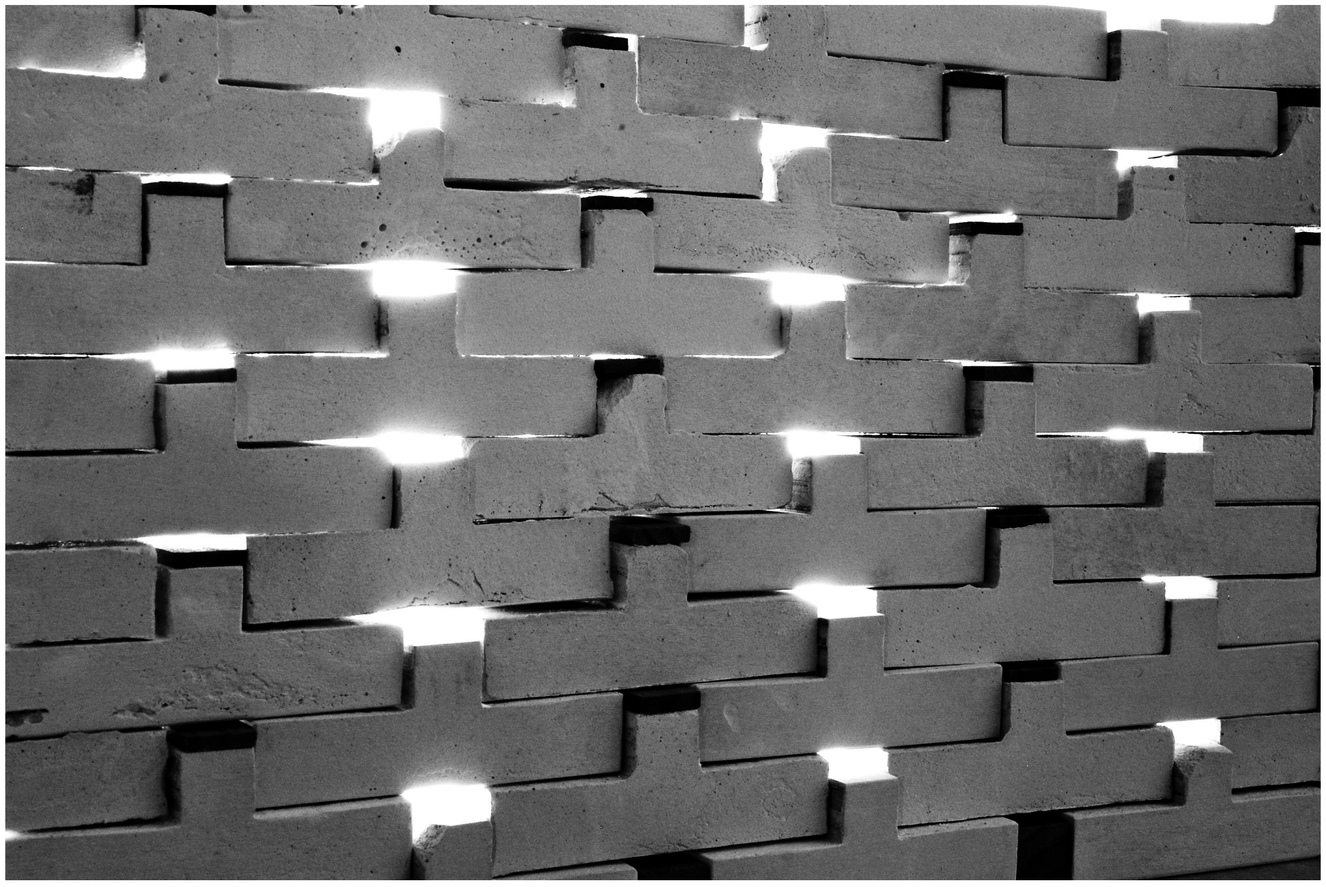

COURSEWORK Constructing a Building from a Brick

COURSEWORK Constructing a Building from a Brick

G. Michael Cincala

Thesis submitted to the faculty of the Virginia Polytechnic Institute and
State University in partial fulfillment of the requirements for the degree of

Master of Architecture

In Architecture

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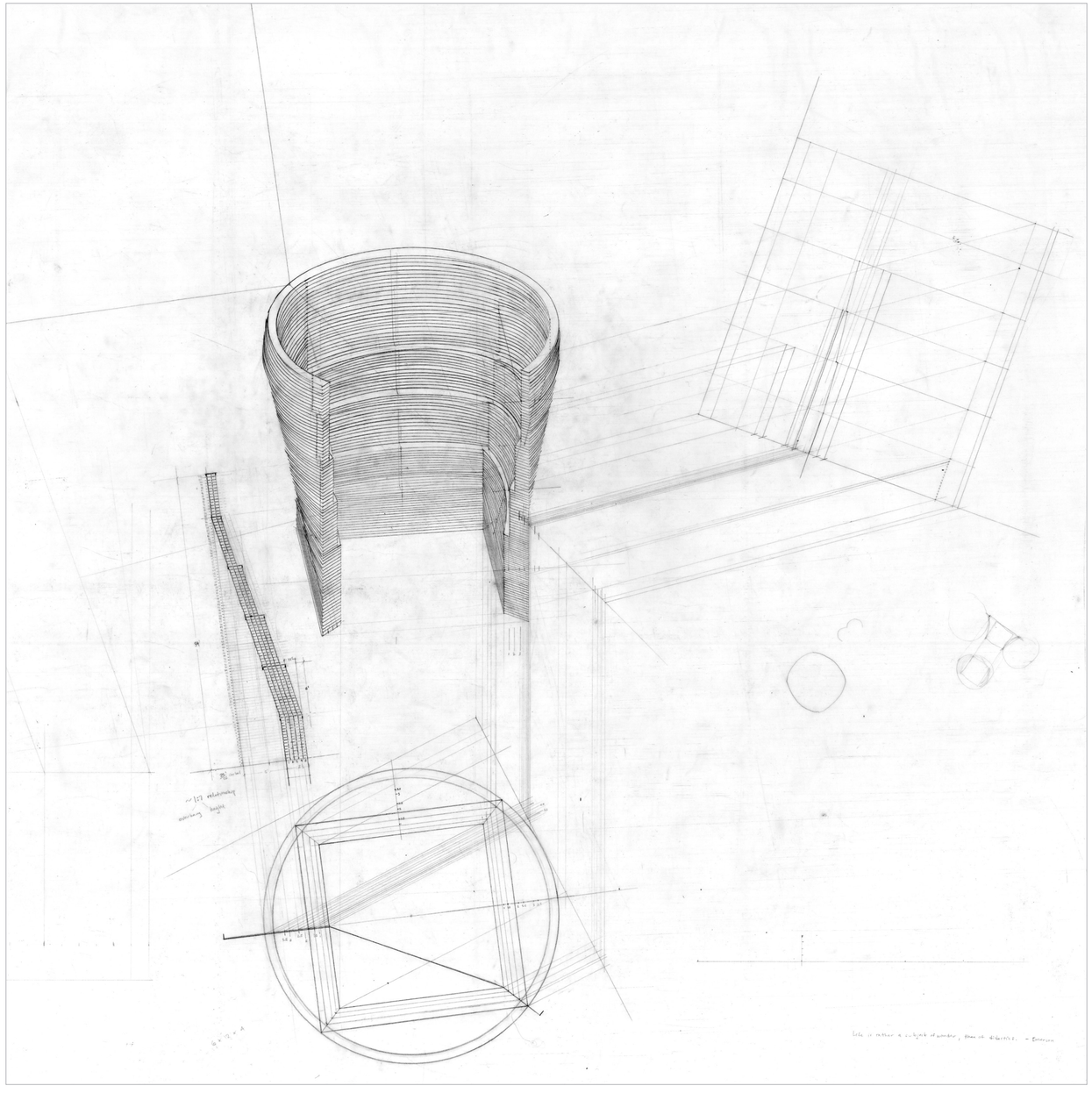
COURSEWORK Constructing a Building from a Brick

G. Michael Cincala

Abstract

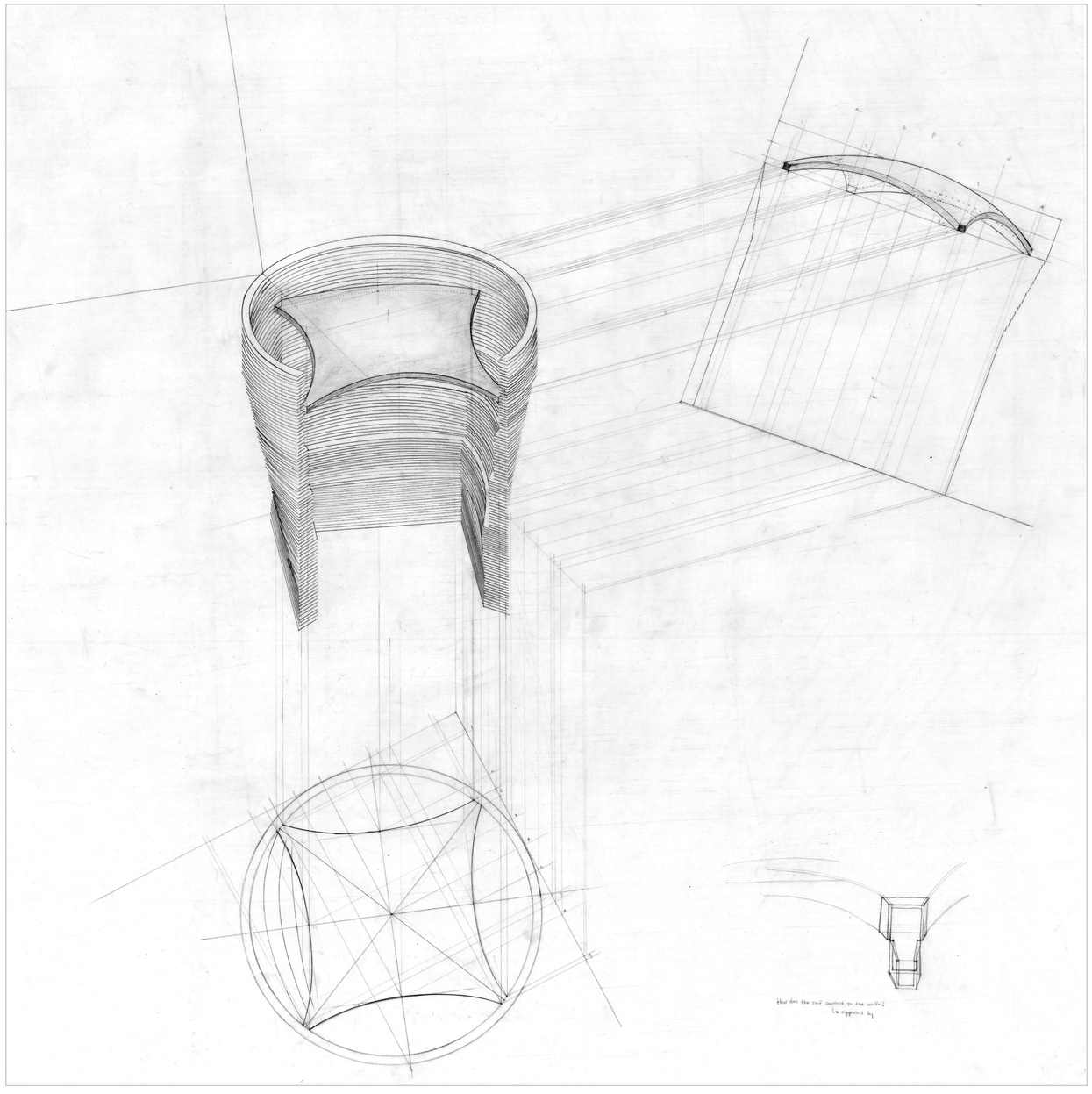
This thesis explores the design of a T-shaped brick and its influence throughout the course of the project. The T-brick established a significant direction towards weaving masonry and my firsthand recognition of the utmost importance of poetic construction for an architect. This thesis helps to affirm that construction is vital for architecture to be autonomous.

Programmatic requirements, technology, social change, new inventions, etc., can distract from the potential of architecture. We must first concern ourselves with how a building is to be made and trust that those things outside of architecture will only be right when a building is ready to accept them, not vice versa. But, that is not to say a building should not serve human needs well. Rather, serving needs well is but a bare minimum of good architecture.



Geometric form with generic corbelled courses drawn in an axonometry

Dedicated to my Grandparents



Geometric form with generic corbelled courses and roof drawn in an axonometry

Acknowledgements

I would like to thank the following people: Katy for helping me balance my personal life with school and patiently supporting my intellectual growth and happiness; Mom, Dad, and Nicole for graciously supporting me throughout graduate school; Gabe for challenging my positions and helping me grow; Pete for reminding me there is more to life than work; my classmates for contributing to intellectually stimulating conversations; the architecture graduate faculty for fostering a rich environment for students to discover architecture in personally satisfying ways; Bill, Frank and Hans for giving me the guidance to make it all the way through the most challenging and rewarding year of my formal education; and Steve for giving countless hours to help me find my direction with this thesis and guiding me towards a genuine course as an architect.

Completing a Master of Architecture degree at Virginia Tech has been one of the most demanding, introspective, and satisfying experiences of my life. I could not have made such a drastic life change without all of your support.

