

# UMAR MAHMOOD

Architecture Portfolio



# CONTENTS

<b>Aesthetics of Concealment</b>	<b>Pg. 04</b>
<i>Chip Innovation Facility and School Dormitories</i>	
<b>Spirudelphia</b>	<b>Pg. 18</b>
<i>Speculative Fiction</i>	
<b>Hemp Tech Garden</b>	<b>Pg. 30</b>
<i>Market for Callowhill district</i>	
<b>New Institute</b>	<b>Pg. 42</b>
<i>The Penn Museum Archive</i>	
<b>Fractal Units</b>	<b>Pg. 52</b>
<i>Housing and public spaces</i>	
<b>Contrasting Convergence</b>	<b>Pg. 64</b>
<i>Bath-house In Philadelphia</i>	

# AESTHETICS OF CONCEALMENT

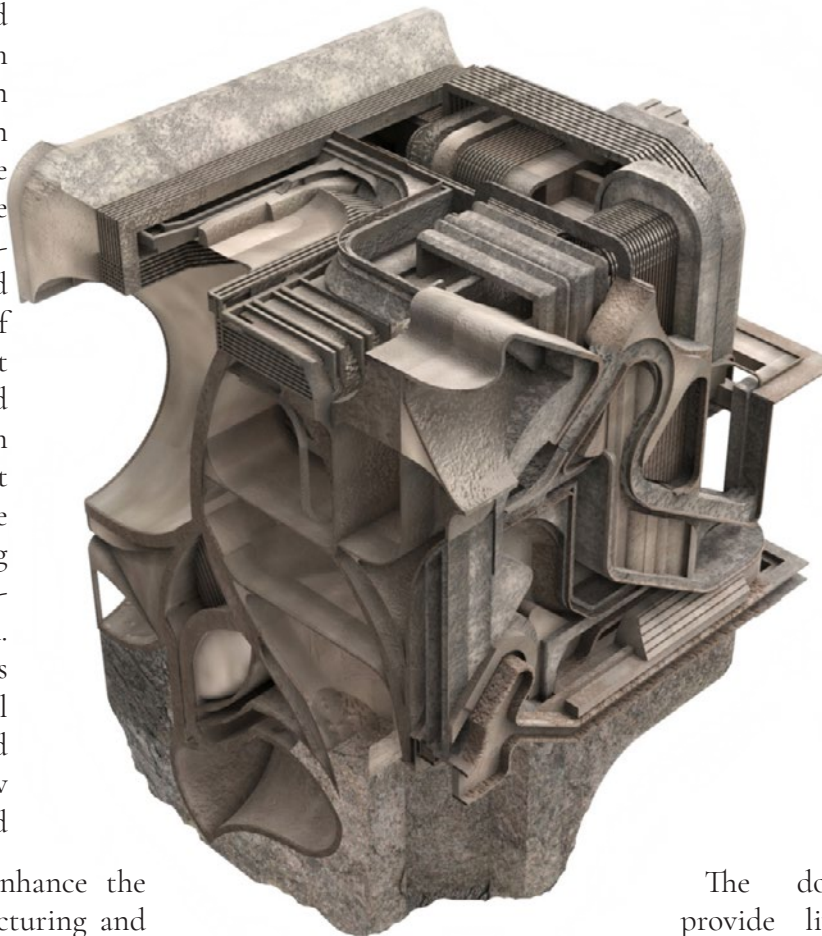
## Chip Innovation Facility and School Dormitories

Instructed by **Ali Rahim**  
Collaborated with **Bashayer Bamohsen**  
Site located in Gilgit Baltistan , Pakistan

The project was to design protected and concealed dorm spaces for the girls in the Northern Pakistan region. The site for the dormitories was near the girls' school in Gilgit-Baltistan. The social and political instability of the region in the past has severely impacted the education system of women. The project aims to empower the schoolgirls by providing them with cutting-edge tech education. The building includes research spaces, digital libraries, classrooms, and prototyping labs to allow the girls to innovate and

design new ideas to enhance the process of chip manufacturing and fabrication.

The project was developed by studying the architecture elements of Eastern culture. It references those elements through an interdisciplinary architectural survey of the significant cultural elements and architectural styles.



Learning from eastern architecture techniques of layering and hybrids, in the former studies, developed the aesthetics of concealment for the project.

The building is designed by layering multiple architectural

pieces, providing a protected interior. It merges itself within the site by mimicking the materials of the context, hence remains hidden in the plain site. In addition, the rich terrain played a key role in camouflaging the building with the surroundings and reinforcing the aesthetic of concealment within the overall context. The diagrammatic chunk shown here shows the design of those carved spaces accentuates the complexity of the interior elements, concealed by the facade of layered geometries.

The dormitories not only provide living spaces but also give opportunities to foster an educational environment. The interior of the building hosts labs and machine spaces to help girls learn about computer chip manufacturing technologies. Knowledge like that will empower girls and elevate future generations of Pakistan.

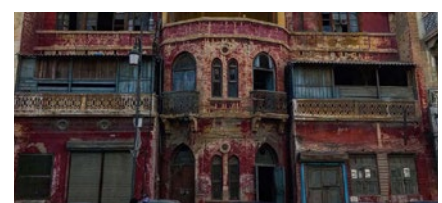
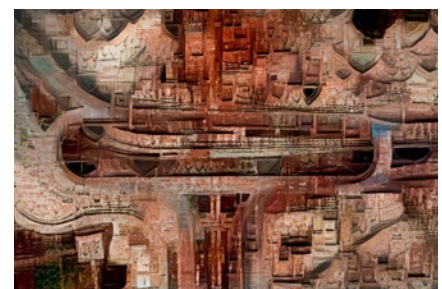
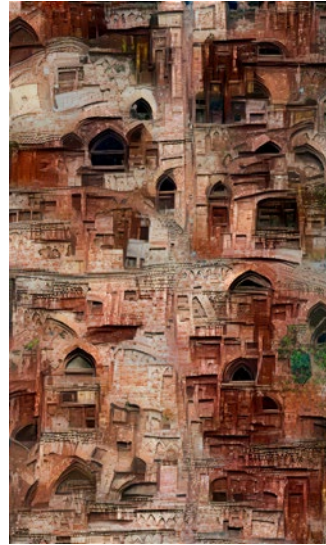




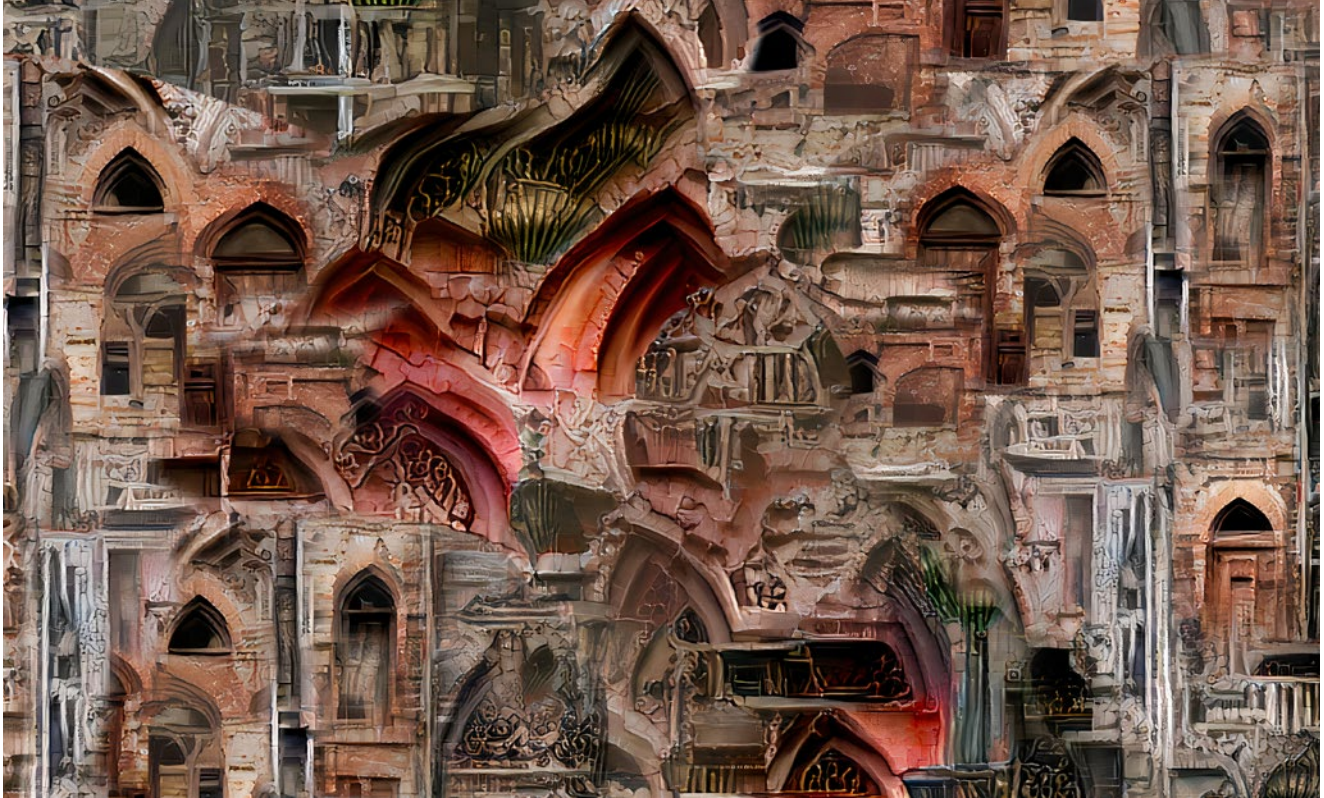
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AESTHETICS OF CONCEALMENT









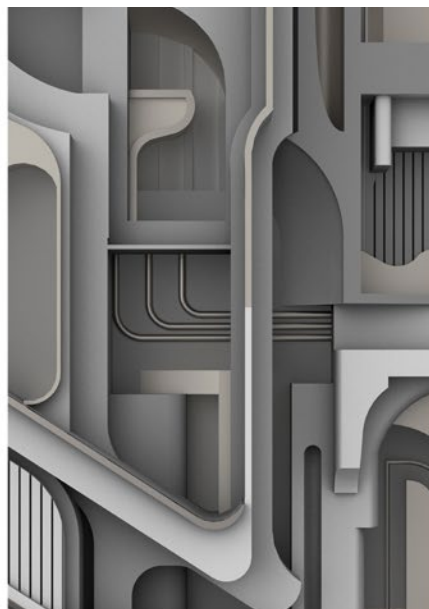
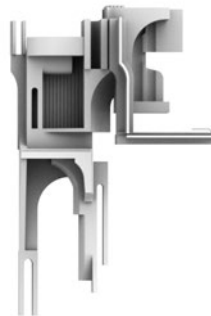
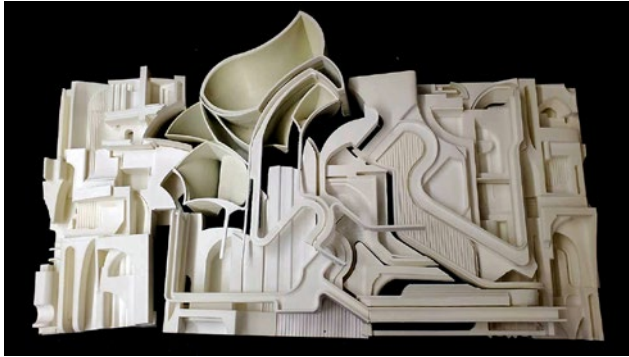
### **Eastern Aesthetics**

Different techniques were used to understand the Eastern aesthetics through the lens of Pakistan architecture. The idea of layering was tested out by collecting and manipulating images that mimicked the innate quality of agglomeration used in contemporary architecture of that region. These images replicated the quality of the site terrain as well as the unique quality of the region's architecture and infrastructure.

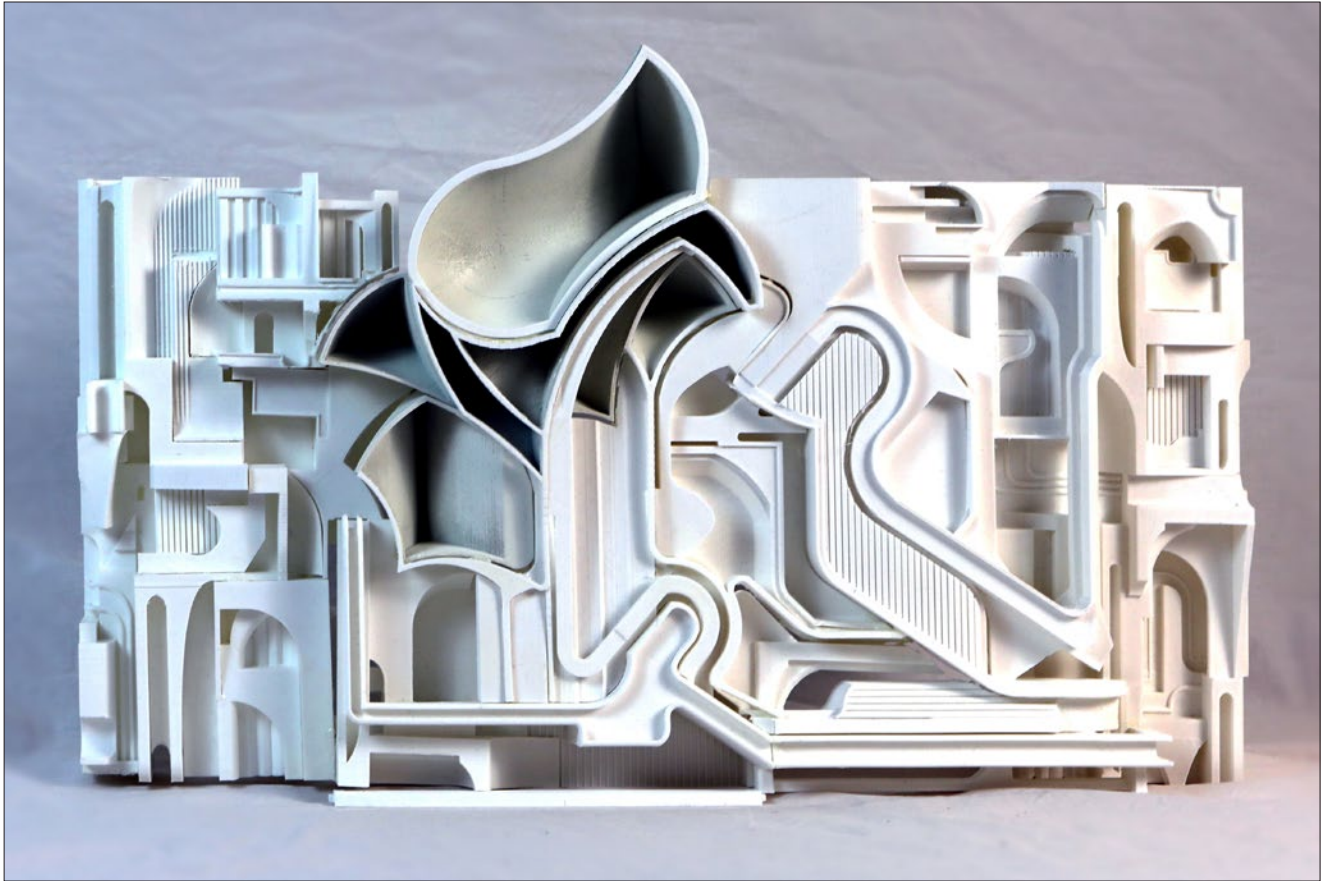
These images were investigated to understand the layering of multiple geometries and their textures. The line drawings for those images were done to see the baseline geometry and the configuration of pieces. The colors and texture palettes were also developed by those images.







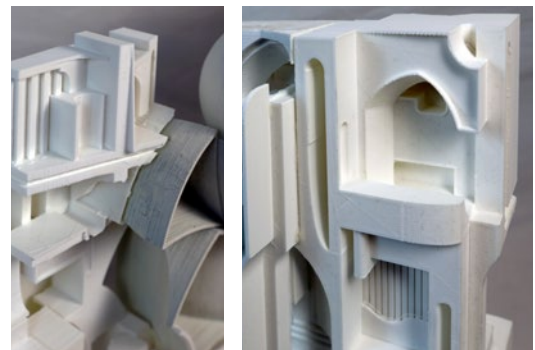


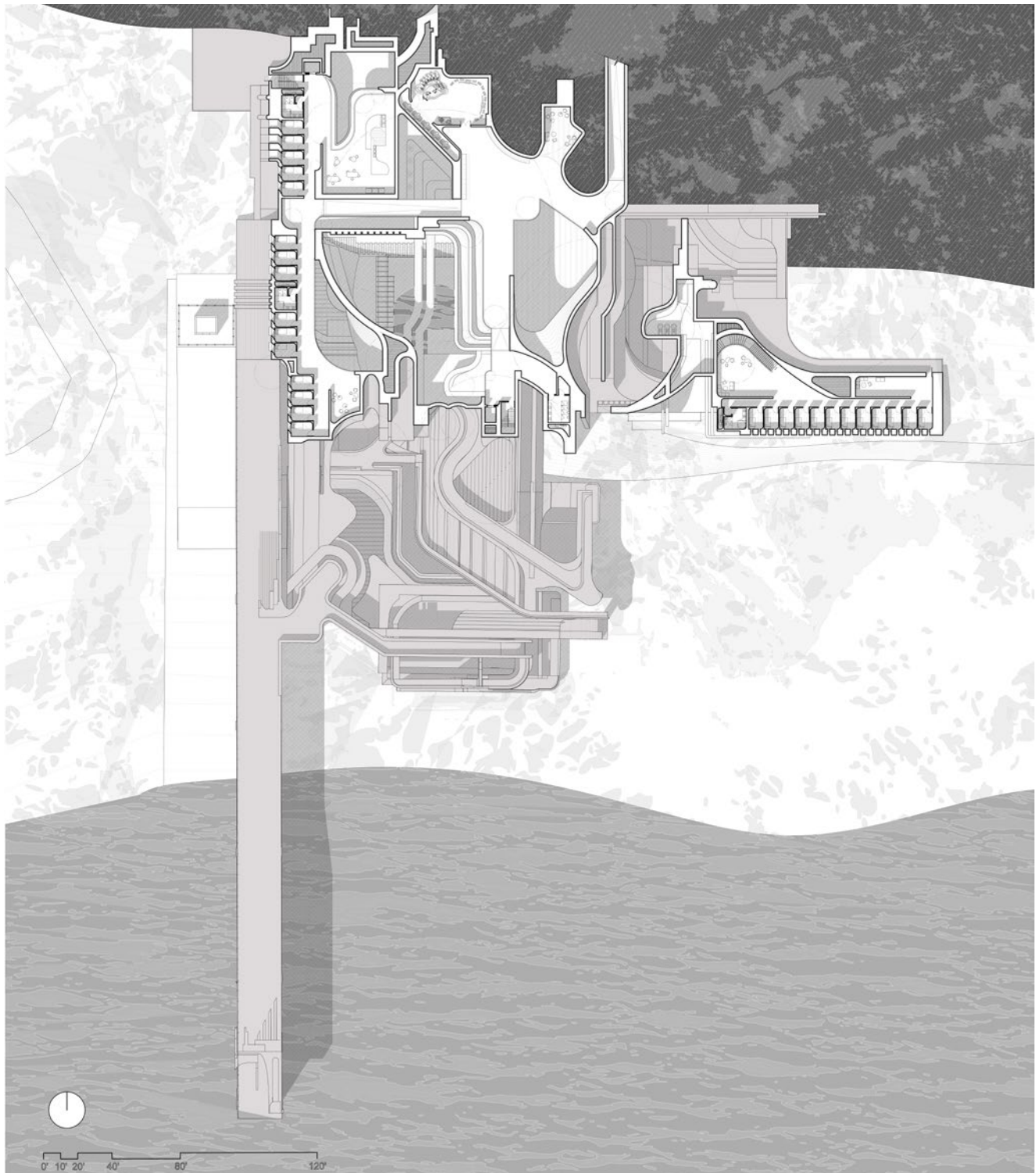


### **Hybrid Architecture Techniques**

The Hybrid Panel was developed through the techniques that were investigated via images. The panel shows the collection of multiple architecture elements coexisting and harmonizing the entire scheme. Those elements document the rich history of Eastern architecture and provide the protected chamber spaces nested within the agglomeration.

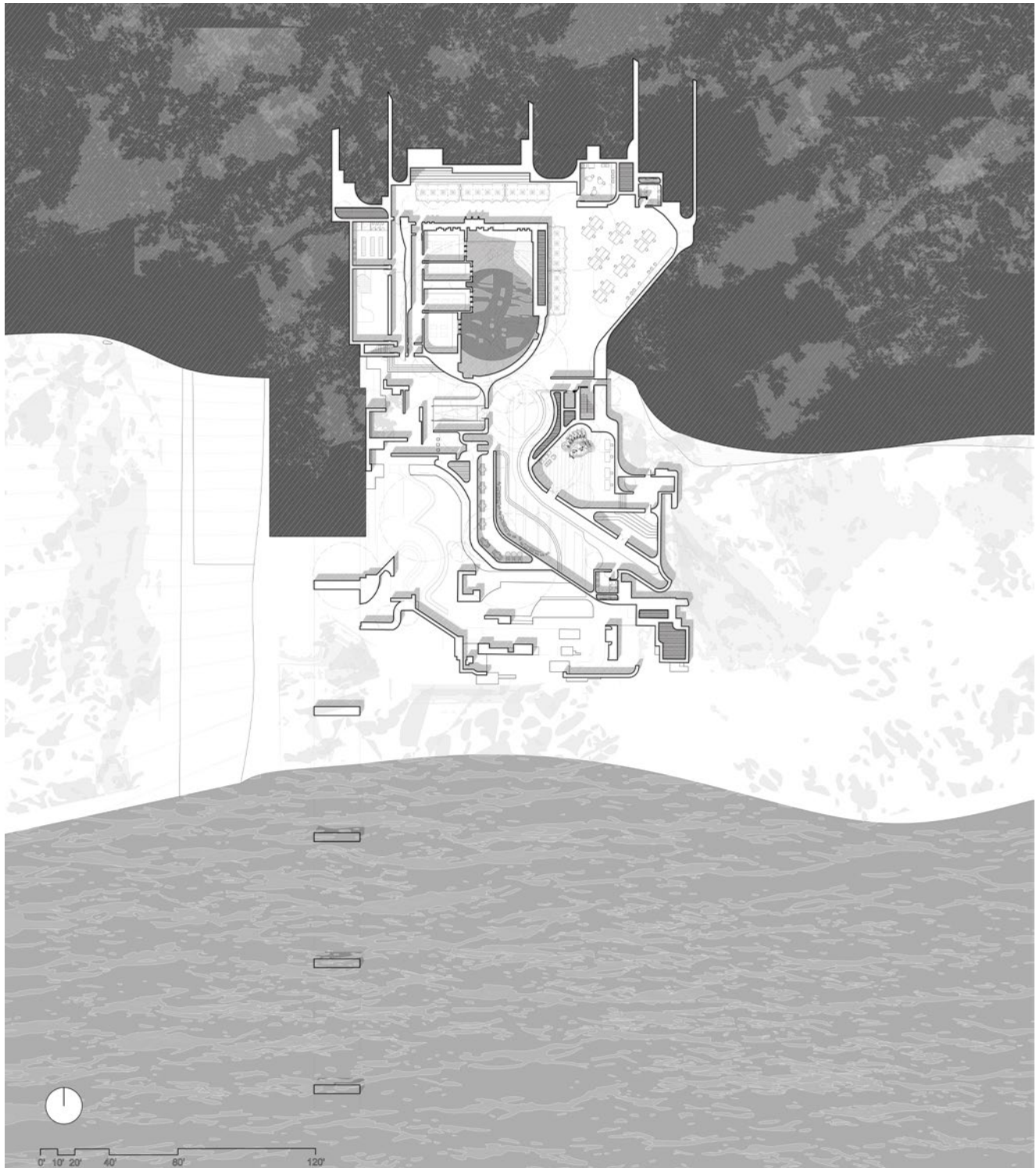
The images on the left show the individual pieces used to build the panel. Those pieces interlock and connect to form a full scheme.



**Upper Level Floor Plan**

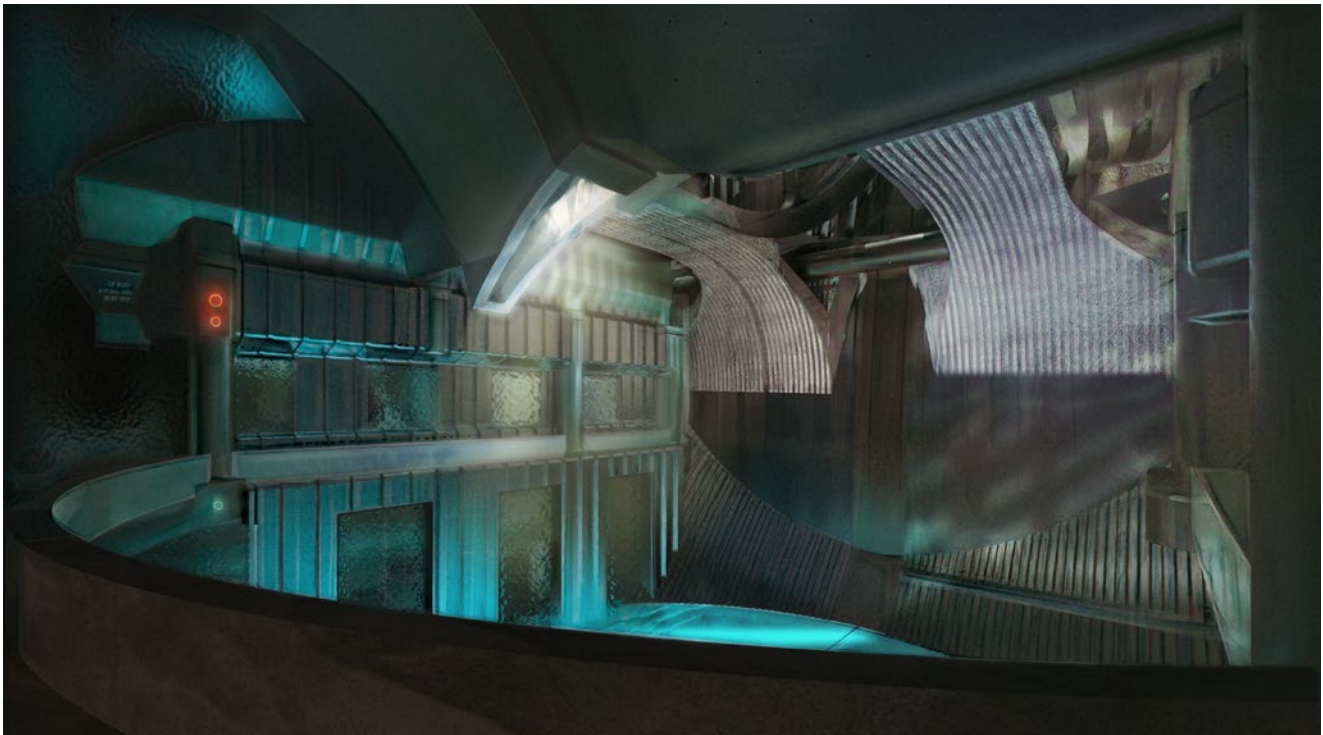
The upper level floor plan shows the connection of the building with the adjacent bridge, the concealed entrance tunnel at the North-East corner, the machine spaces and labs in the central area. The plan also shows the dorm spaces at the West end adjacent to the building and at the East end following the site contours.





