MUSEUM OF MODERN ART

PARAMETRIC BEYOND VISUAL

AN INTERIOR ARCHITECTURE AND DESIGN THESIS
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DREXEL UNIVERSITY 2018

ABSTRACT

The thesis sought to interweave the conceptual quality of parametricism with the haptic experience of phenomenology. The program of museum has been selected as the vehicle for this design exploration. Throughout history, museums have symbolically represented important spaces in cities to express the connection of our shared cultures. Today, museums are no longer just a place for art to be exhibited, the museum has morphed into a destination site and tourist attraction. The museum as a cultural institution, a place for communities to gather together, a place aside from showing original art, providing spaces for various and multiple social activities is key to a vibrant, often visited and engaging place for all.

The thesis is designed from the interior with multiple promenades to be accessed through the smooth use of light, curvilinear forms and generous use of natural and fabricated materiality. (It's comparable to a pasta dinner of spaghetti and gravy – the spaghetti being the parametric form and the gravy being the haptic spice to enliven and articulate the phenomenological.) The thesis argues that parametricism has a unique capacity to articulate programmatic visual complexity and intellectualized imperatives. The MOUJ - museum of modern art - creates a new paradigm both within itself and the contextual surrounding. The design ensures that visitors' experience is not fragmented but a continuous, fluid interaction between different elements and theatrical aspects. In such a fluid place, despite the separations and specific spaces and its unique diversity, a total single space can be recognized. We invite you to the newly birthed gateway between center city and university city, complementing the already vibrant and thriving landscape of the Schuylkill river walk and the explosion of development along this connective corridor of Philadelphia. Welcome to MOUJ!

ACKNOWLEDGMENT

I would like to show my deepest gratitude to the individuals who afforded this research to develop. I would first like to thank my advisor Jeff Fama; for his expertise, generous guidance and encouragement without which this thesis would not have been possible. His enthusiasm and thoughtful feedback has provided a strong role model for my work and inspired me everyday throughout the year while working on this research. He consistently allowed this thesis to be my own work, but steered me in the right the direction whenever he thought I needed it.

Finally, I must express my very profound gratitude to my parents and to my spouse for providing me with unfailing support and continuous encouragement throughout my years of study and through the process of researching and writing this thesis. This accomplishment would not have been possible without them. Thank you.

CONTENTS

1 INTRODUCTION

INTRODUCTION

'Parametricism' has come to play a major role in contemporary architectural design and is now considered as one the dominant mode for avant-garde practice. This thesis argues that despite parametricism's unique capacity to articulate programmatic complexity, visual and intellectualized imperatives at the loss of experiential imperatives have limited parametricism as a medium through which architecture is produced, promoted, and evaluated. Architect Juhani Pallasmaa believes that this leads to the deprivation of vital human existential questions that enable us to relate to our built environment and that provide meaning to that environment. This thesis explores how parametric design can further develop by addressing the deficiencies that Pallasmaa has described, to further incorporate a sense of temporality, experiential depth and personal belonging.

Based on these critical examinations, the second half of the thesis includes design experiments which test the integration of sensory experiences within parametric design. Museum of modern art has been selected as the vehicle for this design exploration because throughout history, museums have symbolically represented important spaces in cities to express the re-connection of our history and culture. The thesis tests how the interior design of a museum can be conceived through parametricism, while also incorporating symbolic and phenomenological imperatives.

2 LITERATURE REVIEW

INTRODUCTION

In the past decades, digital technologies have had a significant influence on architectural design. From the early use of digital drafting applications to the more experimental contemporary use of generative design tools, parametric design has now come to play a major role in architectural development. 'Parametric design' is a paradigm in design where the relationship between elements is used to manipulate and inform the design of complex geometries and structures. Form-finding is one of the strategies implemented through Parametric modeling systems. The idea behind form-finding is to optimize certain design goals against a set of design constraints.[1]

Critics argue that among five archetypal human senses (Sight, Hearing, Touch, Smell and Taste), parametric design has become heavily dictated by the sense of sight, lacking multi-sensory qualities and approach. When sight is held in the highest regard, the other senses are not given equal standing to each other, or to human experience. This can lead to "the deprivation of vital human existential questions that enable us to relate to our built environment and that provide meaning to that environment."[2]

My intention is to understand how interior design can be conceived through parametricism, while also incorporating phenomenological imperatives. Design of the space should provide a multi-sensory experience and designer should bring more than visual attraction. Buildings should be designed from inception to completion with all the senses in mind and to provide an enjoyable and stimulating experience for occupants. By taking parametric design beyond the visual, I think this is possible.

This review is presented in four sections: First an overview of parametric design and talking about history of it. Second, talk about critiques of parametric design. The third section is about exploring design for corporeal experience and the last section is about possible integration of sensory experience and parametric design.

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01 Jabi "Parametric Design for Architecture" P2

02 Pallasmaa "The Geometry OF Felling: The Phenomenology OF Architecture" p449

PARAMETRIC DESIGN – OVERVIEW

The term parametric originates in mathematics but there is debate as to when designers initially began using the word. One of the earliest examples of parametric design was the upside-down model of churches by *Antonio Gaudi* in the early 20th century. In his design for the church of *Colònia Güell* he created a model of strings weighted down with bird shot to create complex vaulted ceilings and arches. By adjusting the position of the weights or the length of the strings he could alter the shape of each arch and see how this change influenced the arches connected to it. He placed a mirror on the bottom of the model to see how it should look upside-down.[3]

In the 1940's, the Italian architect *Luigi Moretti* defined principles of what he named as "architettura parametrica" or "parametric architecture", which he defines as the study of architecture systems with the goal of "defining the relationships between the dimension dependent upon the various parameters.", to produce variations of the form of buildings. Moretti uses the design of a stadium as an example, explaining how the stadium's form can derive from nineteen parameters concerning things like viewing angles and the economic cost of concrete.[4] Moretti had a genuine interest in science and mathematics. Mathematics provided him with a gratifying sense of intellectual order, which he believed should be applied to architecture and town planning. His premise was that a new architecture, one he labeled Parametric Architecture, should be derived from absolute mathematical truths, independently of other factors. "The clarity, purity, and objectivity of mathematics and geometry should be the primary determinants of form and space."[5]

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03 Davis "A history of Parametric" p2

04 Ibid

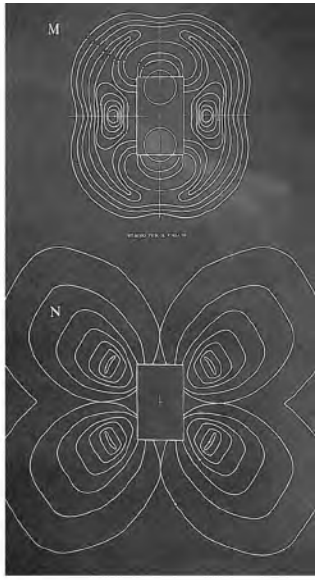
05 Sheppard "Luigi Moretti: A Testimony" p207

1901

Hanging model of Colònia Guell
Antonio Gaudi

1941

Model of Stadium M
Luigi Moretti



Christopher Alexander, working in 1960s, also tried to describe the relation between the pattern of a problem and the process of designing a form. "My main task has been to show that there is a deep and important underlying structural correspondence between the pattern of a problem and the process of designing a physical form which answers that problem"[6] Alexander proclaimed. His thesis was that any design problem could be rationally broken down into overlapping subsets of functional requirements, and that these sets had a hierarchical relationship. He gave a kettle as an example, and listed 21 specific patterns that governed its design: "It must not be hard to pick up when it is hot," "It must not corrode in steamy kitchens," "It must not be hard to fill with water," and so on.[7]

Greg Lynn was one of the first architects and theorists who used computers to generate architecture. He was an innovator in redefining the medium of design with digital technology as well as pioneering the fabrication and manufacture of complex functional and ergonomic forms. His blob and fold architecture is among the early examples of computer generated architecture.[8]

In 2008 Patrik Schumacher of Zaha Hadid Architects defined parametricism as a 'solid new paradigm' of our post-modern society. Schumacher believes that parametricism is establishing hegemony within avant-garde architectural practice today due to its creative exploitation of parametric design systems to articulate increasingly complex social processes and institutions.[9]

Instead of reliance on rigid geometrical figures, parametricism is in favor of architectural elements that are parametrically malleable, which Schumacher believes "delivers complex order for complex social institutions."[10]

The mode consists of methodological rules: some tell us what paths of design to avoid (negative heuristics), and others what paths to pursue (positive heuristics).

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06 Alexander "Notes on the synthesis of form" p132

07 Alexander "Notes on the synthesis of form" p90-106

08 Davis "A history of Parametric" p3

09 Schumacher "Parametricism: A New Global Style for Architecture and Urban Design" p16

10 Schumacher "let the style war begin" p4

1990

2008

Grand Theatre de Rabat
Zaha Hadid

o FORMAL GUIDELINES

- Negative principles

1. Avoid rigid forms (lack of malleability)
2. Avoid simple repetition (lack of variety)
3. Avoid collage of isolated, unrelated elements (lack of order)

- Positive principles

1. All forms must be soft
2. All systems must be differentiated (gradients)
3. All systems must be interdependent (correlations)

o FUNCTIONAL GUIDELINES

- Negative principles

1. Avoid rigid functional stereotypes
2. Avoid segregated functional zoning

- Positive principles

1. All functions are parametric activity/event scenarios
2. All activities/events communicate with each other[11]

11 *Carpo "The Digital Turn in Architecture" p240*

Daniel Davis, a researcher specializing in the technology of the building industry, talks about "parametric models" based on the definition of the parametric equation in mathematics. Parametric, in mathematics, is a set of quantities expressed as an explicit function of several parameters. Hence, "a parametric model is set of equations that express a geometric model as explicit functions of several parameters". Davis concludes that "a parametric model is unique, not because it has parameters (all design, by definition, has parameters), not because it changes (other design representations change), not because it is a tool or a style of architecture, a parametric model is unique not for what it does but rather for how it was created. A parametric model is created by a designer explicitly stating how outcomes derive from a set of parameters."[12] To create parametric models, designers use algorithmic editors that usually incorporate visual programming languages (like Grasshopper/Rhino3d, Max/MSP or Revit/Dynamo), to overcome the constraints of the interface, and to design directly, managing not the form, but the code that generates the form.[13]

PARAMETRIC DESIGN – CRITIQUE

Parametricism has its critics. Some of them talk about the paradigm shift of the style to computational architecture. Among them, Christopher Alexander had serious reservations about the use of computers in architecture. He saw a real danger in architects' fascination with computing. "The effort to state a problem in such a way that a computer can be used to solve it will distort your view of the problem. It will allow you to consider only those aspects of the problem which can be encoded—and in many cases these are the most trivial and the least relevant aspects." This could still serve as a warning to the eager parametricists of today.[14] The main concern here is about neglecting the qualitative factors of the design problems. The focus of computational models is primarily limited to building performance, optimization, and the functional requirements of the design problem.

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12 Davis "A history of Parametric" p3

13 Burry "The New Mathematics of Architecture" p71

14 Alexander "Notes on the synthesis of form" p61

Yet, qualitative factors, such as social, cultural and contextual aspects are also important dimensions in solving architectural design problems. "Building performance is not the only component of a project. Optimization must be addressed in all facets of the project. Computational design has emerged because it has the capacity to resolve multiple constraints and deal with extreme complexity of variables. By optimizing a more holistic set of constraints, computational architecture will be difficult to contend with."[15]

Neil Spiller addresses this deficiency in his article "Surrealistic Exuberance – Dark Matters" He critiques parametric design as lacking any character, cultural influence, human engagement, or communication. Because of this, he states that these projects are devoid of interest and mystery.[16]

Another main deficiency in parametricism involves the prioritizing of aesthetic ideals rather than personal experience as the medium through which architecture is produced, promoted, and evaluated. Juhani Pallasmaa has addressed concerns about this predominantly architecture of our time "As building are conceived and confronted through the eye rather than the entire body, the actual experience of a building, of its spaces and materials, is neglected. By reinforcing visual manipulation and graphic production, computer imaging further detaches architecture from its multi sensory essence. "[17] He further adds that, "Design has become so intensively a kind of game with form that the reality of how a building is experienced has been overlooked."[18]

Kent C. Bloomer and Charles W. Moore also acknowledged this deficiency in their book Body, Memory, and Architecture: "What is missing from our dwellings today are the potential transactions between body, imagination, and environment."[19] They also proposed that as architects we have overlooked a realm of human spatial experience with a "historic overemphasis on seeing as the primary sensual activity in architecture."[20]

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15 *Castellano "Humanizing Parametricism" p260*

16 *Spiller "Surrealistic Exuberance – Dark Matters" p67*

17 *Pallasmaa "Toward an Architecture of Humility" p2*

18 *Pallasmaa "The Geometry OF Felling: The Phenomenology OF Architecture" p242*

19 *Bloomer and Moore "Body, Memory, and Architecture" p33*

20 *Ibid*

DESIGN FOR CORPOREAL EXPERIENCE

Some contemporary designer, to ground their work in corporeality, have adopted a phenomenological approach to architecture, an approach that incorporates a multi-sensory experience of place. In 'Architecture of Humility' Pallasmaa talks about 'emerging a desire for haptic architecture in reaction to ocular centricity' and named some recent architects who "offer glimpses of the continuous vitality of architecture … Renzo Piano designs exemplary structures that combine technological ingenuity with contextual concern and ecological morality … The delightful buildings of Glenn Murcutt are elegant blends of reason and modesty… Alvaro Siza's architecture fuses a contemporary formal and spatial complexity with a reassuring sense of tradition and cultural continuity … Steven Holl resensualizes space, material, and light ... Peter Zumthor's recent projects convincingly unite opposites: conceptual strengths with sensual subtlety, thought with emotion, clarity with mystery, gravity with lightness."[21]

Pallasmaa's argument is based around the imperative to integrate our sensory responses rather than to prioritize any one over the other. He argues that, "Every touching experience of architecture is multi-sensory; qualities of matter, space and scale are measured equally by the eye, ear, nose, skin, tongue, skeleton and muscle."[22] Our experience in architecture does not merely rely on a single sensory experience, but rather on a collective environment fusing and stimulating all our senses. In "Questions of Perception – Phenomenology of Architecture", Holl argues, "Architecture holds the power to inspire and transform our day-to-day existence… To see, to feel this physicality is to become the subject of the senses."[23] He believes that, "Architecture, more fully than other art forms, engages the immediacy of our sensory perceptions."[24] Likewise, Tadao Ando states, "In architecture, there is a part that is the result of logical reasoning and a part that is created through the senses. There is always a point where they clash."[25]

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21 *Pallasmaa "Toward an Architecture of Humility" p193*

22 *Pallasmaa "The eye of the skin: Architecture and the Senses" p22*

23 *Holl "Questions of Perception: Phenomenology of Architecture" p91*

24 *Ibid*

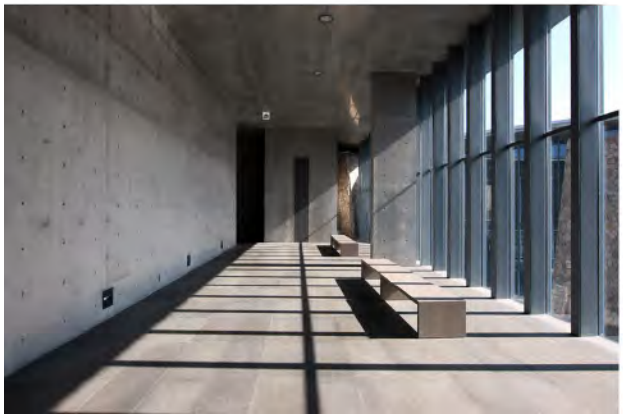
25 *Jordido "Tadao Ando: Houses" p9*

It is from such a phenomenological approach that Pallasmaa proclaims that the human body is equipped with sensory systems which we identify with space, place or moment, and he adds that these dimensions reflect our existence: "Sensory experiences become integrated through the body or rather, in the very constitution of the body... Our bodies and movements are in constant interaction with the environment; the world and the self-inform and redefine each other constantly. The percept of the body and the image of the world turn into one single continuous existential experience – there is no body separate from its domicile in space, and there is no space unrelated to the unconscious image of the perceiving self."[26] His central argument is strongly based around the imperative to integrate all our sensory responses rather than to prioritize any one over the other. Our experience in architecture does not merely rely on a single sensory experience, but rather on a collective environment fusing and stimulating all our senses.