COURSEWORK Constructing a Building from a Brick

G. Michael Cincala

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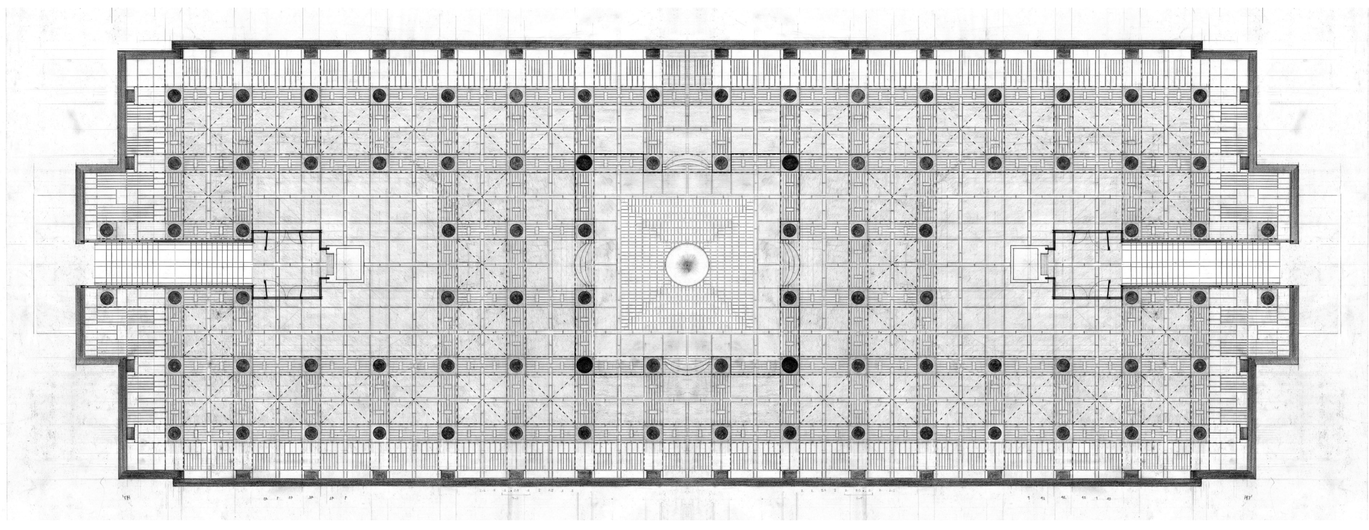
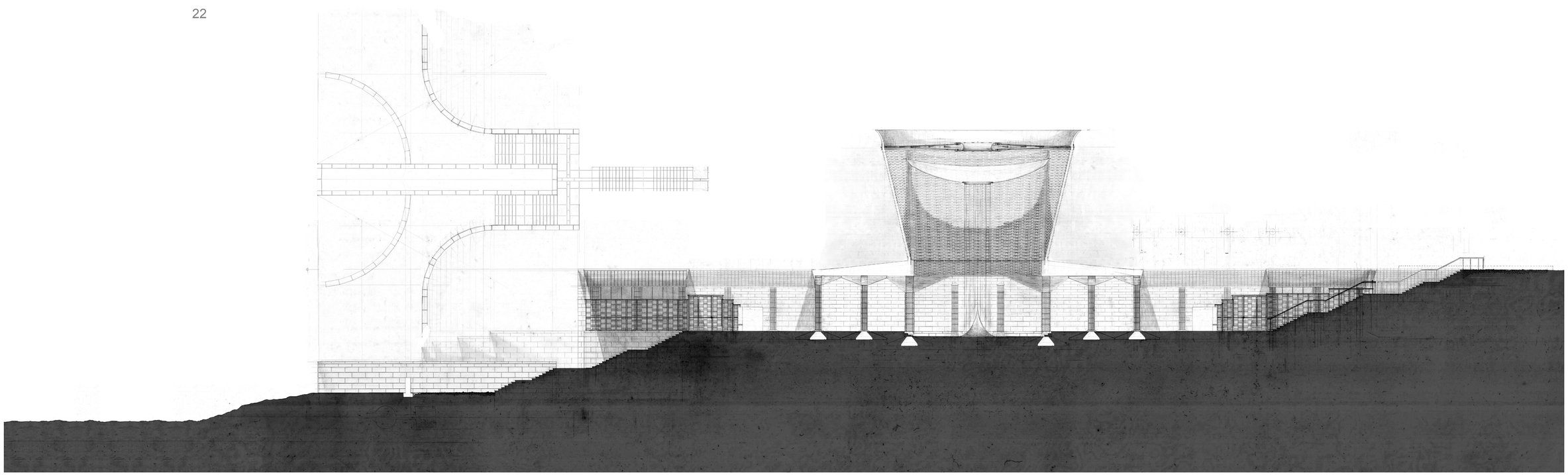
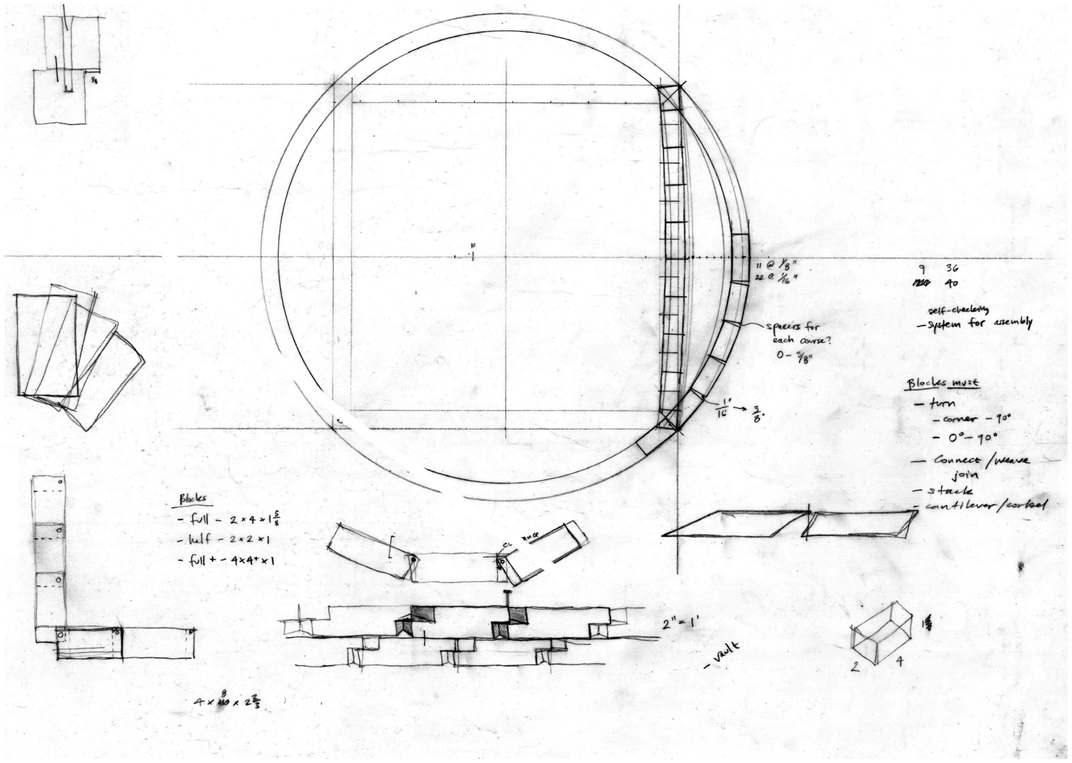




Longitudinal Section and Plan of entire project, all spawned by T-brick

0 5 10 25 50



An initial attempt at weaving revealed a design too complicated to be made in masonry

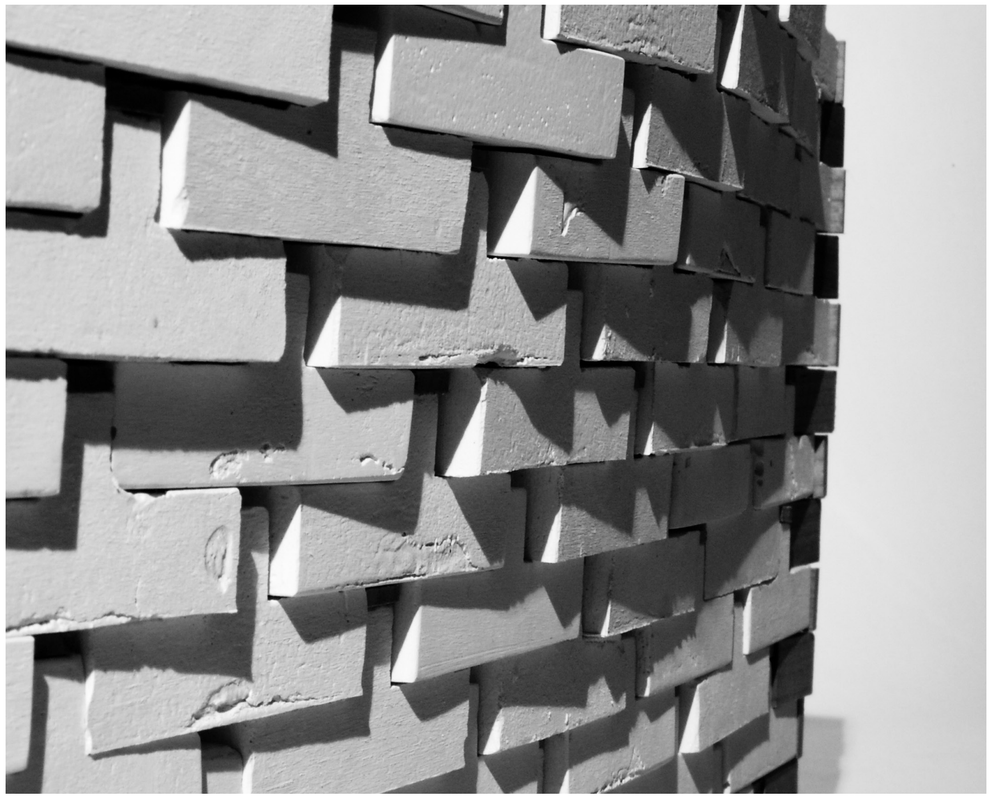
Foreword

My background in computer science and software engineering comes with a certain kind of baggage, including a mind for rational thinking, problem solving and risk mitigation. I have been trained, like most engineers, to work through situations by applying certain theorems and best practices, proven by another scientist or engineer. In other words, my judgment often relies on someone else's objective rules. Rational sensibilities are necessary and have helped me succeed in my previous career. I have learned in architecture school that too much rationality obstructs intuition, personal expression, and a richness of life. Objectivity and formulation alone might make a good computer program, but cannot make a good a building.

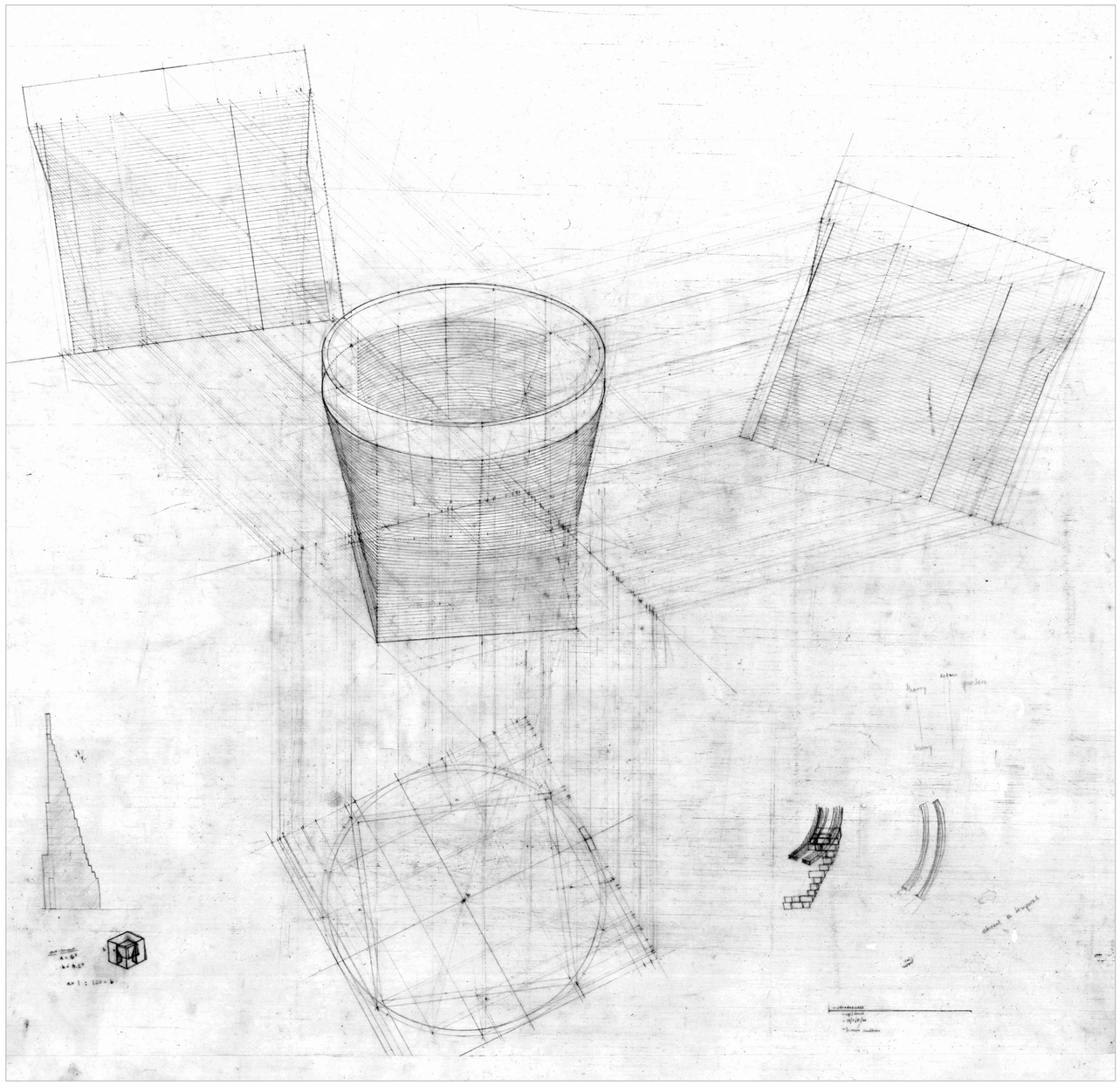
During the course of architecture school I have consciously worked to not only learn as much as possible about philosophy, architecture, and construction, but to unveil my intuition and become more confident about expressing my personal taste for beauty. It has been a pleasure to imagine a building or a fragment and to realize it (often only partially) through various modes of exploration, from hand drawing and model-making to photography. Bringing my images into the world and discovering beautiful possibilities along the way are some of the most powerful feelings of being an architect.

Throughout my thesis project I was approached many times by passers-by about my choice to hand-draw my project instead of using design software or parametric programming. At certain times, I did use AutoCAD or Sketchup to do various tedious tasks. But, I consciously kept all software at the fringes of my thesis because of the nature of the project and the importance of my own development without computer aids or constraints. By hand drawing the entire project on various papers, I was able to more directly express the textures and subtleties of the building. Furthermore, by manually constructing the building I have learned geometry on a deeper level and gained confidence in my drawing abilities. This project would not be the same had it been designed with parametric programming or any other software package.

I have laid a solid foundation to continue building my architectural intuition through the manual exercises of this thesis and throughout all of architecture school. I now feel more prepared to take on the possibilities and challenges of practicing architecture. Although I have made a new beginning for myself, I hope to join my past experiences in search of a harmony between technology and architecture.



