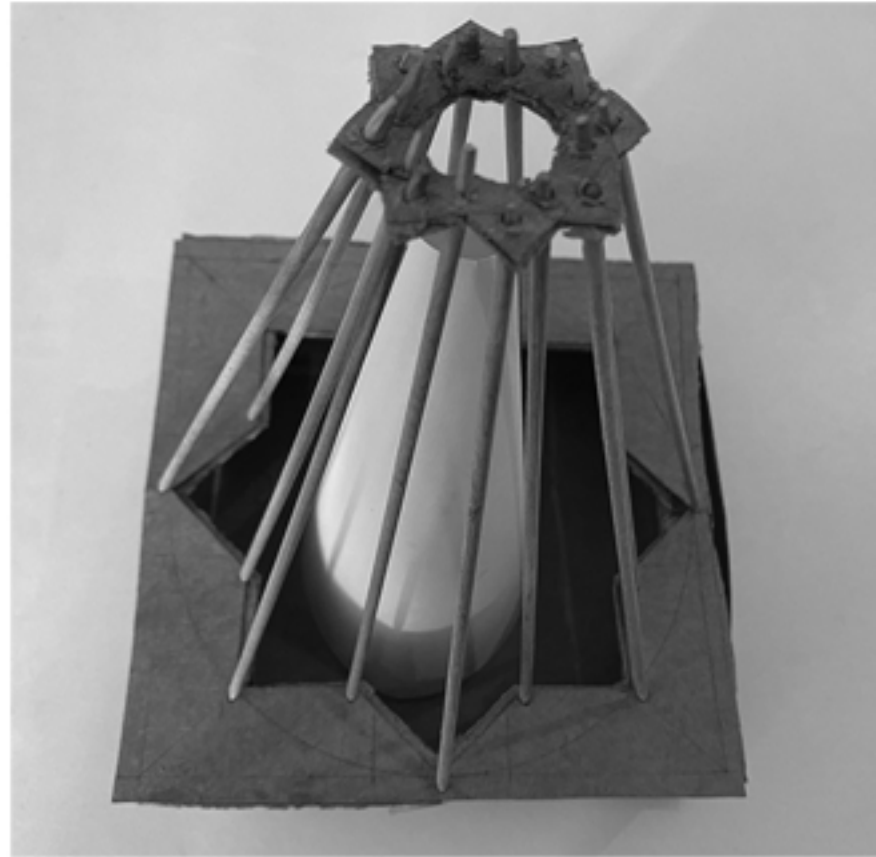


Figure 31

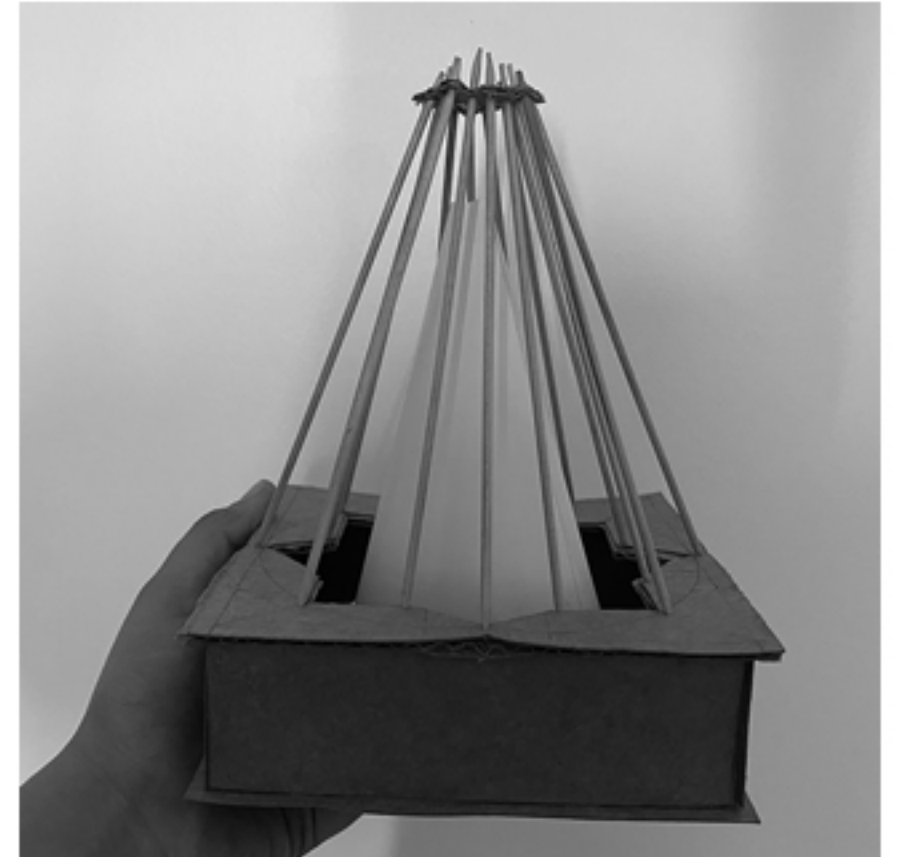


Figure 32

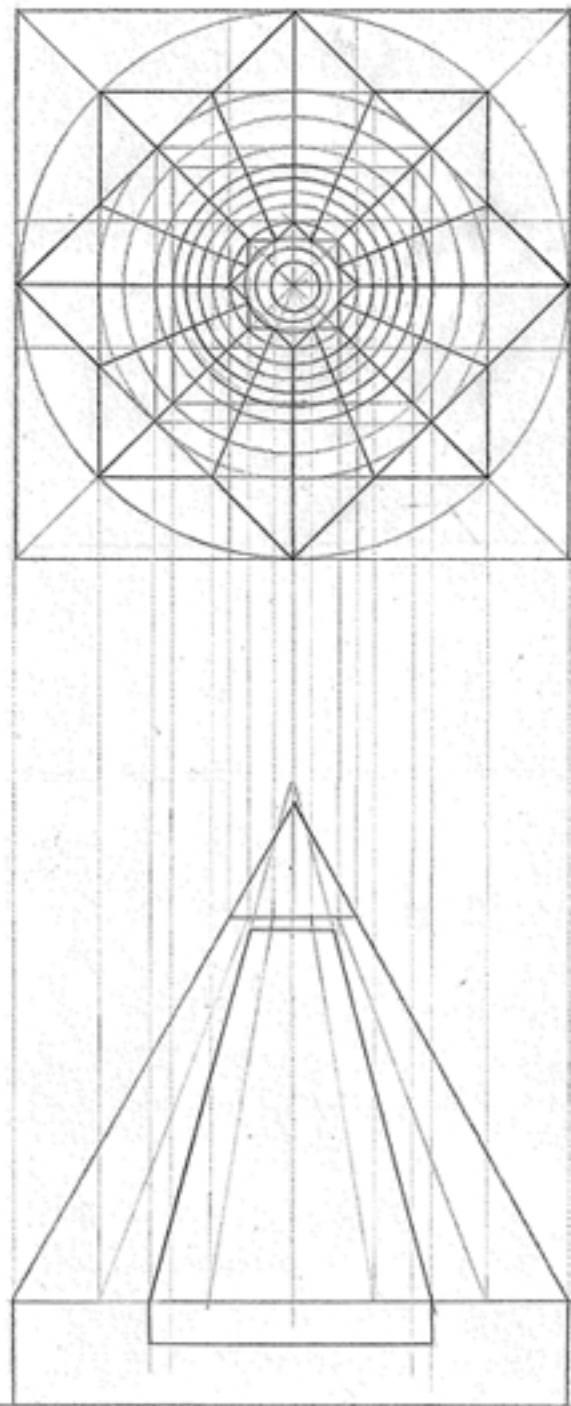


Figure 33

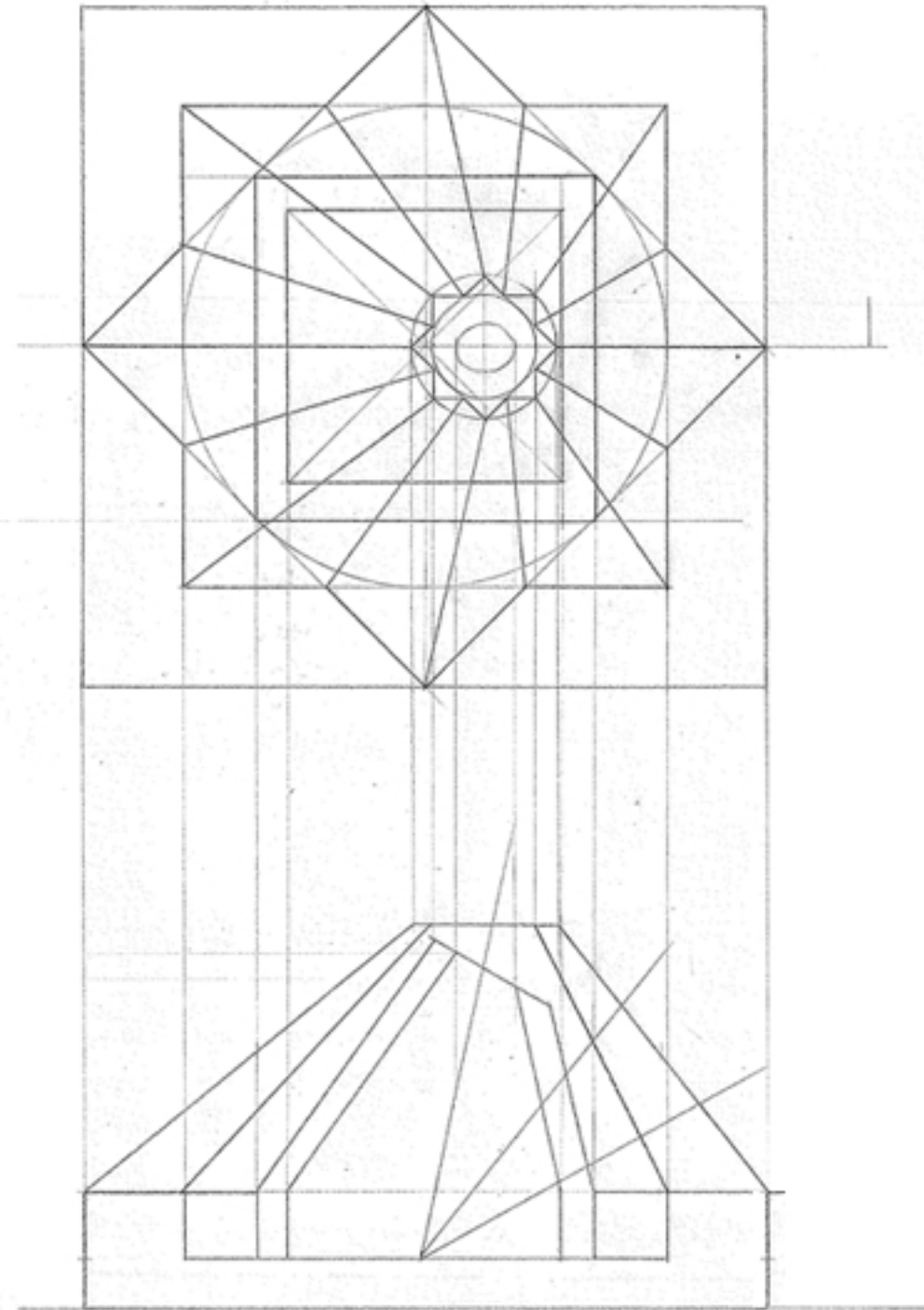


Figure 34

These geometric projections explore the interplay of the interior conic form and the outward crystalline form.



Figure 35

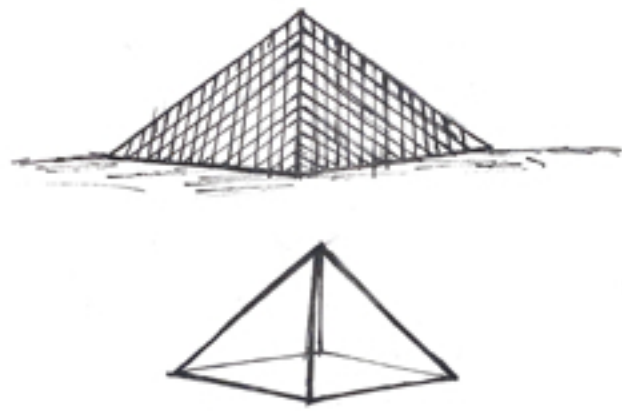


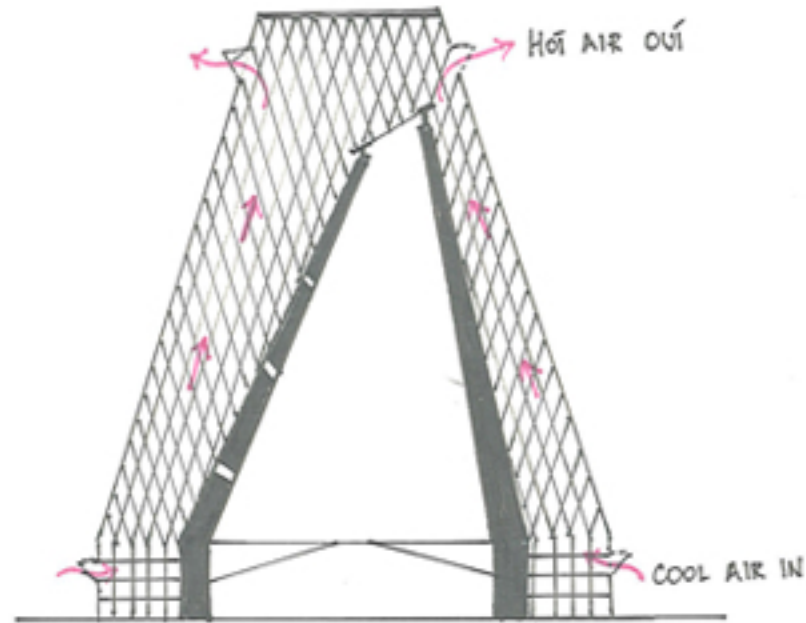
Figure 36



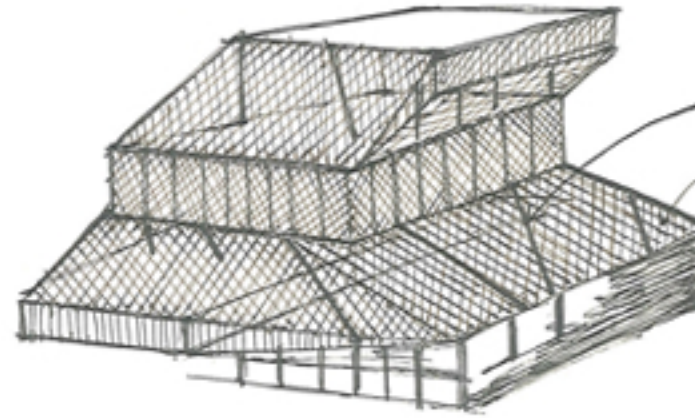
Low-emissivity (Low-E) Coated glass - reduces heat gain & heat loss

Emissivity of clear glass is 0.84
 Emissivity of low-e coated glass is 0.15
 -15% of heat is absorbed & re-emitted, rest is reflected.

For ventilation:



Seattle Public Library - Crystalline diagrid form



diagonal steel columns provide additional support
 Glazing supported diagrid

The exterior diagrid frame carries lateral wind loads efficiently, creating stiffness that is complemented by the axial action of the diagonal member.