CRITIQUES OF PARAMETRIC DESIGN

Heavily dictated by the sense of sight

Lacking multisensory qualities



DESIGN FOR CORPOREAL EXPERIENCE

Phenomenological approach to architecture

Multi-sensory experience of place

26 *Pallasmaa "The eye of the skin: Architecture and the Senses" p27*

INTEGRATION OF SENSORY EXPERIENCE AND PARAMETRIC DESIGN

A memorable experience in architecture can be distinguished when all our senses are engaged simultaneously during the design process. In "Geometry of Feeling: The Phenomenology of Architecture" Pallasmaa talked about two different design approaches "the architecture of essence and the architecture of form. The architecture of essence perceives the metaphysical and existential problem of being human and tries to reinforce man's foothold on earth. The architecture of form aims at capturing the viewer's attention and approval through its voluble language of expression."[27]
It could be argued that these two oppositions are the result of the way we perceive architecture with different eyes and aspirations but There should be a way to enable the formal and aesthetic strengths of parametric architecture, while understanding its limitations as visually formalistic architecture. The essential task is to negotiate an alternative that invites integration of these differing categories and oppositions. The main concern is about finding a possible way to integrate these two smilingly irreconcilable opposites.
Alvar Aalto, an architect in favor of multi-sensory engagement, wrote: "In every case [of creative work] one must achieve the simultaneous solution of opposites. Nearly every design task involves tens, often hundreds, sometimes thousands of different contradictory elements, which are forced into a functional harmony only by man's will. This harmony cannot be achieved by any other means that those of art."[28]

27 Pallasmaa "The Geometry OF Felling: The Phenomenology OF Architecture" p452

28 Aalto "Art and Technology" p87-88

3 PRECEDENT

BAKU CULTURAL CENTER

HEYDAR ALIYEV CENTER / Zaha Hadid Architects

Architects: Zaha Hadid Architects
Location: Baku, Azerbaijan
Design: Zaha Hadid, Patrik Schumacher
Project Designer and Architect: Saffet Kaya Bekiroglu
Client: The Republic of Azerbaijan
Area: 101801.0 m²
Project Year: 2013

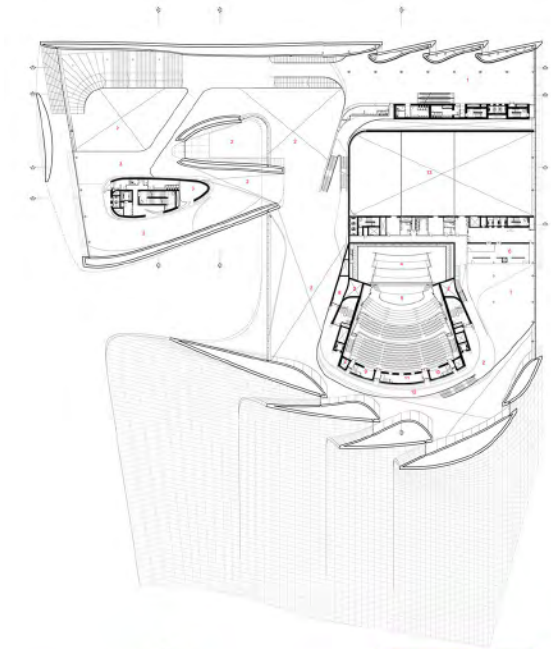
DESIGN CONCEPT

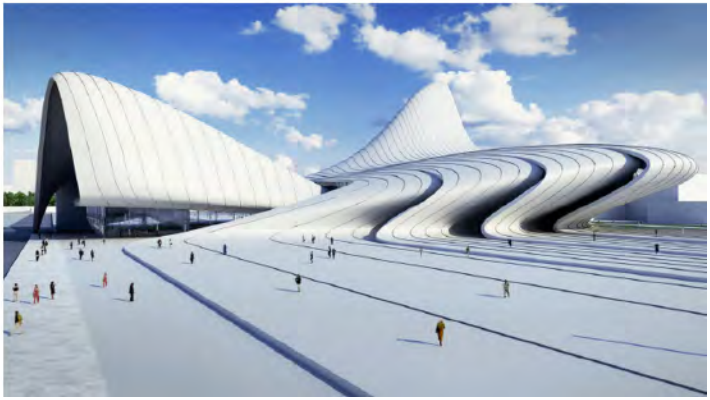
The design of the Heydar Aliyev Center establishes a continuous, fluid relationship between its surrounding plaza and the building's interior. The plaza, as the ground surface; accessible to all as part of Baku's urban fabric, rises to envelop an equally public interior space and define a sequence of event spaces dedicated to the collective celebration of contemporary and traditional Azeri culture.

Fluidity in architecture is not new to this region. In historical Islamic architecture, rows, grids, or sequences of columns flow to infinity like trees in a forest, establishing non-hierarchical space. Continuous calligraphic and ornamental patterns flow from carpets to walls, walls to ceilings, ceilings to domes, establishing seamless relationships and blurring distinctions between architectural elements and the ground they inhabit. Our intention was to relate to that historical understanding of architecture, not through the use of mimicry or a limiting adherence to the iconography of the past, but rather by developing a firmly contemporary interpretation, reflecting a more nuanced understanding.

Responding to the topographic sheer drop that formerly split the site in two, the project introduces a precisely terraced landscape that establishes alternative connections and routes between public plaza, building, and underground parking. This solution avoids additional excavation and landfill, and successfully converts an initial disadvantage of the site into a key design feature.

Elaborate formations such as undulations, bifurcations, folds, and inflections modify this plaza surface into an architectural landscape that performs a multitude of functions: welcoming, embracing, and directing visitors through different levels of the interior. With this gesture, the building blurs the conventional differentiation between architectural object and urban landscape, building envelope and urban plaza, figure and ground, interior and exterior.





GEOMETRY, STRUCTURE, MATERIALITY

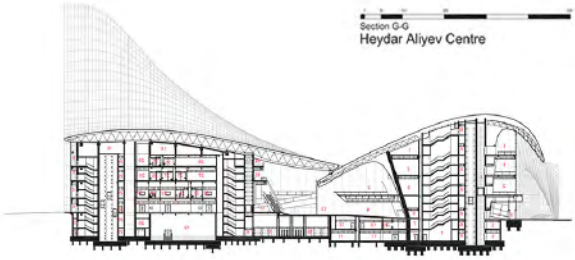
One of the most critical yet challenging elements of the project was the architectural development of the building's skin. Our ambition to achieve a surface so continuous that it appears homogeneous, required a broad range of different functions, construction logics and technical systems had to be brought together and integrated into the building's envelope. Advanced computing allowed for the continuous control and communication of these complexities among the numerous project participants.

The Heydar Aliyev Center principally consists of two collaborating systems: a concrete structure combined with a space frame system. In order to achieve large-scale column-free spaces that allow the visitor to experience the fluidity of the interior, vertical structural elements are absorbed by the envelope and curtain wall system. The particular surface geometry fosters unconventional structural solutions, such as the introduction of curved 'boot columns' to achieve the inverse peel of the surface from the ground to the West of the building, and the 'dovetail' tapering of the cantilever beams that support the building envelope to the East of the site.

The space frame system enabled the construction of a free-form structure and saved significant time throughout the construction process, while the substructure was developed to incorporate a flexible relationship between the rigid grid of the space frame and the free-formed exterior cladding seams. These seams were derived from a process of rationalizing the complex geometry, usage, and aesthetics of the project. Glass Fiber Reinforced Concrete (GFRC) and Glass Fiber Reinforced Polyester (GFRP) were chosen as ideal cladding materials, as they allow for the powerful plasticity of the building's design while responding to very different functional demands related to a variety of situations: plaza, transitional zones and envelope.

In this architectural composition, if the surface is the music, then the seams between the panels are the rhythm. The seams promote a greater understanding of the project's scale. They emphasize the continual transformation and implied motion of its fluid geometry, offering a pragmatic solution to practical construction issues such as manufacturing, handling, transportation and assembly; and answering technical concerns such as accommodating movement due to deflection, external loads, temperature change, seismic activity and wind loading.

The inside center is characterized by continuous surfaces that twist to transform the ceiling, walls and ramps. The shapes remind TWA flight center at JFK, which its architect Eero Saarinen said "… it's all one thing …"



4 PROGRAM

MUSEUM OF MODERN ART

BACKGROUND INFORMATION

The design of museums has evolved throughout history. However, museum planning involves planning the actual mission of the museum along with planning the space that the collection of the museum will be housed in. The way that museums are planned and designed vary according to what collections they house, but overall, they adhere to planning a space that is easily accessed by the public and easily displays the chosen artifacts.

SPACE ANALYSIS	
	Area (sq ft)
Existing Museo de Arte de Puerto Rico	32,000
New Construction:	
Circulation and common area	4,900
Library	2,000
Conservation and restoration	1,750
Recieving, registrar, security, general storage, loading dock	2,600
Administration	4,000
Café/food service	3,400
Auditorium (stage/backstage)	6,800
Education center	2,875
Puerto Rican gallery	2,500
Special exhibition gallery	5,000
Total	67,825

A REGIONAL ART MUSEUM, PUERTO RICO

EDWARD DURELL STONE (1964)

SPACE USAGE	
	Area (sq ft)
Exhibition galleries	50,000
Theater	6,200
Education center	3,000
Library	3,800
Conservation laboratory	3,000
Art study and storage	15,000
Book/gift shop	4,000
Multiuse event space	4,200
Central atrium entry	5,000
Café	2,500
Administrative and curatorial offices	22,500
Note: This disposition of space is typical for art museums of this size in urban settings.	

SAN FRANCISCO MUSEUM OF MODERN ART

MARIO BOTA (1995)

Today's museum is no longer just a place for art cognoscenti to gather and admire art. On the contrary, the typical museum of 20th century became a bustling combination of destination site and tourist attraction. Such a place, aside from showing original art, now provides places to eat, to buy souvenir and reproduction, and to view virtual showing of real art in electronic format.

SCHEDULE OF PROGRAM AREAS	
	Area (sq ft)
Permanent galleries	8,610
Changing (temporary) galleries	2,600
Study Collection galleries	3,100
Lecture auditorium	2,650
Reading room and library	1,020
Offices and backup facilities	41,795
Entrance and circulation	1,225
Total Area	61,000

UNIVERSITY ART MUSEUM, HARVARD UNIVERSITY

JAMES STERLING (1985)

SCHEDULE OF AREAS			
	Area (sq ft)		**Area (sq ft)**
Lower-level promenade		Level 4	
Public circulation	7,800	Public circulation	3,050
Exhibitions	27,600	Auditorium (170 seats)	3,700
Administrative and support	24,300	Exhibitions	1,600
Plaza level		Level 5	
Public circulation	11,000	Public circulation	2,100
Exhibitions	7,800	Exhibitions	700
Level 2		Level 6	
Public circulation	3,350	Public circulation	500
Exhibitions	3,400	Exhibition (Hall of Fame)	1,450
Level 3		Total	143,000
Public circulation	3,350		
Exhibitions	3,200		
Museum café	3,450		
Outdoor terrace café	3,450		
Note: These dimensions are typical of music and performance-related museums of this size			

ROCK & ROLL HALL OF FAME AND MUSEUM, CLEVELAND, OHIO

I.M.PEI ARCHITECTS (1995)

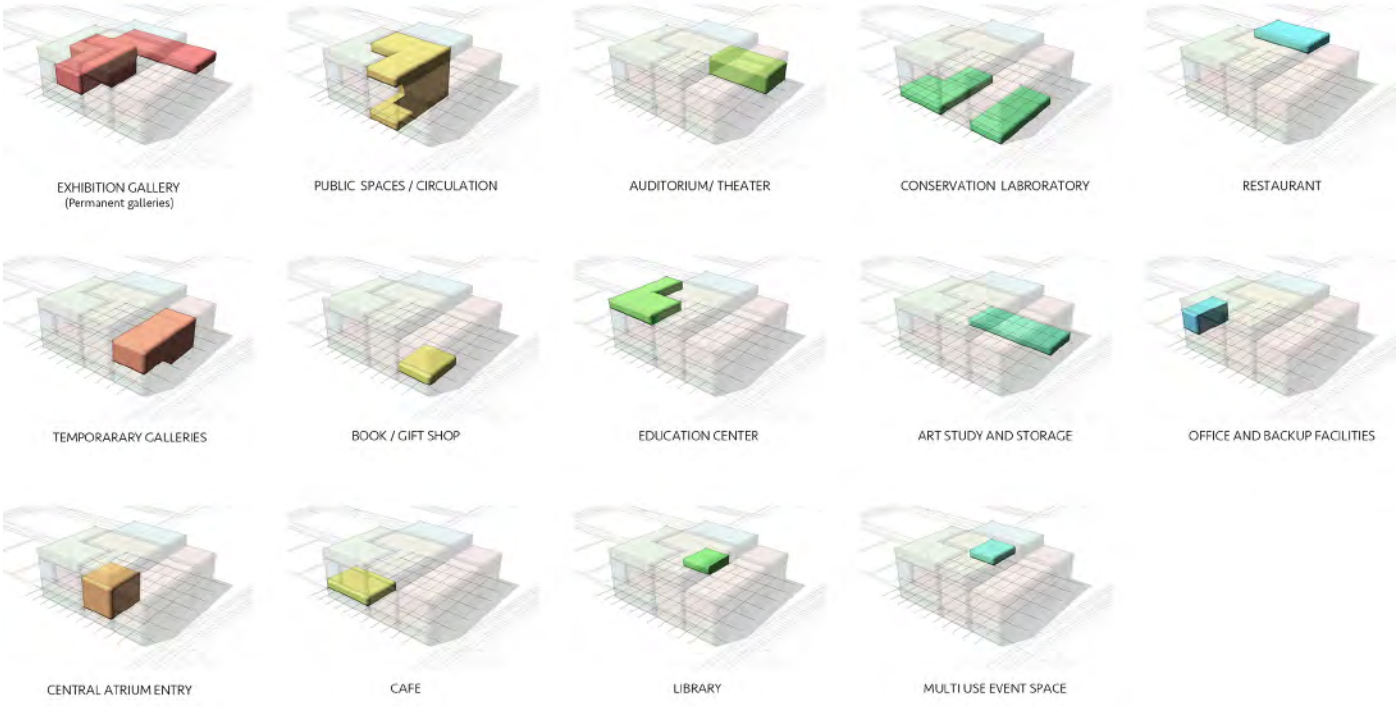
MASTER LIST OF SPACES

These are the main spaces of the museum which totally are about 120,000 sq ft.
Approximately 25 percent of the total space is devoted to permanent galleries which is mostly dedicated to parametric designers to show their product designs or 3d model of parametric projects. With another 12 percent allotted to temporary or special exhibitions.

SPACE	Sq. ft.		Floor
Permanent galleries	30000	%25	1,2,3
Temporary Galleries	15000	%12.5	1,2,3
Central atrium entry	5000	%4	0,1,2,3
Public Spaces / Circulation	13000	%11	1,2,3,4
Book/gift shop	4000	%3	1
Café	2500	%2	1
Auditorium / Theater	6000	%5	2,3
Education center	3000	%2.5	4
Library	4000	%3	2
Conservation laboratory	3000	%2.5	0
Art study and storage	9000	%8	0
Multiuse event space	4000	%3	2
Restaurant	5000	%4	4
Offices and backup facilities	17500	%14.5	1,2,3
TOTAL	121000	%100	

GENERAL ADJACENCIES DIAGRAMS

Series of primary 3d blocking diagram show different spaces and relation of them.
Main entrance is located on the north part of the site (Market street) which will lead to a central atrium. Galleries are located on three different levels (first, second and third floor) around the central atrium. Bookshop and café are located on the first floor. Laboratory and storage are placed on basement floor. Restaurant in addition to a large terrace (having an open view to river) is located on the fourth floor.