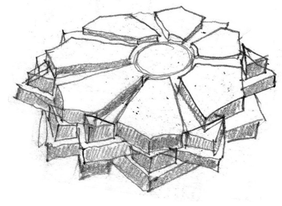
Building



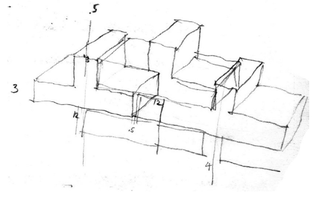
Geometric form drawn in an axonometry

Introduction

This thesis tells a story of how a building was constructed from a brick. The story begins with a sketch of a column at the Basillica of Pompeii. The column demonstrates a Roman masonry construction, weaving together structure and ornament to make a whole. The column and Gottfried Semper's work on tectonic arts provoked my exploration of weaving masonry, leading to the design of a T-shaped brick. After discovering the brick, my goal became to typologically design a building with weaving as its end. The T-brick gave me a powerful direction, guiding my decisions through the entire course of the project and taking me from geometric form towards architectural form.



Basilica of Pompeii Column



Initial T-brick

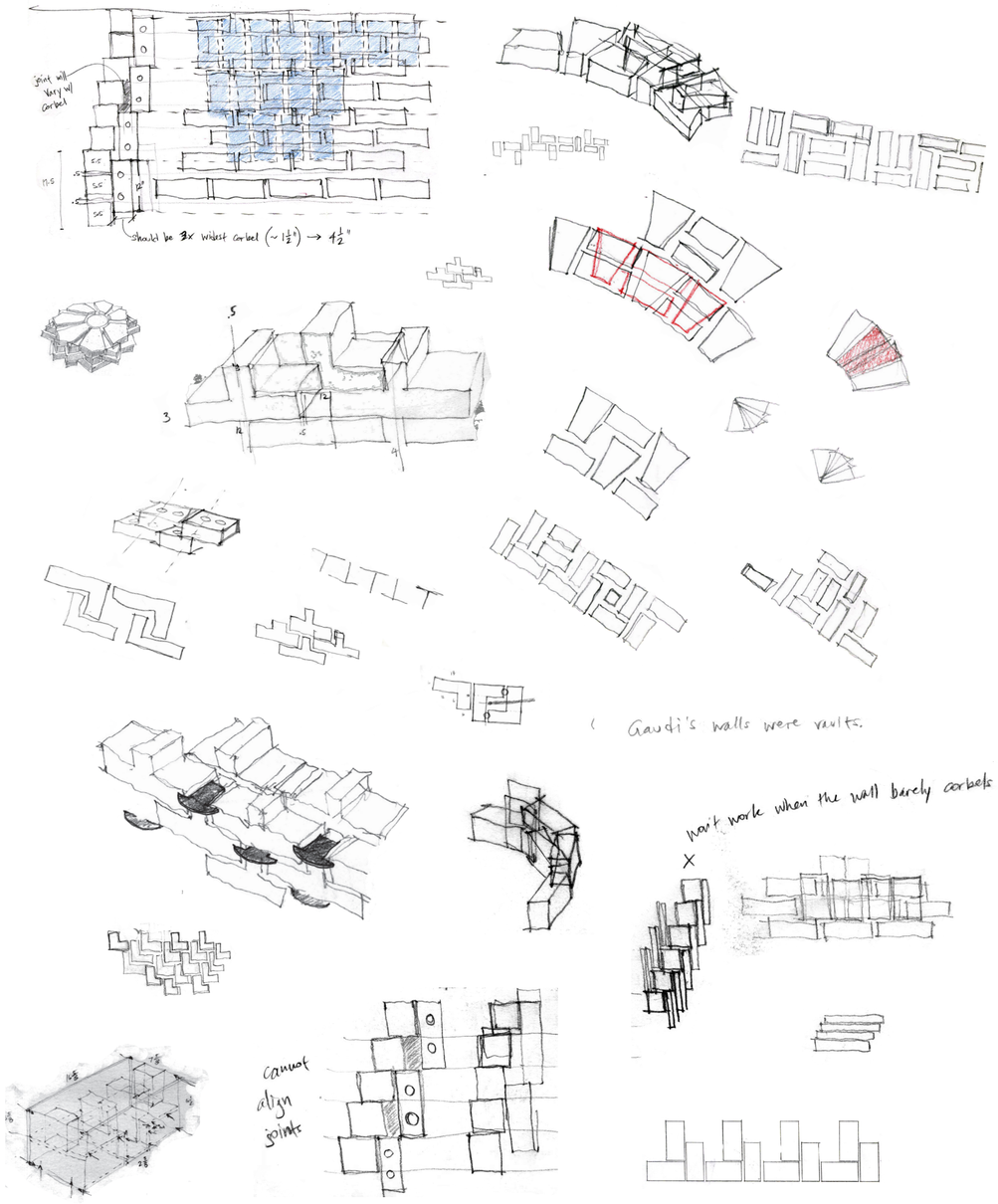
Beginnings

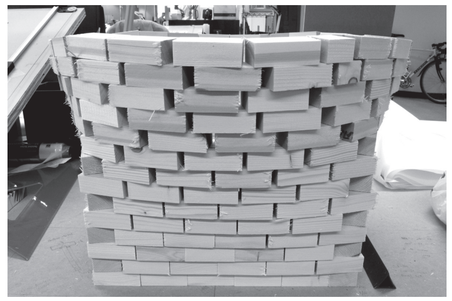
The architectural beginning of this building did not start at the chronological beginning, but came later in the project. The particular course of this building caused me to wonder about the significance of beginnings, especially for architects. Architects are often presented in the beginning of a project with a client's wants and needs for a building. It is the architect's responsibility to understand the needs and determine an appropriate building. But, architectural beginnings do not come from programmatic requirements, financial considerations, social causes, or anything else outside of architecture. I learned firsthand through this thesis that architecture begins with an artistically considered direction towards construction.

It took considerable time over this project to recognize the utmost importance of thoughtful construction for an architect. In the very beginning, many axonometric drawings and sketches were made. The focus at that point in time was *what* the building could be, with geometry and program at the fore. However, I eventually realized the building could be many things and that architecture must come from *how* the building could be made. To move towards architecture, program was put aside and construction was prioritized.

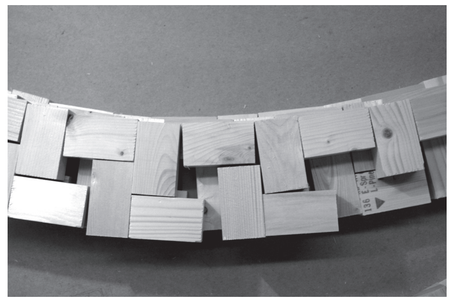
The T-brick became my first move towards construction using masonry. Masonry can carry a strong architectural expression of weaving, which has a rich history in art and architecture, elucidated by Gottfried Semper. Weaving complimented the geometric form I already designed and gave the building considerable strength. The move from geometric form to architectural form happened with the T-brick. It gave me a direction towards structural weavings, non-structural weavings or dressings, a carpet, a roof, qualities of light, sections, plans, etc. The brick gave me the entire course of the project.

Wickerwork was the essence of the wall. Gottfried Semper

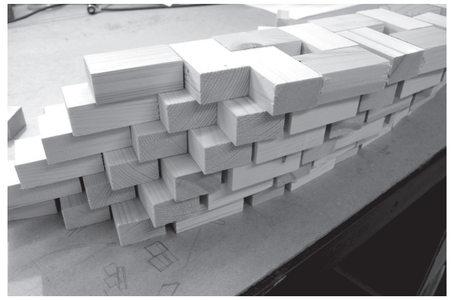




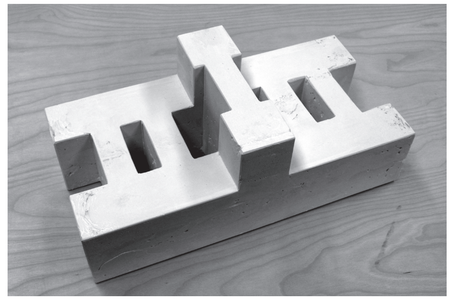
Simple stacked model of geometric form reveals lateral loads, putting the blocks into tension and pulling the walls away from the center of the model



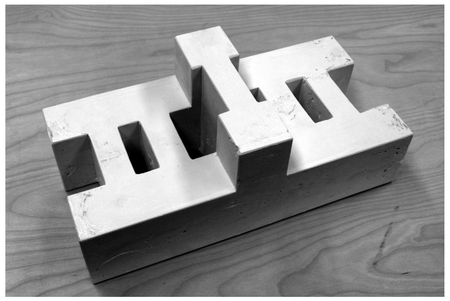
Woven block patterns across wythes are stronger, but still cannot resist lateral loads without significant wall thickness



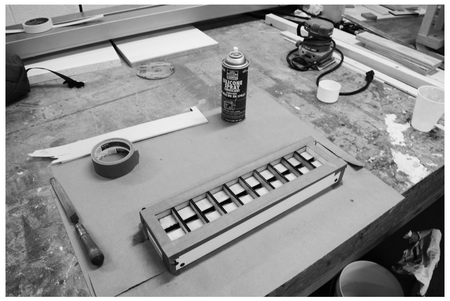
Thick block walls were undesirable for the quality of natural light intended for the interior of the tower



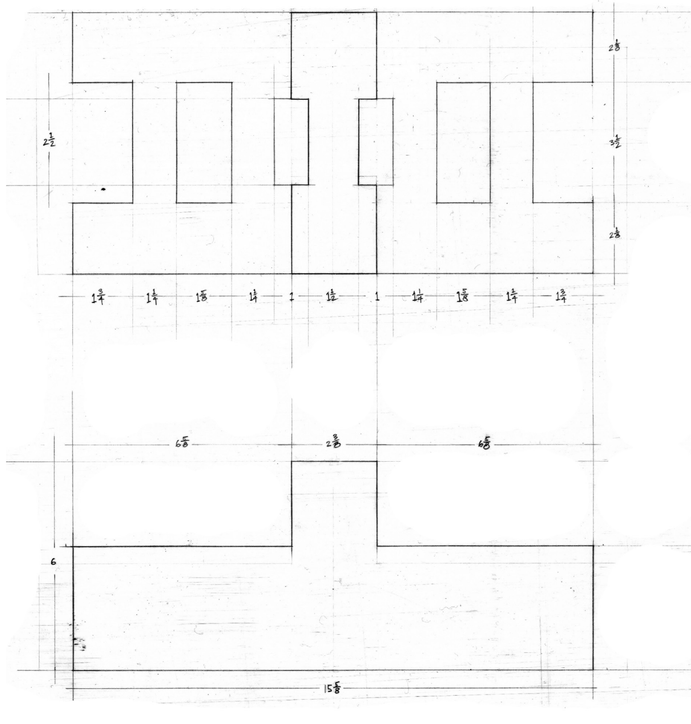
A T-shaped brick was developed to increase the connection between masonry courses and to express a tectonic nature of the walls; the woven brick helps the wall act more like vault

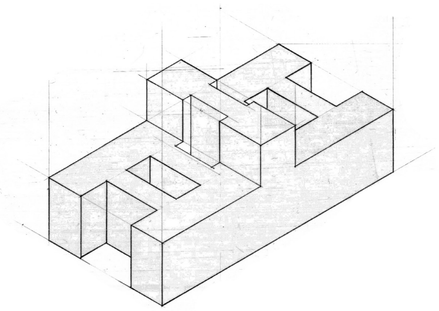


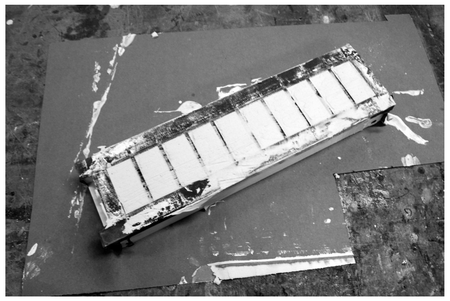
The T-brick is approximately the same size as a half-height concrete masonry unit at its foot, allowing it to be used with standard masonry units



Reusable wood formwork allows casting 10 units at a time at 1:8 scale







10 plaster units drying in the formwork

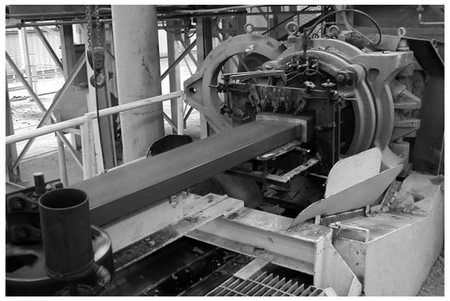
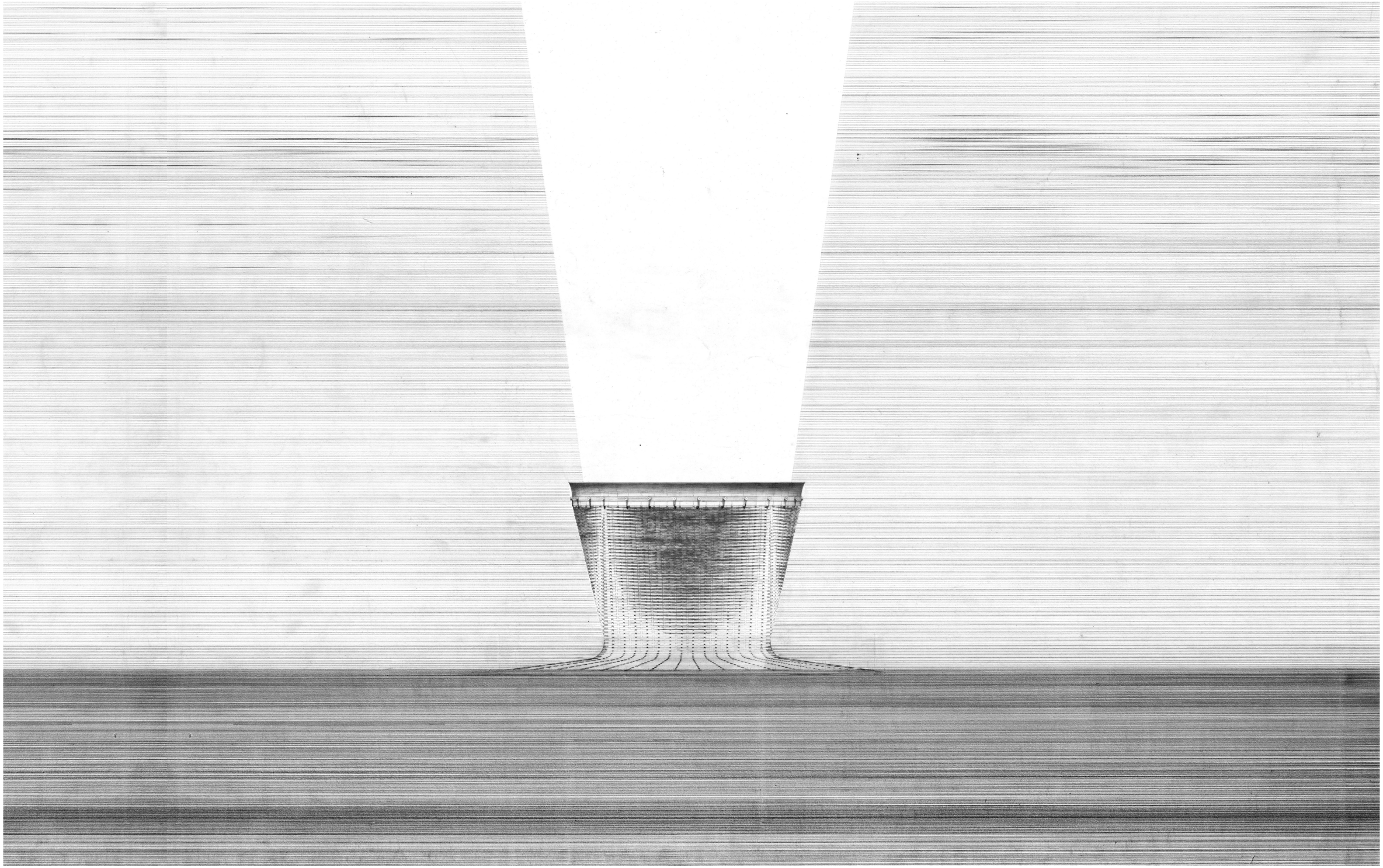


Image 1, Fair Use. http://www.pugmaster.com/application.htm. 2011.