Glass enclosure - diagrid

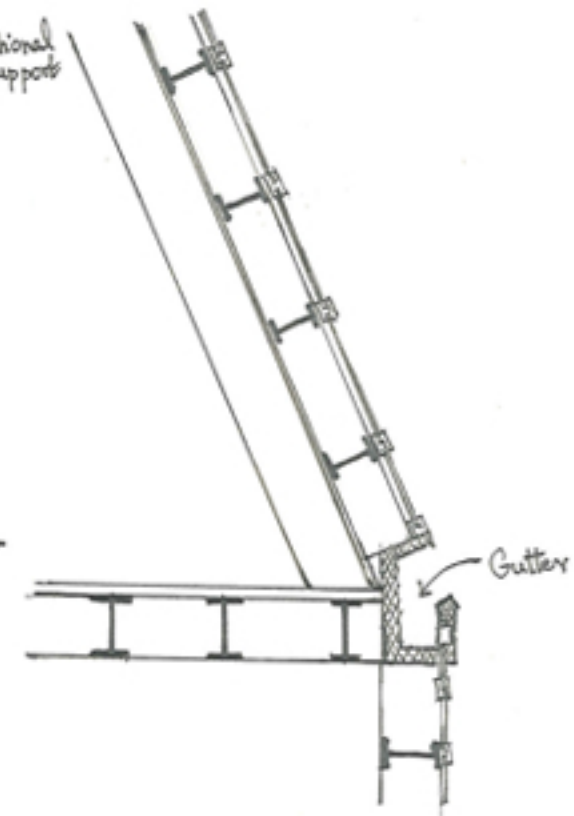
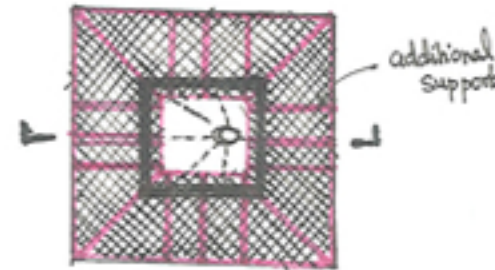
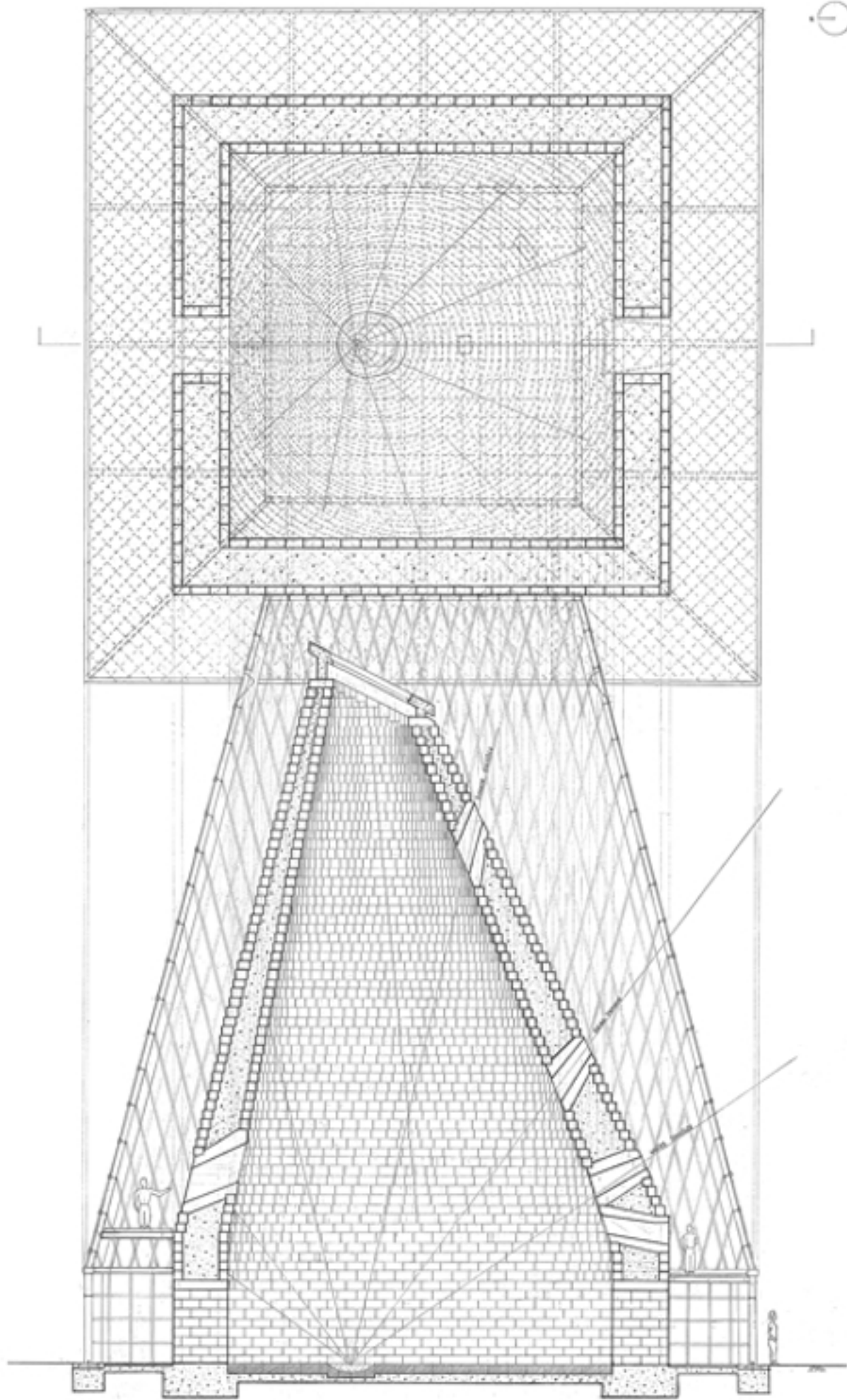


Figure 37



①

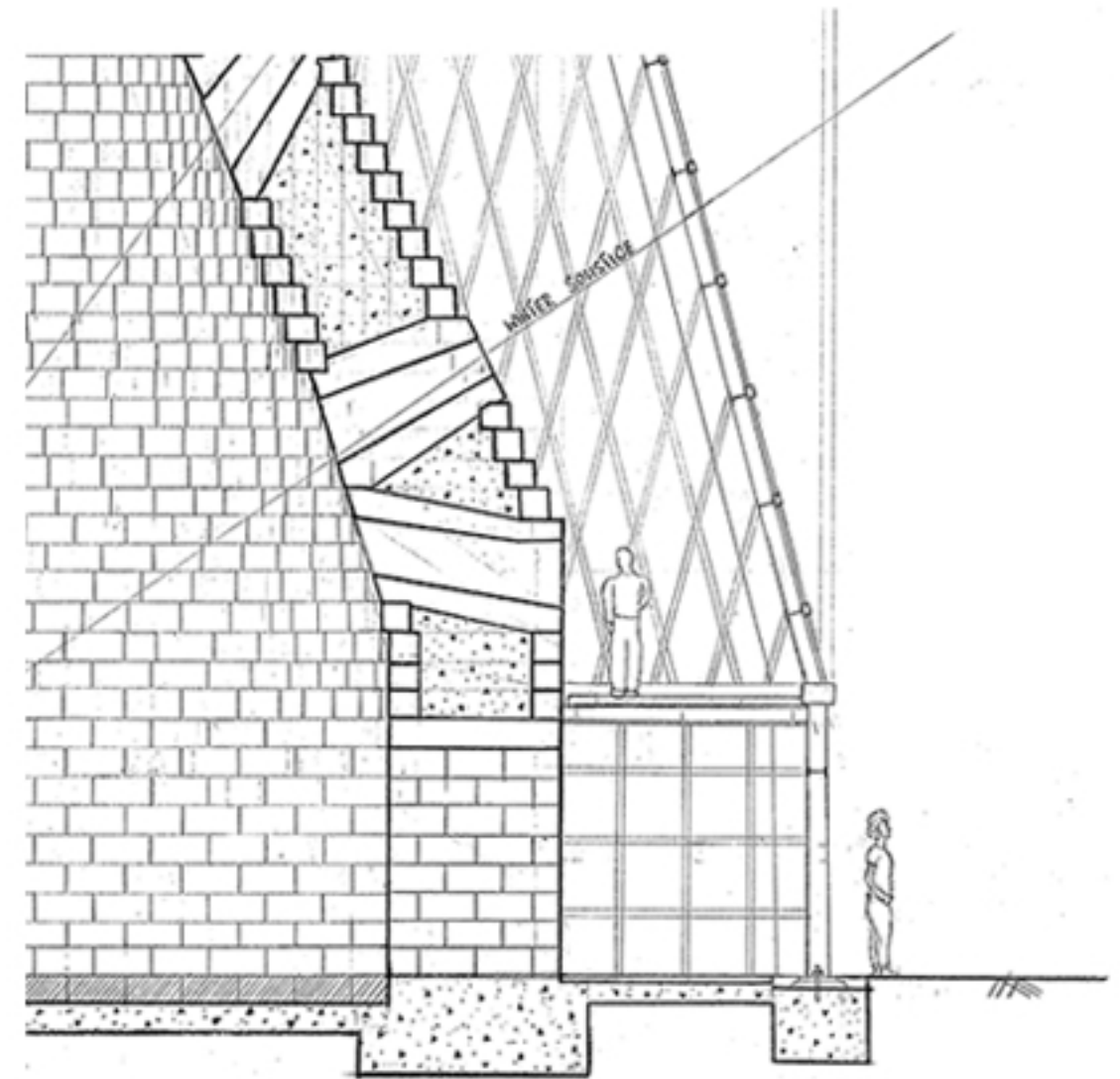
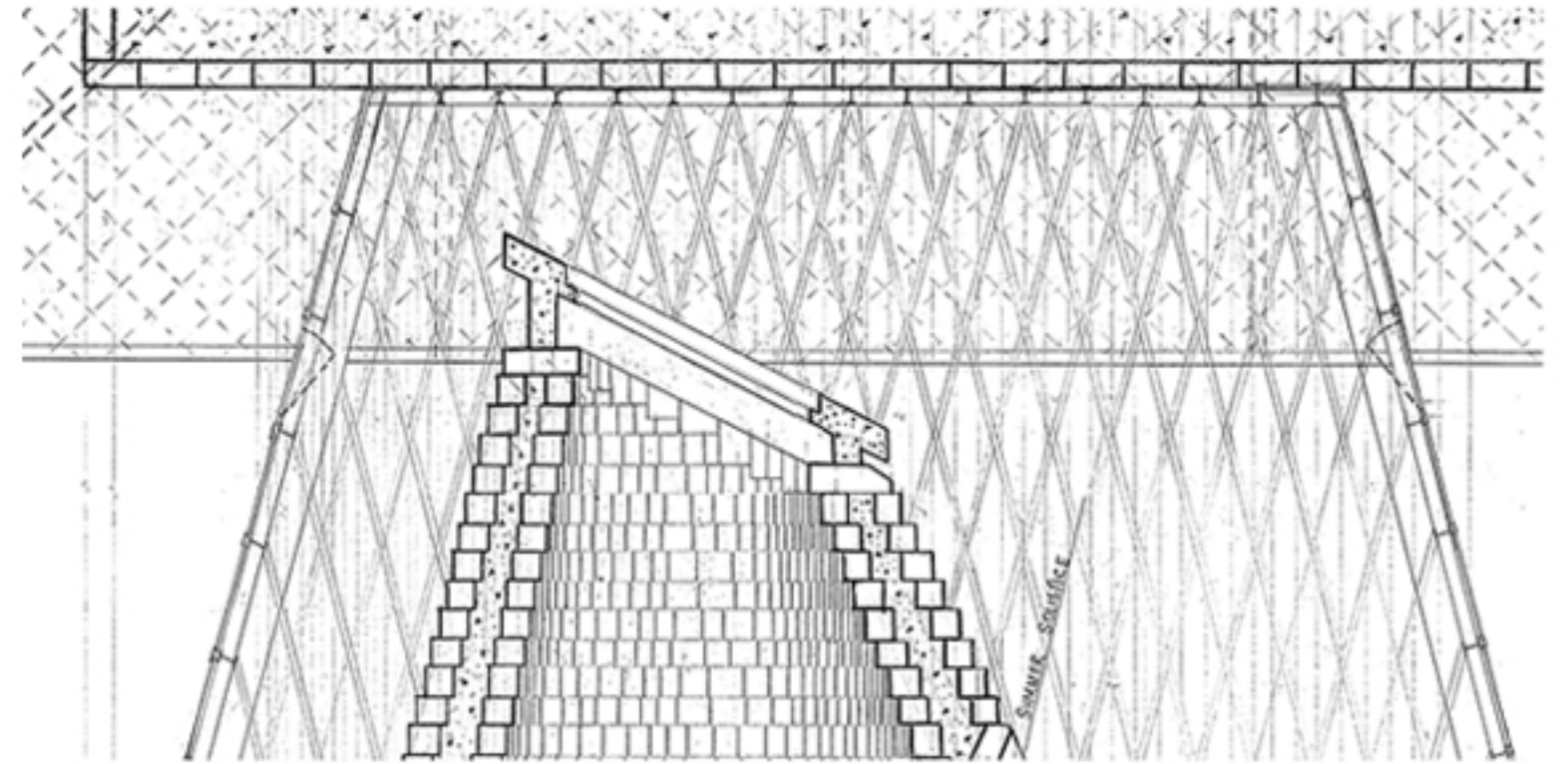