**Lower Level Floor Plan**

The lower level floor plan shows the connection of the building to ground and the outdoor yet concealed spaces at the South end of the building. The interior spaces show the classrooms, labs and cafeteria spaces.



**Render Views**

Top: Interior of the lab and common educational spaces.

Bottom: Interior of the central space, where girls can access the controlled laboratory to test out their designs and manufacture the prototype chips.





**Render Views**

Top: Elevation view shows the blending of the building on site. The existing broken bridge becomes the part of girl's dormitories by blocking the access to the public from the road and giving access only to girls from the dorm building.

Bottom: Section shows the dorm's spaces, labs and building's access to the existing bridge space.



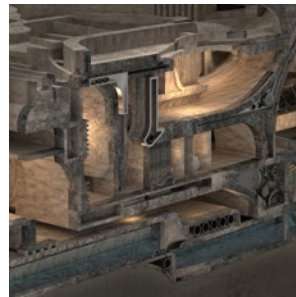
**Chunk and vignettes**

Chunk shows the layered architecture elements and geometries displayed on different facades while the chamber spaces are hidden and protected in the interior.

The vignettes show the detailed portions of the building.







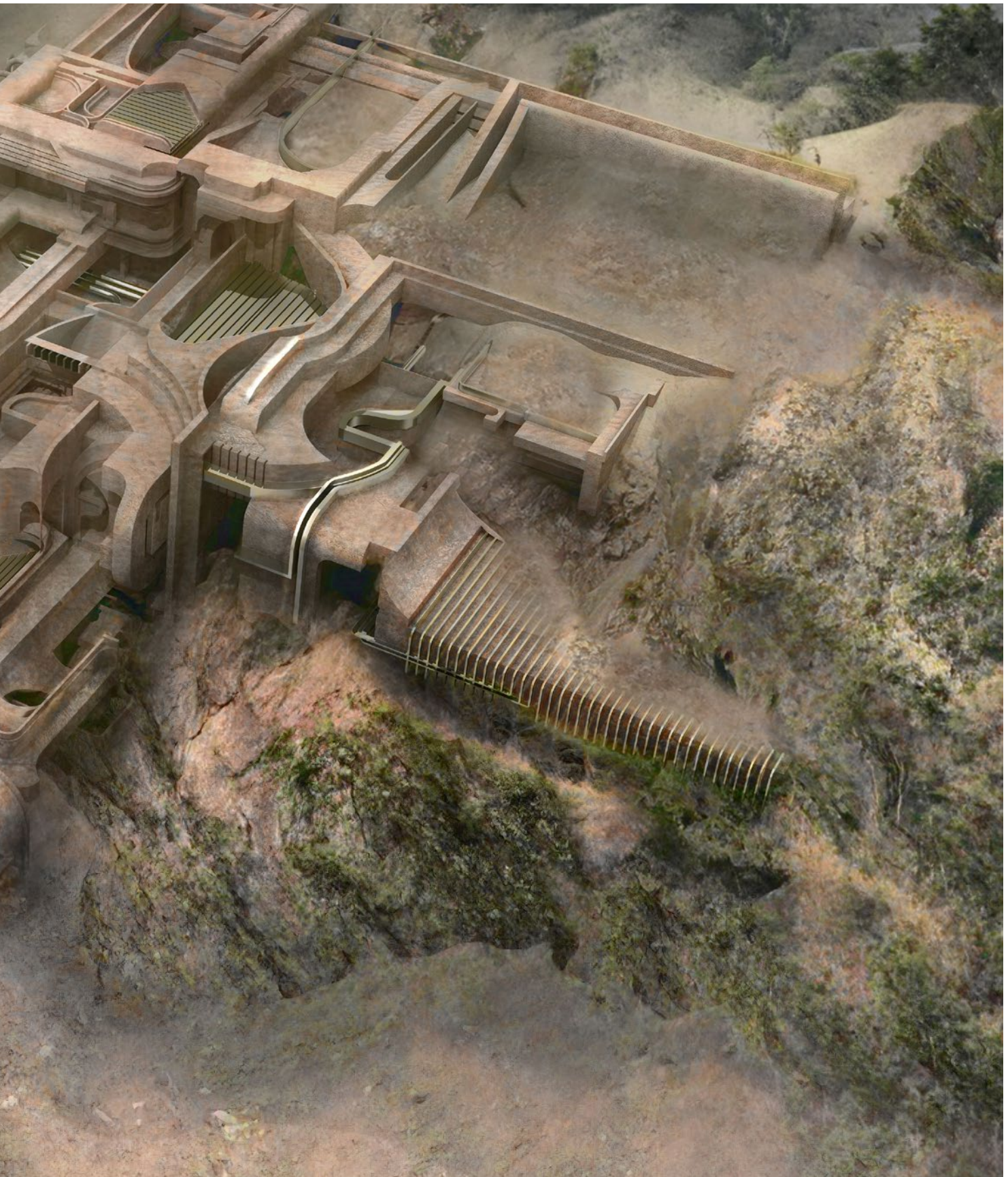
### **Section**

The longitudinal section reveals the interior scheme of the building. The central space acts as a core from which machinic spaces extend into human spaces and provide a collaborative learning environment.









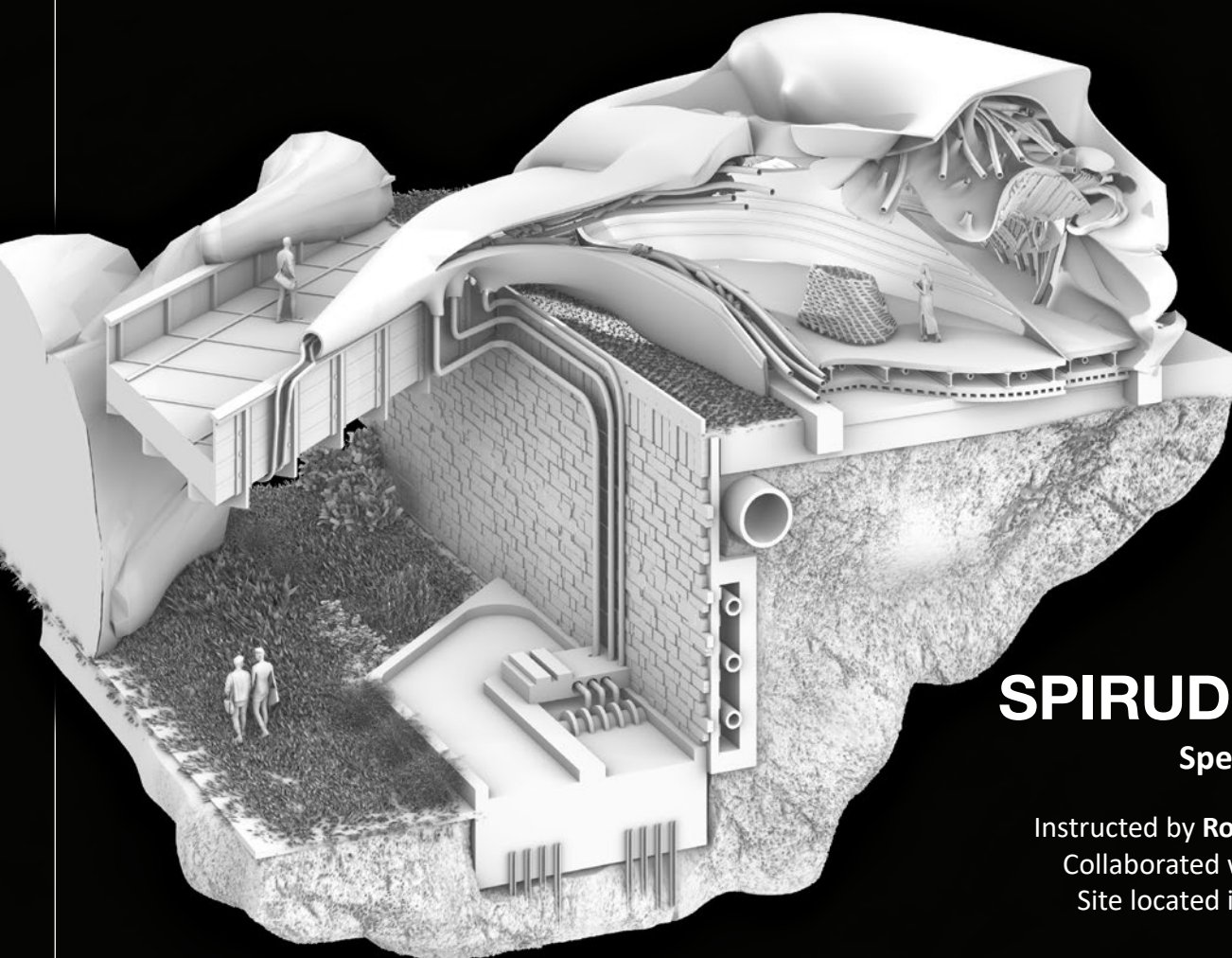


Around three years ago, two unidentified objects housed themselves in “The Cut” area of an unbuilt railroad park. The cut area of the Philadelphia railroad park was scheduled to be built in the third phase of the project, but two rare and unique objects have resided in the portion near the Community College of Philadelphia. These objects have grown from the ground and appear as a flora species that have contributed to the natural diversity of the surroundings. Scientists have monitored their growth very closely and examined the interior and exterior of the shell-like structures

of those rare objects. These objects have developed their own habitat by consuming the carbon dioxide and nitrogen from the environment and soil.

Almost a year ago, the scientists confirmed that the objects have stopped growing, they believe that the objects have reached their full age. According to scientists, these objects appear as unidentified forms of algae, the kind which are grown as architectural artifacts. They require less than normal sunlight and form their colonies where carbon dioxide is in abundance. These objects

give oxygen and water as their by-product. It seems as if nature is helping us save the environment. The team of architects along with scientists have designed and built water collection pools around these objects and cleaned the interior of those objects so the visitors can see the amazing natural processes from the interior of these shells. The city of Philadelphia is excited to see a natural phenomenon unraveling in front of their eyes. The architects, designers, scientists, and city officials have named these objects as “Spirudelphia”.



## SPIRUDELPHIA

Speculative Fiction

Instructed by **Robert Stuart-Smith**  
Collaborated with **Hadi El Kebbi**  
Site located in Philadelphia, PA





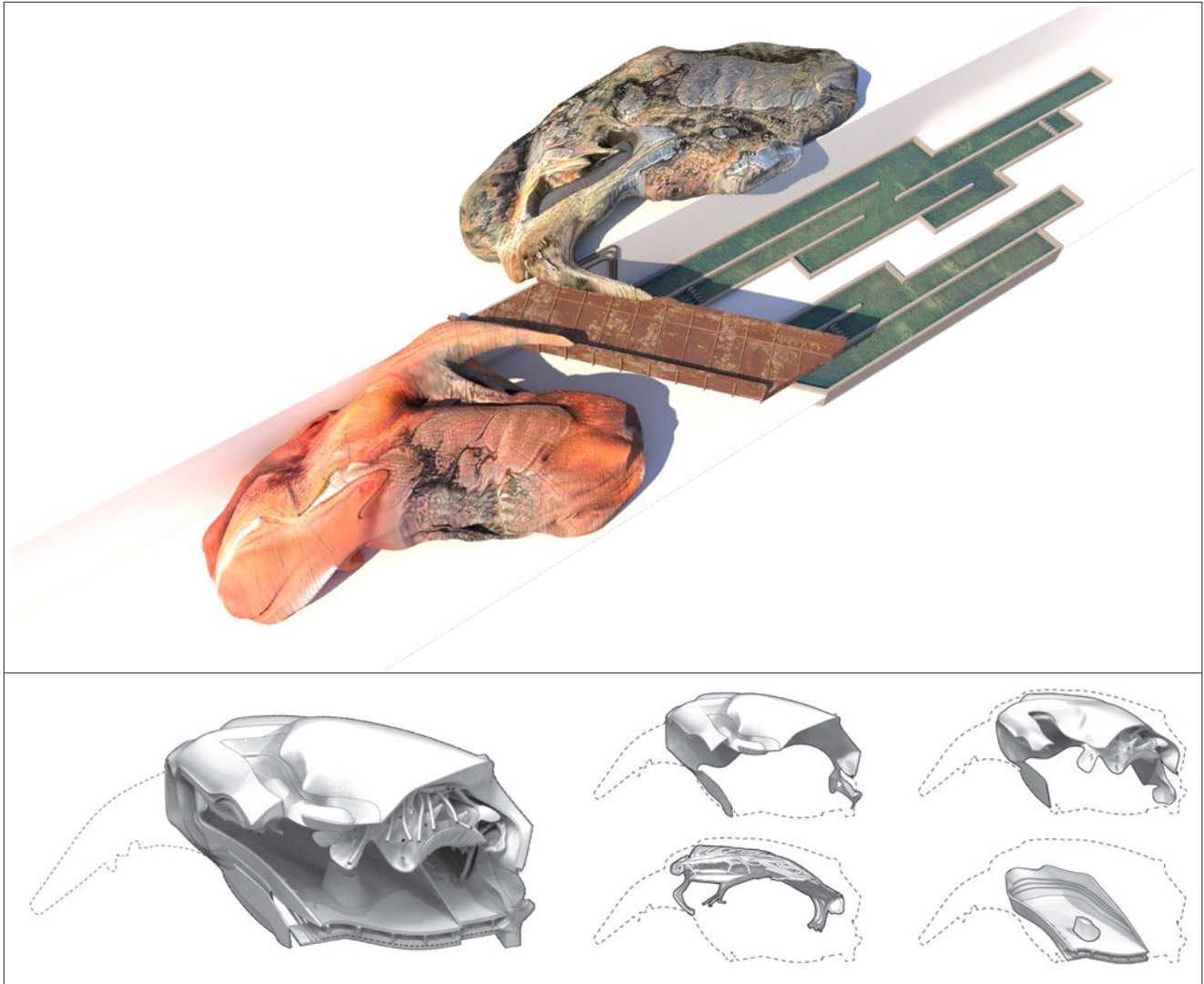
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SPIRUDELPHIA







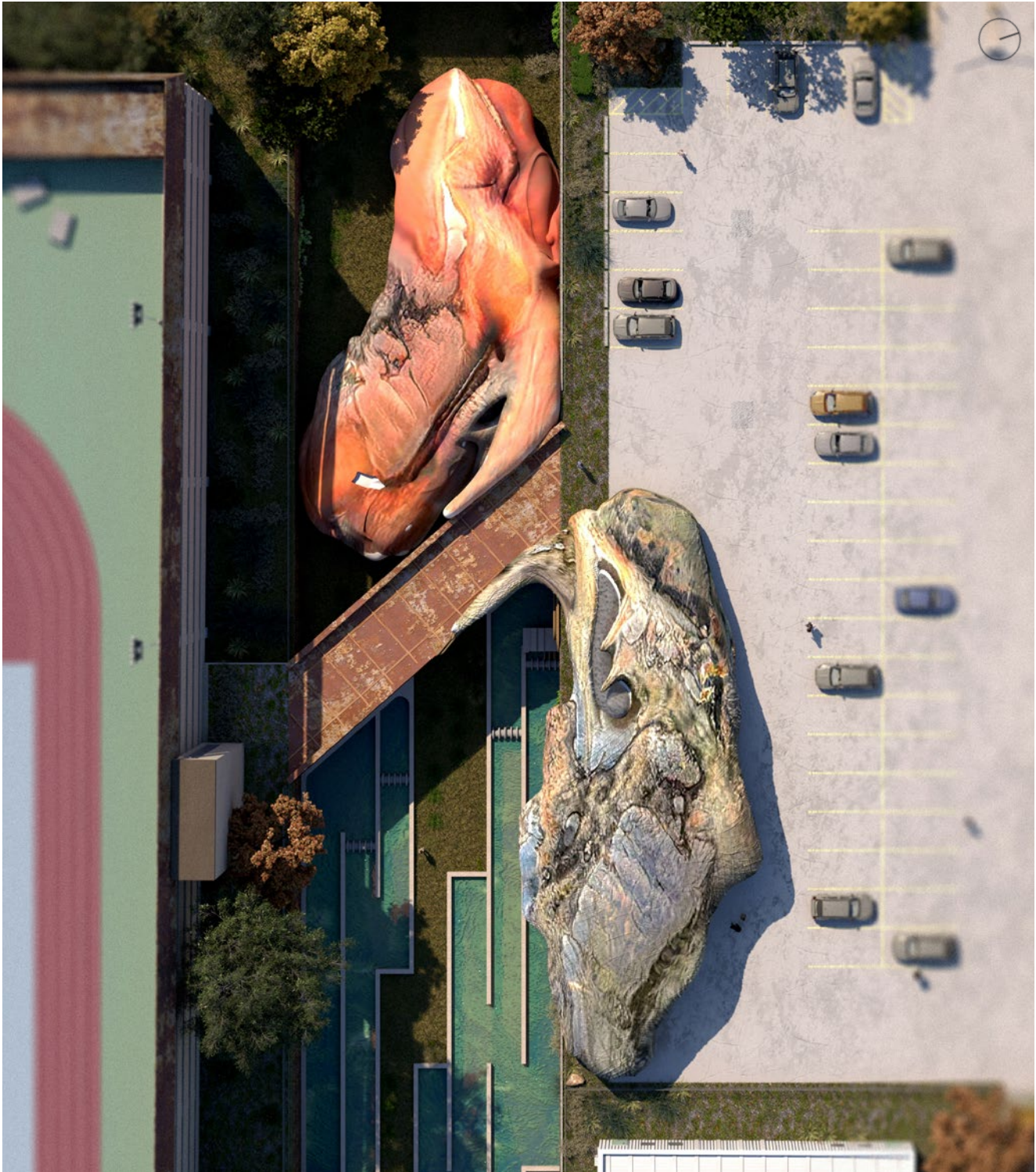


### Diagrams and structure analysis studies

The scientists have discovered that these new algae can occur in multiple shapes, colors, and forms. The lab grown algae shows multiple variations of the same species of algae. They have a naturally stable structure.

The 3D laser scanning of these natural structures has revealed rippling patterns within the layers of these structures. The rippling patterns are formed due to the dense accumulation of algae in those areas. Due to their stalagmite growth, the stress points in those shells have strengthened themselves via accumulation.



**Top View**

The top view shows the two fully grown algae shells inhabiting near 'The Cut' area. They formed a connection with the existing steel bridge near them. The pools in the cut areas are designed to collect the non-toxic liquid residue extracted from the algae. That residue is planned to be treated in a water treatment plant to extract clean drinking water.





**Floor Plan**

The floor plan shows the interior carved space to be utilized by the public. These spaces are retrofitted to have usable spaces, like exhibition spaces, labs, public lounge, café etc. These structures are used as temporary spaces that the public can access.



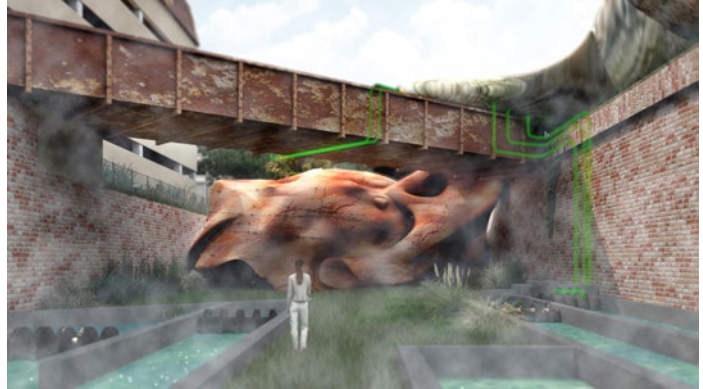
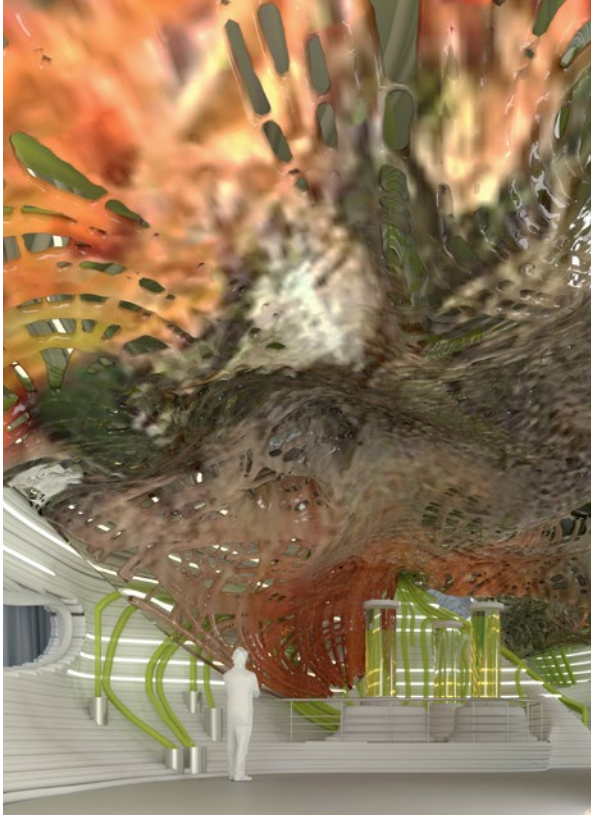


### Renders

Top: North elevation view of the parking lot shell

Bottom: View of both shells from the bridge





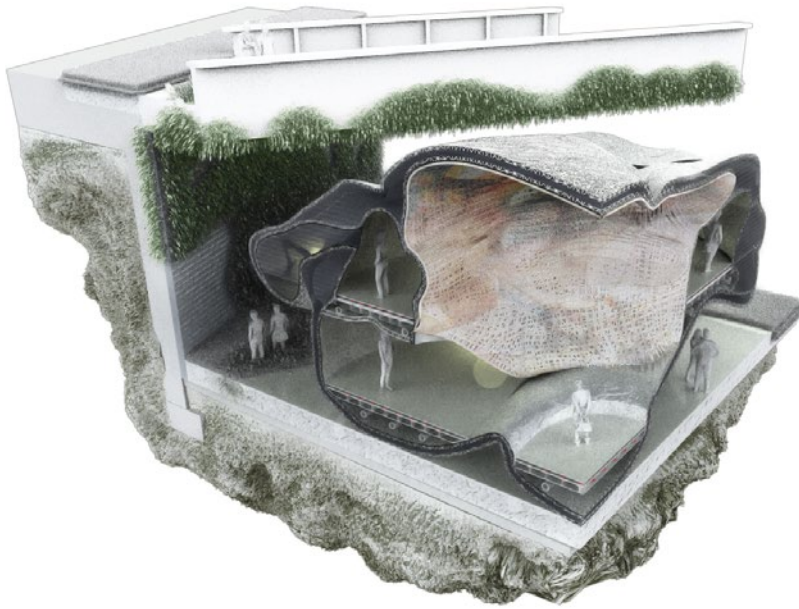
### Renders

Top left: Interior view of parking lot shell showing the lab and display spaces.