The T-brick could be extruded into a column through a custom die and stamped to make individual bricks; alternatively, the brick could be hand-made, like how it was cast for the model



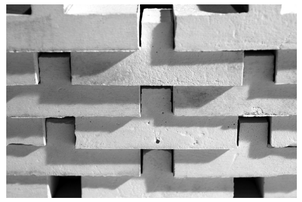
Approach Elevation

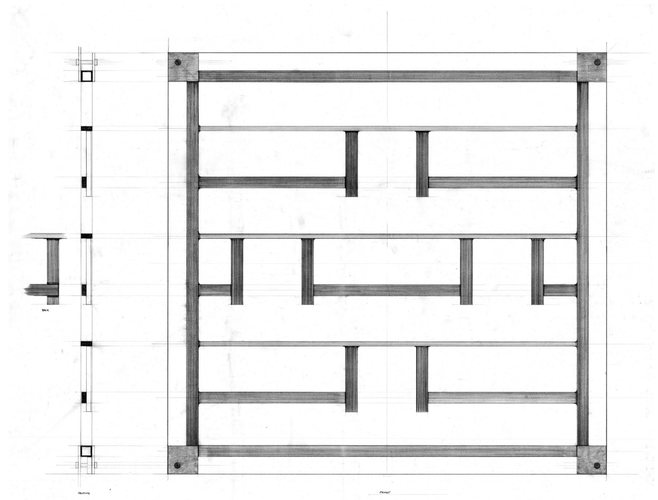
0 5 10 25 50

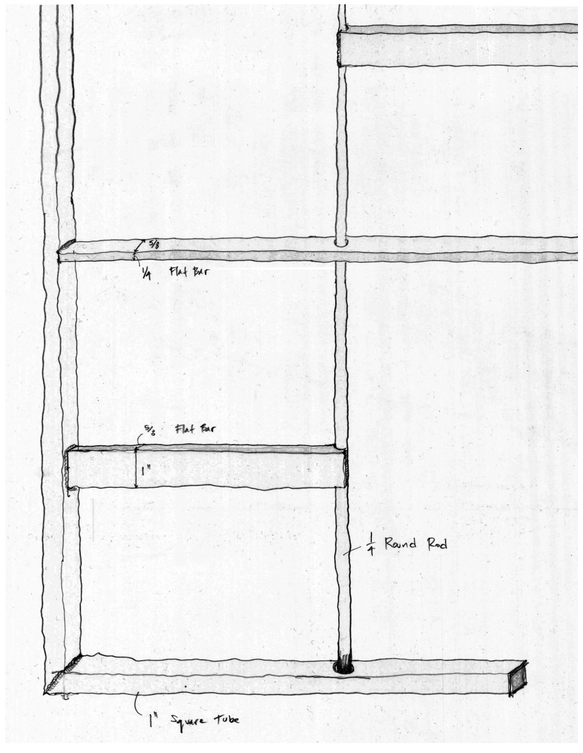
Entry Gates

Entry gates on either end of the building are constructed with various kinds of steel bar stock, arranged in a woven manner. The initial design was inspired by the T-brick masonry joints. However, after further considering the design for this project, the gates seem to more closely express the tower's internal, steel reinforcement. I find it interesting that the gates, the first element one might touch when entering the building, relate to something else in the project that cannot be sensed at all. This important relationship confirmed that I was on the right track while conceiving the gates and typologically strengthens the woven nature of the building.

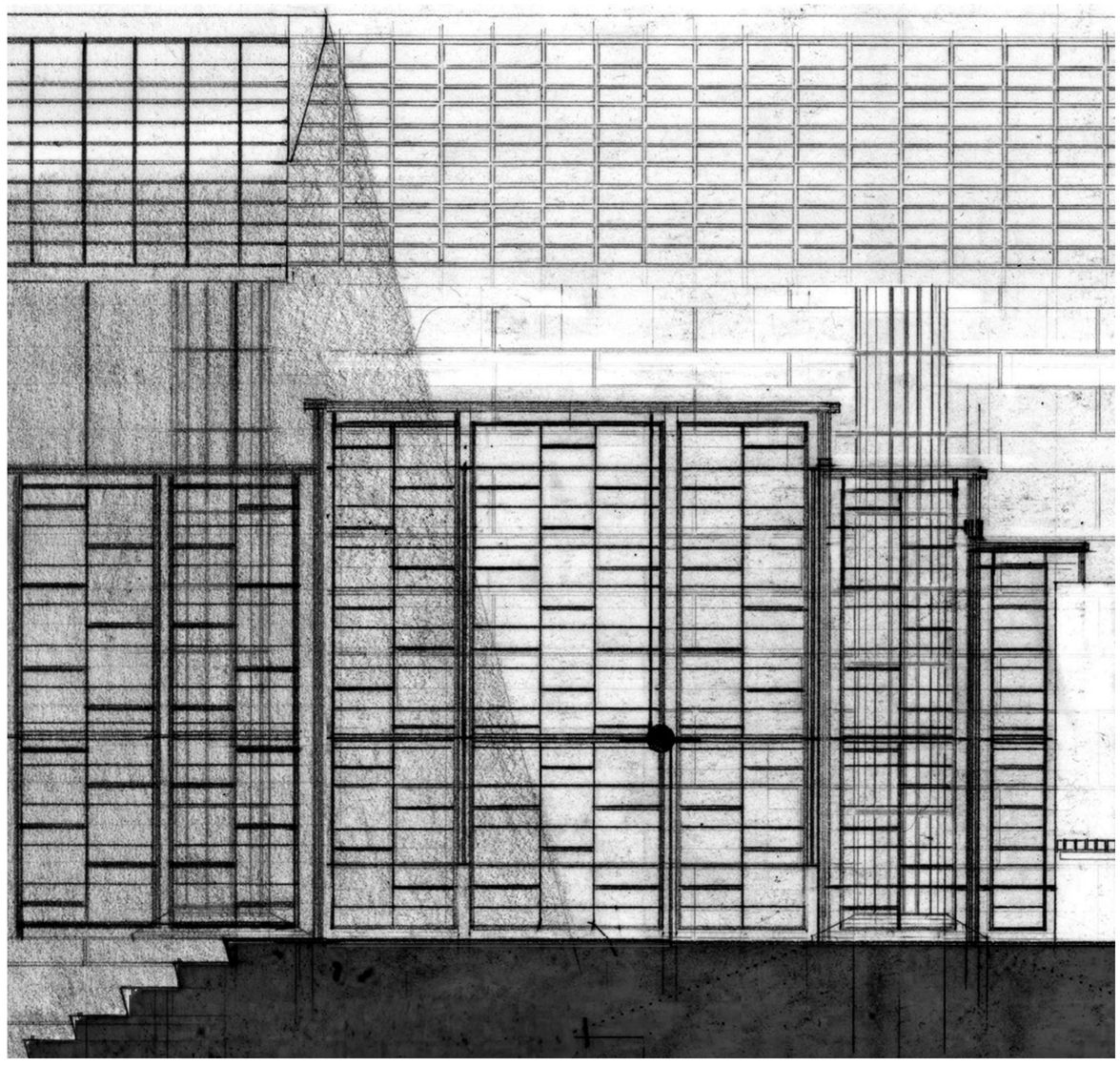
Initial gate design motivated by T-brick joints



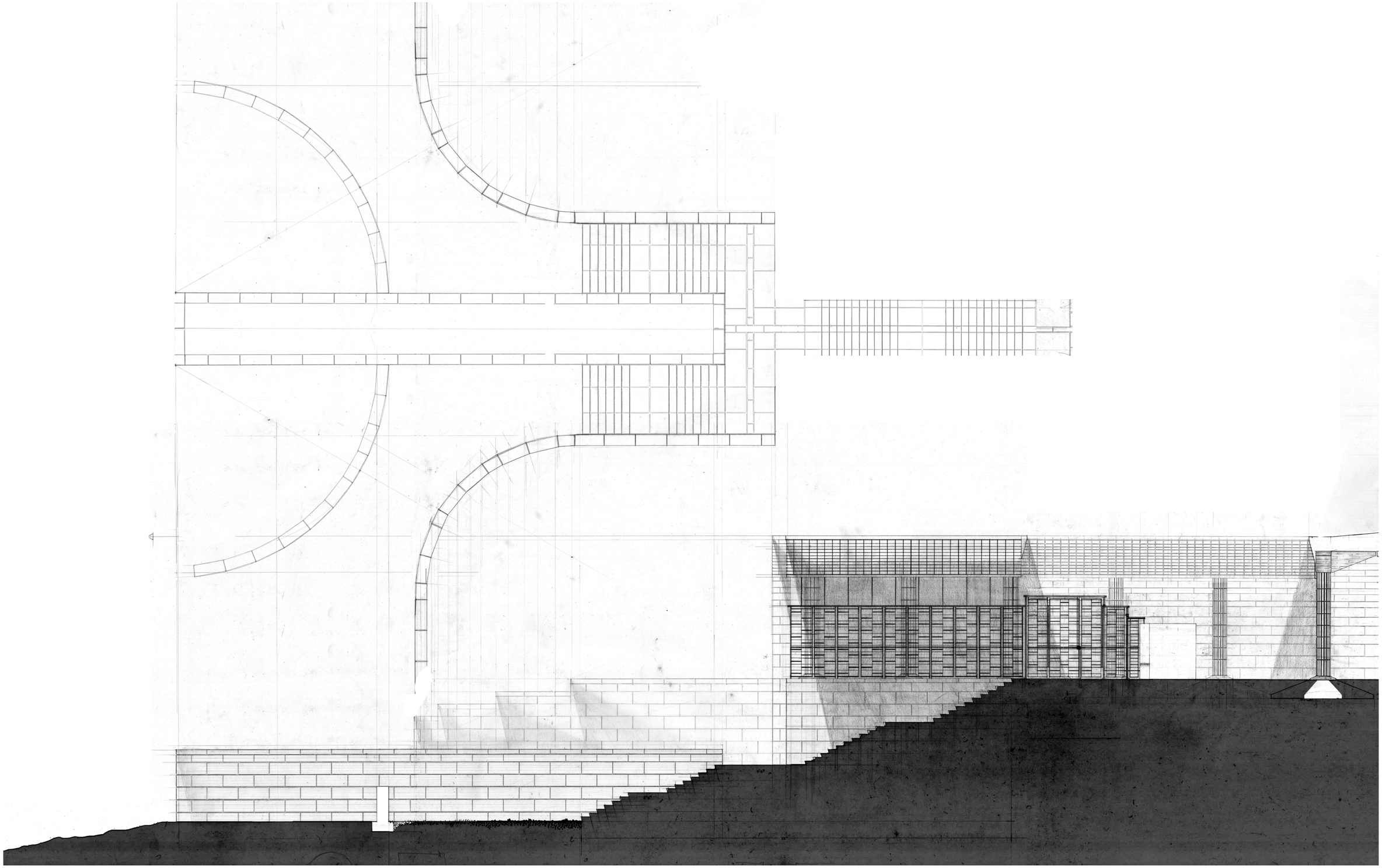




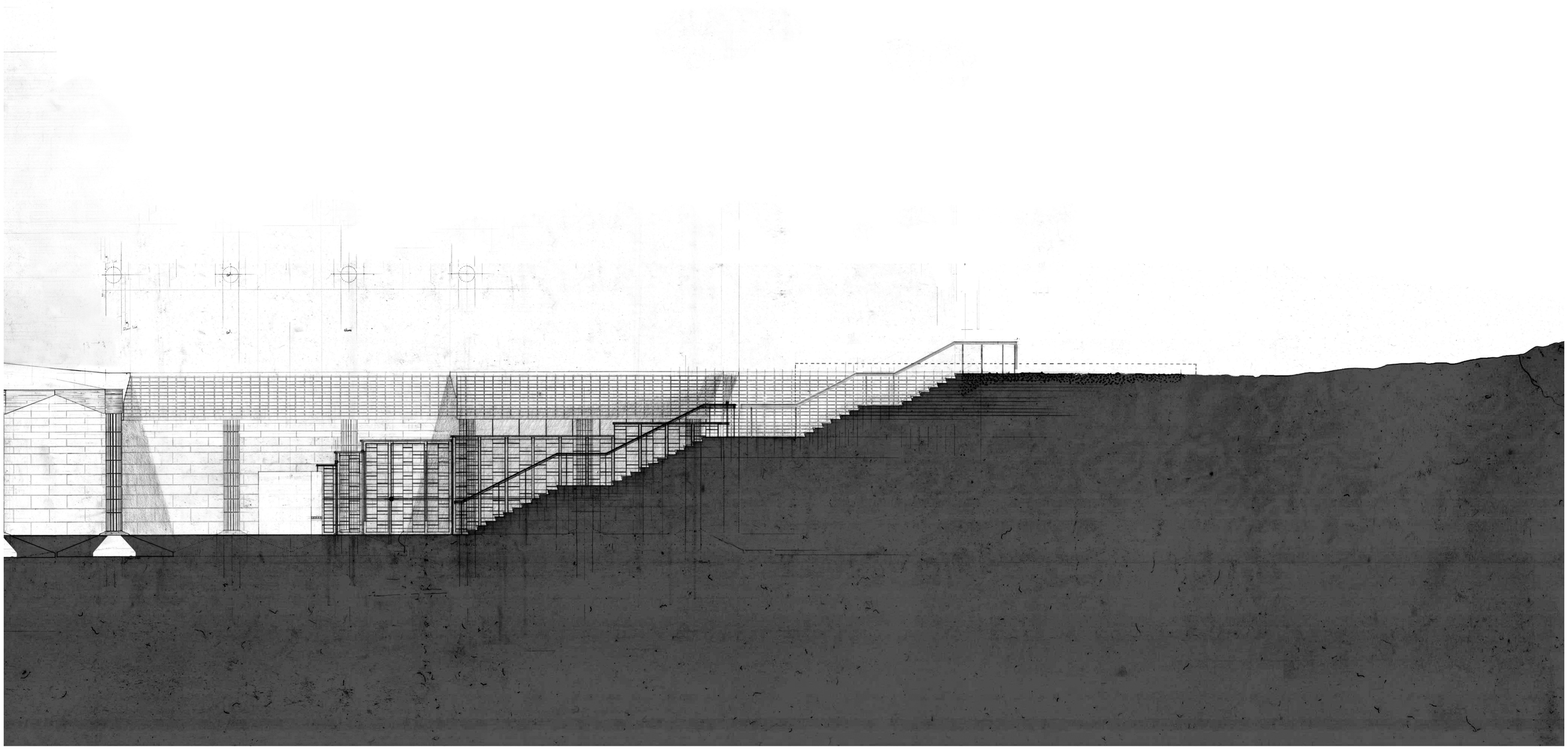
Steel Gate Construction Round rods run vertically, joining with horizontally oriented flat bars; flat bar connections alternate between a welded joint and penetration. The internal members are all captured by a square tube, framing each section of the gate and providing connections to the gate's super structure.