Figure 38

DETAIL SECTION

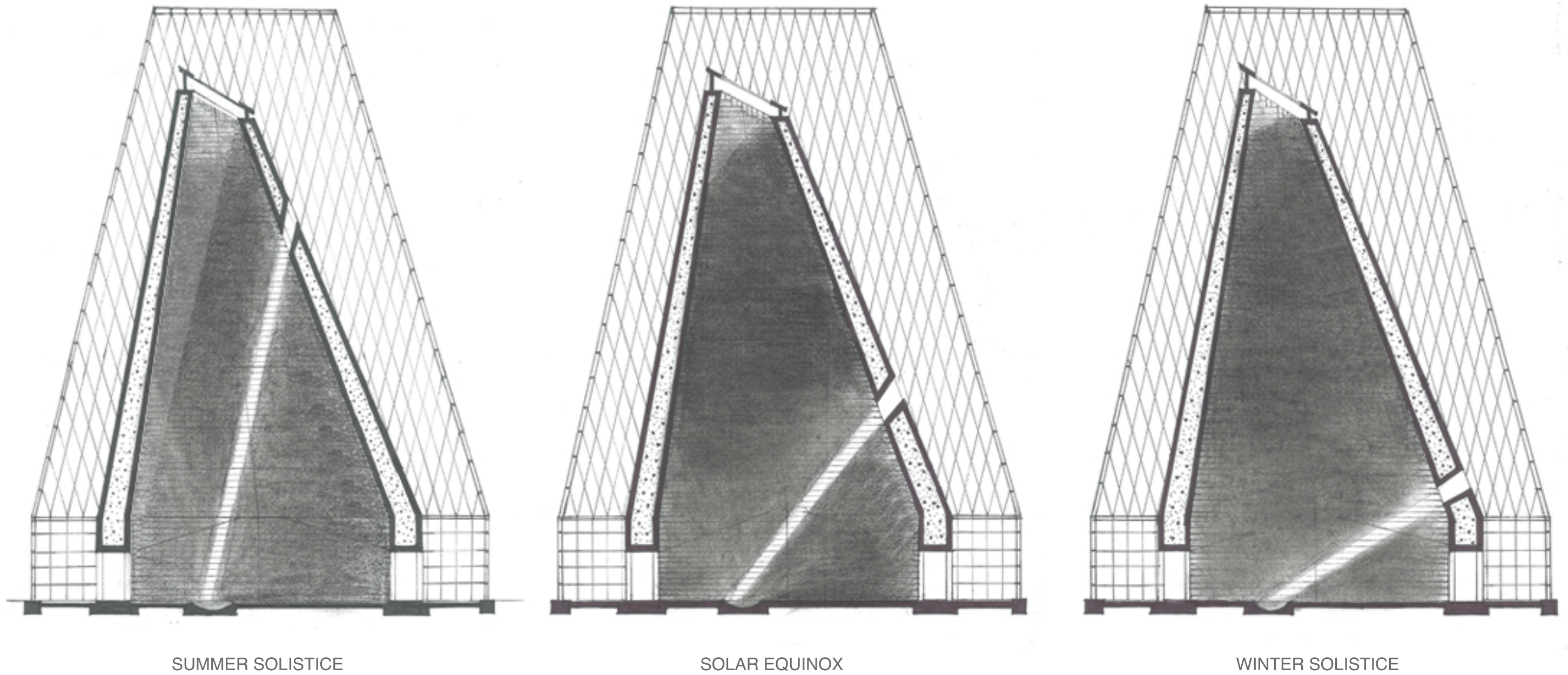
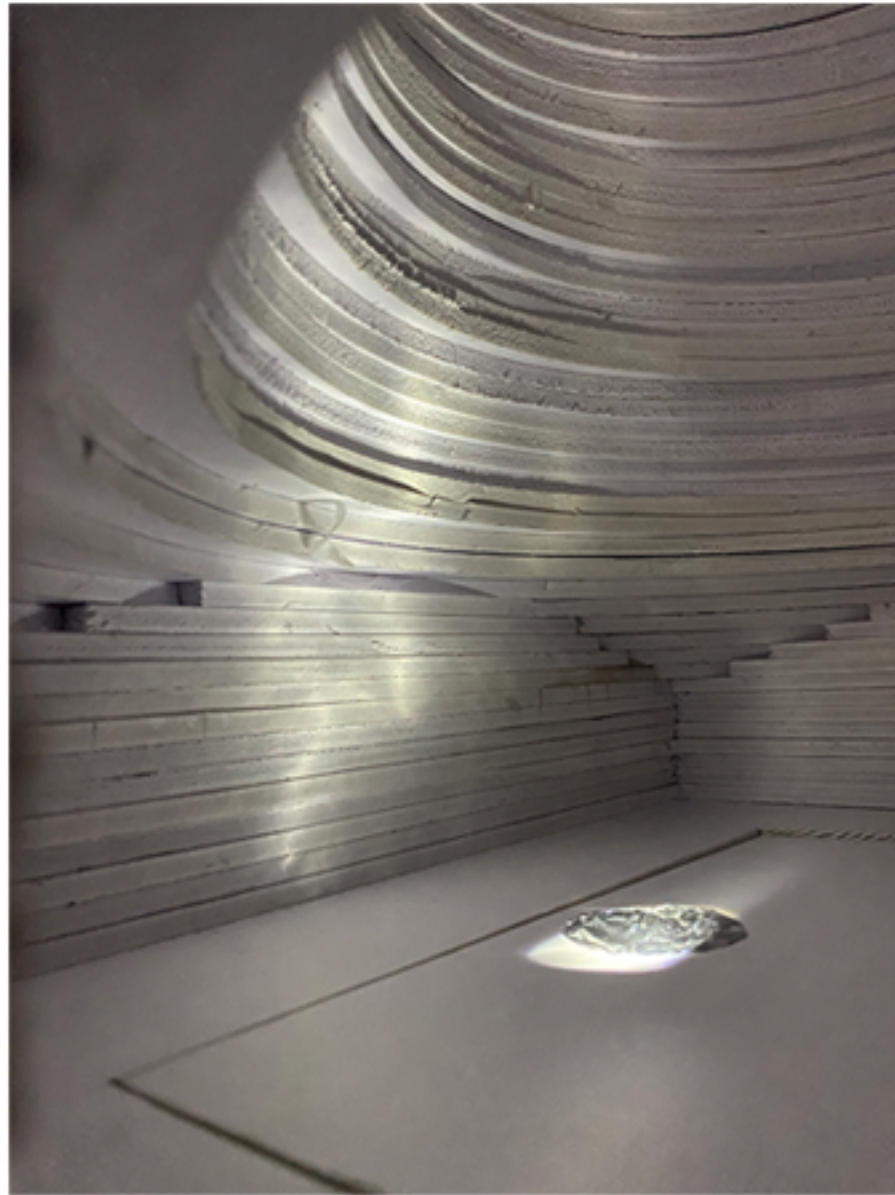
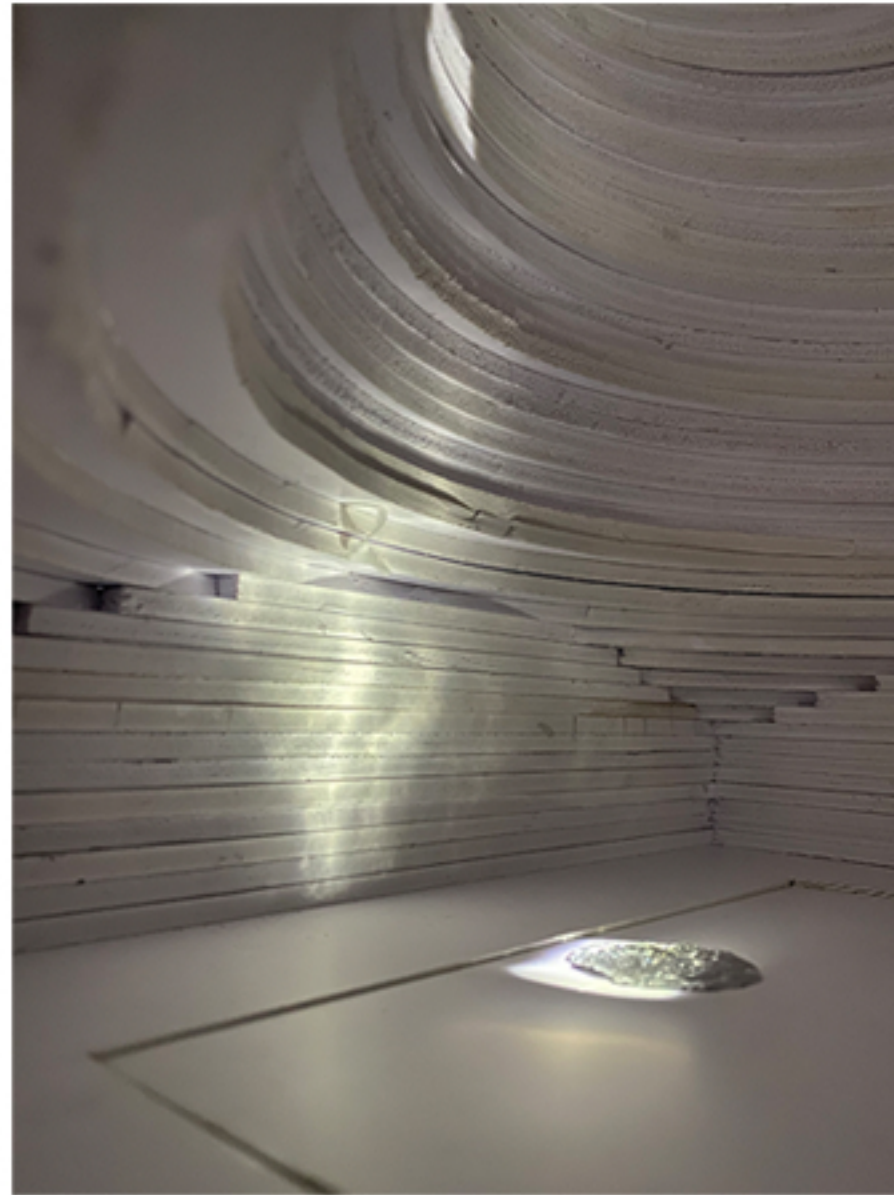


Figure 39

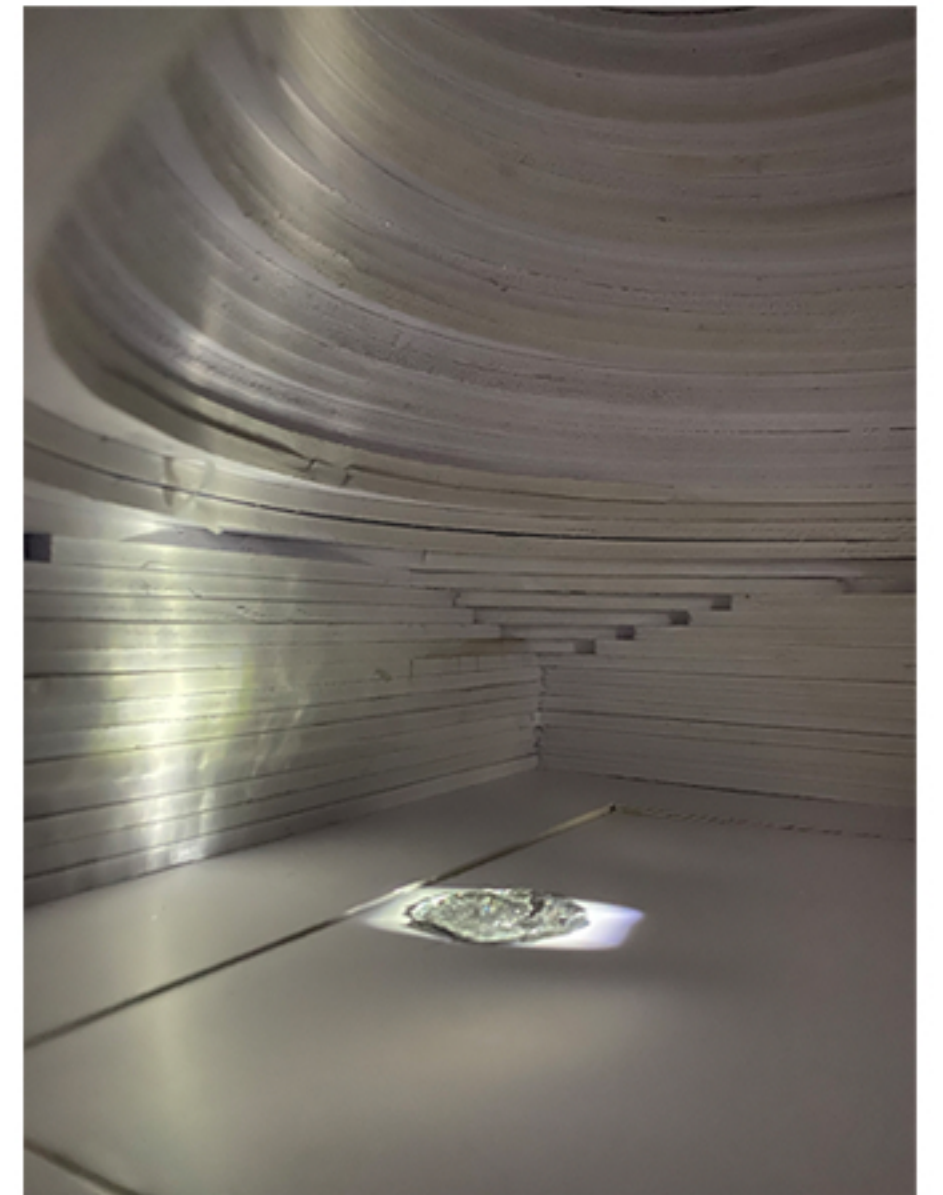
The charcoal drawings represent the desired effect to be created with the three conditions - bringing in daylight at solar noon on summer solstice, equinox and winter solstice. The slits cut in the cone allows one to experience the passing of time and making of time in a sense.



SUMMER SOLISTICE



SOLAR EQUINOX

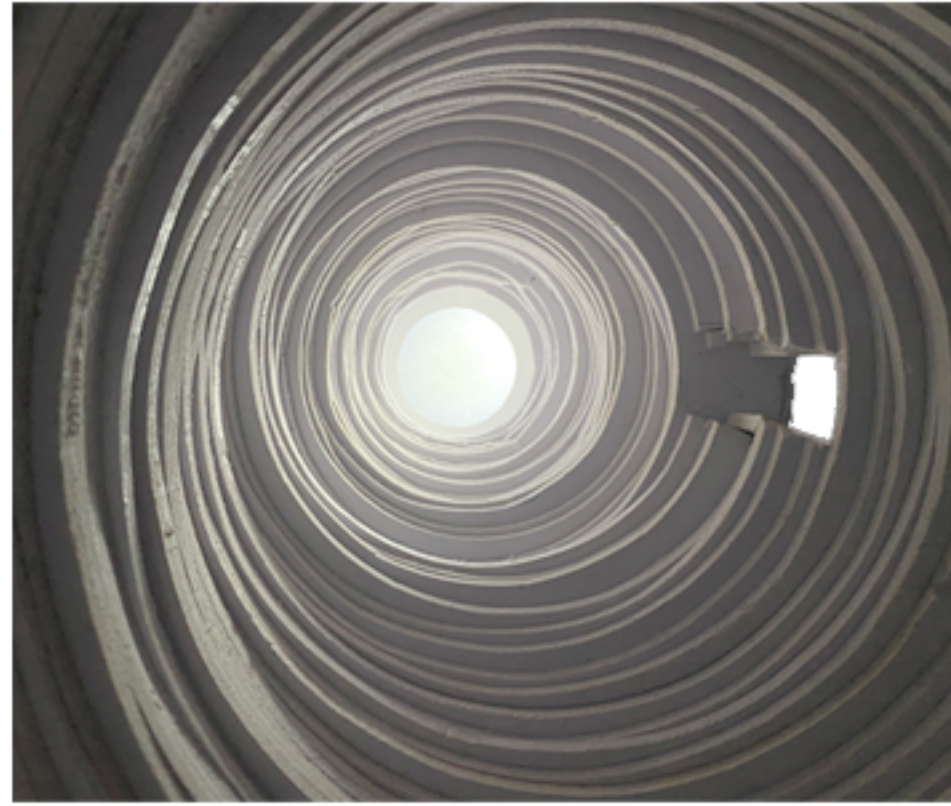


WINTER SOLISTICE

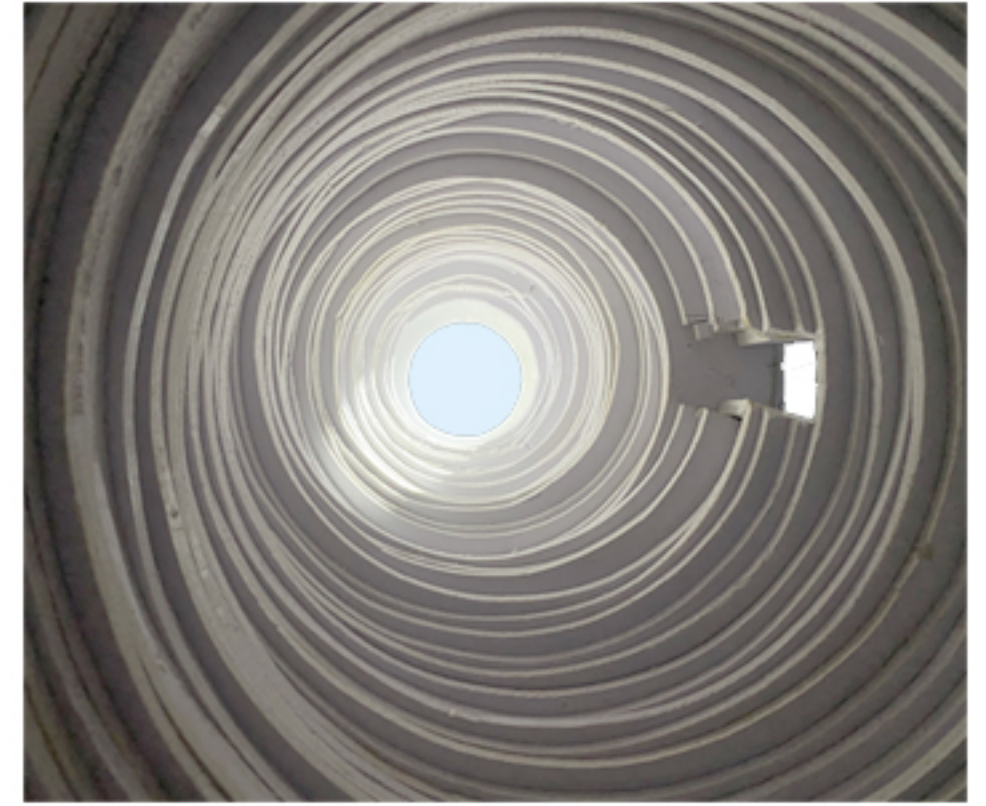
Figure 40



OPAQUE



TRANSLUCENT



OPEN TO SKY

Figure 41

TREATMENT OF THE CROWN

The exploration for the treatment of the crown lead to the decision of the openness to the sky due to the spiritual connections to the heavens that it brings.

