Olympic Legacy: Flexible Architectural Strategies for Boston's 2024 Olympics Proposal

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ABSTRACT

The Olympics present the perfect opportunity for host cities to show their value to the world. This opportunity introduces immeasurable pressure to create an impressive display of entertainment for the spectators. The architecture and planning of the Olympic venues provide the optimal platform for countries to impress the world where the architectural forms, innovation, and technology are on full display. What happens to the Olympic venues when the events conclude? How can buildings be designed to, first of all, host the games and impress the viewers, and secondly, be used efficiently for decades after the closing of the Olympic events? Boston withdrew their proposal to host the Summer Olympic Games in 2024 due to lack of public support. This paper introduces flexible design strategies for the sports venues in Boston's original proposal that allows the buildings to be adaptively reused after the Olympic events conclude. Through site analysis and efficient design, Olympic venues can change to suit the needs of the city and its inhabitants. The event venue spectrum established for this paper places strictly temporary venues on one end and permanent venues on the other end, while flexible design strategies are a mixture of those two types. Case studies of past Olympics and individual venues (temporary and permanent) establish a set of design guidelines that influence a new model of Olympic venues. An analysis of flexible design strategies provides the adaptability that is required for Olympic venues to establish a lasting legacy.

Keywords: Olympics, flexibility, legacy, Boston, architecture, technology

Introduction

The Olympics are a global performance where athletes and spectators travel across the world to attend and participate in competitive sporting and entertainment events. Every country in the world has the opportunity to send their athletes to compete. There is immeasurable pressure on the host cities to create an impressive display of entertainment and architecture for passionate spectators. The architecture and Olympic planning present the most valuable opportunity for countries to impress the world - where the architectural forms and technological innovation are on full display. As an architectural spectacle, the social, political, and economic factors are significant. What happens to the Olympic venues when the events conclude? How can buildings be designed to, first of all, host the games and impress the viewers, and secondly, be used efficiently for decades after? Venues designed without future considerations are inefficient and can't be expected to survive. Through site analysis and efficient design, Olympic venues can change to suit the needs of the city and its inhabitants. Without losing the spectacular architecture, a new flexible Olympic typology needs to be established where buildings adapt to life after the games. The city of Boston, Massachusetts submitted a proposal to the United States Olympic Committee and was selected as the American candidate to host the Summer Olympic Games in 2024. In July 2015, they withdrew their proposal largely due to lack of public support.[1] This proposal presents the perfect opportunity to implement flexible design strategies into Boston's original plan.

Analysis of the following projects and events will establish either end of the venue spectrum (fig.1). At one end are the permanent buildings will exist in the future as they had in the past. The strictly temporary structures are at the other end of the spectrum. These projects leave no visible trace after the events conclude. The spectrum also includes annual festivals and events that can address the temporary and removeable ideas presented in this paper. These events present an opportunity to enhance the opening and closing ceremonies of the Olympics. As the events open and come to a close, the process of introducing and converting a venue to its new use can become a spectacle. At the center of the venue spectrum is the opportunity for flexible design strategies that enhance the users' experiences, integrate adaptability, and create events that will become part of the Olympic spectacle.

Through an analysis of different Olympic case studies, other large flash spectacles, and understanding what it means for architecture to be flexible, I will begin to shape new design

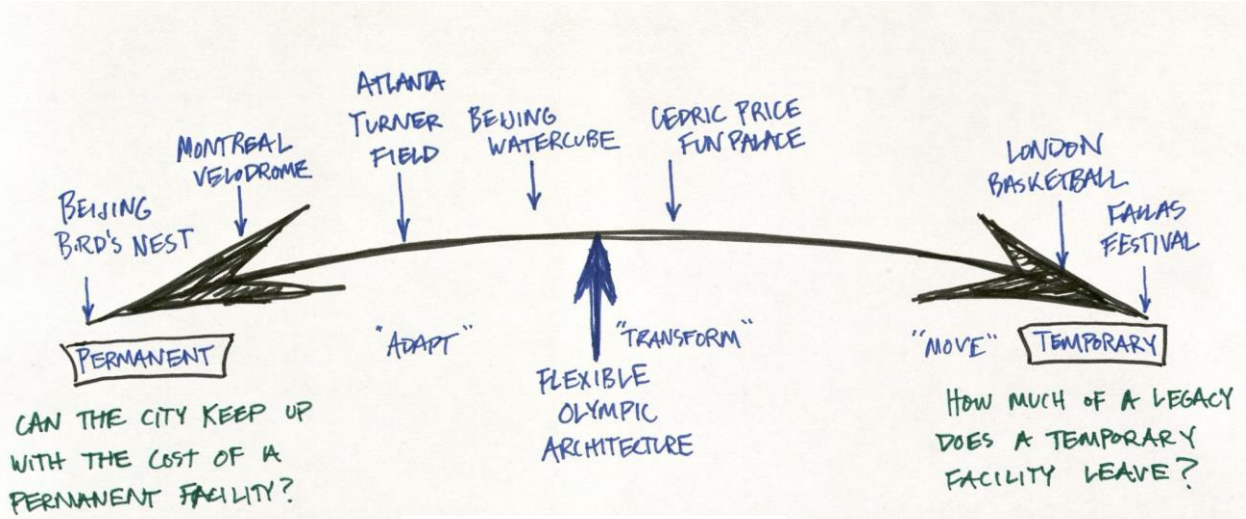

Figure 1. © Kevin Cramer, 2015

strategies for Olympic venues – strategies that will enhance the Olympic performance and provide the necessary flexibility for the future. The process will begin by documenting the successes and failures of Olympic planning in order to establish concepts that will translate from the overall Olympic scale to the individual venues. By studying buildings that cover the entire venue spectrum, the paper will establish a base for the introduction of new design ideas.

PLANNING THE OLYMPICS

Summer Games	Number of venues
1896 Athens	7
1900 Paris	14
1904 St. Louis	5
1908 London	12
1912 Stockholm	12
1920 Antwerp	17
1924 Paris	17
1928 Amsterdam	14
1932 Los Angeles	15
1936 Berlin	22
1948 London	25
1952 Helsinki	24
1956 Stockholm/Melbourne	17
1960 Rome	34
1964 Tokyo	33
1968 Mexico City	25
1972 Munich	32
1976 Montreal	27
1980 Moscow	28
1984 Los Angeles	31
1988 Seoul	31
1992 Barcelona	43
1996 Atlanta	29
2000 Sydney	30
2004 Athens	35
2008 Beijing	37
2012 London	31
2016 Rio de Janeiro	36

Winter Games	Number of venues
1924 Chamonix	3
1928 St. Moritz	5
1932 Lake Placid	5
1936 Garmisch-Partenkirchen	6
1948 St. Moritz	8
1952 Oslo	10
1956 Cortina d'Ampezzo	8
1960 Squaw Valley	5
1964 Innsbruck	8
1968 Grenoble	10
1972 Sapporo	12
1976 Innsbruck	8
1980 Lake Placid	7
1984 Sarajevo	9
1988 Calgary	9
1992 Albertville	13
1994 Lillehammer	10
1998 Nagano	15
2002 Salt Lake City	10
2006 Turin	15
2010 Vancouver	10
2014 Sochi	11

Figure 2. © Wikipedia, 2015

The Olympics are a unique event that involves the entire world. Athletes and spectators travel from all over the world to one city in order to participate. Everyone who is involved, whether they are participating or watching on television, exhibit immense pride for their country. This pride puts pressure on the host city to expose its country to the rest of the world in the most flattering light as possible. The size of the Olympic Games has grown considerably over the last 100+ years. Cities are now responsible for providing around 35 different venues to sufficiently host the Summer Olympics (fig. 2). This can be a huge burden for cities that don't have the capacity or infrastructure to provide for the people and buildings. Not only do the city's physical factors impact the planning for the Games, but so do the social, political, and economic. A city that has financial stability and a thriving economy has a much better chance of gaining long-term success from the Olympics than one that doesn't. Many cities attempt to use the Olympics as a boost to their economy. In many cases, this does not work. The adaptability of the venues is something that a city can have more control over than the status of the economy. Political instability is another issue that some cities/countries face when hosting the Olympics. All of these factors need to be taken into account when the city plans for the Olympic Games.

Adolf Hitler's Berlin Olympic Games in 1936 was one of the earliest Olympics to use the events as a way to showcase the country's wealth and power. Hitler had just come into power, so he wanted to display Germany as a country that had been reborn after the First World War.

While his corrupt intentions were hidden behind the veil of the events, the precedent was set.[2] Olympics from then on were advertised as opportunities to showcase a country's wealth to the rest of the world. The Olympics would become a global spectacle. This intense pressure to impress the rest of the world became a big problem for host cities. Instead of spending the money on infrastructure and buildings that would benefit the country for the future, it was wasted on unusable Olympic venues.

One of the most unsuccessful Olympics was the Summer Games of 2004 in Athens, Greece. Greece's economy was failing and so when Athens spent $12.2 billion on the Olympics, which was almost double what they budgeted for, the economy completely crashed. There wasn't proper planning for what to do with the venues after the Olympics were over, so the majority of them are unused and falling apart. This colossal waste of money was the nail in the coffin for Greece's economy.[3] Flexible building technologies would not have saved Greece's economy, but they would have prevented the venues from becoming visible metaphors for the state of the country's economic stability.

The Barcelona Olympic Games of 1992 are widely known as one of the most successful Olympics in history. It propelled the Spanish city into one of the most popular cities in Europe. The designers of the Barcelona Olympics were very clear and direct with their design intentions – How can we improve the city? "The Olympic areas within the municipal boundaries of Barcelona were located in sectors of the city whose urban development would resolve a number of large scale problems which had been apparent for some time, and would, moreover, occupy sufficiently clear strategic positions as to produce an osmotic expansion outwards into many adjacent sectors."[4] There were four main locations that were identified as where the focus should be placed. These four locations were then connected with public infrastructure to enhance the city's circulation. Barcelona recognized that by focusing on these four areas, it would not only maximize the Olympic experience, but would improve the city greatly.[6] This idea was made the priority for the Olympics. The designers sought to identify the areas of the city that needed rejuvenation. The Olympics were the perfect opportunity to pour money into these important areas of the city.

Barcelona was presented with a perfect opportunity. They didn't get absorbed in the publicity of the Olympics by investing in the spectacle alone. They seized the opportunity to improve their city and created a model for future Olympics. The Barcelona Olympic Games of 1992 provide a successful example of Olympic planning. The money that goes into the events needs to have priorities other than the two months that the world is watching. This will allow the city to establish a beneficial use for an Olympic venue after the games have concluded.

The overall planning of the Olympics contains certain venue requirements. The city is required to have proper facilities for over 300 events and almost 11,000 athletes. Many of these events are not widely popular on their own, so how can the city provide adequately sized venues for the Olympics, but also have a plan for the venue after the events conclude? By analyzing case studies of past Olympic venues, this paper will introduce problems with the current model of Olympic stadium/arena design. What have Olympic cities already done? For new venues, Boston plans to use entirely temporary structures. What legacy does that leave? And what goes in its place when it is removed?

2012 LONDON OLYMPICS – BASKETBALL ARENA

This was a temporary structure that hosted the basketball events in the London Olympics of 2012. After the events concluded, the arena was disassembled and returned to the manufacturer. A problem that faces cities that use temporary structures is: what legacy does this temporary structure leave? Can the Olympics still be successful by using only temporary structures where necessary? (fig. 3).

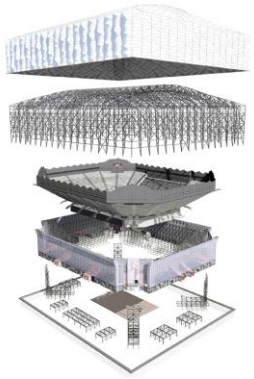

Figure 3. © Wilkinson Eyre Architects, 2012

1976 MONTREAL OLYMPICS – MONTREAL VELODROME

The Montreal Olympics of 1976 were very grand. The architecture for the Olympic park was fascinating. The main Olympic stadium, the natatorium, and the velodrome were all constructed of large curving concrete forms. These forms were so complicated that they were almost not completed. Arguably, the most incredible of the buildings was the velodrome. The venue was a "…5,900-seat cycling stadium in the form of an upturned shield."[7] The roof had a main span of 560 feet. This span was achieved by using a single, low concrete arch with transverse ribs bringing the building to the ground. In between the ribs were panels of glass, which gave the space tremendous amounts of natural light.[5]

As with many Olympic projects, the velodrome became a problem after the events were over. What was Montreal going to do with a $70 million stadium that was five times the original budget?[6] That is a very expensive cycling track. The major problem is that track cycling is not a popular sport. The costs to maintain this building would be much higher than what Montreal

could gain from hosting events there. Without a plan for the stadium after the Olympics were over, Montreal was presented with a huge problem.

Figure 4. © Montreal Biodôme

In 1989, Montreal announced that they were going to renovate the velodrome into a "biodome". The renovation would introduce exhibits of different ecosystems from around the world. With the shell of the building already built, the renovation was quick and easy. The biodome opened in 1992.[7] The spaces on the interior were placed without constraints because of the massive open area created from the large concrete spans. It was an easy changeover, but still not an efficient use of the space.

The success of the design of the Montreal velodrome could have benefited greatly from efficient pre-planning. When the city of Montreal and the architect were planning this stadium, there needed to be a discussion of what this stadium can do for the city after the Olympic games are completed. Can this building change and adapt itself to a use that will benefit the city? The biodome has turned out to be a very successful institution, but could there have been a more effective use of the design?

2008 BEIJING OLYMPICS – WATERCUBE NATIONAL SWIMMING CENTRE

The 2008 Beijing Olympics were one of the most expensive summer games ever. The total cost tallied to $42 billion, with $500 million of that going to the "Bird's Nest" Olympic Stadium.[8] Among the less expensive venues, at $51 million, is the "Watercube", which held the aquatic events for the games.[9] An Australian architecture firm, PTW, designed the building to be "visually striking, energy efficient, and ecologically friendly."[10] While the design is spectacular, Beijing was presented with the problem of having an Olympic-sized swimming venue without a post-Olympic need. PTW's simple, yet striking design of the form and structure allowed Beijing to convert it into a different use. Immediately following the Olympics, the building underwent a renovation to convert half of the building into an indoor waterpark.

PTW's design of the envelope of the building is modeled around the traditional Chinese square and its appearance is emulating soap bubbles.[12] These simple and unique design concepts are the strengths that allow this building's flexibility. The strengths of the envelope are what make this building successful. The venue's shape allows for unlimited flexibility. The simple box shape enabled its adaptation into a waterpark once the games were over. The exterior façade is made up of ETFE (Ethylene tetrafluoroethylene) panels.[11] The panels are very energy efficient and transmit light very well. Because of the well-designed exterior envelope, there was no need for exterior alterations when the venue was renovated. All of the alterations happened in the interior. The interior waterpark was designed by architectural firm, Forrec, and completed in 2010.[13] The original design of the water cube allowed for the waterpark to be seamlessly incorporated into the existing shell. The ETFE paneled façade turns into the building at the main entrance then turns again to shape the main competition hall. This façade gesture arranges plan into sections that can be easily converted to a different use.

Figure 5. © Lara Farrar/CNN Go

It has become very successful as a community building and a tourist attraction. This is in stark contrast to the problems Beijing is facing with the "Bird's Nest" National Stadium. The stadium does not have regular users and the maintenance costs are incredibly high.[10] It is another unique design that became the symbolic image of the 2008 Olympics. How can a building that provided so much for the games become something so insignificant? Beijing was able to establish a future for the Watercube. They were provided with the opportunity and flexibility by the designers. We can't say that with the Bird's Nest.

Is the new waterpark worth the $51 million dollar price tag? Aesthetically, the building is fascinating, but when it gets down to it, Beijing has a $51 million waterpark. Will the city be able to get any return on that? It is hard to estimate questions like these, so how do we judge the success of a building like this? The waterpark is experiencing high attendance, but is that good enough? What is the correlation between original cost and future programming? Can cities justify spending that much money on a waterpark? Flexible architectural design strategies will help answer some of these questions.

Each of these case studies establishes all of the different factors that impact the design of an Olympic sports venue. Does a temporary facility leave any legacy? Does the city have a use for a permanent structure? Can a permanent be adapted programmatically? Structurally? Both programmatically and structurally? What aspects of architectural flexibility become part of the spectacle of the Olympics? Flexible architecture can begin to provide answers to these questions.

THE FALLAS FESTIVAL – VALENCIA, SPAIN

The Fallas Festival in Valencia, Spain is a wonderfully simple and exciting event that is held every year in March as a celebration of art and entertainment. The fallas are wooden sculptures that all the participants create with their own theme (fig. 6). The sculptures are typically a "…satirical and ironic vision of local, provincial, national and even international problems and themes."[9] There are two categories of fallas – the adults and the children. Each category votes for their favorite falla, and a winner is selected. There is musical entertainment, food, art, and fireworks. The fireworks are an especially important piece of the festival. Each morning the people set off fireworks in the streets to wake everyone up for the day. At the end of each day, there are large firework displays, with the largest one being the "Nit del Foc" (Night of Fire).[12]

The Fallas festival can be described as a celebration of art and fire. The culmination of the entire festival is the closing ceremony called "La Cremá". In the evening of the final day, all of the fallas are burnt in a fantastic display of fire (including the winners). All of the fallas are placed out in the streets and burned leaving only a black stain on the street (fig. 7).[13]

Figure 6. © Valencia City Guide

The Fallas Festival thrives on the performance. Similar to the Olympics, the festival takes place in a short amount of time. The size and scale of the two are vastly different, but the intentions are synonymous - to impress the spectators. What happens to the built forms, constructed specifically for these events, after the events have concluded? In order to leave a lasting Olympic legacy, the majority of the Olympic venues are designed to last for a long time. Conversely, the Fallas Festival is at the other end of the spectrum. When the festival is closing,

the instruments of entertainment are burned leaving no trace, which becomes part of the spectacle. Can Boston take cues from the Fallas festival and incorporate the flexibility of the venues into the closing ceremonies?

Just like the Fallas festival, the Olympics are entertainment. They differ, though, in their solutions to the question – What happens to the built forms when the events are over? The Fallas festival simply burns it all. Valencia leaves no trace. The Olympics leave behind large stadiums and event halls; that are sometimes used permanently and sometimes go relatively unused. I want to eliminate the possibility of a venue going unused. How can a building house an Olympic event and then dramatically change its form and use once they are over? The changeover can become part of the Olympics. It can become its own version of "La Cremá". Instead of burning or demolishing it, can the building be converted to a different use? Maybe, the Olympics leave absolutely no trace – like the Fallas festival.

FLEXIBLE ARCHITECTURE

For each of the case studies, we can place them into different categories of flexible architecture, as defined by Robert Kronenburg in his book, *Flexible: Architecture that Responds to Change.* Kronenburg breaks flexible architecture into four categories – Adapt, Transform, Move, and Interact. "Adapt" is a type of building that is easily converted into a different use. It is here that we can place the Beijing water cube and the Montreal velodrome. Major structural renovations were not needed in order for these buildings to be adapted to a different use. Kronenburg's "Move" is a typology that is completely temporary. The architecture can be packed up and moved to a different location and reassembled. While the Fallas festival's sculptures are not designed to be re-located, they are still completely temporary.[14] The London Basketball Arena is designed to be disassembled, packed up, and moved to storage or a new location. Olympic architecture needs to be inserted into the "Transform" category. Here is where the buildings can take strategies from both ends of the spectrum. The venue can have the permanence to fill a need for the community and establish itself as part of the legacy left behind by the Olympics, while also becoming part of the spectacle when the transformation happens. The venue will be able to morph itself into a new program and use. This is the solution that can establish a new Olympic venue typology.

