TWO AUTONOMOUS SPATIAL SYSTEMS + THEIR JUXTAPOSITION

Syntactic Grid + Pure Geometric Volumes

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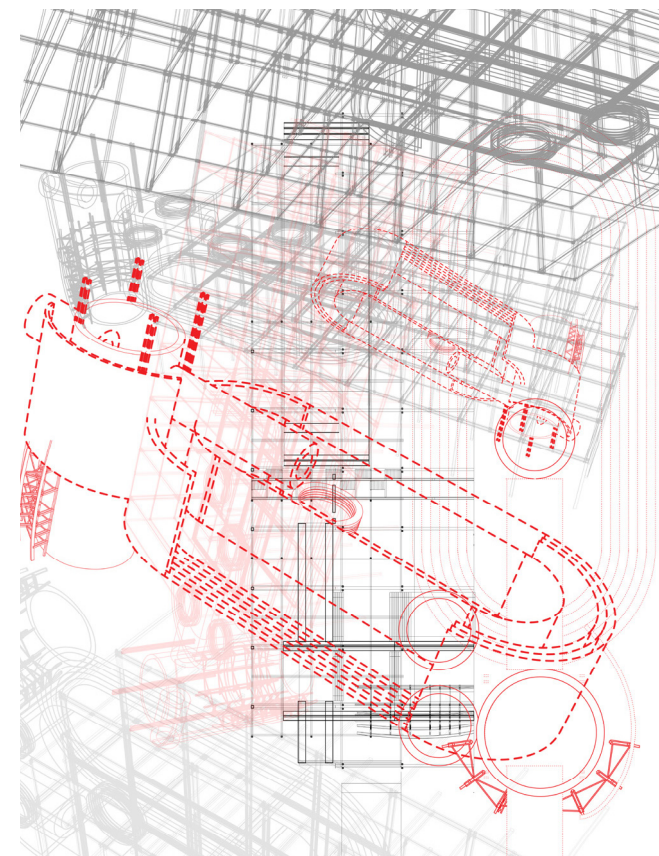
MASTER OF ARCHITECTURE

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Hilary Bryon, Committee Chair

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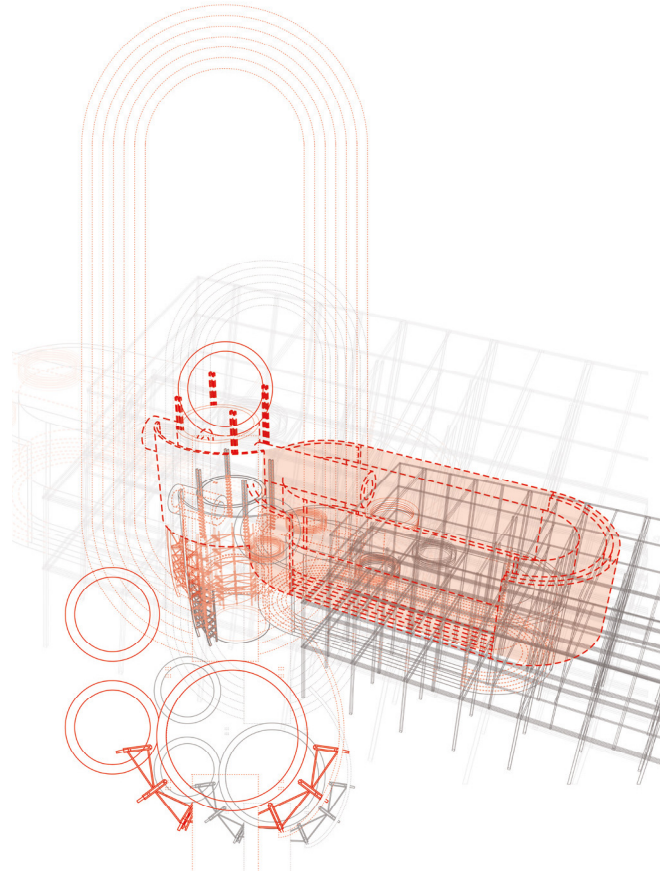William Galloway, Committee Member

June 23, 2017
Blacksburg, VA

Keywords: grid, syntax, pure form, autonomy, action, situations, juxtaposition

ABSTRACT

This thesis explores the idea of two autonomous spatial systems and their interaction: a syntactic grid and a pure formal volume. The juxtaposition of these two elements allows for insight into and exploration of their autonomous ordering potentialities, as well as the potential relationships or consequences that can occur in the presence of both systems. The syntactic grid articulates structure and strength for the architectural project , while the pure volume translates the programmatic function and their distinction from the grid.
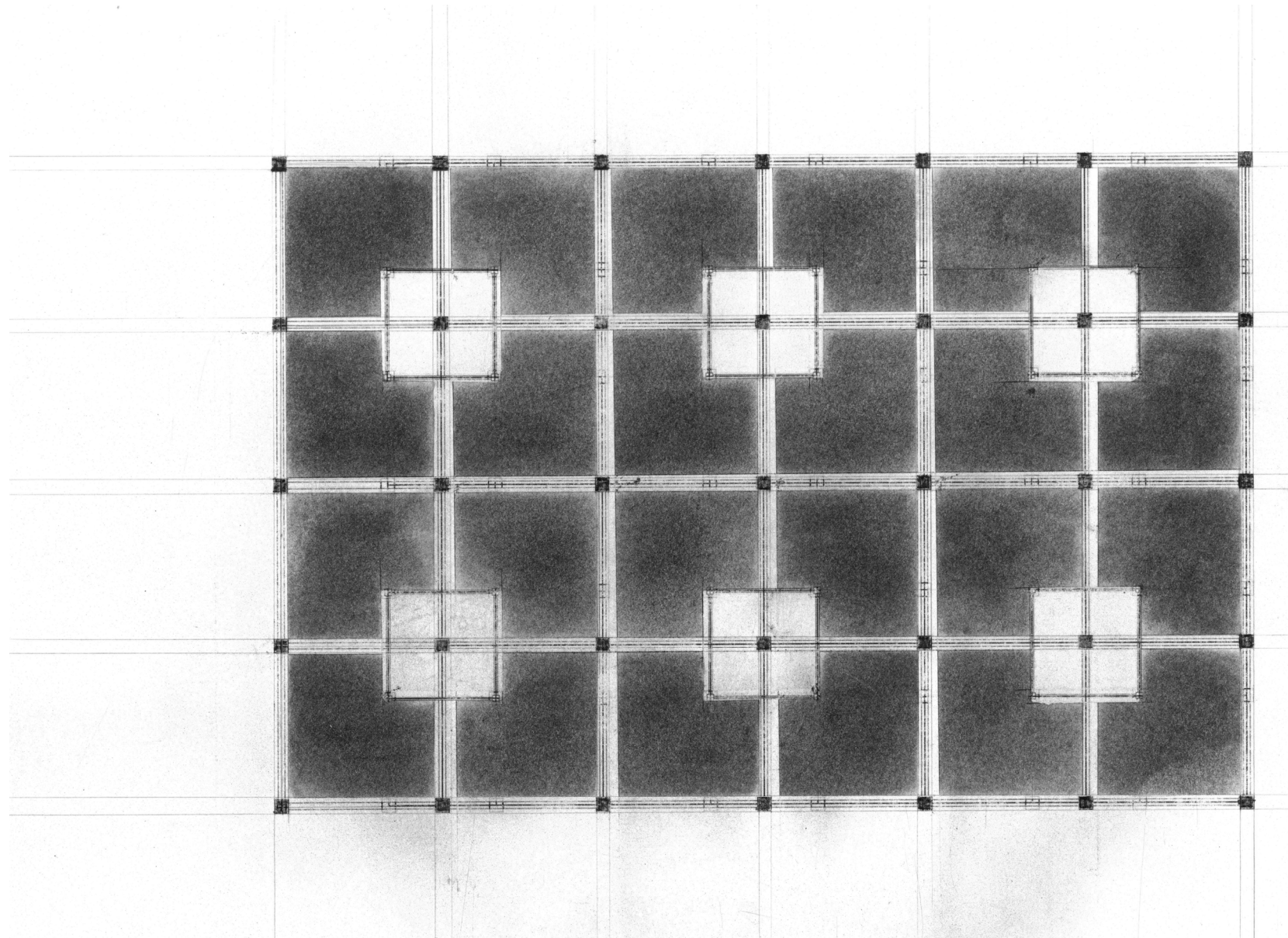
ACKNOWLEDGEMENTS

CONTENTS

AUTONOMOUS SPATIAL SYSTEM I: SYNTACTIC GRID

There are many ways in which architecture is ordered, for example, material limitations, site specific constraints, or functional demands. However in the ongoing search of how one might order architecture, syntax itself became the dominant systematic approach for ordering during the late 20th century. Thus, the thesis found a path through studying points and lines in space, where syntax could not only order these abstract architectural forces, but eventually the physical, material constructs, as well.. Oxford English Digtionary defines syntax as the " A set of rules for or an analysis of the syntax of a language". Investigating syntactic ordering allowed for the development of a materio-spatial system that operated autonomously, providing order and structure by following operations inspired by linguistic principles.
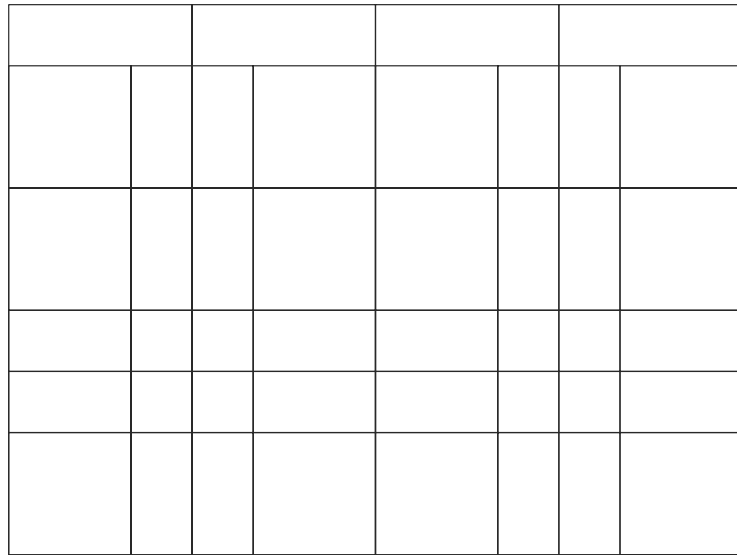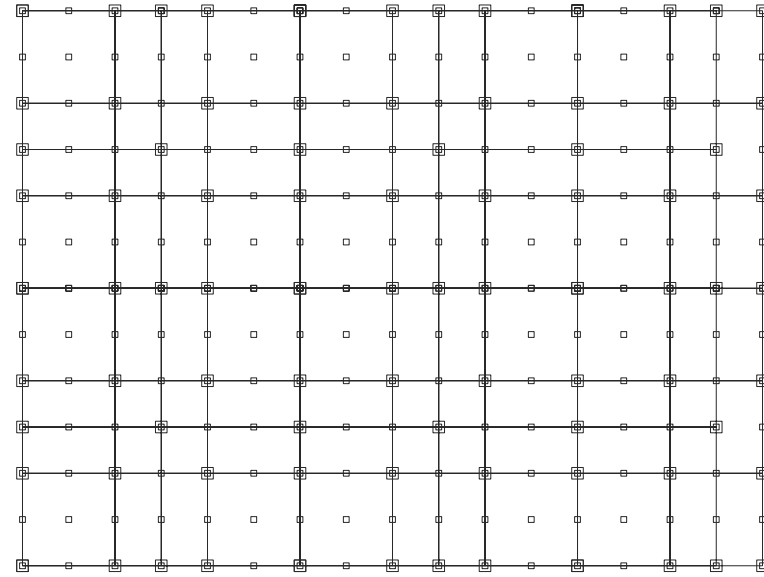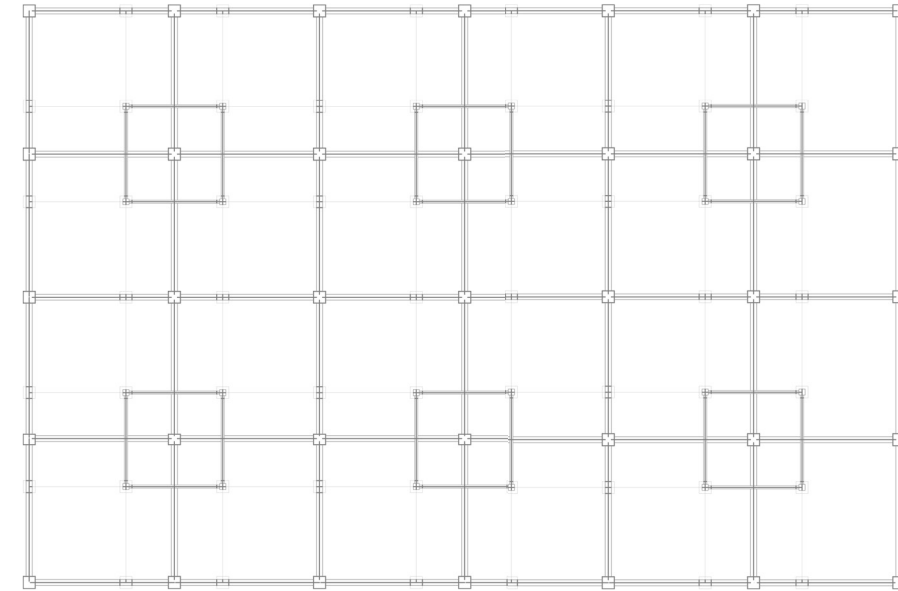
SEARCH FOR ORDER

Diagram of Spatial Ordering Grid

Developing Hierarchical Order

The grid transformed into a cohesive
structural system of columns and beams.

DEFINING SYNTACTIC GRID

The syntactic possibilities in the perpendicular intersections at points by lines to manifest a grid was studied. A "pure" grid is defined by Cambridge dictionary as " a pattern of horizontal and vertical lines that cross each other to make a set of squares." The Oxford English Dictionary describes a grid in spatial terms, specifying uniformity with even spaced horizontal and perpendicular lines that can be used to locate one's orientation. Springing from these definitions, one can create a uniform grid of points and lines, but it lacks any hierarchical order. Applying syntax developed from linguistic operations like: shift, rotate, compress, and extend results in hierarchy throughout the rhythmic grid. Syntax begins to bring cadence and varied order to the grid by the rhythm and repetition of elements as a continued means of measure.

Through precedent studies, we can find methods for a point-line grid system to become translated into architectural elements. Le Corbusier translated his gridded system into pilotis, a method he described in "Rappel a l'orde". Pilotis provides a continued horizontal measurement, offering support and order. This structural ordering principle, provided for the other advantages seen in Le Corbusier's designs. Programmatic floor plans can now be arranged independently of the structure, allowing the structure to straddle the demands of structural load with harmonic proportion and thus provide a means of measure in which building components can achieve order within. By abstracting proportions following linguistic operations, our grid begins to develop itself hierarchically. Through the application of architectural elements like pilotis the grid can be transformed into a structural system that can provide infrastructure to architectural works.

STRUCTURE FOLLOWS ORDER
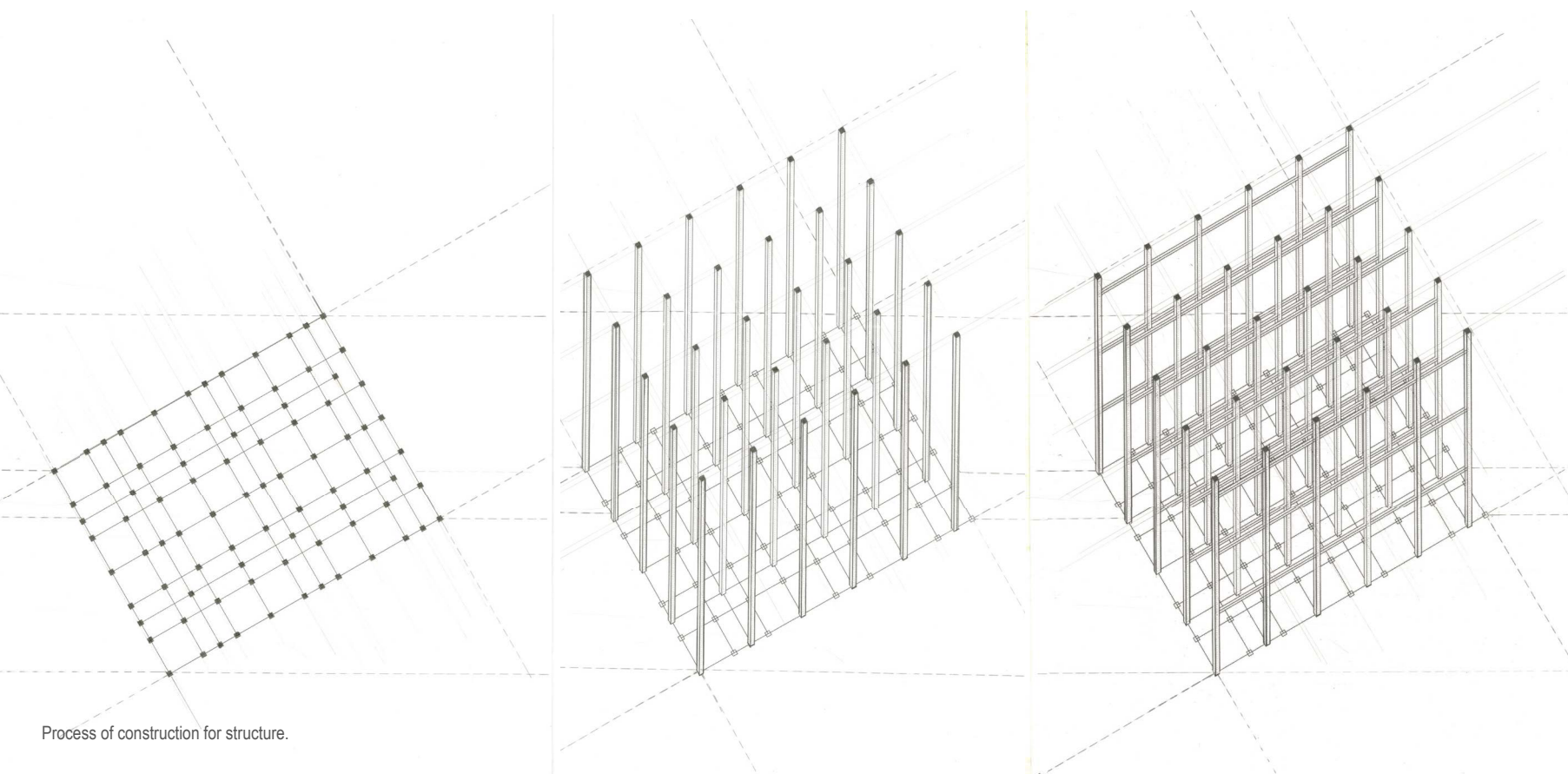

Process of construction for structure.