5 CASE STUDY

MUSEUM OF ARCHAEOLOGY AND ANTHROPOLOGY

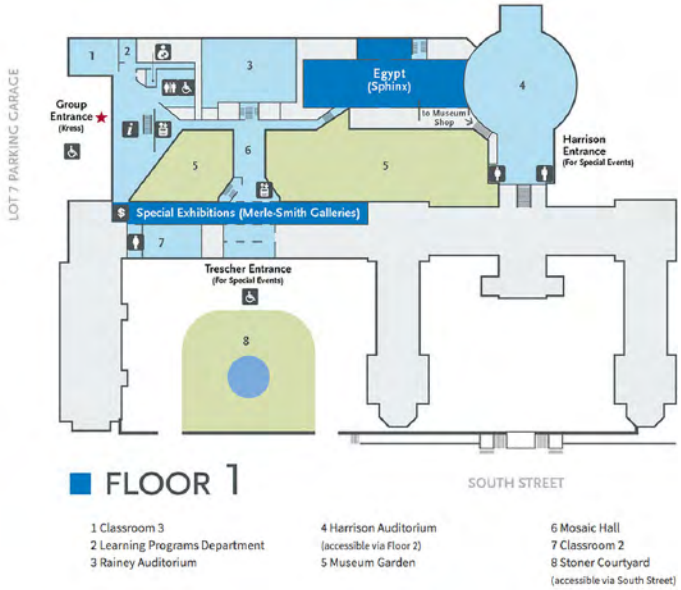
Museum of Archaeology and Anthropology

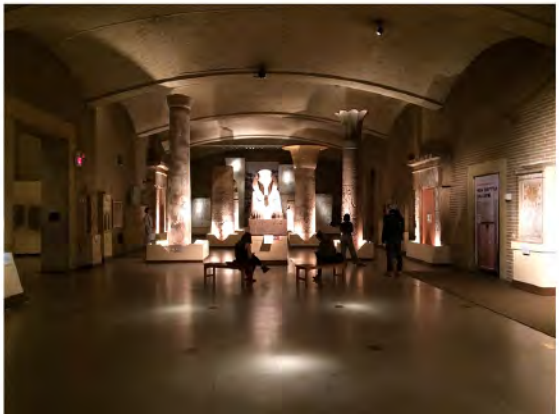
HISTORY

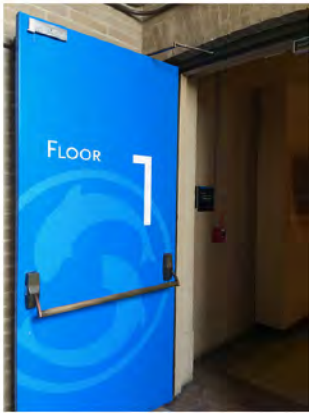
An internationally renowned educational and research institution dedicated to the understanding of cultural diversity and the exploration of the history of humankind, the University of Pennsylvania Museum of Archaeology and Anthropology—which has conducted more than 300 archaeological and anthropological expeditions around the world—was founded during the administration of Provost William Pepper. In 1887, Provost Pepper persuaded the Trustees of the University of Pennsylvania to erect a fireproof building to house artifacts from an upcoming expedition to the ancient site of Nippur in modern-day Iraq (then part of the Ottoman Empire). During the late 19th and early 20th centuries, North American and European museums regularly sponsored such excavations throughout the Mediterranean and Near East, sharing the ownership of their discoveries with the host country. Penn Museum followed this practice in acquiring the vast majority of its collections, and, as a result, most of the Museum's objects have a known archaeological context, increasing their value for archaeological and anthropological research and presentation.
Today the Museum's three floors of gallery space feature materials from the ancient Mediterranean World, Egypt, the Near East, Mesopotamia, East Asia, and Mesoamerica, as well as artifacts from the indigenous peoples of Africa and Native America. Since 1958, the Penn Museum has published Expedition magazine. “As an internationally renowned resource for studying and learning about the world, the Penn Museum has a mission to transform understanding of our shared human experience,” said director of the Penn Museum, Julian Siggers. “This multi-faceted educational program in an object-based museum environment — with touch points for teachers, students and families — has multiple opportunities for those exceptional revelations that can be the sparks to inspire life-long learning.”

OBSERVATIONAL RESEARCH

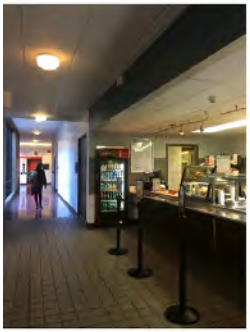
The Penn Museum is the largest university museum in the United States with roughly one million objects in its care. The style of the building is classic and it's not relevant to my design style but it is helpful in terms of the size of the museum, variety of spaces, applying different kind of materials and also bringing natural light in interior spaces. In the first floor, there are permanent galleries, multi-use event space and Auditorium.

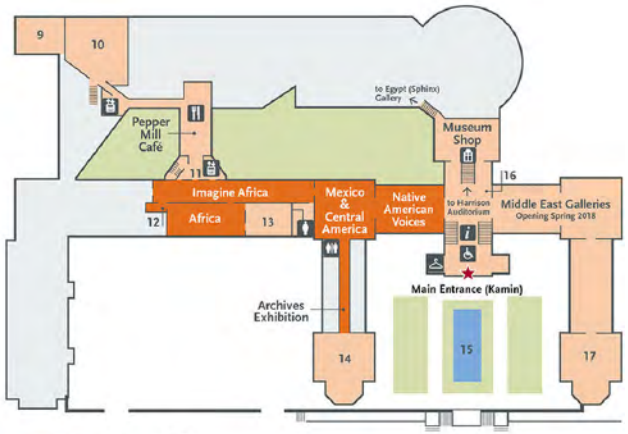




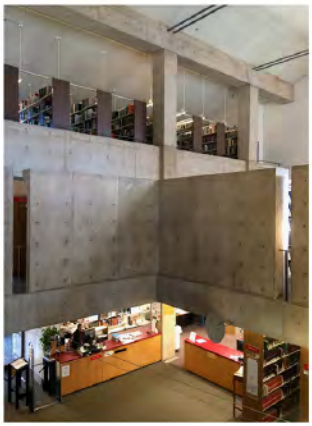


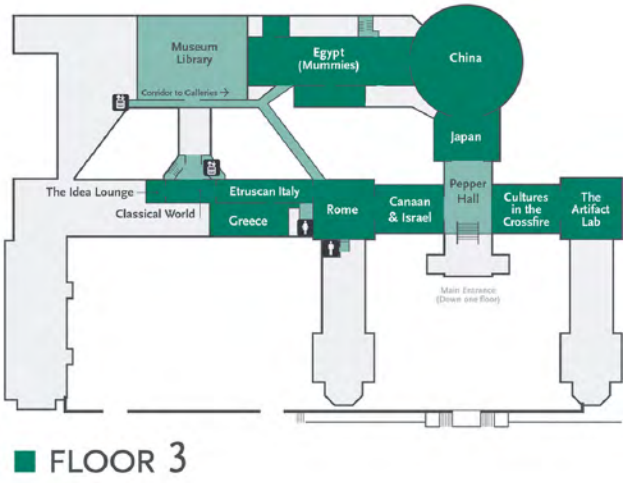
A team of three prominent Philadelphia architectural firms created the original design for the Penn Museum, all of whose principals taught on the faculty of the University of Pennsylvania—Wilson Eyre, Cope & Stewardson, and Frank Miles Day & Brother. As shown below, There is a large gift shop beside a specious café in the second floor. One of the interesting aspect of the project is the way finding elements.

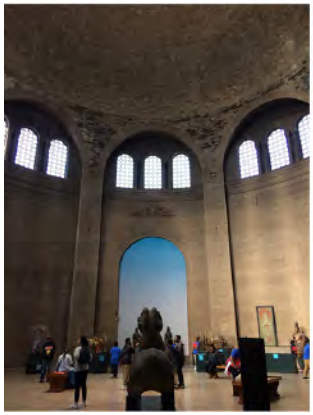


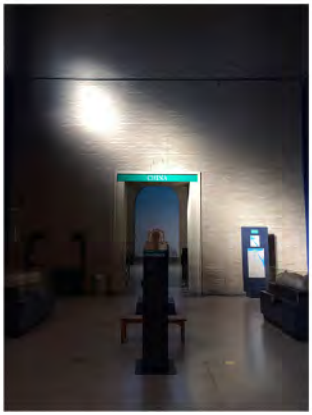


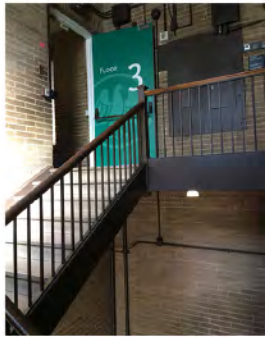
One of the distinctive architectural feature of the building is rotunda which is the largest unsupported masonry floor-dome in the world (bottom left). In terms of materiality, different types of material have been used in the building: from brick in rotunda, to concrete in library which all emphasize the feeling of mass. Another interesting aspect of the interior is use of natural light in space that creates dramatic perspectives (bottom picture).









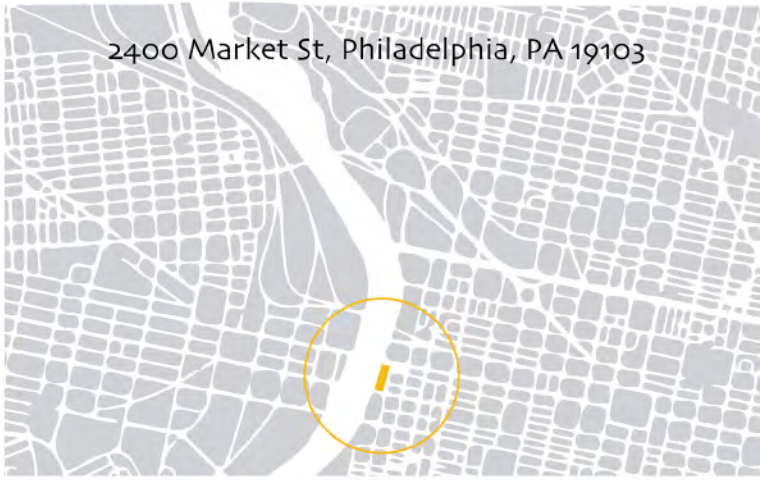


6 SITE

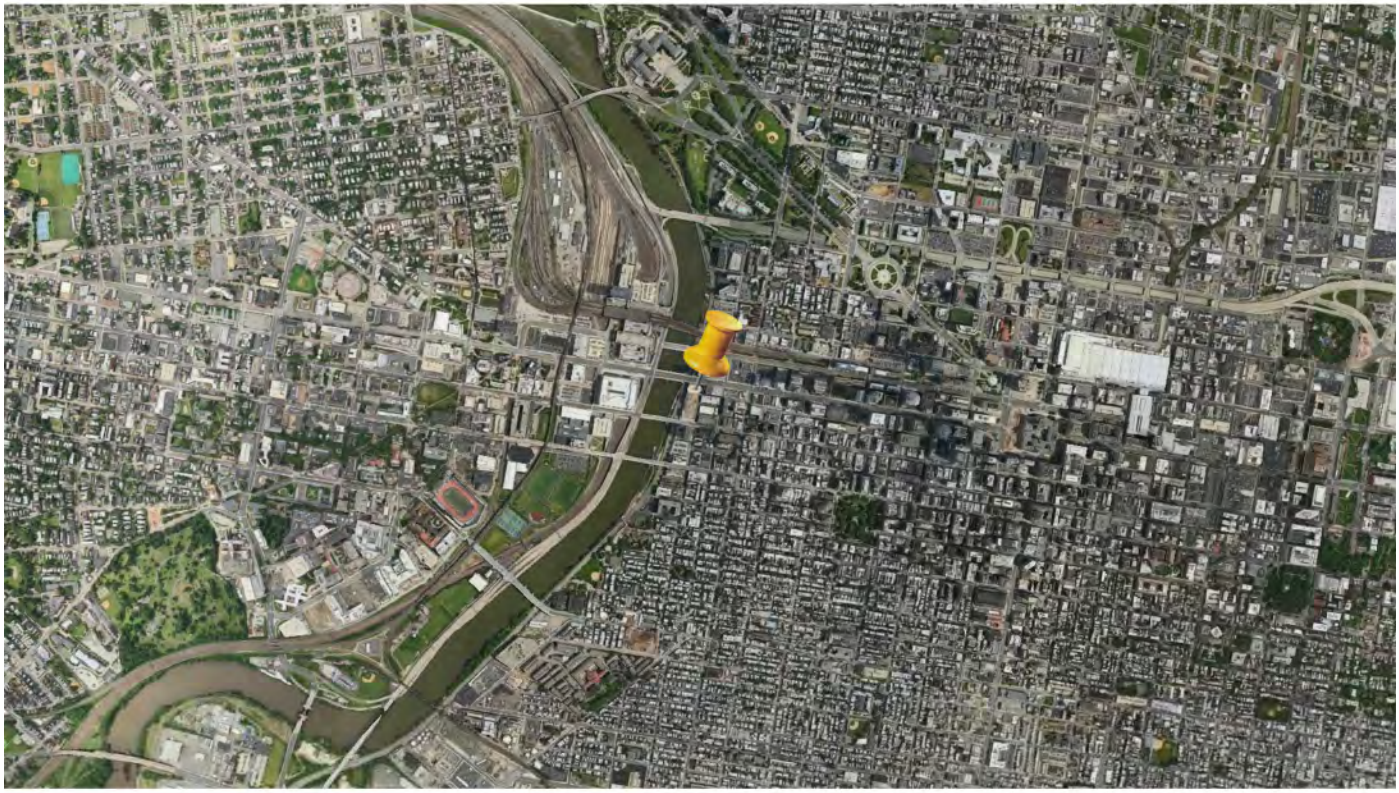
2400 MARKET STREET

BACKGROUND INFORMATION

The proposed site of the project is 2400 market street Which was used as the “Marketplace Design Center”. The building was built sometime between 1915 and 1922.
At first, it was used as a car factory. The building was built with two-way ramps that went up to each super-reinforced floor.



The building languished on for decades as an industrial space (called the Loft Building) until becoming the Marketplace Design Center.
One of the prominent feature of the building is a mural of “east coast humpbacks” on the west façade by Robert wyland which was painted in six days in 1993.
Right now, building is on a massive renovation, a plan which turn it into a mixed-use building.



SITE ANALYSIS DIAGRAMS

There are several reasons for choosing this site. First, It is located at the gateway of university city and center city. It can be seen as a symbol of connecting science and culture.

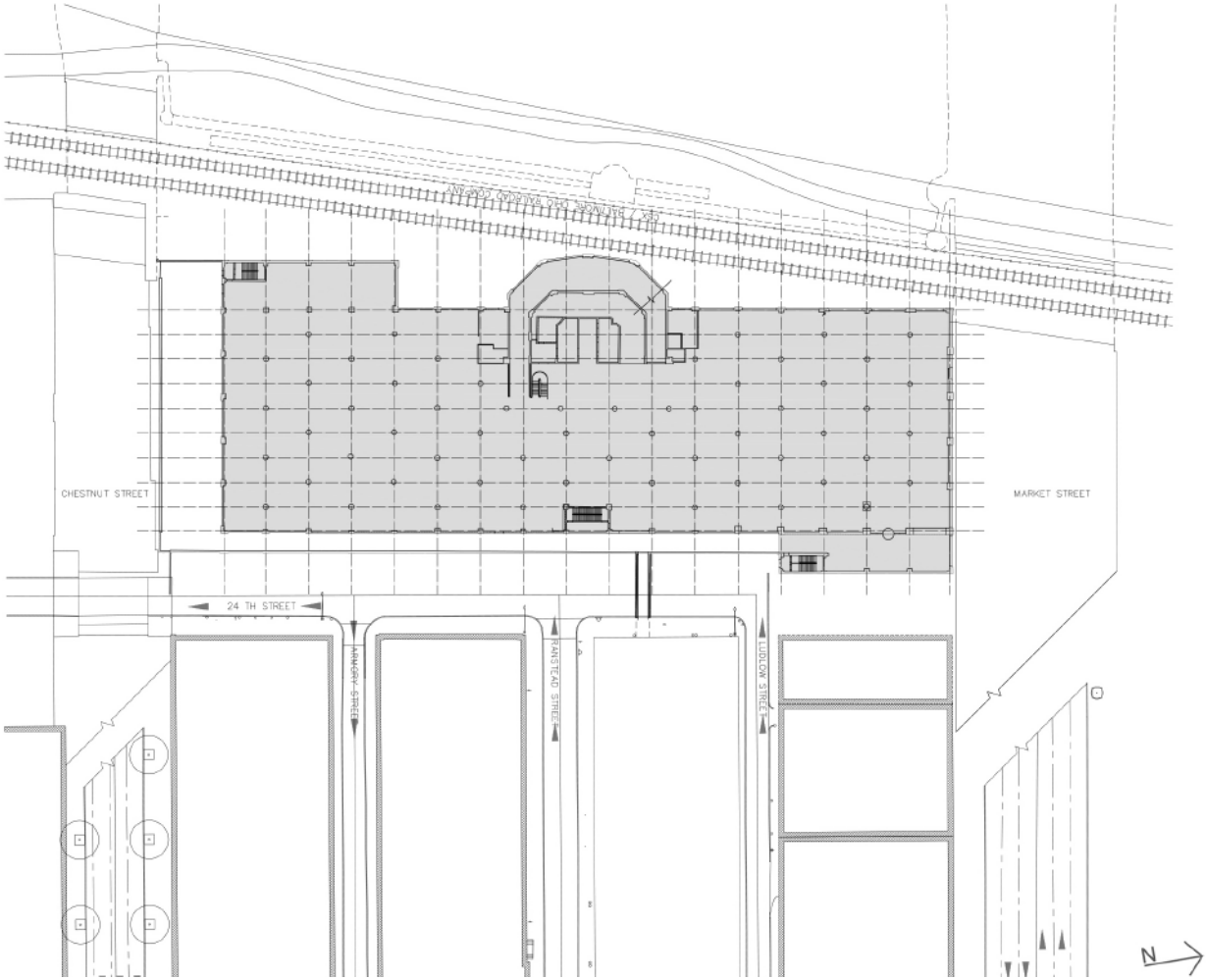
The other reason is placing by the side of Schuylkill river trail, which generally follows the river bank, and is used for walking, jogging, bicycling, rollerblading, and other outdoor activities. First, there is a great view from inside of the building to the river. Second, knowing the fact that no further structure is going to block the view of the building in future.

As shown in the below map, there are some important places in the area:
30th street station is located on the other side of the bridge as a main transportation center.
Also, It is 15 min walk (5 min transit) to city hall.
Philadelphia museum of art is on 20 min walk distance beside other smaller museum in the area which totally can create a new cultural zone.