The British architect, Cedric Price, believed that a building would always outlive its program, so in order to be useful, it would need to be able to adapt itself to the changes. He said that the architect must "acknowledge the impossibility of totalised planning, and build in a

degree of indeterminacy to allow for uncertainties in program, obsolescence and complete changes of use throughout the life of the building."[15] His design of the Fun Palace in London was about leaving the arrangement of spaces in the building up to the people who use it. The permanent steel structure held programmed spaces that moved along the structure according to the user's preference. There is an opportunity to use this idea with Olympic venues. This will allow the building to have multiple uses and be influenced by the users. The building will have permanence to establish a legacy from the games.

The building needs to be able to adapt to the people. This is where the opportunity lies. Giving the control to the people is the ultimate form of entertainment – and flexibility. The people have the opportunity to decide what the building looks like and feels like. Through data collection technologies, the designers can collect movement patterns, sightlines+, program, and many other things in order to transform the Olympics throughout the entire event. The building can start out in one form, then as the events that it hosts change can physically morph as people use it. Throughout the entire Olympic Games, the building can collect information that will allow it to accurately and efficiently morph into its final form that will bring the Games to a conclusion.

Current stadium design technologies allow for a wide range of flexible options. The retractable roof has become a very popular component to baseball stadiums built in the United States. The Miami Marlins baseball team, located in Miami, Florida has a stadium that utilizes a retractable roof. The roof is composed of three panels that span 560 feet with a total area of 338,000 square feet. The roof travels approximately 750 feet in 13 minutes. With a weight of 19 million pounds, the roof requires significant structural and mechanical technology in order to safely operate.[16] This dynamic feature provides evidence that the technology required for the transformation of Olympic venues is there. Architects can harness this mechanical technology into a plethora of different ideas: operable wall panels that can open up entire stadiums into public spaces or collapse into dividable smaller spaces. Flexible architecture becomes a mechanical problem.

CONCLUSION

The Olympics are designed to be a celebration of athletics and national pride. A very important part of the celebration is the architecture of the venues that host the events. A new Olympic typology needs to be established in order to prevent buildings from decay and neglect.

What happens to the venues after the Olympic games are over? To answer this question, we need to look toward flexible architecture – architecture that transforms into something new once the events have concluded. It is a mixture between an entirely permanent design and an entirely temporary design. Olympic venues need to be dynamic structures. They need to be able to adapt to life after the Olympic Games. Flexible architecture can change its appearance and program. Boston has a unique opportunity to include this transformation in the Olympic ceremonies. Then, the architecture becomes part of the spectacle.

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ADDENDUM

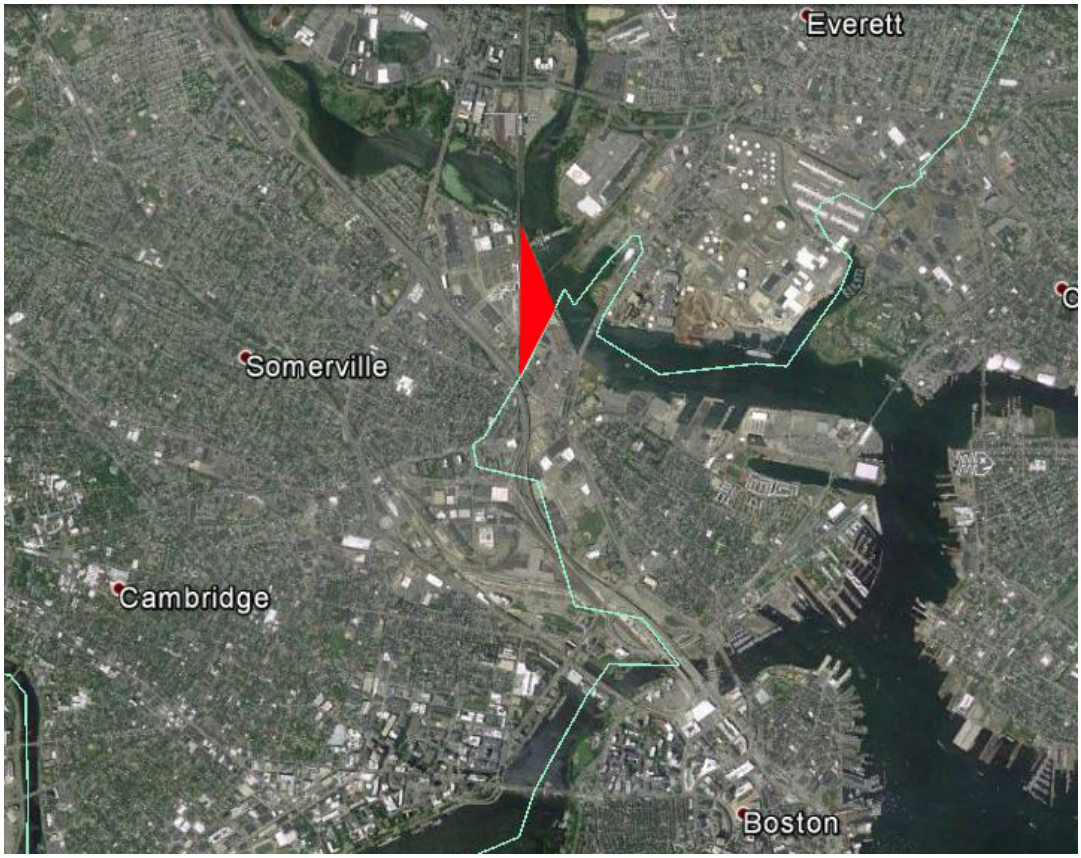
The written thesis was a preliminary discussion on what exactly this thesis was going to do. I wanted to present the problems and allow the design process to tease out solutions to those problems. The whole thesis was a process of presenting different ideas that allow sports arenas and stadiums to respect the societies that they are intervening within. This is not a finished thesis. The process of exploring different options for sports facilities should not and will not be completed with the printing of this document. I feel strongly that the way that society views sports design will not change if architects don't present alternatives. There are solutions out there and I think that this thesis begins to introduce new ways of thinking that can lead to better solutions to accommodating sports facilities.

The design of the velodrome facility in Boston really presented a challenging narrative. How do I treat the problem of flexible architecture? Is it an architectural problem or a mechanical problem? Through the site analysis and initial design phases, I treated the project as an architectural problem. The design consisted of permanent and temporary parts that were sculptural and looked like traditional stadium designs. The ways in which the design was going to break down and morph into different spaces started to get lost behind the formal design. It wasn't until I was told I needed to stop thinking architecturally and think mechanically. The design of flexible architecture became more about the mechanical problem than the formal and architectural problem. I think this design addresses the large scale breakdown of program and space, but the smaller scale flexibility has yet to be fully developed. The small scale mechanics of the design's moving parts are also underdeveloped. The details of structure and mechanics would be a "next step" issue.

My thesis is a neverending process of ideation and exploration. I plan to take this thesis into the future and develop more ideas about mechanical solutions to a mechanical problem. The idea of stadium flexibility is something that needs to enter the sports discussion. The ideas presented in this thesis are intentionally aggressive, but I think that is how we can begin to expand and adapt our thinking towards traditional sports facility design. I believe that flexible designs are the future of sports architecture, so this thesis can help begin the discussion.

PROCESS WORK

SITE ANALYSIS - BOSTON, MASSACHUSETTS



SITE ANALYSIS

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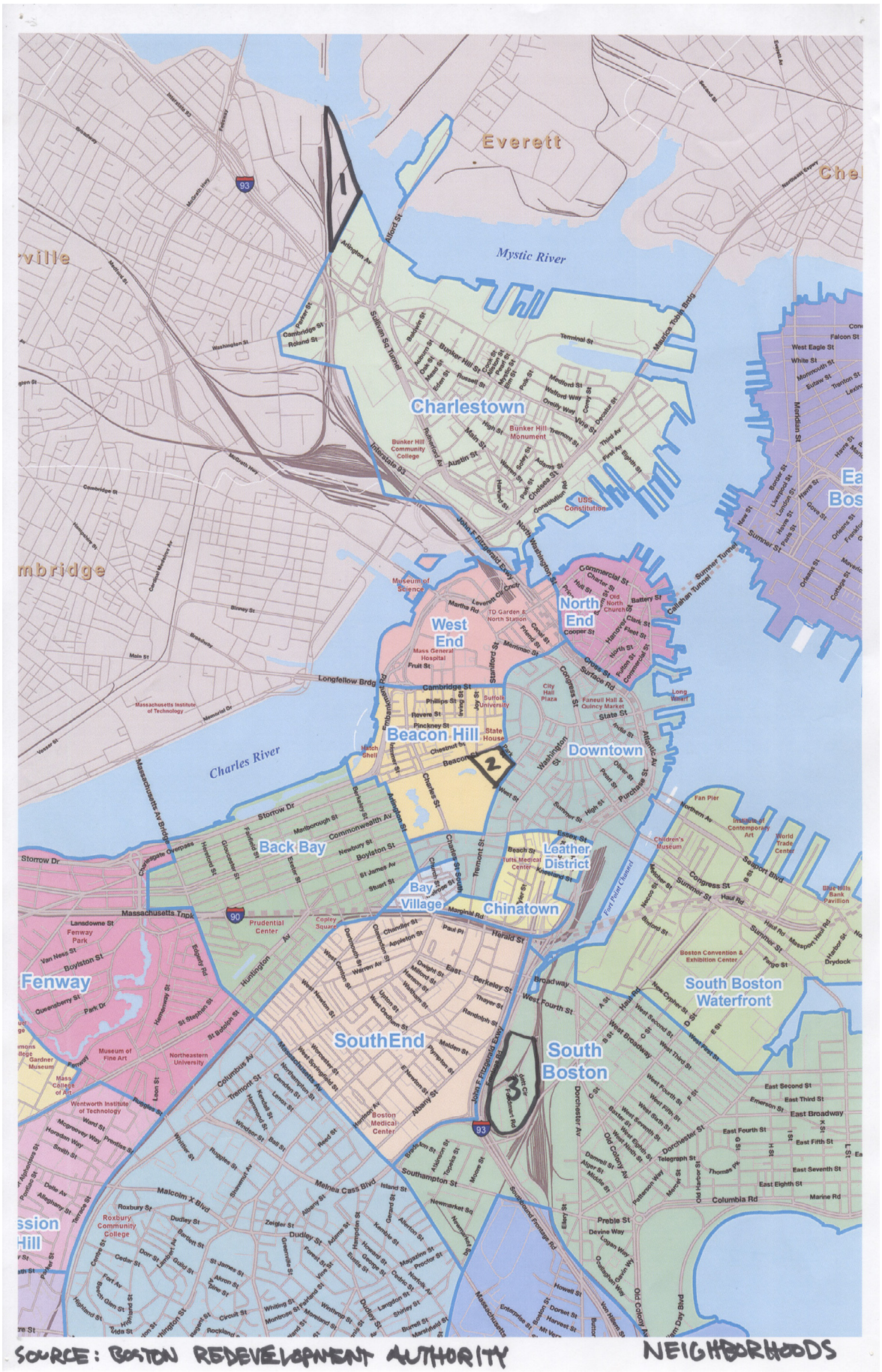

SITE ANALYSIS

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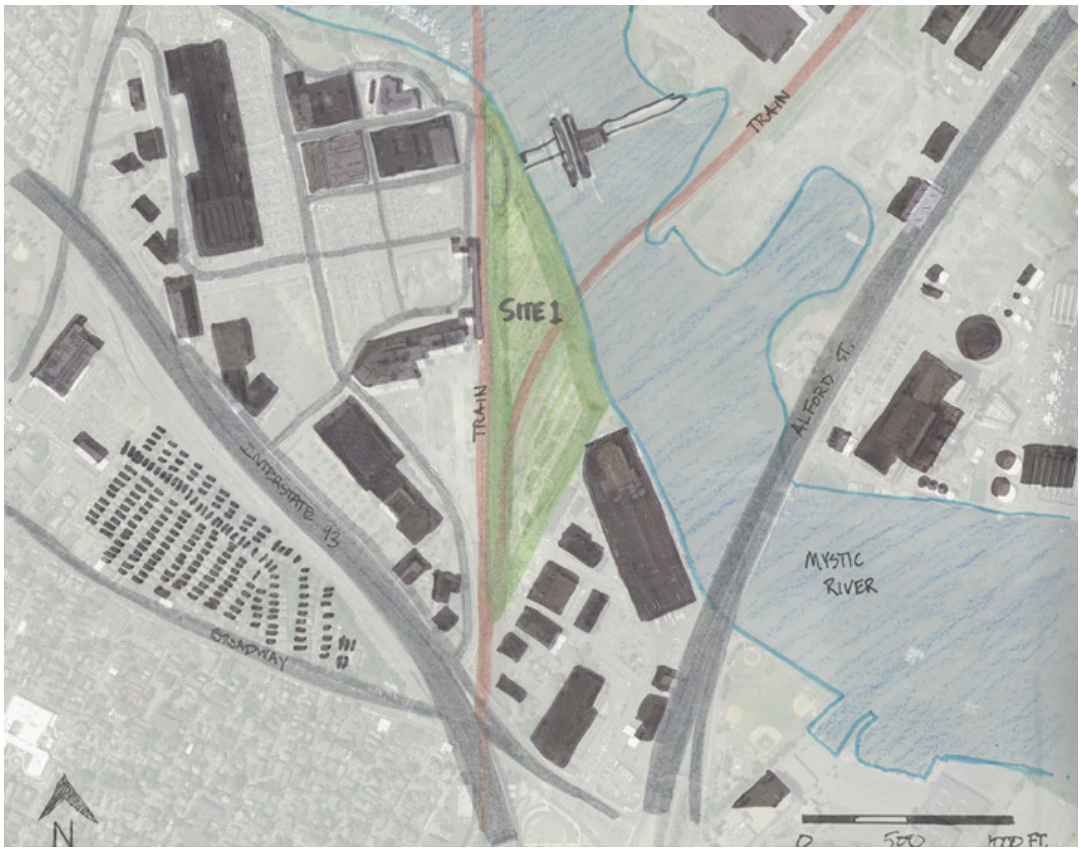

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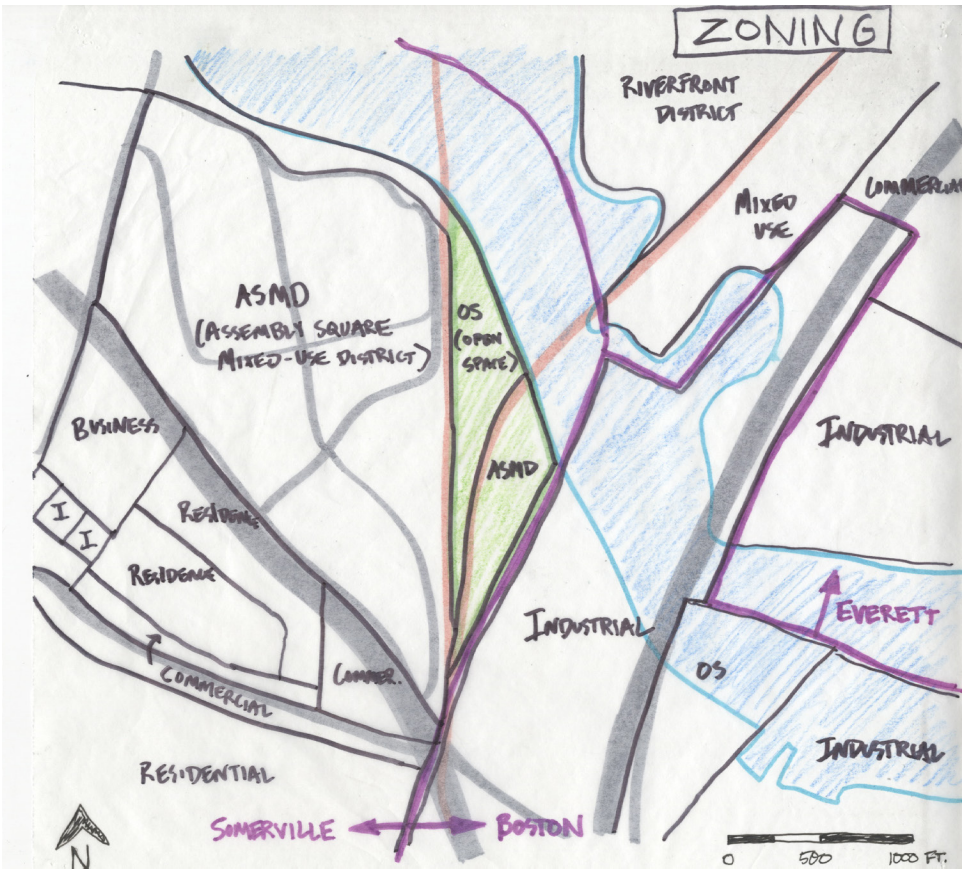