Studio di elementi architettonici, 1968, Franco Purini. A study of relationships between volumes and linear elements through a drawing analysis of a procedure of construction. Axon drawings revealing the process of construction from a grid. Precedent
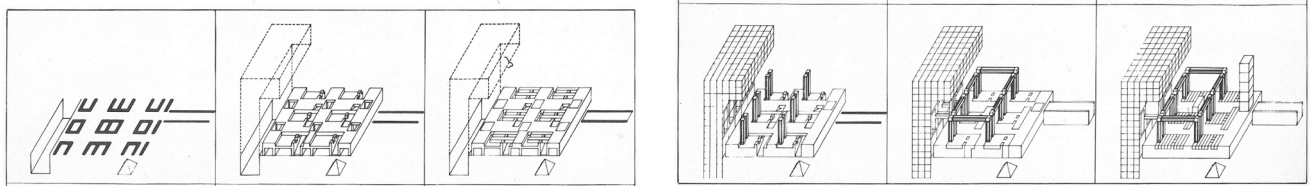
DEVELOPMENT OF AN ORDERED STRUCTURAL SYSTEM
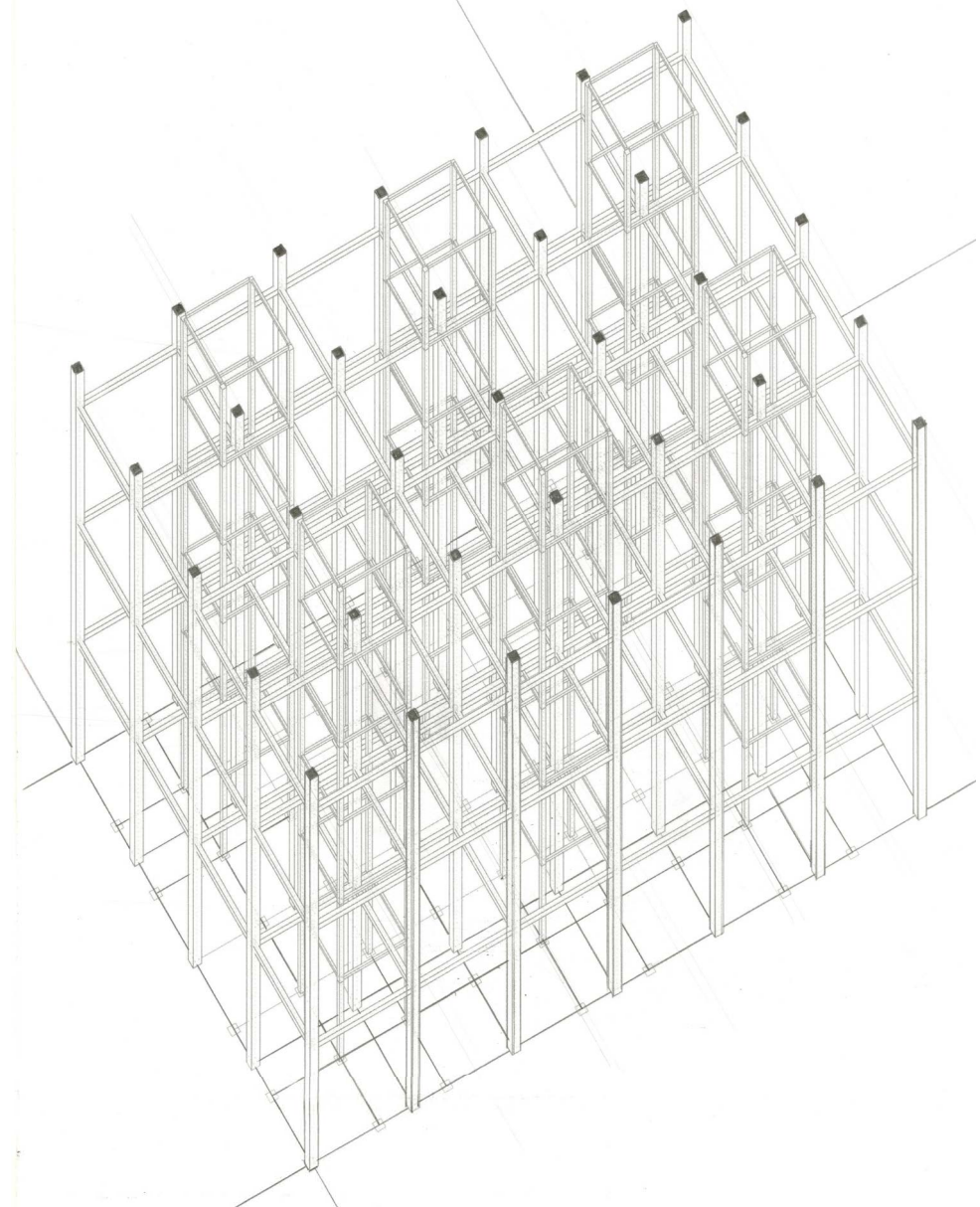
Using the column grid developed from syntax, a study of relations between the base grid and the structural grid can occur through a process of construction. The grid developed into a three dimensional network which now serve as an ordered structural system.

The grid is comprised of a 24-foot bay column and beam structure that works autonomously. This trabeated structure gives little indication of site or material, instead it is tuned toward being an abstracted, proportional component in the architecture.
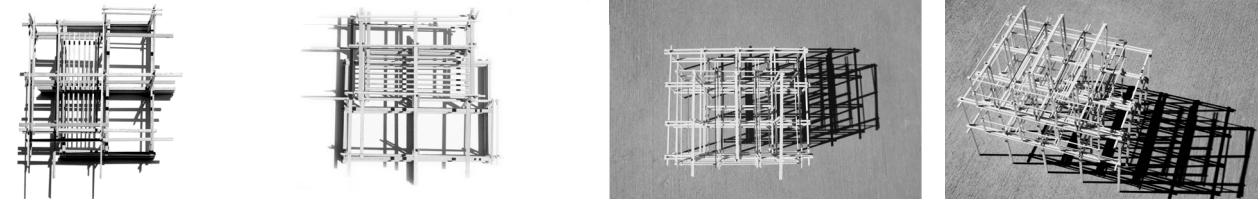
Models analyzing the new structure and its hierarchical organization.

SYNTACTIC GRID HOLDS INFRASTRUCTURE

Rem Koolhaas' 2014 Venice Biennale curated exhibit entitled *Elements of Architecture*, studies the fundamentals seen across all architecture: past, present, and future. If these critical elements engage with the syntactic grid a systematic infrastructure can be formed to serve architectural program and volume. Using three elements that deal with human scale and movement, studies of ordering elements of architecture can begin. The stairwell, ramp, and elevator can be guided and organized by the spatial structure and inserted to create order and proportional relationships with the elements.
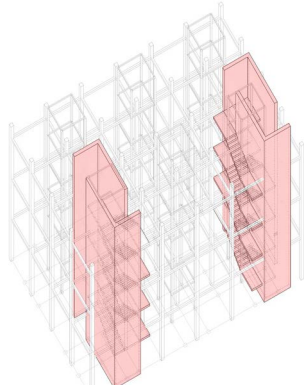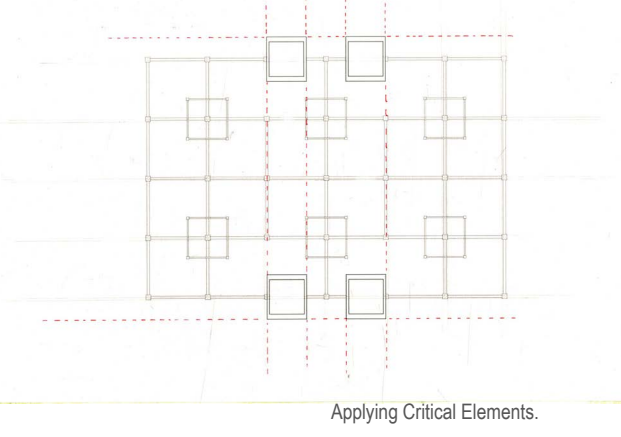
Element 1 : Stairwell
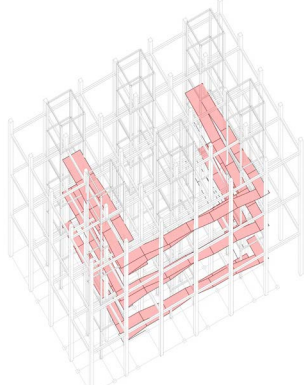
Element 2 : Ramp Promenade
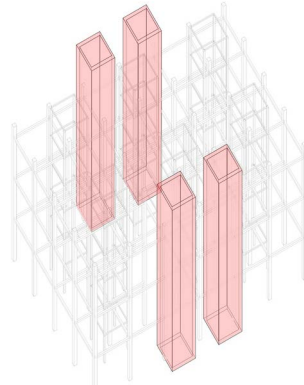
Element 3 : Elevator Shaft
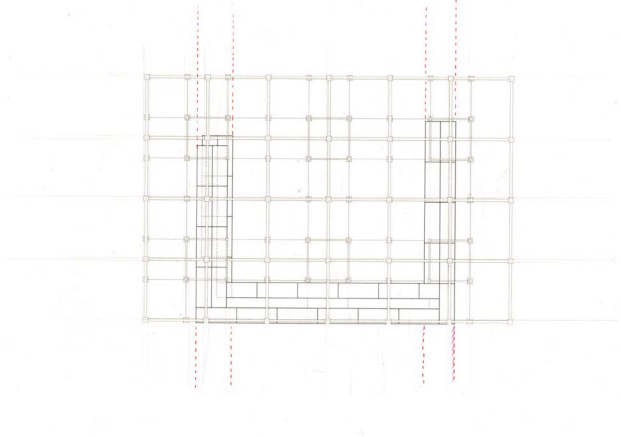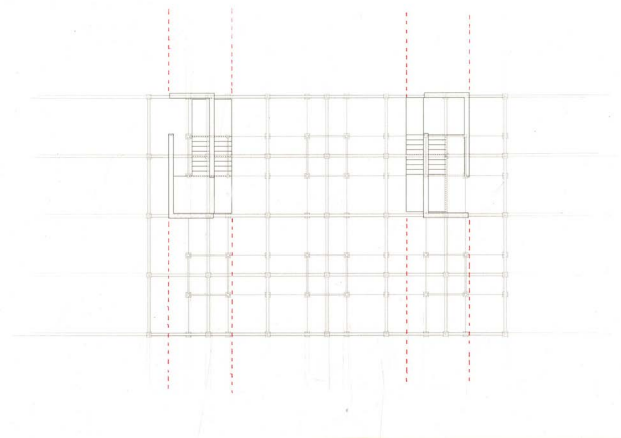
Applying Critical Elements.

A SYNTACTIC GRID THAT SERVES ARCHITECTURE

Following the order of a syntactic grid, organization can occur during all processes of construction. This provides a continued measurement of relationships from the base grid to the linear elements that are creating the spatial circulation system. Now that a structure has been born, fundamental elements of architecture can be inserted, giving a harmonious relationship between all components that act as servants to program. This development of the first autonomous spatial system: the syntactic grid, works as a servant of architecture. The syntactic grid is not finely turned to any program or use, but blindly obeys the order of syntax.

Synthesis of Circulation Elements and Grid

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AUTONOMOUS SPATIAL SYSTEM II : GEOMETRIC VOLUMES

Pure, formal geometric volumes
can disrupt the syntactic grid
and the study of the geometry
of a circle and the extrusion
of that geometry with a pure
cylindrical volume holding
programmatic activity is placed
within the syntactic grid.
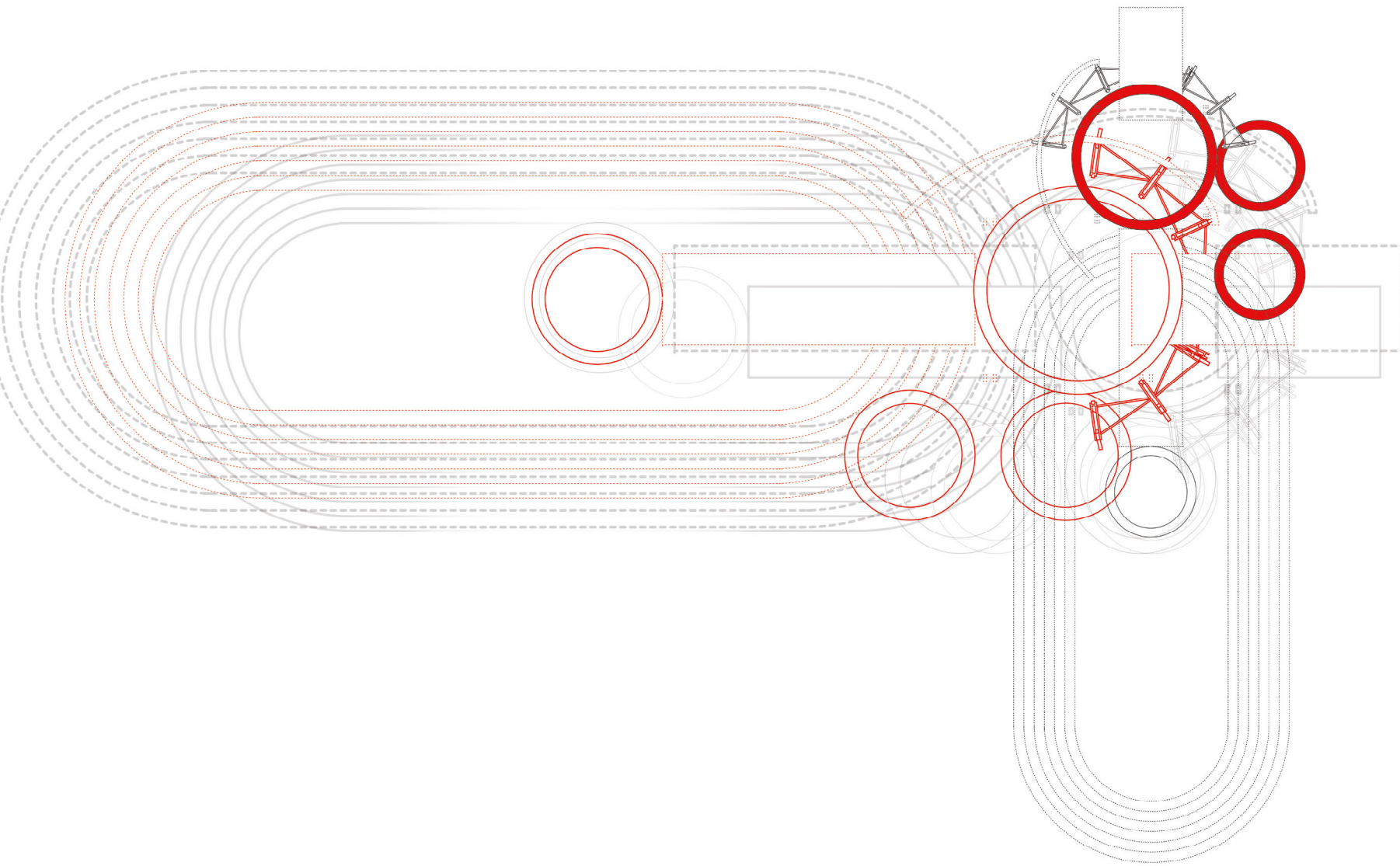
Abstracting pure geometry of a circle.
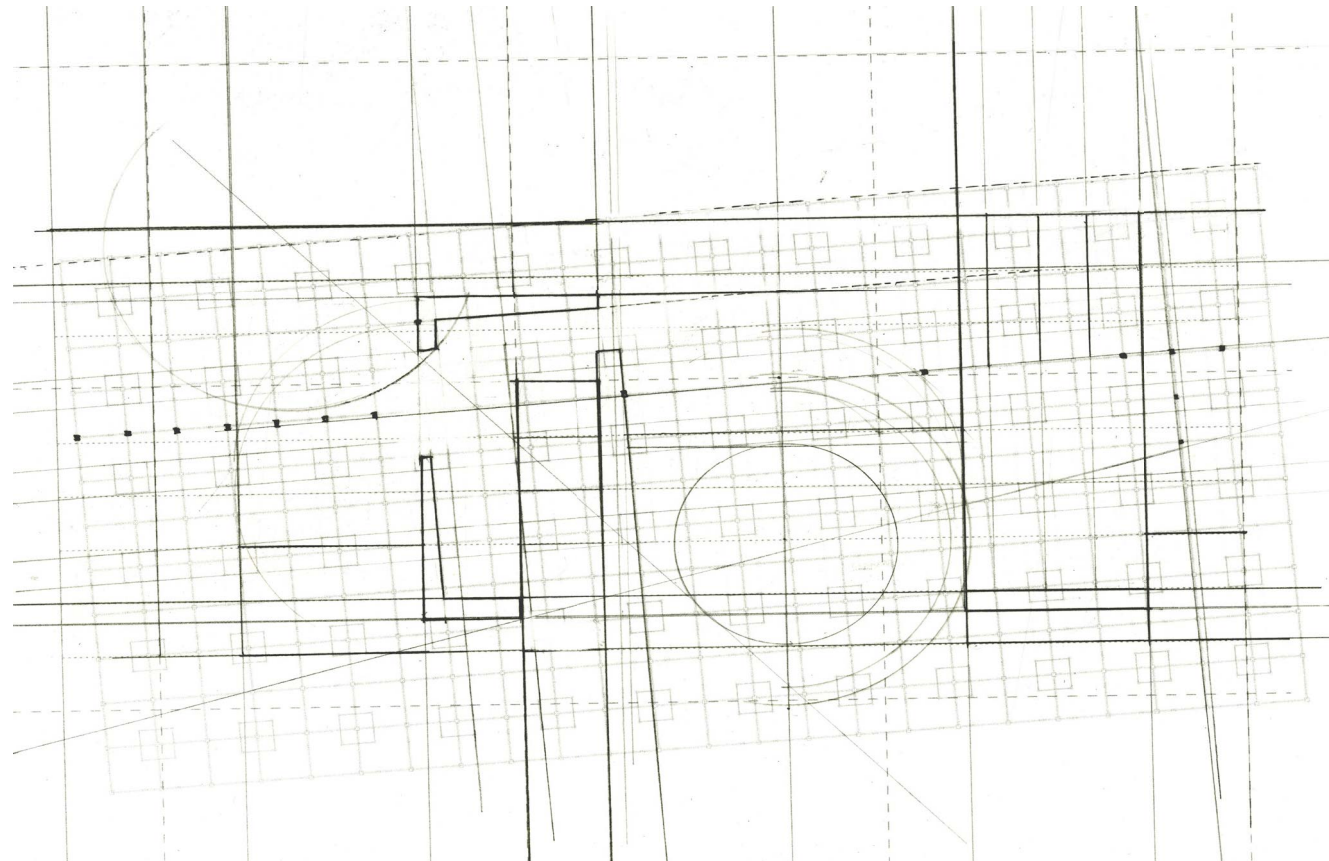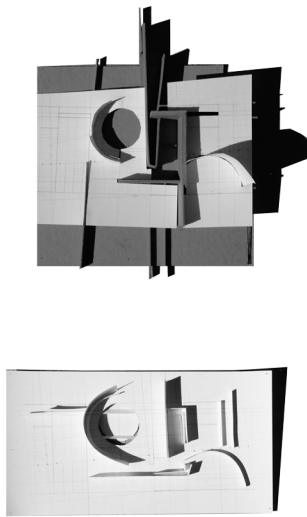
Overlaying the grid with pure geometry that disrupts the grid.