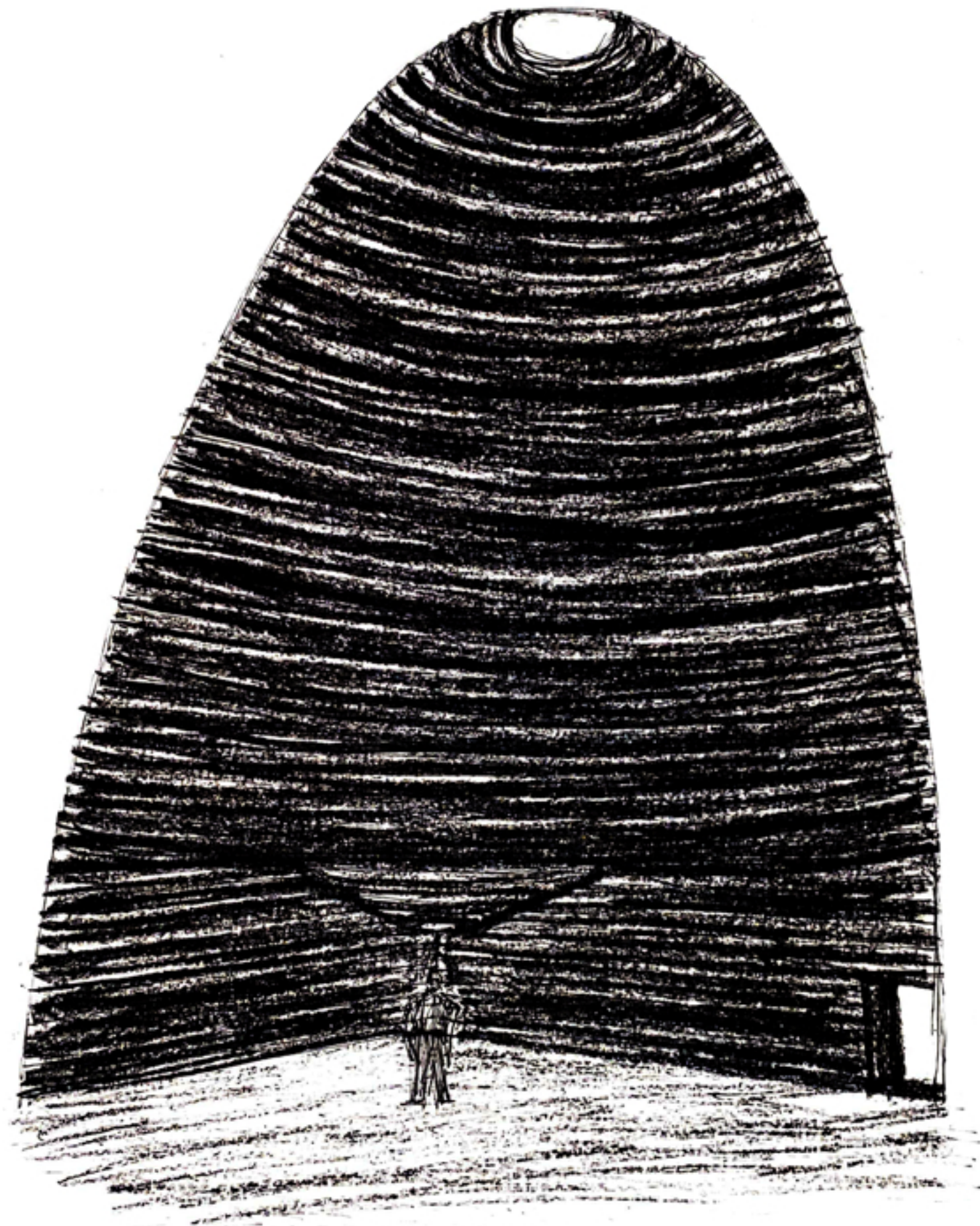


Figure 42

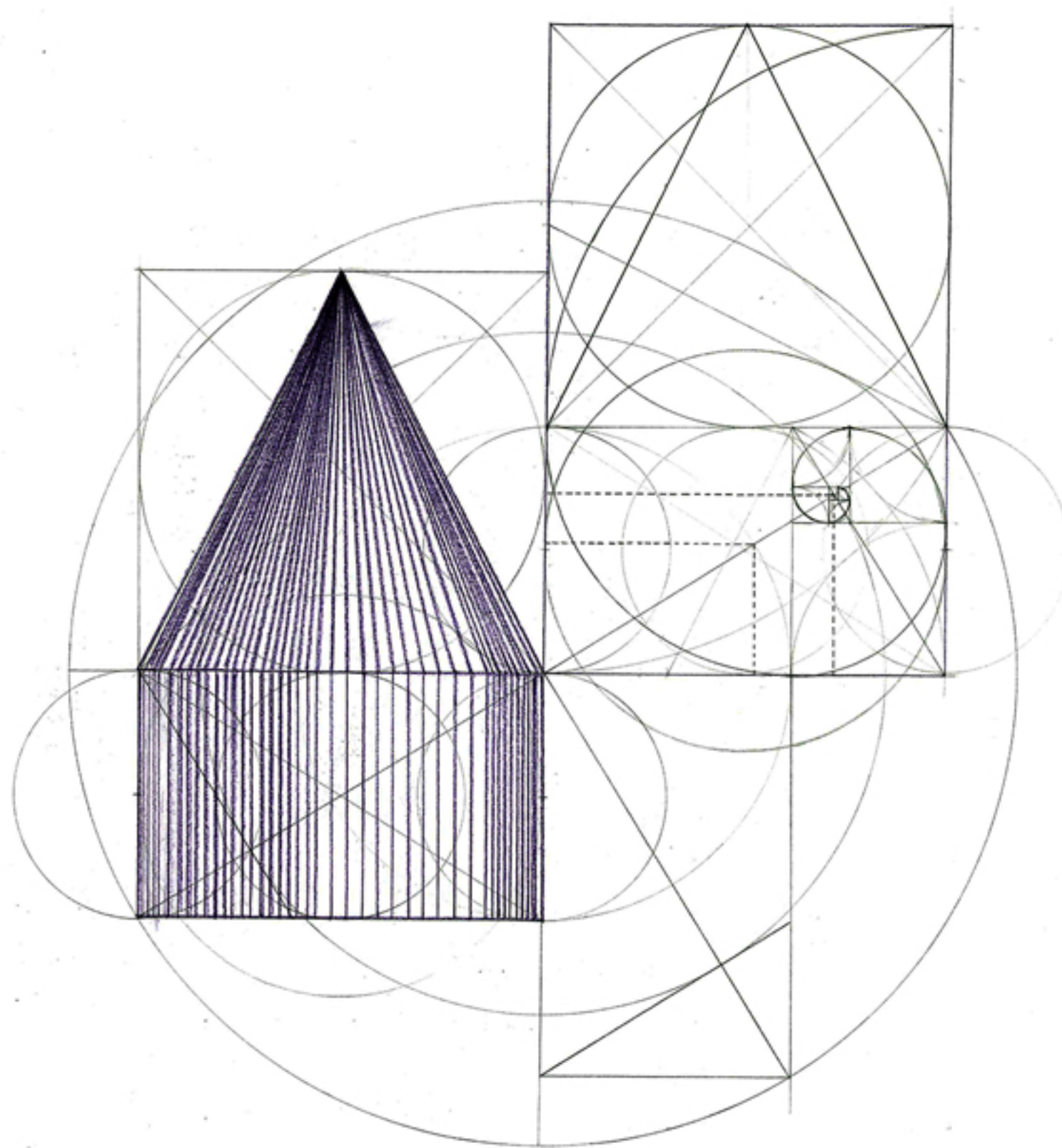


Figure 43

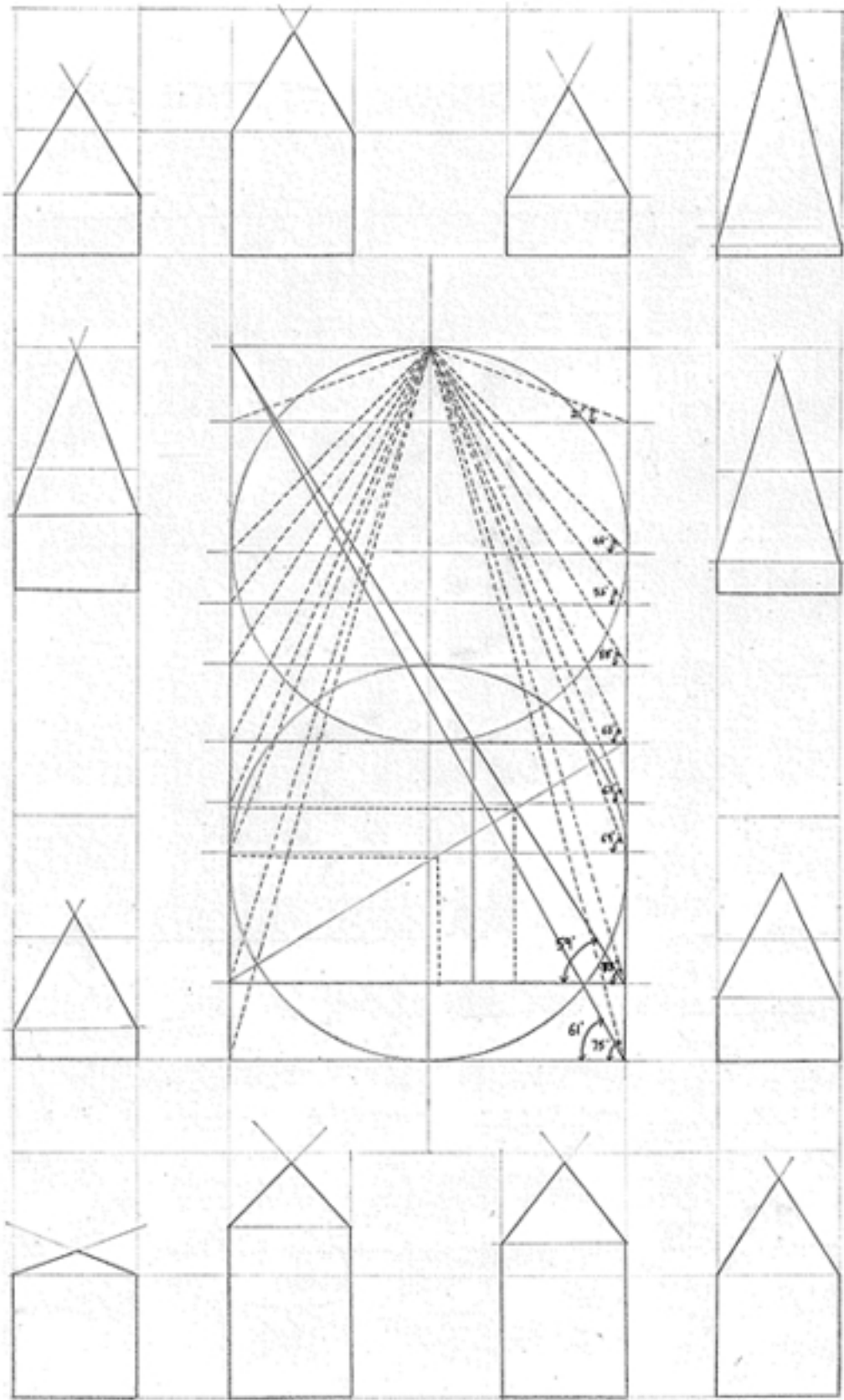


Figure 44

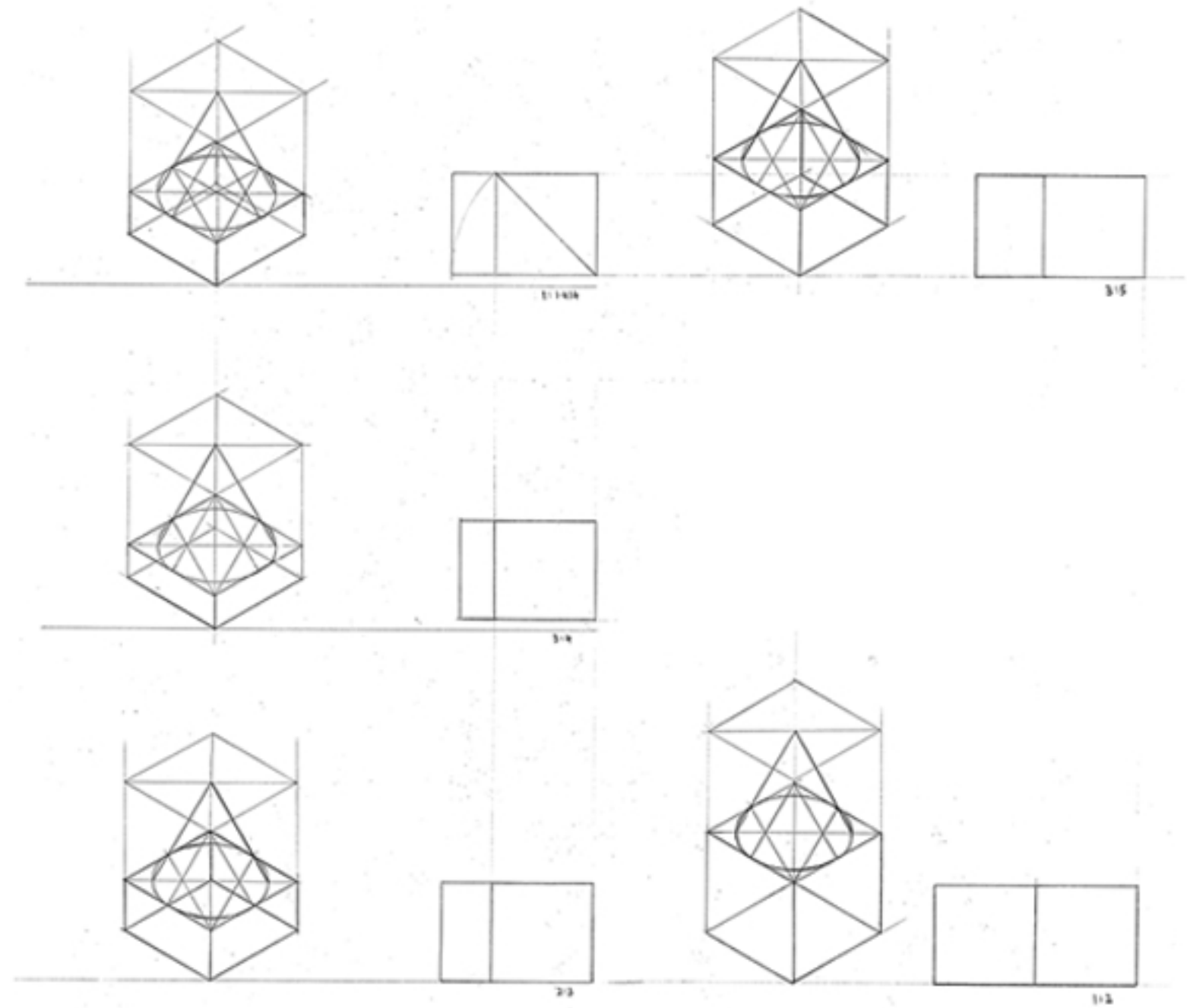
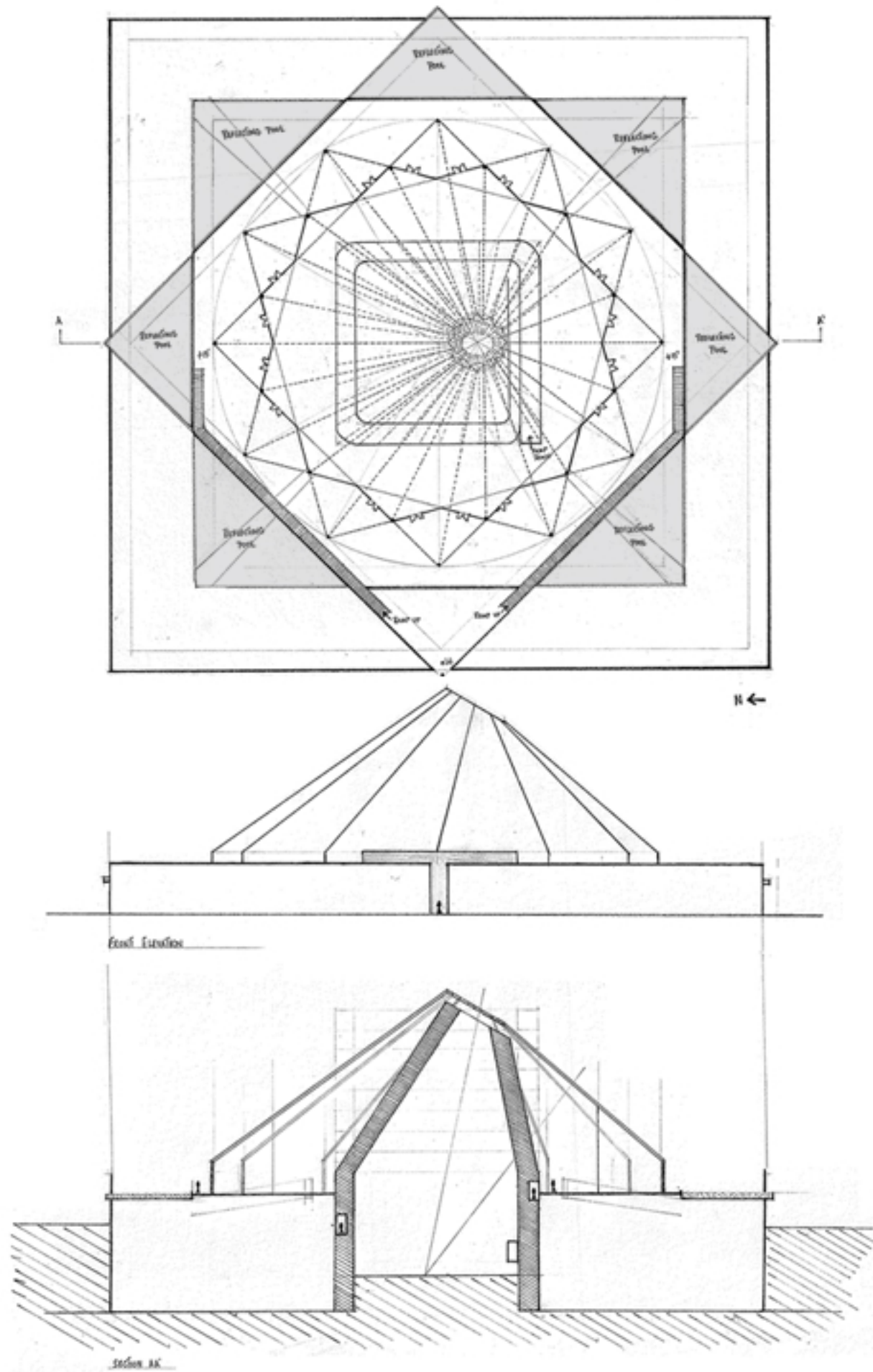