Top Right: Two views of 'The Cut' shell from different angles

Bottom: South elevation showing both shells



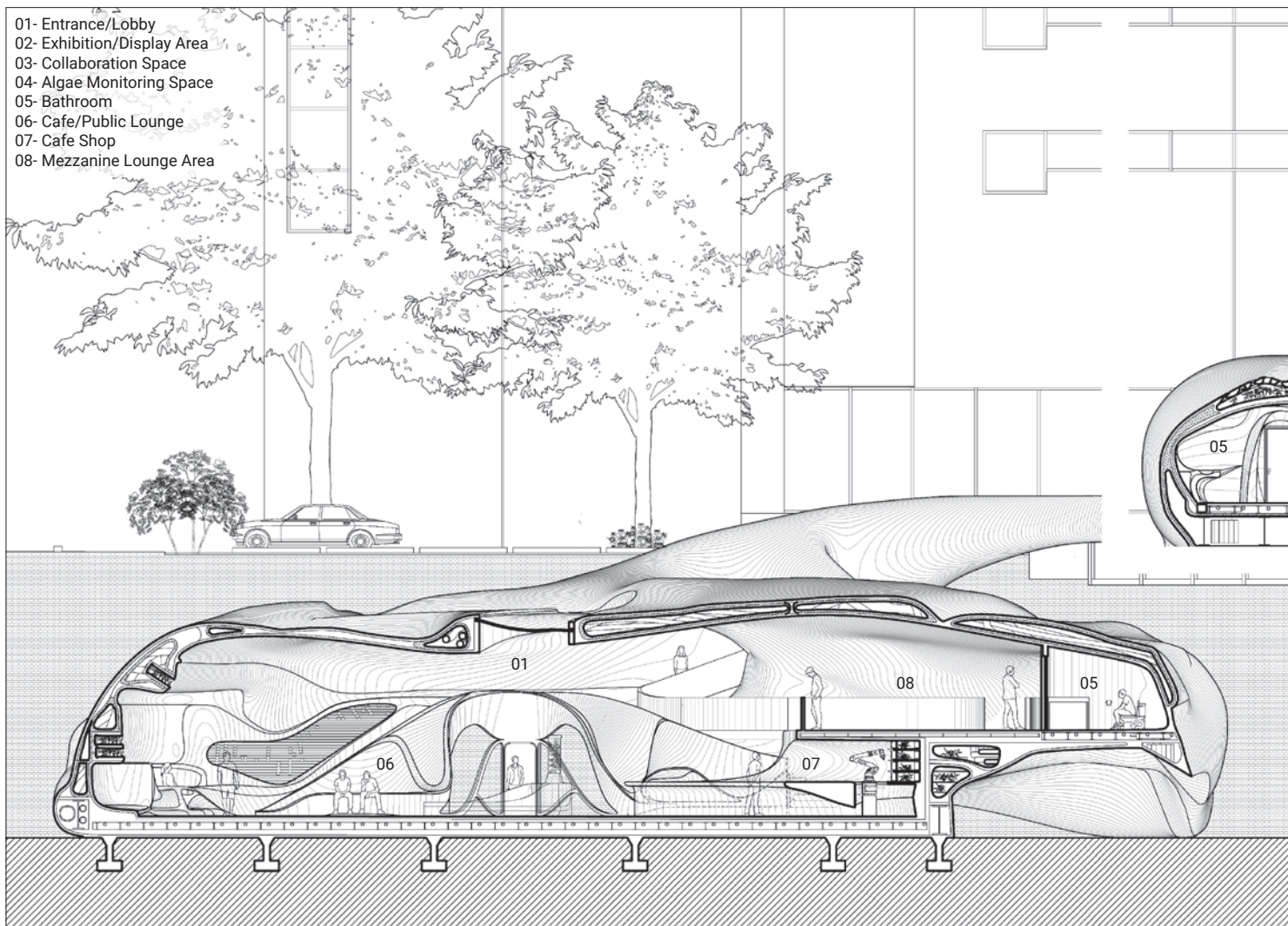


### Chunk and vignettes

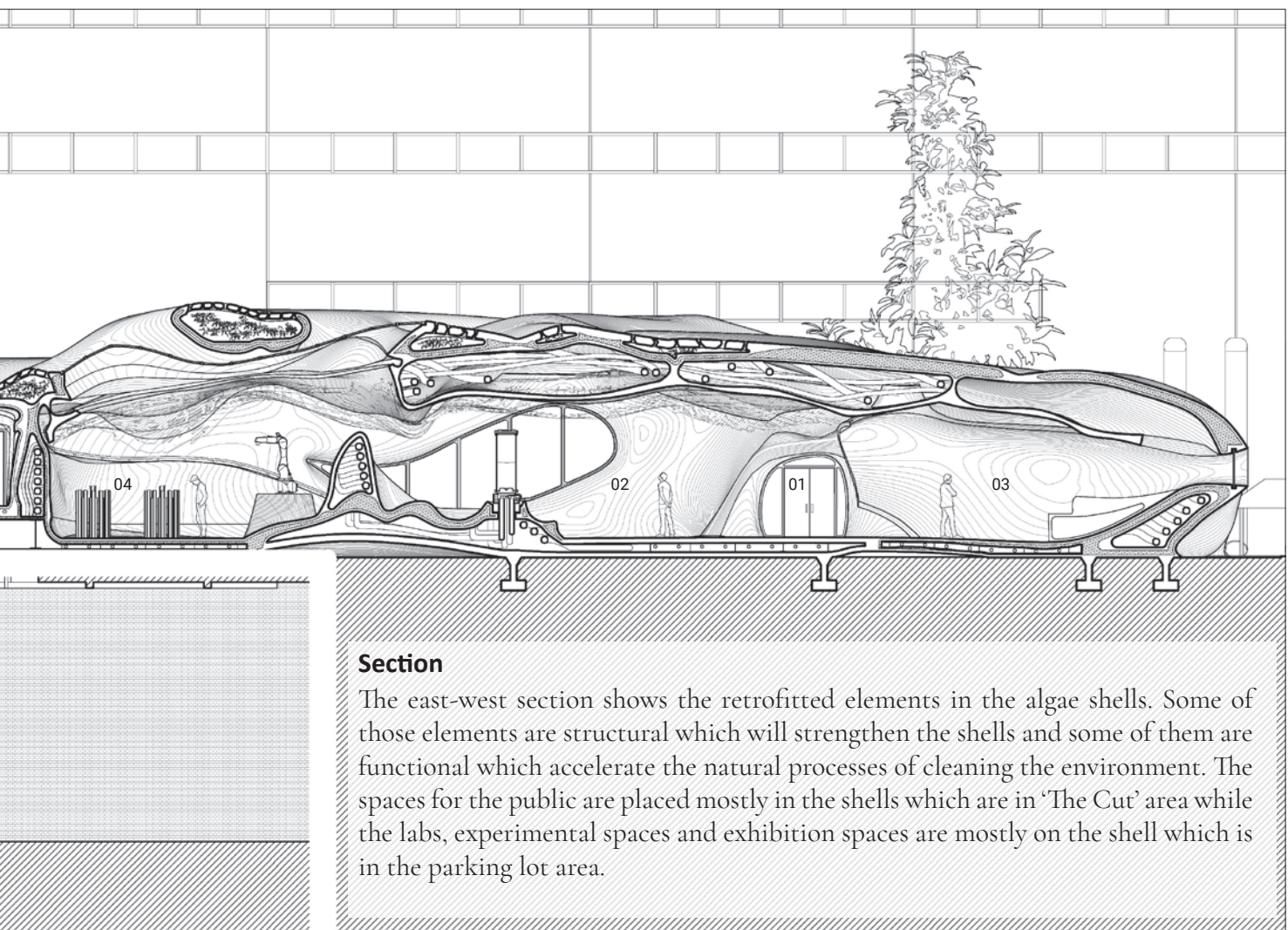
The closeup of these algae shows unique patterns and gives us an insight of these structures. The exterior patterns mimic the internal structure of those shells, hence developing an ornate façade.

The interior is carved out in such a way that the natural process of the algae was not disturbed but facilitated. The carved spaces provide not just the floor areas and stairs but also furniture and fixtures.

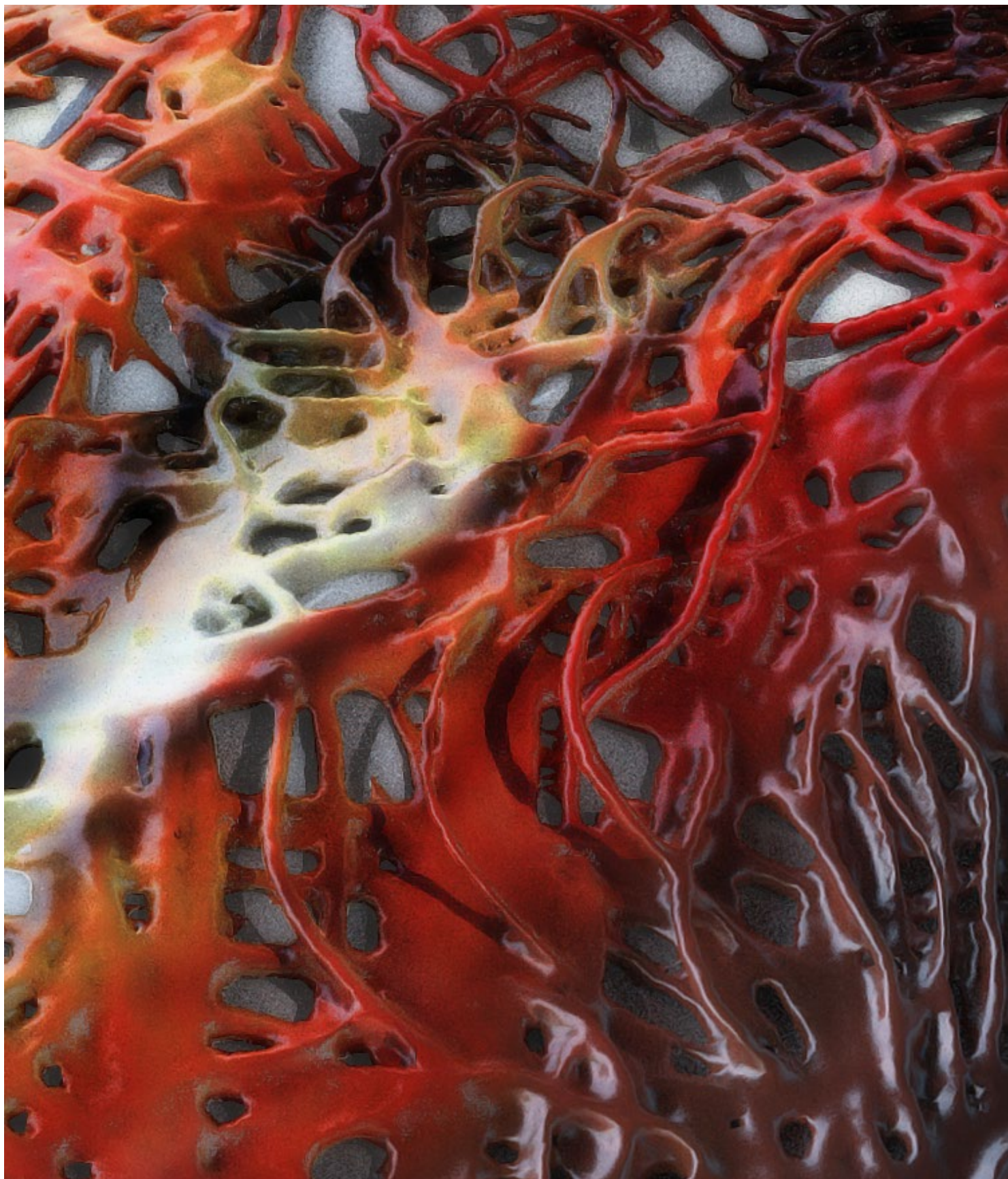
The diagrammatic chunk developed to understand the design of those carved spaces accentuates the complexity of the interior elements.



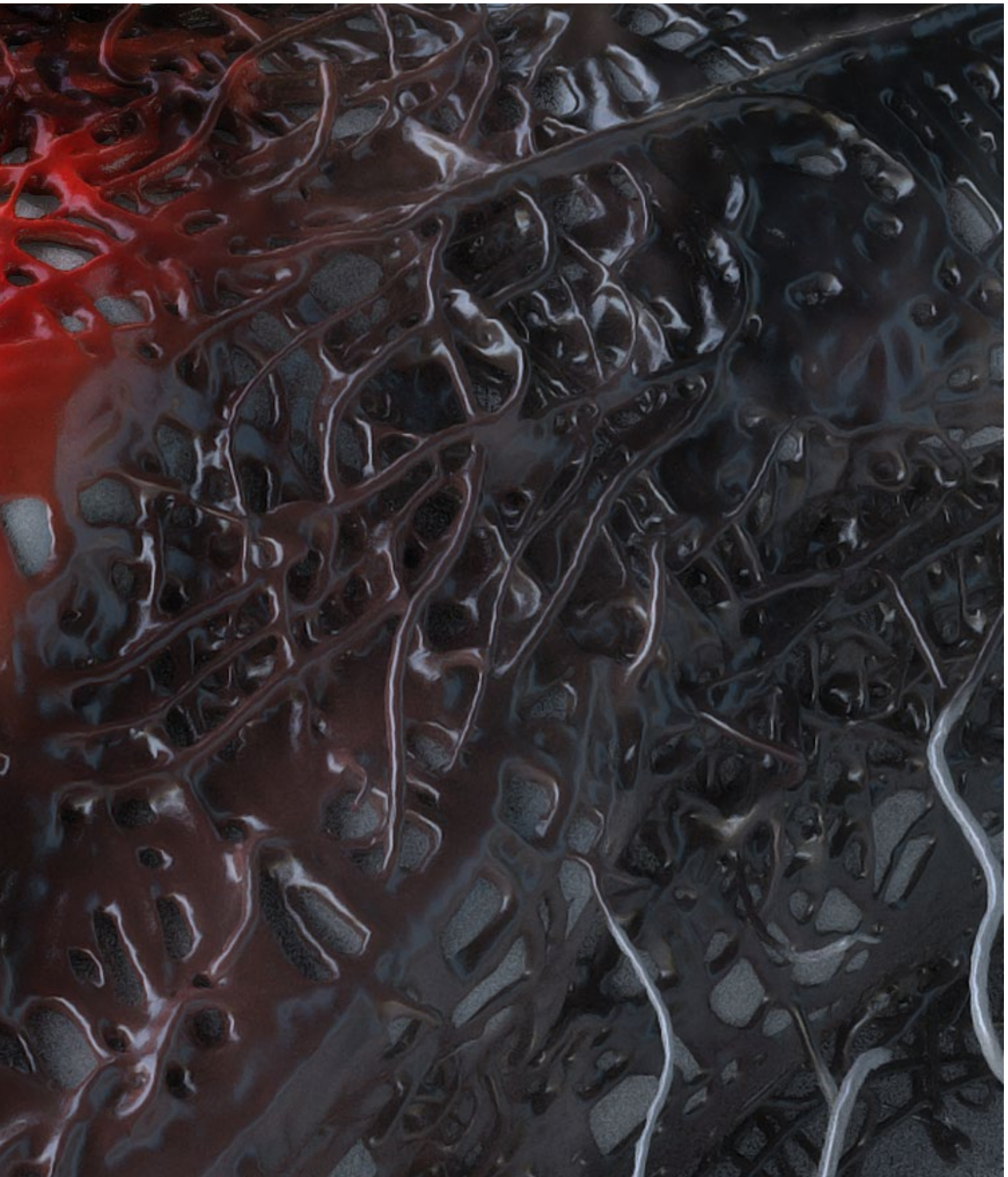
















# HEMP TECH GARDEN

Market for Callowhill district

Instructed by **Andrew Saunders**  
Site located in Philadelphia, PA

The market is planned by dividing the site in five sections or quadrants. Each quadrant is treated similarly in terms of building the mat density of crisscross Cartesian elements. Their walls are also carved with the artifacts having linear quality. Those walls act as a container of Cartesian elements but do not limit them within those spaces. Hence, there are multiple intersections of elements of adjacent quadrants. The main difference between each quadrant are the unique figural artifacts wrapped in dense Astroturf. Those sculptural vessels function as a breathing space between the thick mat Cartesian elements.

The market operates on four program areas. The retail space, industrial section, the harvesting area and public gardens. From retail space people can buy many environmentally friendly Hemp and Cannabidiol products. The industrial section has given people the opportunity to start up their small-scale businesses of processing and refining Hemp plants. The farming fields and sculpture vessels act as public garden spaces.

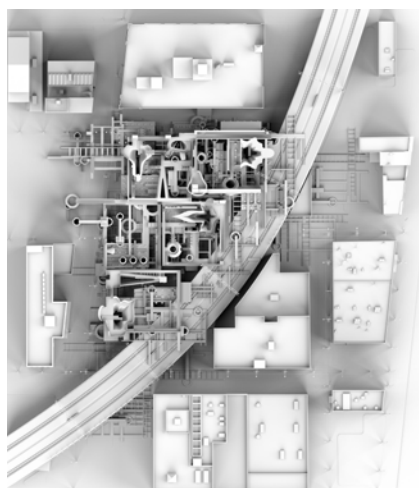
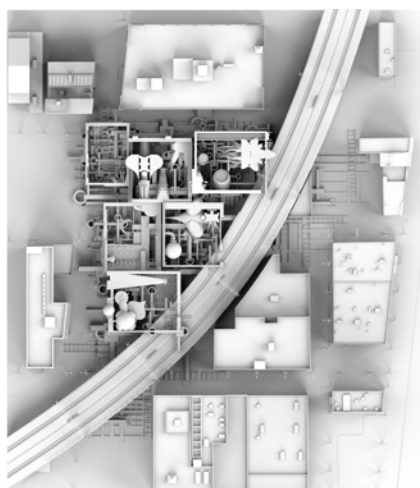
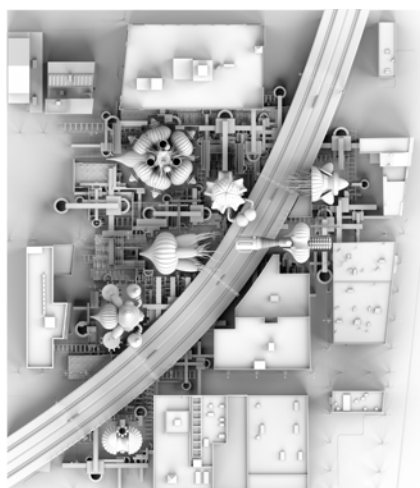
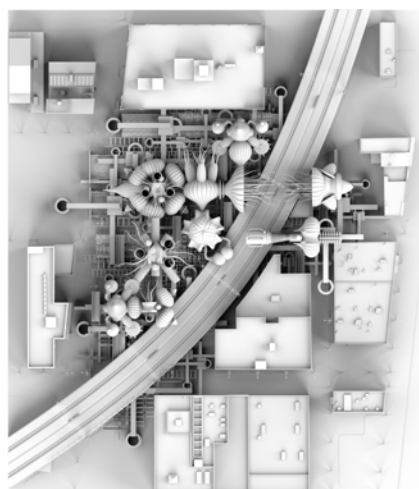
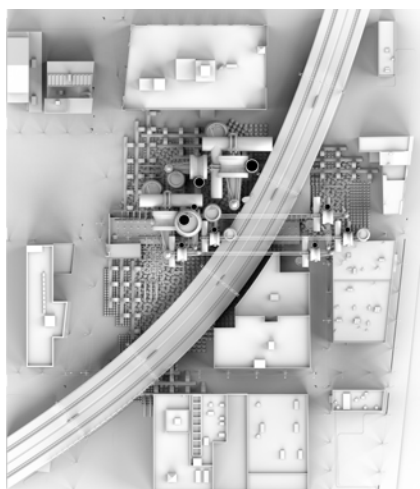
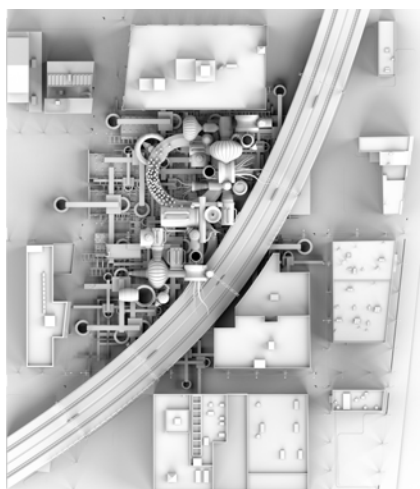
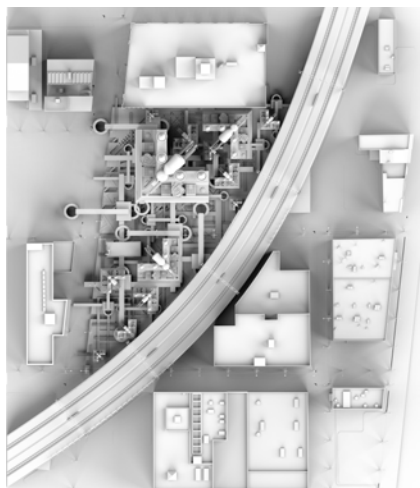
The Callowhill district in Philadelphia city has a new market that provides the much-needed facilities of Hemp products for the city. The market has a design of dense lettuce structure, carved spaces for courtyards and labyrinth build up by farming Cannabis plants. The building placed itself in the city as a collection of the neighboring architectural artifacts, but the density made those artifacts hardly recognizable.

The market is serving the city with sustainable, environmentally friendly and ethical products. It carves its identity in the city as the density of ubiquitous elements while having unique courtyards of rare figures. The market has an industrial and synthetic programmatic interaction with the city. Moreover, it inhabits nature by providing an urban farming platform.

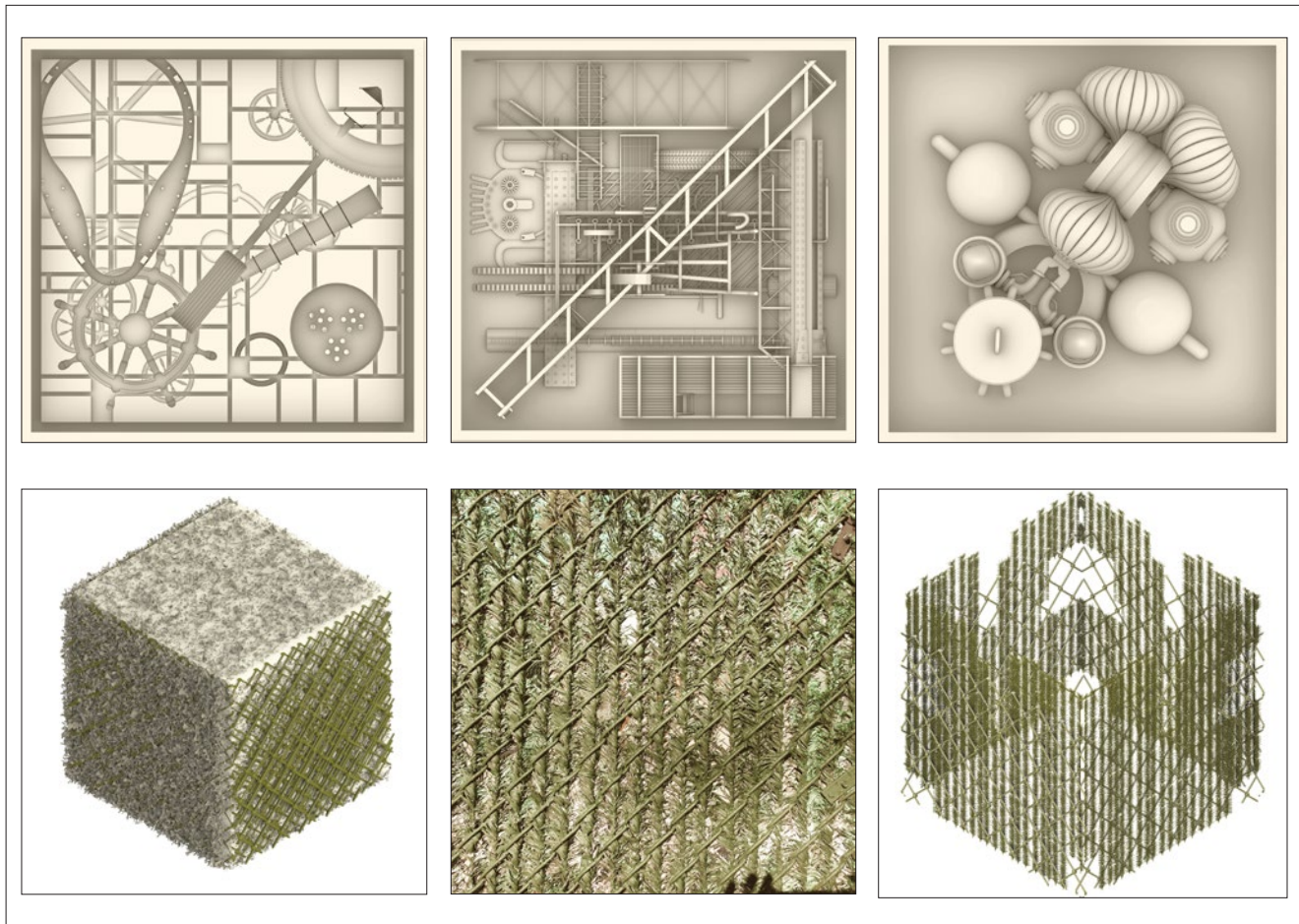












### Relief models and material studies

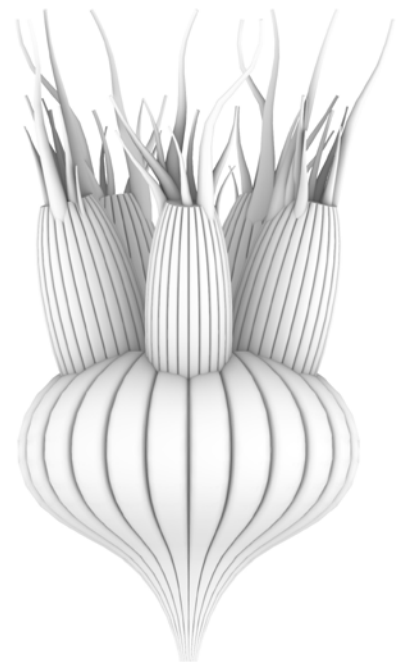
The reliefs were made by collecting different artifacts from the site surrounding and the neighborhood of Callowhill district and Chinatown in Philadelphia. The artifacts of different volume and depth are used to produce those reliefs. Different materials and texture are also collected from that region to develop a material palette for the project.

Left page: Different iterations of relief on site and their effects on the context and surrounding.

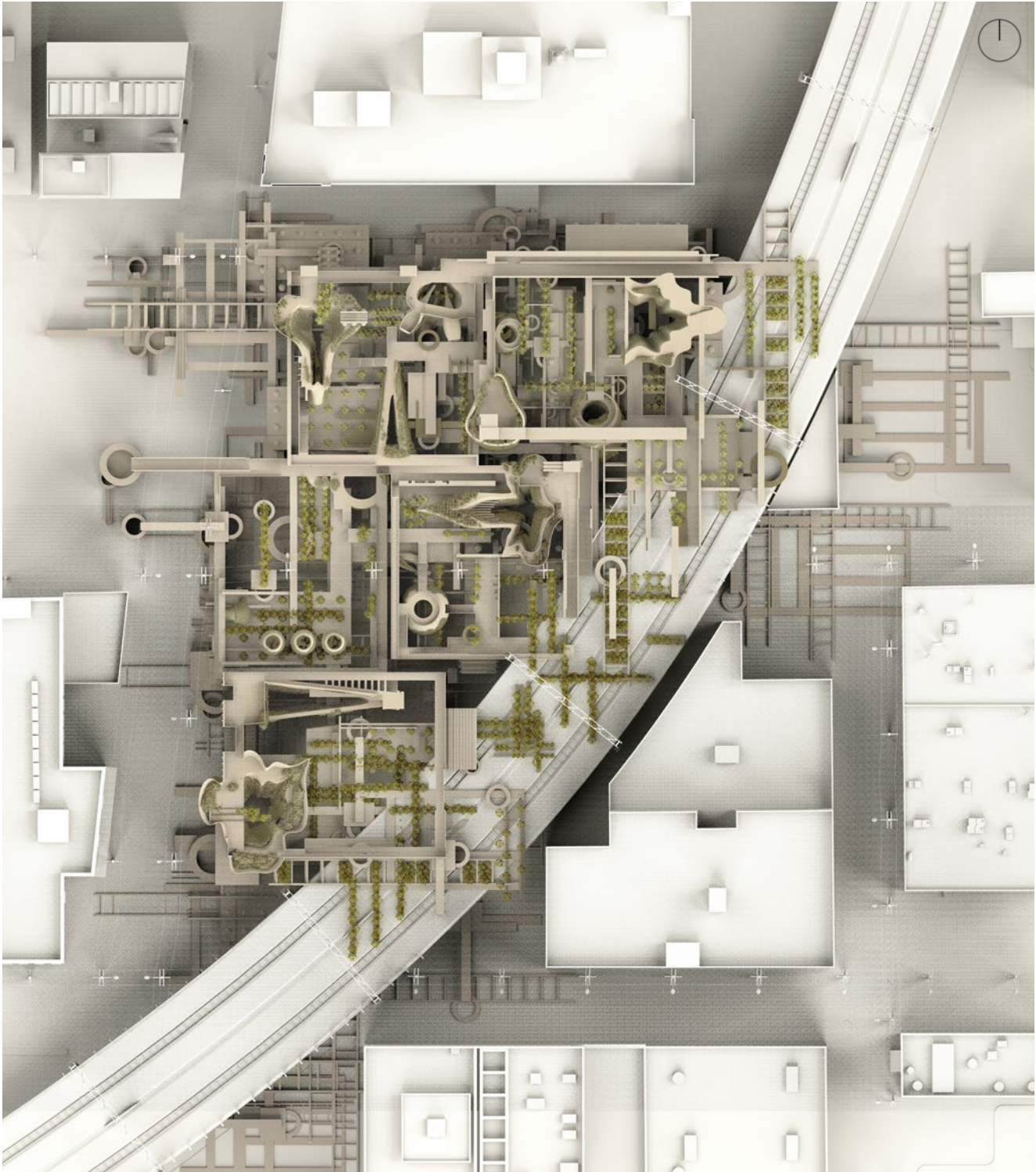
Top row: Three types of reliefs (Bas, High and Figural) designed by using site artifacts.

Middle row: Material exploration and defamiliarizing the context material.

Diagram on right: Model exploration using site artifacts.







**Site Plan**

The site plan shows the top view of Hemp Tech Garden. The top floor of the market has harvest areas and public spaces. The figural volumes provide the leisure spaces for the public while the flat areas provide spaces for Hemp growth.