PURE GEOMETRY LEADS TO PURE FORM

To agitate the syntactic grid, one must utilize the opposite. Since the grid is regular and perpendicular, the geometry of a circle became a stark contrast. The syntactic grid maintains an endlessly extending, linear, perpendicular, and ordered system. A circle, and its volumetric form as a cylinder, is contained, with an in-side and out-side, and directional. Engaging with the geometry and replication of a circle created a variety of spatial conditions. The pure geometry of the circle results in the pure spatial volumes of cylinder and ellipsoid.

Studying Geometry and Form through Modeling.
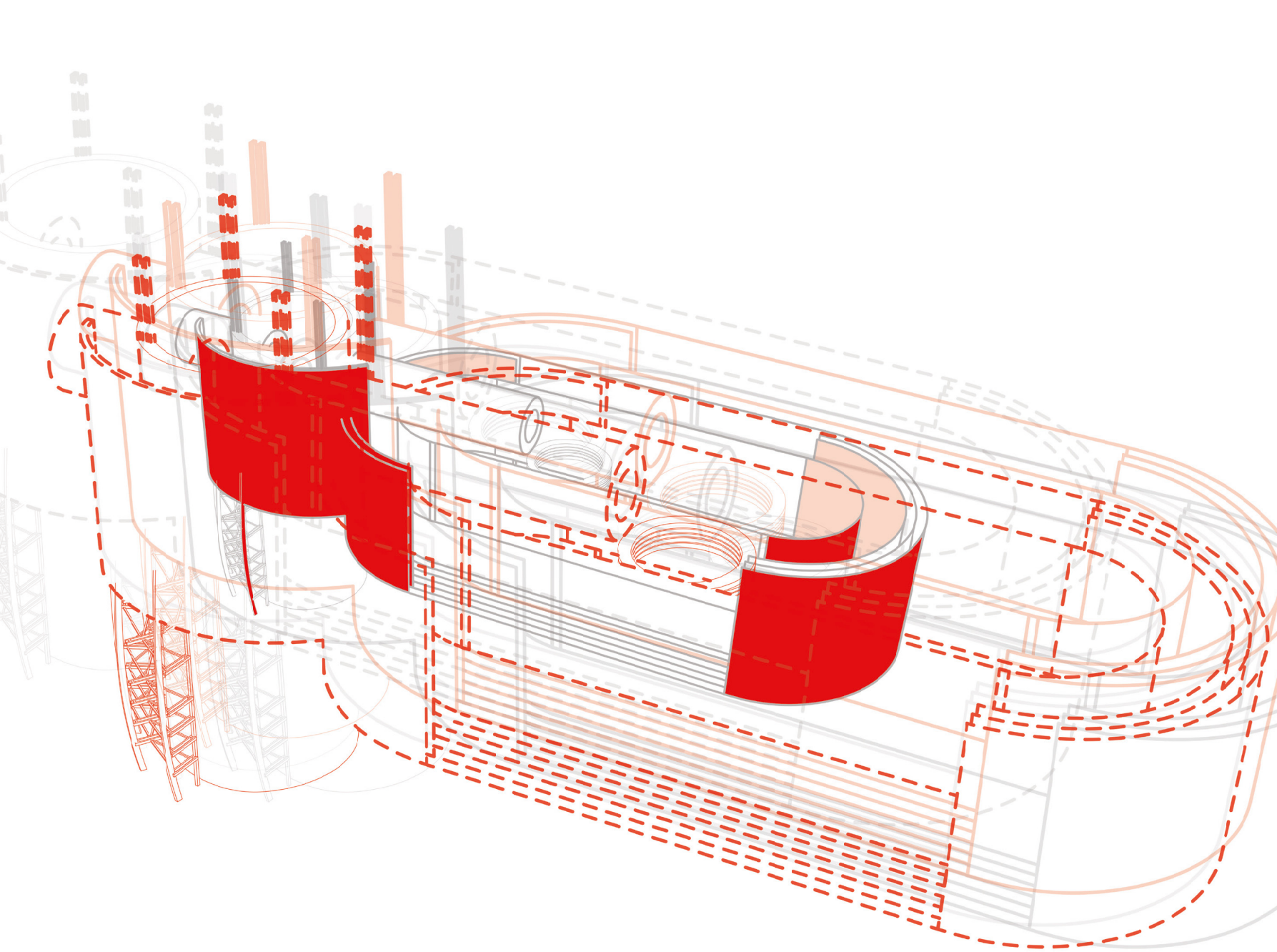
Formal Volumes and their Juxtaposition.

GEOMETRIC VOLUMES ARE QUALIFIED WITH ACTIONS (EMERGENCE OF PROGRAM)

The emergence of pure formal geometric spatial volumes indicates certain programs of use that may be well accommodated within them. Moreover, the geometric volumes do not need to share programs., rather each volume can be considered as dedicated and autonomous. This approach is inspired by the idea of architectural lobotomy, coined by Rem Koolhaas, where programmatic volumes do not need to relate to one another, they can be served by a separate infrastructure (in this case, the syntactic grid). The formal expression of the volume is the only constant. Programmatic variation can occur because the form suggests ways of inhabiting it--and not just one but multiple ways of interacting within the articulated space.
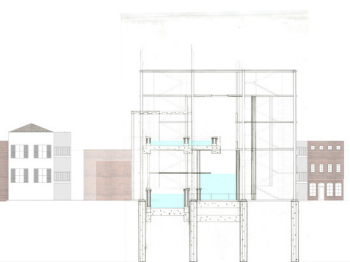
The multiple vessels containing water.
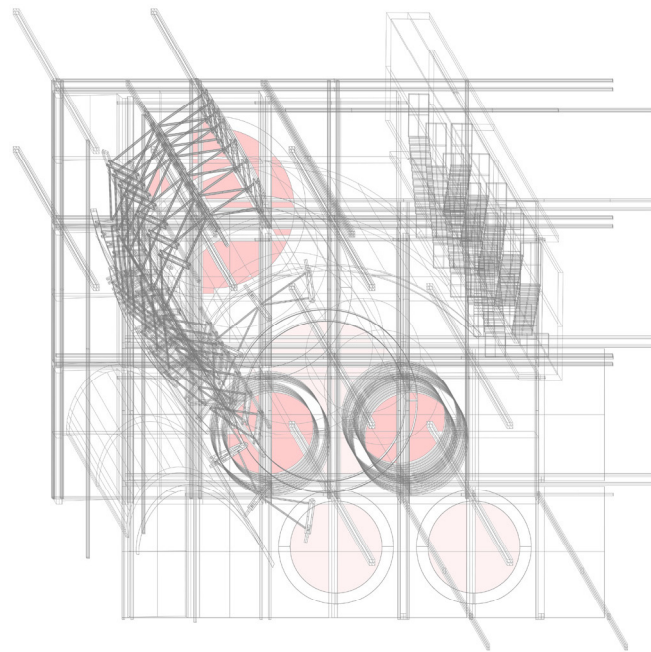
Circles become vessels through extrusion and rotation. The spatial volumes indicate programmatic occupation.
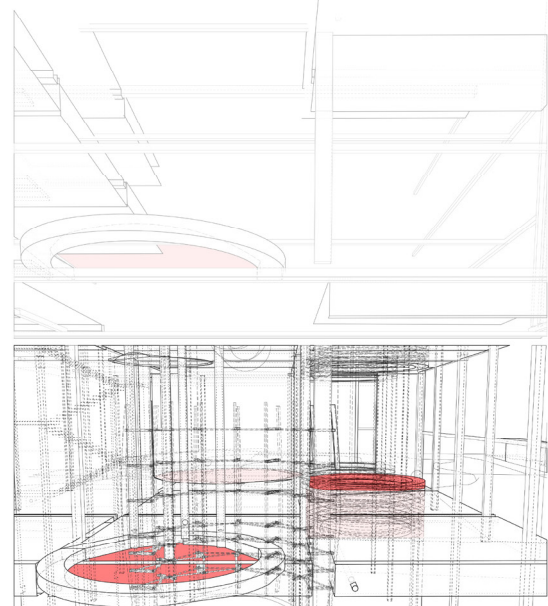
Studying transparency caused by the reflectivity of the water and glass material.
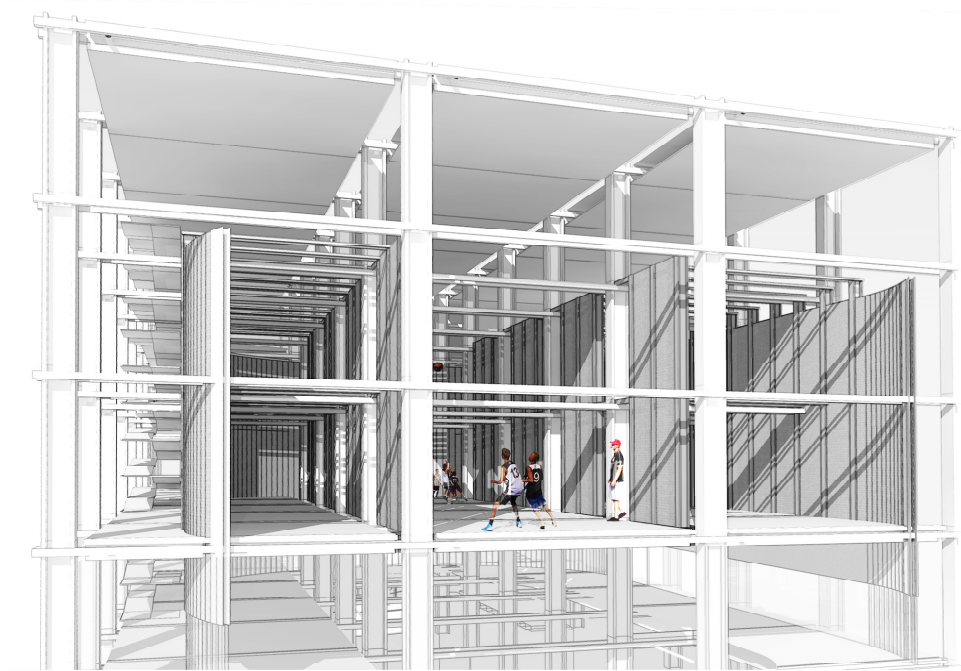
Configuring a game court within a geometric volume.
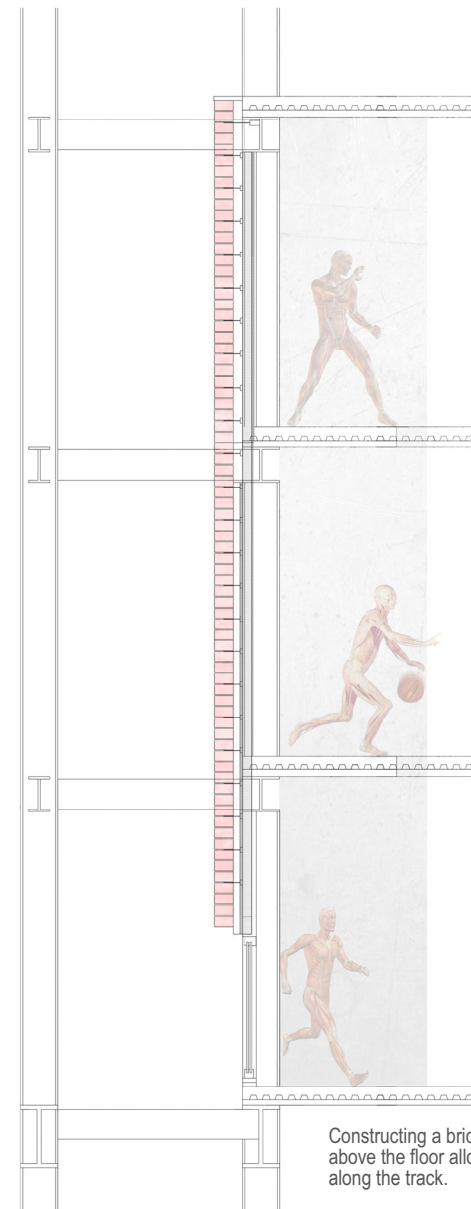
Constructing a brick envelope that floats above the floor allowing for transparency along the track.

PROGRAM 1: BATH HOUSE

The form of the cylinder was manipulated according to rules of translation (shift, rotation, compression, and extension) creating a variety of spatial volumes. A clear cylindrical shell indicates a contained space--perhaps also, a vessel. Activity that could be related to a cylindrical vessel include the containment of fluid--perhaps another clear element--water. Thus, a programmatic bath house develops within this volume series. A cylinder held vertically suggests a bath where one may rest and wade in a sacred program of bathing or ablution, while a cylinder held horizontally indicates a space where one may travel in a lap pool of athleticism. In addition to cylindrical geometries, the geometry of the circle is rotated to create a glass dome--this space, where one can receive a 360 degree view of the sky, suggests the use of a planetarium.