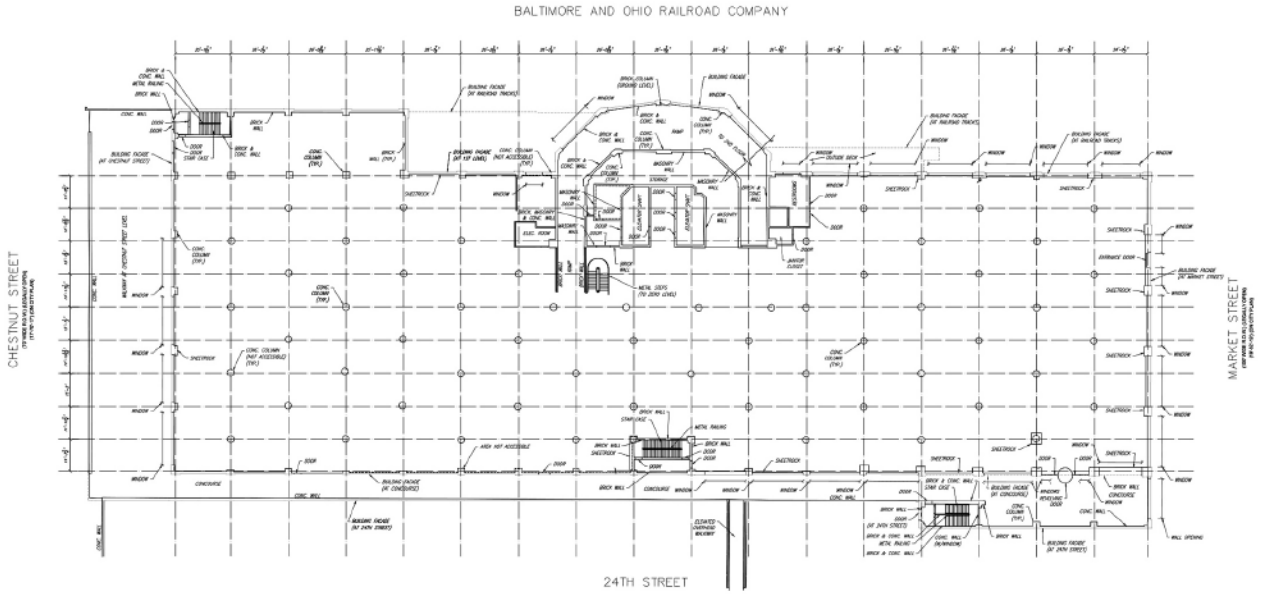
Below is the aerial view of the city, showing the site location in relation to the center city and Philadelphia museum of modern art.

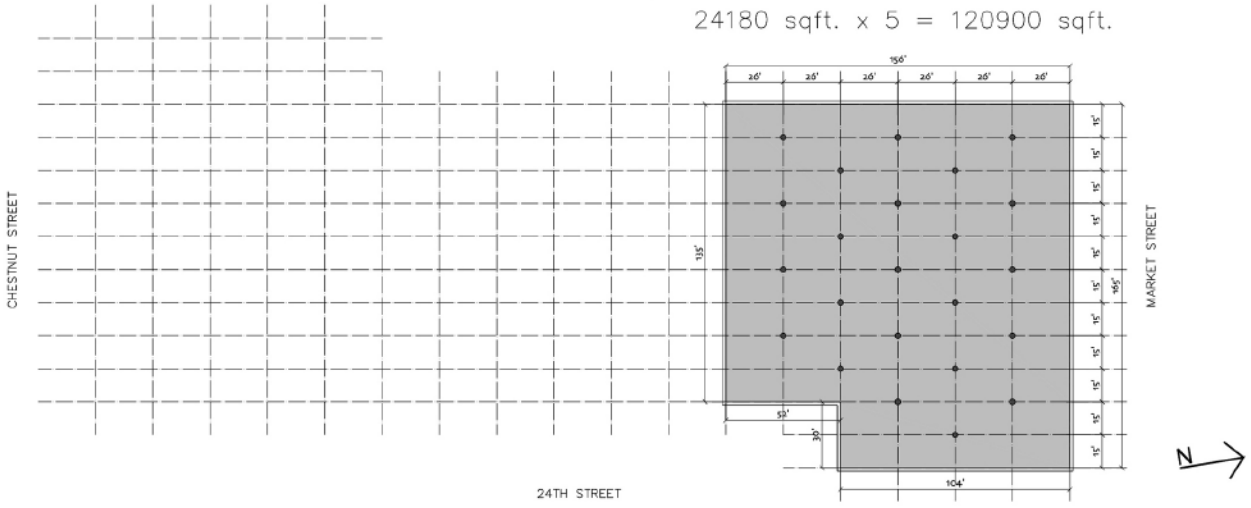
SITE DOCUMENTATION

The drawing below shows the building and its surronding features.
Schuylkill river and railroad are on the west side of the building.
Market street is on the north and Chestnut street is on the south.
24th street is on the east. There is a bridge that connect the existing structure to the other building on the east which is used as a parking facilities..



Drawing on the top shows the existing plan of the building with two-way ramps on the west side that go up to each floor. North part of the building is chosen for the museum which is twenty-four thousand sq ft. per floor . Four floors on the ground and one basement floor which totally become 120,900 sq ft.





EXISTING BUILDING DOCUMENTATION

Drawings below show four elevations of the existing building.
The grey areas show the parts that is chosen for further design.

NORTH ELEVATION

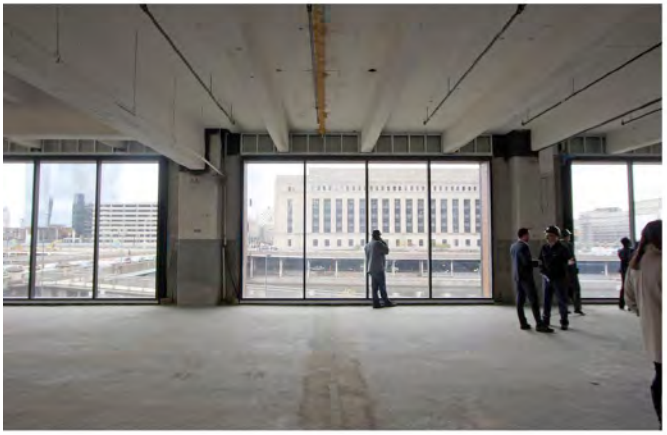
WEST ELEVATION

SOUTH ELEVATION

EAST ELEVATION

Here are some site photos looking at the existing building from other side of the river trail and Market street.

Top left - Interior view of the building with its large windows
Bottom left - View of the building from Schuylkill river trail
Top right - The bridge connecting the existing structure to the other building
Bottom right - Interior view (when building was served as Marketplace design center)



7 DESIGN INTENT

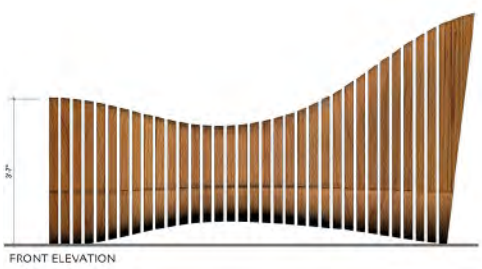
PARAMETRIC DESIGN + CORPOREAL EXPERIENCE

''ARCHITECTURE OF FORM '' + ''ARCHITECTURE OF ESSENCE ''

"The architecture of essence perceives the existential problem of being human and tries to reinforce man's foothold on earth. The architecture of form aims at capturing the viewer's attention and approval through its voluble language of expression."

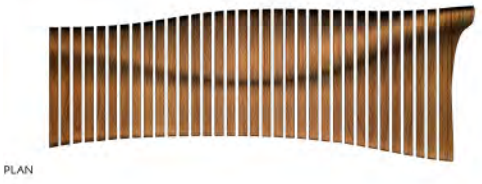
Juhani Pallasmaa

A public bench which is designed with the help of computer modeling. The optimal shape for the seating was determined both by using parametric design tools (software that suggests precise shapes and materials when supplied with a set of inputs) and also ergonomic standard (human factor engineering).

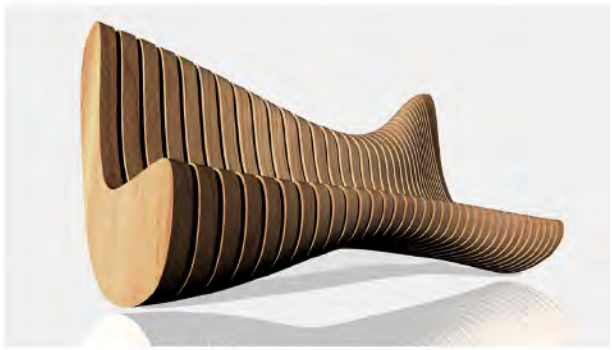


FRONT ELEVATION

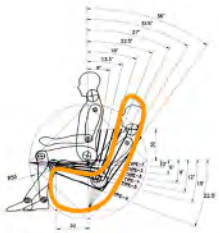
SIDE ELEVATION



PLAN



SECTION A



SECTION B

SECTION C

PROBE I - SCALE

- Identify someone who has experiences related to the topic (parametric project) and research their experiences, perceptions, and attitudes. Pay close attention to the environments that shape their experiences.

PROBE II - EXPERIENCE (Heidar Aliyef Center)

+

We were amazed at the sheer area it covers - the views inside the building are equally awesome. It houses a car, doll and fashion museum and miniature models of the many beautiful buildings around Baku. Although there was a well-stocked bar which was not open when we visited, I think a coffee shop would be a welcome addition. There is also a small but interesting souvenir shop. The white organic structures and walls the ever-changing perspective make it a real wonder. It rooms a permanent museum dedicated to the memory of the deceased president Heydar Aliyev and several other exhibitions.

First, it is an architectural wonder. The building tricks the eye by weaving the floor and the walls of the building as if everything is a huge wave. It does not take long to finish the museum, max. 2 hours. However, there are specific entrance timings. We were lucky enough to arrive 10 minutes just before the opening. This place is pleasant with lots of different things to see. You can easily spend 2-3 hours or more here strolling round the different exhibitions. Stunning white against blue or black skies. Great place for fashion shots or even wedding.

It is one of the most impressive buildings I've ever visited. The center features several museums and exhibitions (including a lovely exhibition of Mini-Azerbaijan), but just strolling through the galleries of the building is pure bliss itself. STUNNING! Don't miss it while in Baku. It is impossible to sum up the place in a limited number of words. For anyone who loves architecture or be in a place with imagination and imagination is endless - this is the beautiful and unconventional place. It is a must in this place for anyone who even a little fond of architecture

-

If rating the building alone, it's exterior and interior only, it would be 10 stars. But, I didn't like the use of interior space. On exhibits are several Baku buildings scale models, some national clothes and artifacts and old cars displayed with a separate paying ticket. First impression when entering is it's looking empty. It is a very fine sight indeed. There is a lack of adequate signage. The contents of the center unfortunately don't quite match up to the brilliance of the building itself. There's lots of information about the history of Azerbaijan and many artefacts from the past, including clothing, prehistoric relics, jewelry and weapons.

It doesn't contain an ancient thing except the part that contain the old cars. Honestly, I visited the place to see what Zaha Hadid designed. I got dizzy when I entered, although the staff are cooperative but eventually there is no plan and you don't know where to start. As interested in history, the oldest item I found was dated back to 1900, Overall, it is a must to see, but if you miss it don't regret it. The only fault was in the organizational of entry ... confusing... entrance not signed posted....Had to get entry tickets in one part of building and then exit it and walk around to the other side.

It is like a contemporary sculpture, worth to see so you can't be blamed because you missed it. Even thegreatest architects don't know how to design a simple stair. Her stairs are very uncomfortable. And dangerous because everything is white. The exhibition is limited to the story of the former president. Not that much interesting. There is a cafe inside but don't serve alcoholic drinks and run out of nonalcoholic. As far as it is considering as a beautiful architecture and in big area, it was recommended to see. problem is about finding your way inside. Also, your way is not clear and you might ask a lot from other people. There are some guards who always tell you to go somewhere. Some parts are mostly political shows and not interesting for me.

(Left) A sample material palette that might be found in a typical parametric project.
(Right) A proposed material palette which also address sensory experience.

PROBE III - MATERIALITY

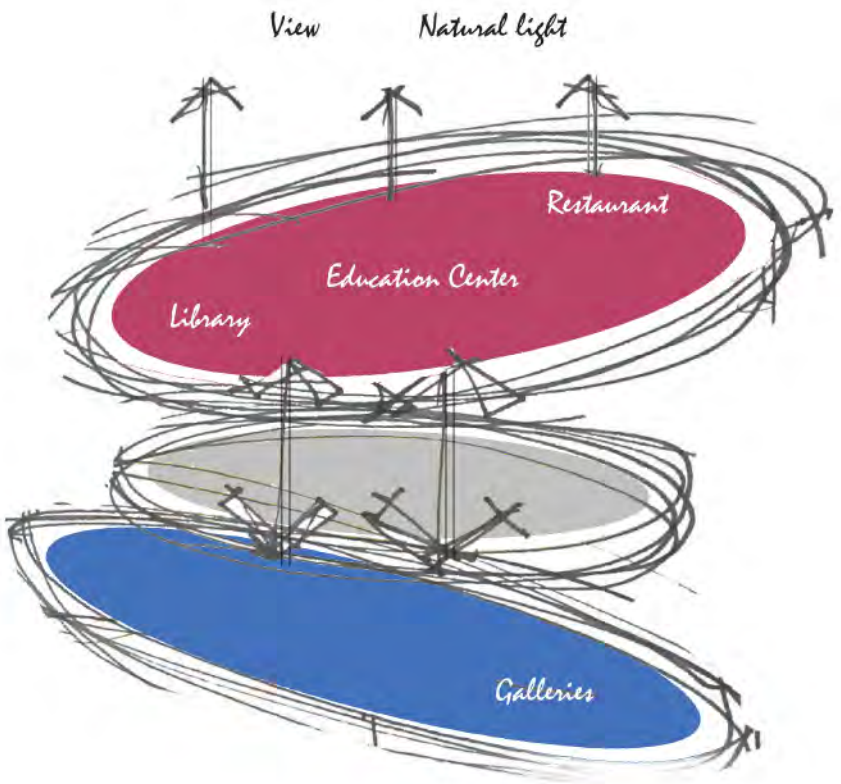
TYPICAL MATERIAL PALETTE

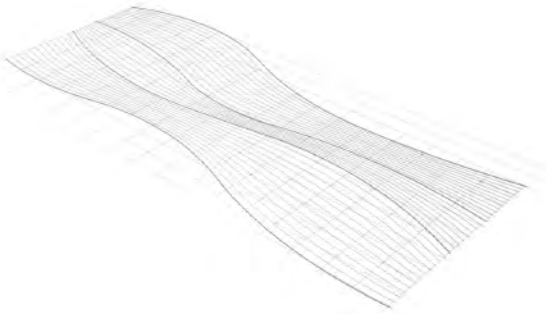
PROPOSED MATERIAL PALETTE

8 SCHEMATIC DESIGN

DESIGN CONCEPT

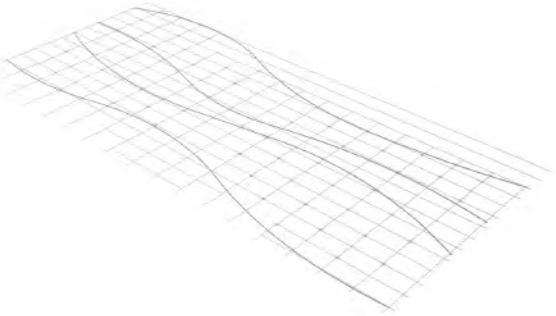
There were two main concerns before starting design: functional and formal
Functional (space planning): there are several operations inside space, some like restaurant, lobby, education center need view to the outside and also access to natural light. For the other ones like galleries these are not priority. Also, in terms of circulation, there is a need of creating a large open space that increase environmental interaction while create visual connection. That leads to designing a full height atrium which also bring the natural light throughout the space.
Formal: Following the main concept of parametricism(fluidity), the main concern is bringing curvature gesture inside the existing rigid grid.