**Ground Floor Plan**

The ground floor provides retail space for the neighborhood. People can buy and sell different products made from Hemp at the ground level.



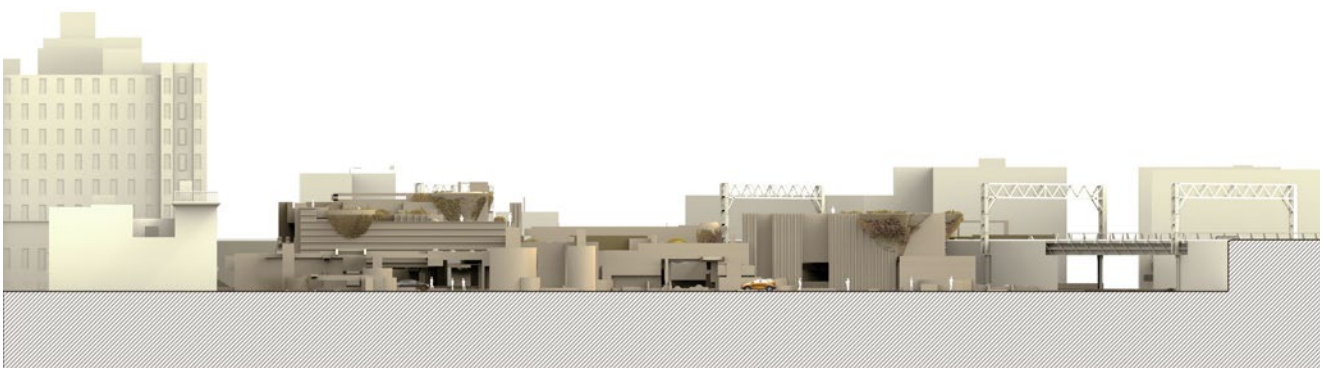
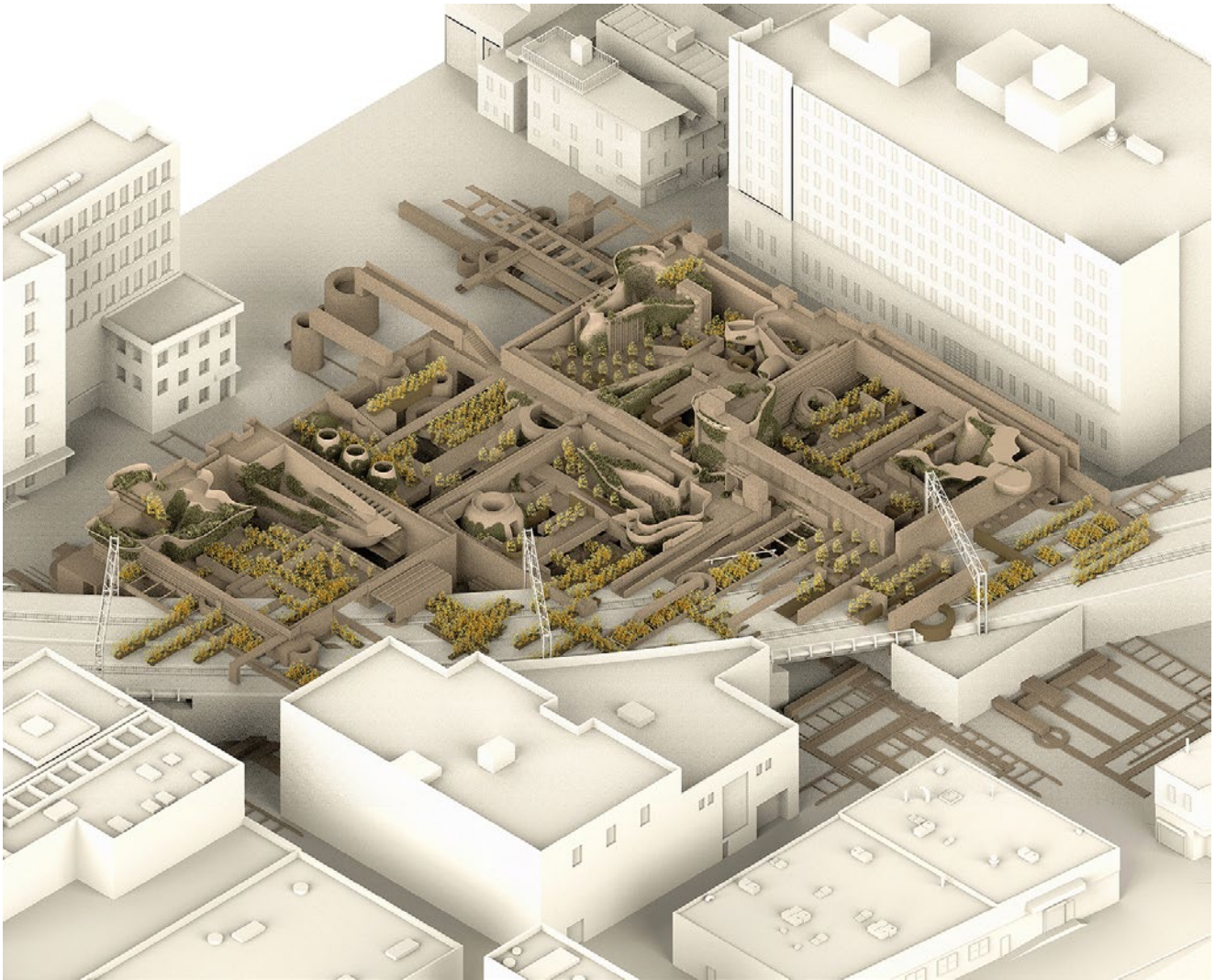


**Render Views**

Top: View of North-West quadrant showing the harvest areas and public spaces at the top level.

Bottom: Interior view of retail area at ground level.



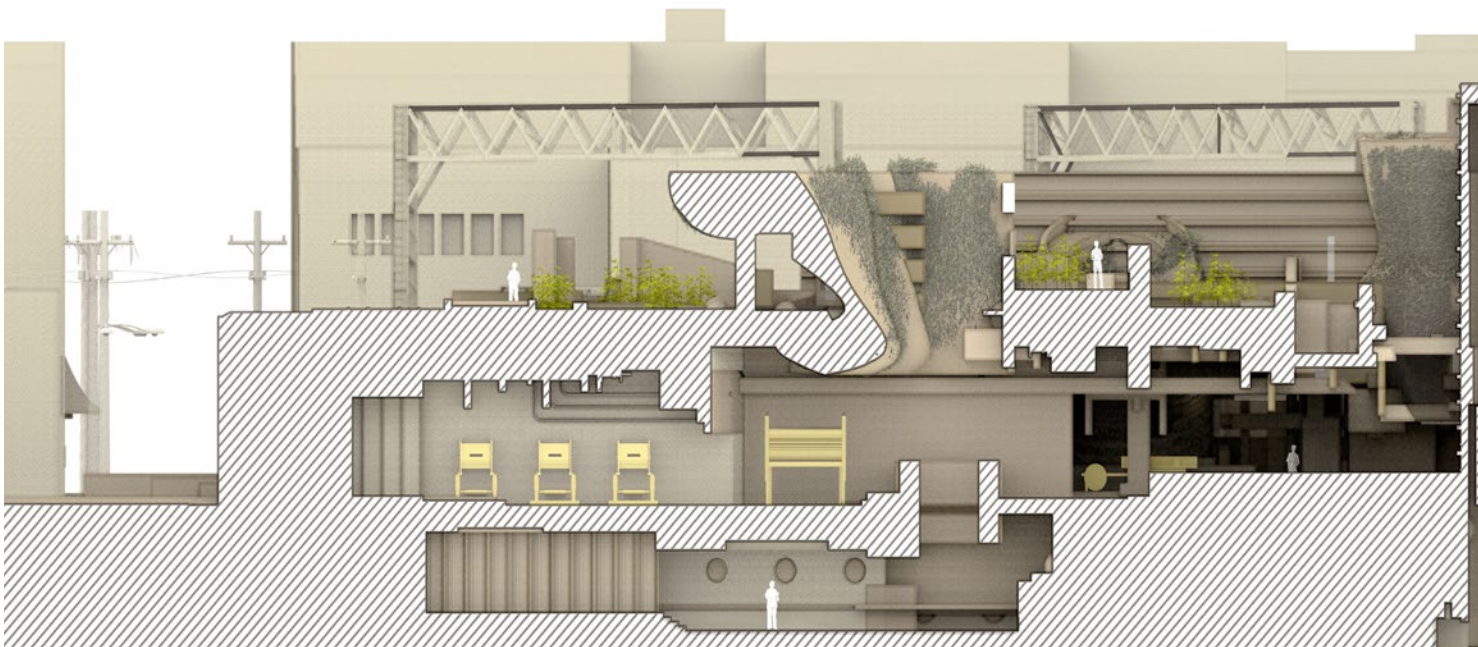
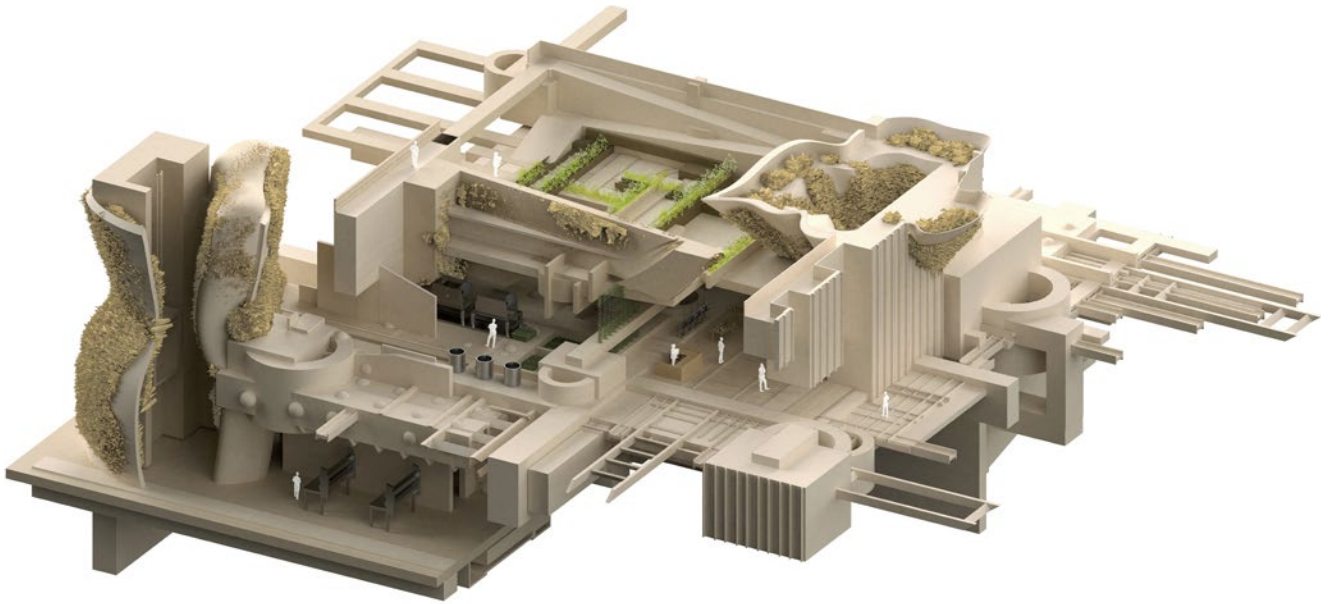


**Render Views**

Top: Bird-eye view of the new market at Callowhill district.

Bottom: West elevation showing the multiple entrances for the retail area.





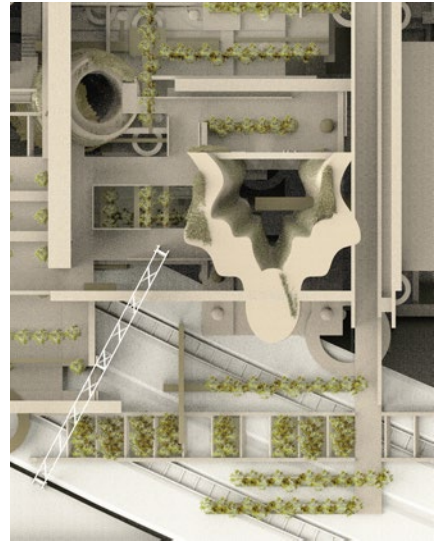
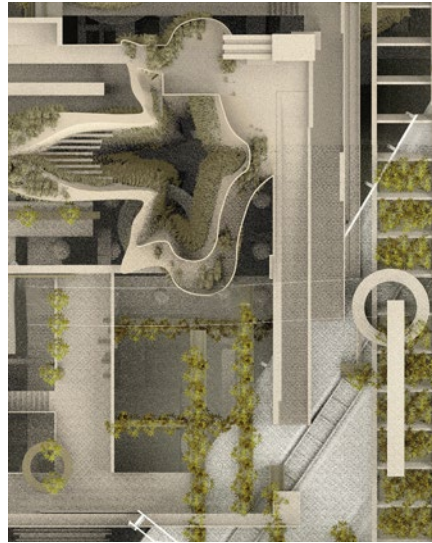
**Section**

The east-west section shows the different programs at each level. The industrial area where the hemp is being processed is on the bottom floor. The ground floor shows retail areas where shops and stores are set up. The top floor is harvesting hemp and the volumetric protrusion are the public garden.

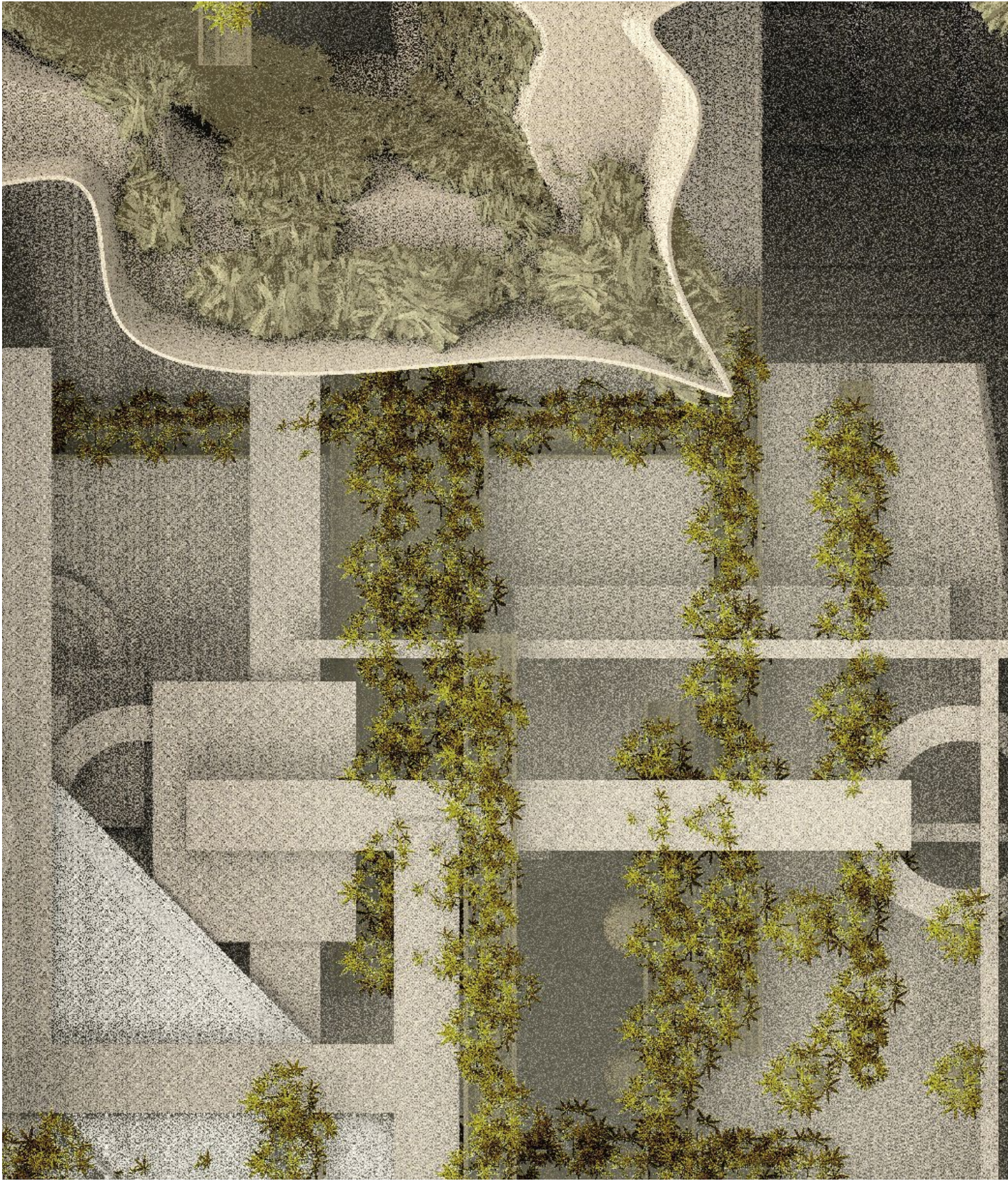


### **Chunk and vignettes**

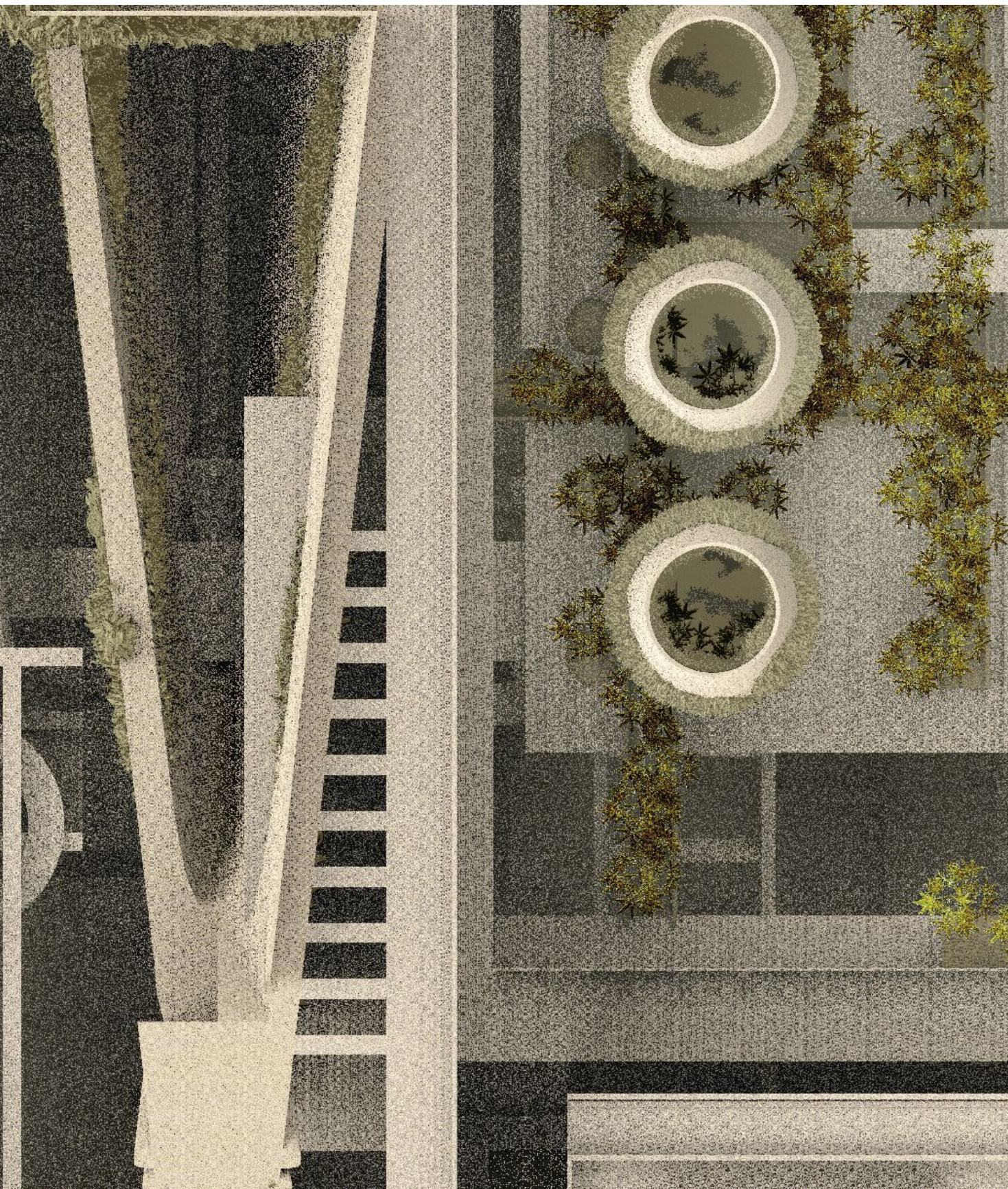
The defamiliarized site artifacts and materials are composed with the dense mat area providing open spaces in the layered structure. The artifacts combined with the programmatic elements gives a cohesive design strategy for the project.









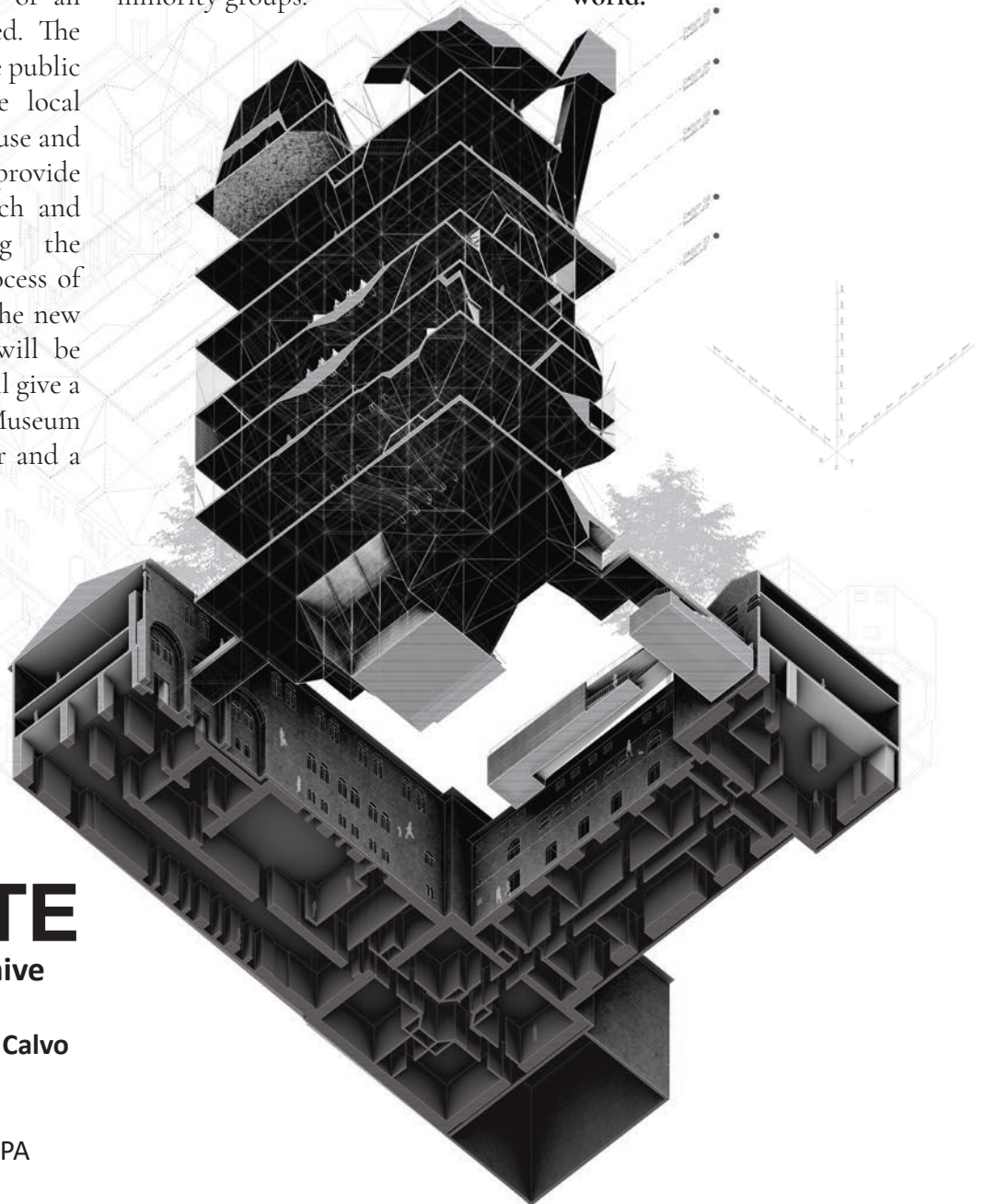




Penn museum's current bureaucratic system keeps its collection in prison, and it misrepresents the displayed artifacts and cultures. Due to that, the museum has become a source of social divide and cultural distortion. The aim of the New Institute is to nationalize the museum which will allow the true representation of cultures because the people of all cultures should be welcomed. The new museum will act as a true public institution governed by the local cultural groups that care for, use and study all the artifacts. It will provide space for knowledge, research and collaboration. Nationalizing the museum will initiate the process of repatriation of artifacts. In the new institute cultural diversity will be celebrated. This structure will give a new definition of museum. Museum will become a cultural center and a knowledge hub.

The project used a spatial tactic of Megastructure critiquing the museum's conventional bureaucratic system. The aim is to establish an educational institute and community center. There are a total of eight datums including ground floor. Each floor supports a different program which helps the community and currently underrepresented minority groups.

A non-conventional model of education in this museum will investigate all kinds of knowledge; tangible and intangible, cultural and traditional, scientific and spiritual, logical and mystical. It will become a bridge between the old and new technologies. The knowledge produced in the new institute will be deployable to other parts of the world.