PROGRAM 2: TRACK

Two circles arrayed a more complex pure form-- an ellipsoid. The curved line suggests movement, and indicates the programmatic function of a racing track. The track's unique ellipsoid form enables it to be cut into a variety of sections, allowing its programmatic function to change based on human need and action. The oval section of the track implies a variety of track and field events (sprinting, long-distance running, hurdling, etc.) The ellipsoid also has a rectangular section that sits inside the track. This rectangular shape defines a court leading to specific athletic games to take place (basketball, squash, volleyball, etc.).
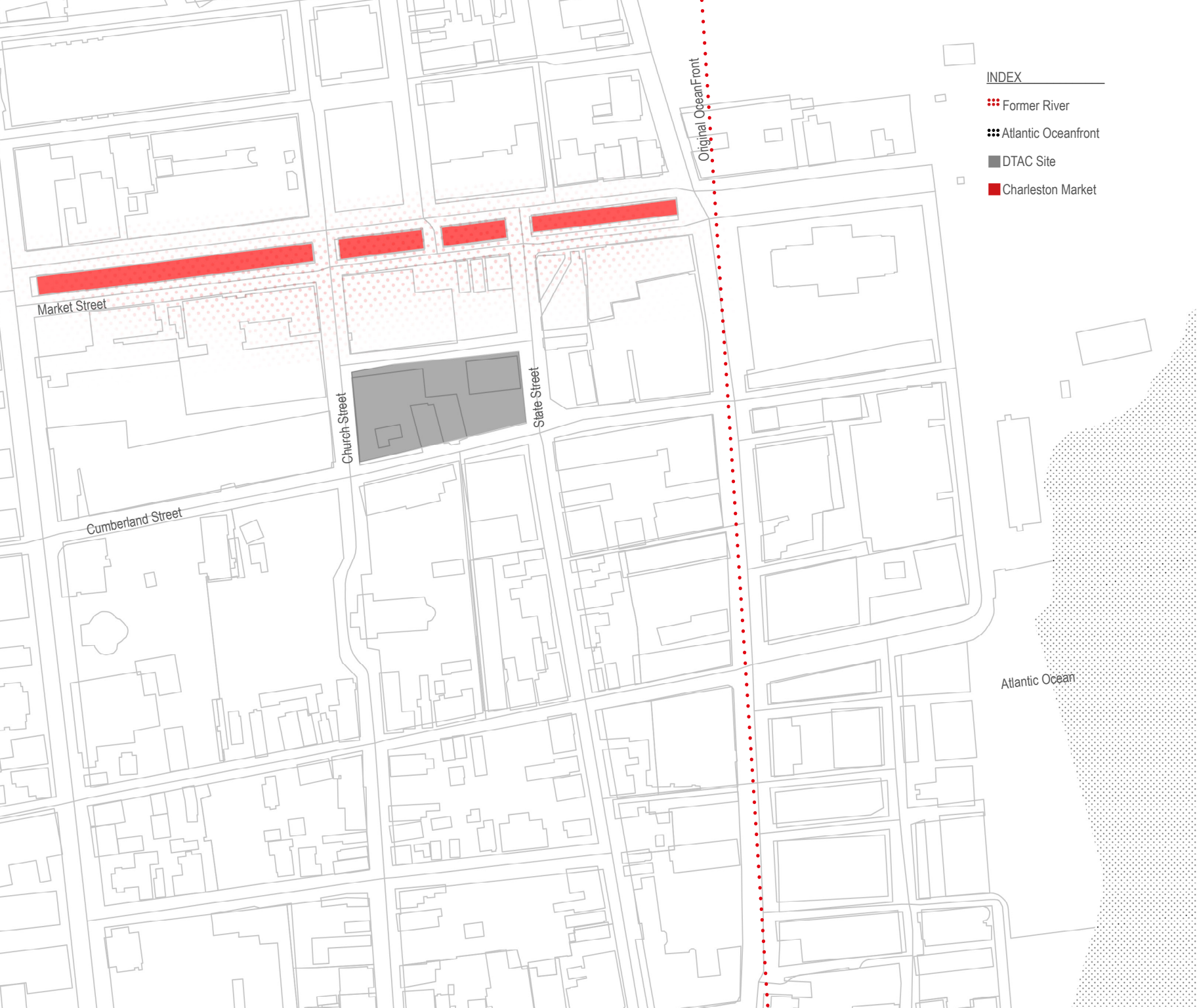
INDEX
::: Former River
::: Atlantic Oceanfront
■ DTAC Site
■ Charleston Market

Original OceanFront

Market Street

Church Street

State Street

Cumberland Street

Atlantic Ocean

IMAGE:
Charleston Historic Market

Charleston Market as it is today, during dry conditions.

IMAGE:
Kayakers in Charleston Market

Charleston Market under natural flood variation.

SITE SITUATIONS IN CHARLESTON, SOUTH CAROLINA

Charleston, South Carolina is the oldest and largest city in the United States, created by the joining of two rivers to form an inlet. Today, the geographic and topographic conditions of the city lead to questions of resiliency as frequent flooding has plagued the historical waterfront town, and future trends indicate even greater challenges related to water infiltration.

The site for the proposed Downtown Athletic Club is located in the historic district of Charleston. Its lot is adjacent to the location of the historic Charleston Market, which runs from Meeting Street all the way to the waterfront. Charleston Market (see images) gets its unique narrow form from the river that once occupied the site. The river was infilled to create the site of the market we see today.

The block for the proposed intervention is between Church and State streets, which both terminate at the Charleston market building, giving the site linkage to this historical building and place.

Charleston itself provides the architecture, comprised of the two autonomous systems (a syntactic grid and geometric volumes), with situations that test and reveal the potential in the systems' rules as, juxtaposed to the grounded, unique location.

The spatial systems, now being grounded to site, brings questions of how they could be situated within place. Place being defined as "a totality of concrete things having material substance, shape, texture and colour." (Norberg-Schulz, Genius Loci)

The spatial systems negotiate with the landscape of the place by being resilient to regular flooding and storm water excess. The site is located in an AE flood zone, which mandates enclosure of new construction to begin at the Base Flood Elevation of 15 feet. The grid allows architecture to exist on the site at the human scale, while still providing structure for the programmatic volumes to rest above the flood zone through the use of pilotis.

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Schematic design elevation studies (left) show how the syntactic grid allows for the formal volumes to rest above all potential flood zones. The grid regulates and measures the landscape and its natural variation. Since two levels of the grid are susceptible to frequent flooding, the grids height must be five storeys tall. Thus, only the upper three floors are designated to hold programmatic volumes. This is similar to the height restrictions around the historic district and its housing typology: the Charleston row house (3 storeys).

IMAGE:
Charleston Historic Rainbow Row
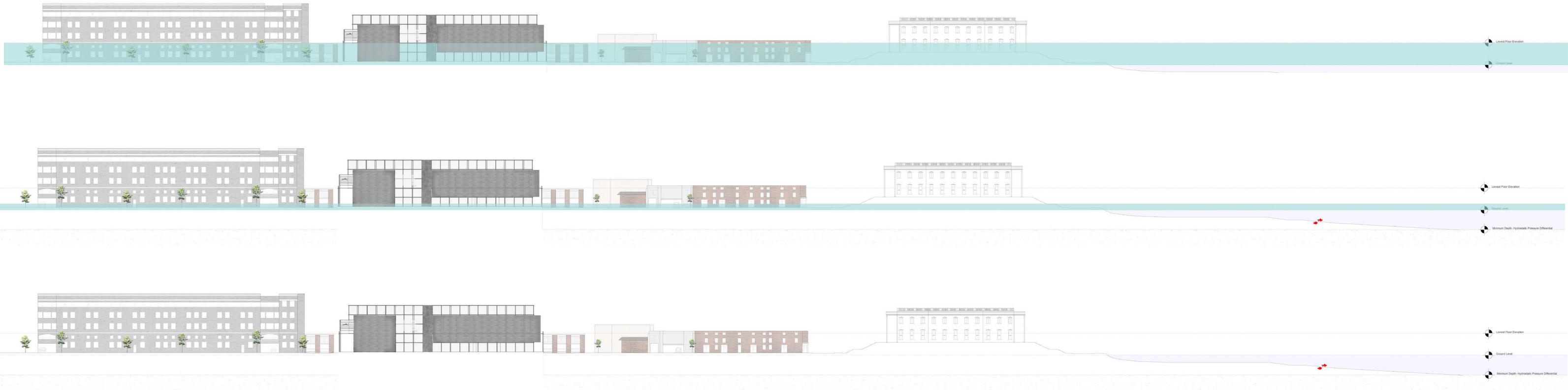
Schematic design elevations showing the Downtown Athletic Club with natural flooding variation.
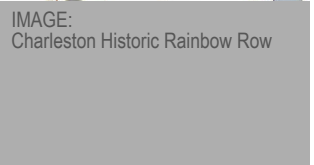
Rainbow Row House, a historical Charleston row neighborhood.

CHARLESTON'S PALETTE

The ground of the city, its material, shape, and texture contribute to the environmental character of place. The ground of historic Charleston, South Carolina was constructed from local clay bricks and cobblestone. The cobblestone traces back to Charleston's deep history as a port city. Cobblestone came to Charleston as ballast for trade ships, and later were used for paving of the streets. Charleston's rich history and character is embedded in the ground's materiality. Decorative wrought iron works define boundaries between public and private spatial conditions around Charleston. The use of ironworks became Charleston's symbol of ornamentation through materiality. Since the site of the DTAC sits in the historic part of Charleston, the DTAC's design uses this materiality to create floor textures that allow the site to become interwoven with the fabric of the historic city.
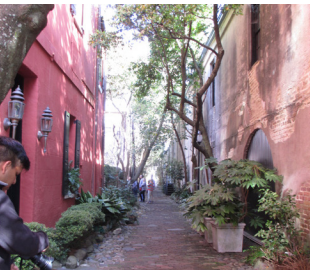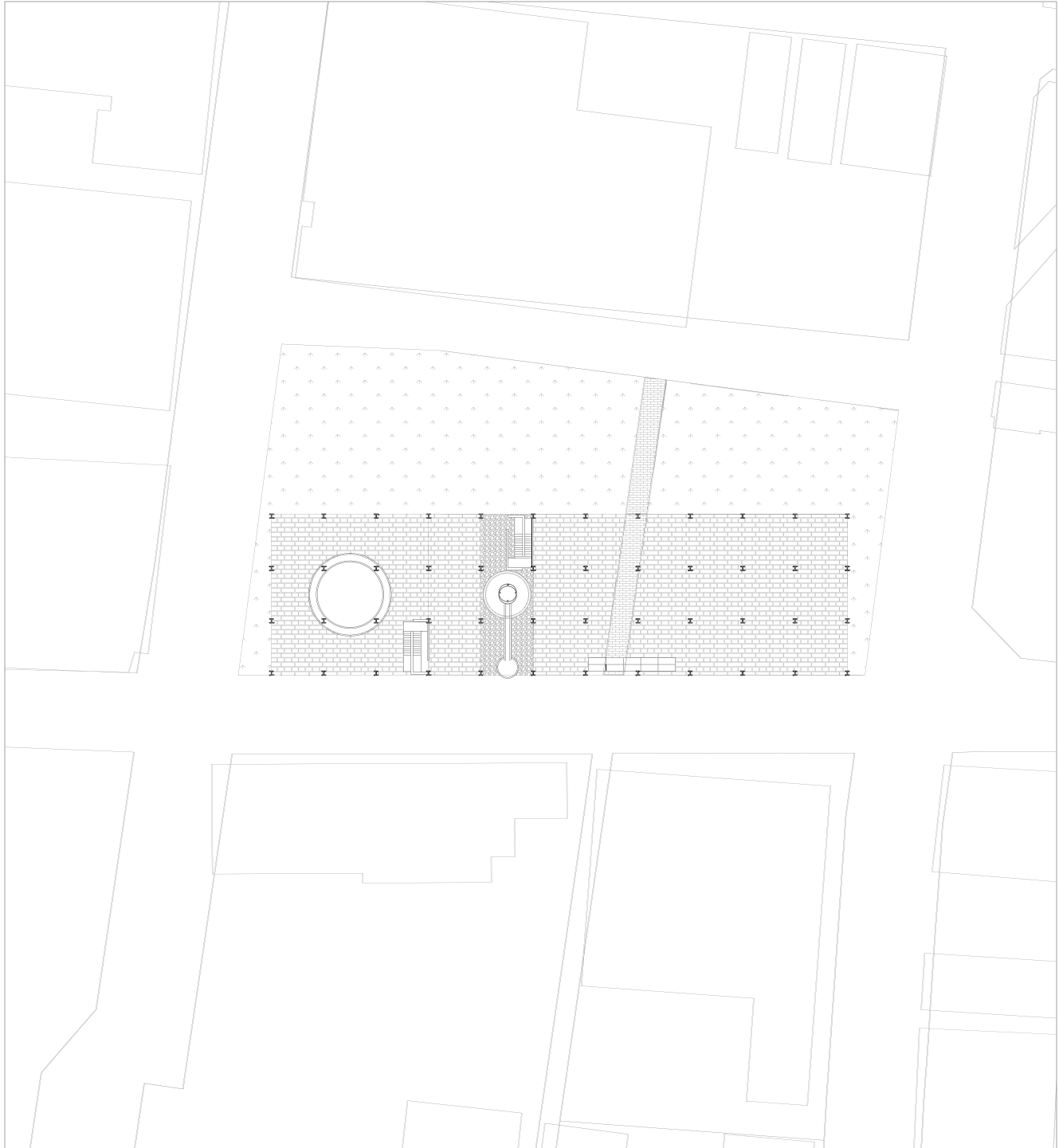
TEXTUAL OBSERVATIONS

Charleston , South Carolina is full of linear paths developed by the occupants' search for relief from the hot southern. These long narrow pathways are shaded by long vertical walls defining their boundaries. These paths became so popular, entrances from these pathways became a common a feature of houses and commercial properties and developed into a typological urban room situation--particular to the site specific conditions of Charleston. These pathways are often heightened with character from the texture and materiality that create them. These pathways not only serve as access routes to destinations, but are also filled with the most scenic views of historic Charleston, navigating you through parks, cemeteries and other picturesque images of nature.

IMAGE:
Local Red Brick, Charleston

Local Clay Red Bricks

IMAGE:
Cobblestone Road, Charleston

Cobblestone once used as ships ballast

IMAGE:
Decorative Iron Gate, Charleston

Decorative Ironworks

Current Flood Elevation Height

Current Stable Water Table

Stable Foundation Soil

Normal spatial condition, showing the
brick floor material palette and the
return of the ground to the city.

Spatial condition during the natural
variation. Kayakers can enjoy a view of
the grids architecture during the flooding
condition.

The Downtown Athletic Club is formed by the two autonomous spatial systems negotiating with one another.

IMAGE:
Rem Koolhaas, Downtown Athletic Club Section in *Delirious NY*

IMAGE:
Rem Koolhaas, Downtown Athletic Club Boxing Perspective in *Delirious NY*

Above: "eating oysters, naked, on the nth floor." Men engaging in multiple programmatic actions represented in *Delirious New York*, by Rem Koolhaas. Right: Cultural programmatic congestion of the Downtown Athletic Club in NY by Rem Koolhaas.

ARISE OF A BUILDING: A DOWNTOWN ATHLETIC CLUB

The Downtown Athletic Club was selected as the program for the combination of these two spatial systems as it is often idealized as the program that allows architectural freedom. Rem Koolhaas states in Delirious New York his infatuation with the activated use of program seen in the Downtown Athletic Club in New York. The Downtown Athletic Club is a cultural congestion of social activity. Koolhaas describes the programmatic variety as a vertical schism, achieved by the replication of floors and the possibility of one infrastructure serving a variety of programmatic needs and functions. Koolhaas' analysis serves as precedent for the proposed Downtown Athletic Club in Charleston, SC. The idea of one infrastructure (the syntactic grid) holding all the apparatus for circulation and use and serving the variable programmatic volumes within allows for each autonomous spatial system to exist and create one condenser of social activity. The Downtown Athletic Club creates a situation in which the two autonomous spatial systems can be manipulated to create one unified piece of architecture while responding to consequences that arise from place. Questions of infrastructure and use occur when these two systems are juxtaposed. Infrastructure serves the geometric volumes while being regulated by the syntactic grid. Building infrastructure is defined as circulation, plumbing, roof, floor, and utilities. While the geometric volumes are being served by the infrastructure and as ruled by the syntactic grid, in which the grid intersects the geometric volumes creating a variety of interesting spatial conditions where these two systems negotiate. This thesis explores the relationships that occur within these two spatial systems as they come together to form the Downtown Athletic Club.
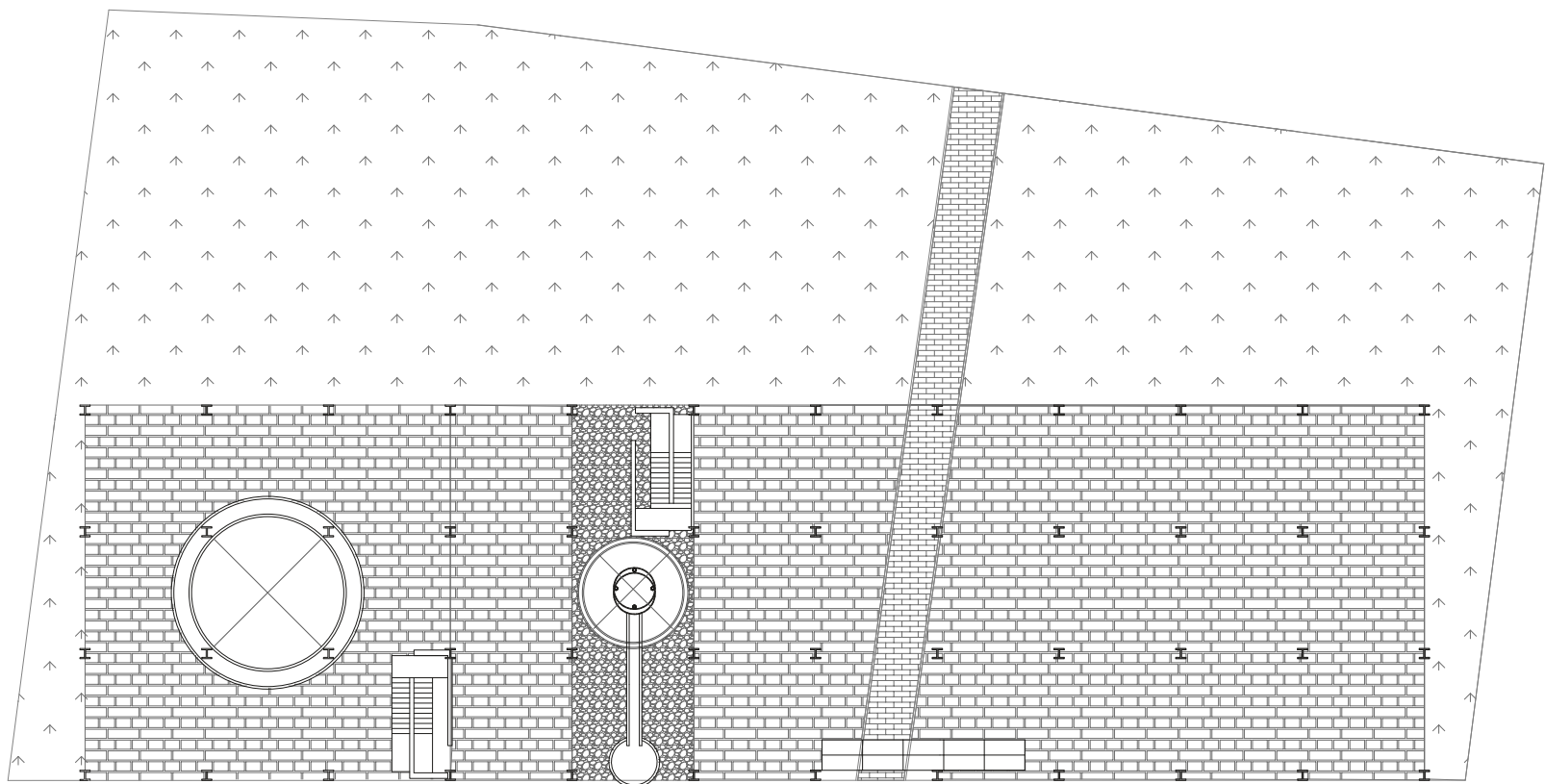
Above; Ground Floor and its Material Texture
Right: Brick texture of the city contrasting the
stark, cold autonomous nature of the syntactic
grids steel.