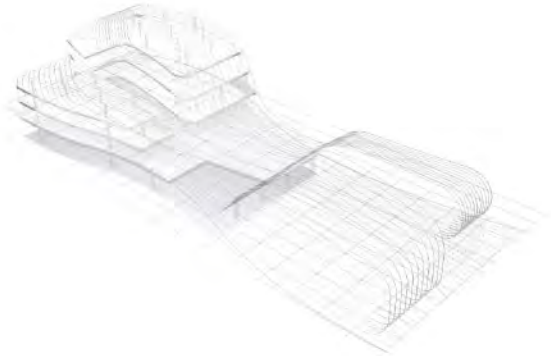


03 Series of curves originate from the basic ones

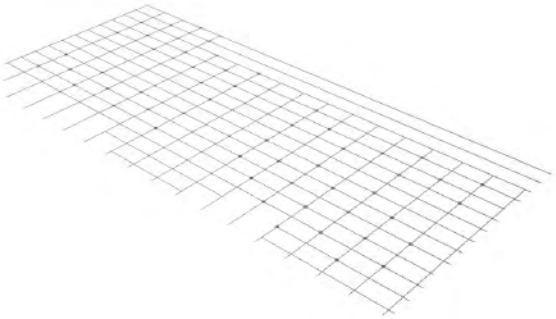
04 Bringing wavy form on the exterior shell



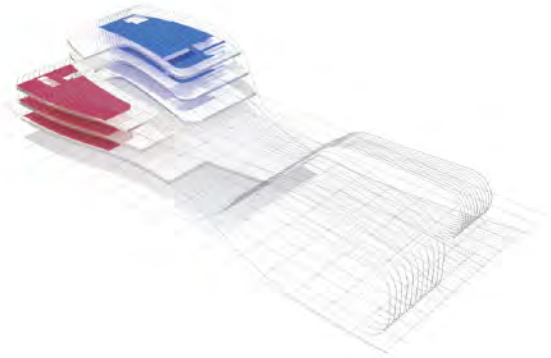
02 Set of curvatures encompass the whole structure



05 Building's facade references rolling waves

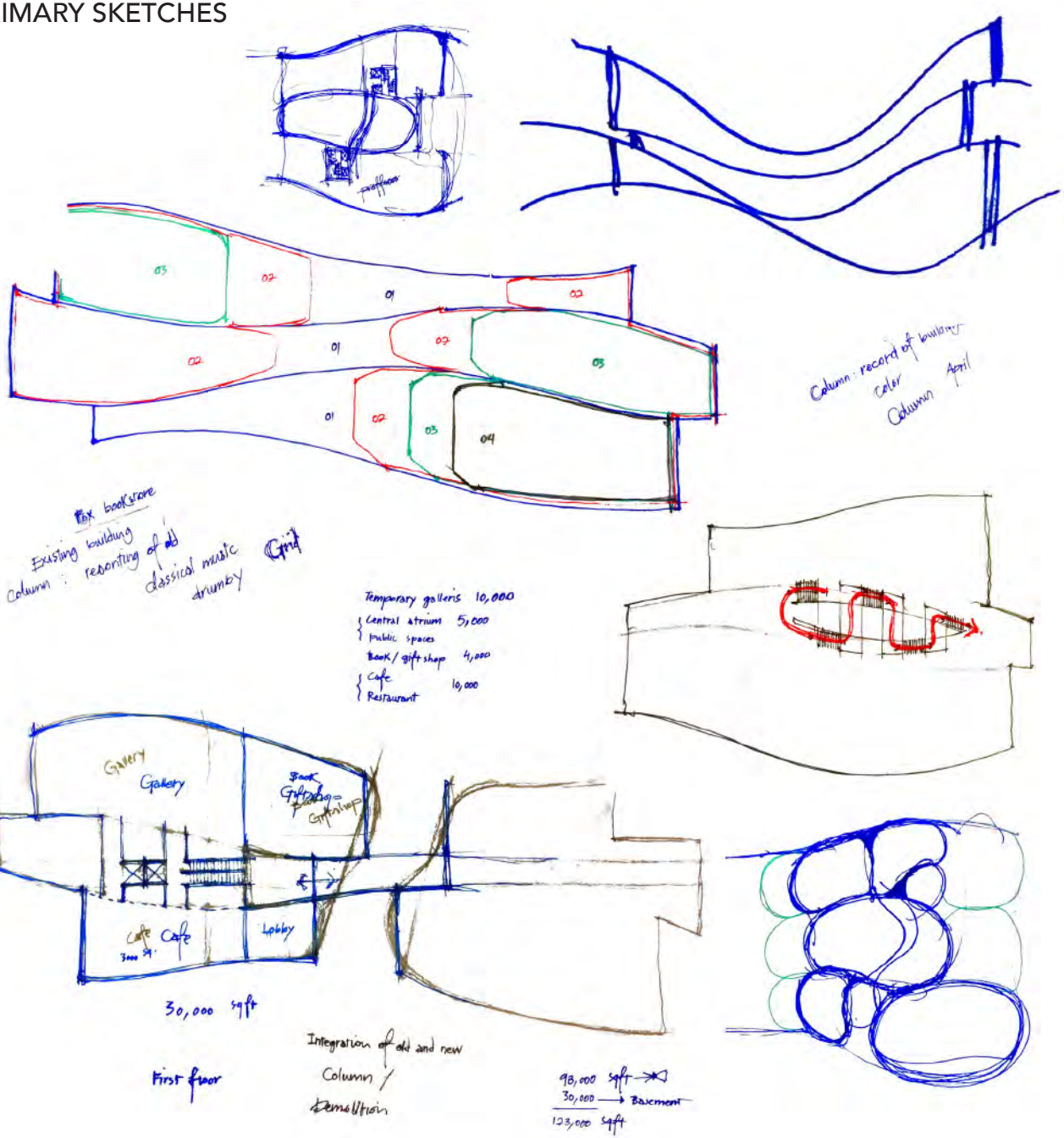


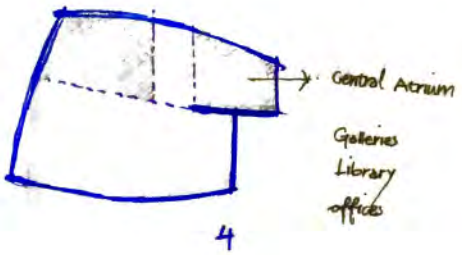
01 Existing structural grid of the building

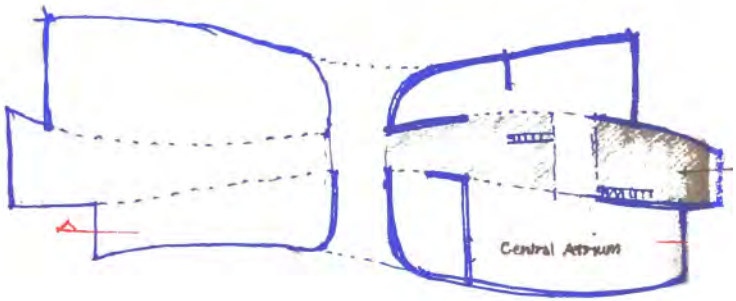


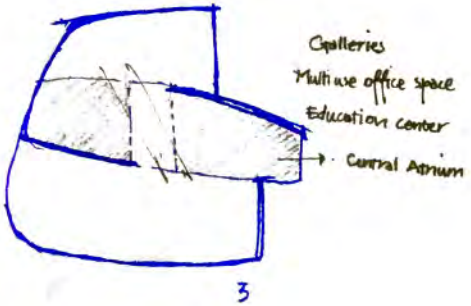
06 3 Separate zones which are related internally