# NEW INSTITUTE

The Penn Museum Archive

Instructed by **Eduardo Rega Calvo**  
Individual design work  
Research done in group  
Site located in Philadelphia, PA

Fall 2019 // University of Pennsylvania





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NEW INSTITUTE

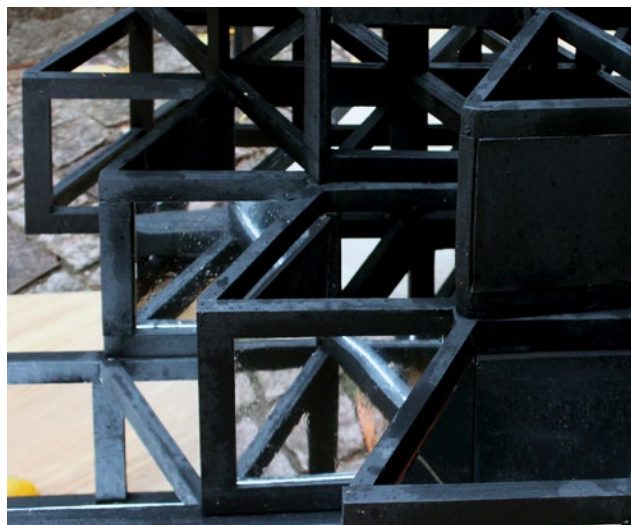




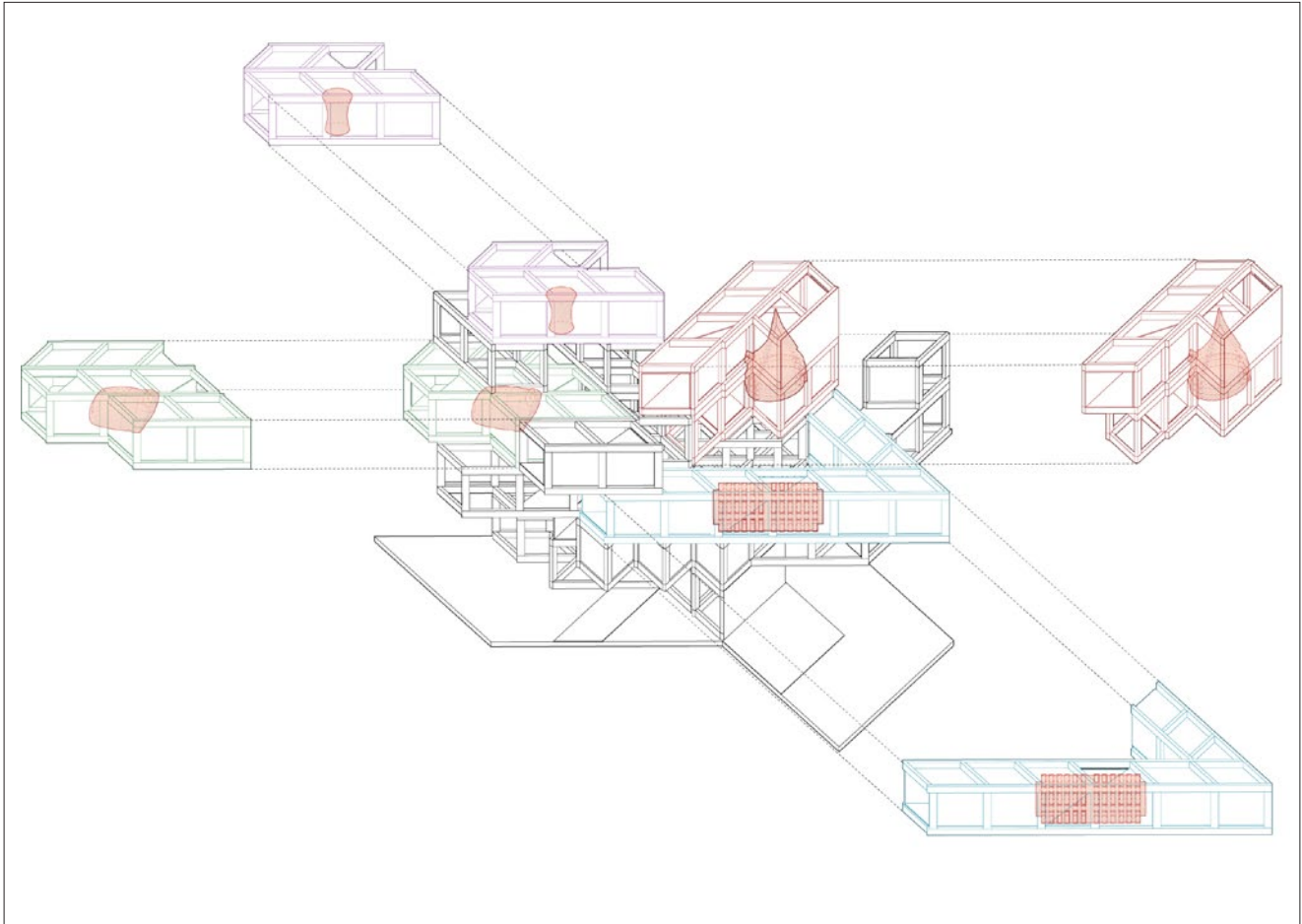
Photo Credit: Lou Caltabiano



Photo Credit: Lou Caltabiano

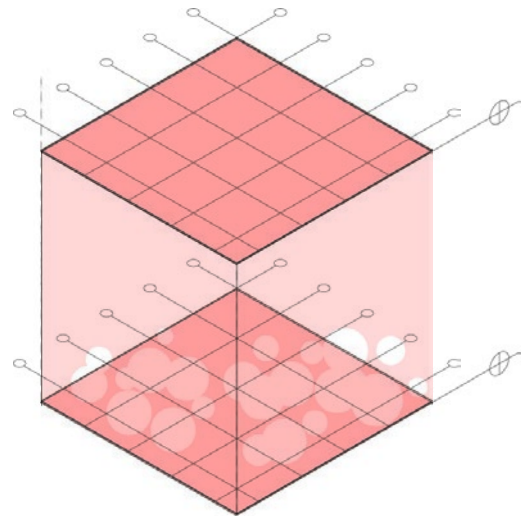






### Curious Cabinet project drawings and model pictures

The ideas of imprisonment of artifacts were depicted in the design of the curious cabinet. The curious cabinet project acted as a testing ground of the strategies that was later applied in designing the Penn museum. The installation of Curious Cabinet in Penn museum courtyard was a blatant critique of the intentions of the west in acquiring foreign artifacts and the unapproachable nature of these objects. The cabinet traps the artifacts in a form that resembles the stacks of shipping crates which were the vehicle of theft. Moreover, it distorts the view of those artifacts by using mirrors and structural maze. The cabinet also tested ideas of Megastructure like setting datum and grid and having unapproachable artifacts act as events within the structure.



Curious cabinet design in collaboration with: **Reem Abi Samra, Shifei Xu, Tingdong Xiong**



**60** ARTIFACTS   **14** PLINTHS   **2** EXITS   **30** DISPLAY CASES   **5** BENCHES   **2** CABINETS

Anonymous flyers call on Penn Museum to return two 'stolen' artifacts to China

The world's third-largest crystal sphere has sat in the Penn Museum since 1927

The Buddhas of Mount Yudono: Sacred self-mummification in northern Japan

Archaeological excavation in China, 1949-1966

Expedition news: South Asia; The search for Sybaris; Gordion 1963; Cuneiform Texts; New Publication

The fifth century A.D. Buddhist cave Temples at Yun-Kang, North China

Excavations at Zhaoqing, Shaanxi, China: More light on the Museum's Chinese horse reliefs

A Chinese Museum demands the return of ancient artifact



Interior Panorama of Asia Gallery

**221** ARTIFACTS   **11** PLINTHS   **2** EXITS   **8** DISPLAY CASES   **0** BENCHES   **5** CABINETS   **1** INTERACTION STATION

The Imperial wardrobe of ancient Rome

The 'Thrice-Ploughed Field': Cultivation techniques in ancient and modern Greece

Reimagining ancient Italy: New directions in Italian archaeology

The Penn Museum hosts an annual event on ancient works concerning sexuality

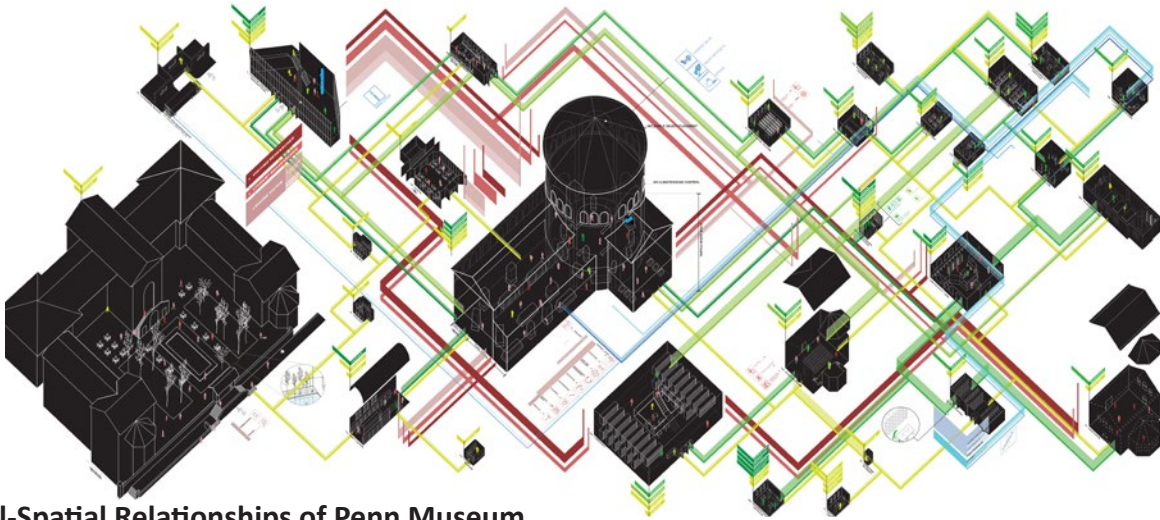
New archaeological techniques and international cooperation in Italy

The Garden portico of Pompey the Great: an ancient public preserved in the layer of Rome



Interior Panorama of Europe Gallery





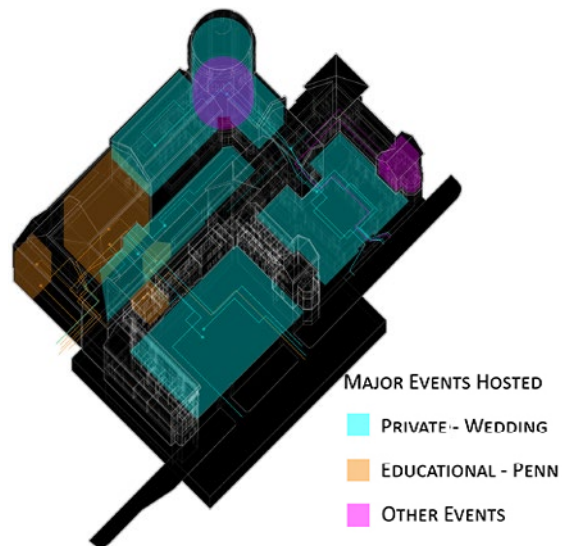
Social-Spatial Relationships of Penn Museum



Dymaxion Map

### Socio-spatial map of the Penn museum

The aim of this research was to develop infographics of the data collected regarding the Penn museum. The map above analyzes relationships between social interactions and physical spaces by means of circulation. The dymaxion map shows the collection of artifacts from different parts of the world. It highlights the loot and exploitation of resources due to colonial rule. The New Institute focuses on the aspect of limited access of artifacts to the public. The public access to the buildings are shown in red lines in the map above. It shows the public does not have access to all artifacts. Penn museum addition is designed to give maximum public access.



Research in collaboration with: **501 Eduardo Rega Calvo design studio students of 2018 and 2019**





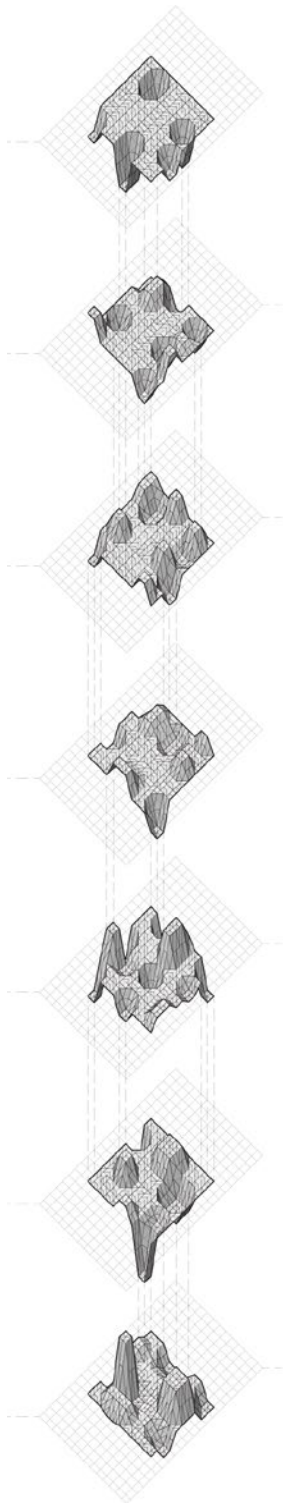
### Renders

Top: Section emphasizing the floor plate design.

Bottom left: View of public space.

Bottom right: View of public spaces of New Institute from the Penn Museum building.

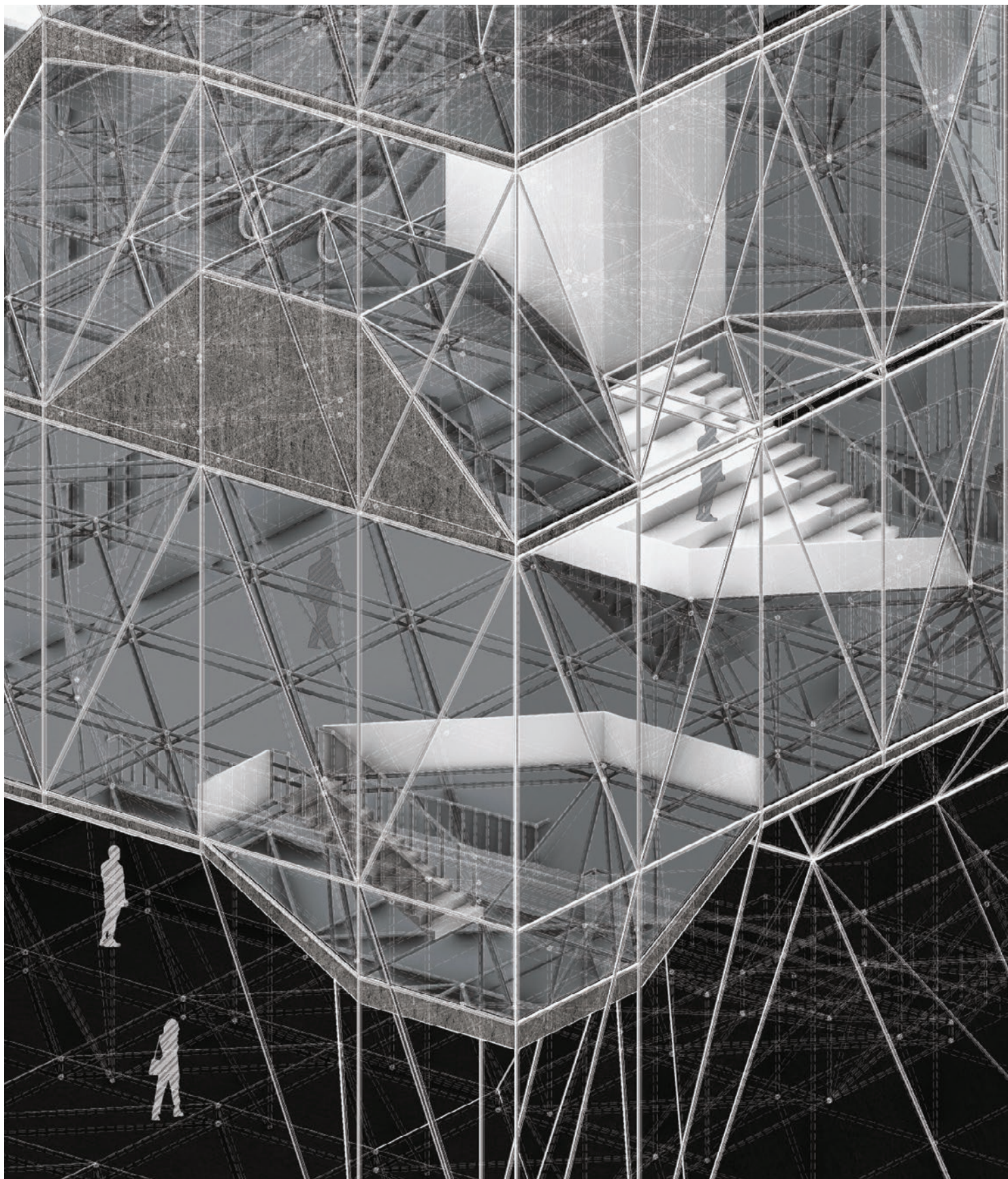




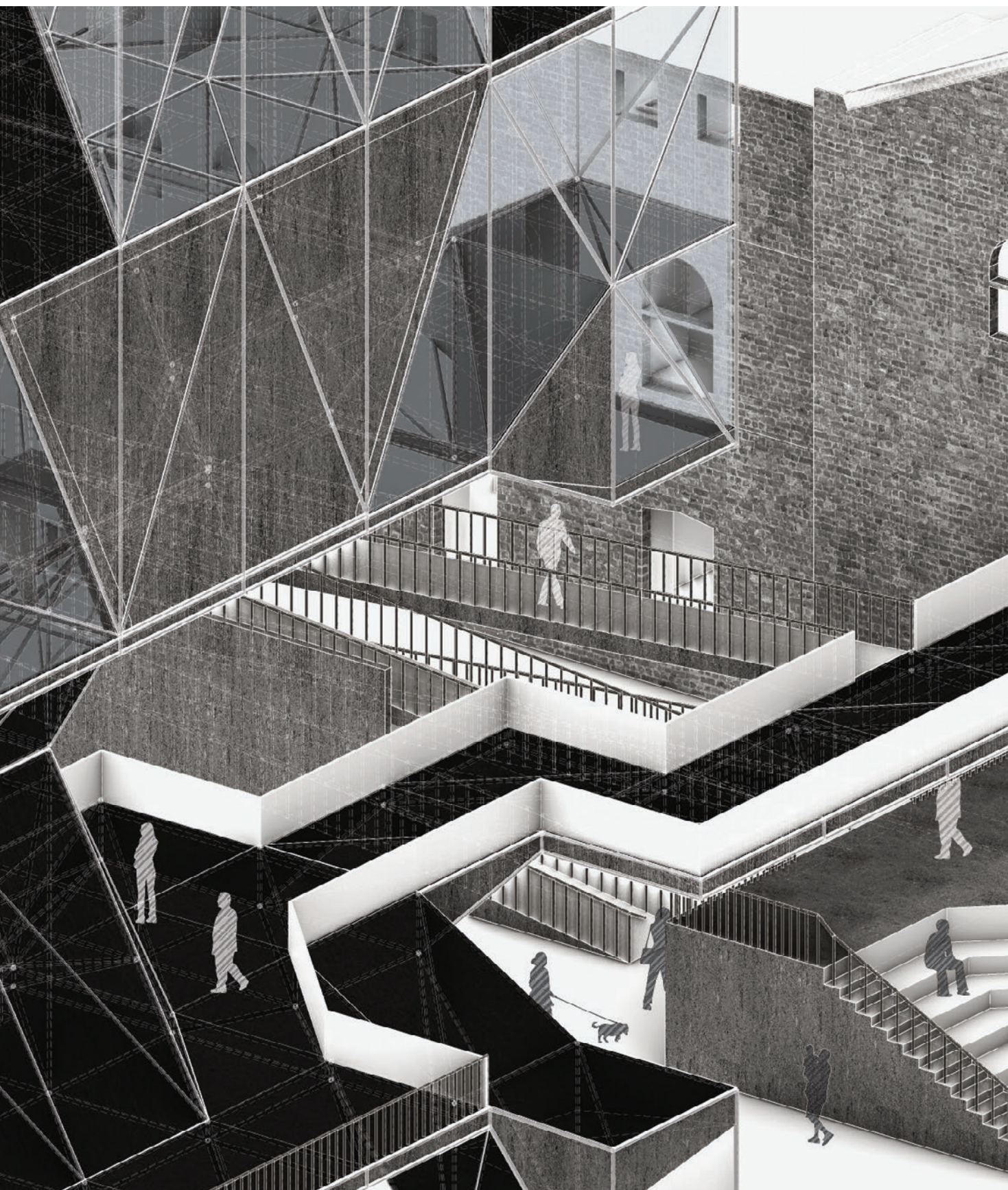
### Diagrams and model picture

There are a total of eight datums including ground floor. Each datum or floor plate is designed with a similar scheme of surface manipulation but produces a different result. Program zones on each floor are also different examples of those spaces include public spaces, library, cultural center, help center, resource bank etc.

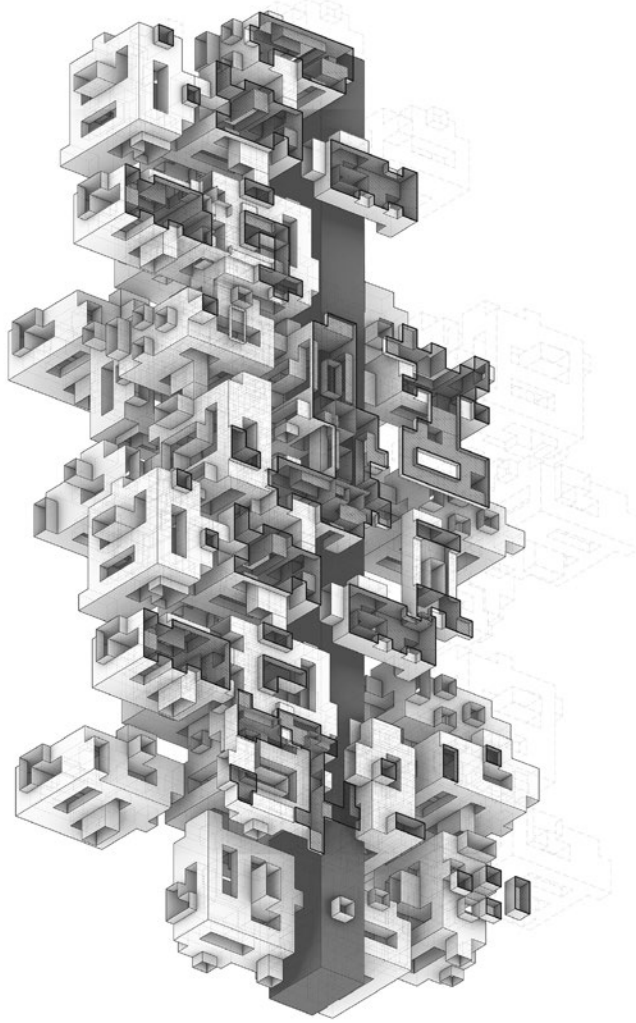












# FRACTAL UNITS

Housing and public spaces

Instructed by **Jonas Coersmeier**

Site located in Brooklyn, NY

The Fractal Units project provides housing on an urban scale in the form of apartments and shelter units. It also focuses on the amenities needed for homeless people so it not only provides sleeping units but also provides soup kitchens as public programs. The massing develops a unique voxel tectonics and has cohesive architecture language. The public and private programs are placed inside the massing in such a way that they develop a collaborative environment.

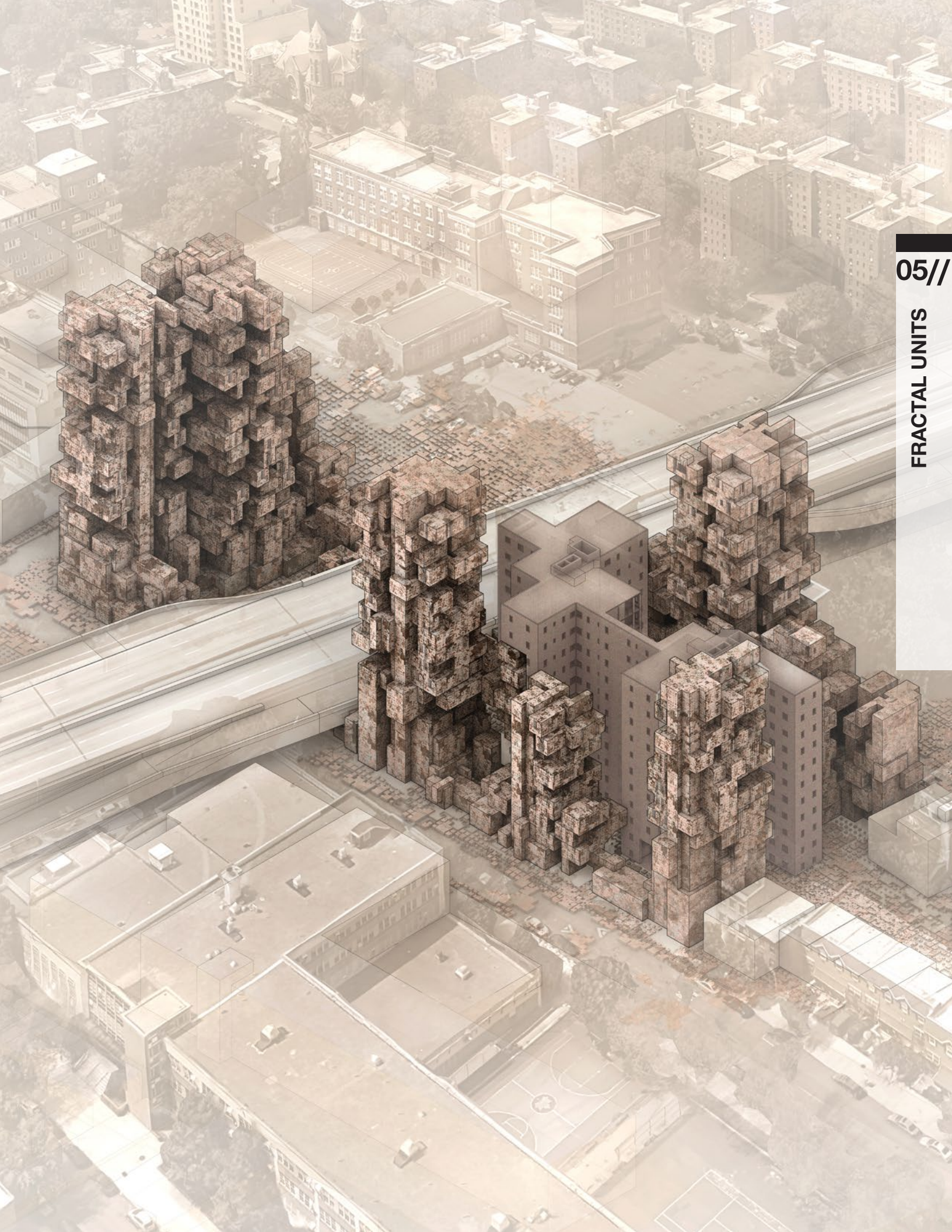
The project researches multiple systems by exploring materials and

mathematical models. The research analyzes the material by studying the biochemical reactions between different ingredients which can produce unexpected results. The material experiments suggest sporadic yet logical growth which relates the voxel studies developed in massing. On the one hand the material studies act as a biological process, while on the other hand the operative drawings develop a machine-like aesthetics. The phenotypic of this organization was also based on a sporadic yet technical system. The project investigates Mandelbrot fractal geometry which can act as a bridge between the

biological accidents and technical systems.

On urban scale the project acts as a hybrid of tower and landform. It behaves both as a Megastructure due to its multiple towers and as a Megaform due to the landform around the urban corridor. The project has a total of 6 different height towers connected via landform which provides the public spaces. The living spaces agglomerate around the tower's core. The new living spaces redesign the floor plan of existing buildings at the levels where they connect. Each living unit was designed by using fractal phenotype and further tectonics were developed by moving the material from the exterior facade to the interior walls. The materials and fractal geometry not only wrap the walls and change the planning organization but also design the furniture and fixture of living spaces.