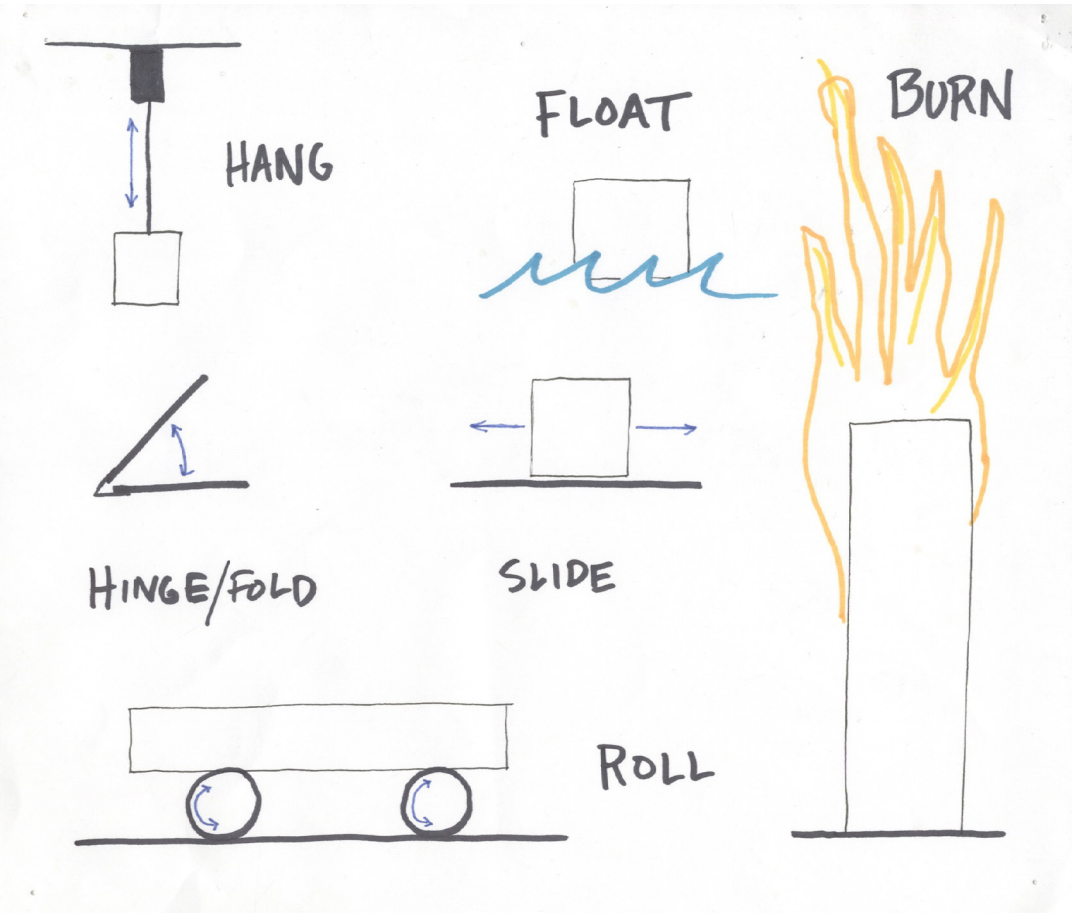

SITE ANALYSIS

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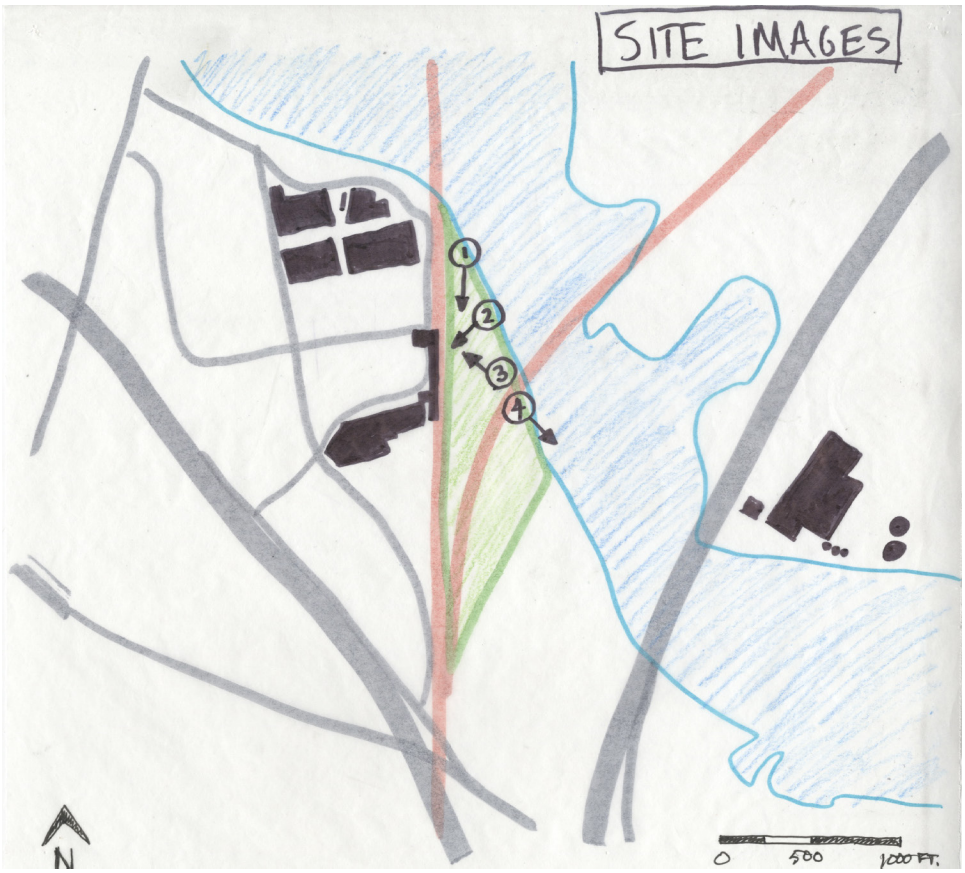


SITE ANALYSIS

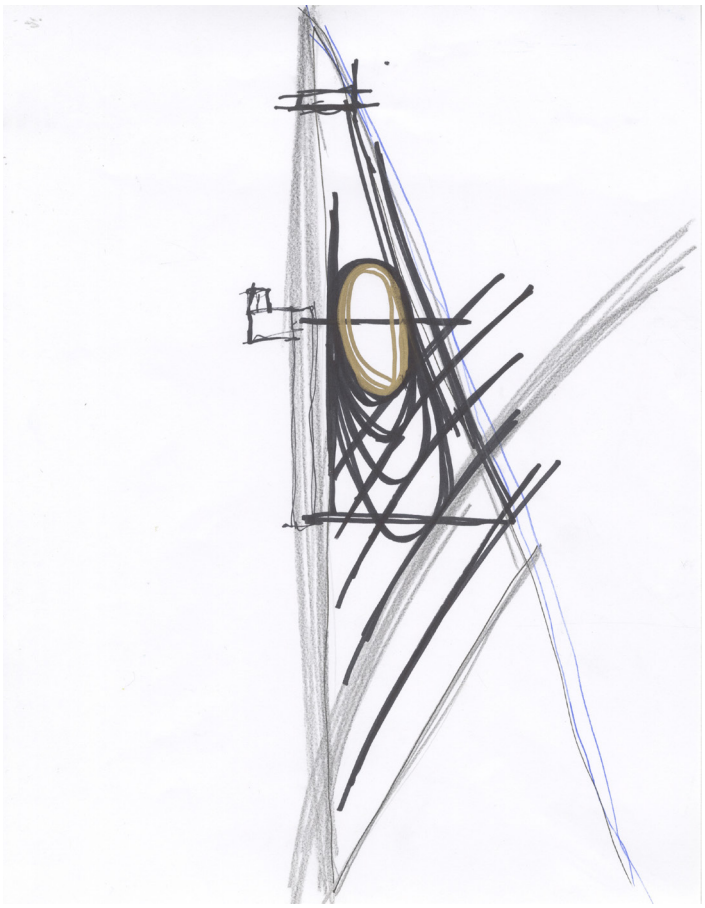
SITE FORCES PAINTING

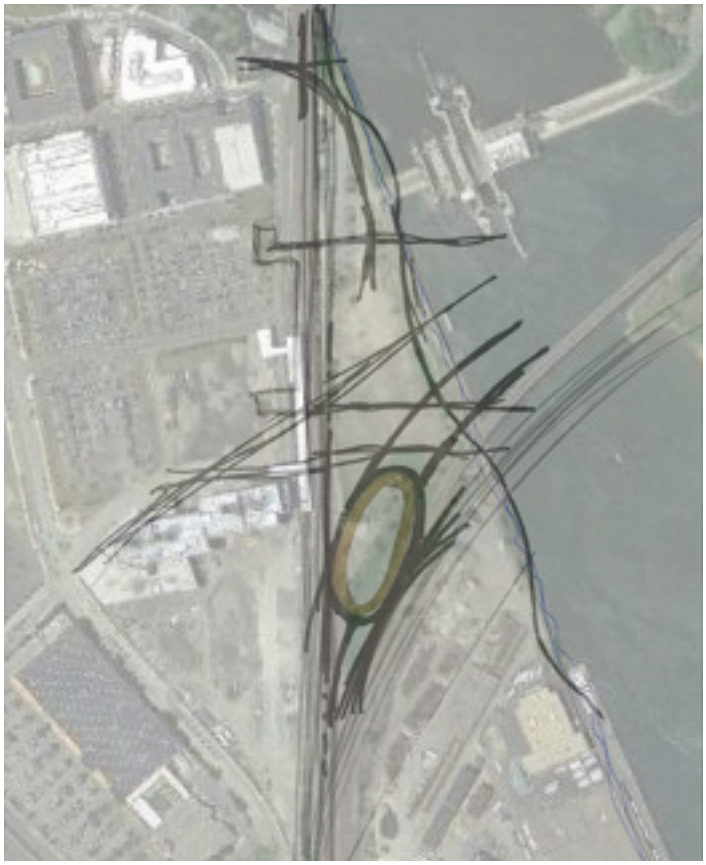
SITE ANALYSIS

SITE FORCES PAINTING

SITE ANALYSIS

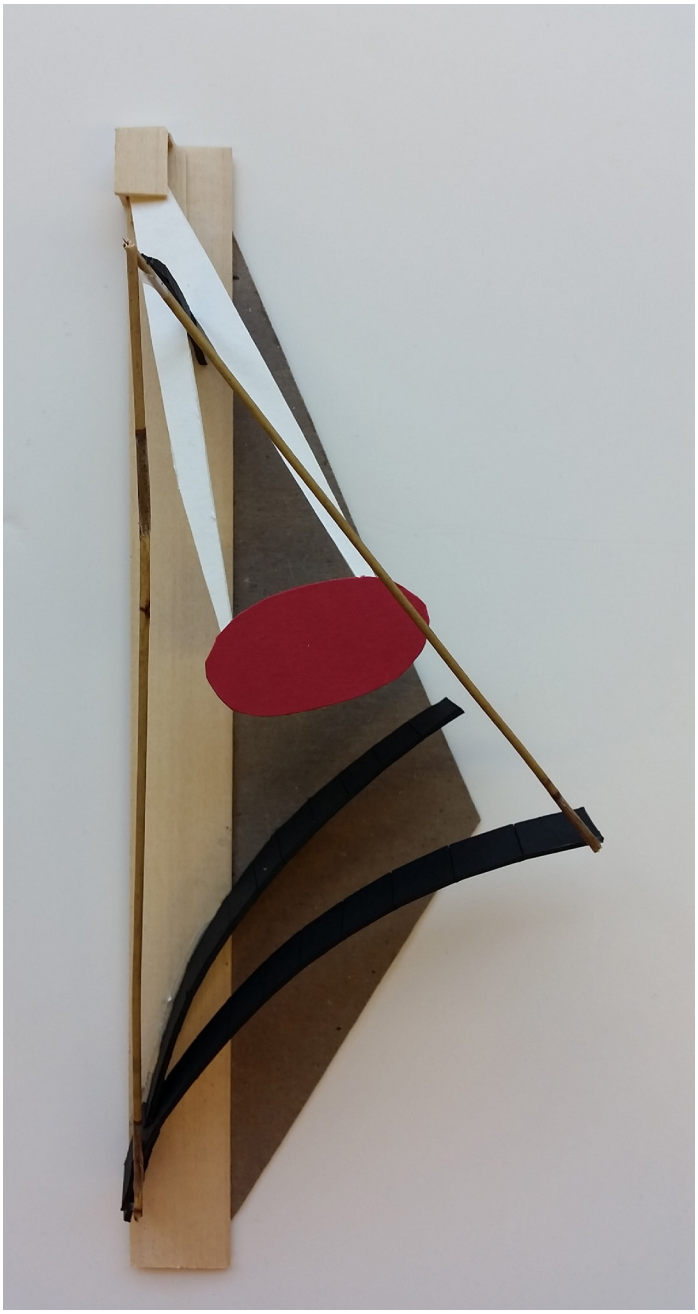
SITE FORCES





SITE ANALYSIS

SITE FORCES MODELS

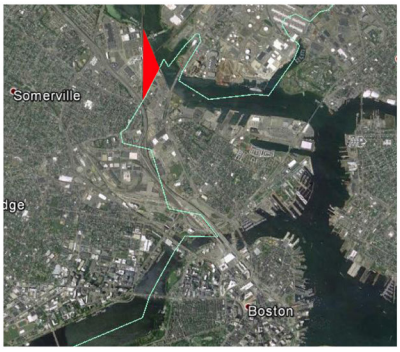


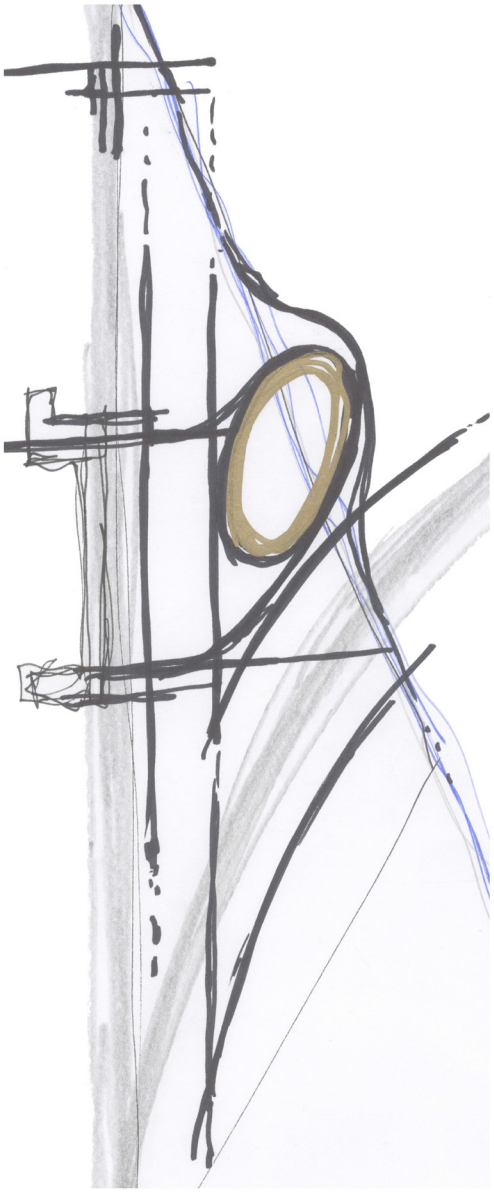
SYMPOSIUM POSTER

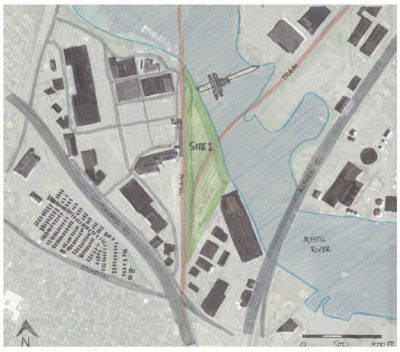
Olympic Legacy:
Flexible Architectural Strategies For Boston's 2024 Olympics Proposal

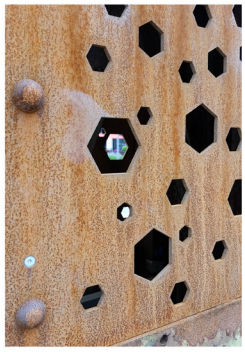
What happens to the Olympic venues when the events conclude?
Venues need to be able to adapt to suit the needs of the city.

Site Documentation - Somerville, MA





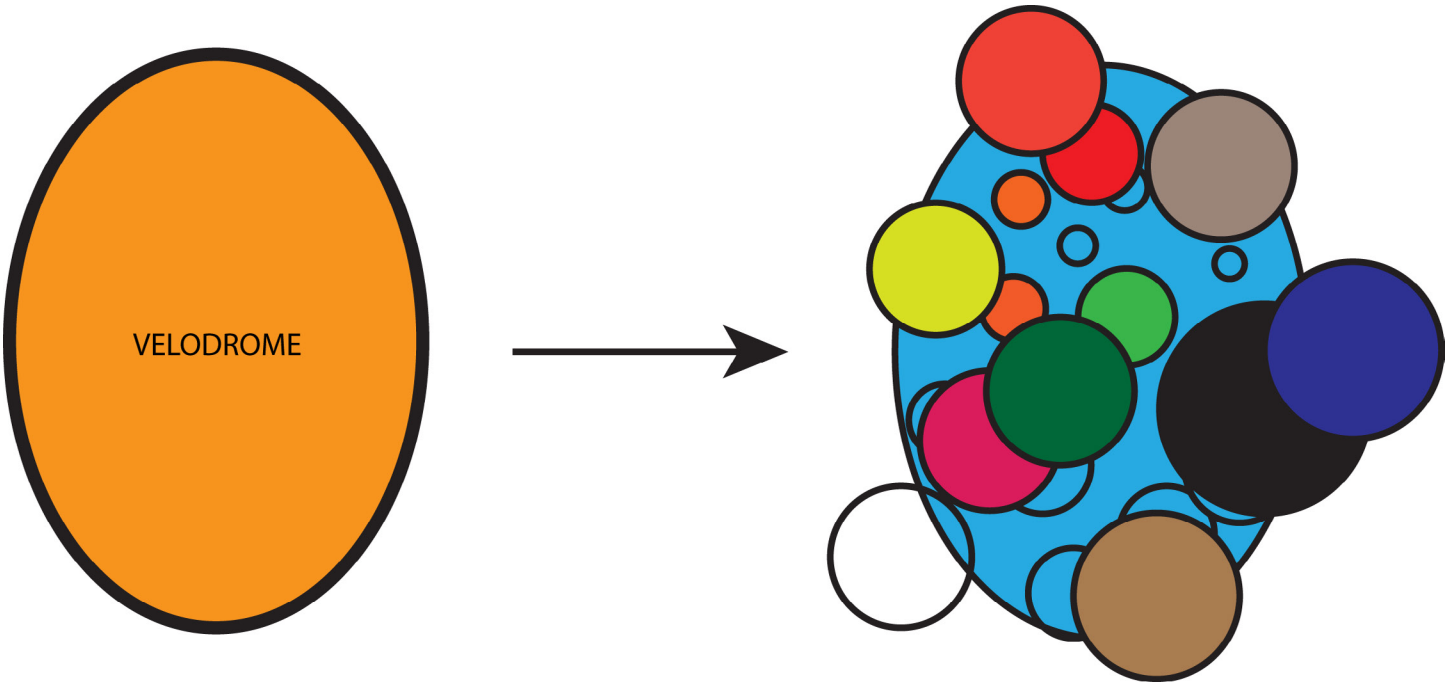




How can an Olympic velodrome transform into a community building?