Figure 45



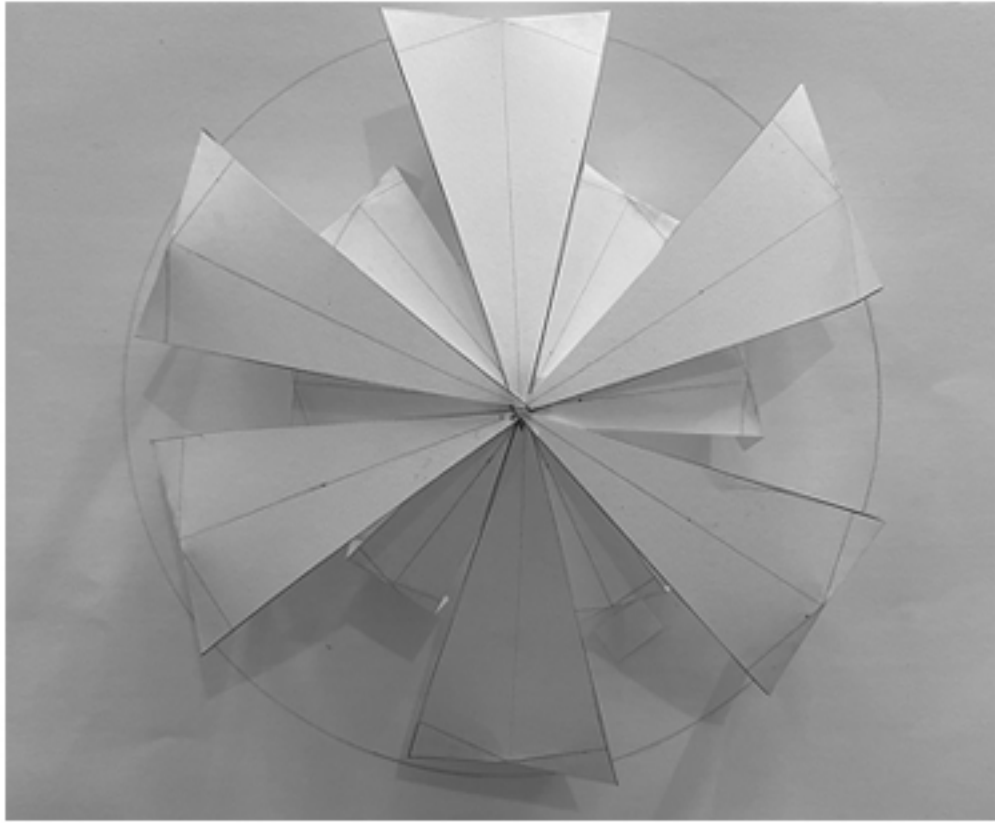


Figure 47

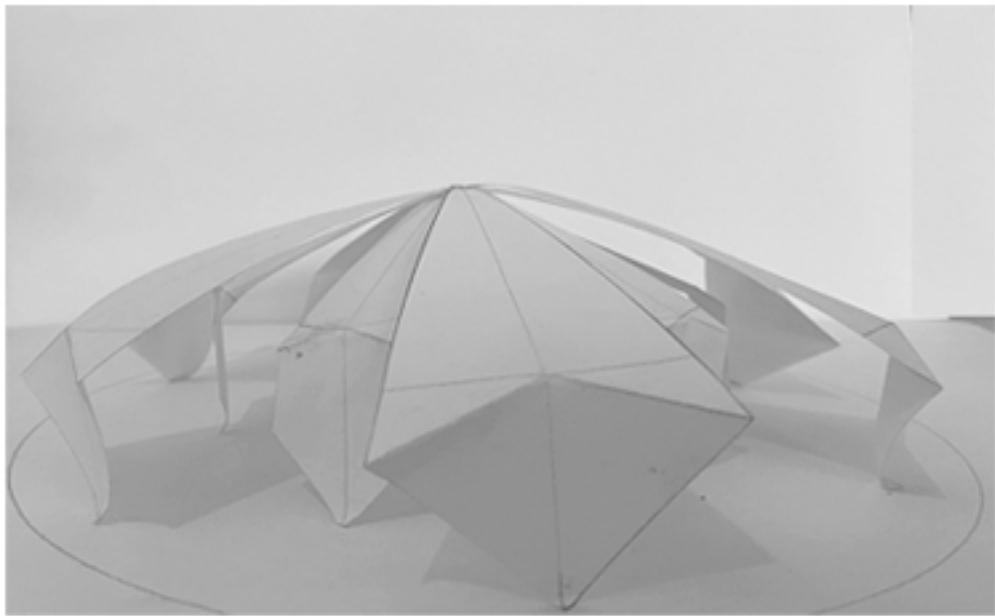


Figure 48

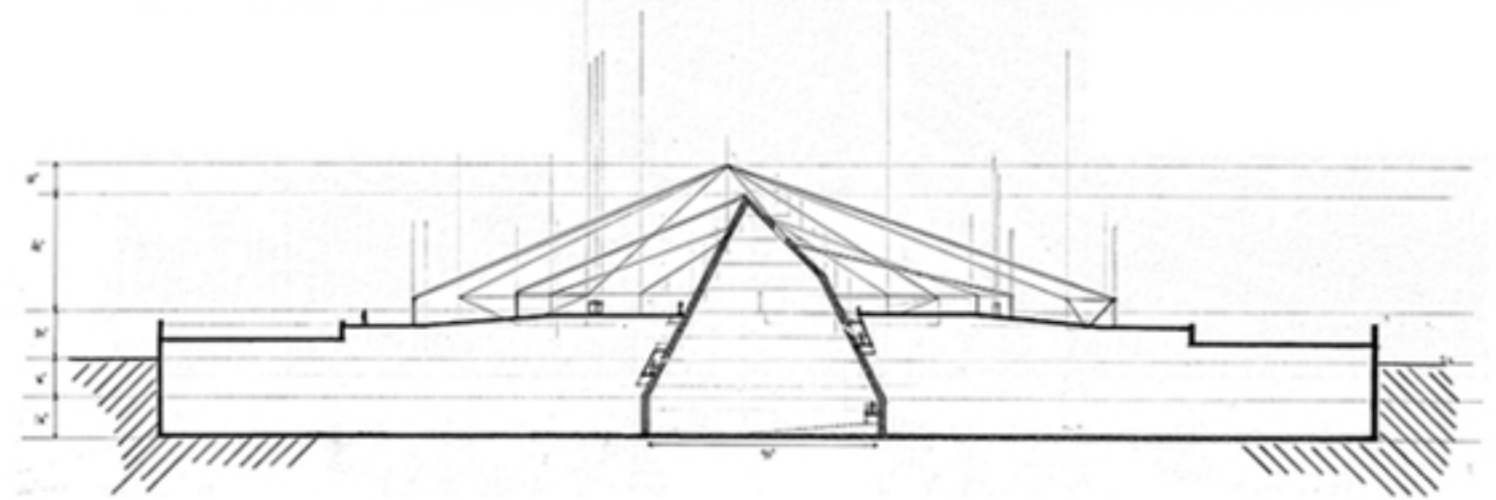
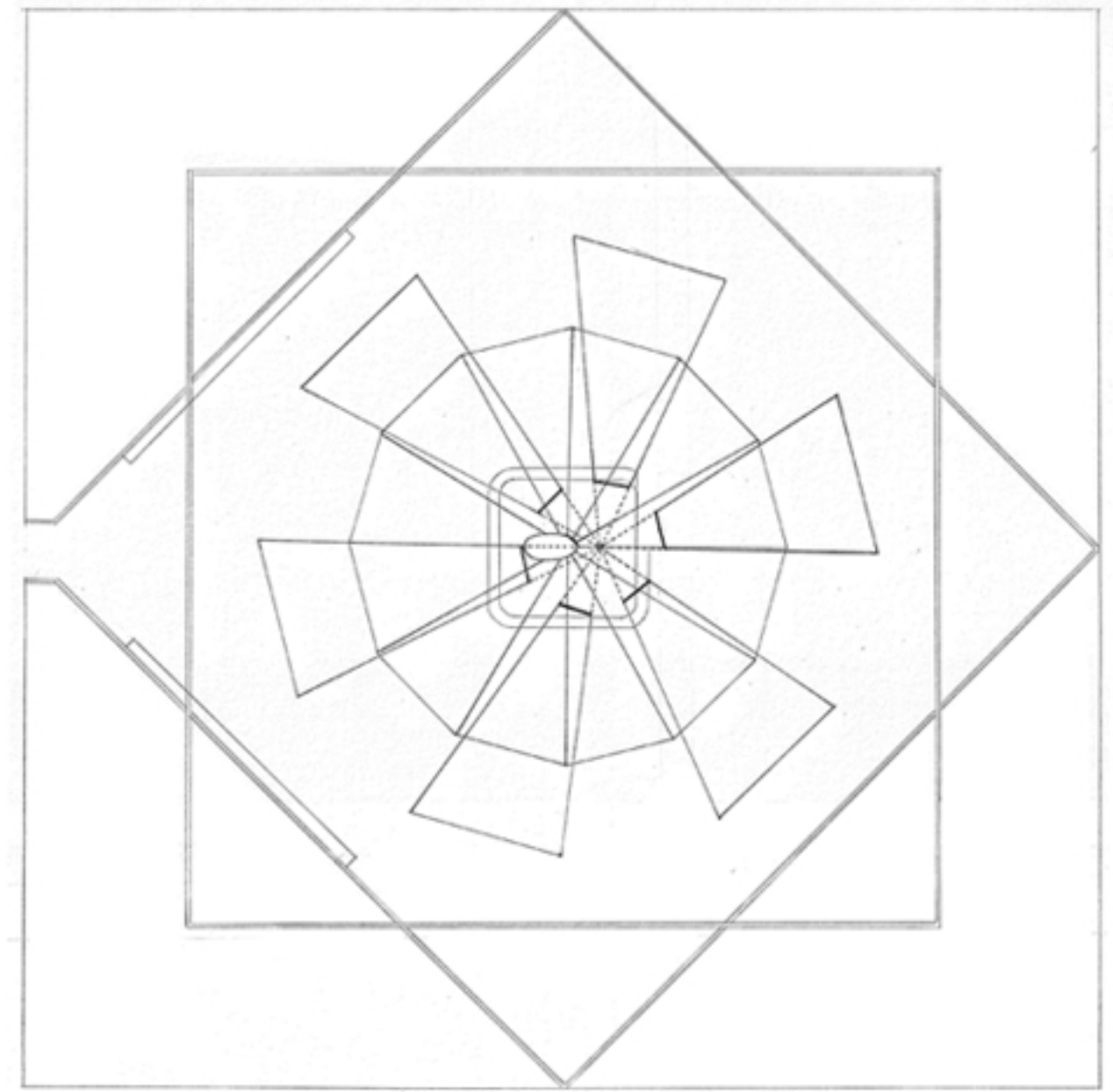