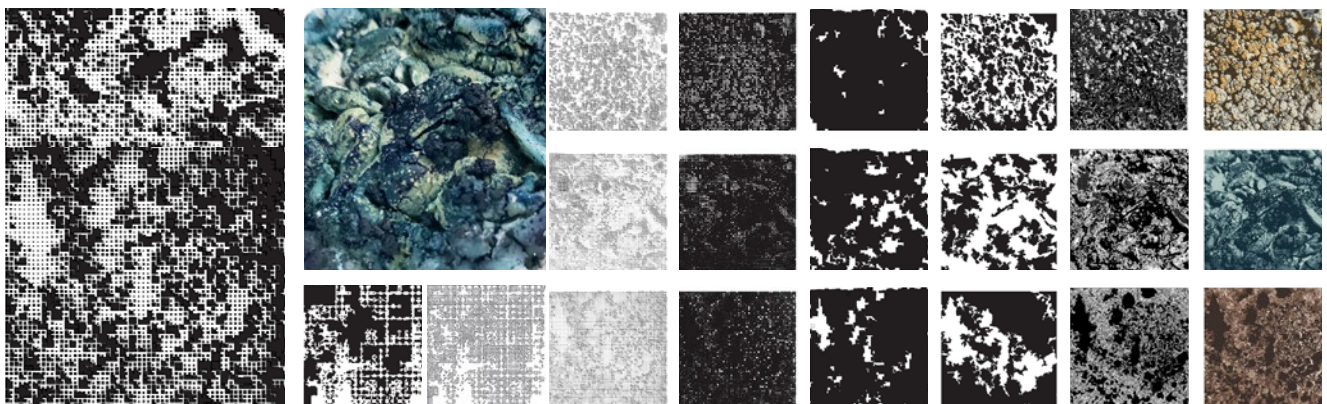
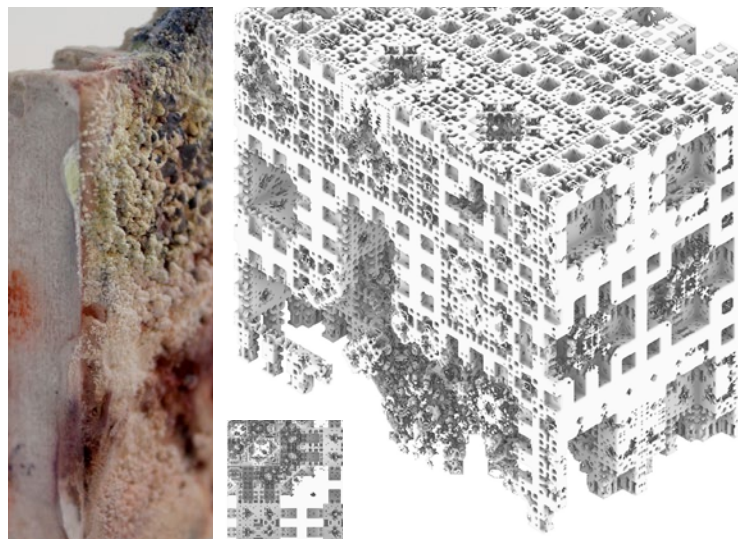
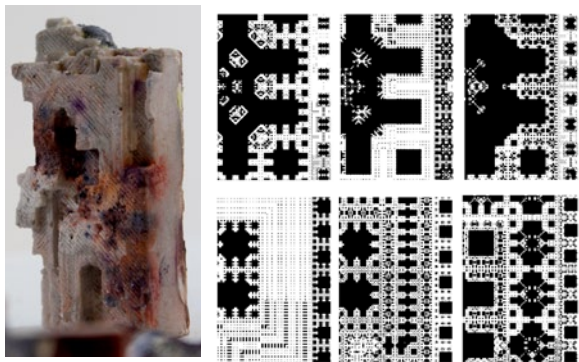
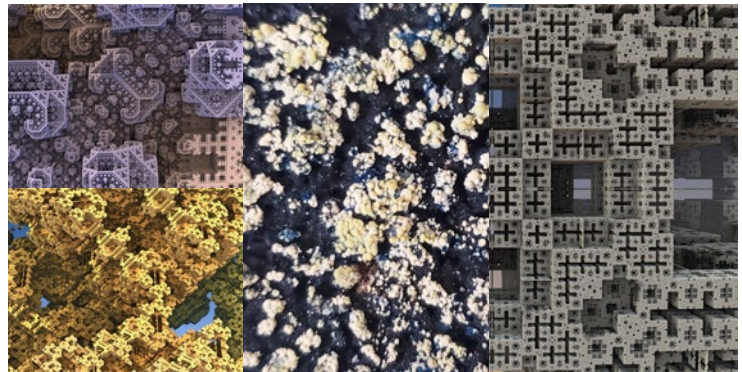
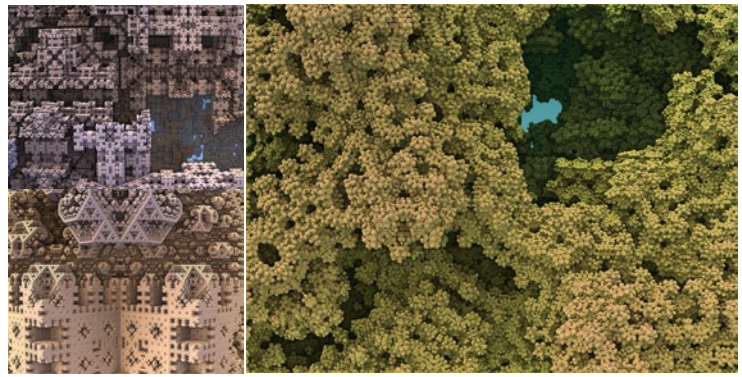




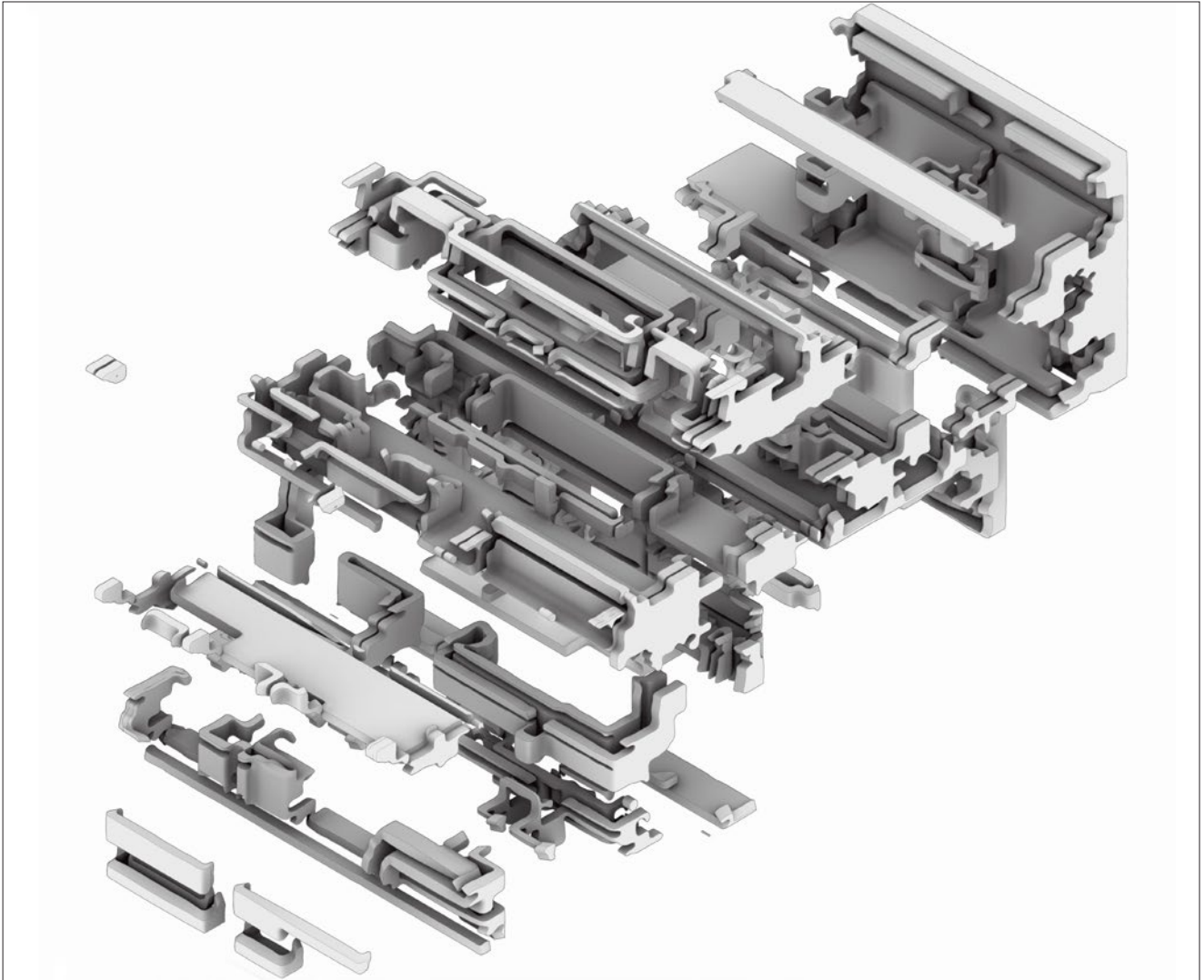
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FRACTAL UNITS









### Explorative Drawings and Material Studies

The project explored different systems that were applied at multiple scales. The operative drawings (above and on project cover page) shows units agglomeration in fractal fashion around a central core and explores the intricacy of interior elements enhanced by material bleeding from facade to interior spaces.

Left page: Material roughness explored via biological growth over time and Mathematical roughness explored via mandelbrot geometry and fractal pixelation.

Image on right: Perspective view of the selected area shown on top from Brooklyn-Queens expressway expresses the architecture language on the facade.





**Site Plan**

Urban scale floor plan highlights vertical circulation core at each tower. This floor plan shows that the project develops as an urban landscape surrounding the existing building and from that landscape the volumes emerge in tower forms intervening the existing building and urban corridor.

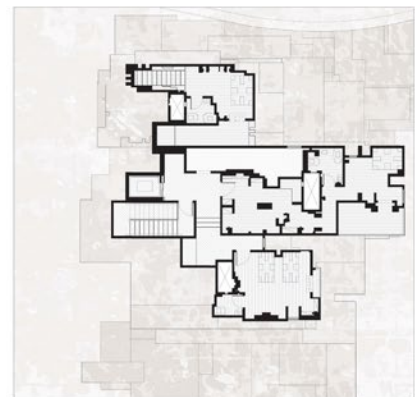
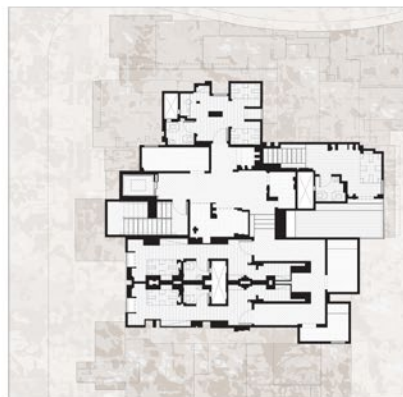
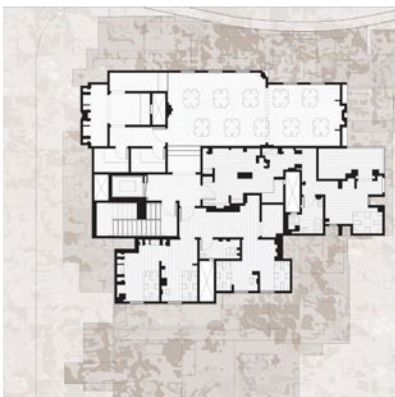
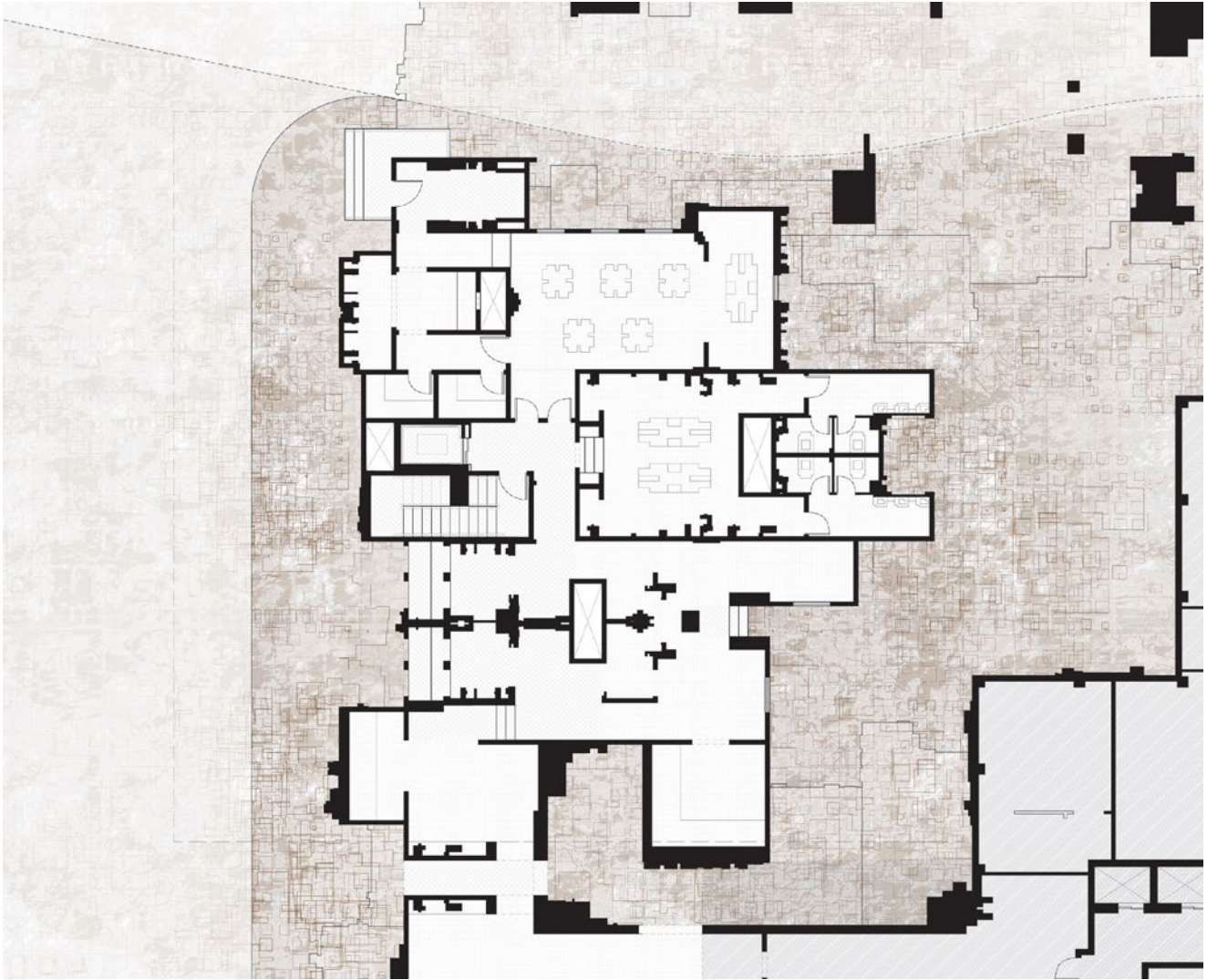




**Apartment Level Floor Plan**

Floor plan of the apartment level showing fractal arrangements of living units and adaptive reuse of existing buildings at the same level.





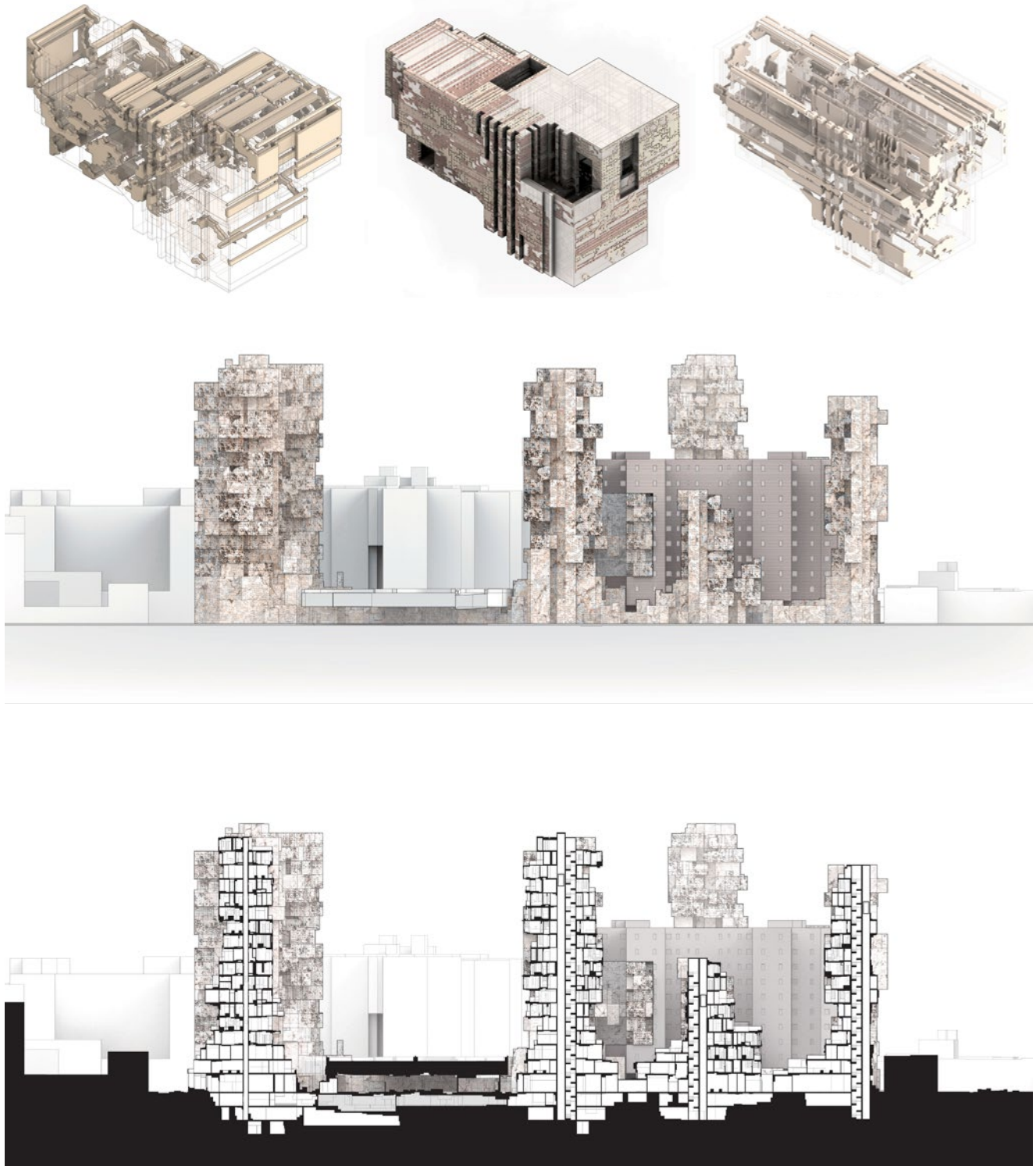
**Floor Plans of selected area**

Top: Ground floor plan

Bottom left: Amenities floor plan

Bottom middle and right: Apartment floor plans

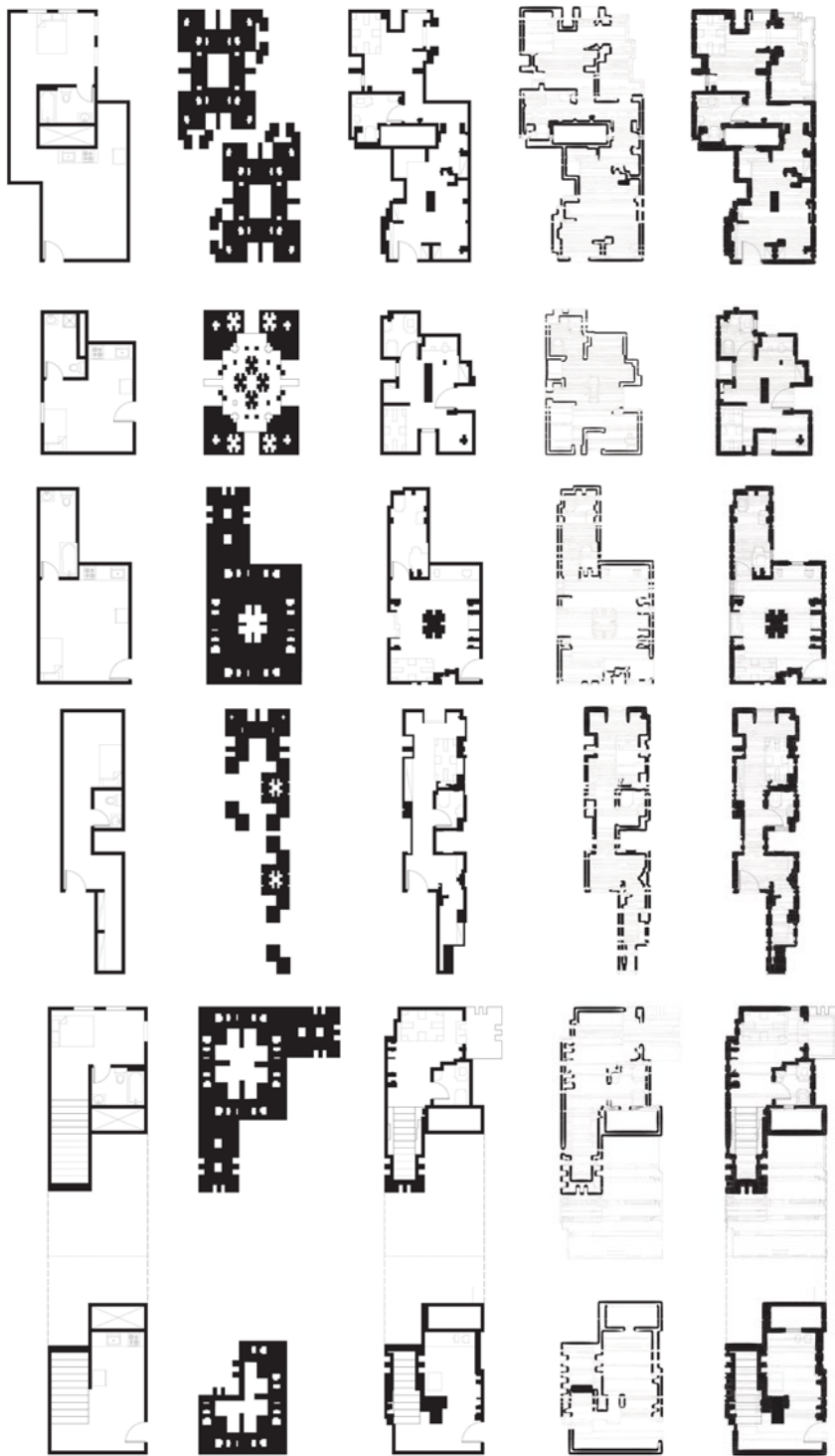




**Drawings**

Section and elevation shows the new development around the existing structure. The new urban housing challenges the site's urban context and becomes a seed for further development of the public spaces in future. The top row shows the material explorations in single units.