GROUND FLOOR, A MATERIAL RETURN TO THE CITY

The first floor is a forest of columns, returning the ground back to
the city. Therefore, the floor is a palette of the city, brick and gravel,
and allows the extension of Philadelphia alley, connecting the
ground to Charleston's historic streets and their past. The pilotis of
the syntactic grid allows for the programmatic volumes to be lifted
off the ground, allowing the first floor to recognize ground and site.
The a-materiality of the syntactic infrastructure and its cold steel
sharply juxtaposes the warmth of the city. The cool steel is a forest
against the warmth of the brick.
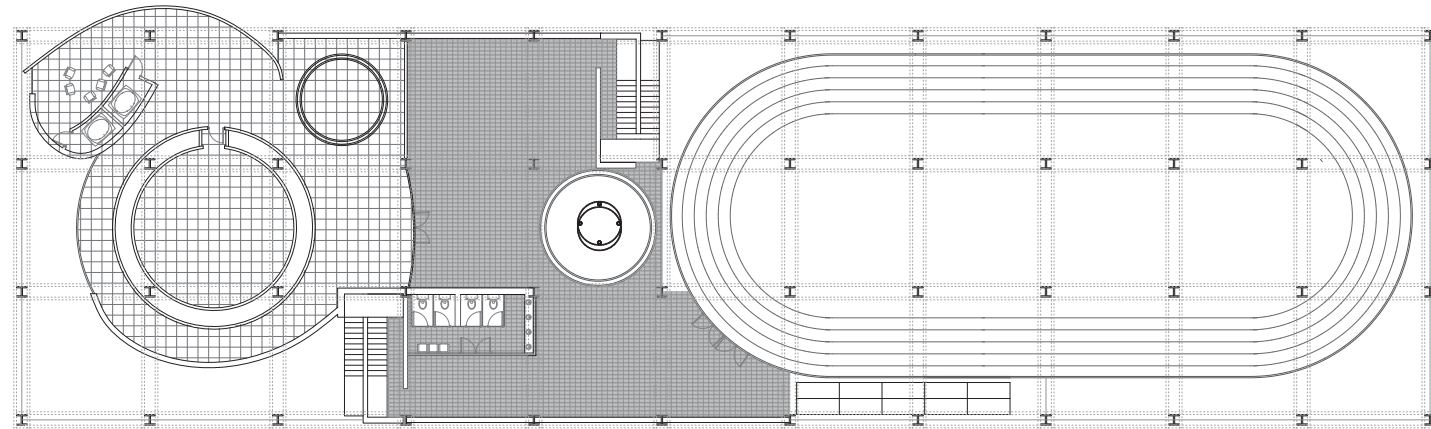
Above; Second Floor showing the large cylindrical bath house and its entry. Right: Reflections from the cylindrical volumes contrasting against the cold concrete.

SECOND FLOOR : A GLASS BATH HOUSE

The bath house stems from the geometric volume of a circle. The program becomes infused into this large cylindrical volume that serves more than the purpose of holding water. Its cylindrical volume suggests certain types of program, an idea seen in Bernard Tschumi's Manhattan Transcripts. The largest cylinder (see in plan above) becomes more than a device for holding the bath water, but becomes a spatial volume--a glass room that serves multiple purposes. On the second floor, you can access the glass cylinder to enjoy a bath full of reflections from the water as well as from the glass material. This plays with the idea of nature and architecture with the materiality of nature and its reflections and the similar reflections and thickened material of glass.
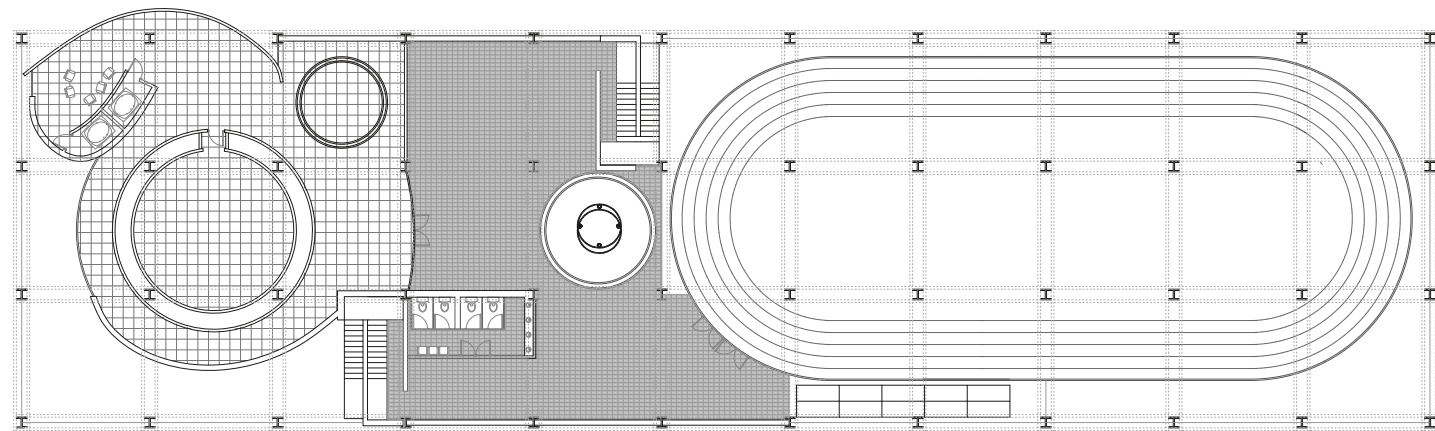
Above: The second floor of the DTAC showing the oval shape of the track.
Right: Standing in the syntactic grid you can see the stark contrast of the steel autonomy grid and the geometric volume that holds the track encased in local clay red brick.

SECOND FLOOR : TRACK

Paralleling the Bath House on the second floor is the geometric volume of the track. The track's form comes from the intersecting geometry of two circles, creating an oval. This oval has not been perfected or altered for track use, thus it demands that human activity alter itself to inhabit the architectural space. The geometric volume is now qualified by actions that may occur within it. The material palette helps bring a material connection to the site. The brick hovers over the ground, implying the oval form while allowing a curated view of the runners in motion. The interest of kinesiology is not new to architecture, Le Corbusier often saw movement throughout a building as a choreographed measure. The track serves as a geometric volume of this choreographed measure, showing how runners must navigate a pure geometric track instead of one fine-tuned to the program of running.


Above: The curated view of the body from the syntactic grid.
Left: The brick hovers over the ground; implying the oval form while allowing view of the exterior grid structure to be revealed while inside the track.
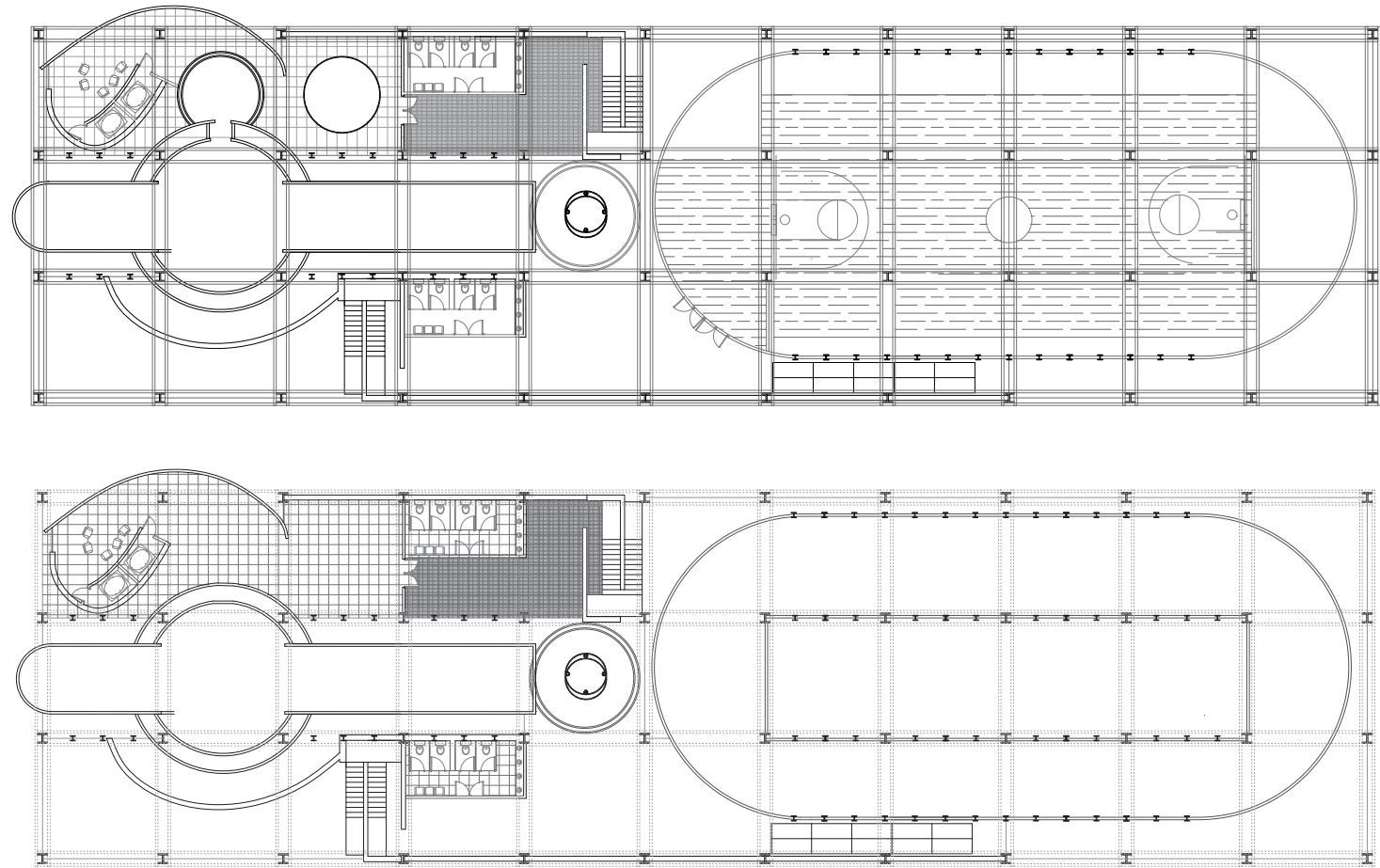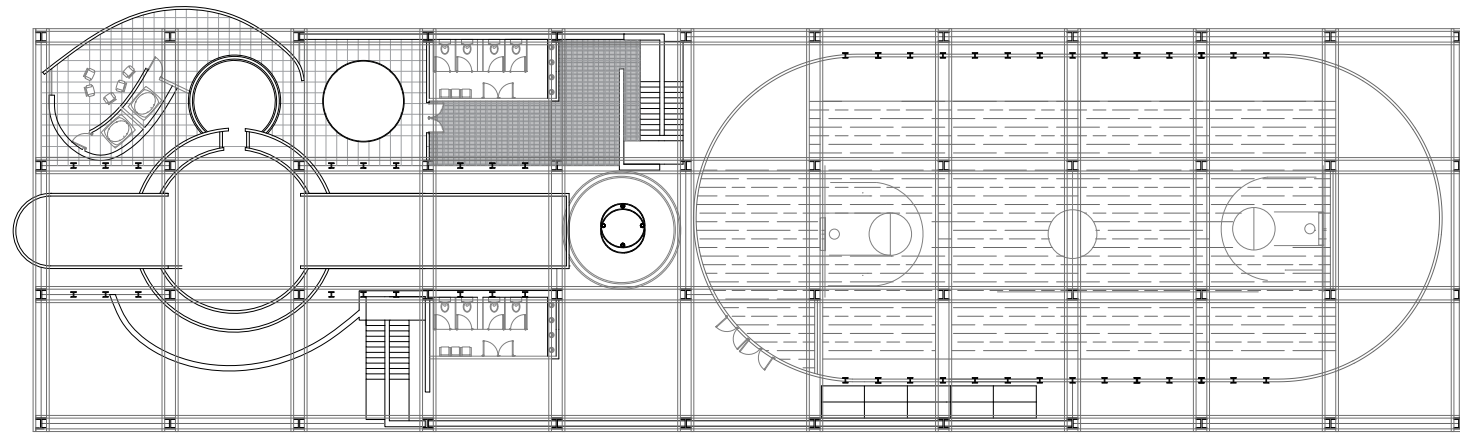
Above: 3rd and 4th floor plans of the
large cylinder swimming tube.
Right: The swimming tube hovers in the
air between the syntactic grid.

THIRD AND FOURTH FLOOR : SWIMMING TUBE

A glass cylinder that runs horizontally through the center suggests an idea of linear movement. The
horizontal glass tube that runs through the glass center bath house indicates the programmatic use of
a lap pool. Swimmers can engage strictly in the horizontal alignment of the body with water. A shallow
tube that allows only for a linear progression creates a disciplined movement within a tight spatial
condition. The pure form of the lap pool creates a moment of violence in architecture, providing a
heightened experience swimming in a glass chamber.
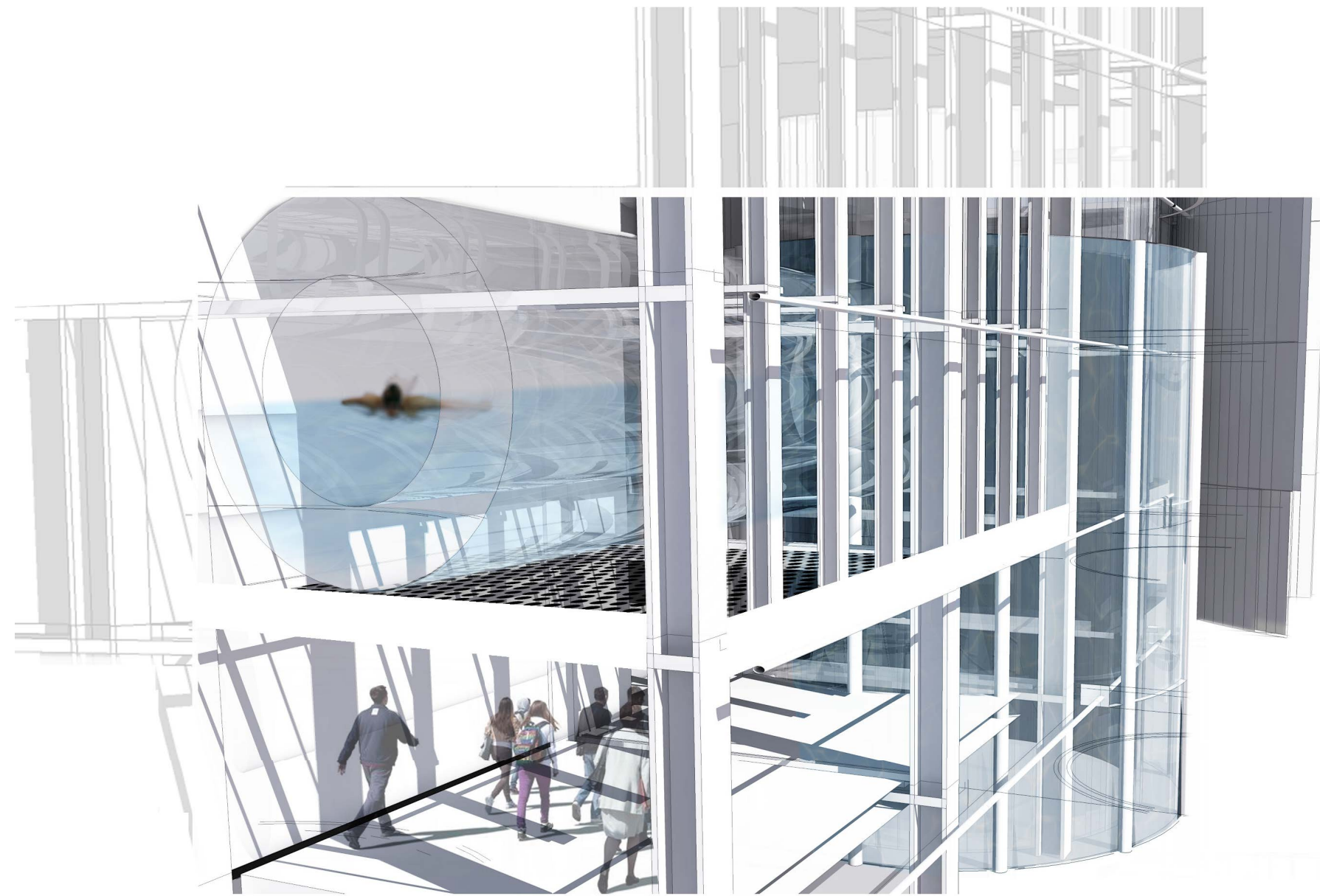
Above: 3rd and 4th floor plan showing the rectangular geometry of the court.
Right: The basketball hoop is attached to the syntactic infrastructure much like its precedent, the Mesoamerican Ball Court.
Below: Image of Ring attached to architectural wall once used in mesoamerican game.