Site Diagrams

PROGRAM



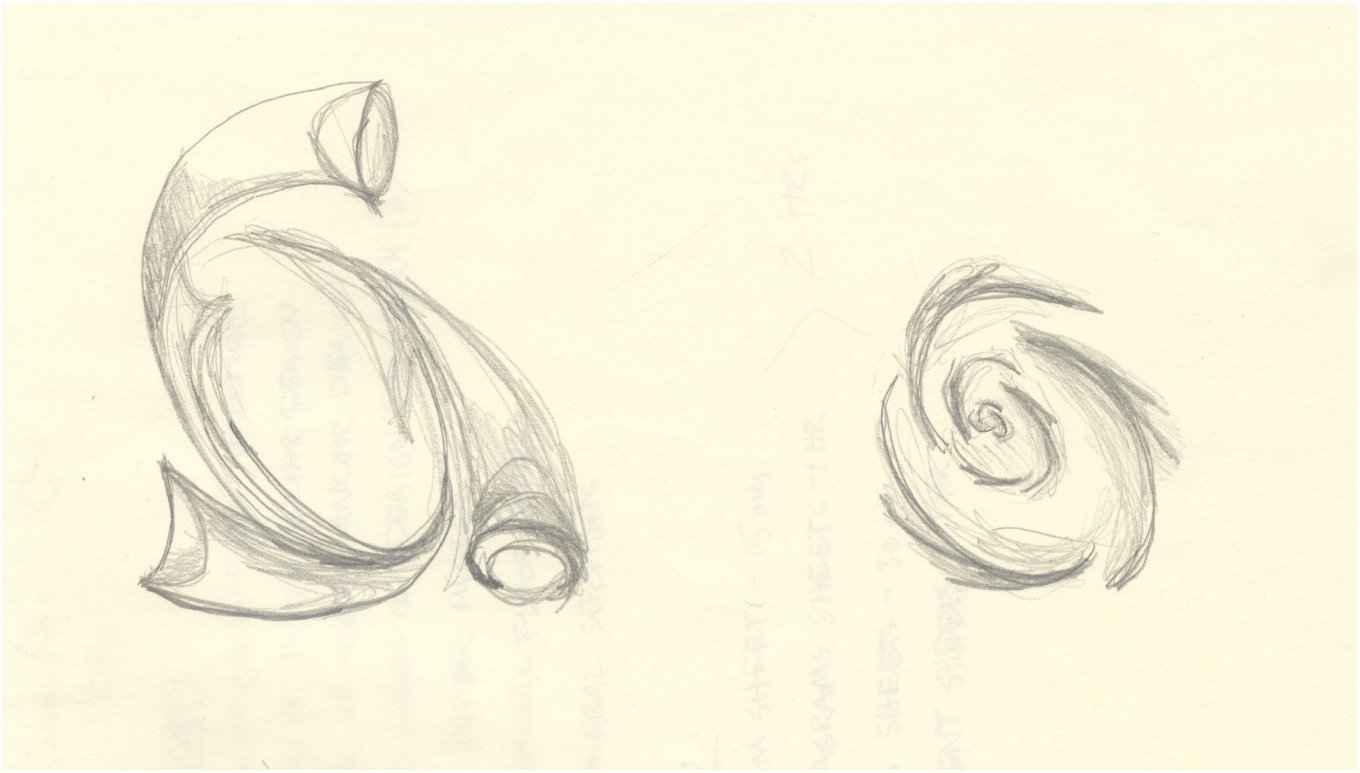
VELODROME REQUIREMENTS:

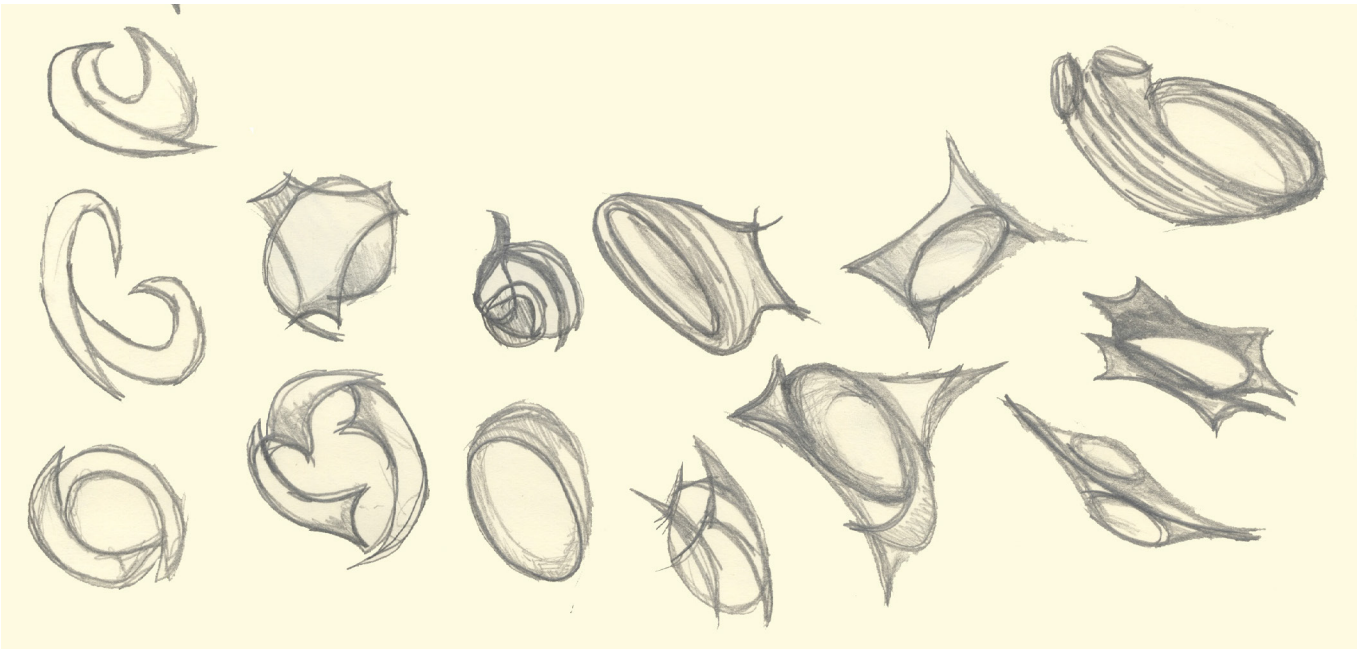
WARM-UP: 30,000 SF
LOCKERS: 4,000 SF
TV AND MEDIA: 8,000 SF
SPECTATOR SEATING: 3,000-4,000 SEATS
AMENITIES: 15,000 SF
CIRCULATION: 20%

POST OLYMPICS:

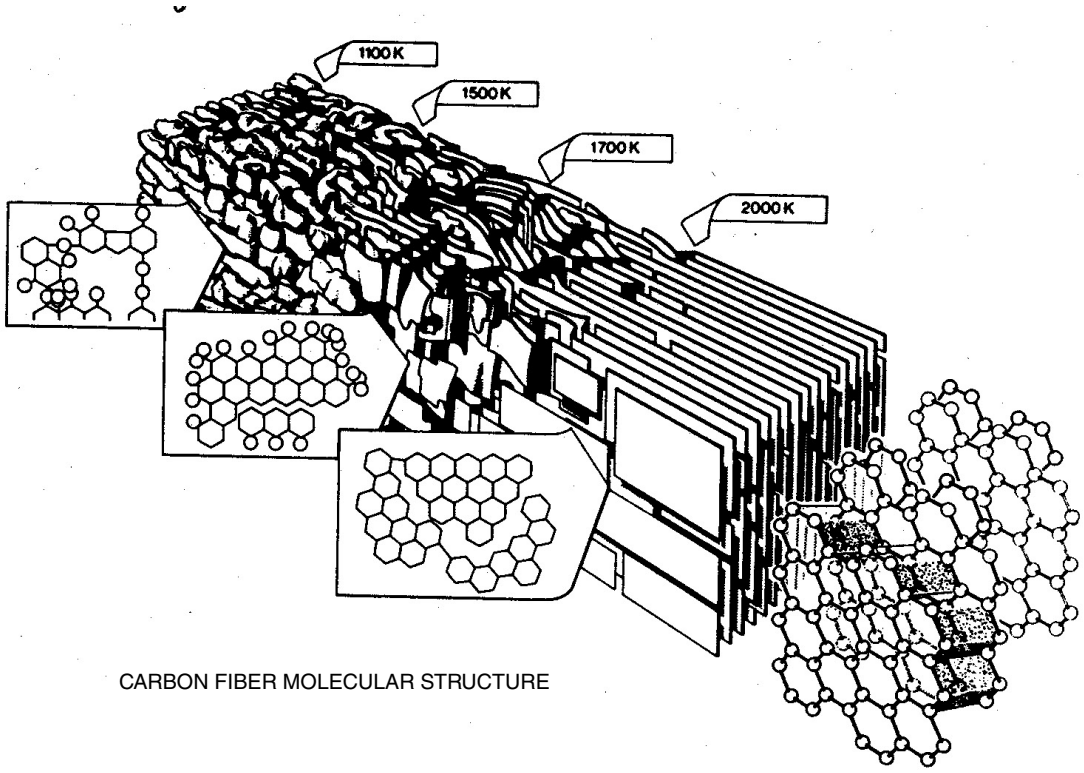
INDETERMINATE SPACES
RECREATION
GAMES
ART EXHIBITIONS
SCULPTURES
PAVILIONS
PORTABLE BUILDING DESIGNS
EXPERIMENTAL DESIGN
LECTURES
CYCLING EVENTS
RESTAURANTS
SHOPPING
PARK
PUBLIC ARTS CENTER
PERFORMANCE HALL
INTERACTIVE PUBLIC SPACE
INNOVATIVE TECHNOLOGY DISPLAY
SOMERVILLE BICYCLE COMMITTEE
POP UP SHOPS
COMMUNITY GARDEN
WEDDING VENUE
UNIVERSITY SUPPORT
BICYCLING LEARNING CENTER
ANYTHING!

EARLY CONCEPTS



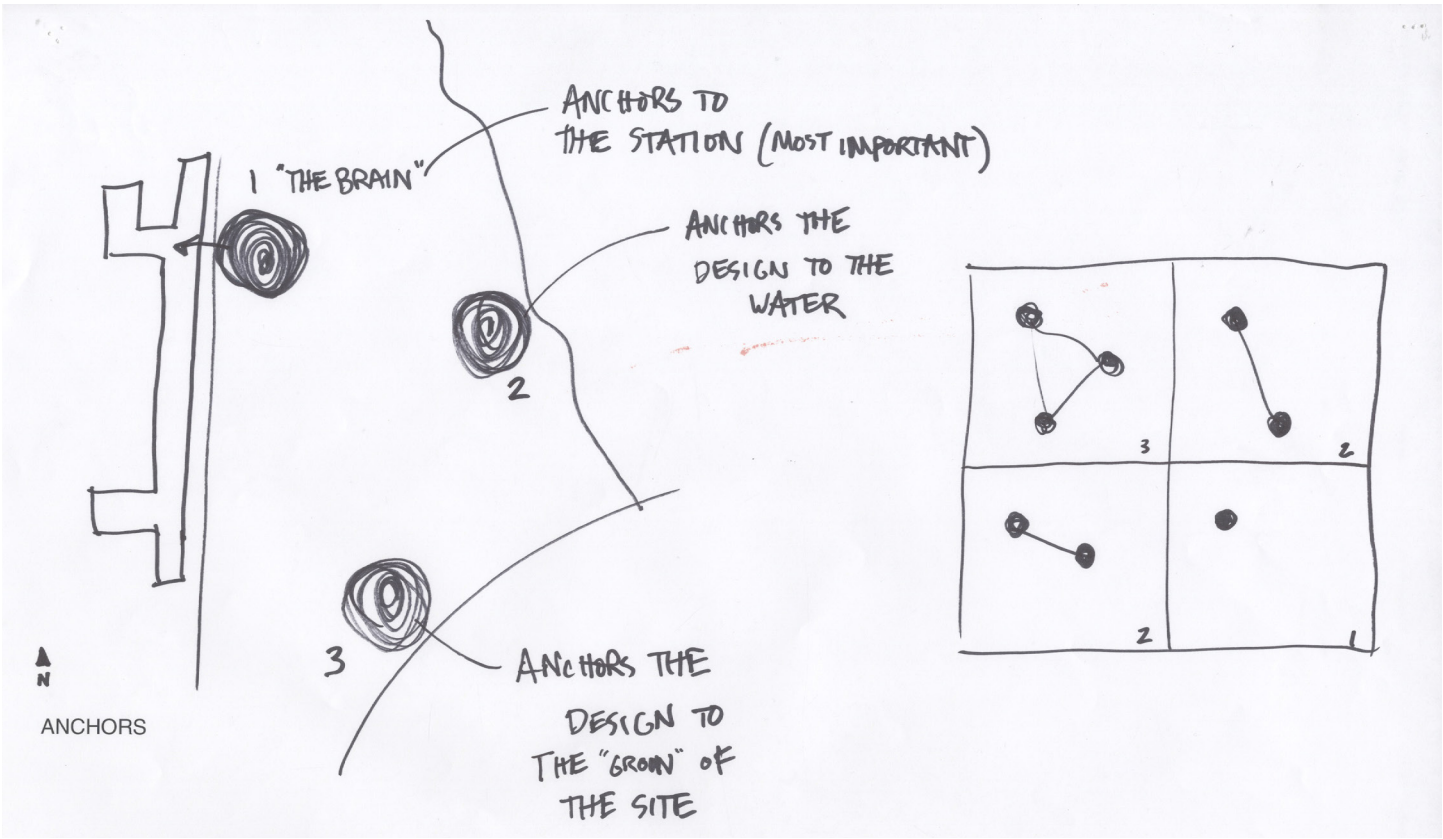


EARLY CONCEPTS



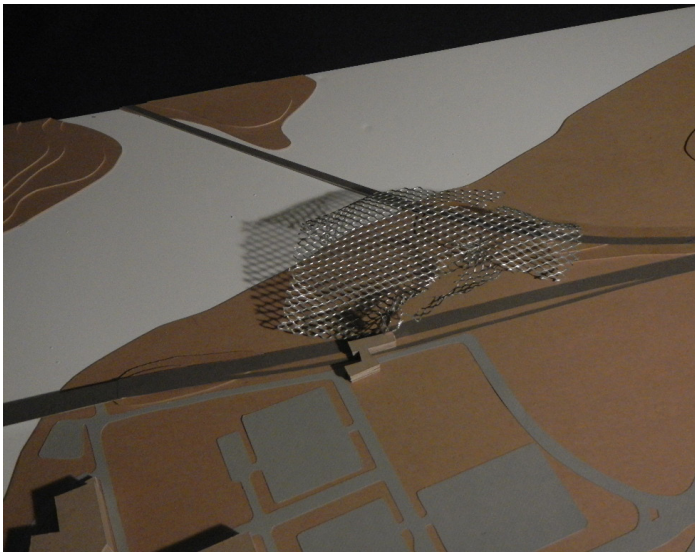
CARBON FIBER MOLECULAR STRUCTURE

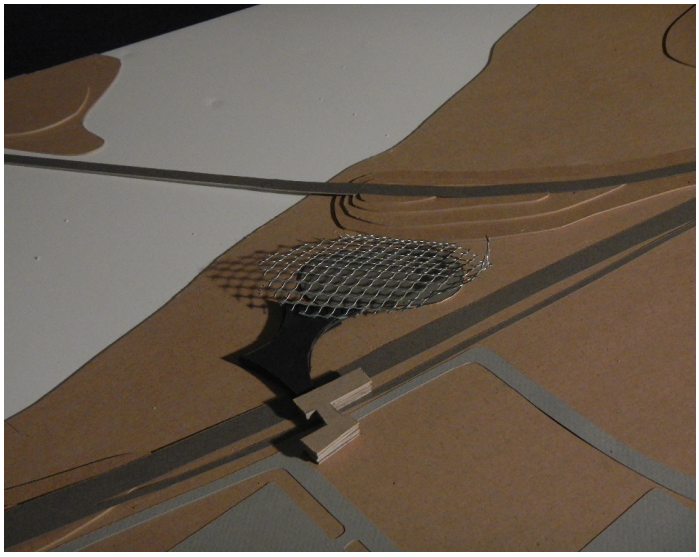
http://www.arrhenius.ucsd.edu/miakel/Image42.gif

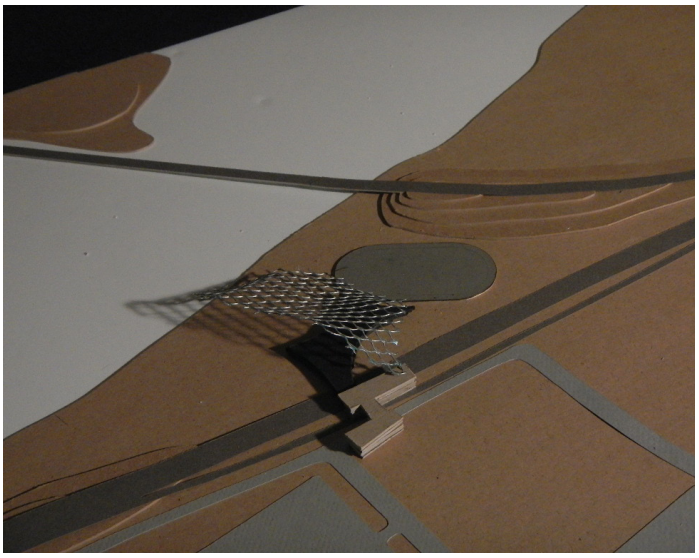


ANCHORS

CONCEPT MODELS







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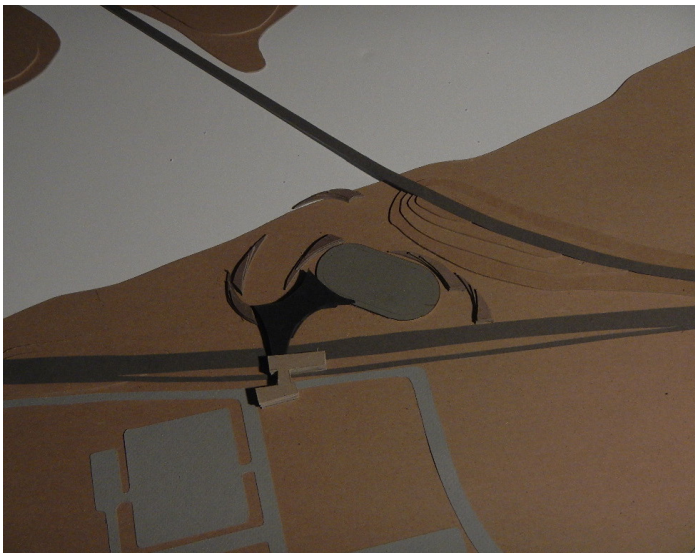
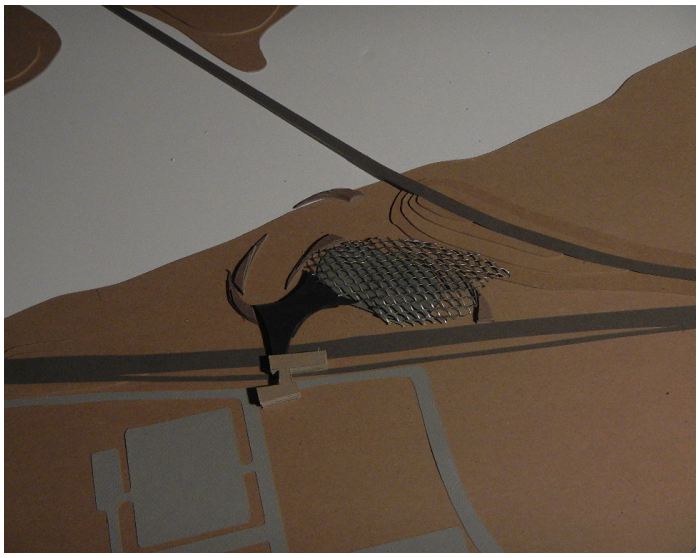
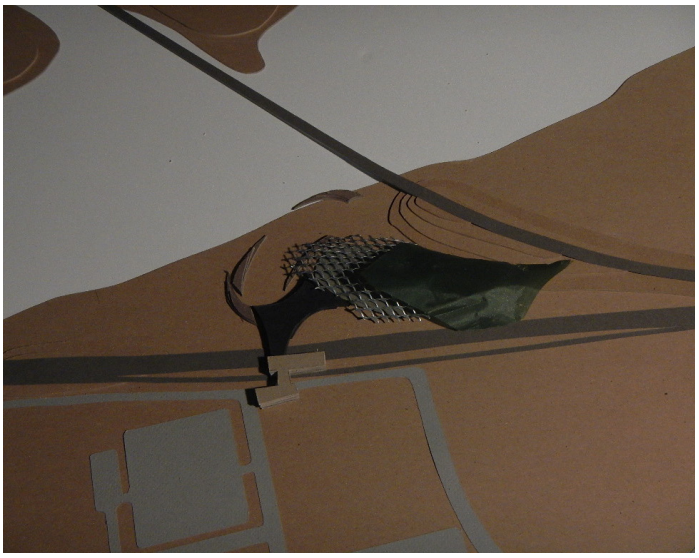
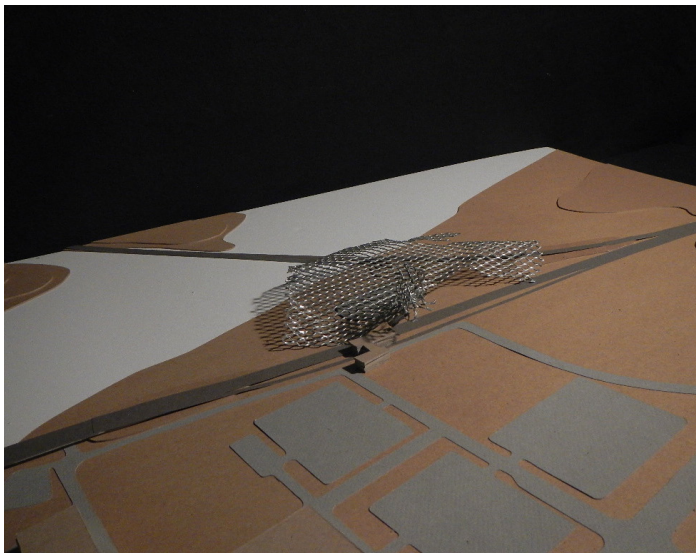
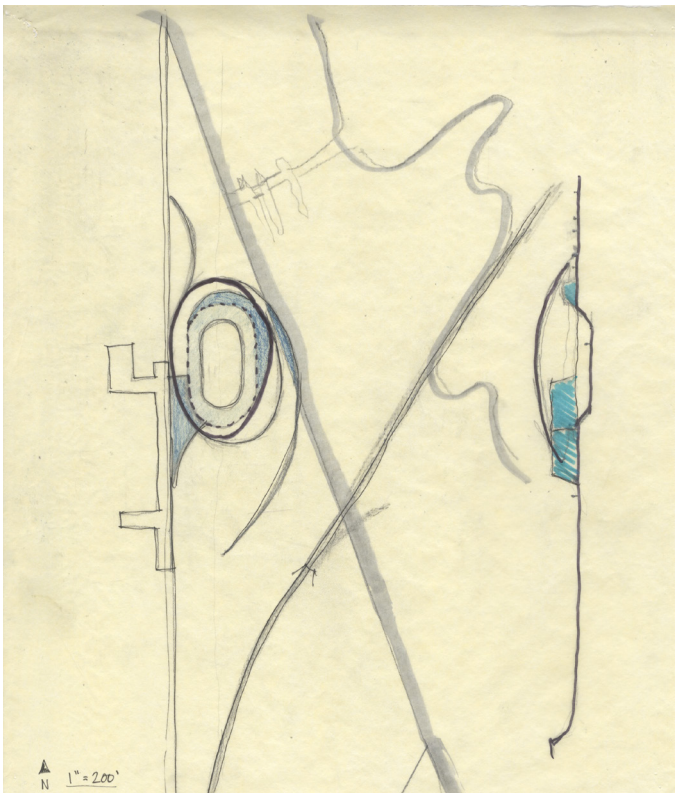