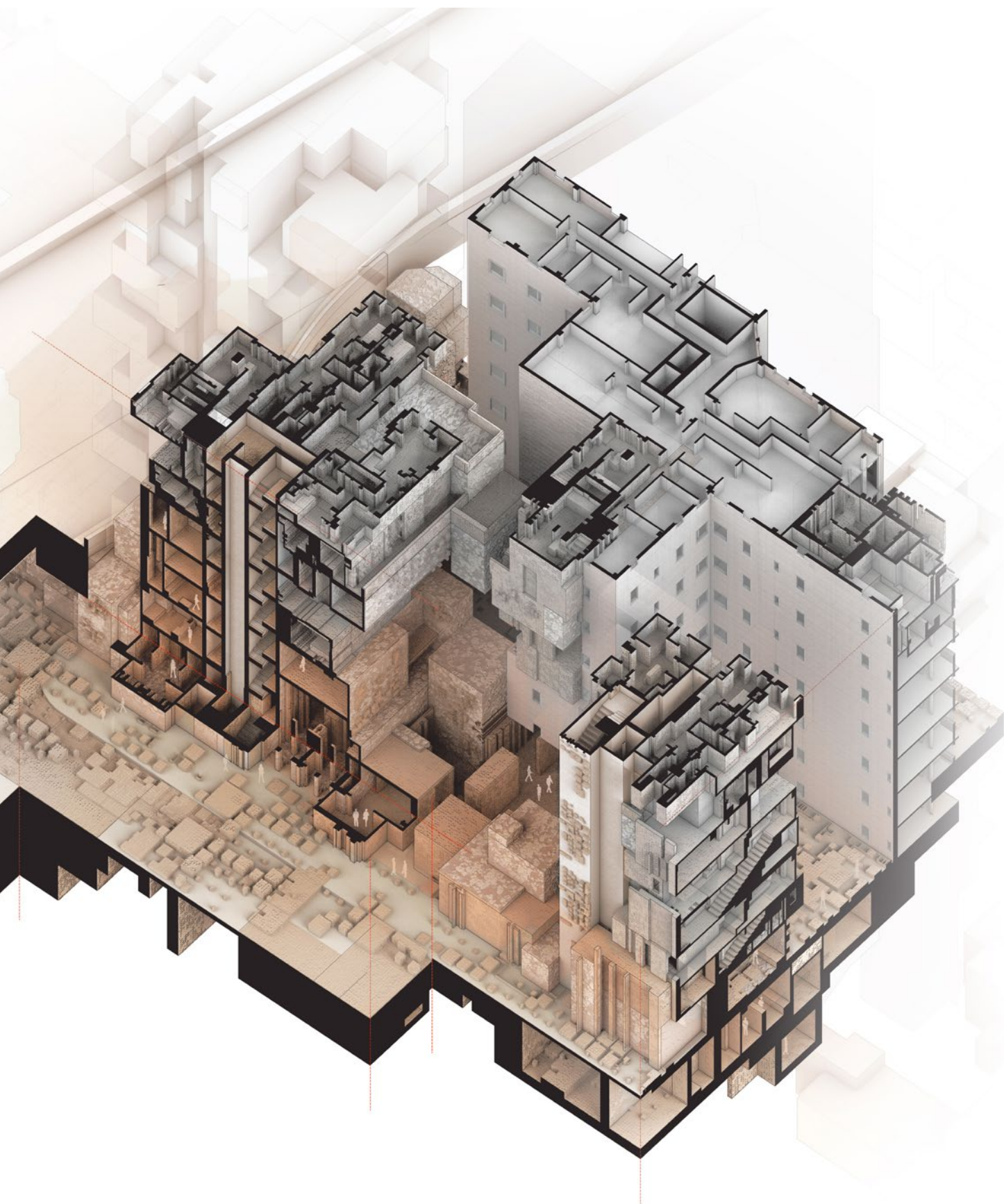


### Drawings

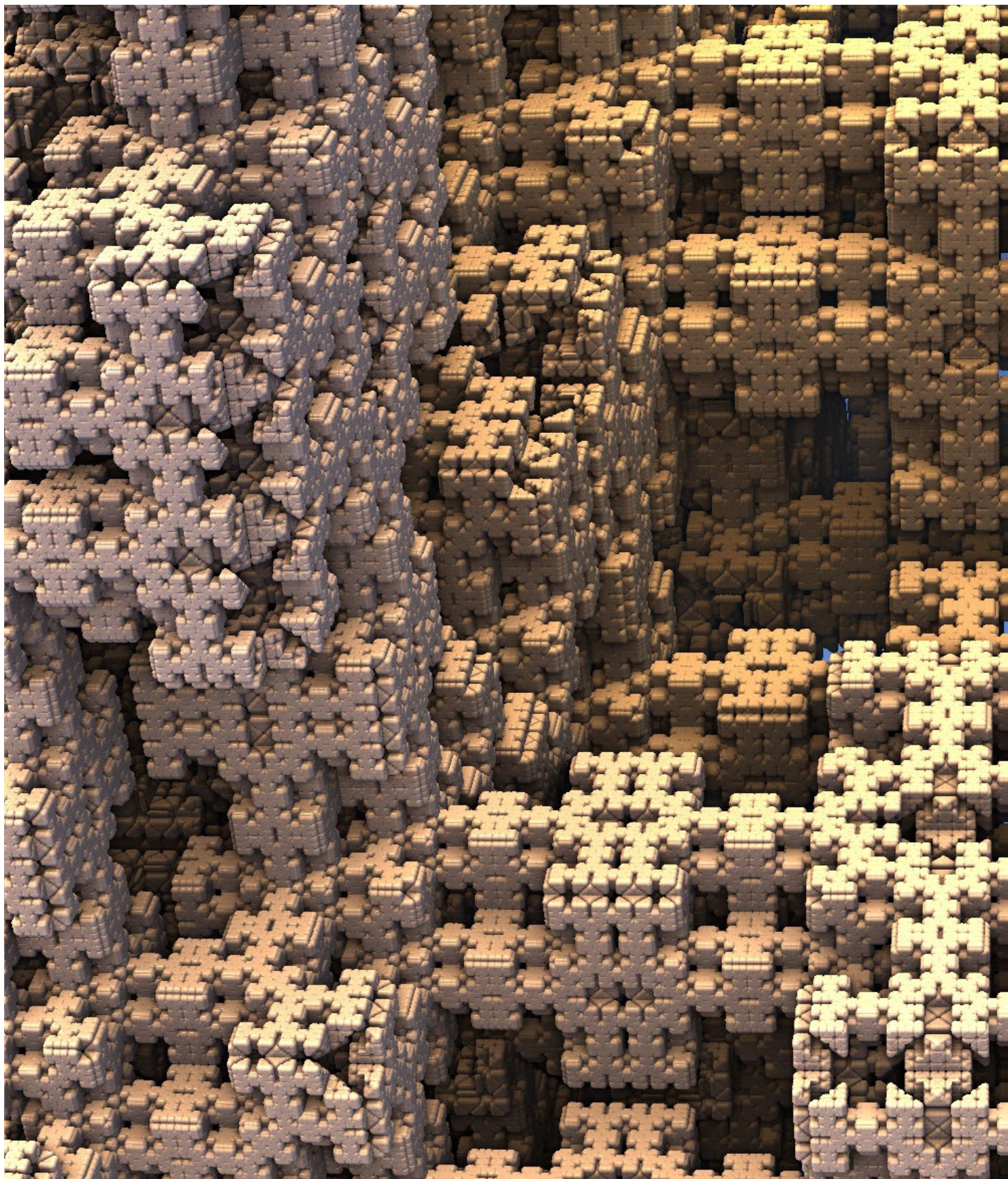
Left page: Plan transformation diagrams of different units.  
 Right page: Chunk model showing the public spaces and apartment units.



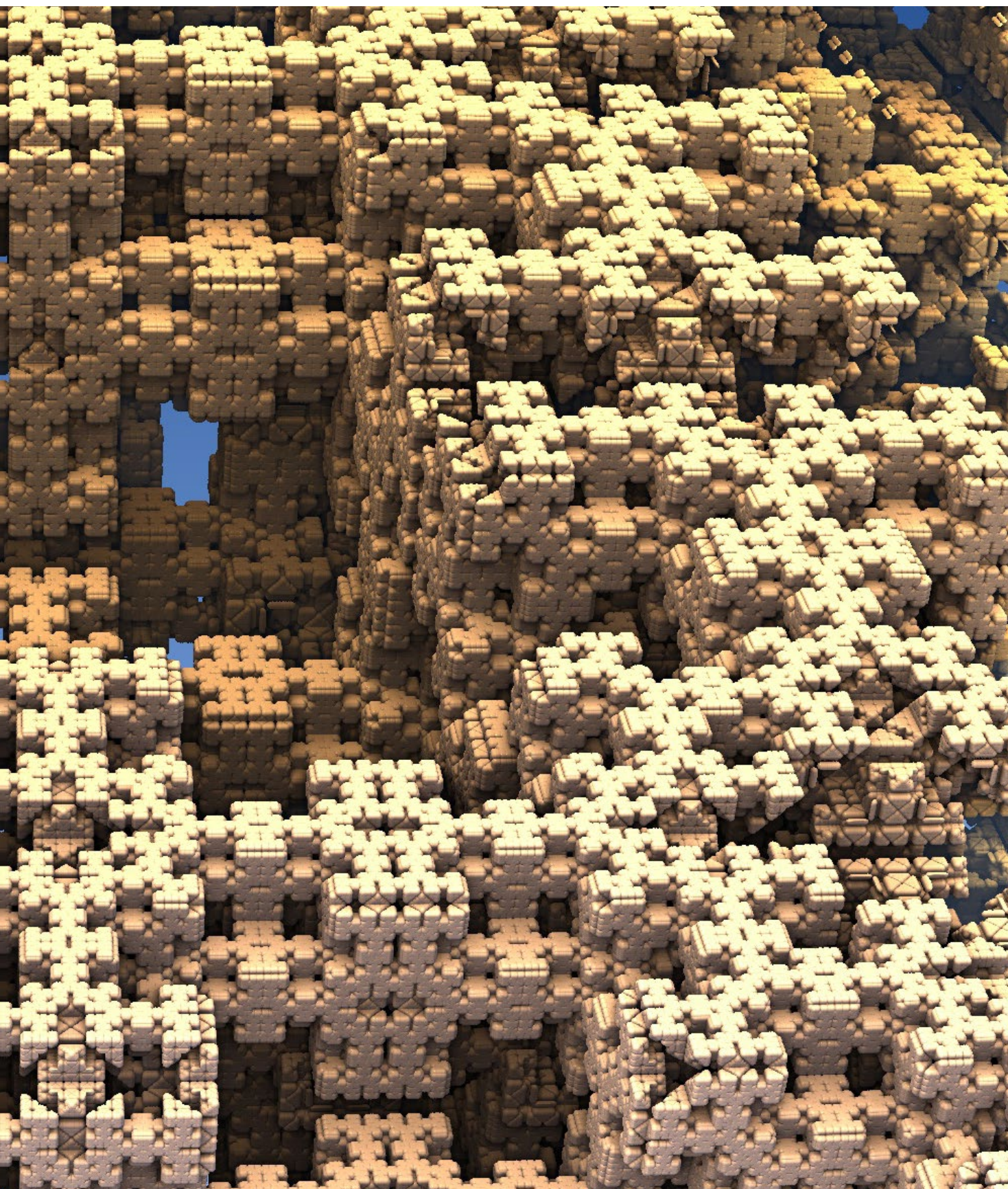














# CONTRASTING CONVERGENCE

Bath-house In Philadelphia

Instructed by **Daniel Markiewicz**  
Collaborated with **Benjamin Hergert**  
Site located in Philadelphia, PA



Situated in a clearing of the Smeadows at The Cliffs in Philadelphia, the Bath-house is a focal point of convergence for the intersection of decadence and degradation. This center invites the users to participate in a journey of exploration and reflection, as they leave the outside world they came from, begin their approach into the site, bathe in the pools of the ground floor, and ultimately engulf themselves in the microcosms of the upper floor.

This Bath-house engages the picturesque through the contrast of two intersecting concepts: The

first, representing decadence, is the hovering mass, an aggregation of 8 pristine volumes around a decentralized courtyard. These pure, platonic cubes are then met with the resisting force of the second concept; the eroding stalactites. These touchdowns, representing degradation, eat away at the form of the hovering mass, creating new profiles at their intersection and finally organize the baths underneath as they meet the ground and become occupied.

The concept of degradation draws from the formal ideas of eroding volumes. This highlights the tension

of the contrasting concepts as the intersection of the corrosive force creates a new edge condition of profiles and subsequently the underbelly of the volumes that break the conformity of the box forms. The organization of the volumes follows the concept of a jewel box in developing their own microcosms while also fitting within the language of the gestalt whole.

The two floors of the bath house have differing programs with the ground floor hosting the various baths and public common spaces while the upper floor contains a series of experiential spaces and administrative functions. This dichotomy is also displayed in the building section by using different structural systems in the building.

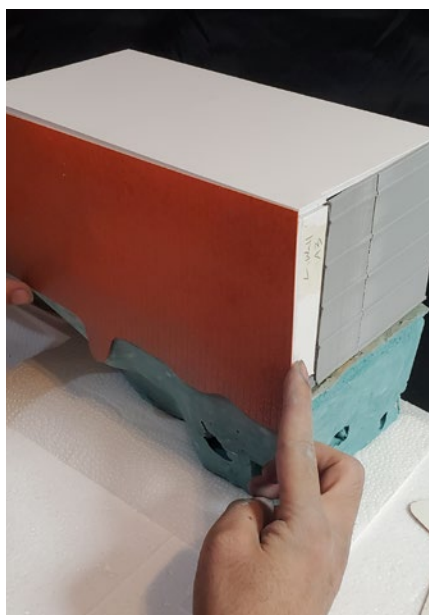
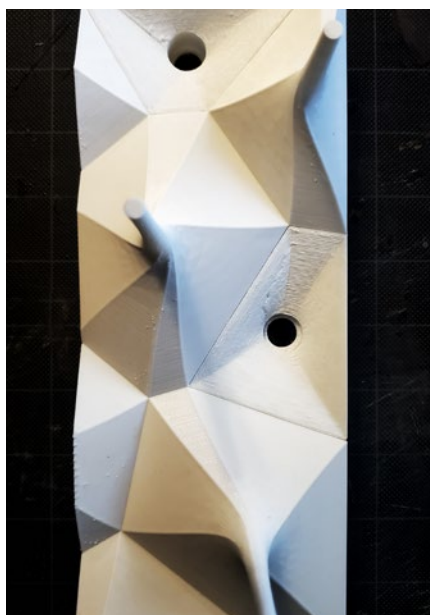
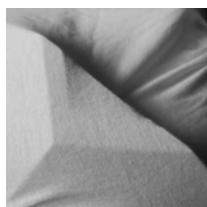
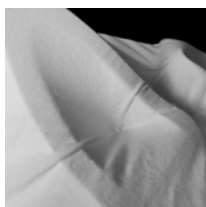
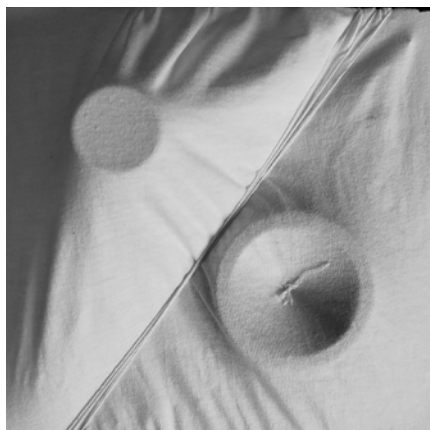




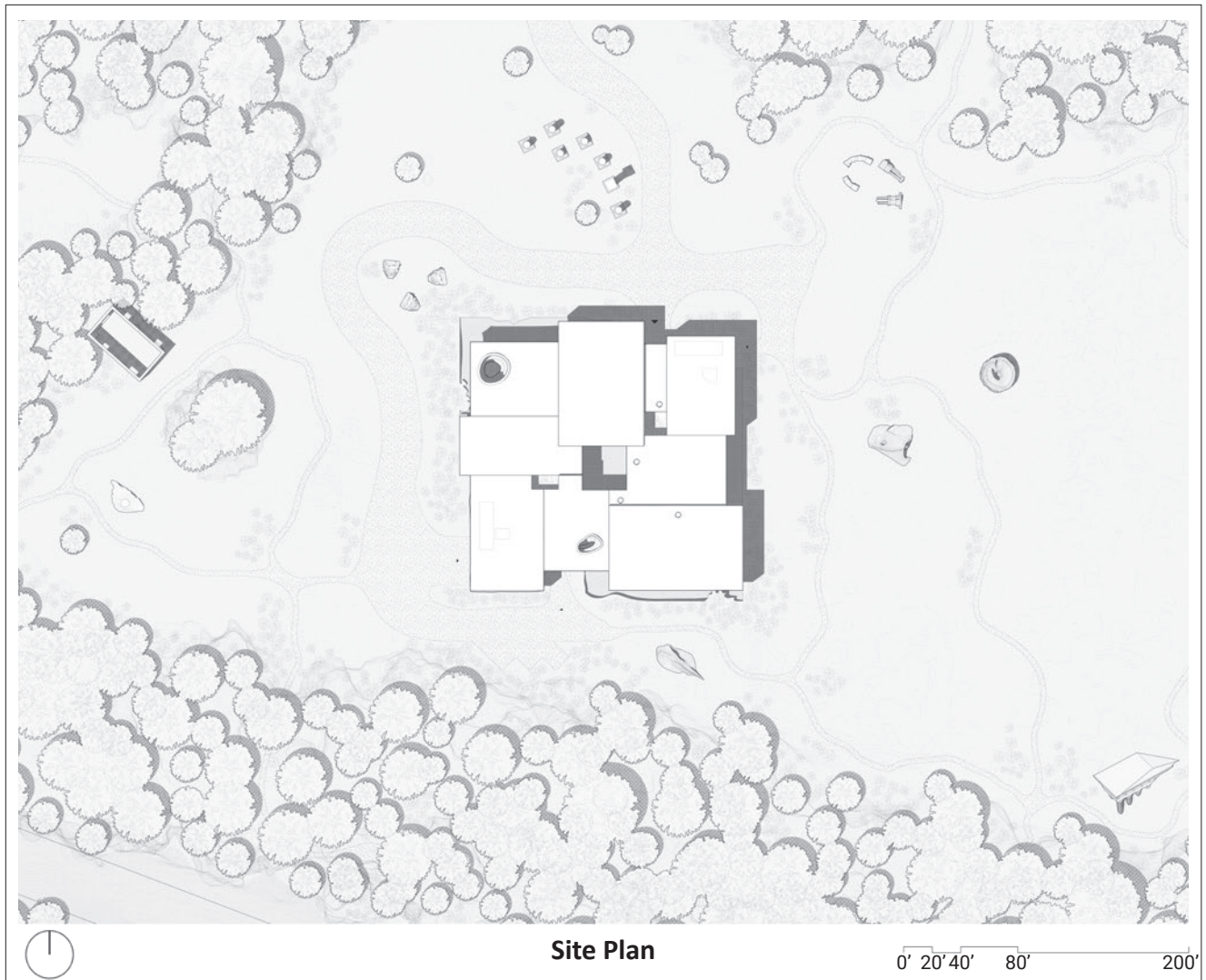
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CONTRASTING CONVERGENCE





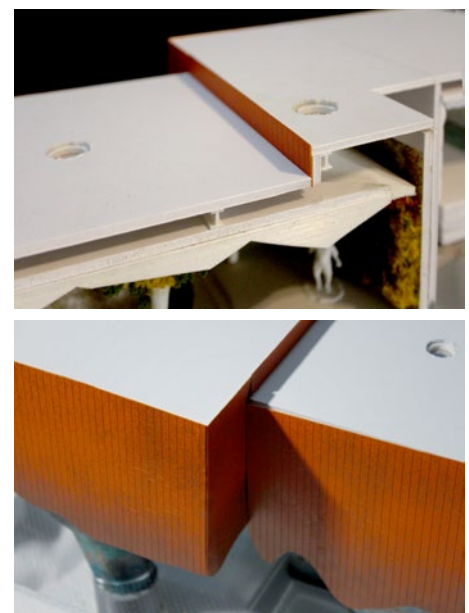




Left page: **Cloth models and material studies**

The cloth studies allowed for the derivation of the stalactite forms as well as a further exploration of degradation as the resolution of the originals became distorted through the process of digitizing.

The project is materialized through corten steel paneling for the hovering mass and monolithic concrete casting for the stalactite touchdowns. The corten paneling system is used to reinforce the pure form of the volumes by maintaining the flat surface condition while also hinting at the degradation of the façade being eaten away by the disruption of these panels. The monolithic concrete stalactites channels the atmosphere of sea caves whose layering and striations work both on topographical and chromatic levels.

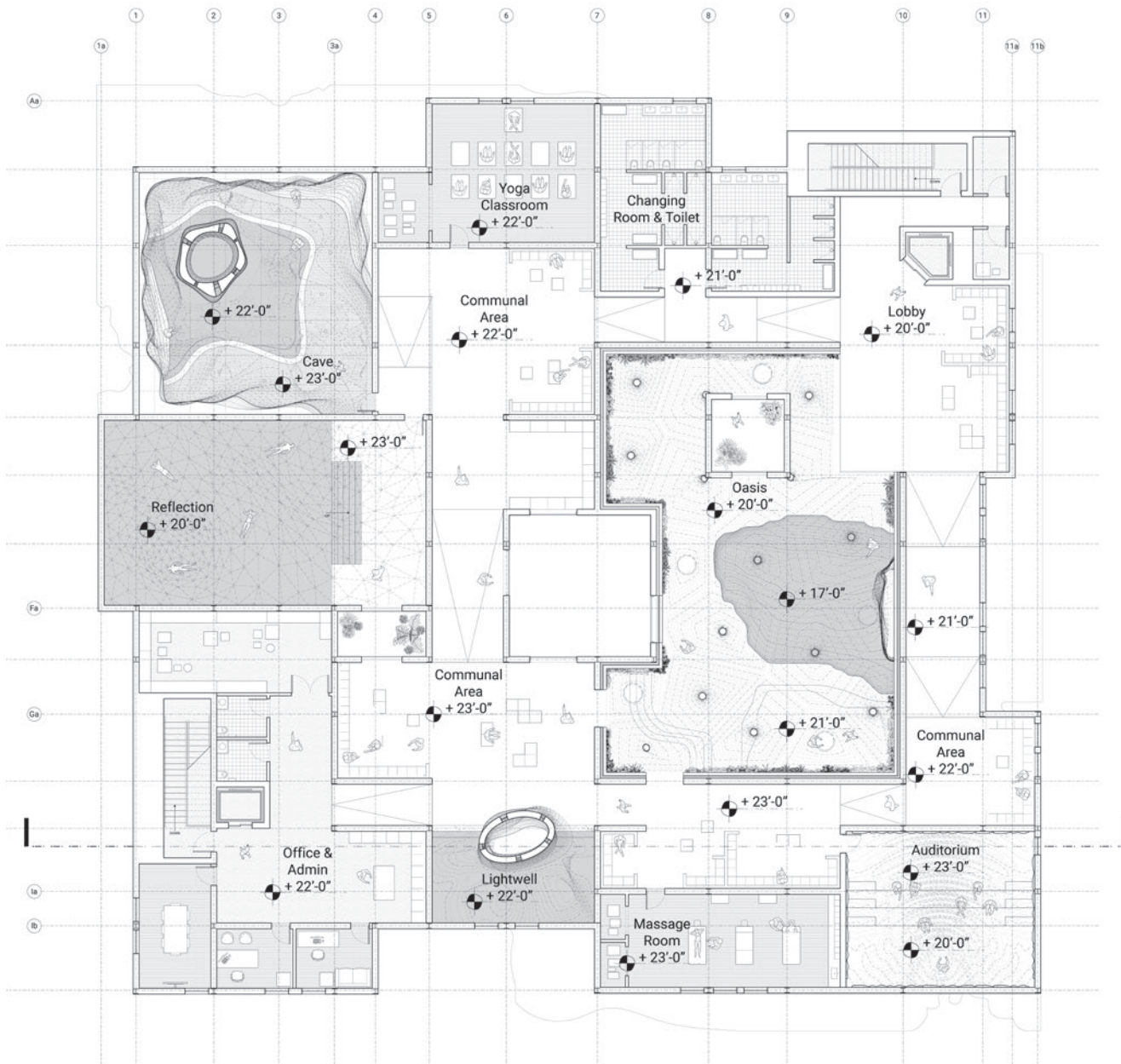






The ground floor is organized by the stalactite touchdowns whose functions and occupation vary according to their scales. The floor has three pools, two of those are small and one is the large pool having a depth of 11 to 12 feet.

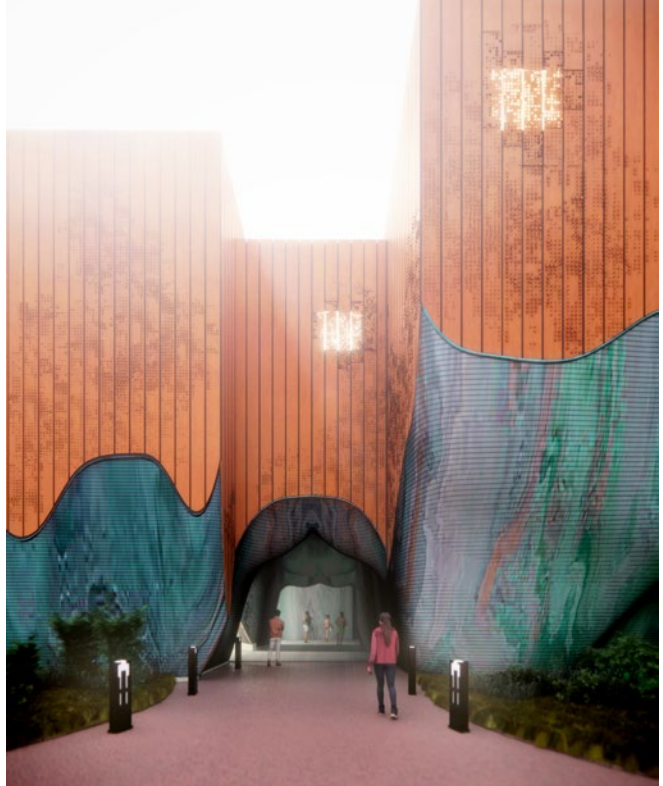




Upper Floor Plan

The upper floor presents a decentralized circulation across communal areas designed as palette cleansers between the different experiential rooms. These experiential rooms engulf their inhabitants in a jewel box concept, creating other worldly sensory experiences through the poches and ceiling systems that build from the preliminary cloth studies and cave inspirations.