THIRD AND FOURTH FLOOR : THE COURT

Athletic showmanship that happens in a rectangular architecture condition has been traced all the way back to ancient architectural works. The rectangular shape of the court indicates certain kinds of actions that could occur within, having the same shape as the Mesoamerican Ball Court, where a game of religious divination was played and where the loser would be sacrificed. Similar Today winners of the court become divine through social media popularity while the loser endures social suicide or sacrifice, no longer being a character of the elite. Current day ball games could occur in this court including: basketball, racquetball, volleyball, soccer, dodgeball, tennis, handball, badminton, and many more--allowing the space to be qualified by action. The court and the limits of the game are defined by architectural means. In ancient Mesoamerica, the rings where the ball would be shot through were attached to the architectural walls that created the boundary of the court. In the DTAC court, a basketball hoop is attached to the syntactic grid, the infrastructure of the court.

IMAGE:
Meso-American Ball Court
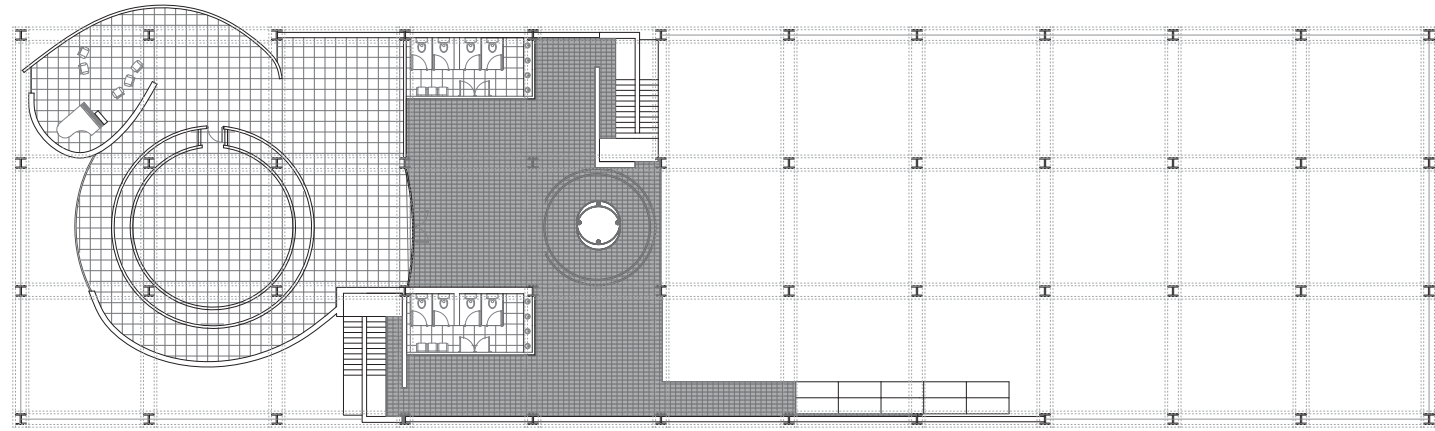
Above: Fifth floor plan of the bath house, showing a glass planetarium.
Right: The room void of water, allows for a reflection of current nature conditions for onlookers.
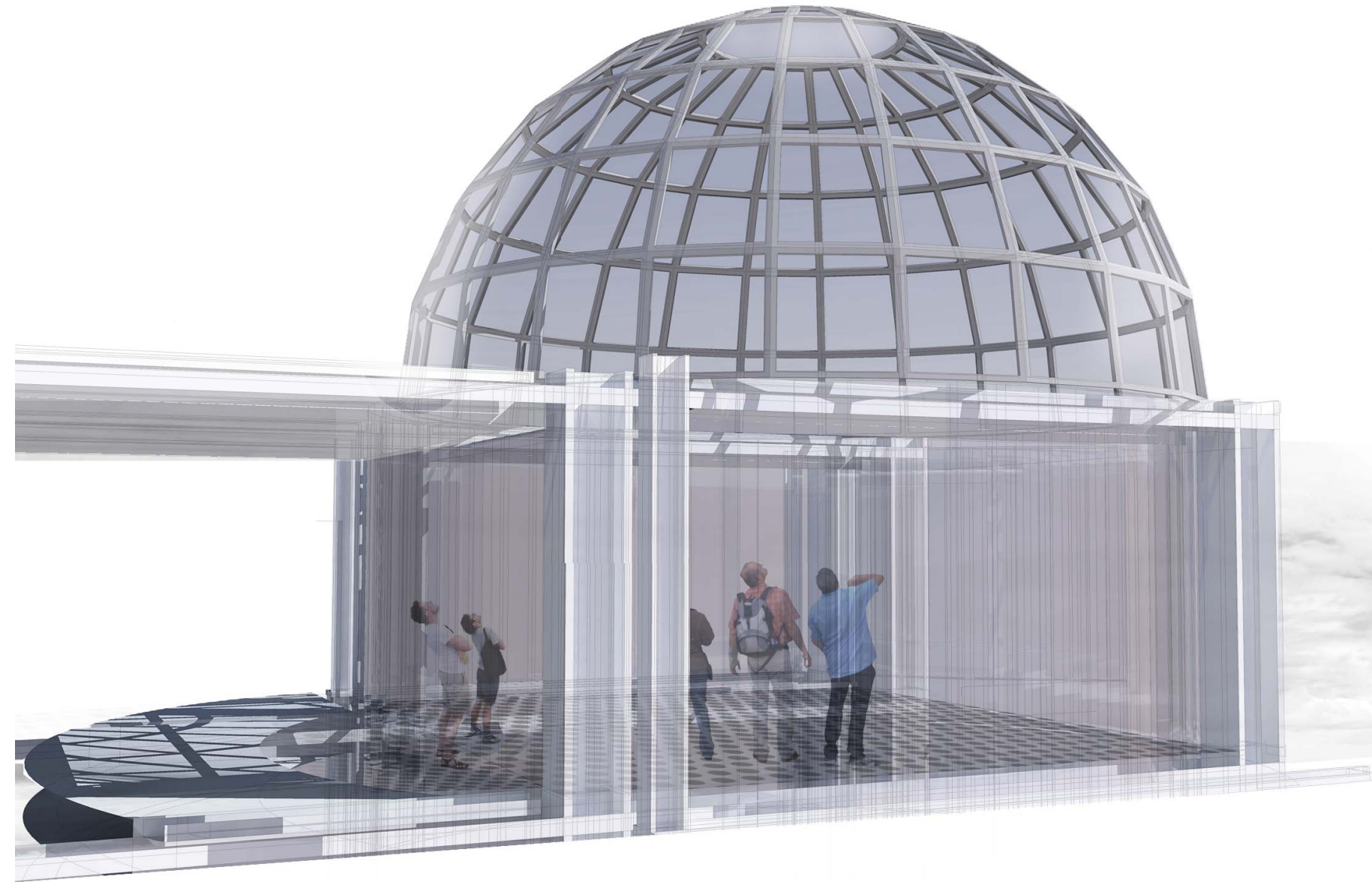
FIFTH FLOOR : A GLASS PLANETARIUM

The only programmatic volume on the fifth floor is the glass planetarium. It is a transformation of a planetarium's original program. Instead of a planetarium that is devoid of light to carefully exhibit simulated projections of the sky, this planetarium is instead a transparent spatial condition encouraging the user to become re-affiliated with nature by framing the existing condition of the sky. Now, specific site conditions are put on display through the glass dome. The exhibit is now humans current condition and negotiation with the world: airplanes flying at night, lights from surrounding buildings, as well as stars can all be viewed at once. The planetarium's form recalls those of ancient Roman bath's that were capped with domes with an oculus that allowed steam to escape from the center. The planetarium resembles this dome-shaped form and translates it by using the current material advances of glass.

IMAGE:
Hadrian's Villa Image of Bath house Dome

Precedent Study of Hadrian's Villa, The Serapeum
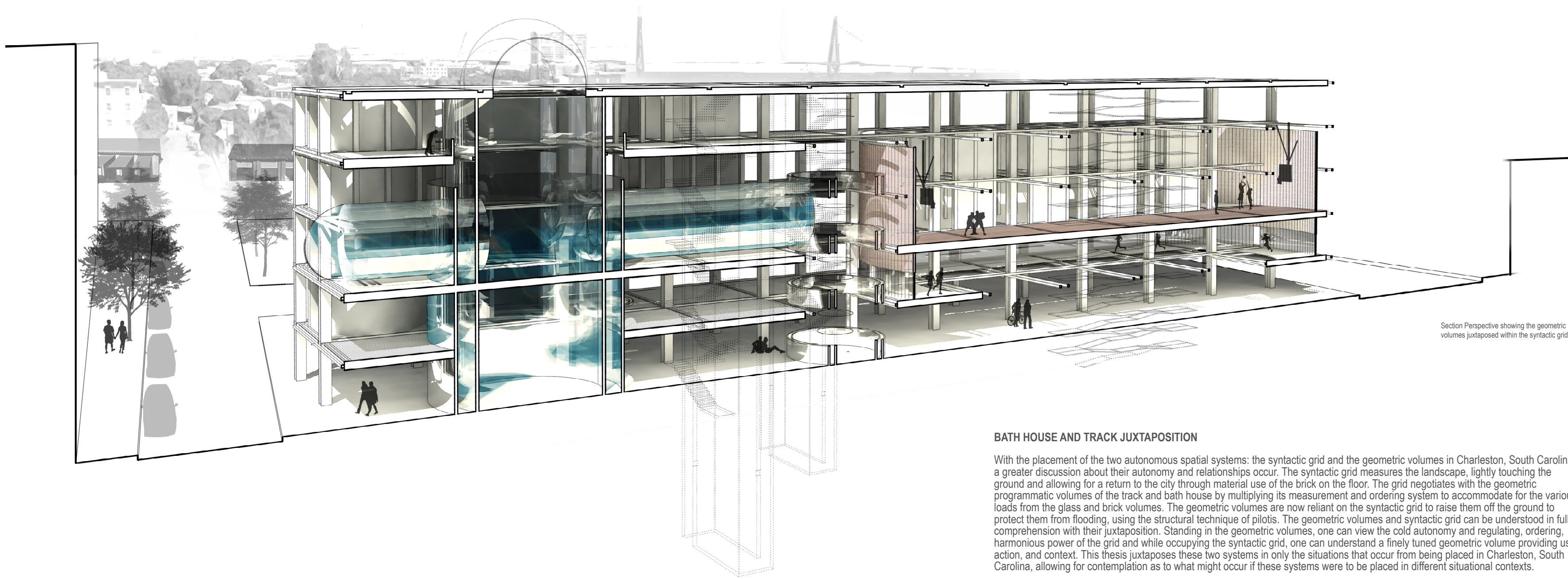
Section Perspective showing the geometric volumes juxtaposed within the syntactic grid.

BATH HOUSE AND TRACK JUXTAPOSITION

With the placement of the two autonomous spatial systems: the syntactic grid and the geometric volumes in Charleston, South Carolina a greater discussion about their autonomy and relationships occur. The syntactic grid measures the landscape, lightly touching the ground and allowing for a return to the city through material use of the brick on the floor. The grid negotiates with the geometric programmatic volumes of the track and bath house by multiplying its measurement and ordering system to accommodate for the various loads from the glass and brick volumes. The geometric volumes are now reliant on the syntactic grid to raise them off the ground to protect them from flooding, using the structural technique of pilotis. The geometric volumes and syntactic grid can be understood in full comprehension with their juxtaposition. Standing in the geometric volumes, one can view the cold autonomy and regulating, ordering, harmonious power of the grid and while occupying the syntactic grid, one can understand a finely tuned geometric volume providing use, action, and context. This thesis juxtaposes these two systems in only the situations that occur from being placed in Charleston, South Carolina, allowing for contemplation as to what might occur if these systems were to be placed in different situational contexts.

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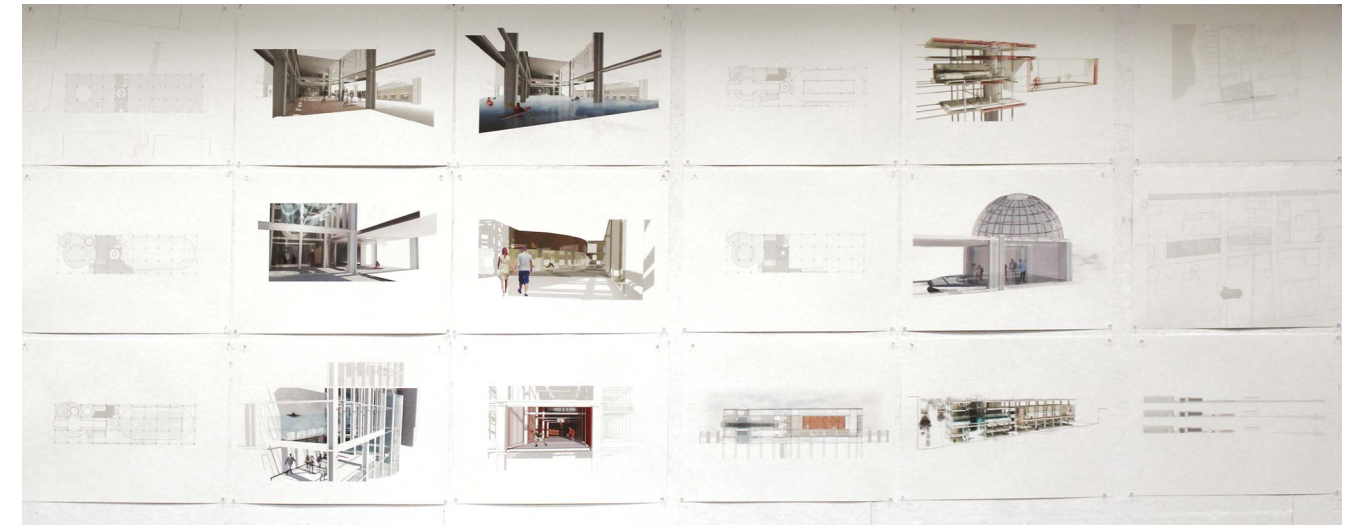
ADDENDUM

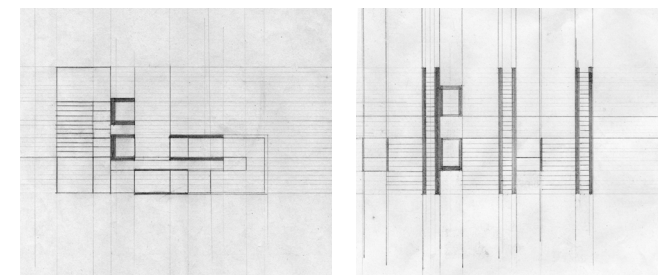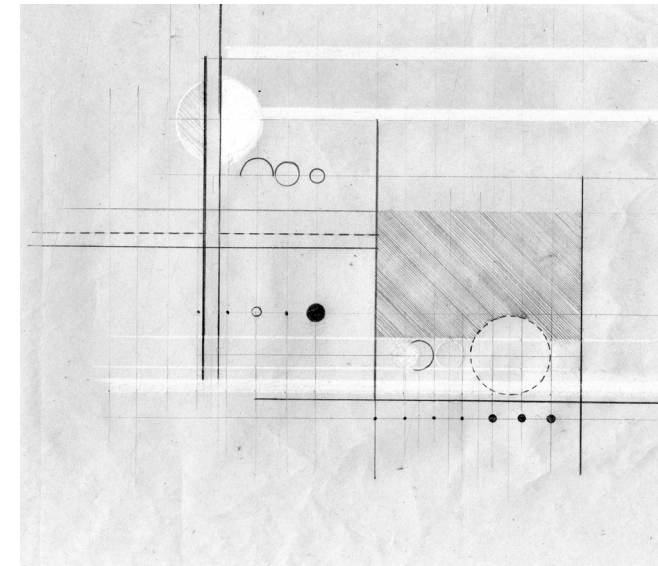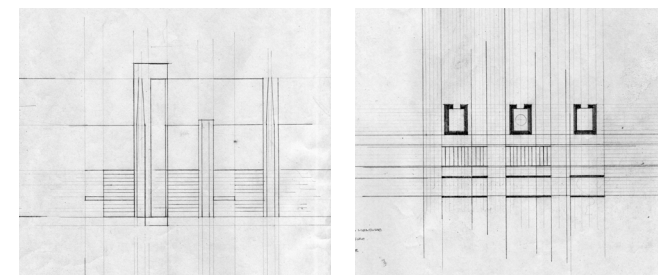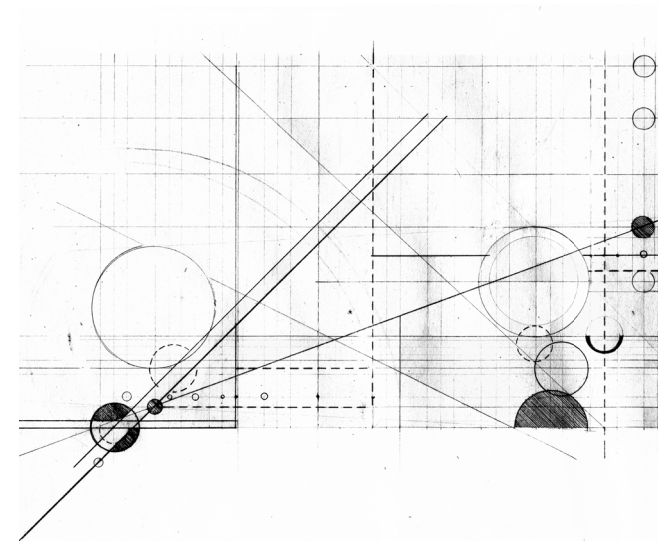Drawings, Photographs, Models that contributed to the process of the thesis.