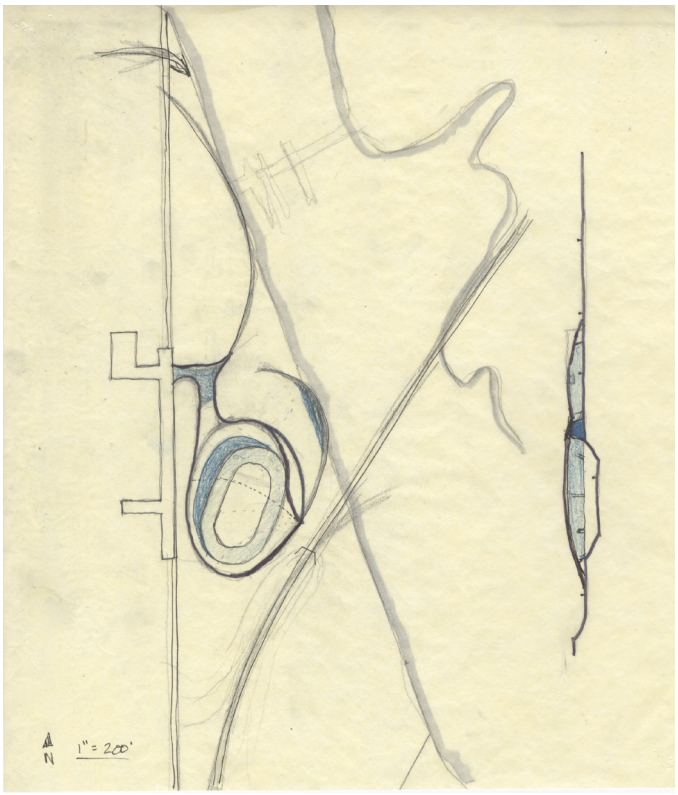


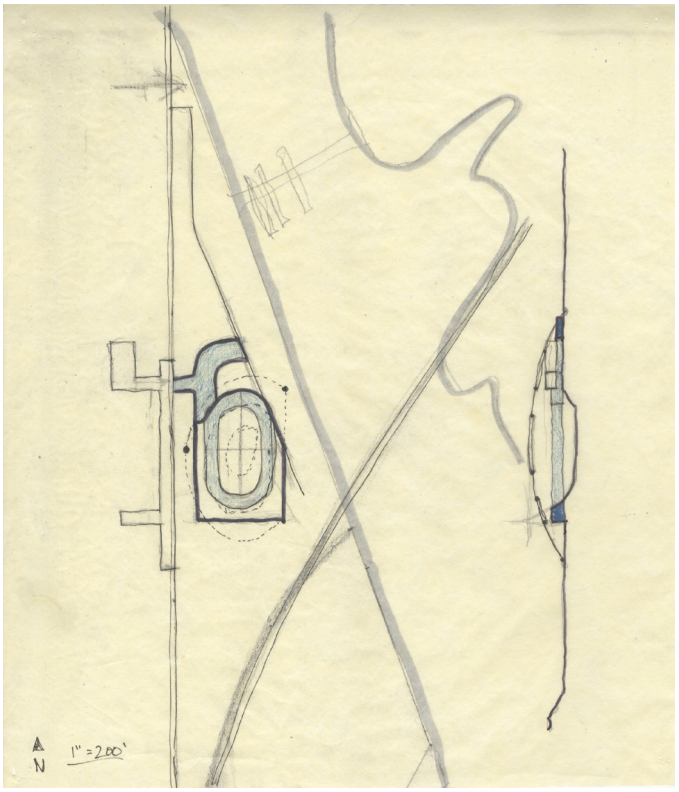




CONCEPT SKETCHES







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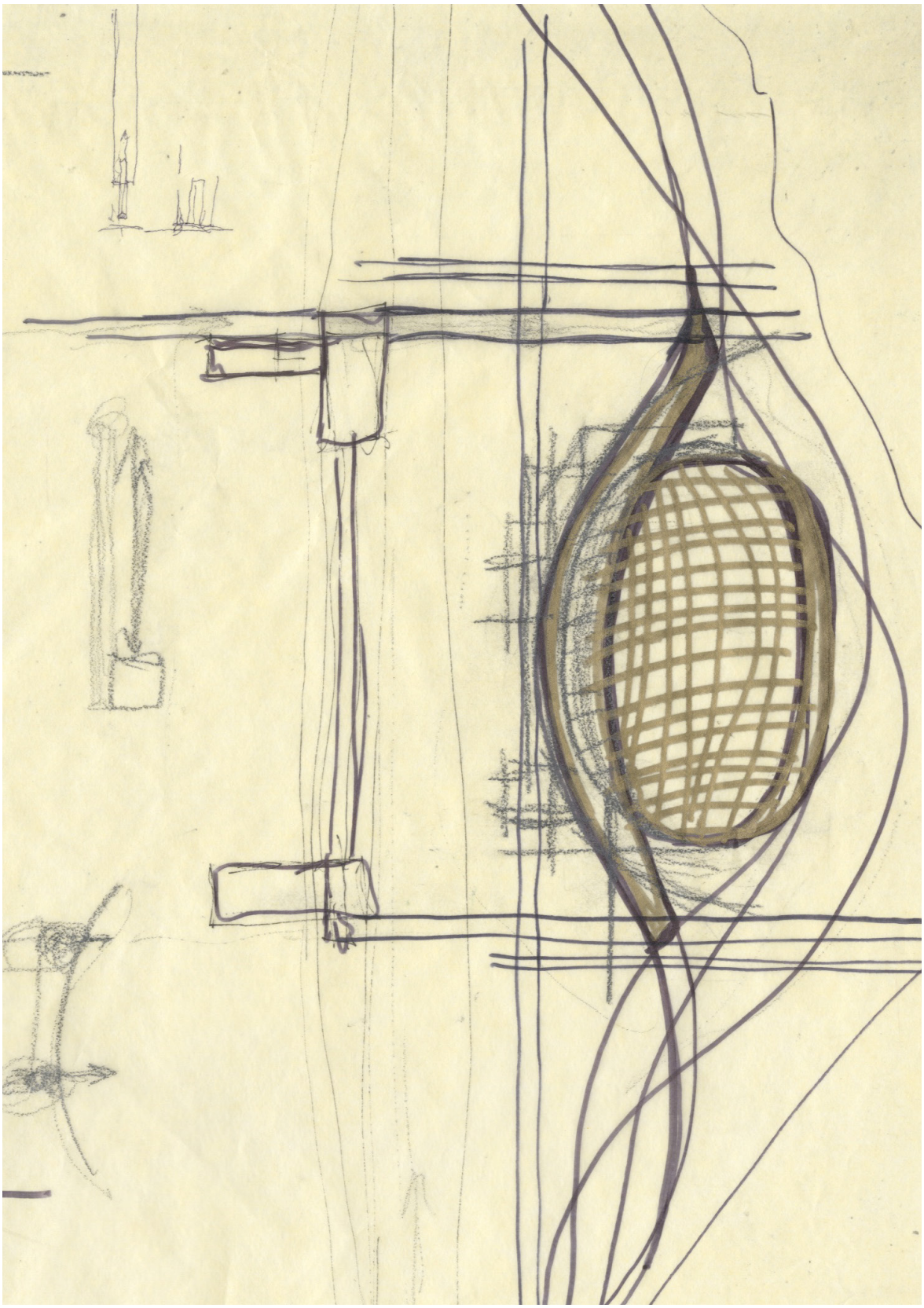

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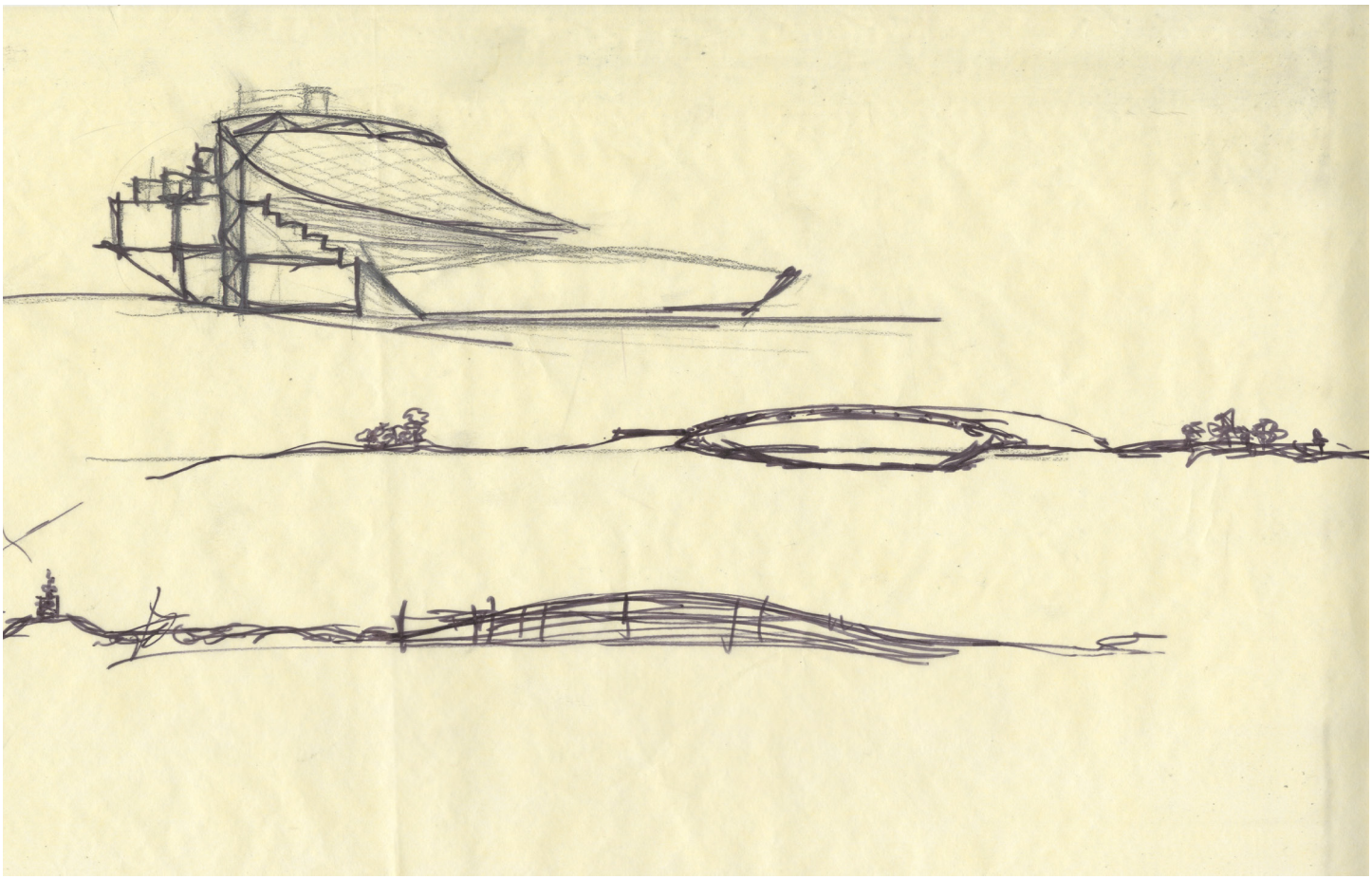