Figure 49

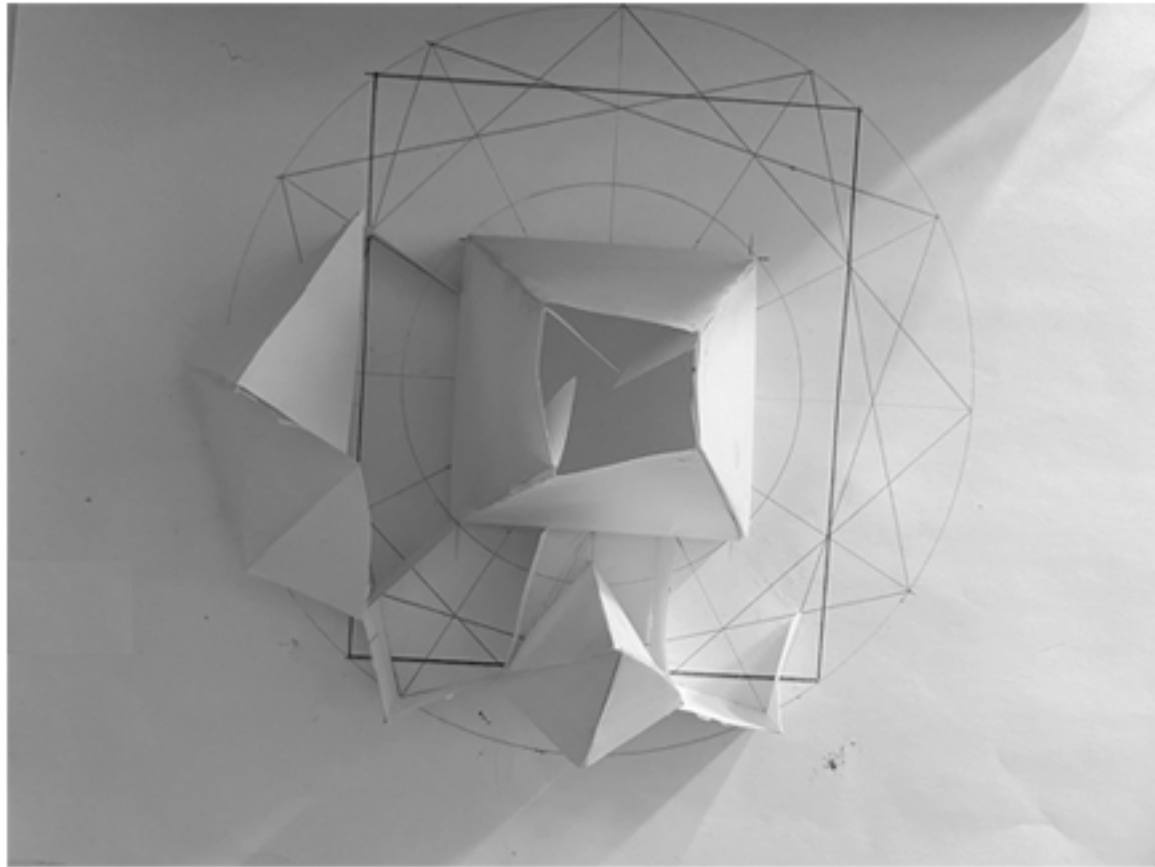


Figure 50

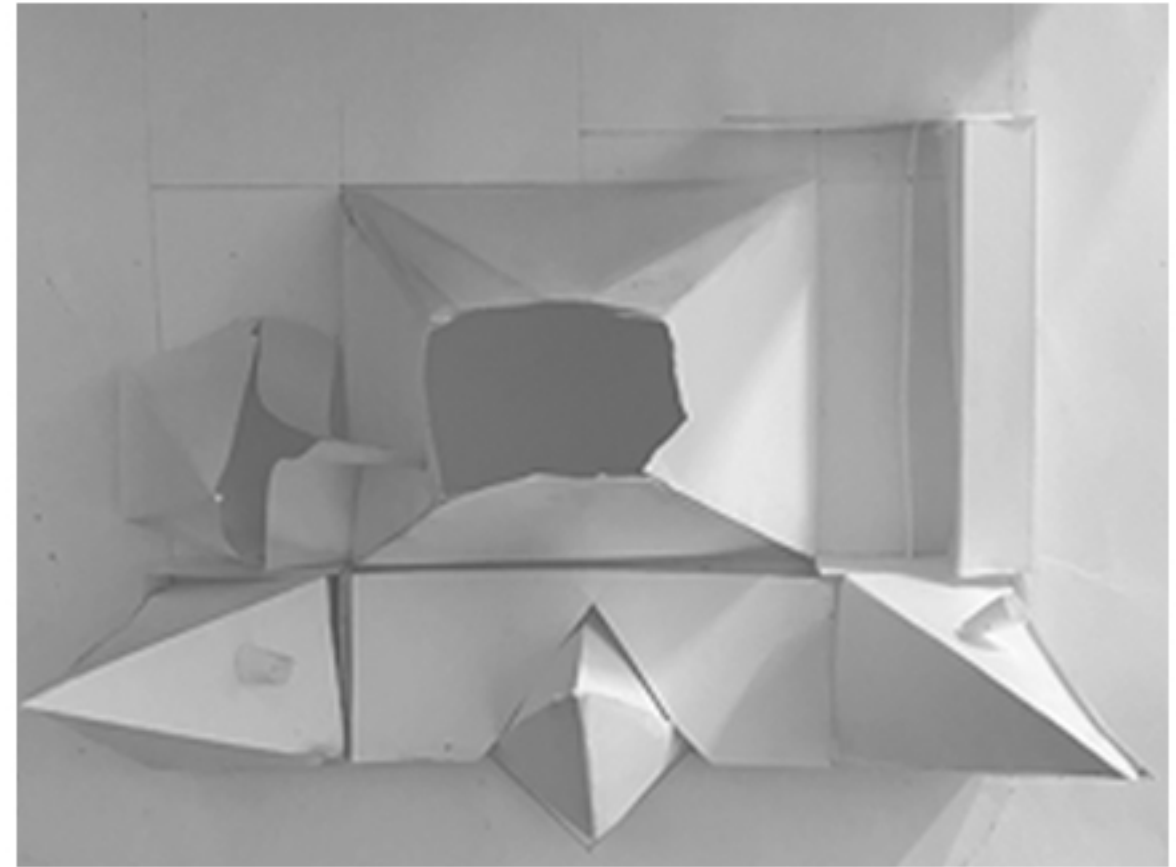


Figure 52

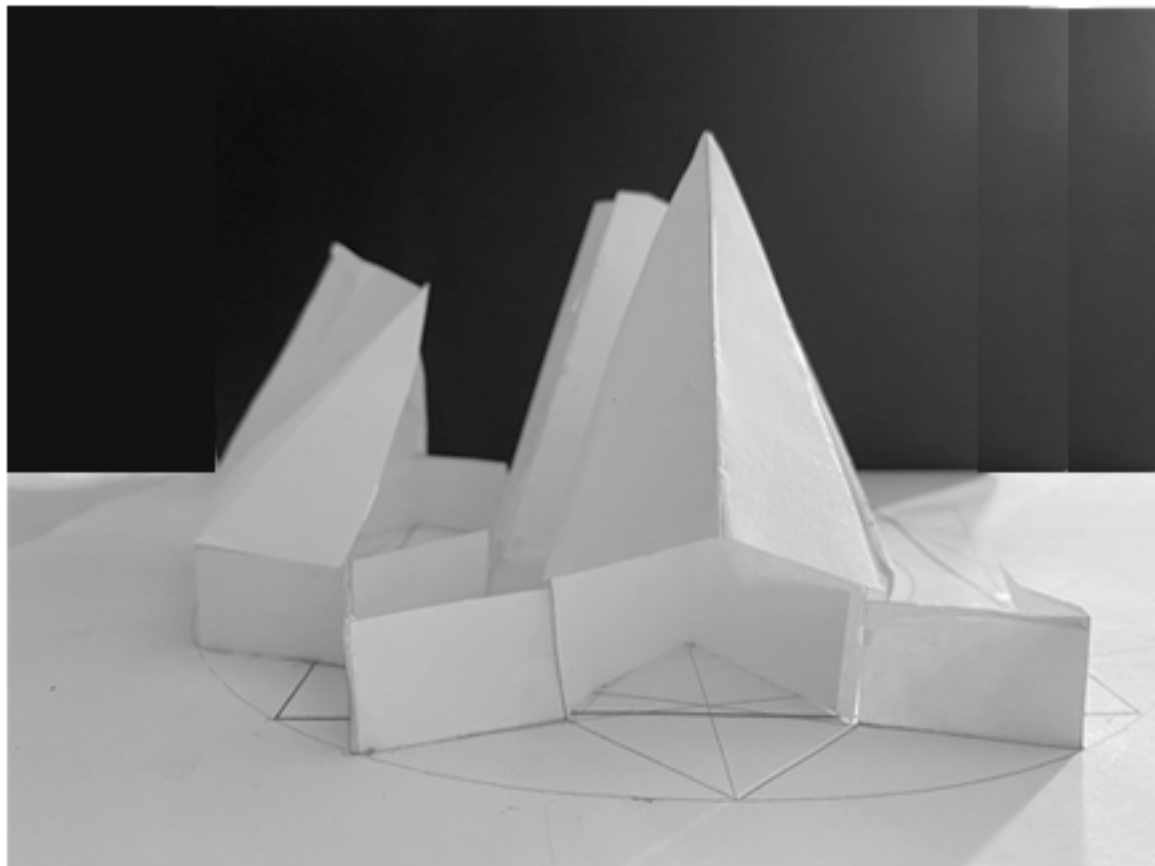


Figure 51

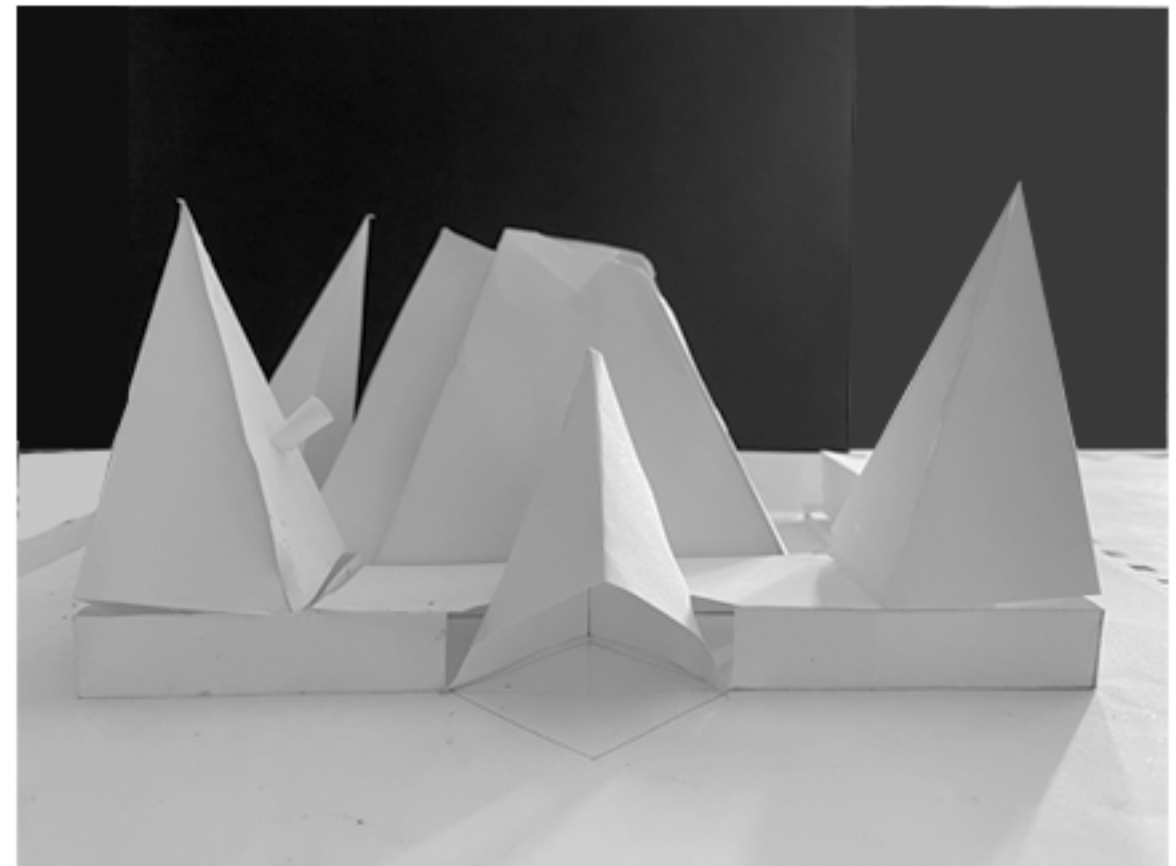


Figure 53

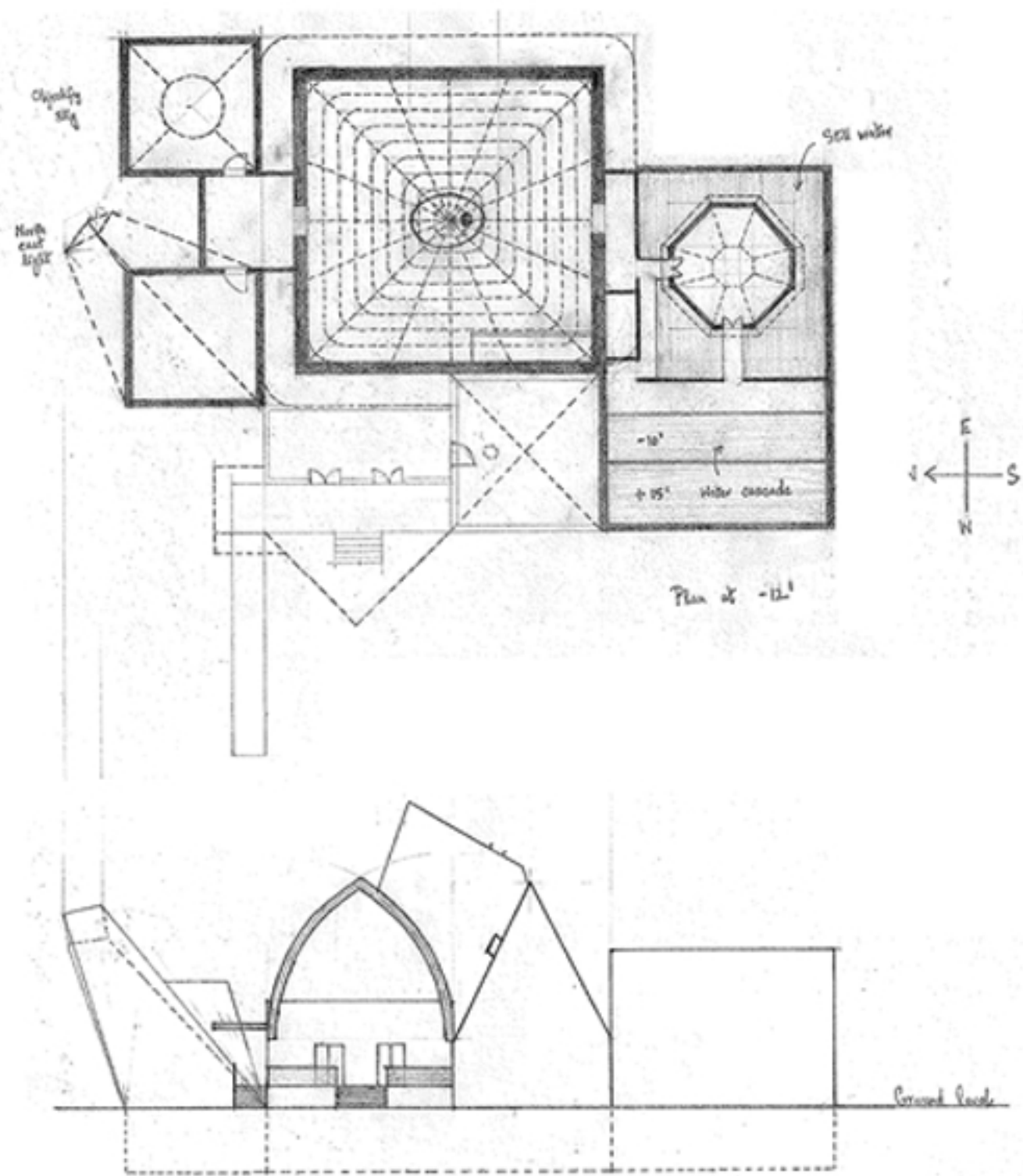


Figure 54

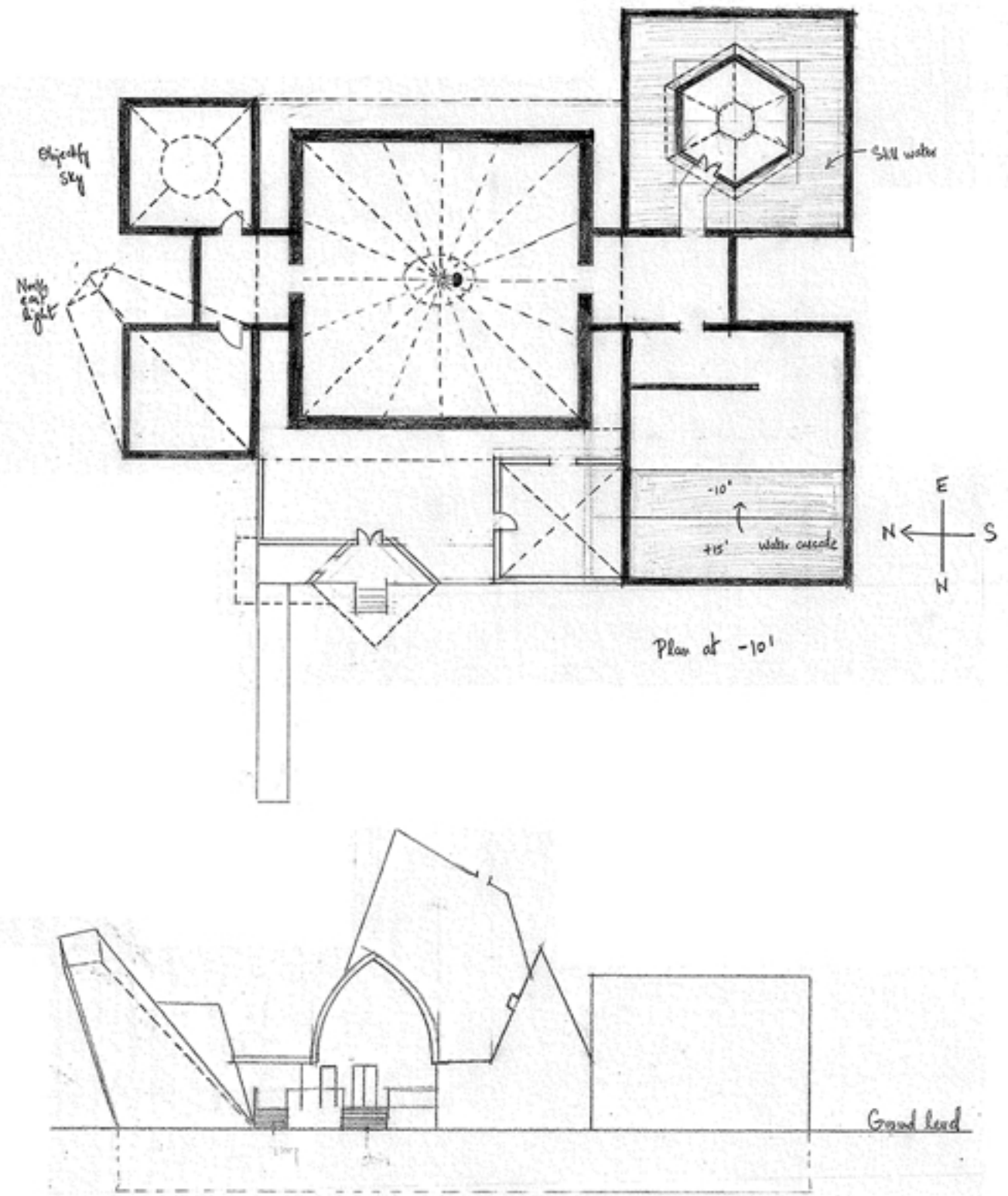
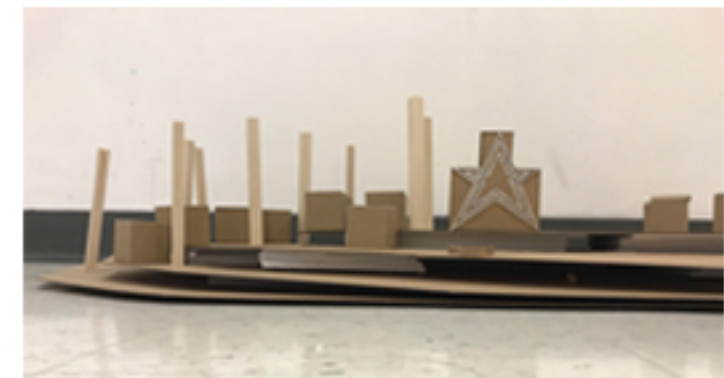
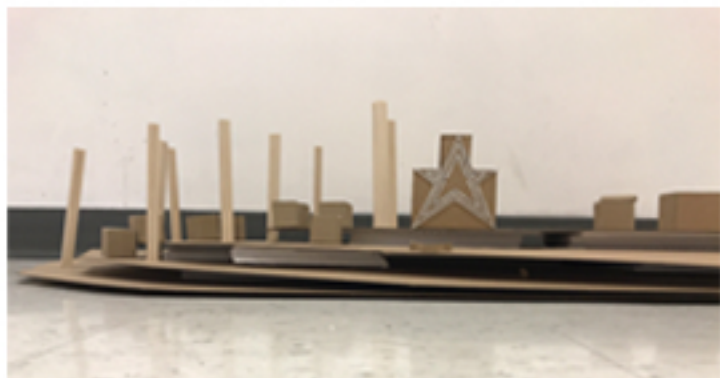
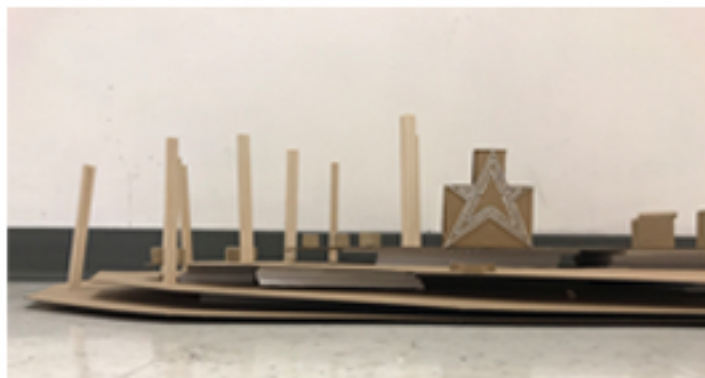