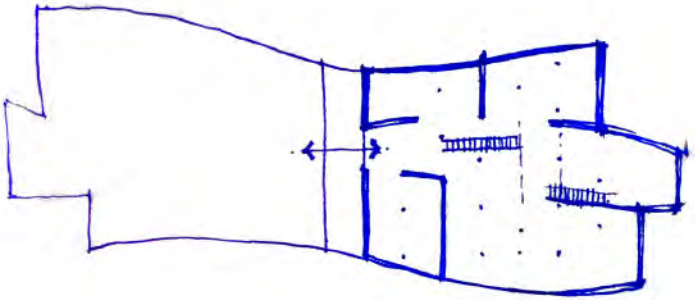
PLAN PRIMARY SKETCHES

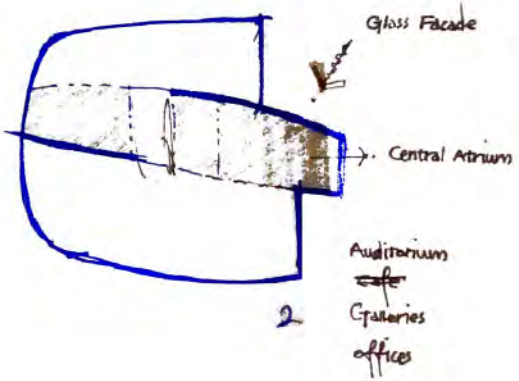


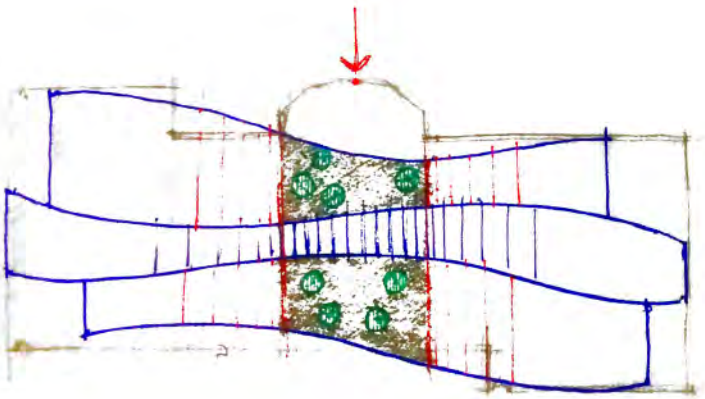

Central Atrium
Galleries
Library
offices
4


Central Atrium

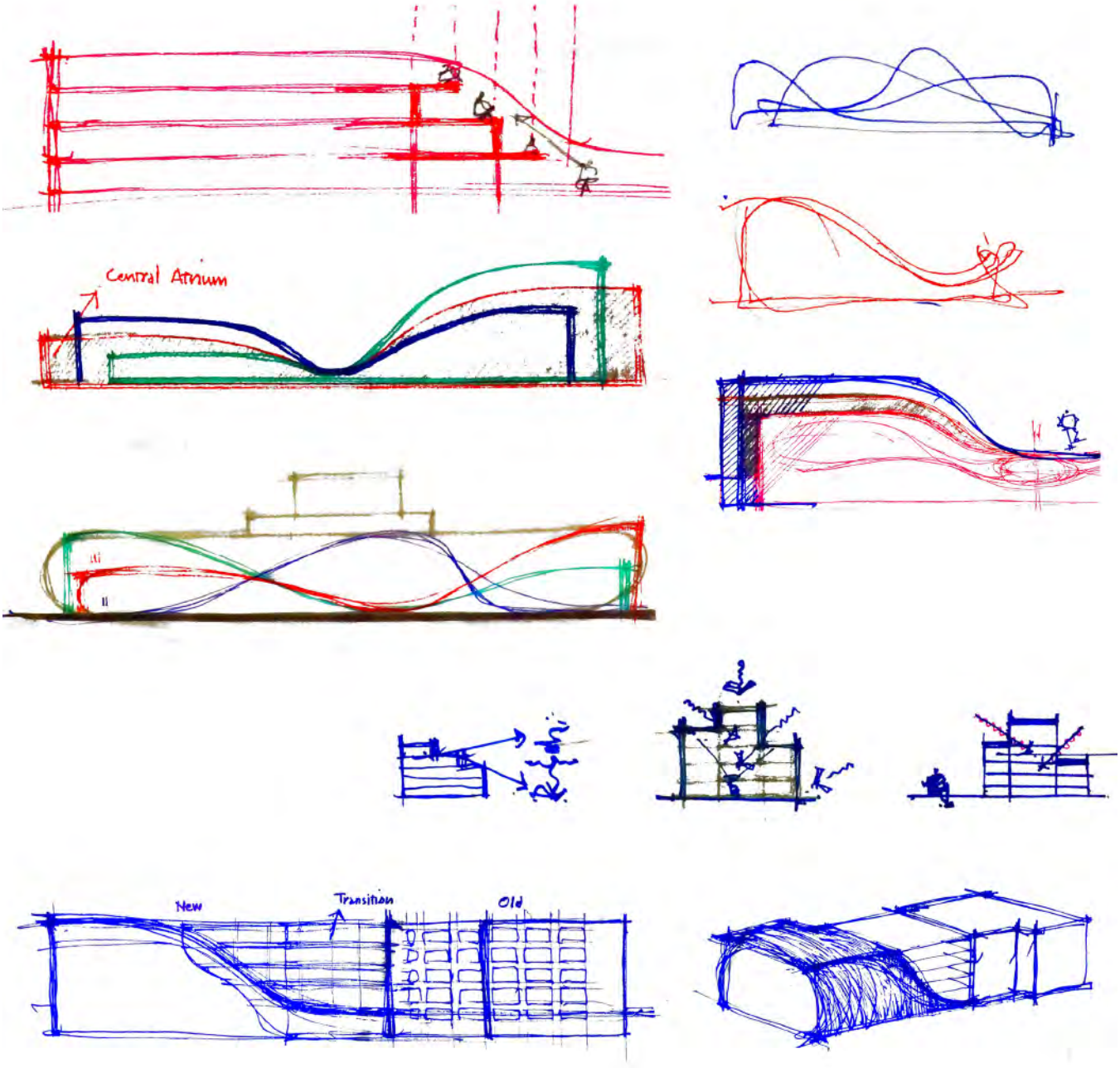

Galleries
Multi use office space
Education center
Central Atrium
3

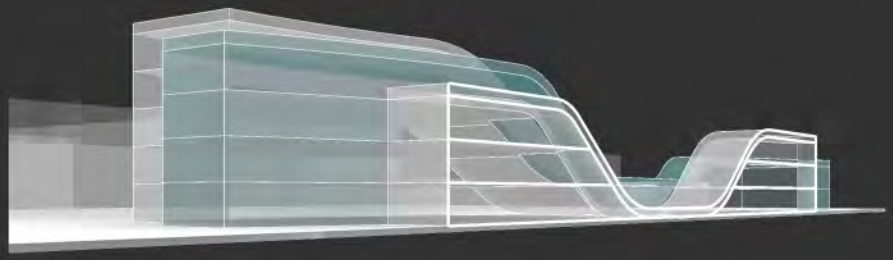



Glass Facade
Central Atrium
Auditorium
Galleries
offices
2

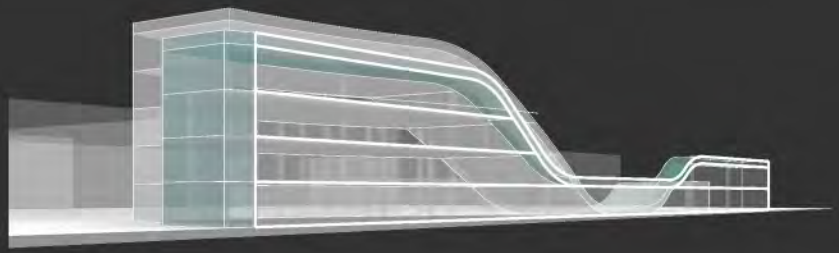


SECTION PRIMARY SKETCHES

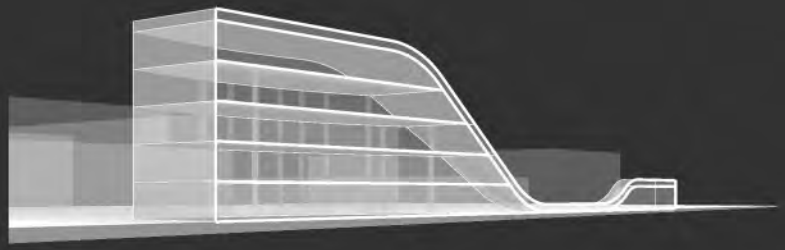




Section C

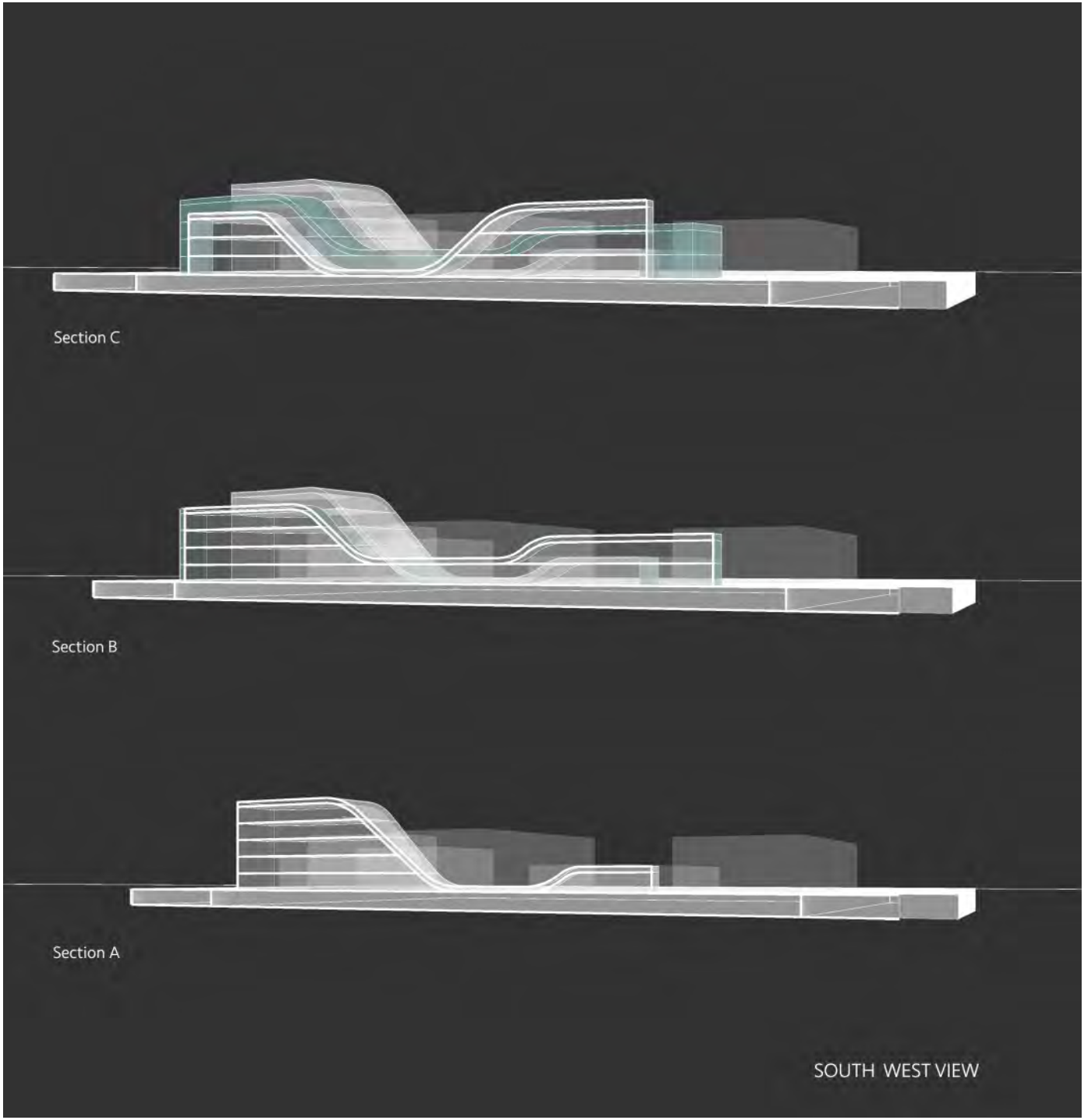


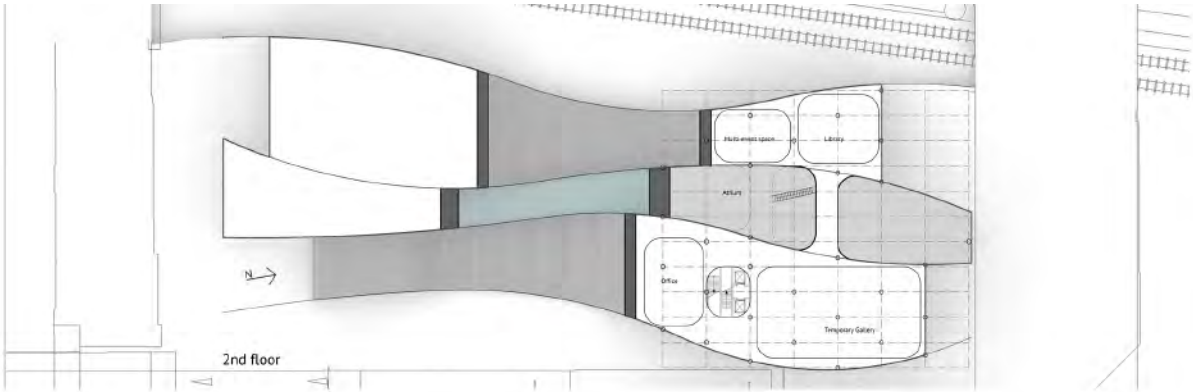
Section B



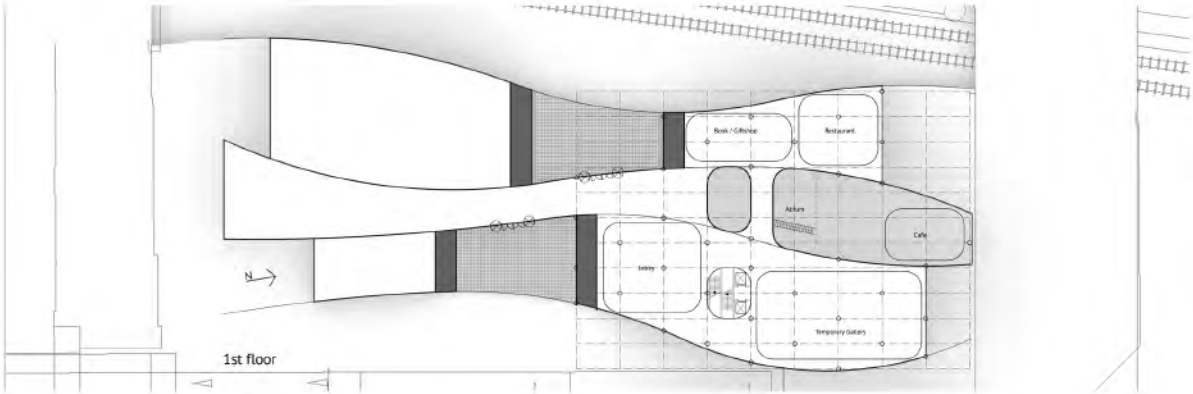
Section A

NORTH WEST VIEW

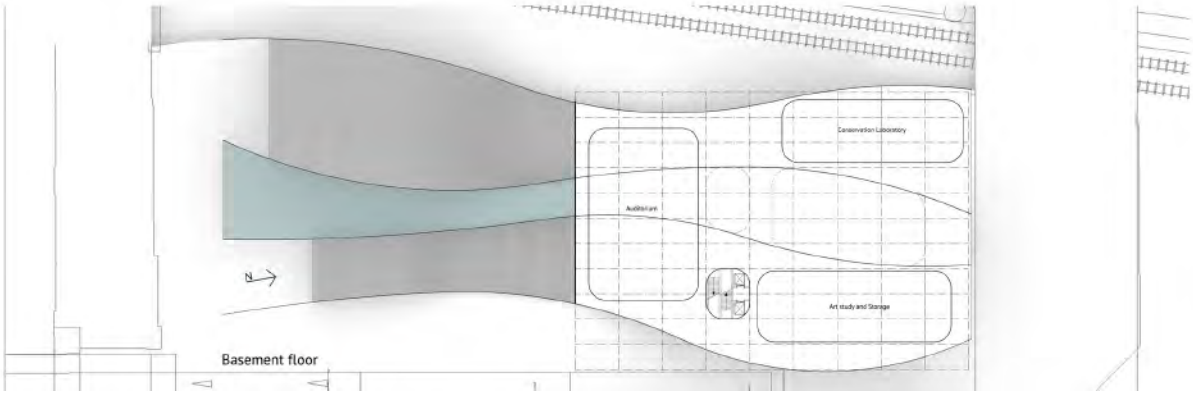

Section C
Section B
Section A
SOUTH WEST VIEW



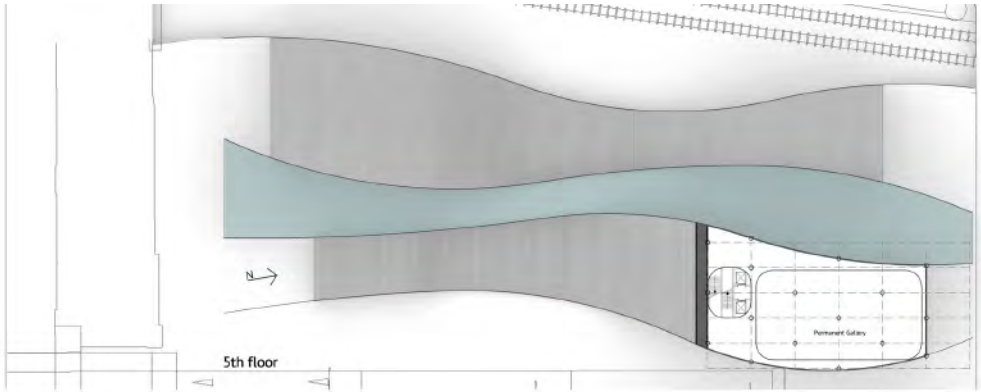
2nd floor



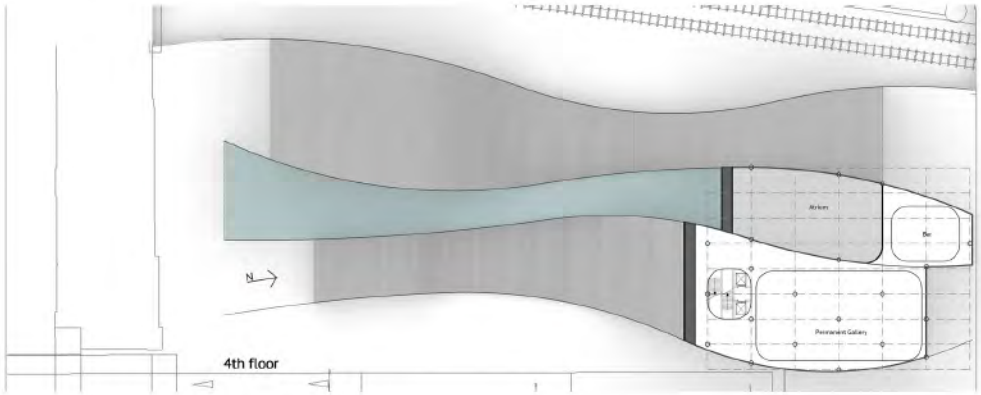
1st floor



Basement floor



5th floor



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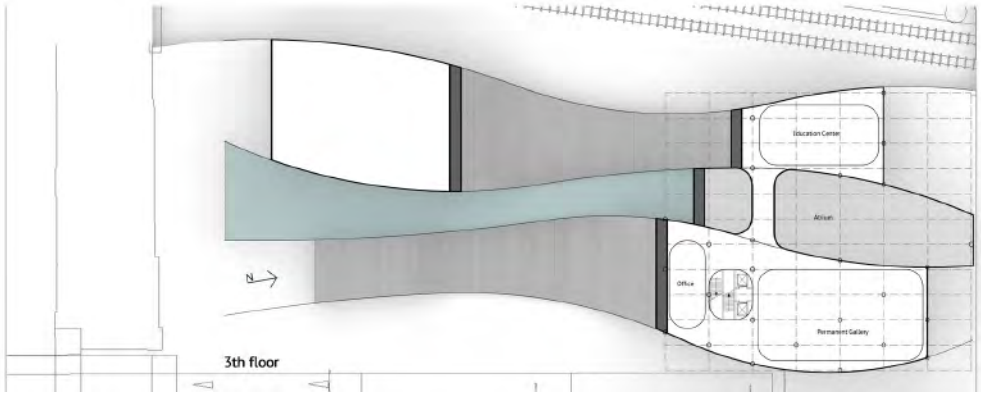
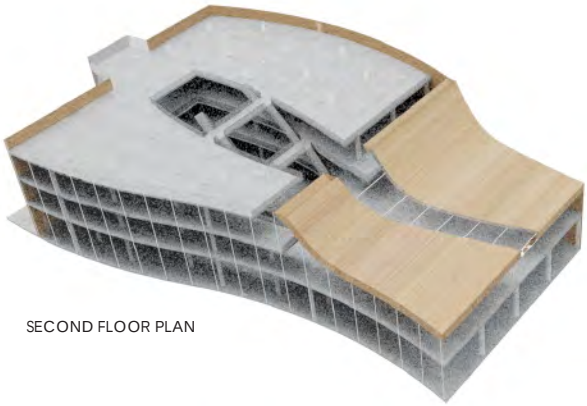
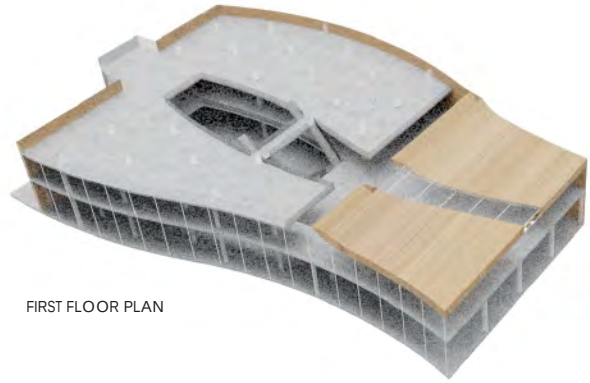


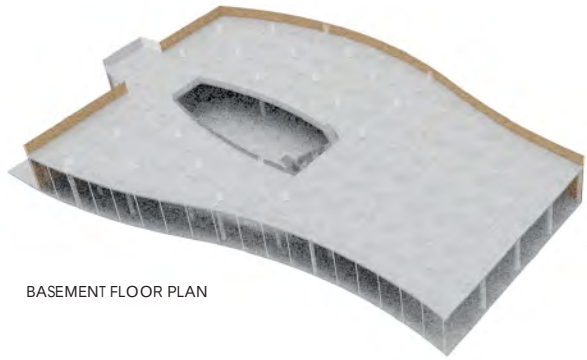
3th floor



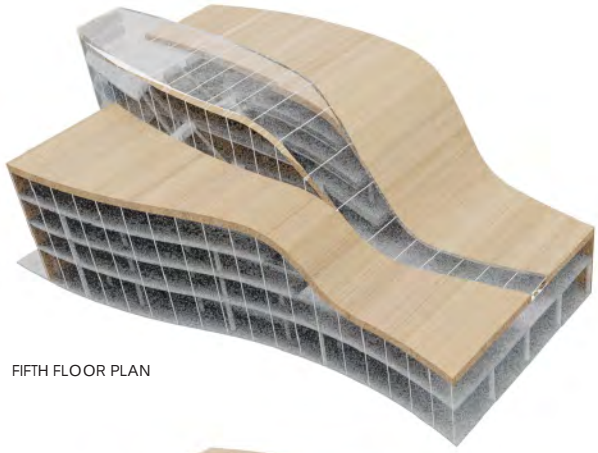
SECOND FLOOR PLAN



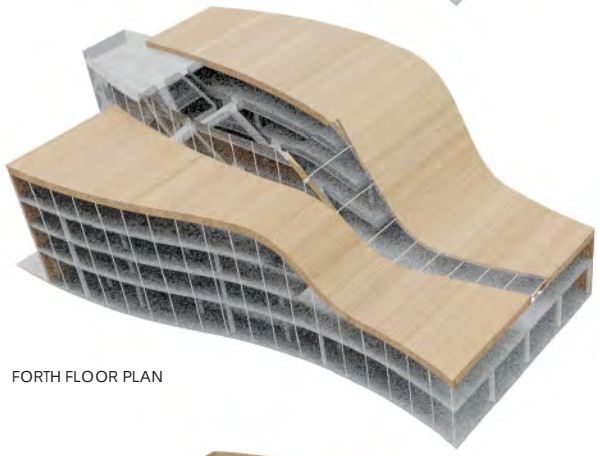
FIRST FLOOR PLAN



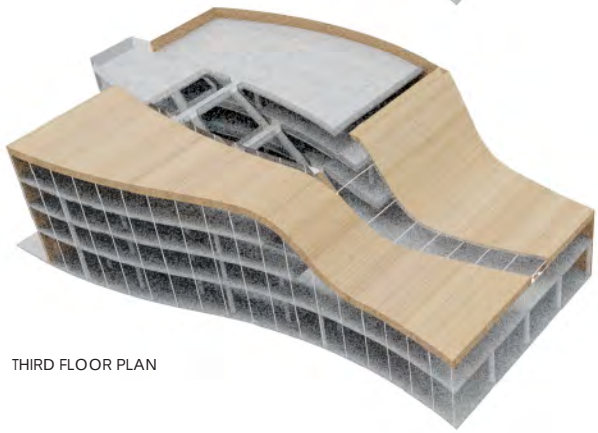
BASEMENT FLOOR PLAN



FIFTH FLOOR PLAN



FORTH FLOOR PLAN



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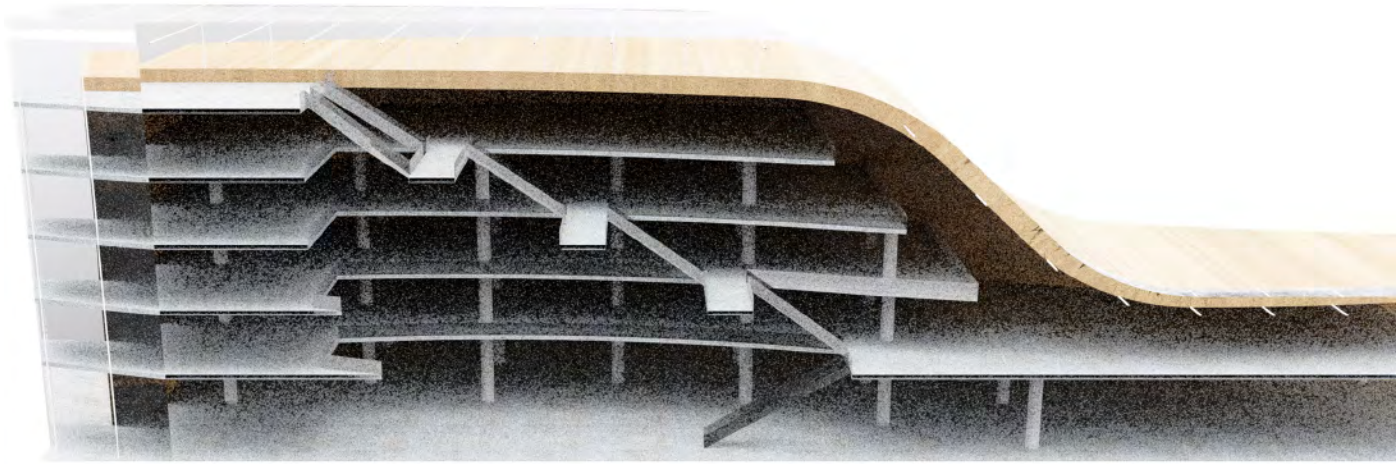