0 5 10



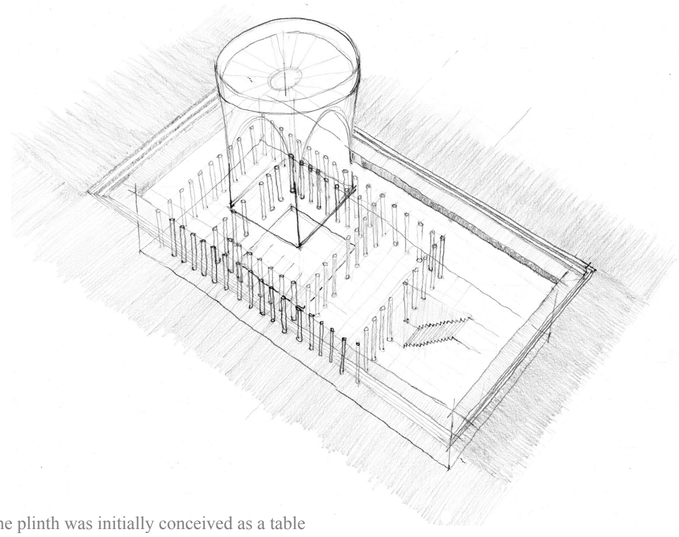
Left Entry Section cut through the center of the entry walkway



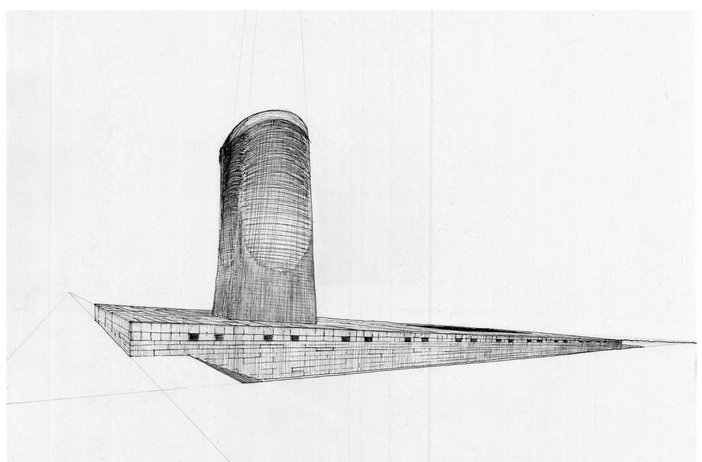
Right Entry Section cut through the center of the entry walkway

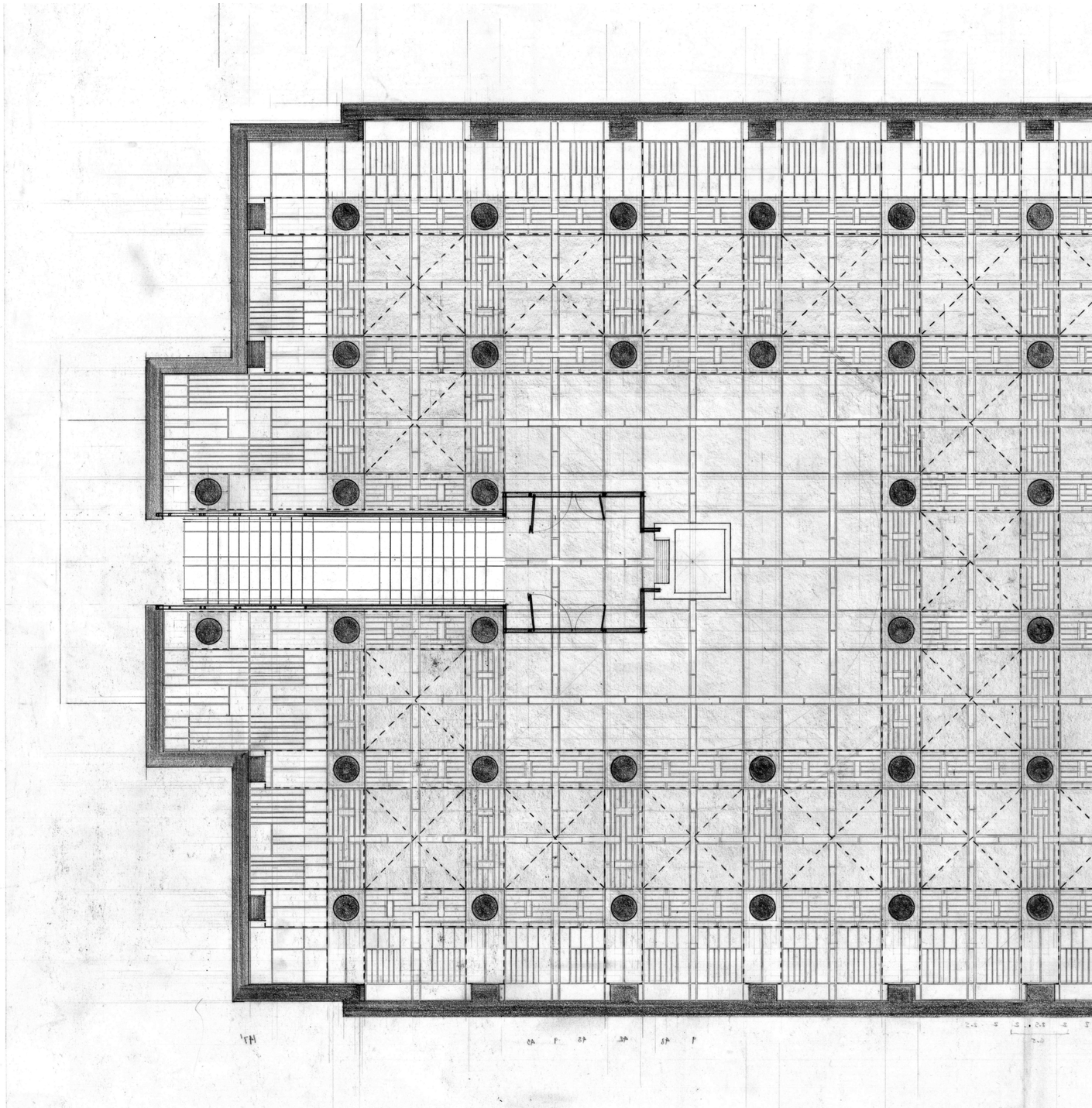
Site

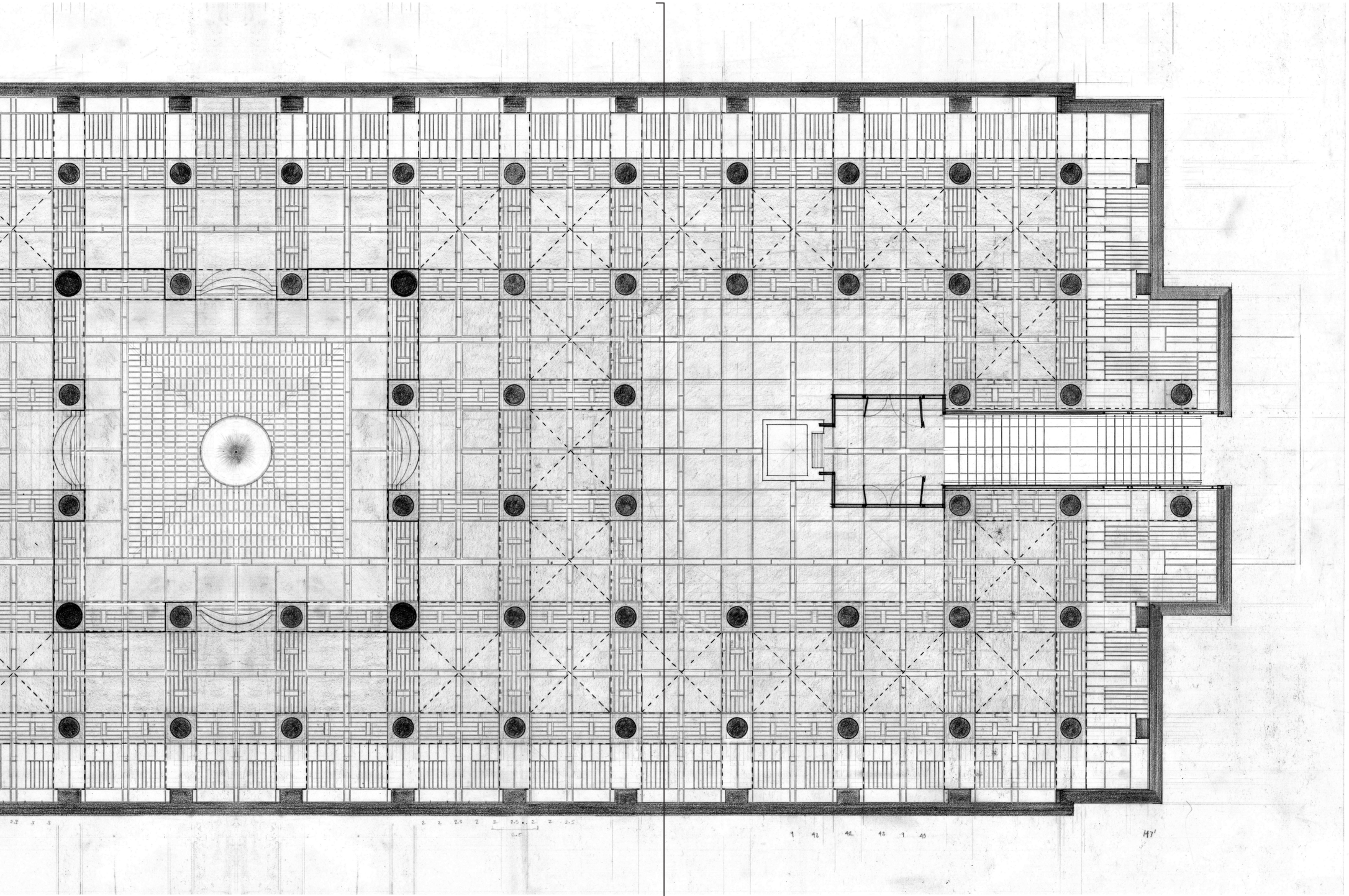
The building's plinth is the site for the tower. Sitting below grade, it helps compliment the tower as a grounding element. The plinth's interior is punctuated by columns acting as pilework, bringing the loads to solid earth; on either side of the central tower is an entrance leading to an anteroom.



The plinth was initially conceived as a table top where the tower would rest. However, the plinth was later buried completely to hide its presence and become the site



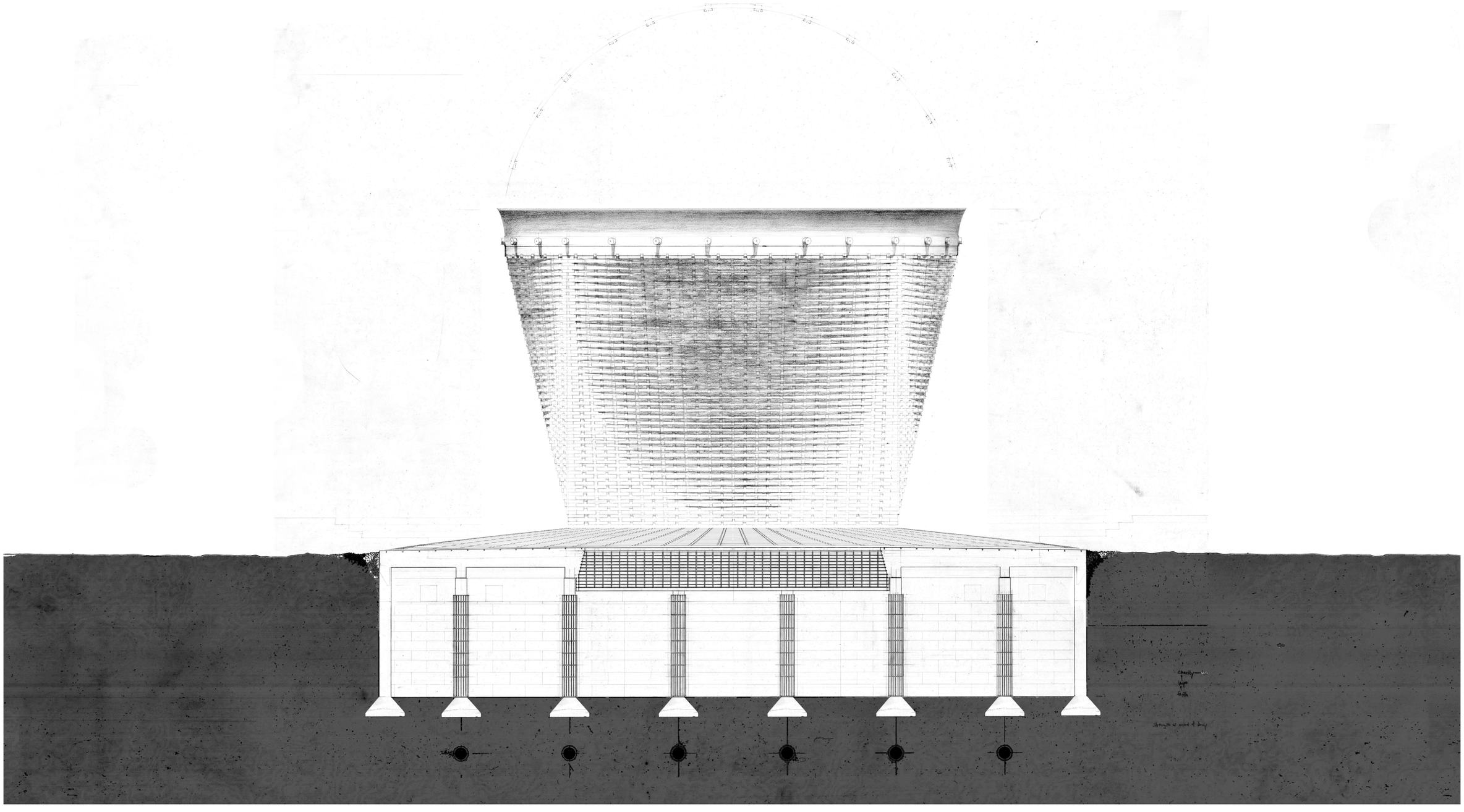




The plinth's carpet-like floor is organized in three parts: an edge, a field of columns, and a center.