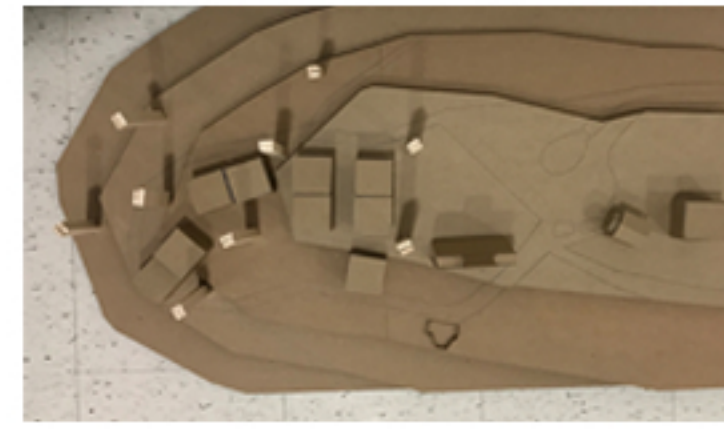
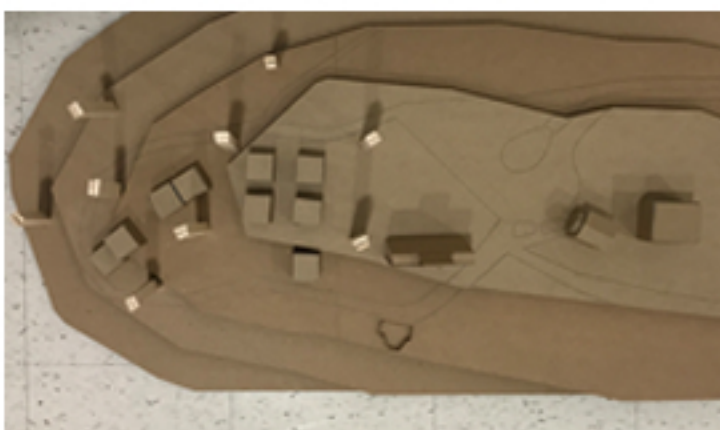
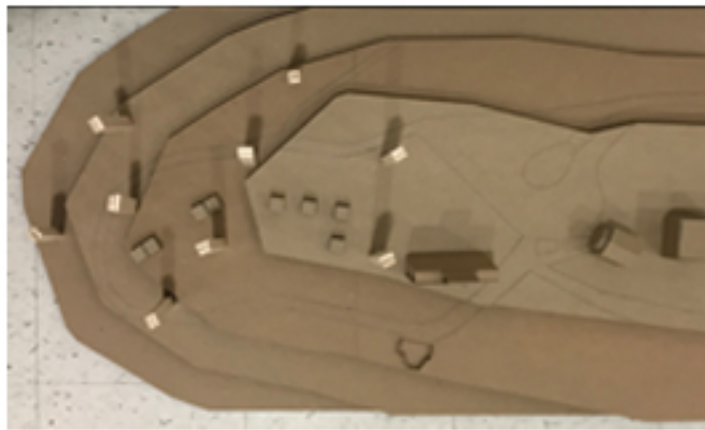
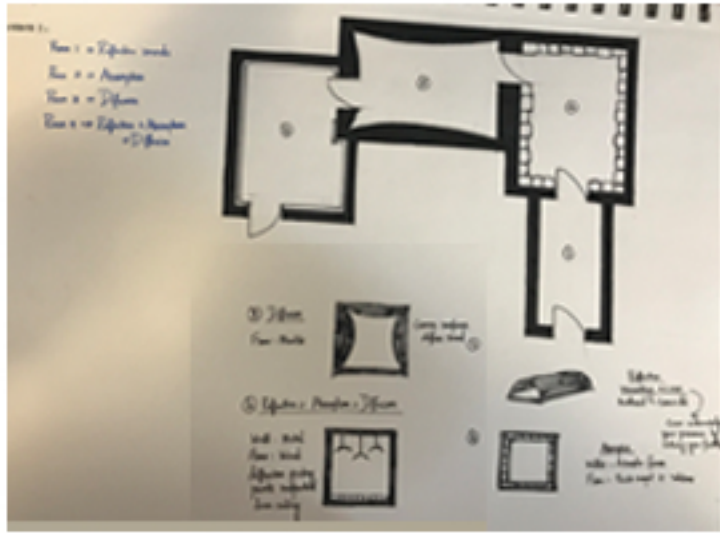
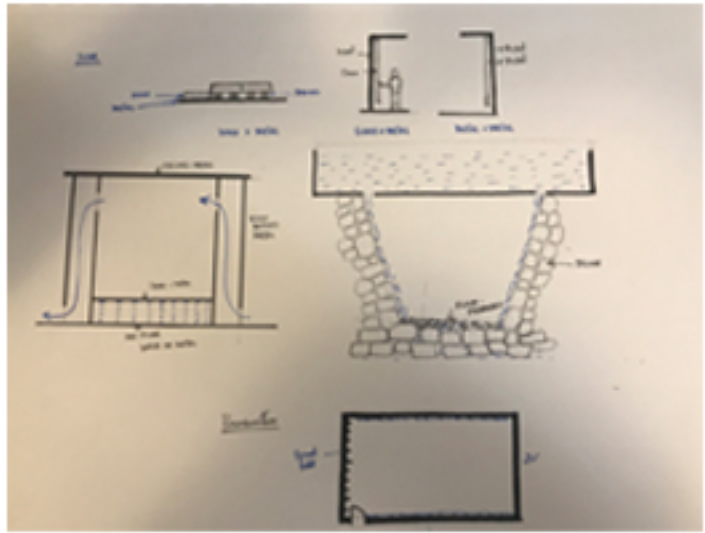
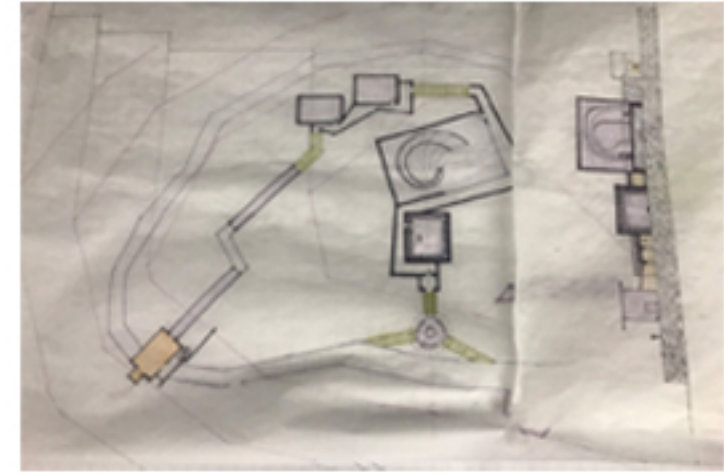
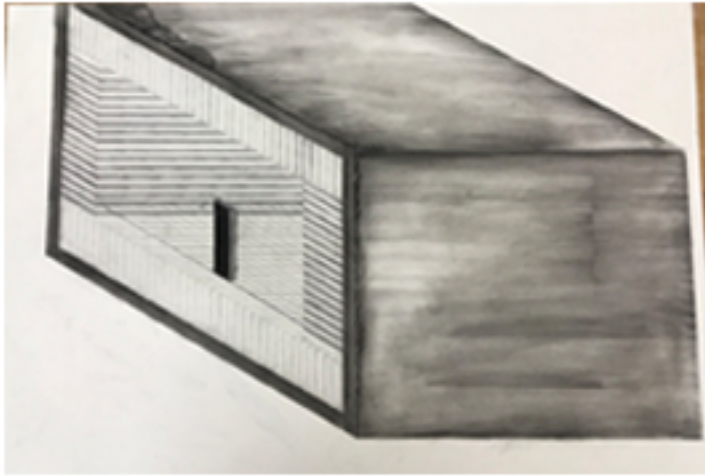
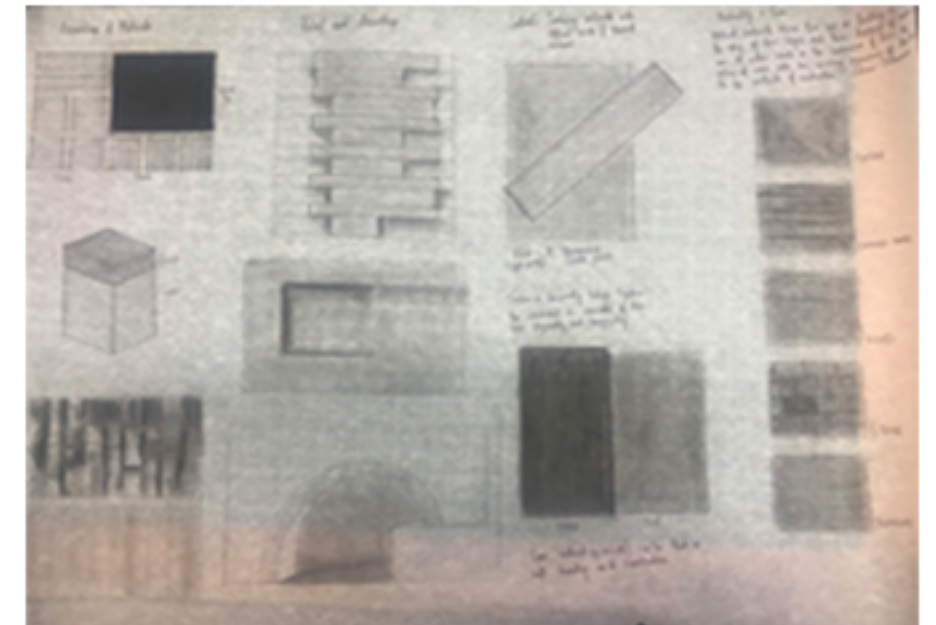
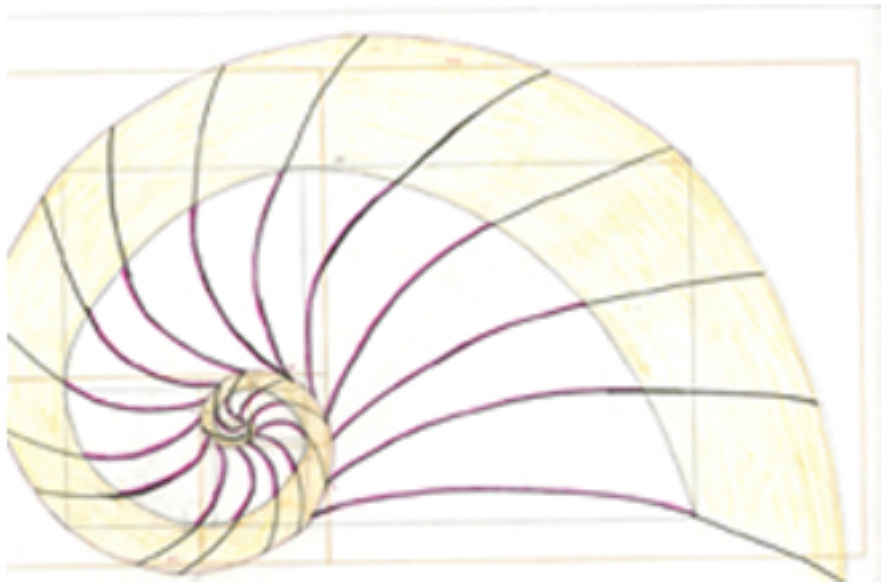
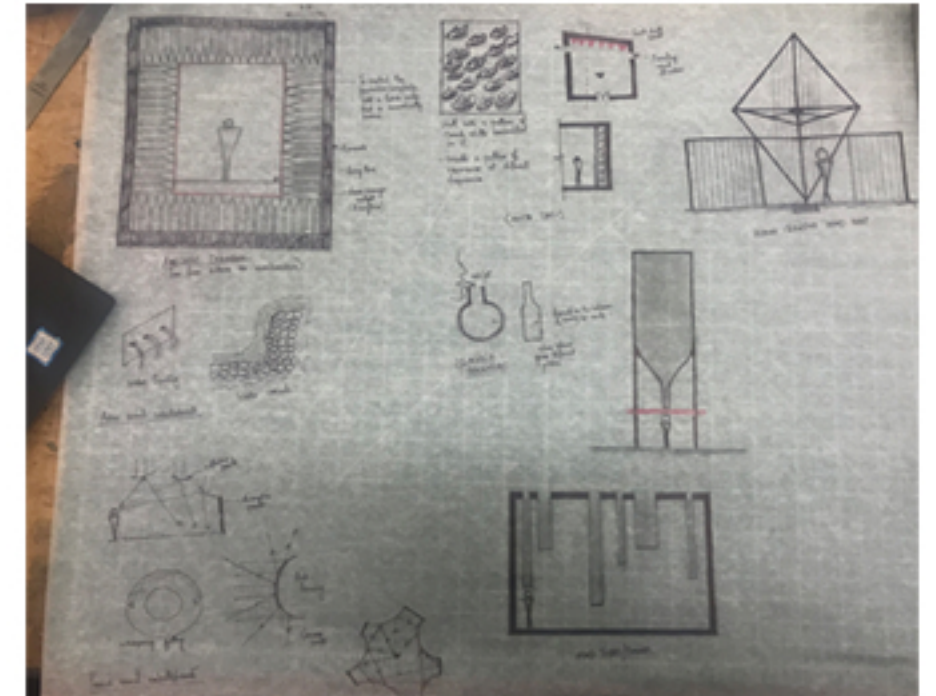