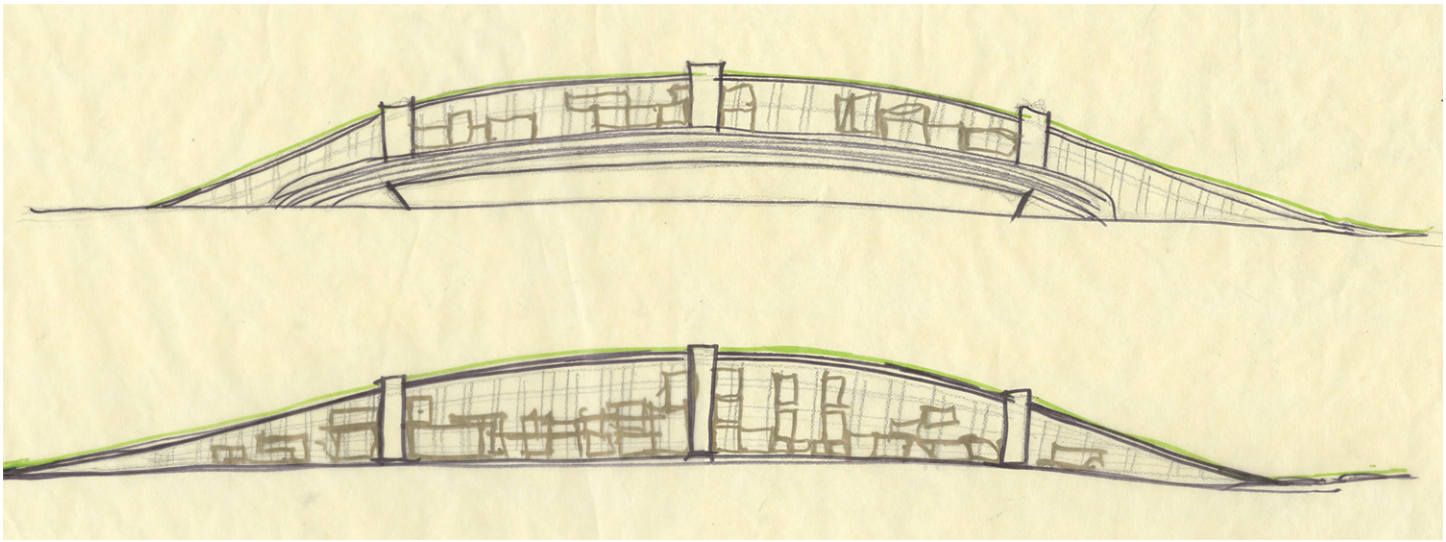

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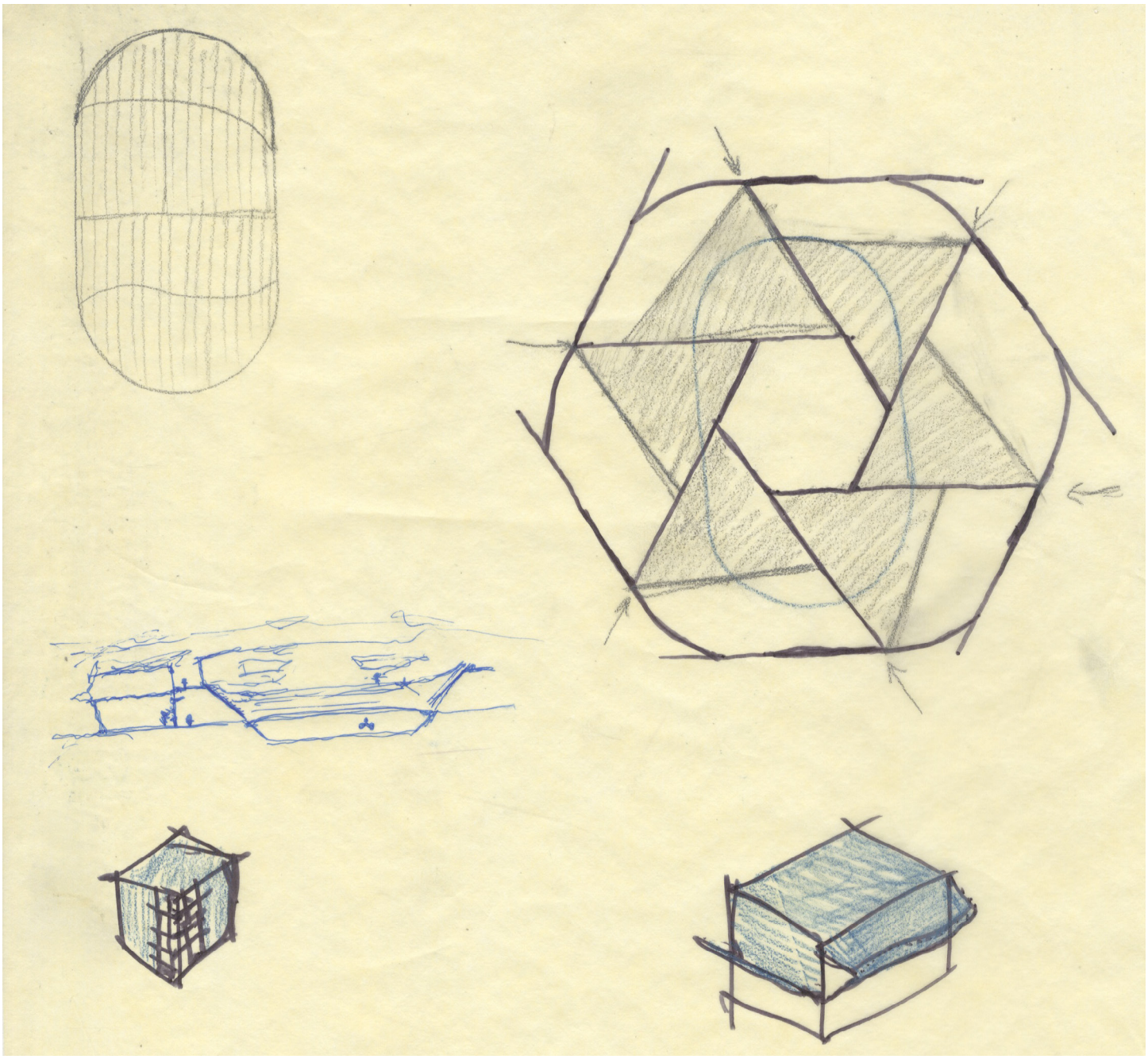
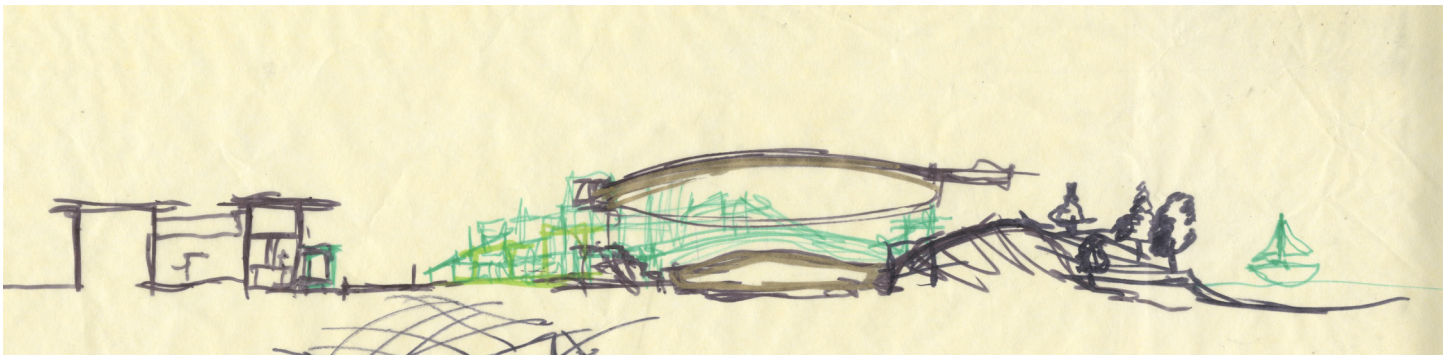
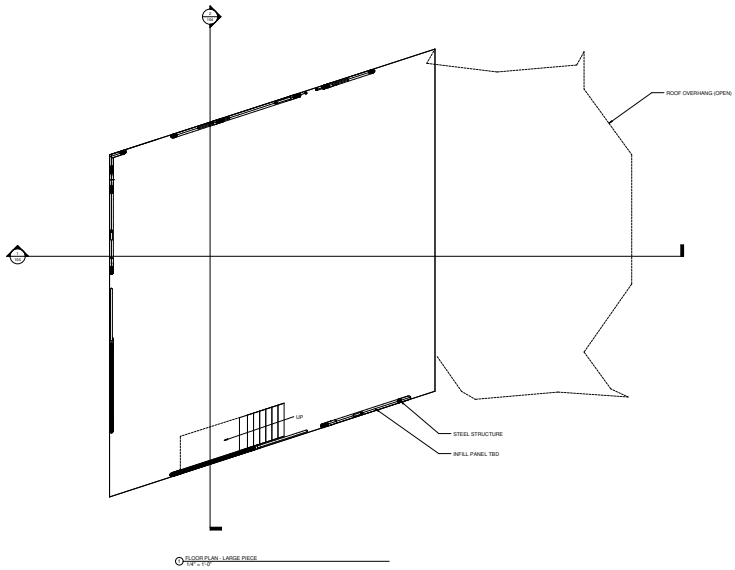
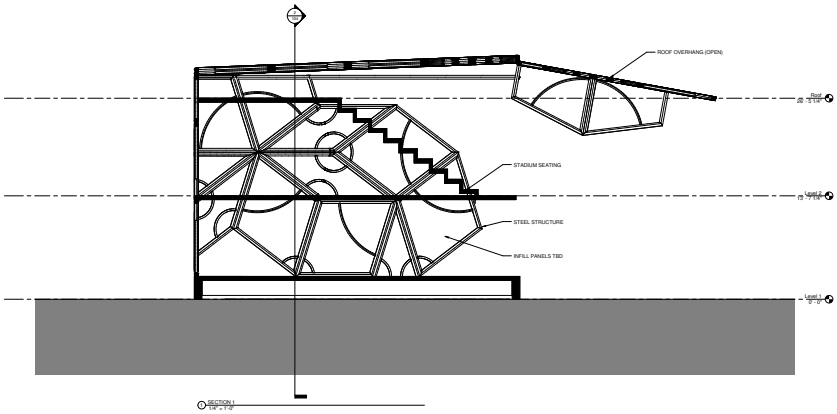




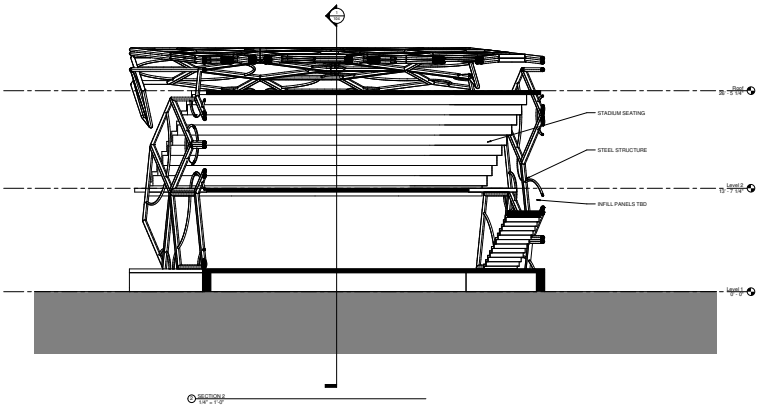
DESIGN ITERATION



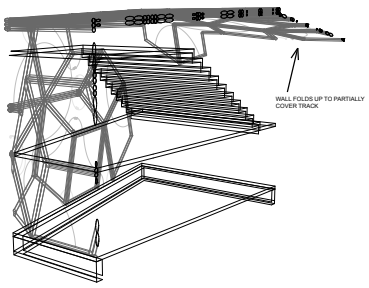
1 FLOOR PLAN - LARGE PIECE
1/8" = 1'-0"

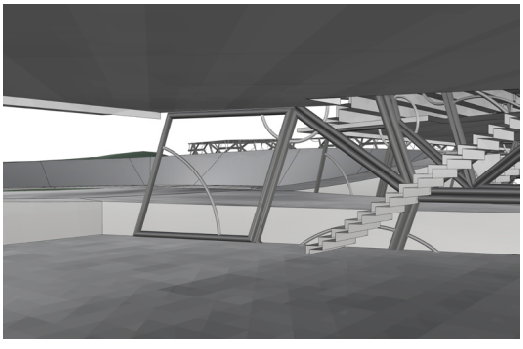


1 SECTION 1
1/8" = 1'-0"



2 SECTION 2
1/8" = 1'-0"





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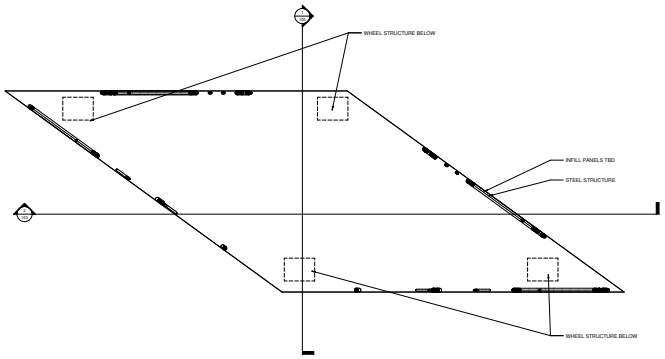
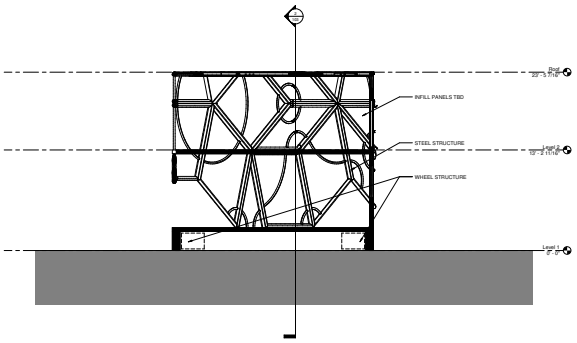
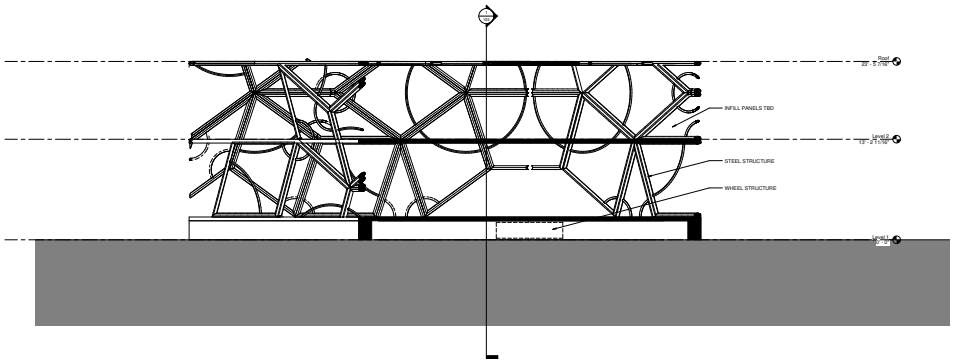


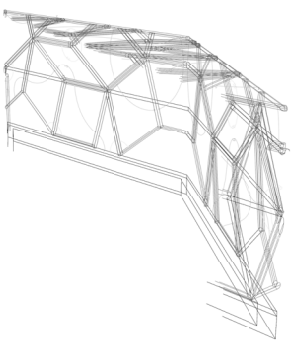
1 FLOOR PLAN - SKINNY PIECE
1/4" = 1'-0"

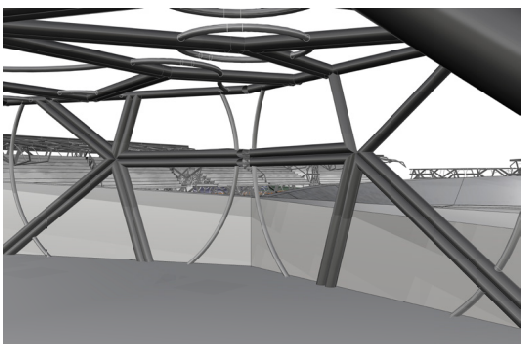


1 SECTION 1
1/4" = 1'-0"



2 SECTION 2
1/4" = 1'-0"





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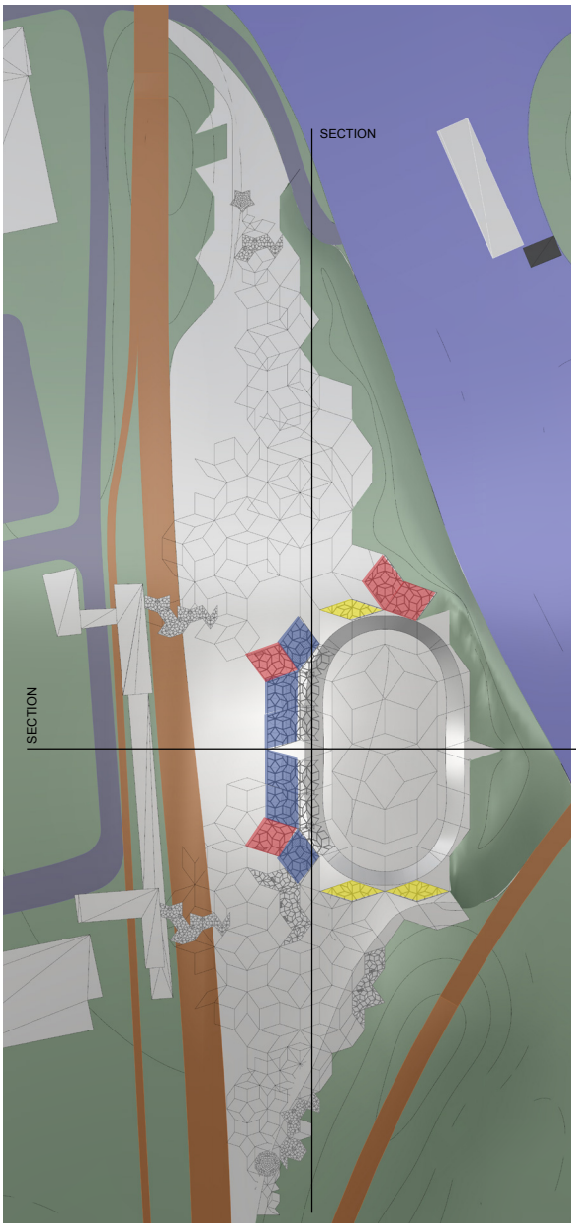
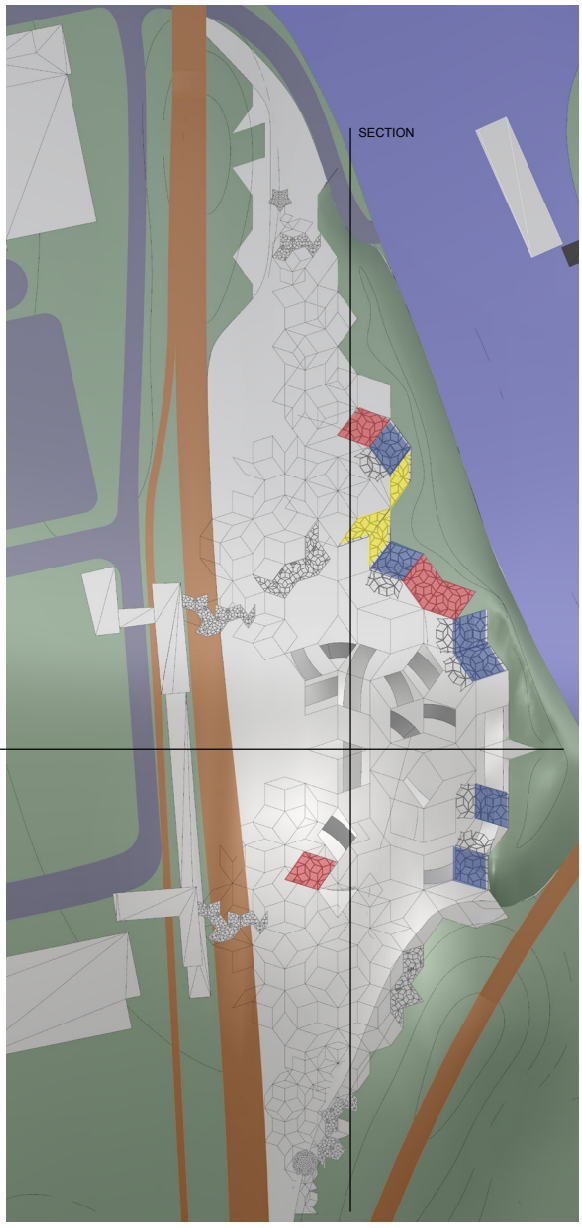
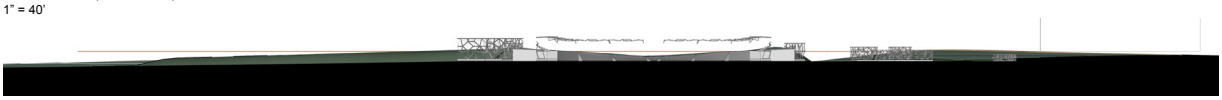


SITE PLAN - OLYMPIC VELODROME
1" = 40' ^NORTH



SITE PLAN - POST OLYMPICS
1" = 40' ^NORTH

SITE SECTION (EAST/WEST) - OLYMPIC VELODROME
1" = 40'

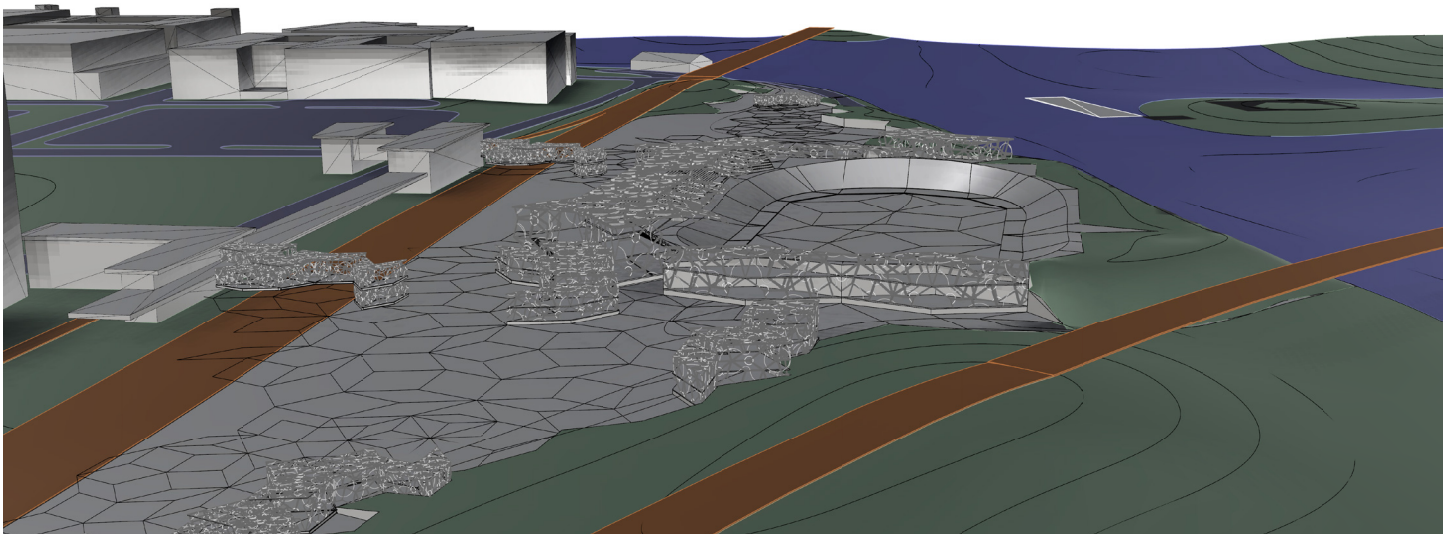


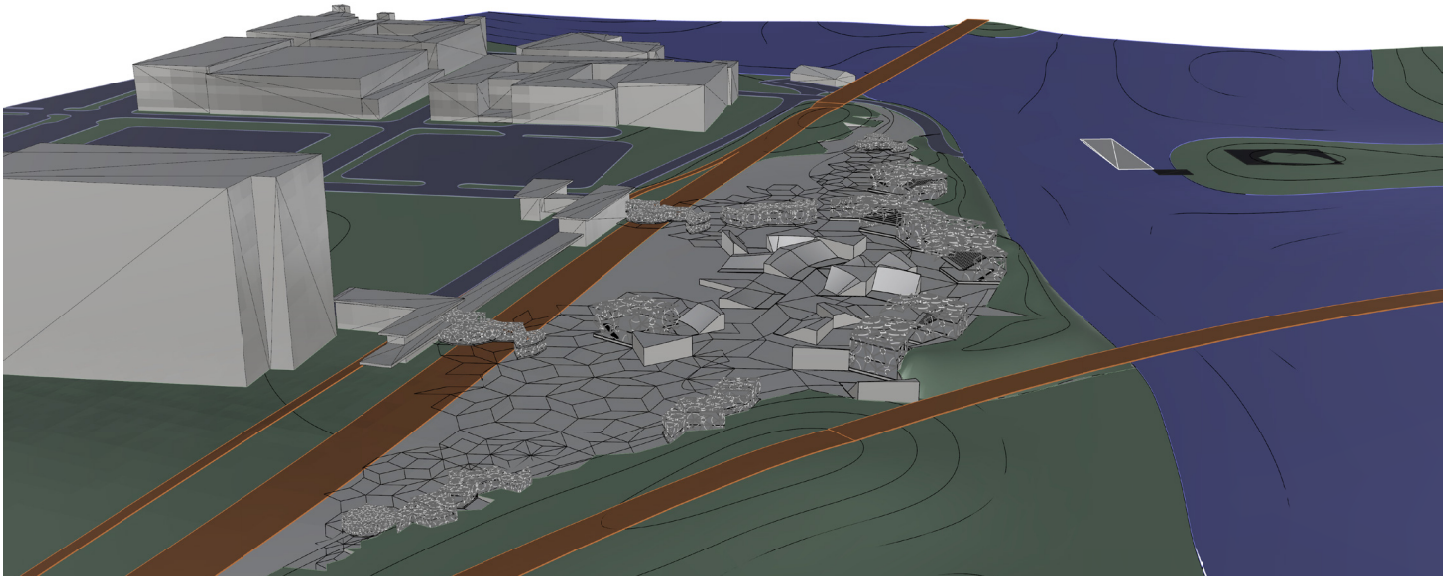
SITE SECTION (NORTH/SOUTH) - OLYMPIC VELODROME
1" = 40'