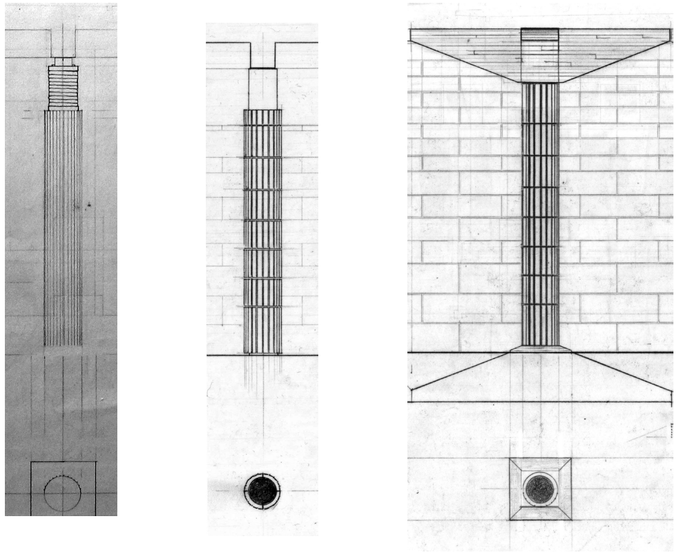
Transverse Anteroom Section on following page

0 5 10 25 50



Transverse Anteroom Section looking towards tower

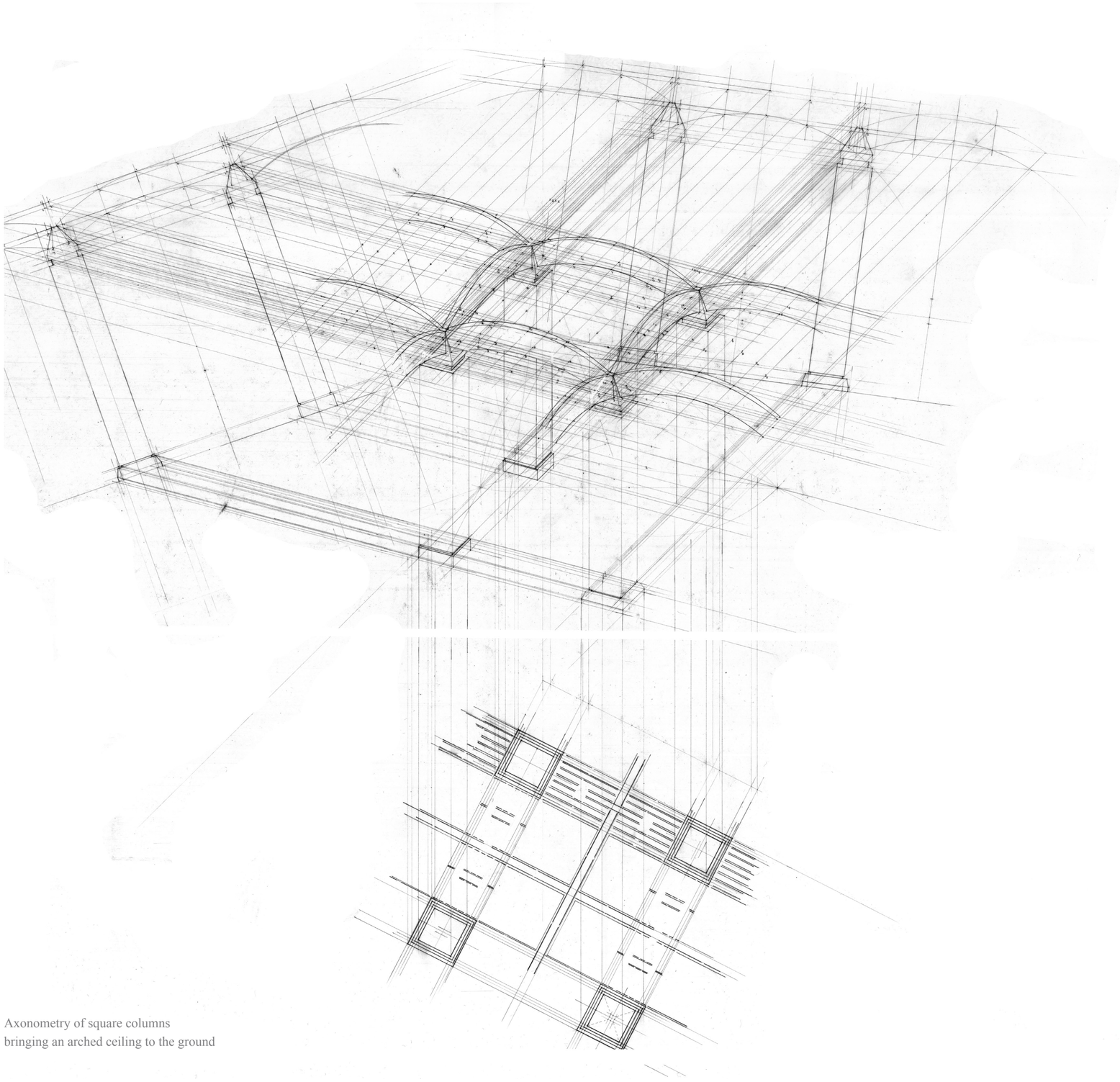
0 5 10 25 50



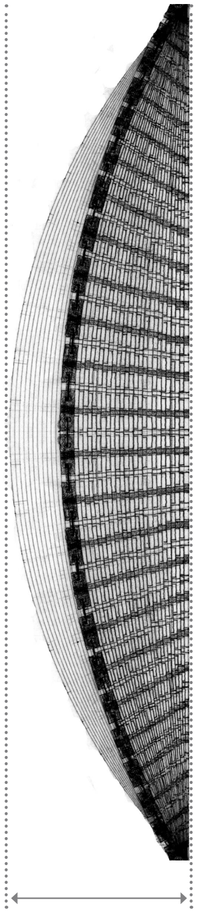
Column Studies

Initial columns were designed without a capital. However, they were lacking the strength in proportion to the tower. The most recent columns (above right) are designed with larger capitals, like reverse footings, bringing the load to the shaft and again spreading the weight at the ground.

Columns supporting the tower could be further developed into a woven construction, allowing the tower's woven expression to be brought all the way down to the ground.



Axonometry of square columns
bringing an arched ceiling to the ground

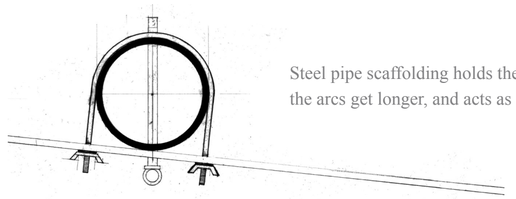


Corbel Distance 8 ft.

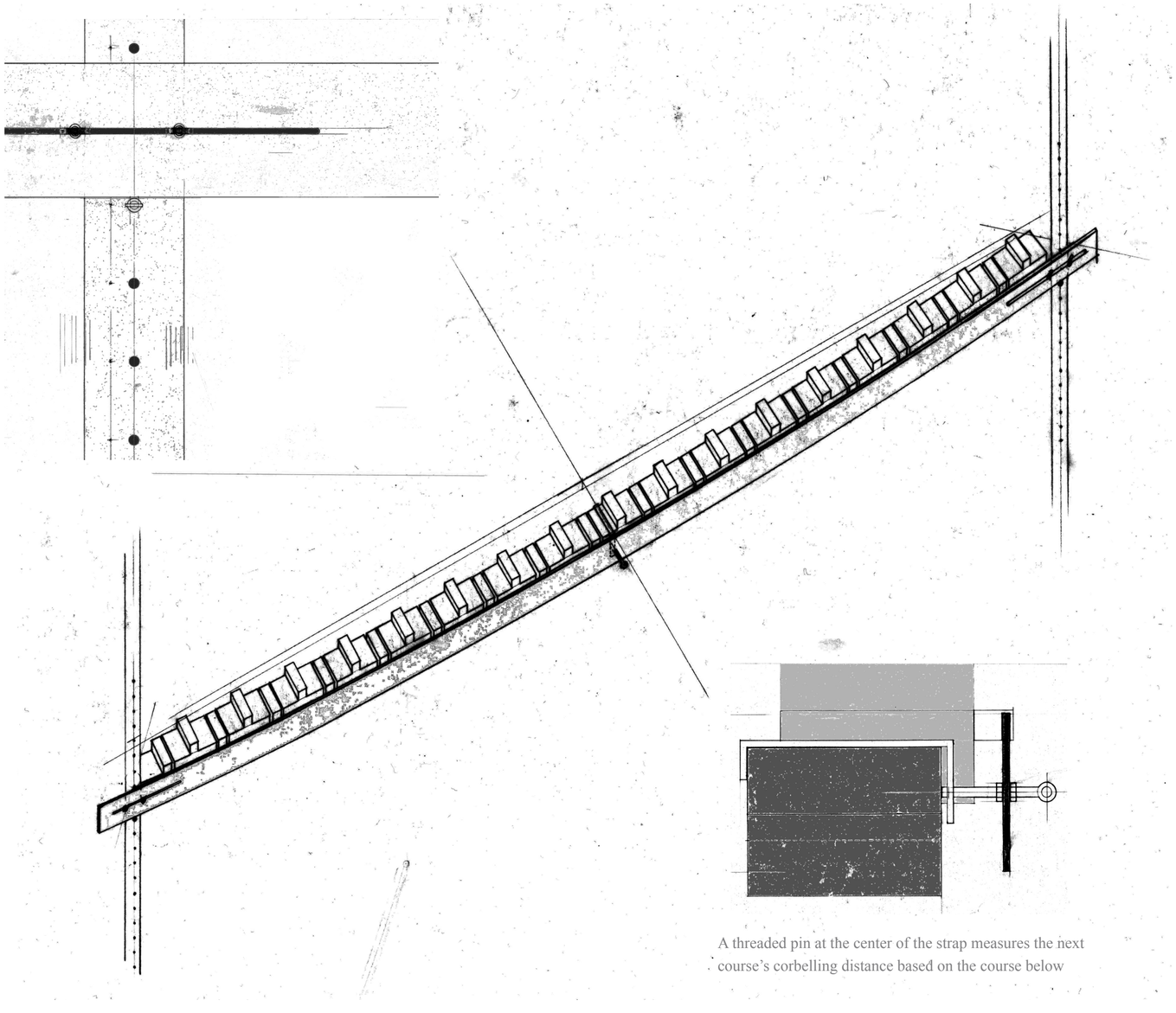
Tower Construction

A transformation occurs from a square at the first course of the tower to a circle at the top. To do so, each masonry course corbels outward 1-1/2 in. over the previous course at the center of each wall. The tower corbels a total of 8 ft. from top to bottom.

However, it is difficult to precisely construct many of the arcing courses because the radii are hundreds of feet away. Scaffolding made from steel bar stock aids in the arc-making and acts as a guide for bricklaying.

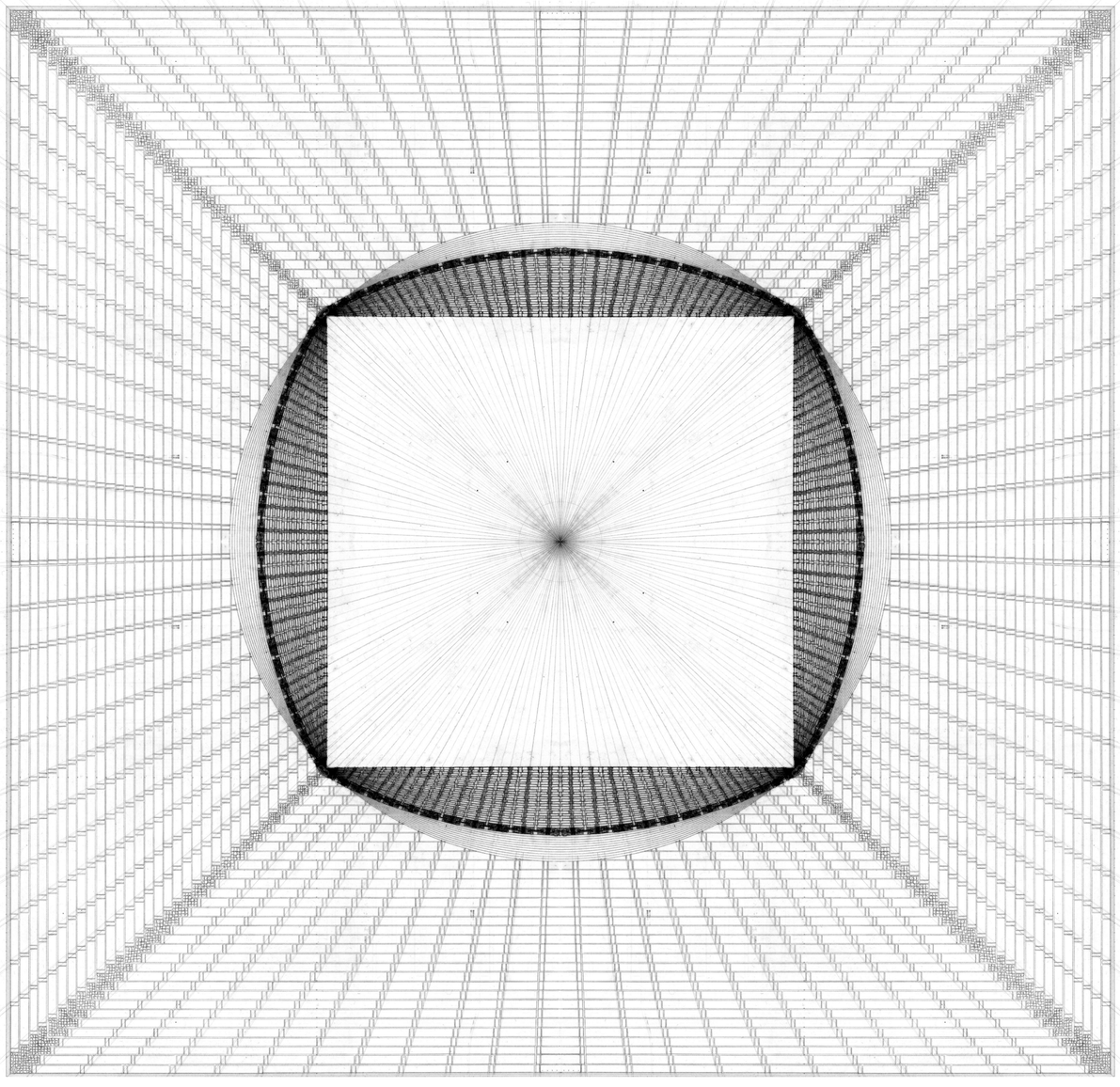


Steel pipe scaffolding holds the strap in place, allowing it to slide as the arcs get longer, and acts as a storey pole for laying each course