Thesis Defense Curation

Left: Classification through sections of spatial sitautions by Franco Purini. These drawings show a study of relationships and proportions through volumes and linear elements.
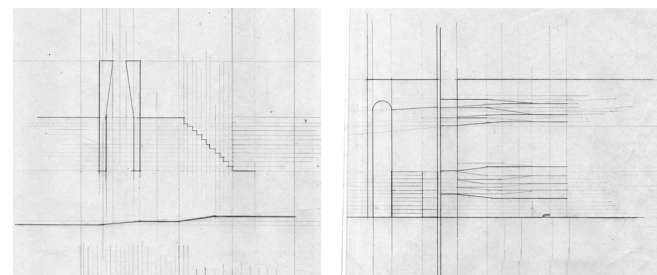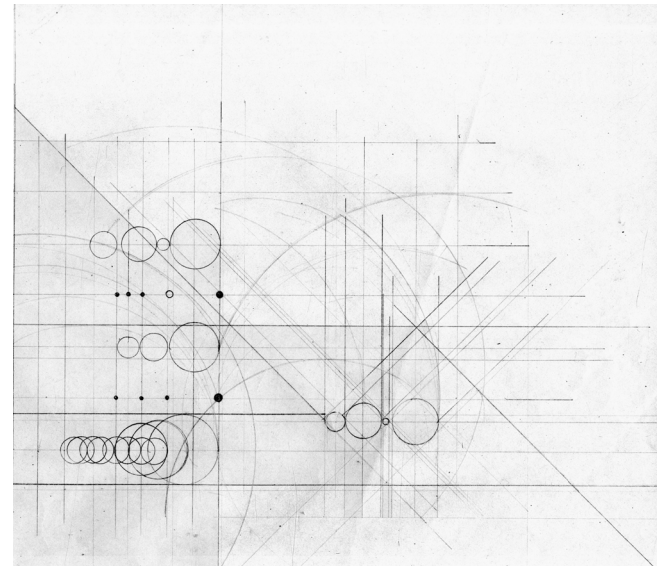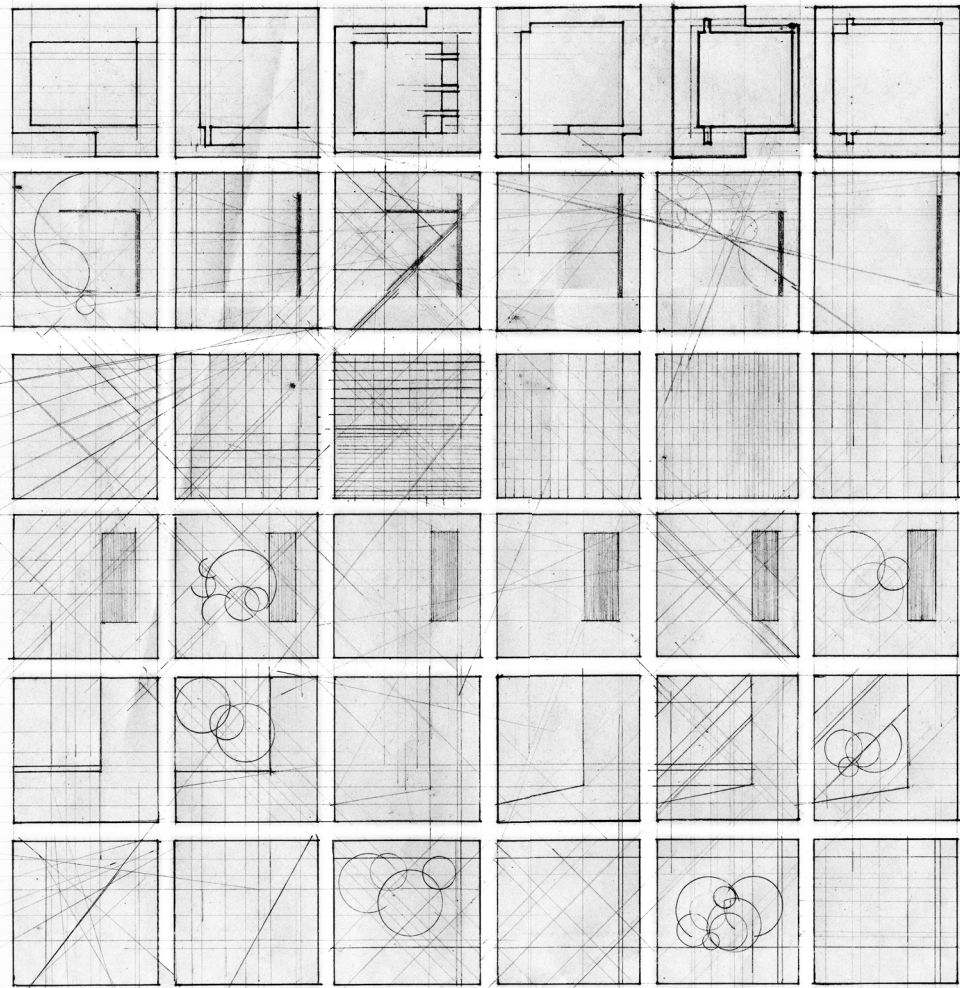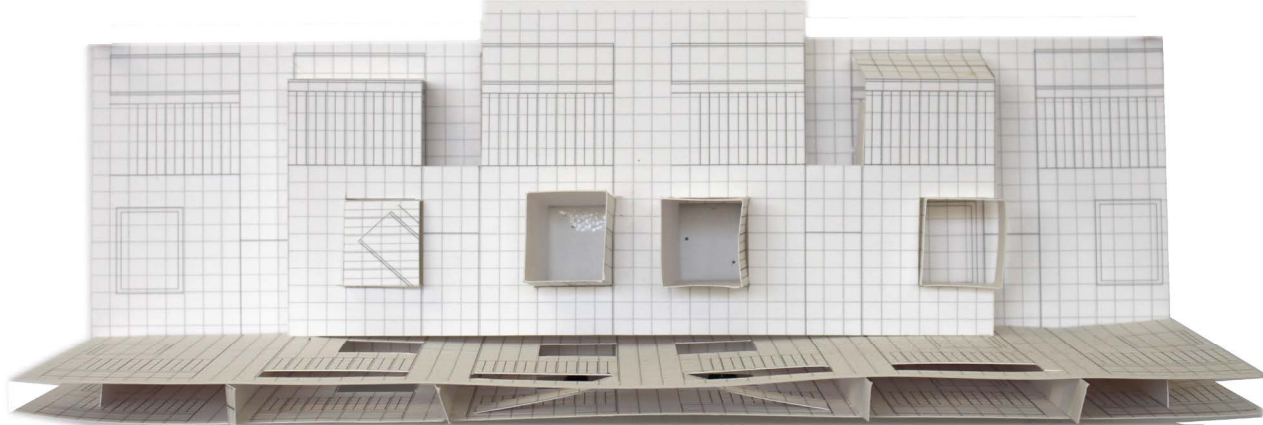

GRID DIAGRAMS

The search for harmony and order using geometric volumes led to the idea of understanding spatial order through section. Inspired by Franco Purini, and his article Studio di elementi architettonici, classifying order through sections of spatial classifications became the primary investigation in a search for architectural order. Drawing studies were done with geometry as well as with architectural elements to study how through repetition, rotation, and translation,one can create an architectural work through organization and harmony.


Left: Sectional Studies of architectural elements in relation to one another. A search for order between elements of architecture.

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DRAWING MODELS

Abstracting relationships and proportions from elements of circulation, including the ramp, stair and elevator, in a search for measure by order. Through drawing and modeling these proportions, a search for order between these elements was established. A proportional grid is drawn on the paper allowing decisions on spatial volumes that occur from modeling to be guided by a repetitive order. The grid is drawn with the same measurements on all the models, however each grid is translated through rotation, shifting, compression and extension to test the orders variety.


Right: Paper models searching for order and variation through a syntactic grid.
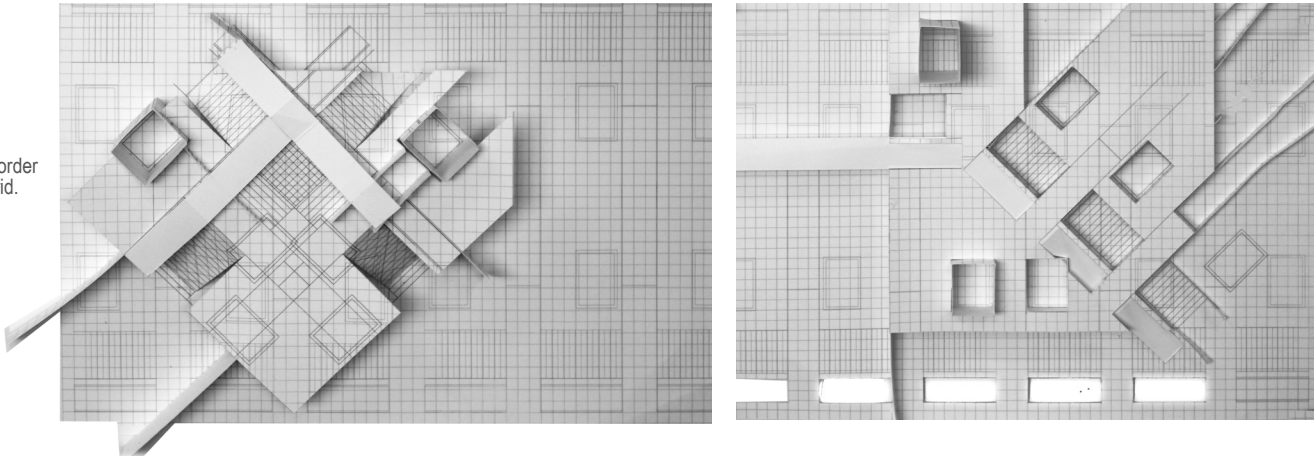
SPATIAL DIAGRAMS

Using a pure form, investigations of harmony and repetition can lead to an understanding of its organizational principles. Analysis shows a variety of ways one can find order: through material means, site conditions, and syntax. Following this series, it became evident that following an order of syntax would be the best method to develop the grid and that eventually led to the infrastructure of the Downtown Athletic Club.
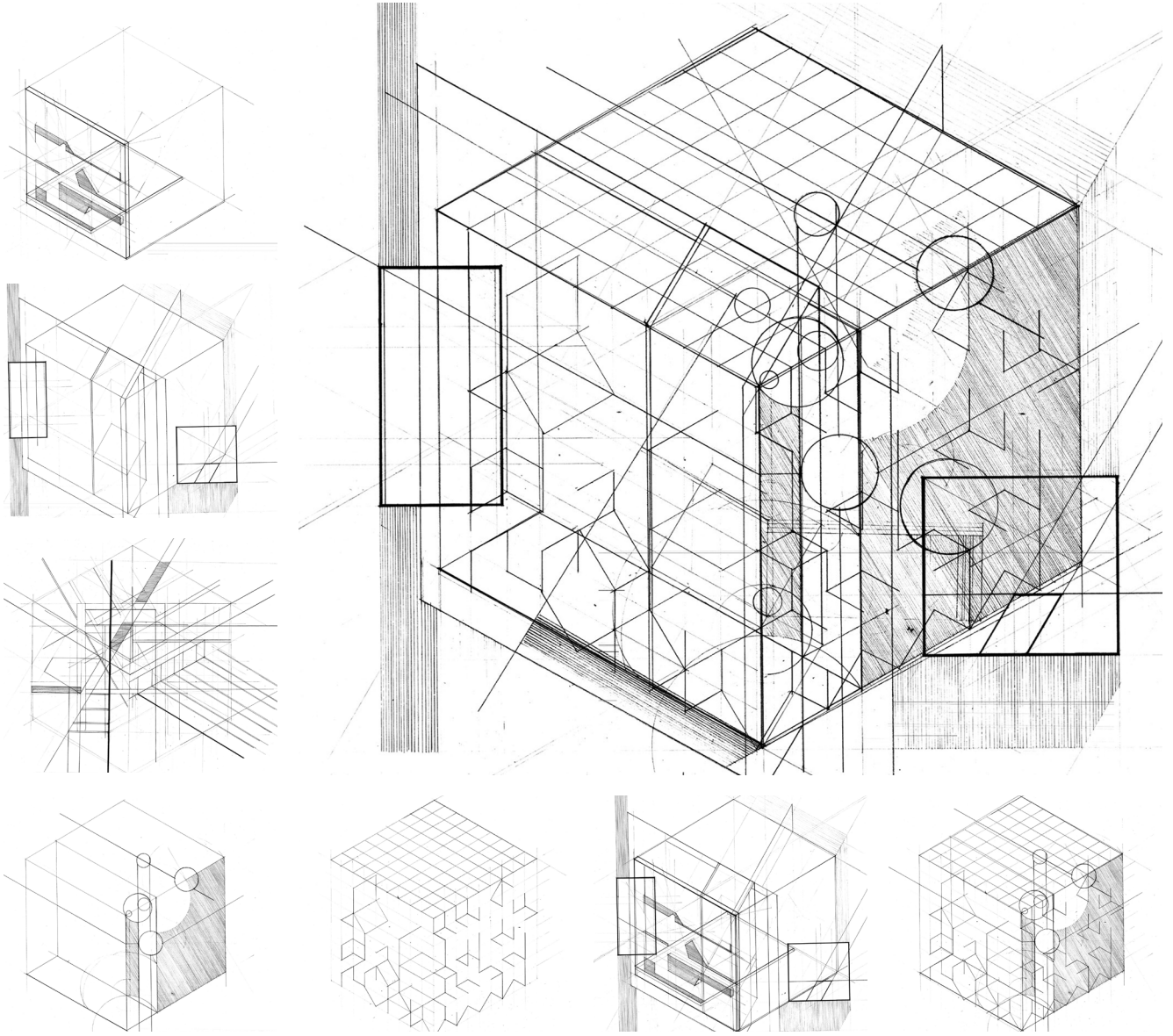
Left: Spatial Organizations of a Cube.

CHARLESTON MAPPINGS

Studying the site for layers of information and histories. The site was once home to the Charleston Cotton Company, Charleston's number one economical good. The site held a variety of cotton gins and coal sheds to edit the cotton before sending it to the port located just a couple blocks away. The grid was rotated and translated to align itself with Charleston's historic grid. Studying the site in elevation and section allows for comparison of height and neighboring buildings. The grid rotated on the same axis as the Charleston Market allows for a repetition of elements between both buildings, allowing for harmonious order to come to the site.

Right: Analysis of the history on the site.