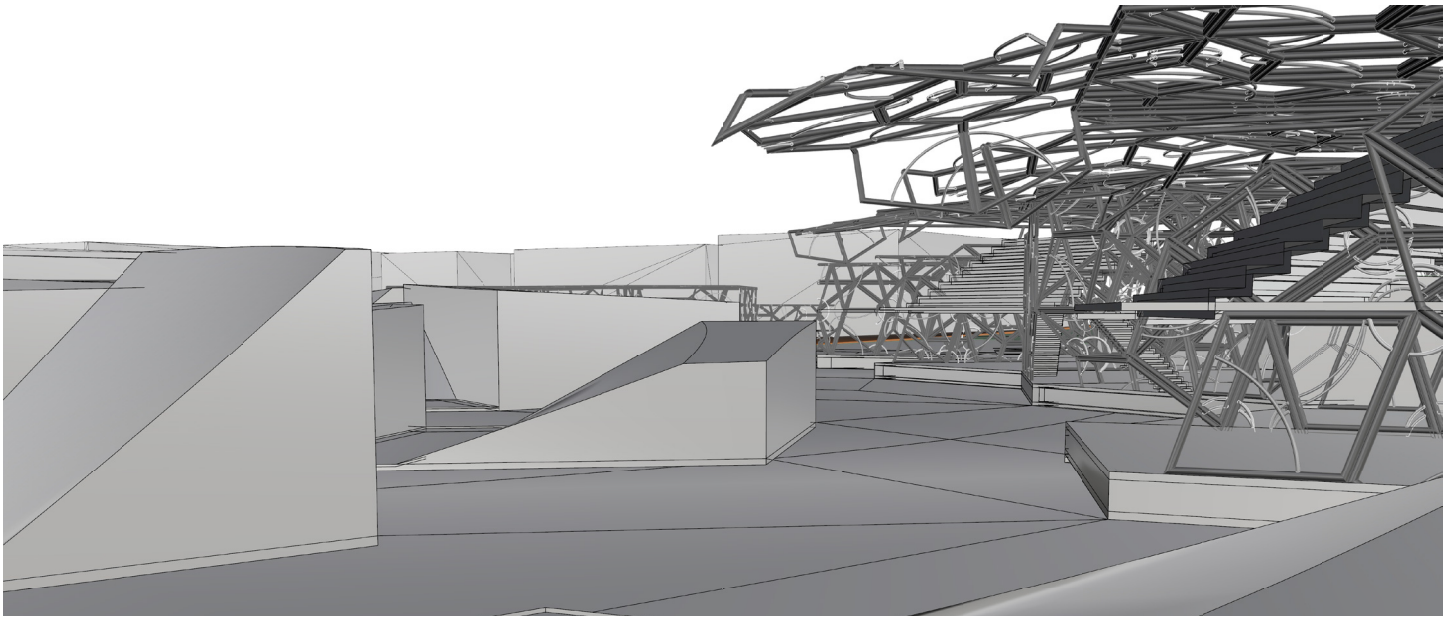
SITE SECTION (EAST/WEST) - POST OLYMPICS
1" = 40'

SITE SECTION (NORTH/SOUTH) - POST OLYMPICS
1" = 40'

DESIGN ITERATION



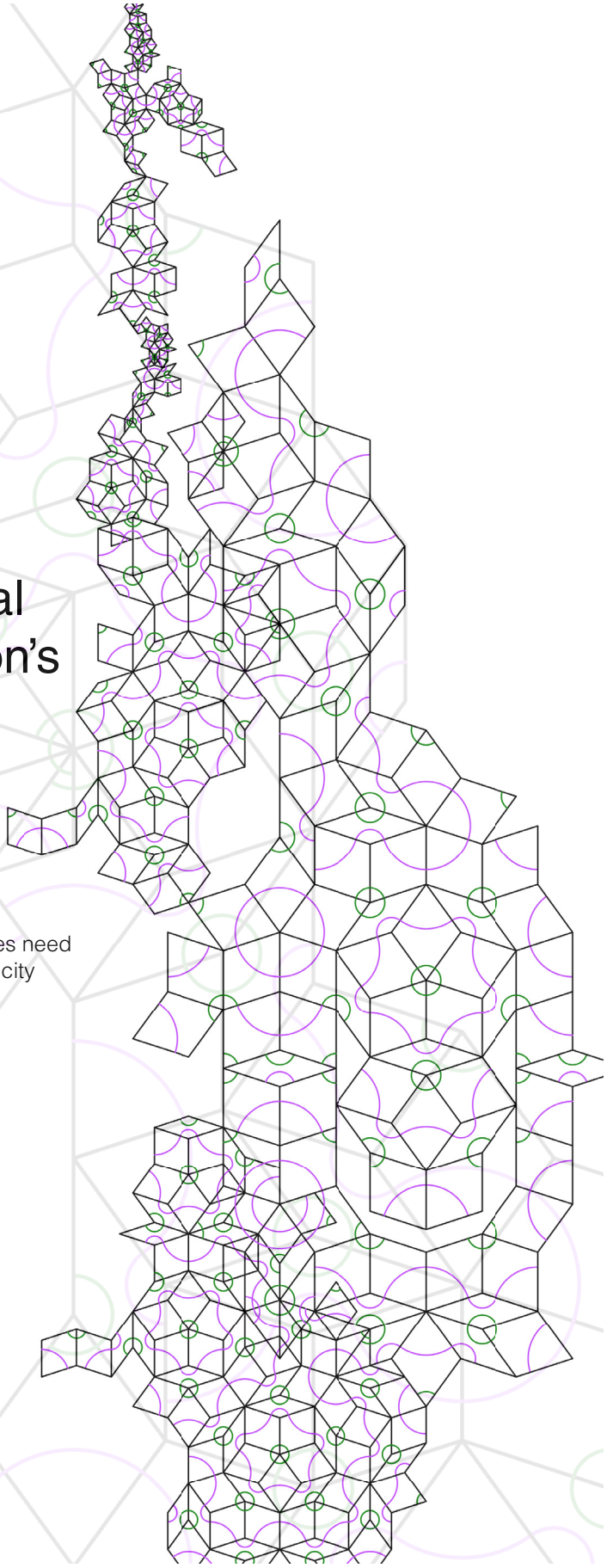




FINAL DESIGN

FINAL THESIS POSTER

Olympic Legacy: Flexible Architectural Strategies for Boston's 2024 Olympics Proposal

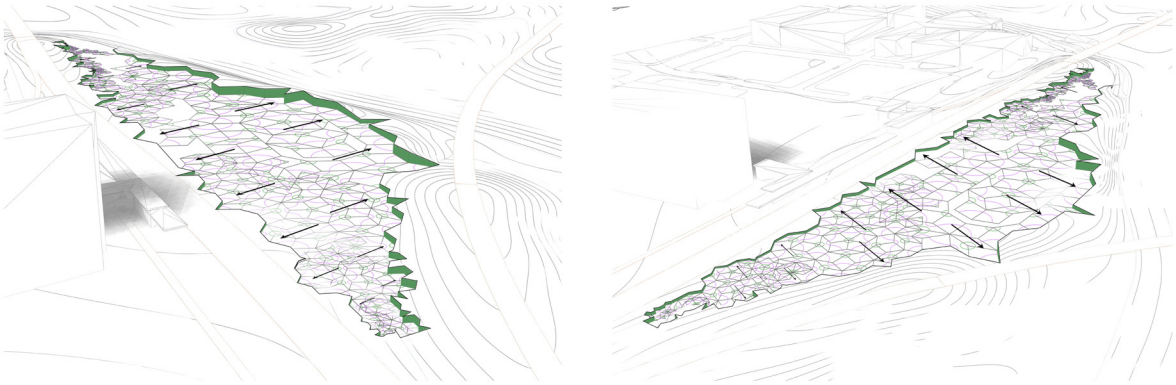


Flexible architectural design strategies can mitigate the negative effect that permanent Olympic venues have on a host city. Venues need to be able to adapt to suit the needs of the city after the Olympics have concluded.

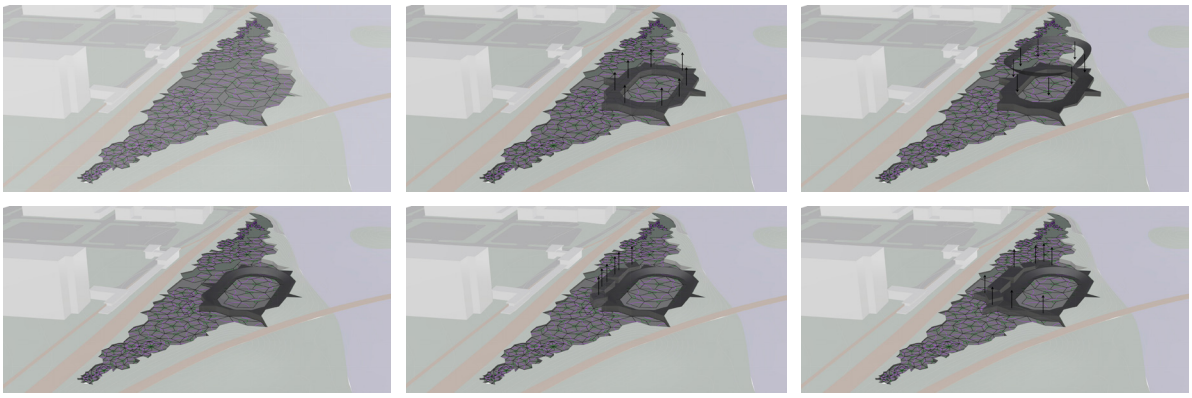
Kevin Cramer

FINAL DESIGN PRESENTATION

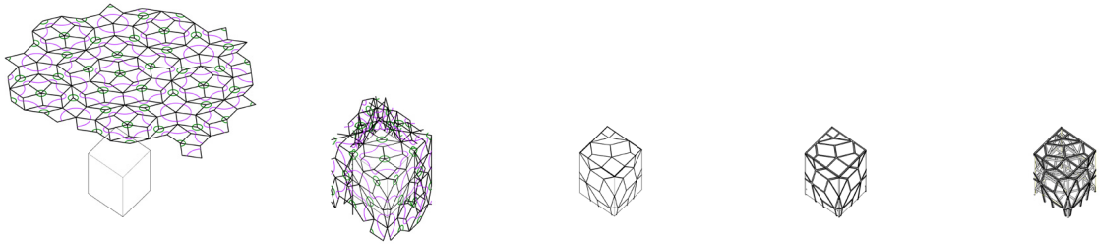
TILING SYSTEM



SITE MANIPULATION

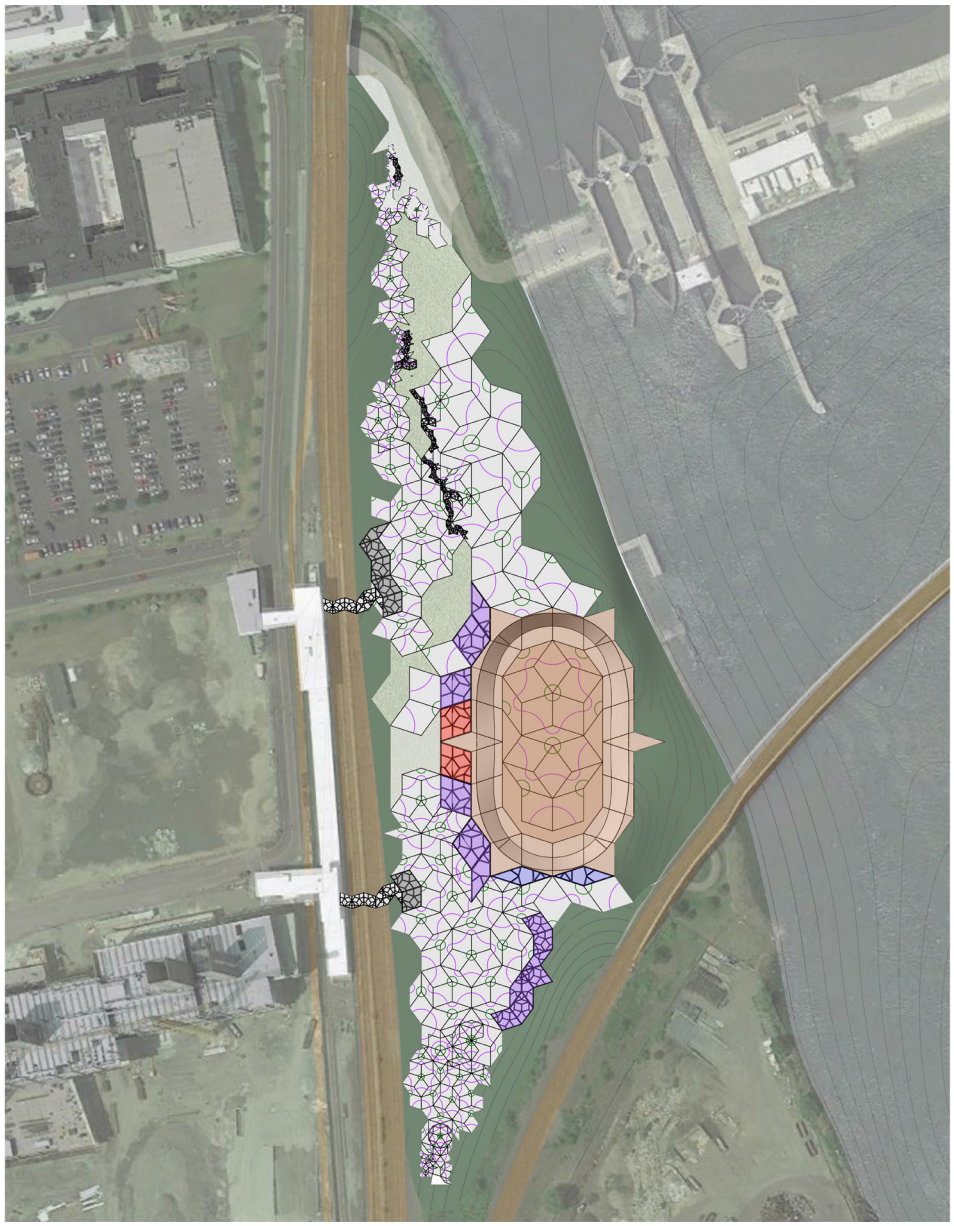


PROGRAM EXTRUSIONS



STRUCTURAL DESIGN OF INDIVIDUAL PIECES

FINAL DESIGN PRESENTATION



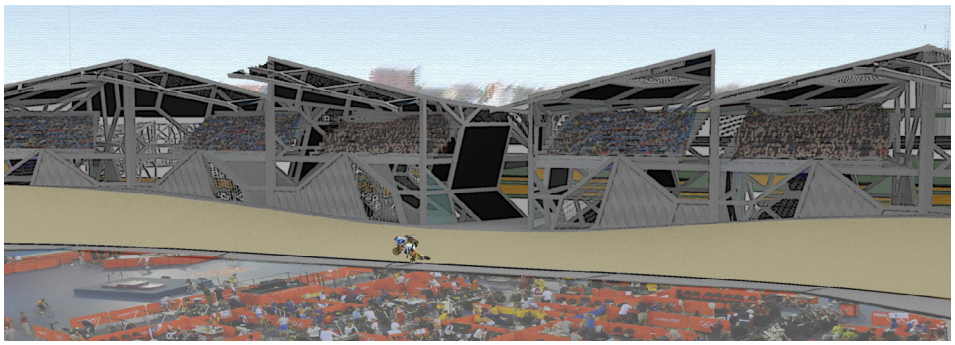
SITE PLAN

OLYMPICS

1” = 40’

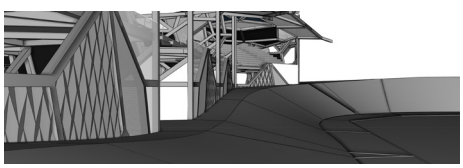
^NORTH

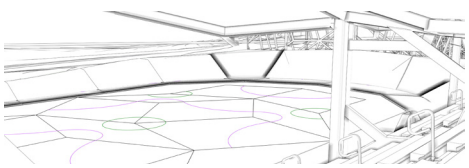
VELODROME TRACK
WARM-UP AREA
LOCKERS
TV MEDIA
PERMEABLE SURFACE
AMENITIES
PERMANENT PROGRAM