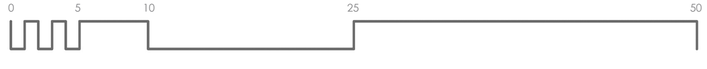


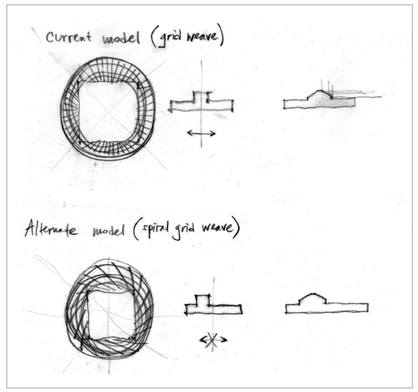
A threaded pin at the center of the strap measures the next course's corbelling distance based on the course below

Steel strap is attached to scaffolding on either end and bowed according the distance of each corbel

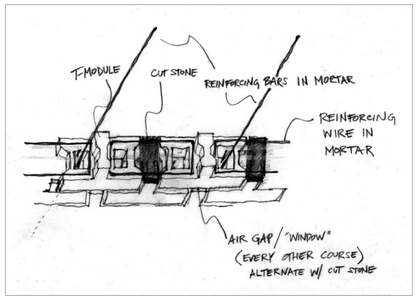


Tower Plan view cut through tower showing its walls corbelling outward surrounded by stone pavers at the base

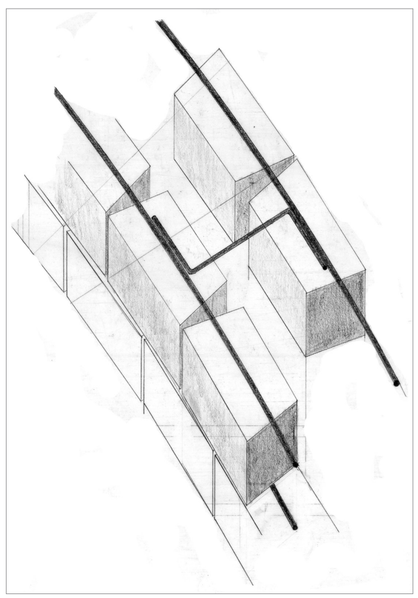




Reinforcement diagrams



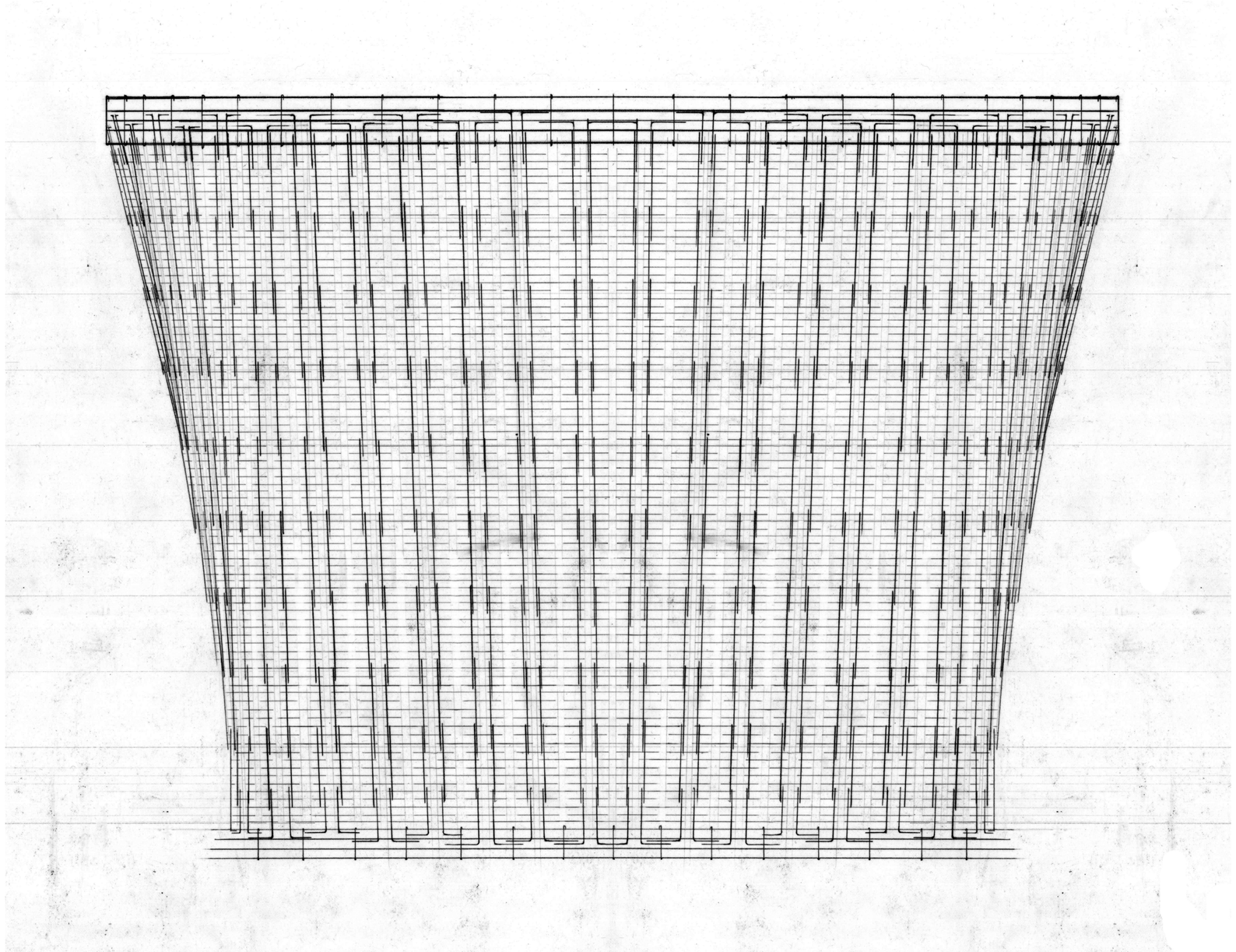
Reinforcement weaves horizontal and vertical bars



Early reinforcement before weaving masonry was studied

Tower Reinforcement

The woven nature of the project is further explored with the tower's steel reinforcement, which acts as a structural basket inside the masonry walls. The basket helps resist tension as the tower's masonry corbels outward and ties the walls into both the plinth at the base and the wheel at the top.



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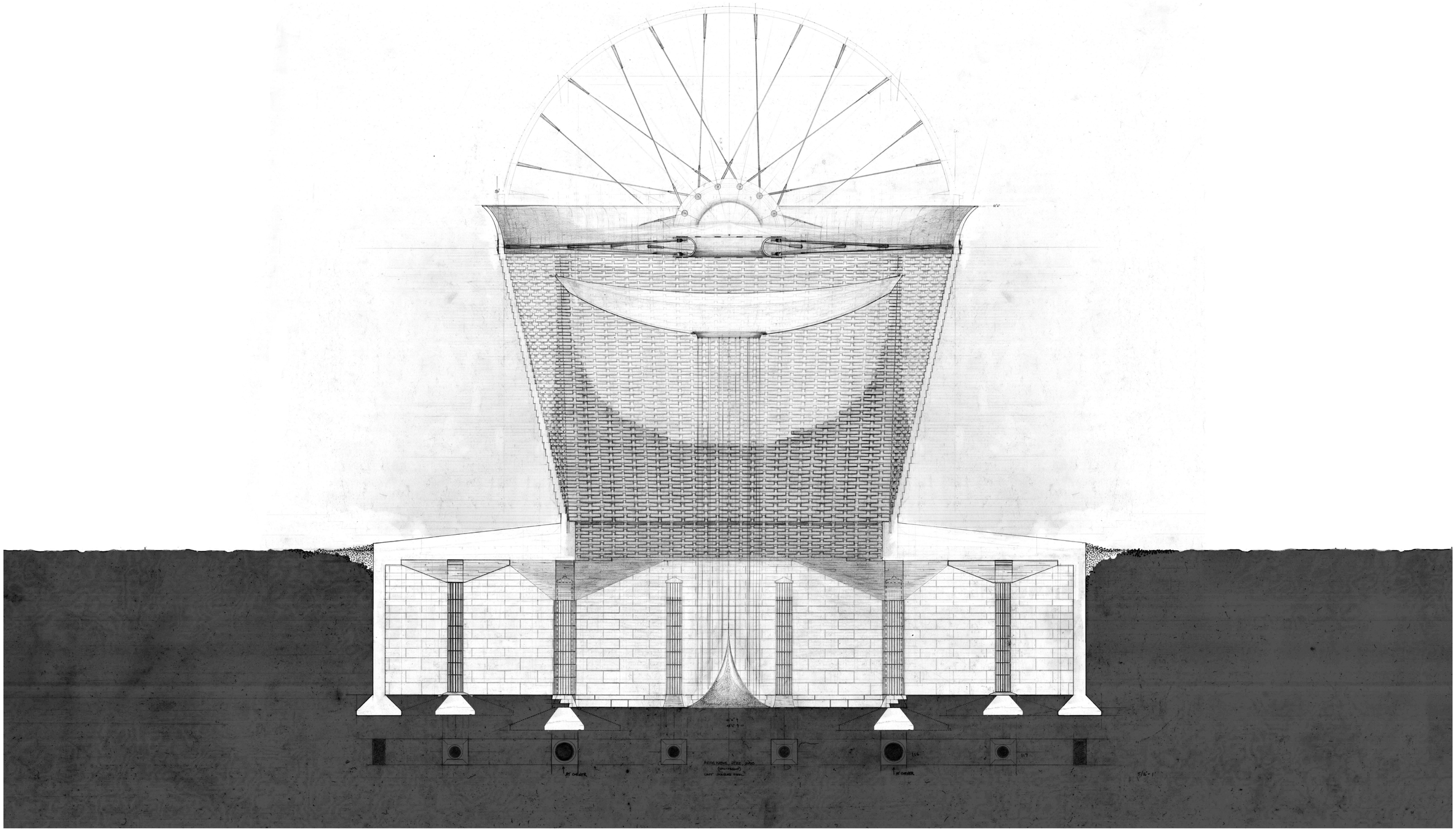
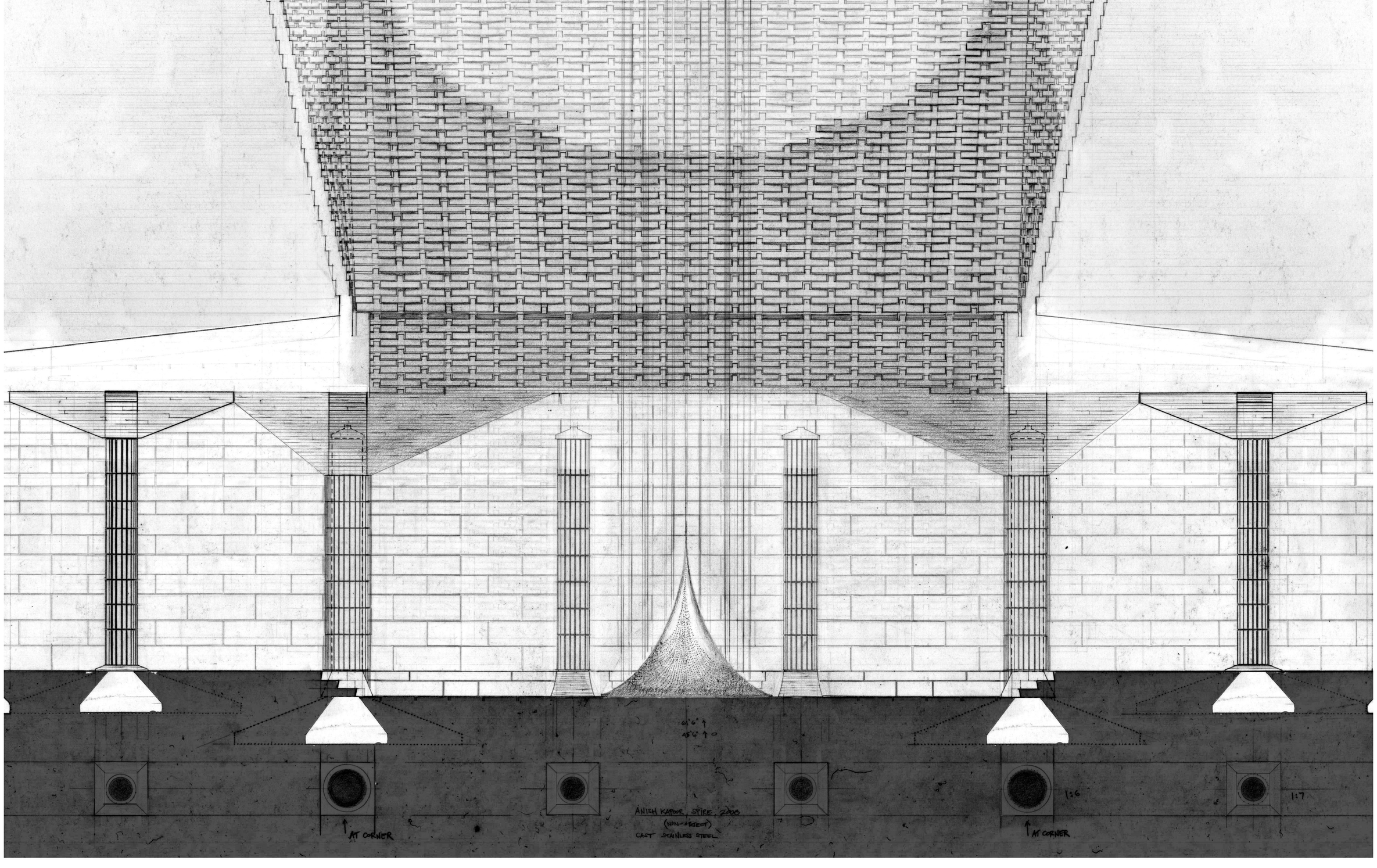