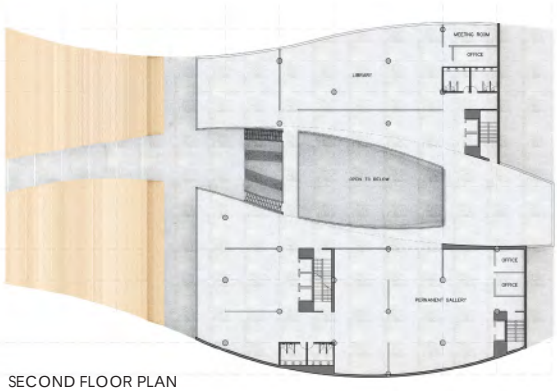

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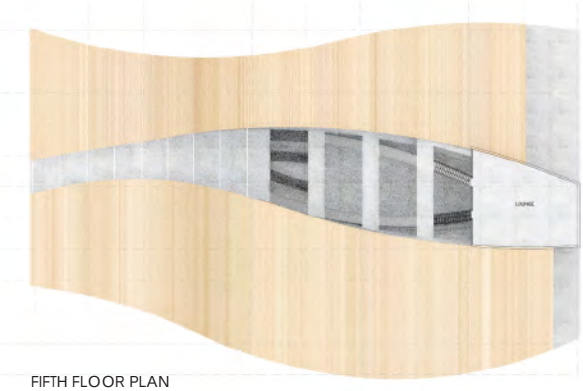

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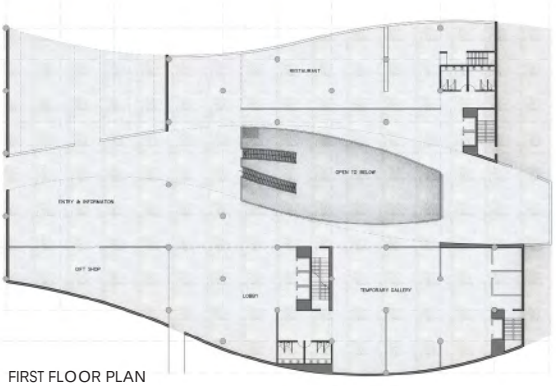

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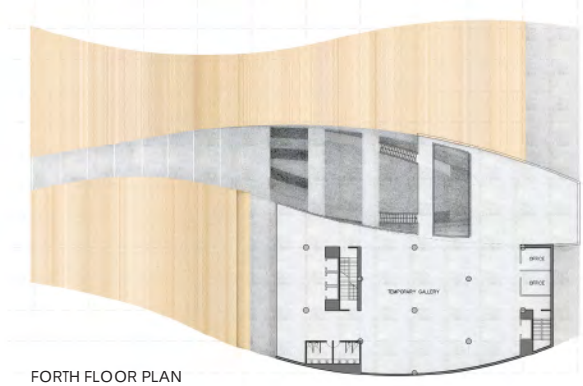

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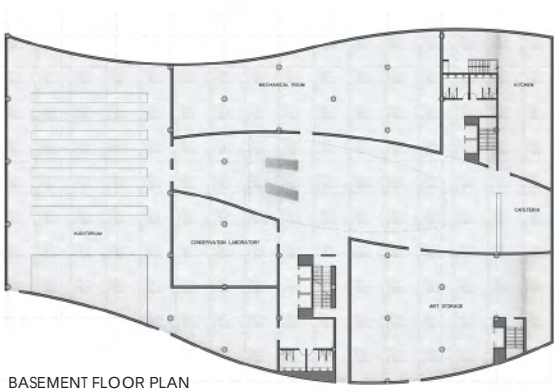
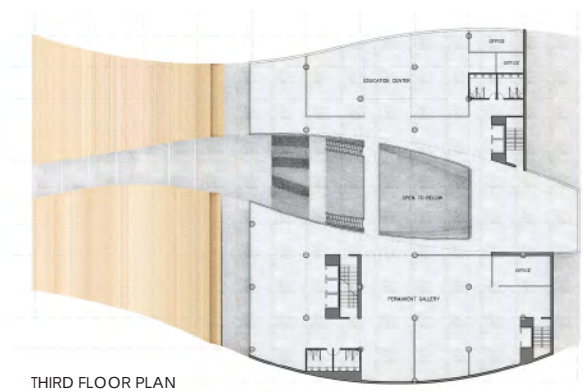


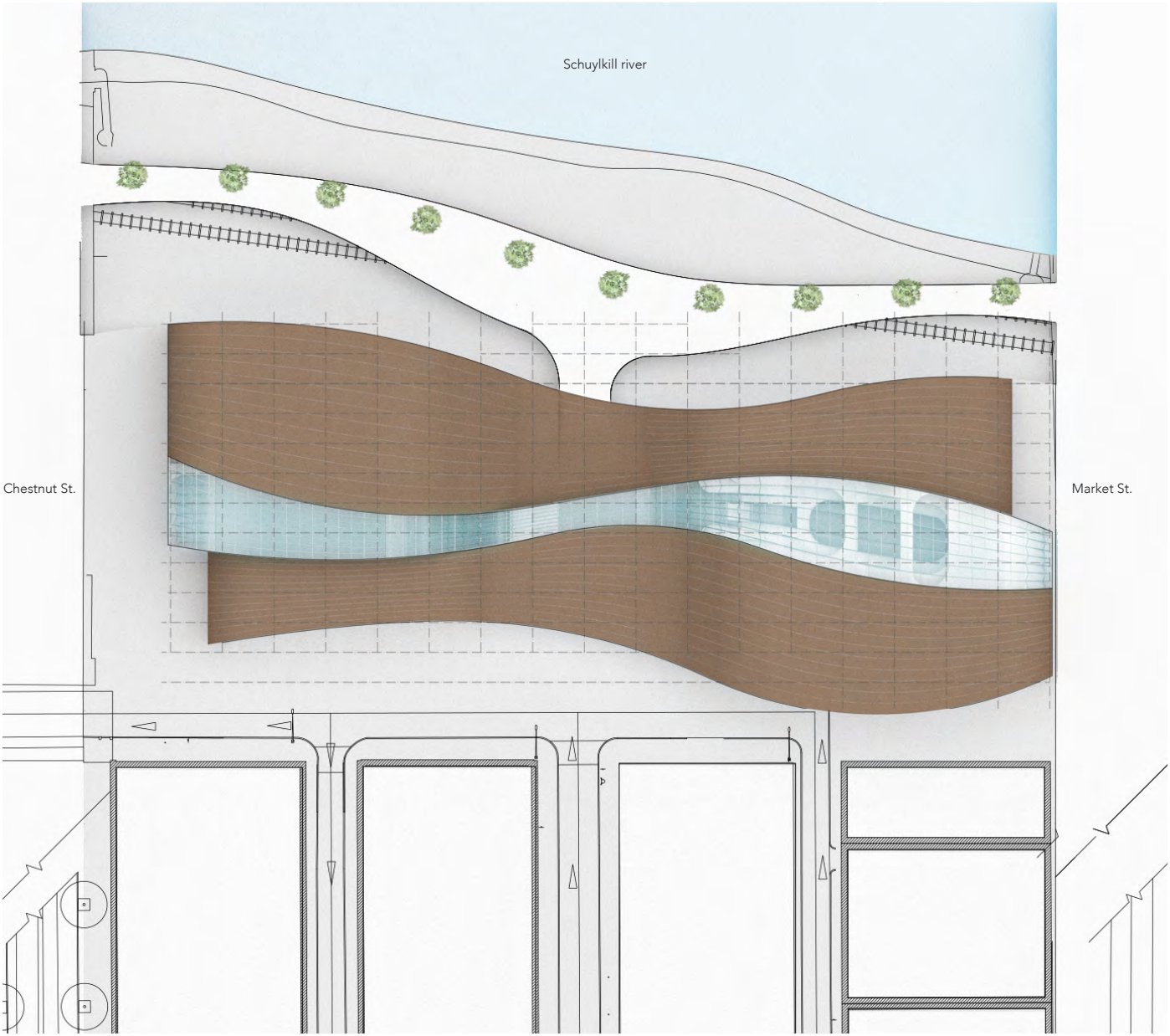
BASEMENT FLOOR PLAN



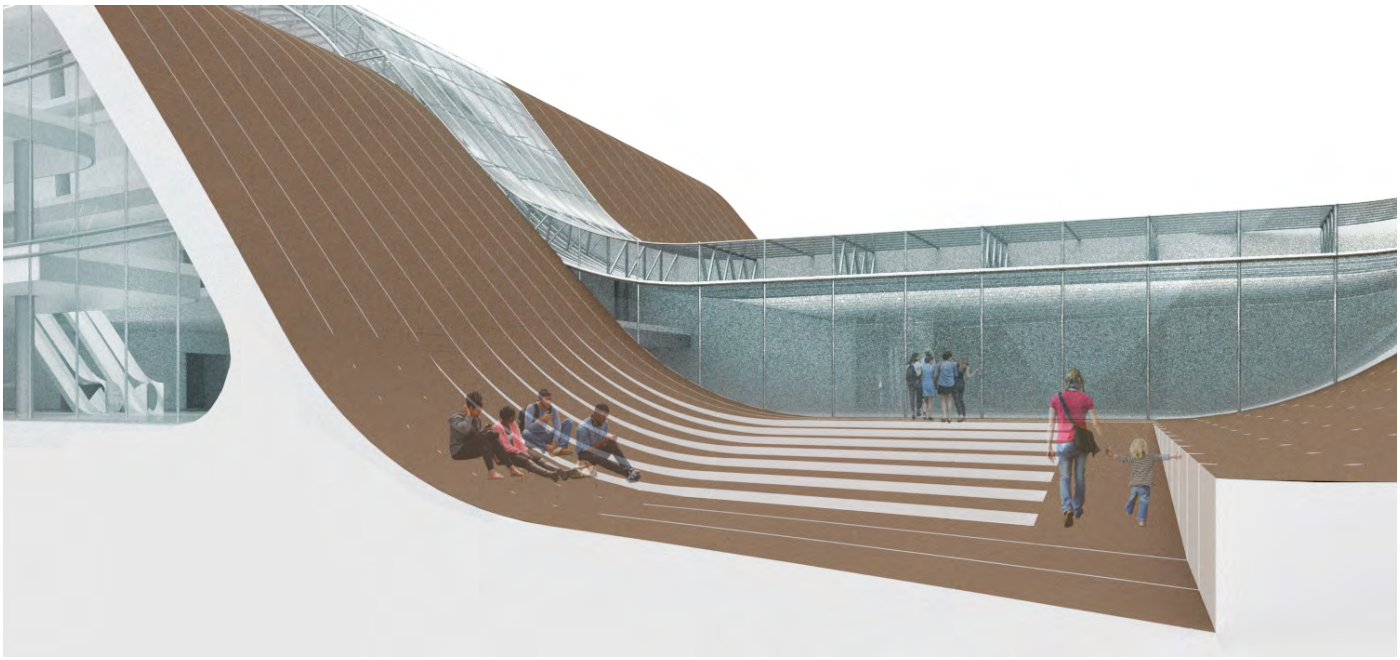
THIRD FLOOR PLAN

9 PROJECT REFERENCE SHEETS

A New Museum of Modern Art for Philadelphia

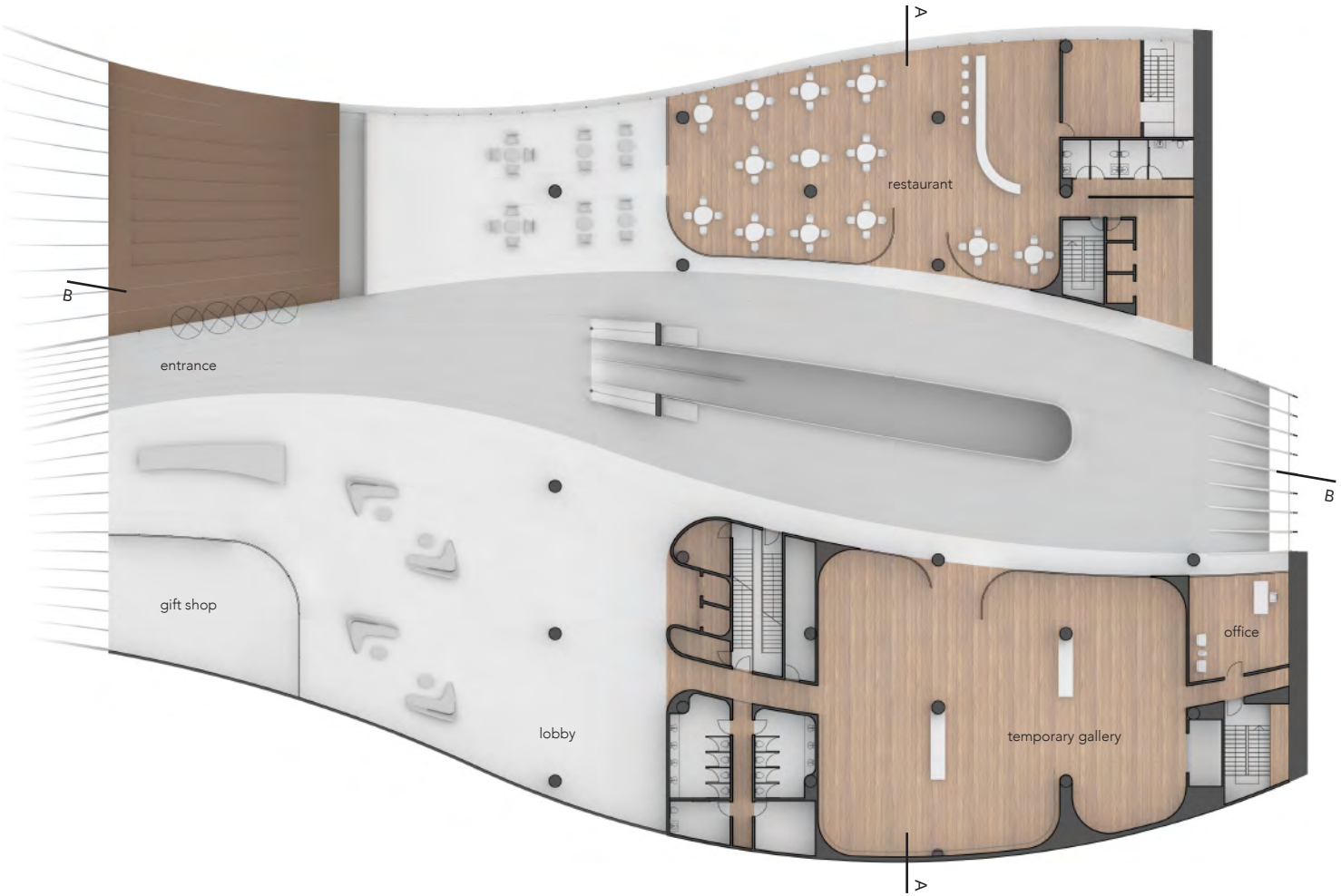


SITE PLAN 0 32' 64' 128'