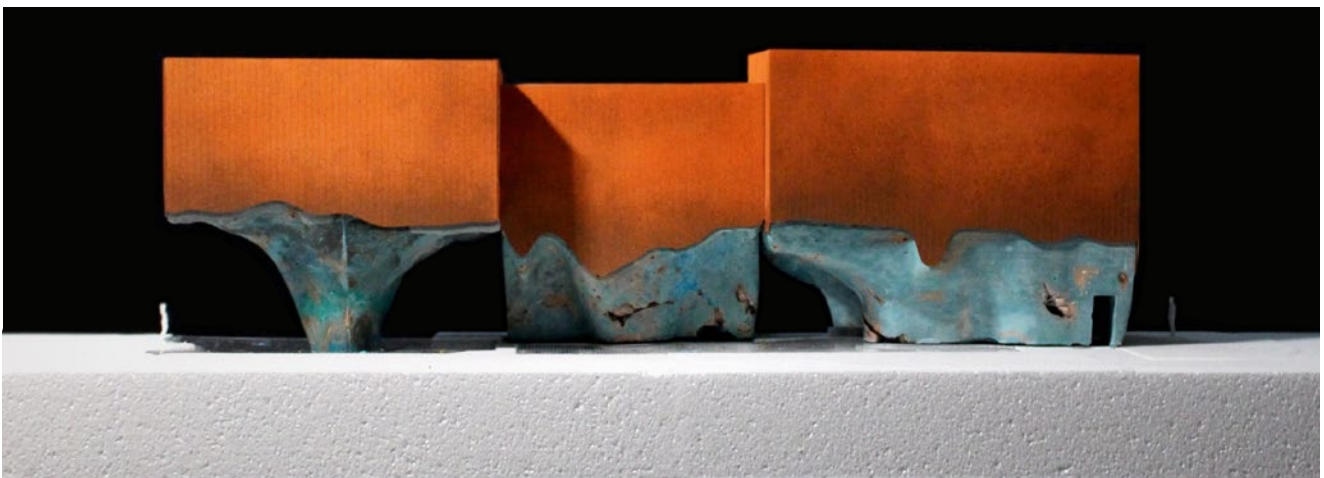
**Render Views**

Top Left: Render view of cave room at upper floor

Top Right: Main entrance view

Bottom: View from large pool





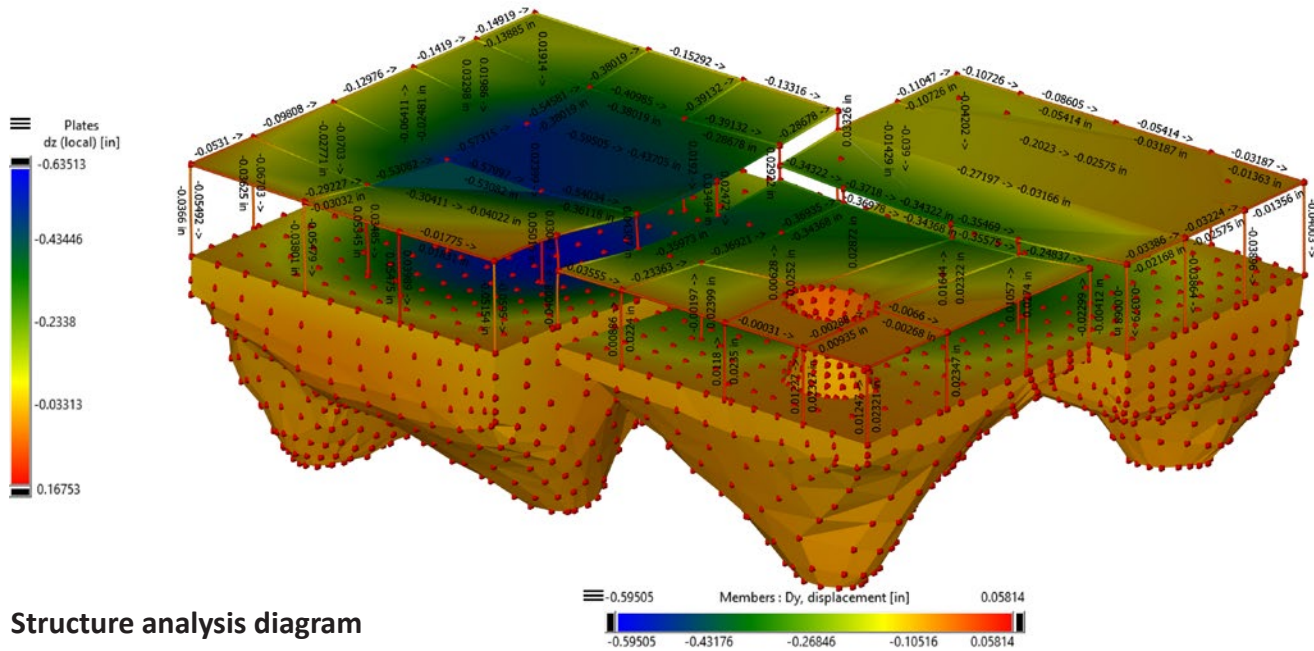
### Model Pictures

Top: Different views of model showing facade details

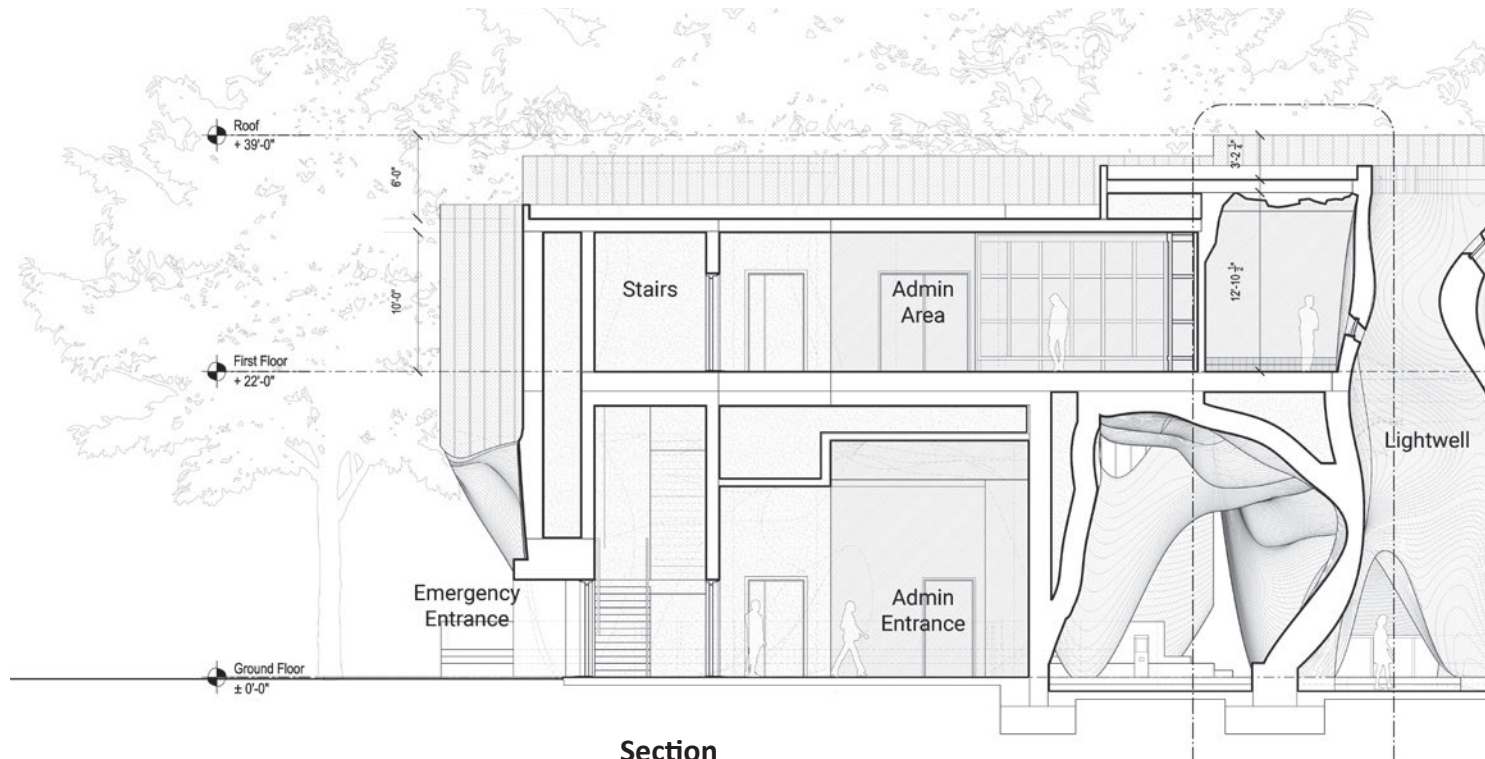
Middle: Section through lobby, Oasis room and Auditorium

Bottom: East facade view highlighting the clear difference between two material





Structure analysis diagram



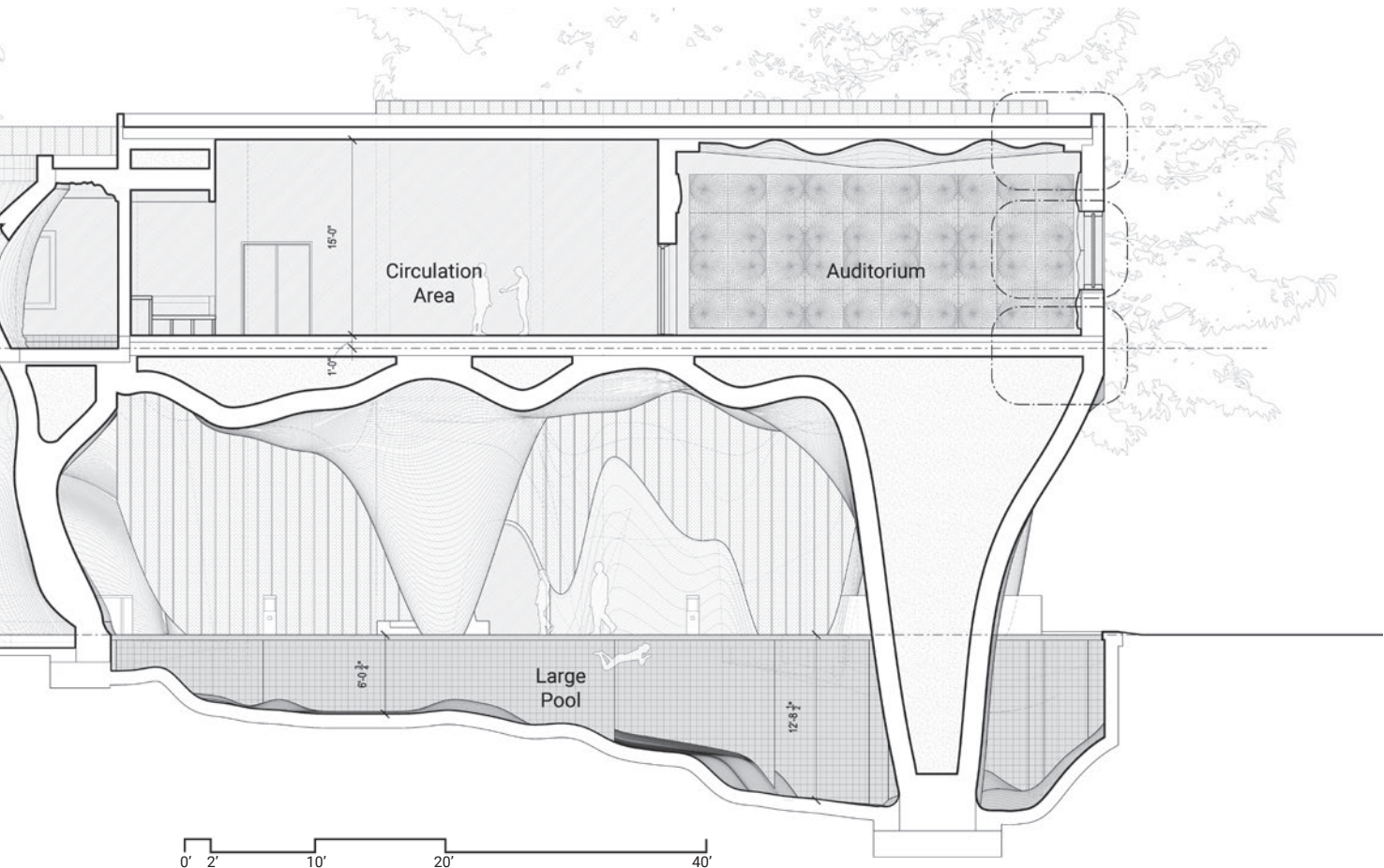
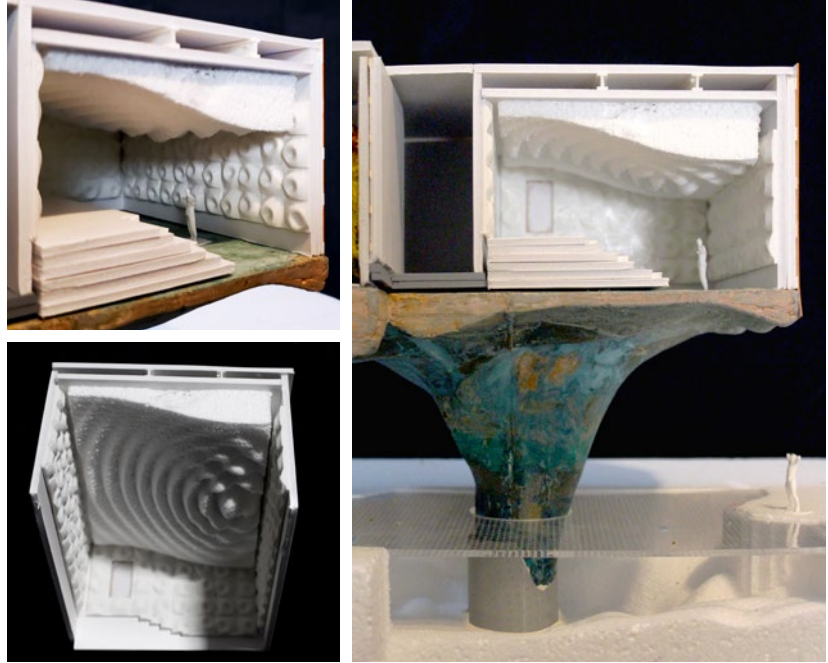
Section

The east-west section cut through the large pool and admin entrance on ground floor, and auditorium, circulation areas and admin areas on upper floor. The lightwell is the area which connects both floors. Displaying how the dichotomy functions, the section highlights how each of these concepts work in tandem and are united by the lightwells that span across both floors.

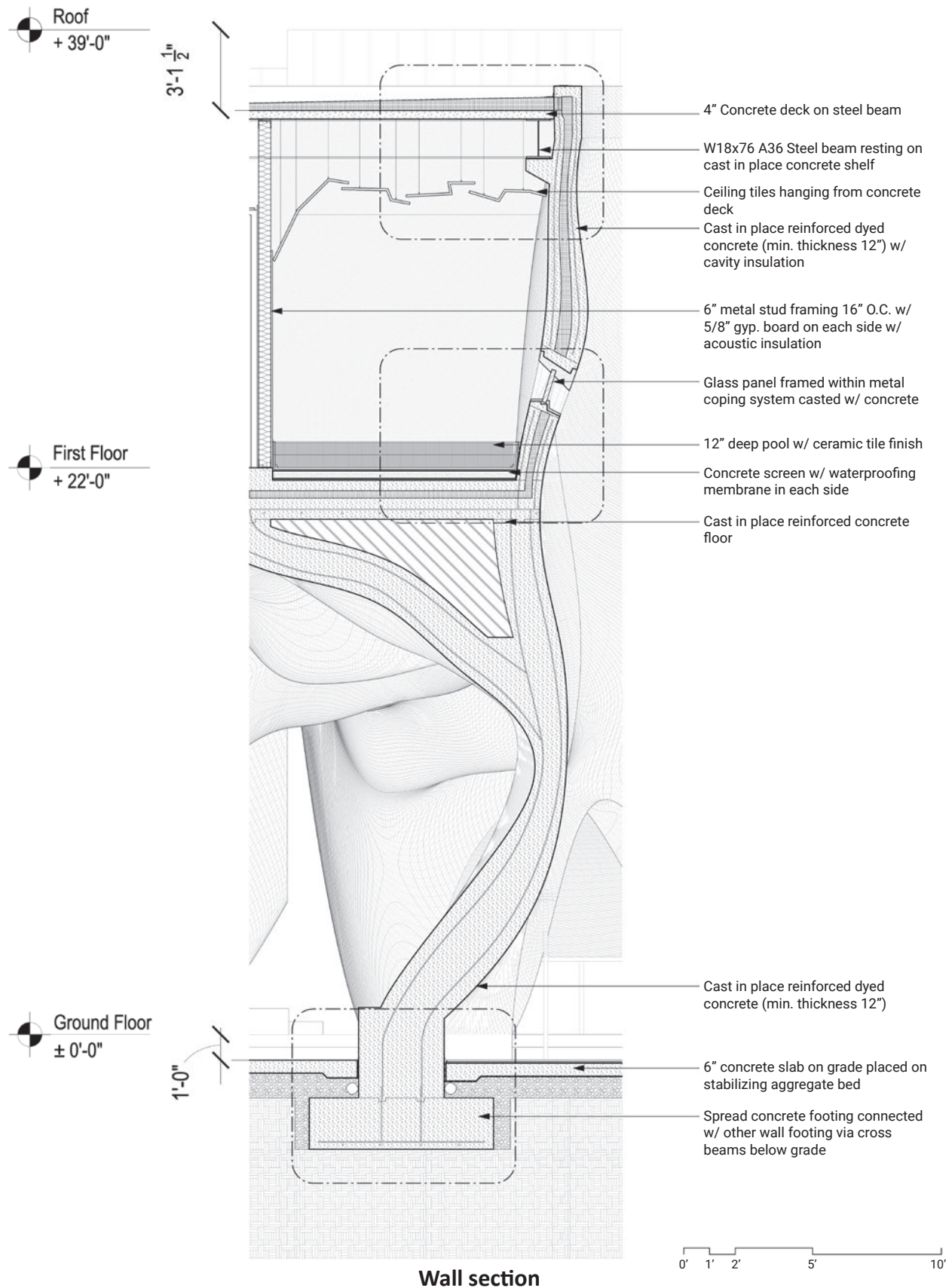


## Structure

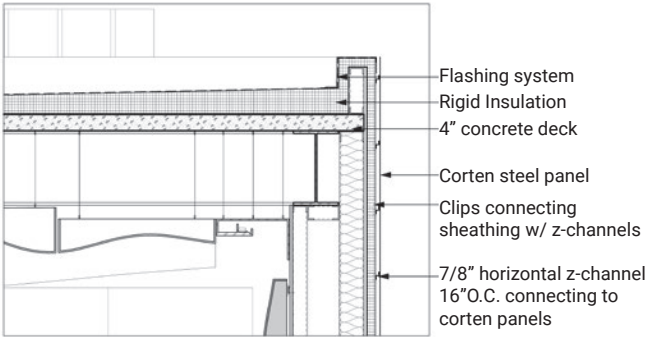
The structure implements a hybridized system of monolithic structural concrete casting for the stalactite base and a grid of steel beams and columns to form the volumes above in the hovering mass. This diverges from the visual perception of the hovering mass being seemingly heavy, weighing on its overhanging form, when in reality the structure allows it to be a light form that enables the construction of the jewel box interiors.



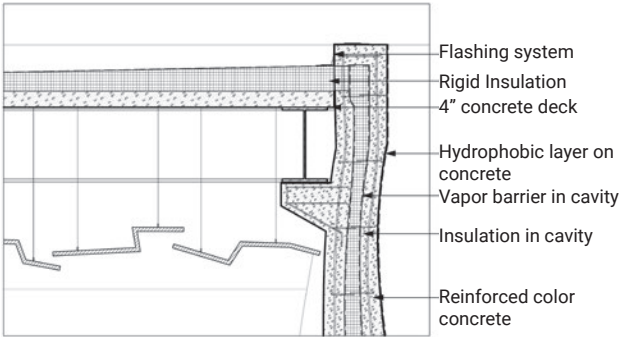




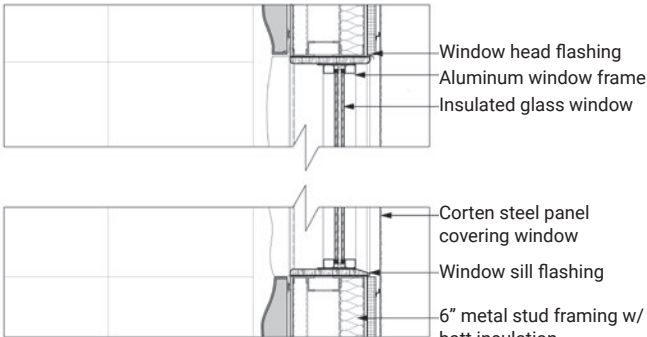




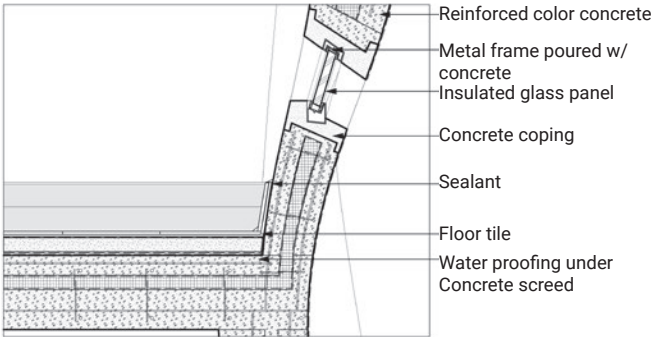
Roof and parapet detail with metal stud wall



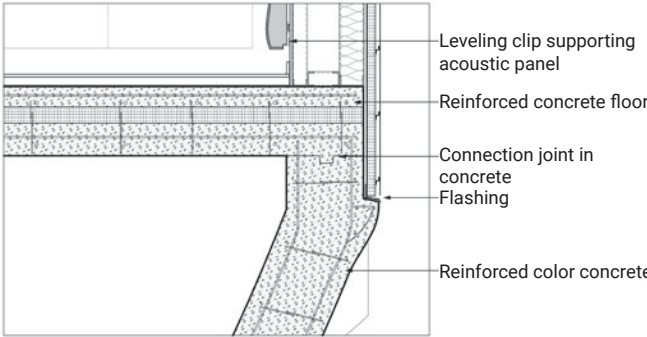
Roof and parapet detail for concrete wall



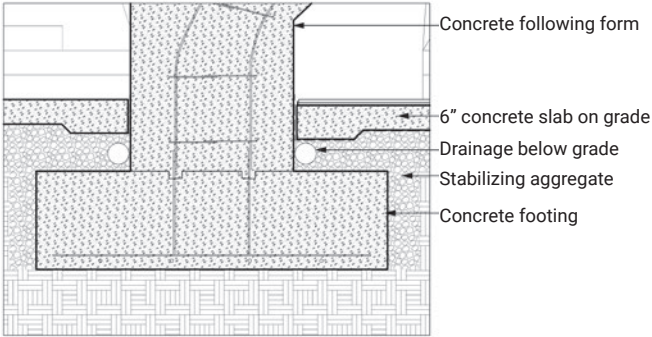
Window head and sill detail



Second floor pool detail with concrete opening



Second floor detail



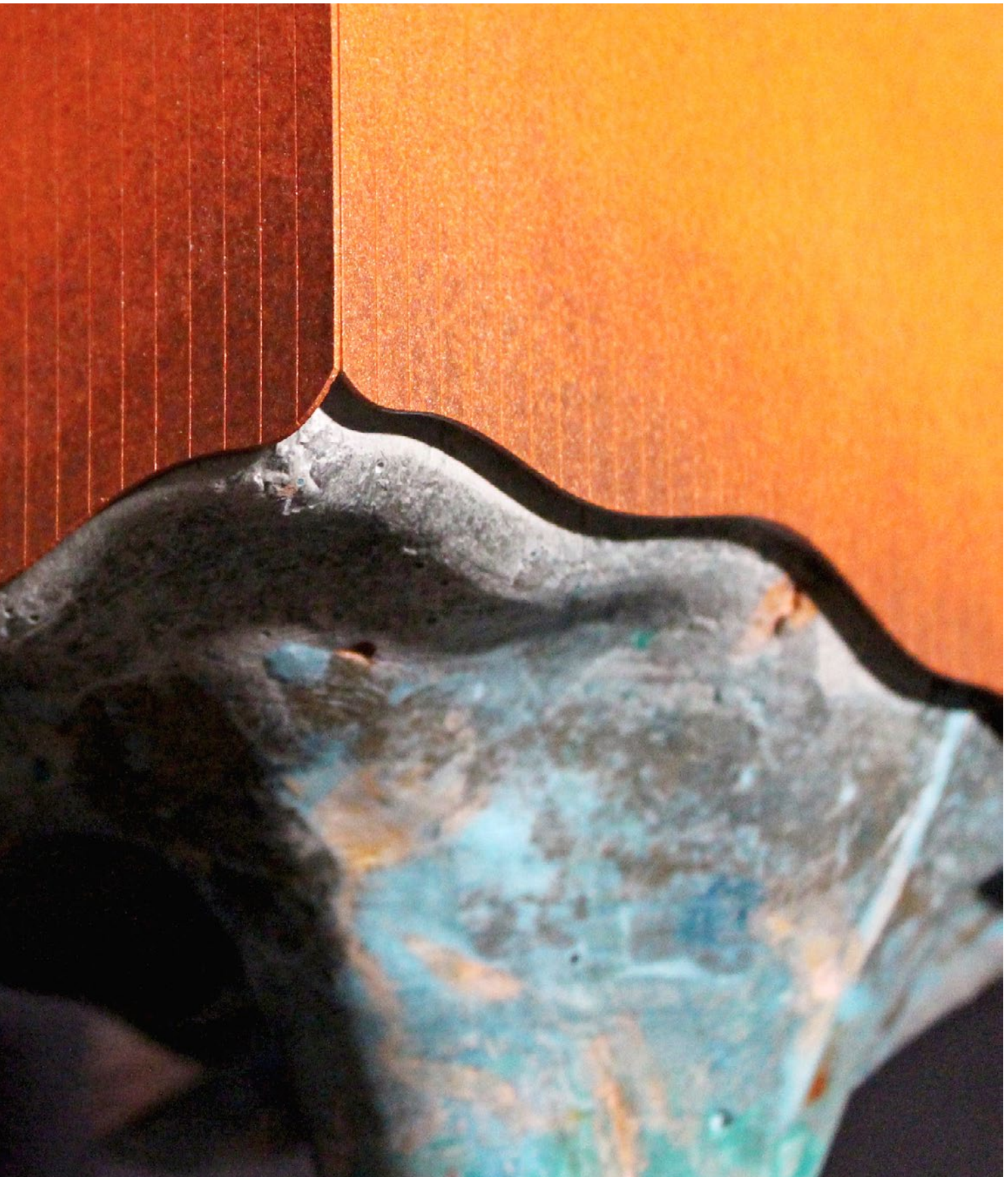
Footing and floor details

0' 0.5' 1' 2' 4'









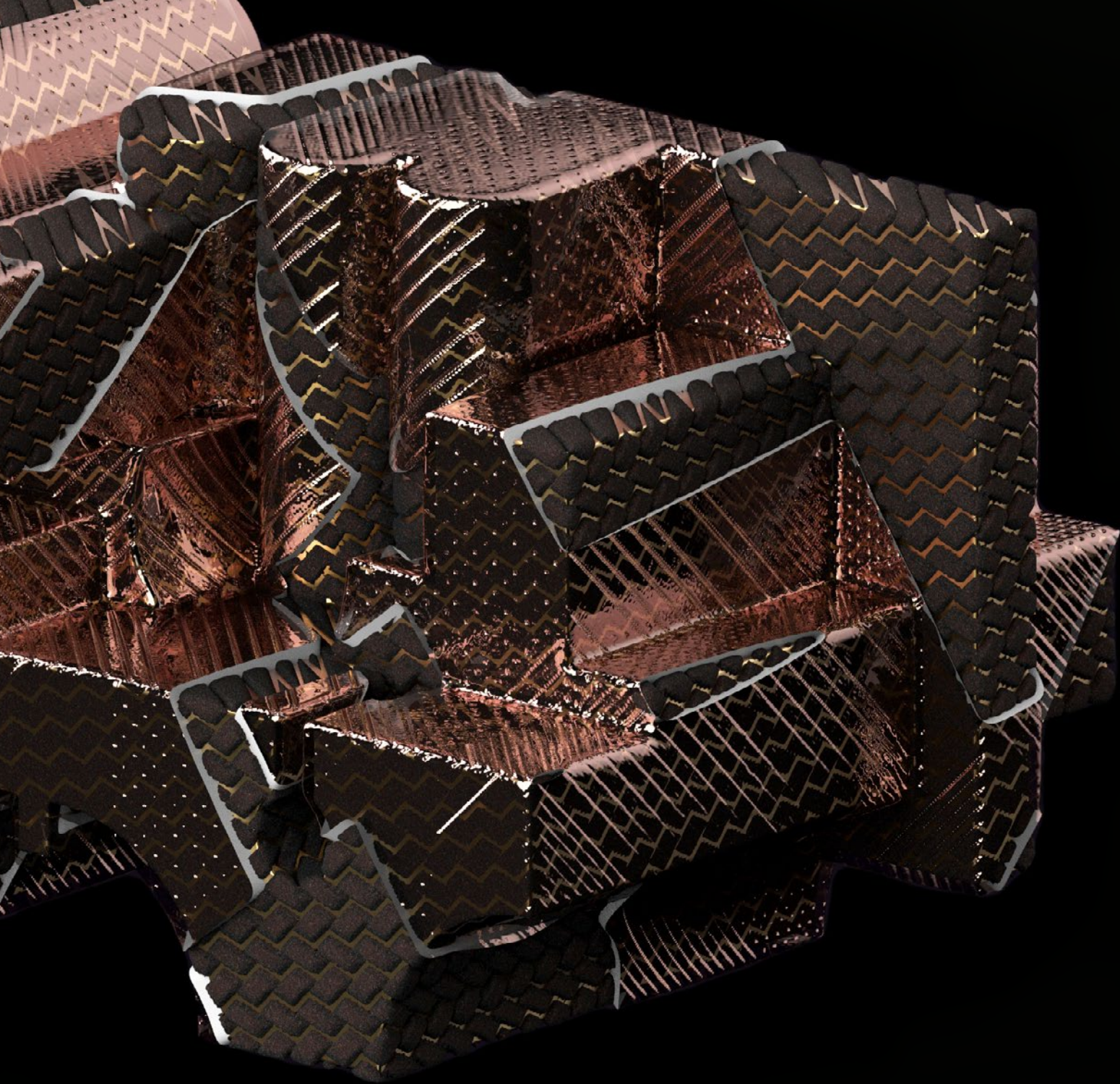












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