INTRODUCTION OF SPATIAL CONDITIONS ON SITE

Placing the grid within the specific site, the grid condenses due to site restrictions. Now that the syntactic grid has been condensed and rotated due to site conditions, the introduction of the formal geometry can occur relating to histories and layers of the site. A secondary grid from the dimensions of historic cotton gins on site help provide disruption where the formal geometric volumes can be placed on site.
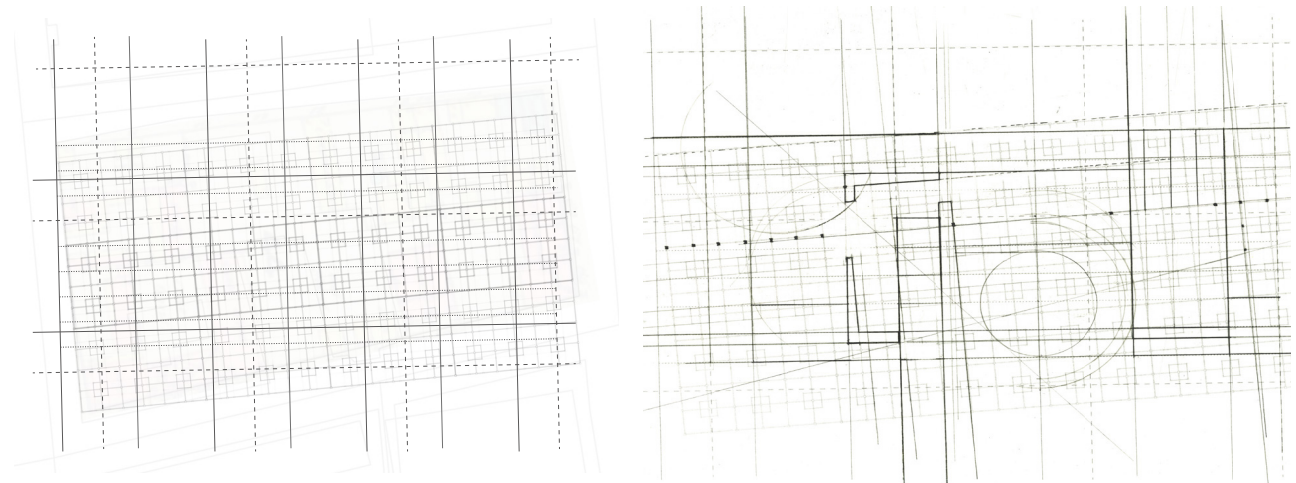
Left: Grid and geometries found on site.
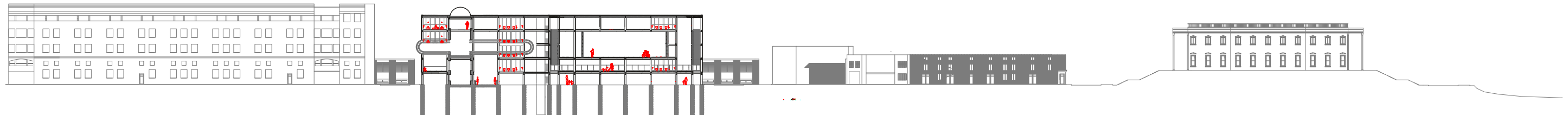
Right: Process of DTAC responding to site elevation and context.
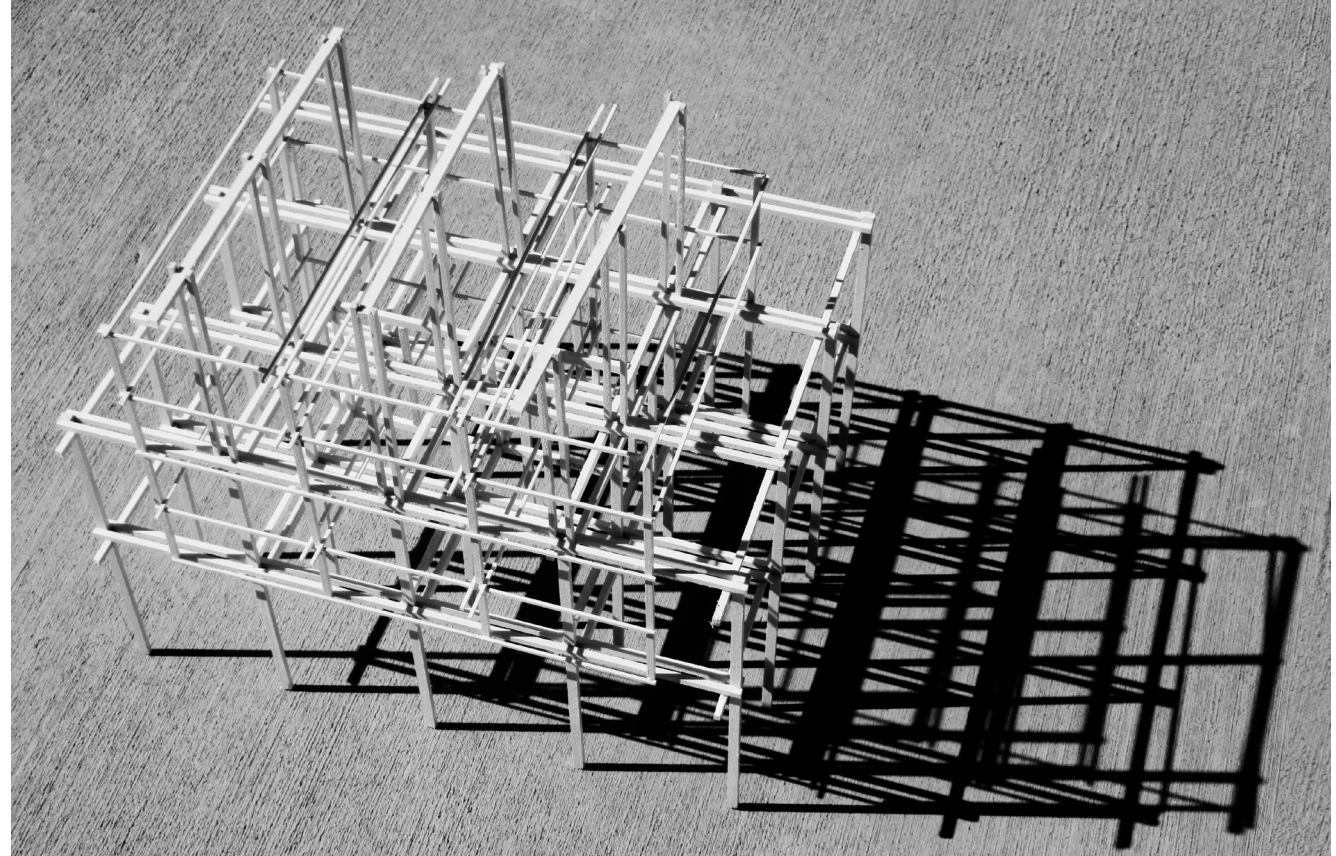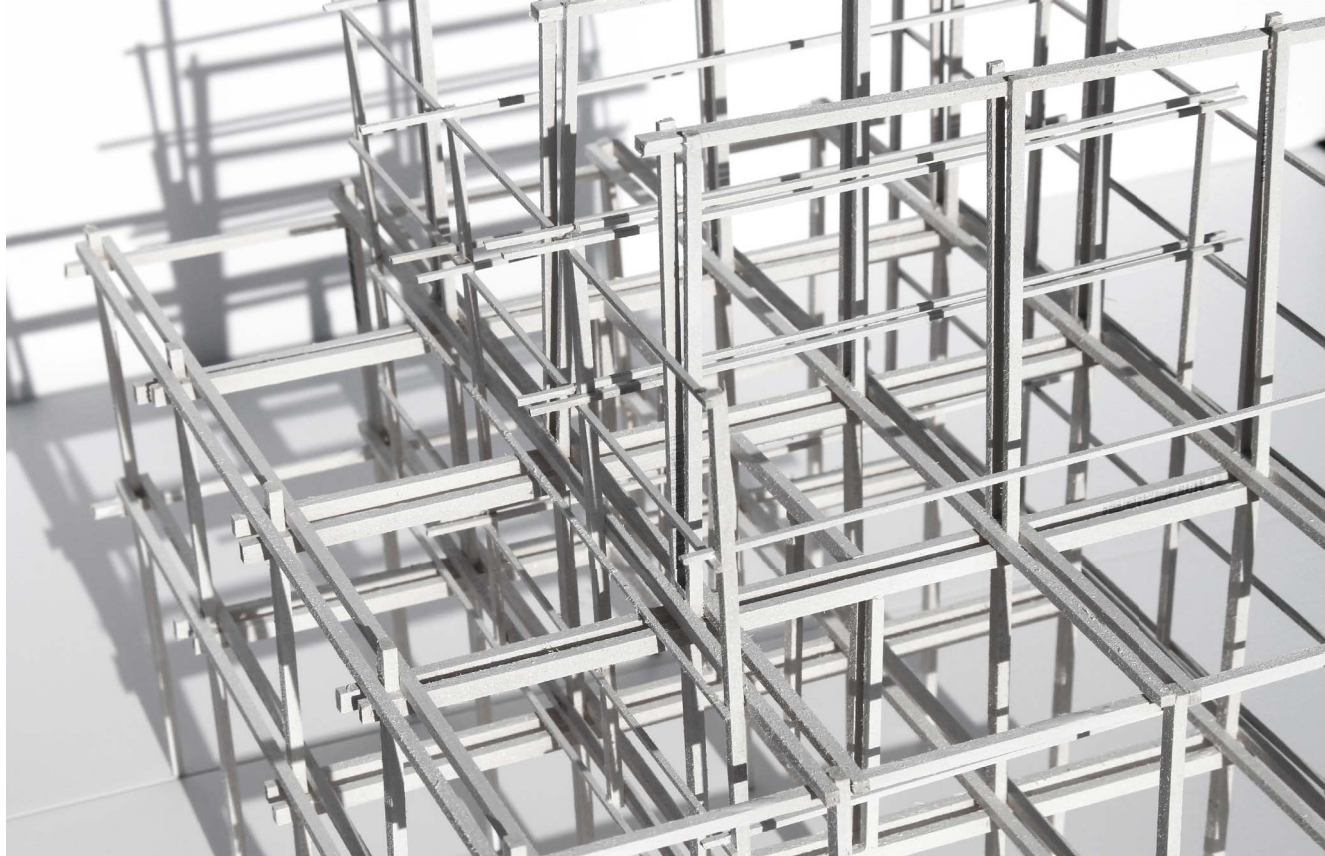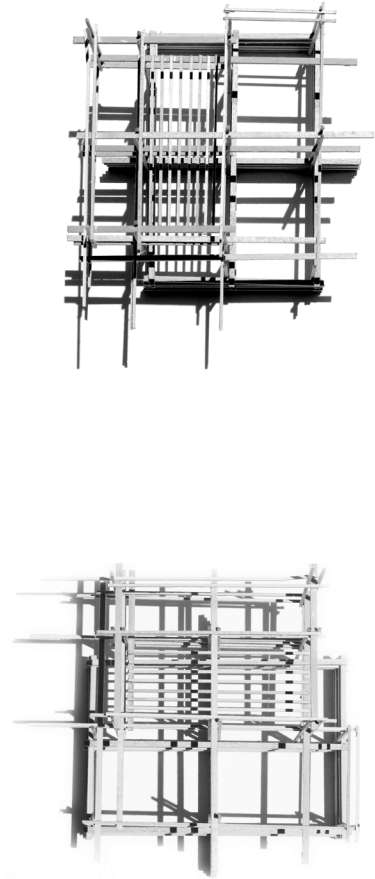
MODELING A SYNTACTIC GRID FRAMEWORK

The syntactic grid transforms from a series of points and lines to a column-beam structure through iterative model making. The structure's order is investigated by duplicating beams and columns, but not for structural purpose, but for rhythm and continued measurement.
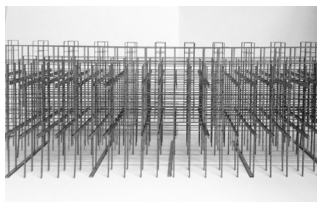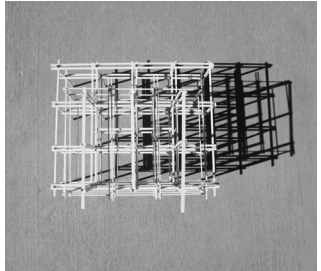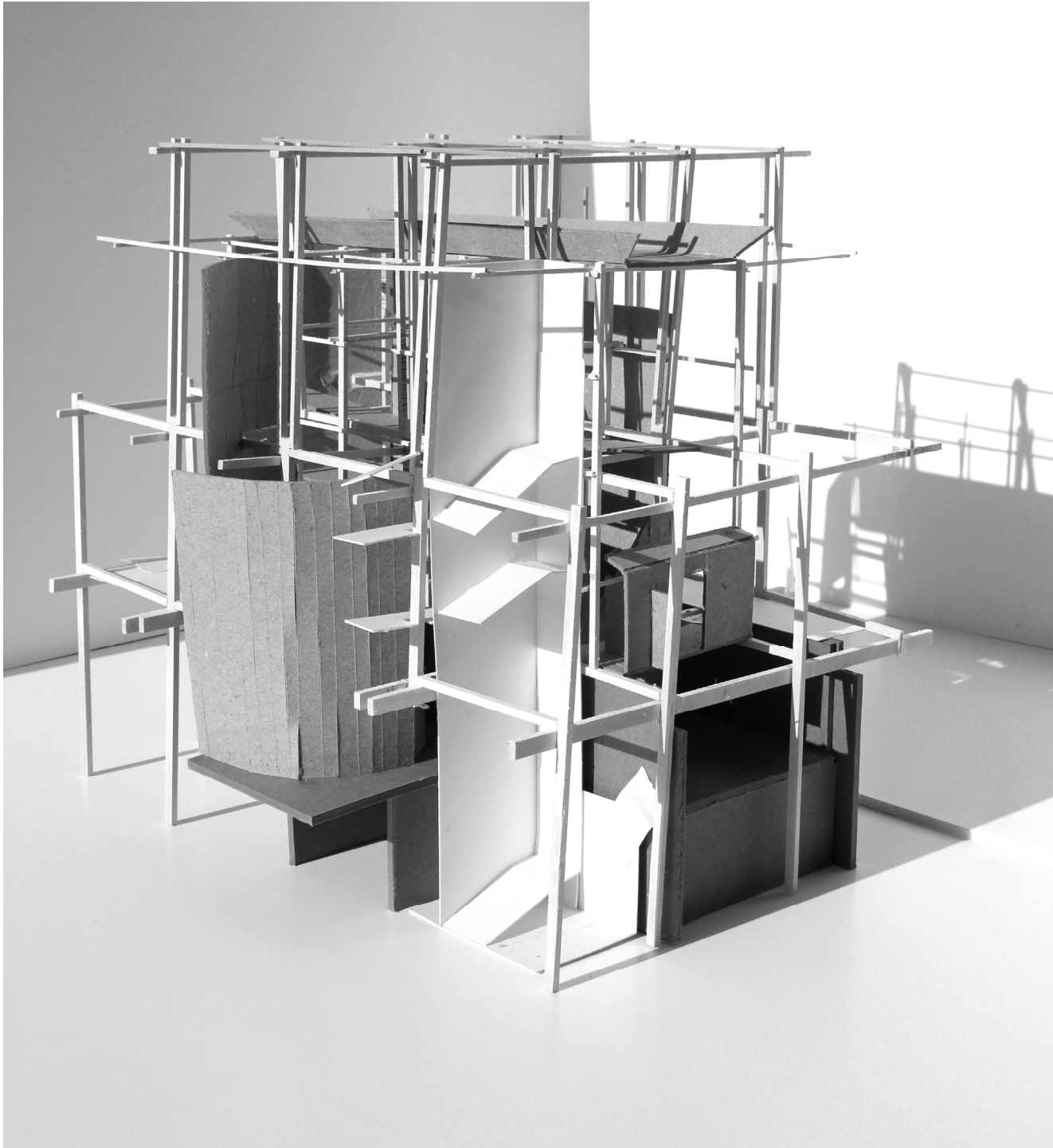
THE INTERDEPENDENCE OF GRID AND VOLUME

Studying the co-dependence and independence of two spatial systems when placed in juxtaposition to one another. One linear structure starkly contrasts the pure formal volumes that rest inside its structure.
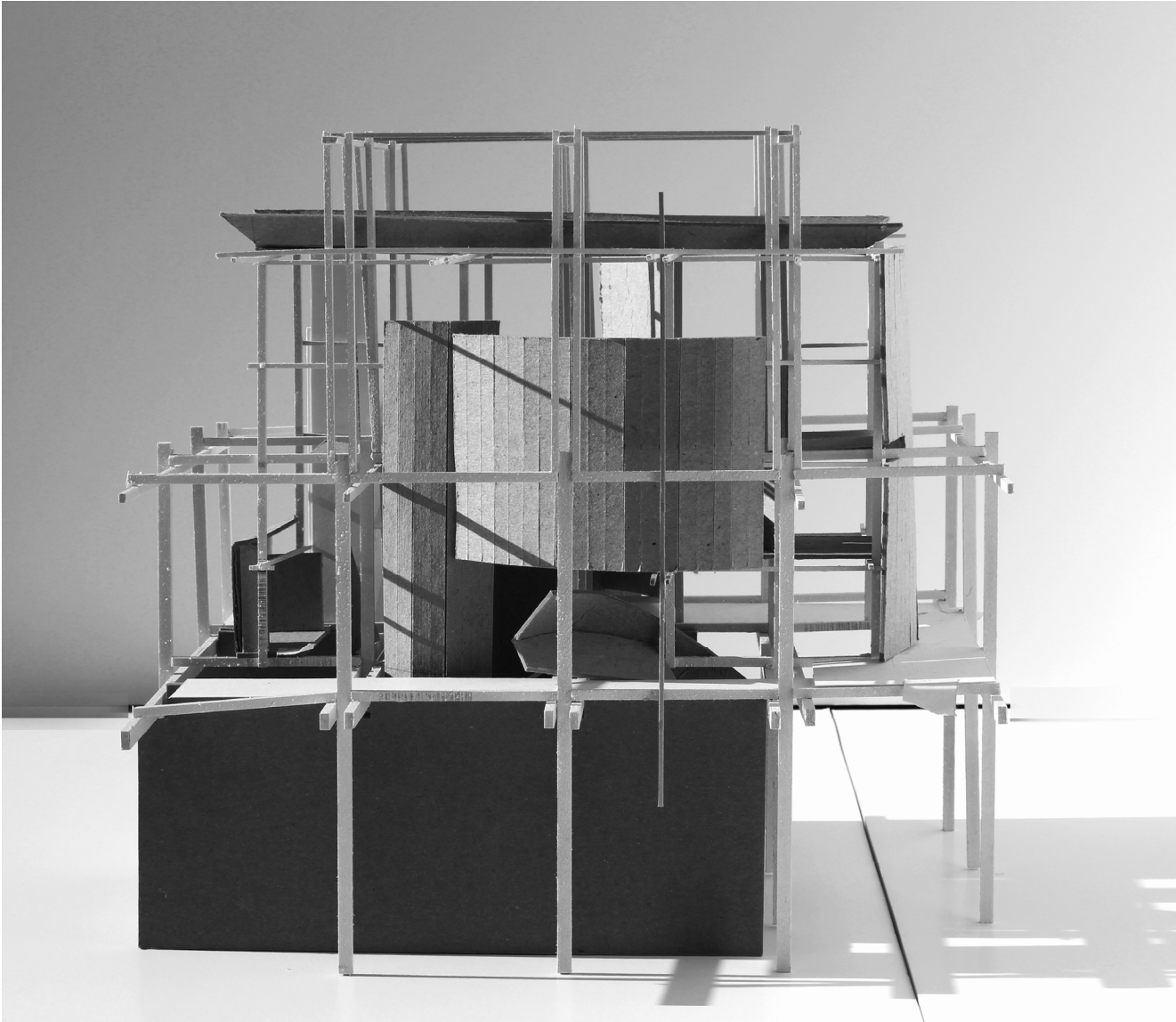
Right: The interaction between materials of the programmatic volumes and the structural grid.

Left: The interaction between planar volumes and the syntactic grid.