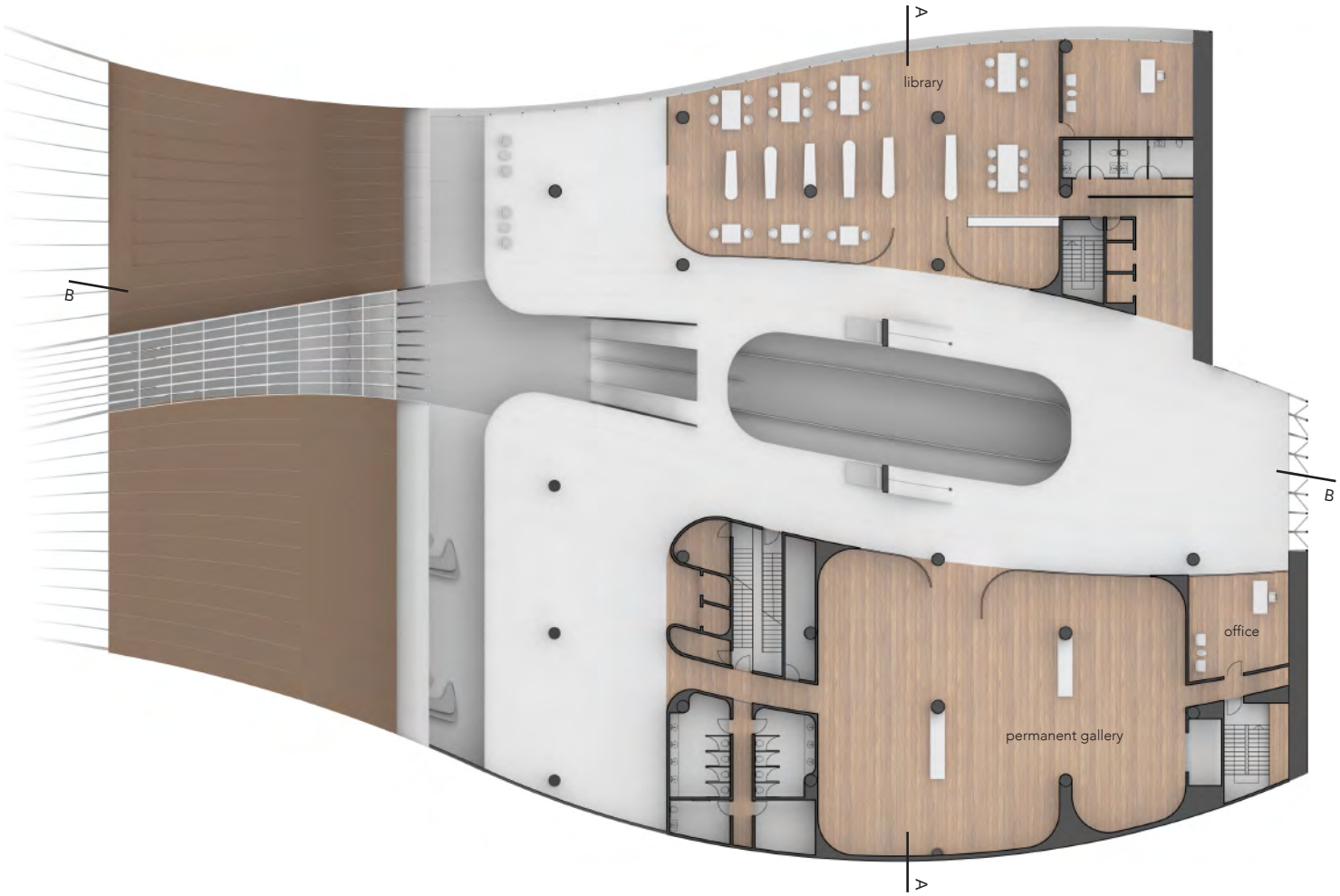


ENTRANCE VIEW

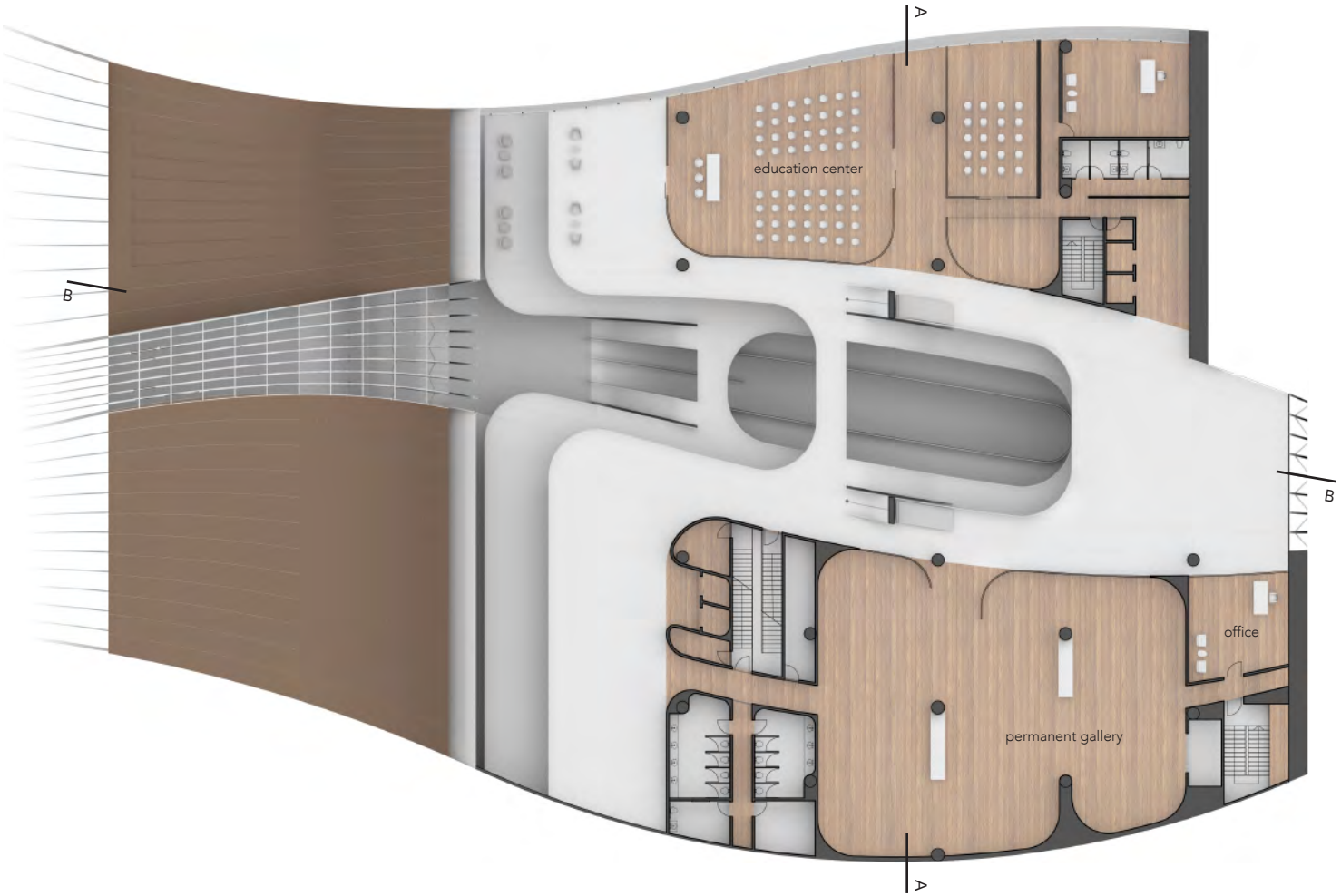
NORTH -WEST VIEW



FIRST FLOOR PLAN 0 8' 16' 32' 64'

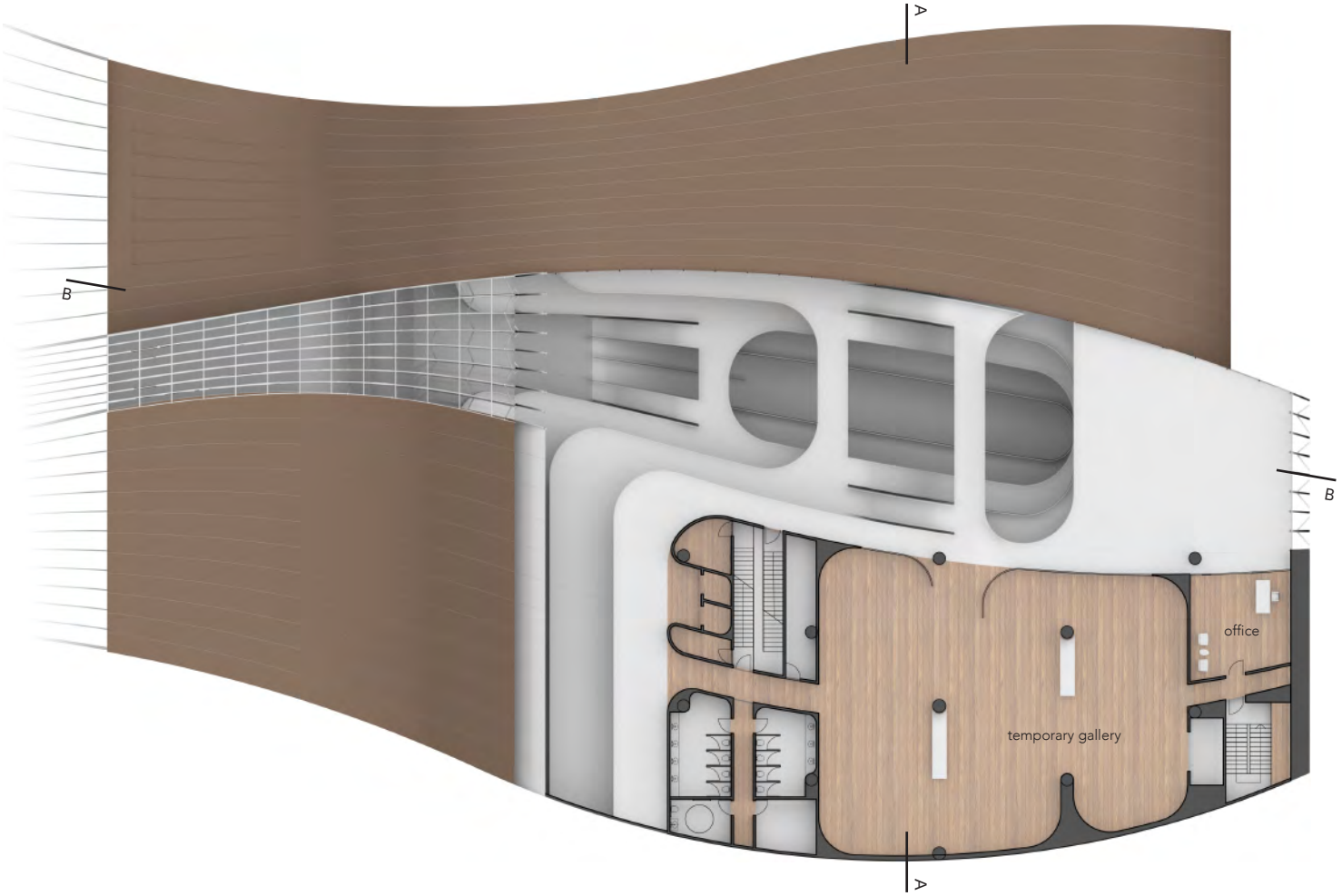


SECOND FLOOR PLAN 0 8' 16' 32' 64'



THIRD FLOOR PLAN

0 8' 16' 32' 64'

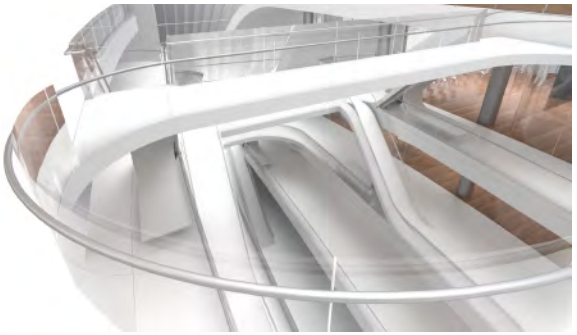


FORTH FLOOR PLAN

0 8' 16' 32' 64'

SECOND FLOOR - PERSPECTIVE

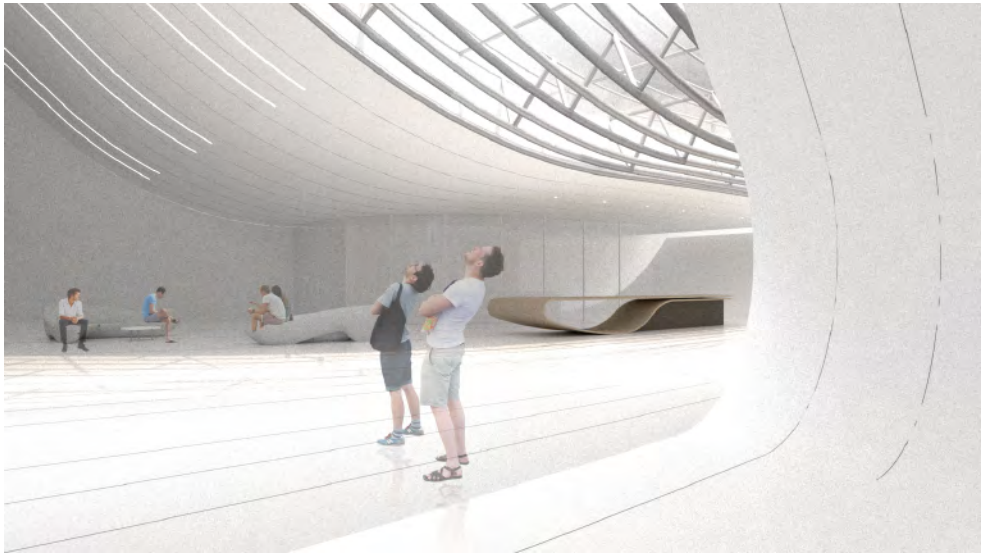
THIRD FLOOR - PERSPECTIVE



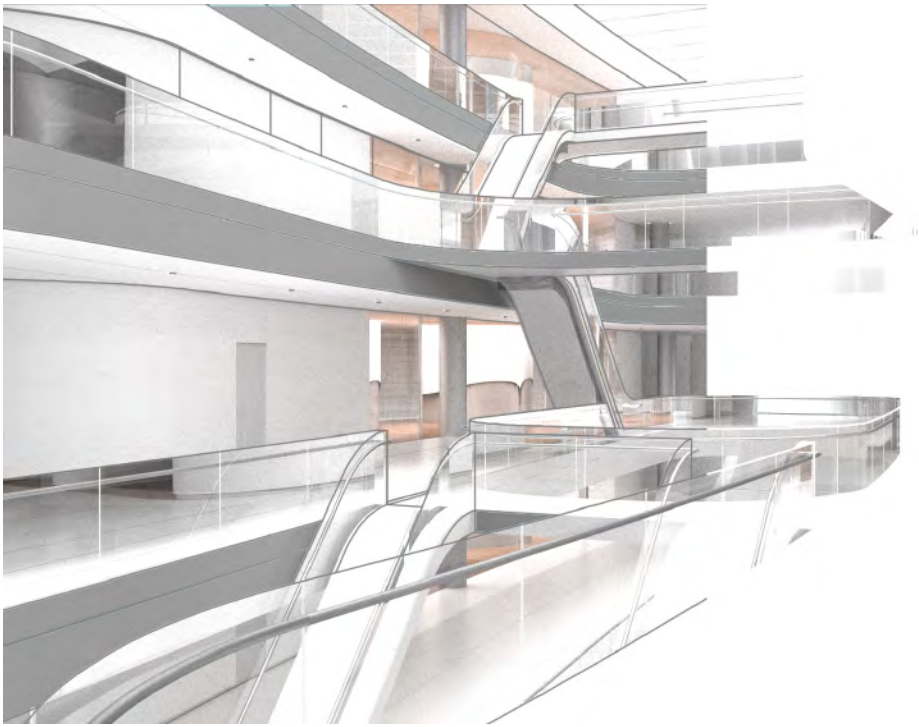
SECTION B-B

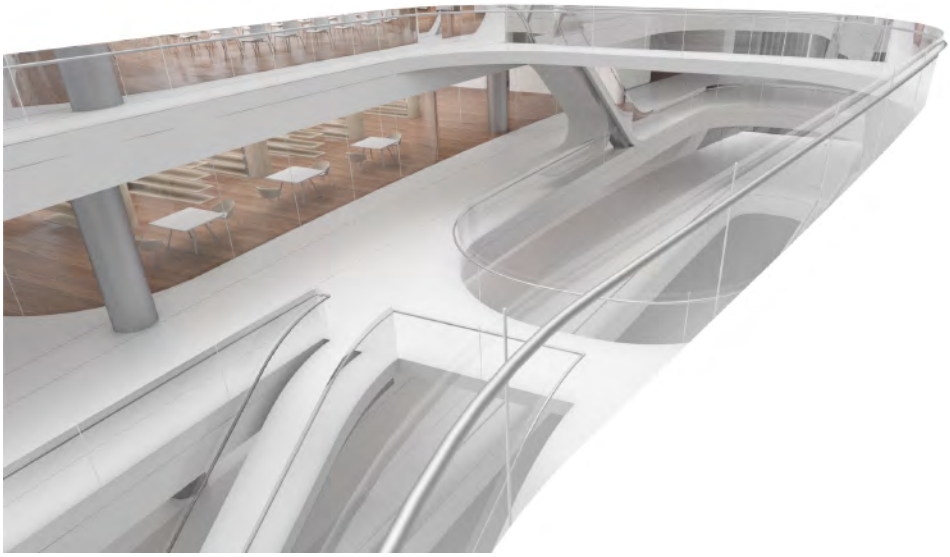
0 8' 16' 32' 64'

GALLERY - PERSPECTIVE



ENTRANCE





SECTION A-A

0 8' 16' 32'

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