Transverse Tower Section with partial roof plan

0 5 10 25 50

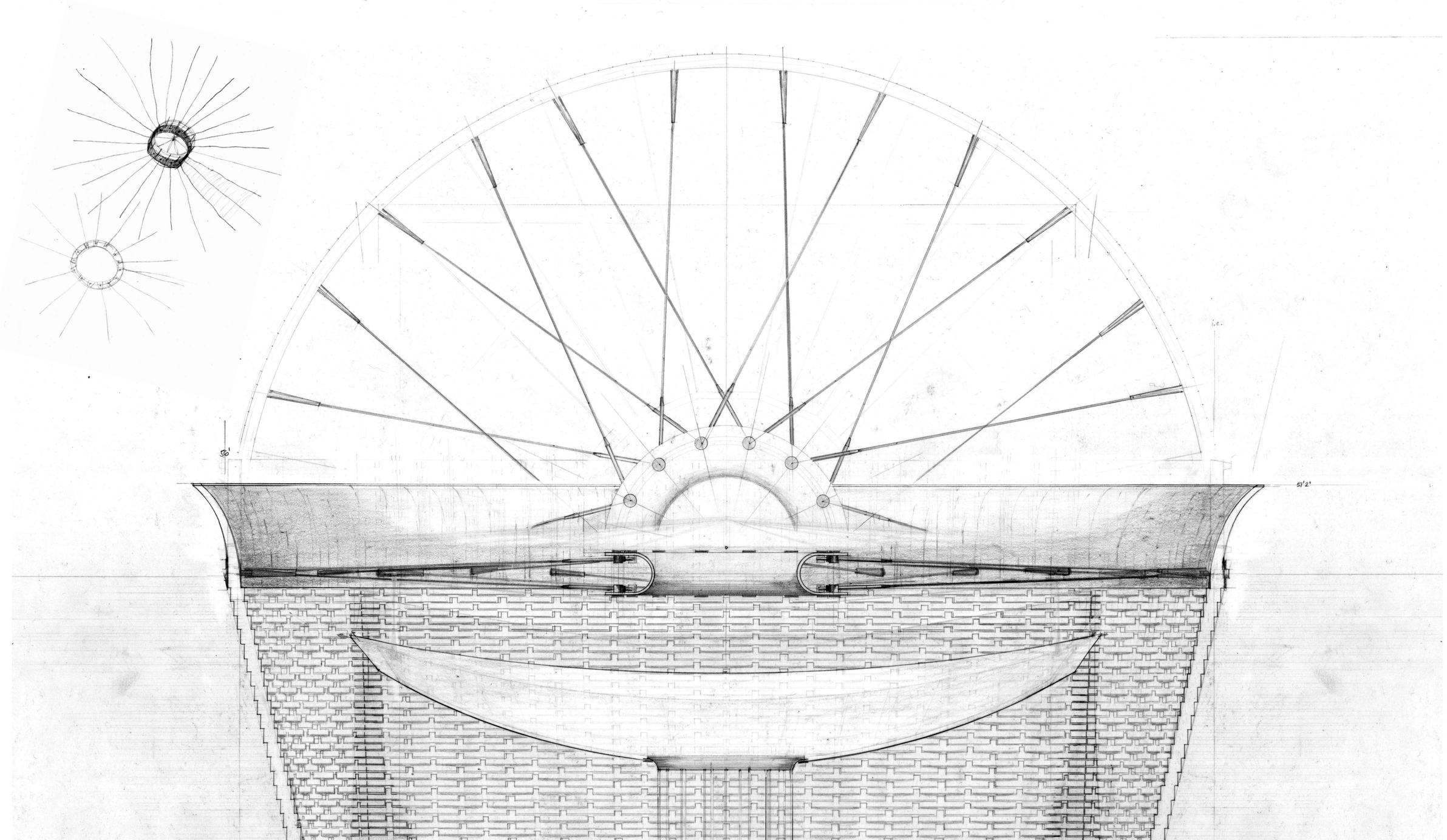


Program

Anish Kapoor's sculpture *Spire* was found while looking for something to resolve the space under the oculus and to compliment the facetted brick and stone surfaces throughout the building. The highly polished stainless steel sculpture beautifully absorbs the world around it and reflects its own world, a world seeming to have no end as it reaches towards infinity. Spire not only compliments the masonry, but it seems to be in harmony with the building form, possibly even completing the building. Standing at the center of the building, one can now gaze through the steel oculus overhead into the infinity of the sky and gaze towards one's feet into the infinity of the sculpture. However, the building was never intended to exhibit a sculpture until Spire was found. I was only able to find Spire and place it in the building when the time was right. Perhaps we should trust that compliments to architecture, like program, technology, and situation, will only be right when the building is ready to accept them and not vice versa.

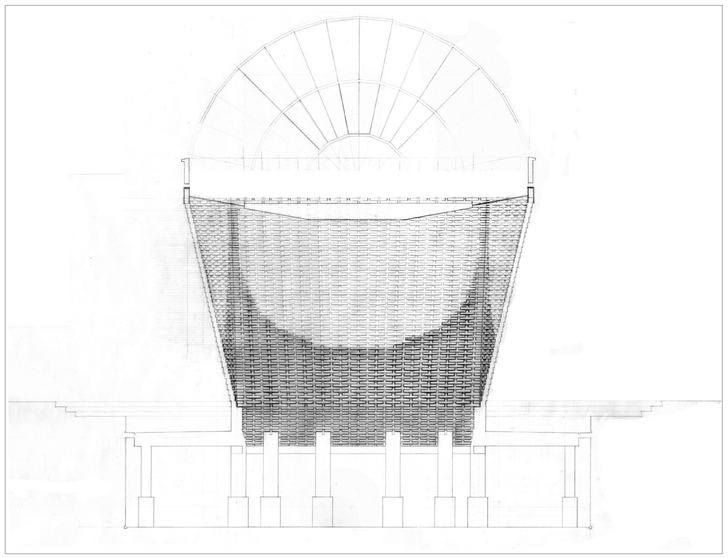
Wheel in the Sky

A concrete and steel wheel cinches the top of the masonry together, providing an end to the building. A translucent shade hangs below the wheel, beautifully directing light and water into the tower. Like the T-brick, the end of the building was not immediately found. Many roofs were drawn until discovering the wheel. It seemed to best fit the form of the building by expressing both strength and infinity.



The Final Section

The Transverse Tower Section drawing evolved over the course of the project. I started the drawing in the middle because I was confident about the T-brick and searched for a good way to both ground the tower and end it at the top. This section is the heart of the project. I always came back to this drawing to test decisions for other parts of the building; it was always most important for decisions to work here. Therefore, I consider the end of the project when I was finally satisfied with this section.



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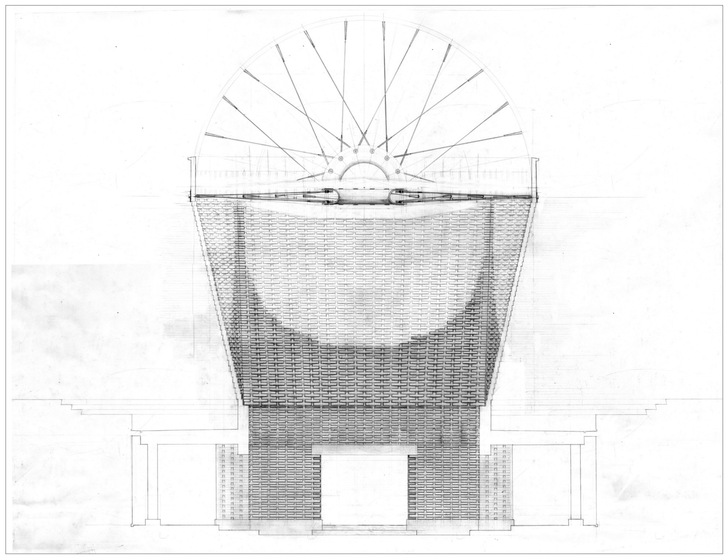

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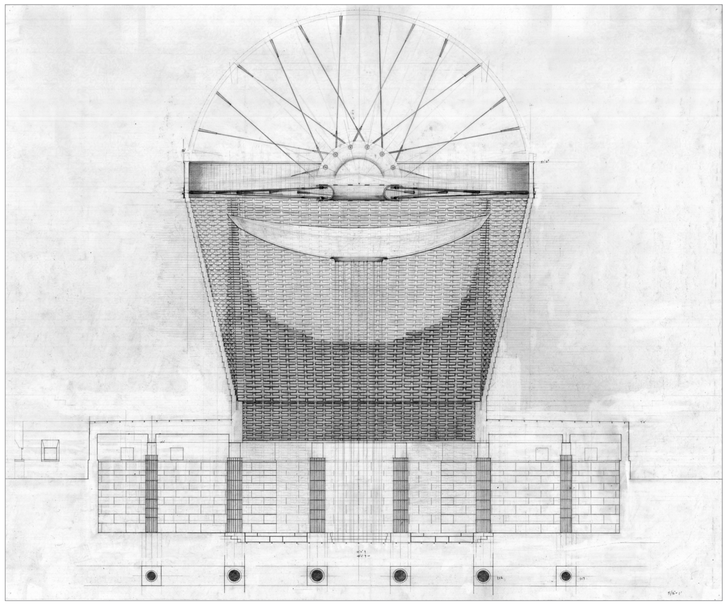

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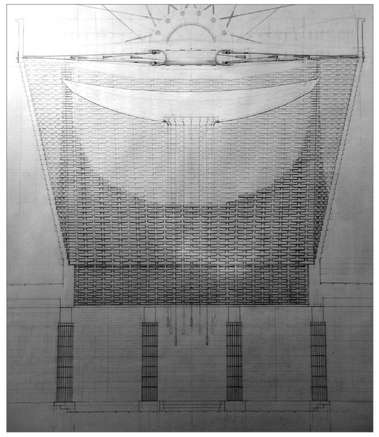

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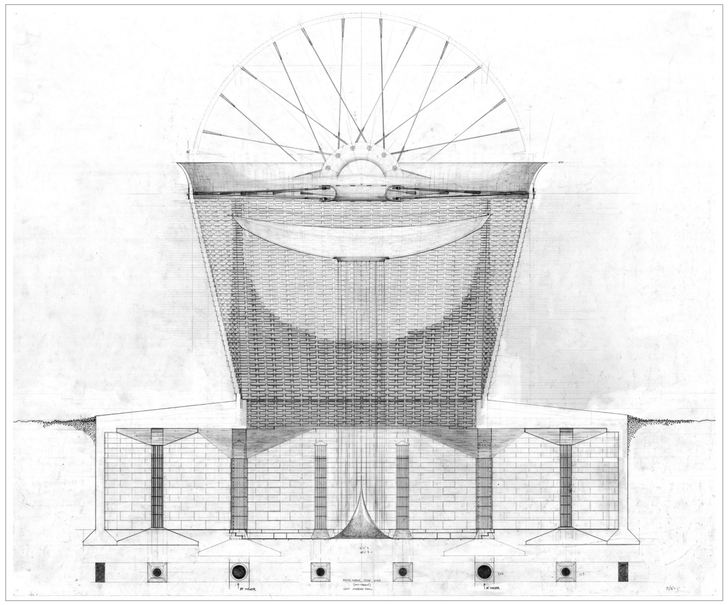


5

Of Being Woven by Rumi

The way is full of genuine sacrifice.
The thickets blocking your path are anything
that keeps you from that, any fear that you may be broken
into bits like a glass bottle.

This road demands courage and stamina, yet it's full of footprints!
Who are these companions?
They are rungs in your ladder. Use them!
With company you quicken your ascent.
You may be happy enough going along, but with others
you'll get farther, and faster.

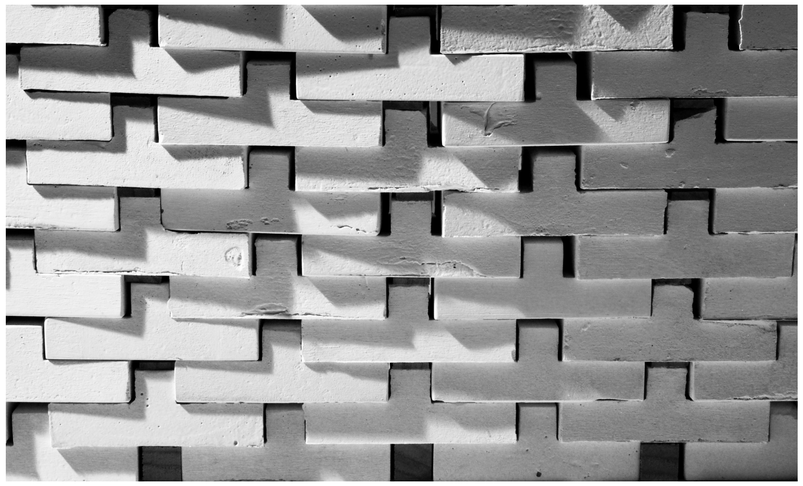
Someone who goes cheerfully by himself to the customs
house to pay his traveler's tax will go even more
lightheartedly when friends are with him.

Every prophet sought out companions.
A wall standing alone is useless, but put three or four walls
together, and they'll support a roof and keep grain dry
and safe.

When ink joins with a pen, then the blank paper can say something.
Rushes and reeds must be woven to be useful as a mat. If
they weren't interlaced; the wind would blow them away.

Like that, God paired up creatures, and gave them friendship.

Cut stone is placed in-between the cast T-bricks to express the textile nature of the tower’s walls



COURSEWORK Constructing a Building from a Brick

G. Michael Cincala

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