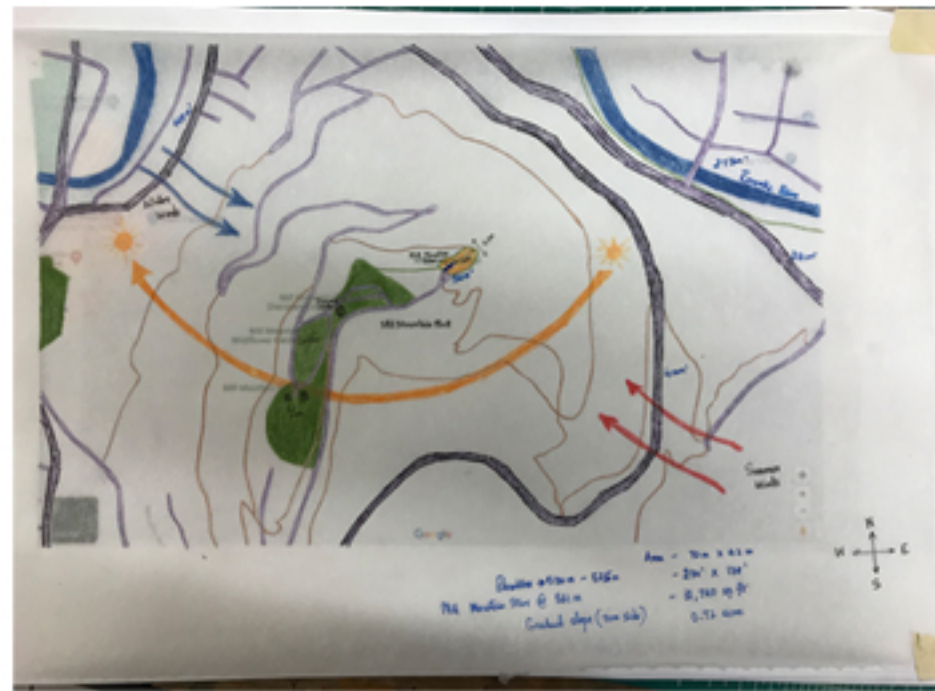
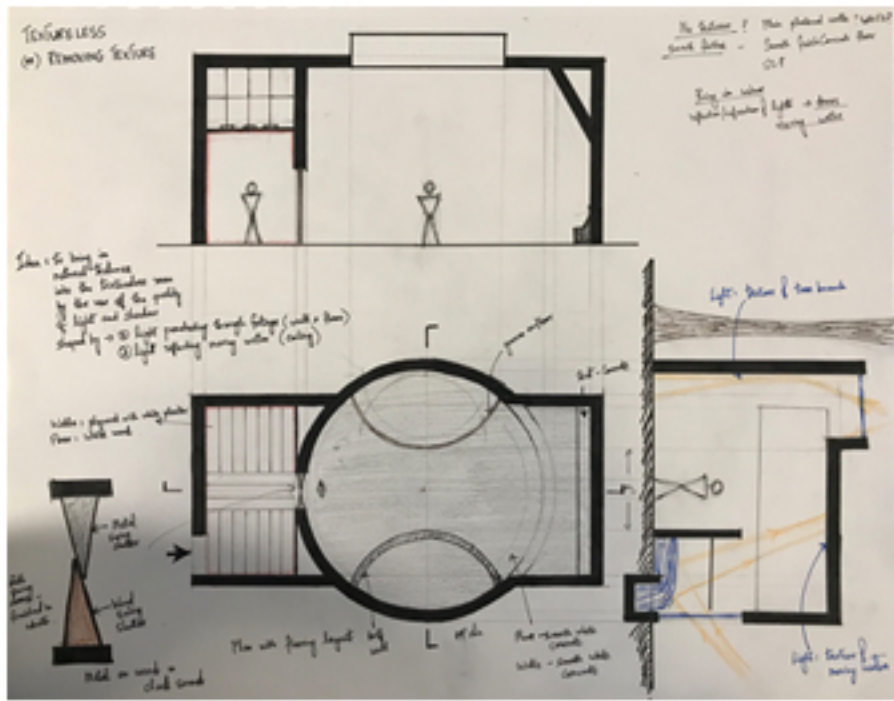
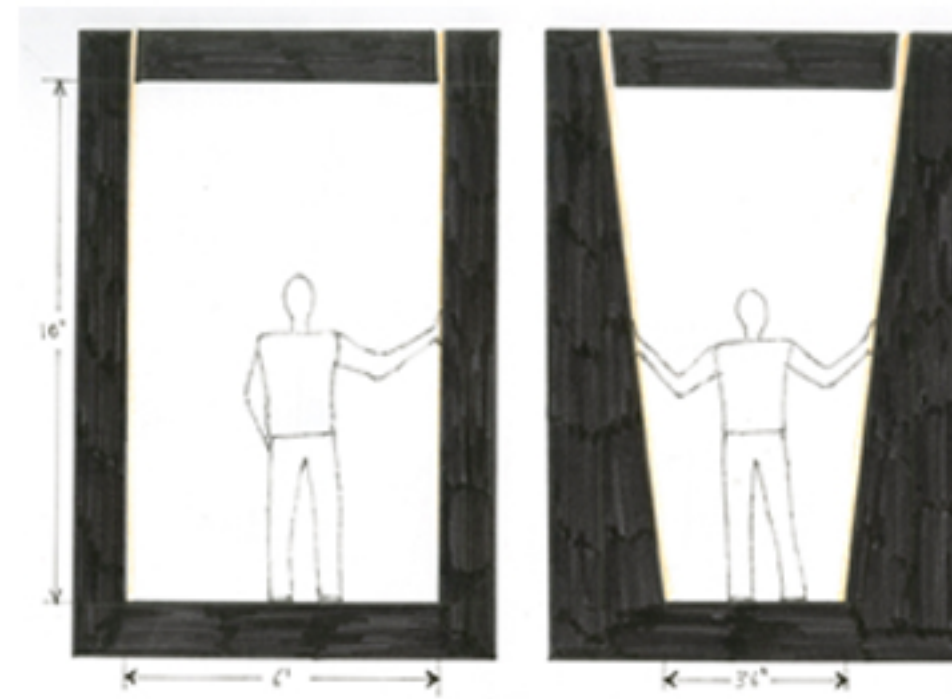
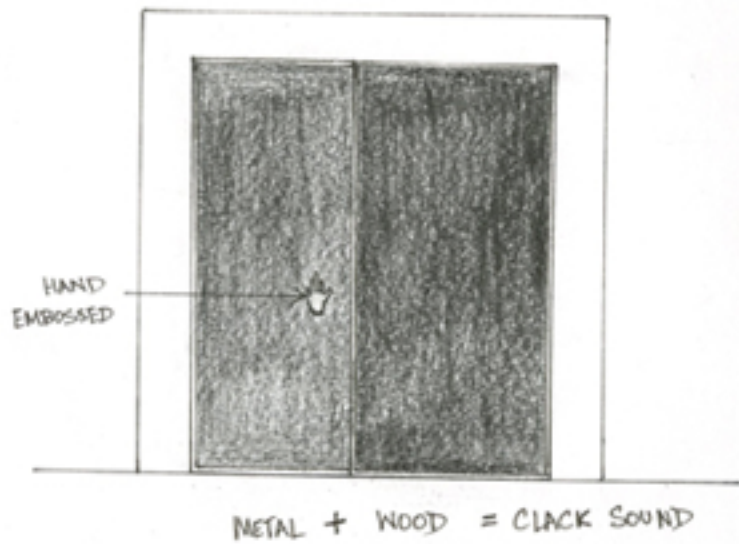
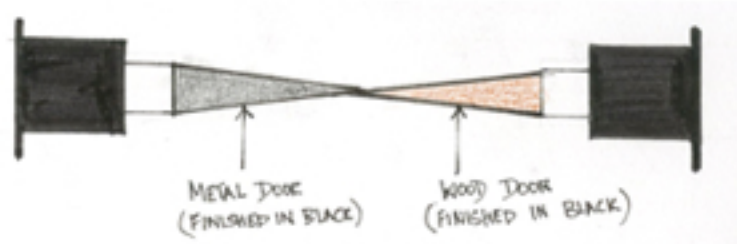
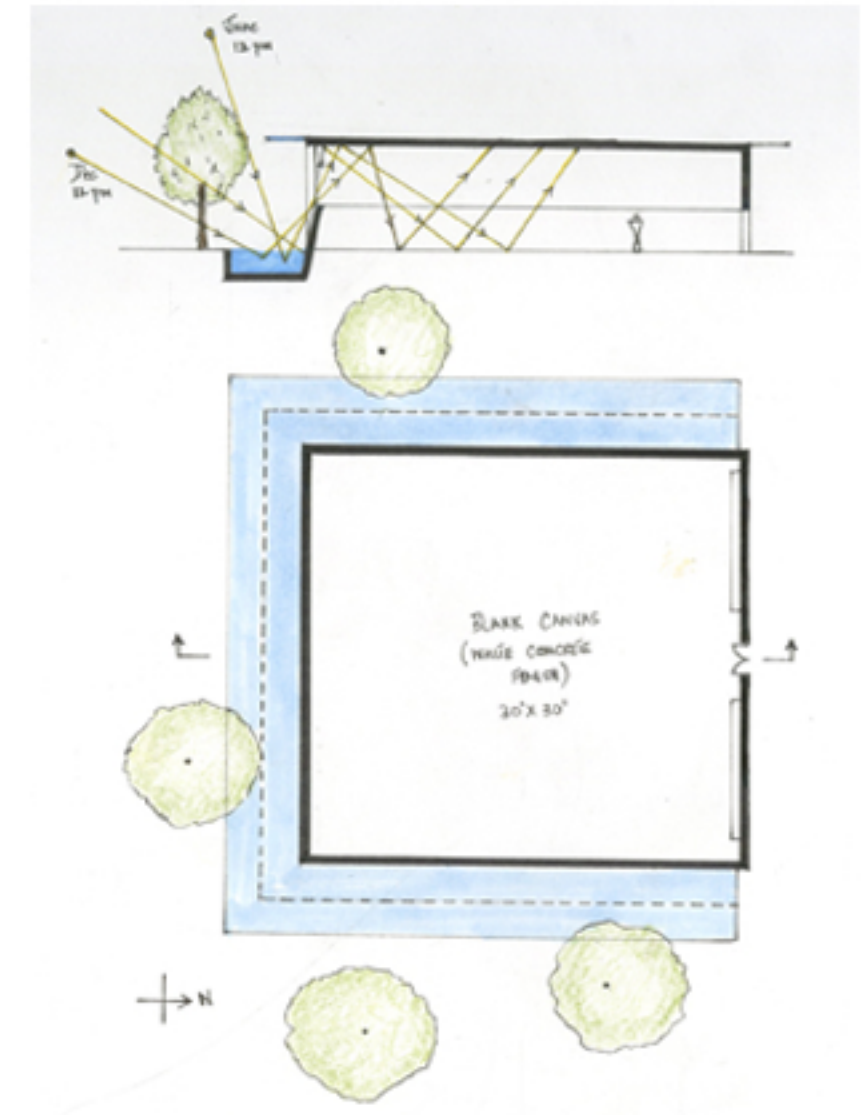
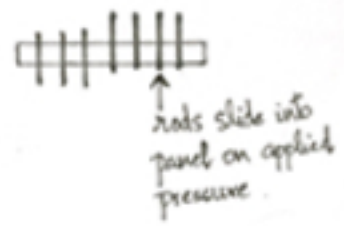
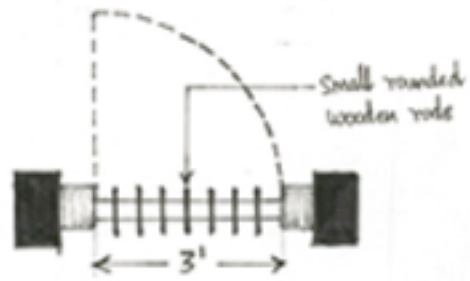
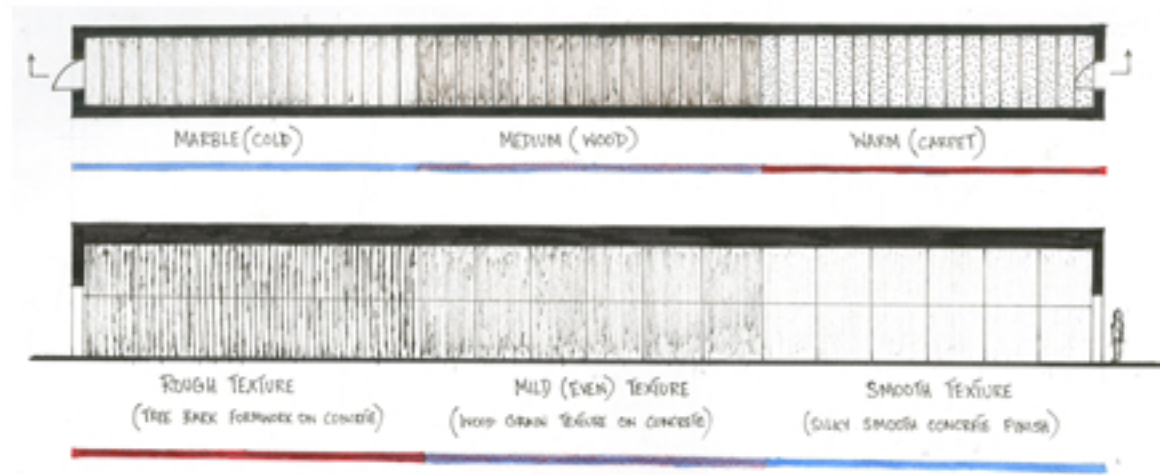


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