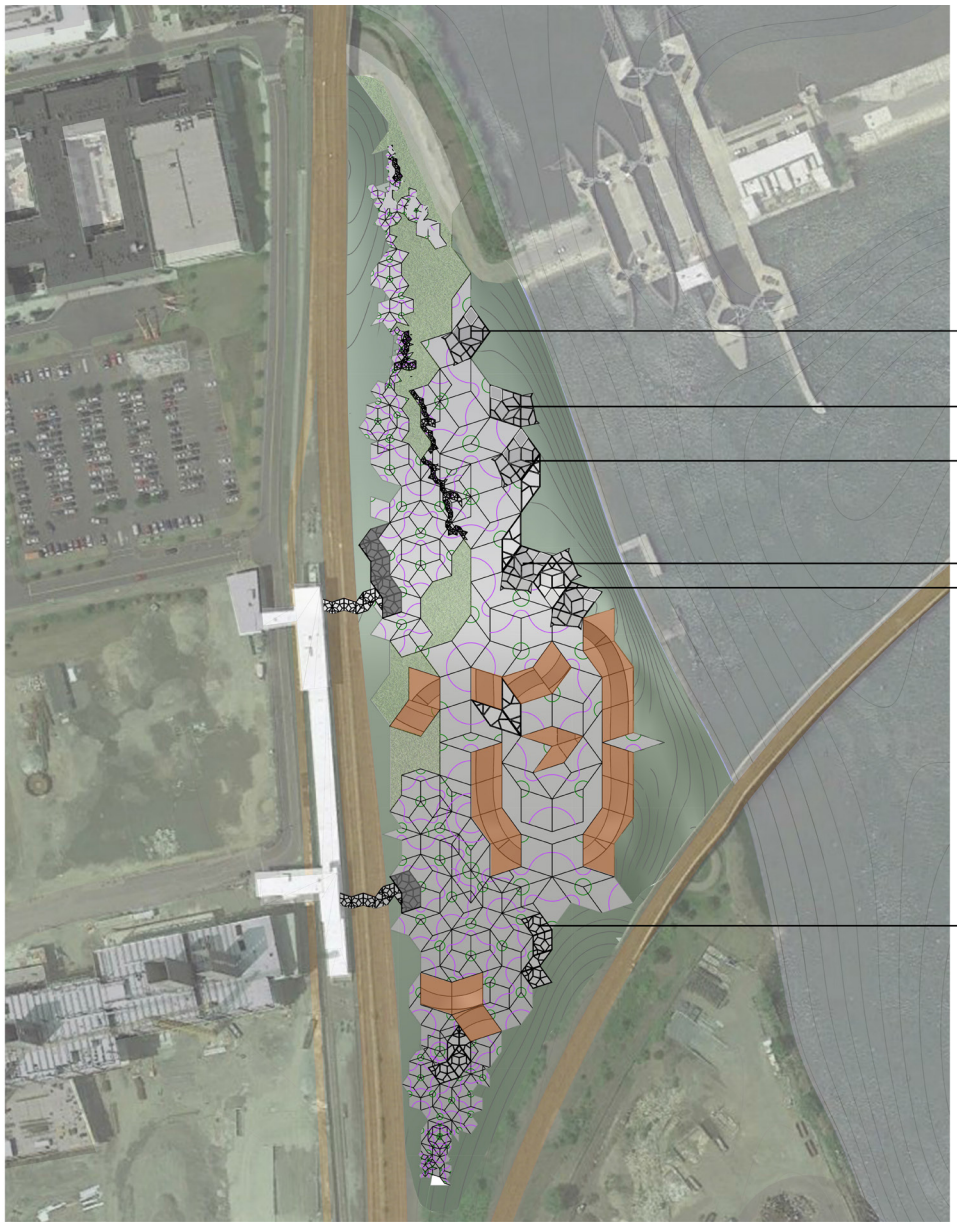
PERSPECTIVES

OLYMPICS





FINAL DESIGN PRESENTATION



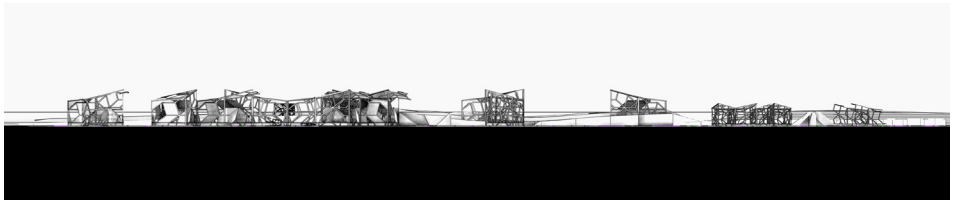
SITE PLAN

POST OLYMPICS

1" = 40'

^NORTH

EAST WEST SECTION



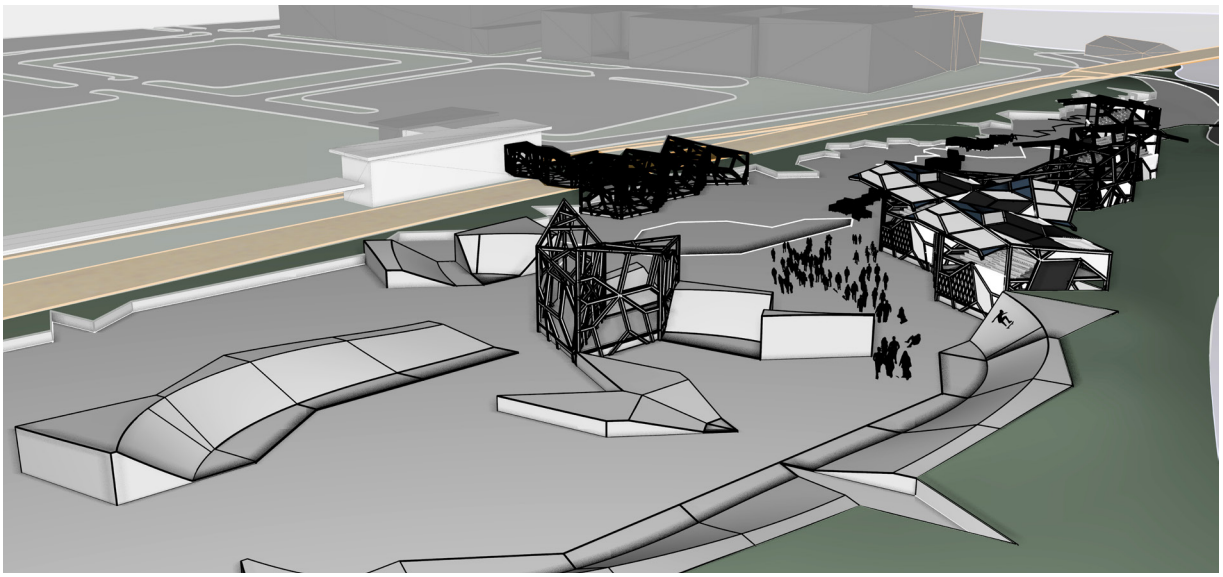
NORTH SOUTH SECTION

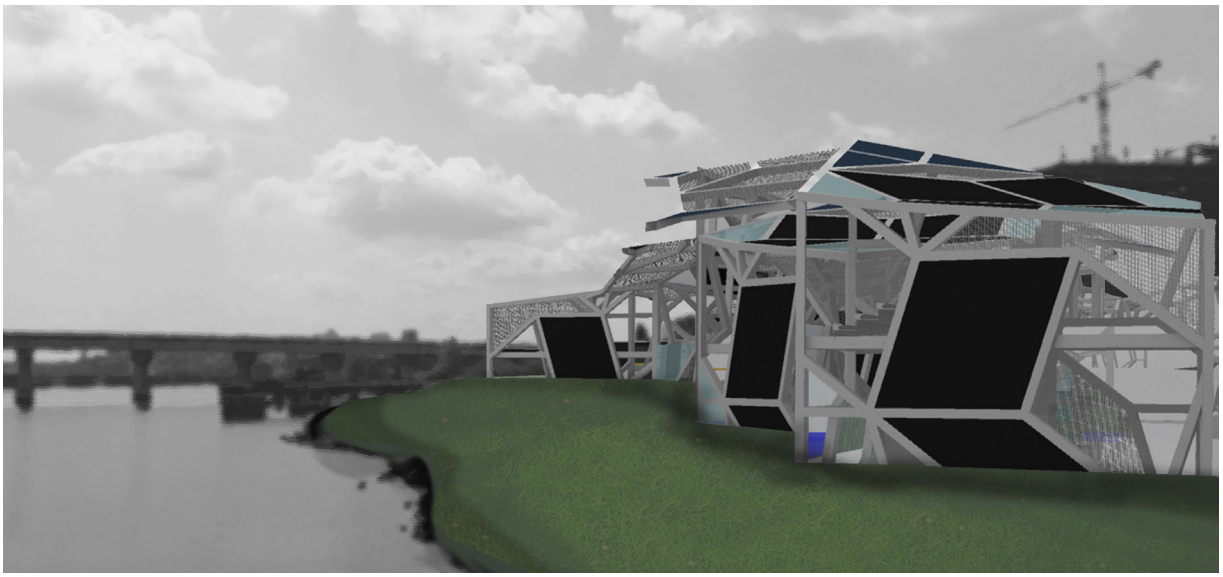
SITE SECTIONS

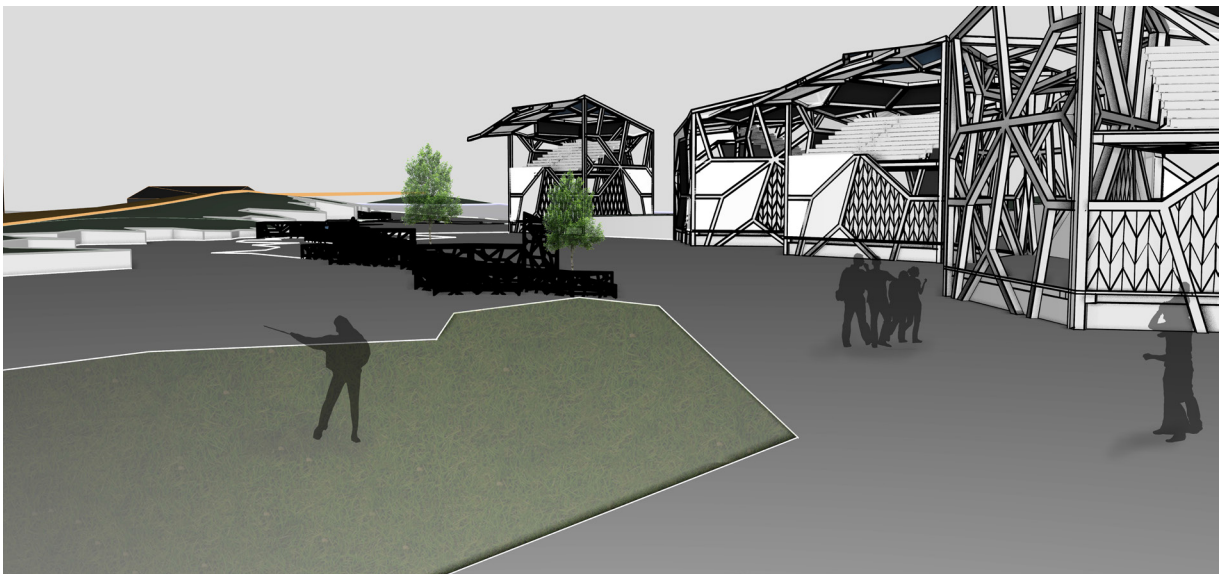
POST OLYMPICS

1" = 40'

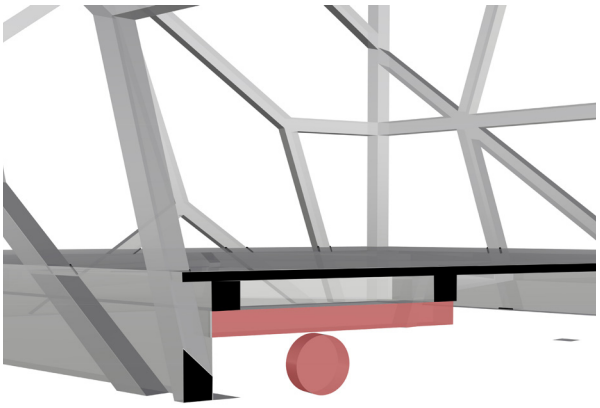
FINAL DESIGN PRESENTATION



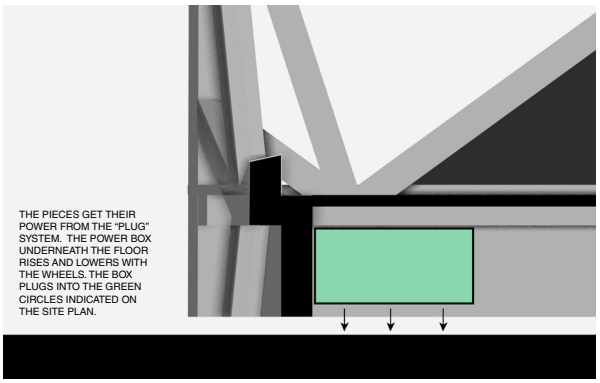




FINAL DESIGN PRESENTATION

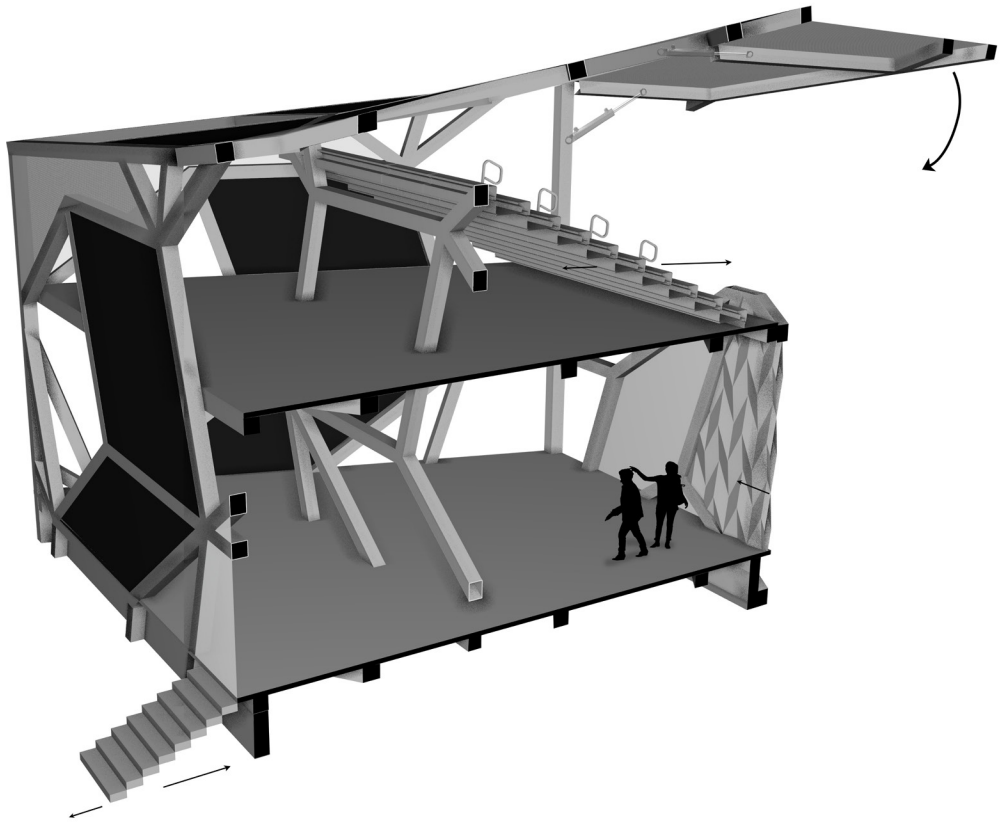


SELF-PROPELLING WHEEL SYSTEM

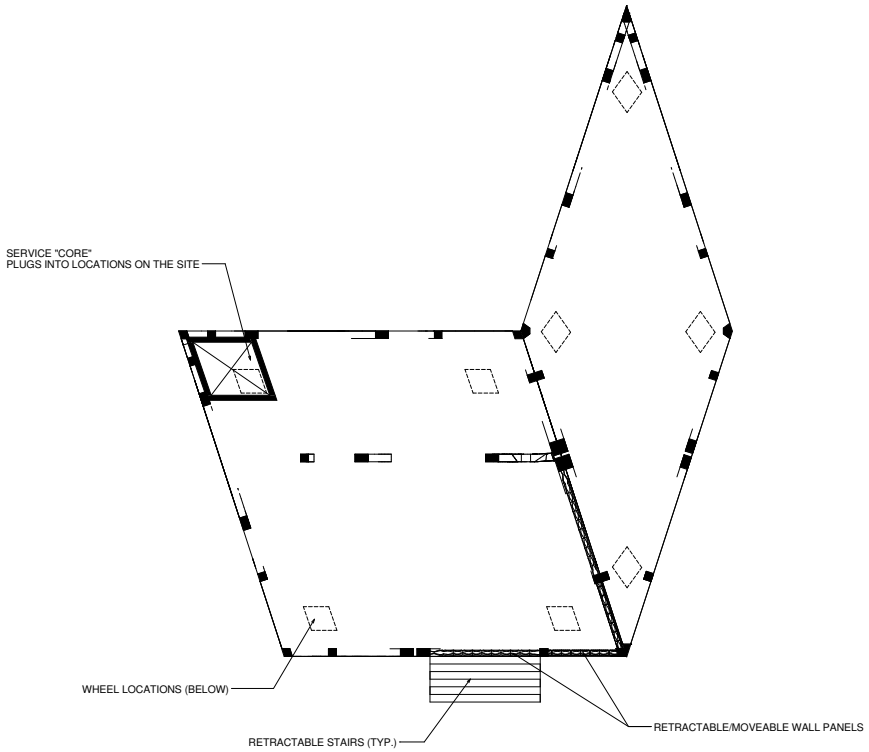


POWER AND SUPPLY PLUG SYSTEM

WALL PANEL SYSTEM

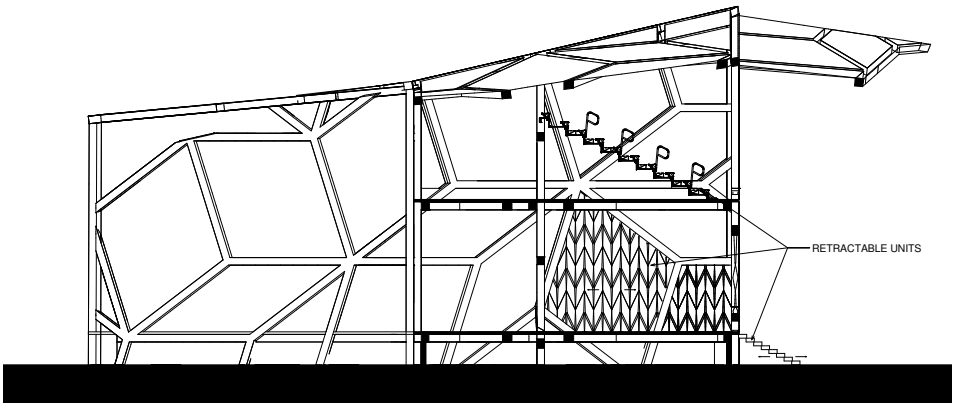


FINAL DESIGN PRESENTATION



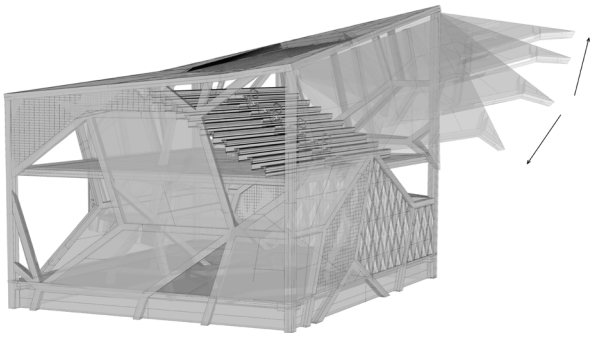
FLOOR PLAN

1/4” = 1’-0”

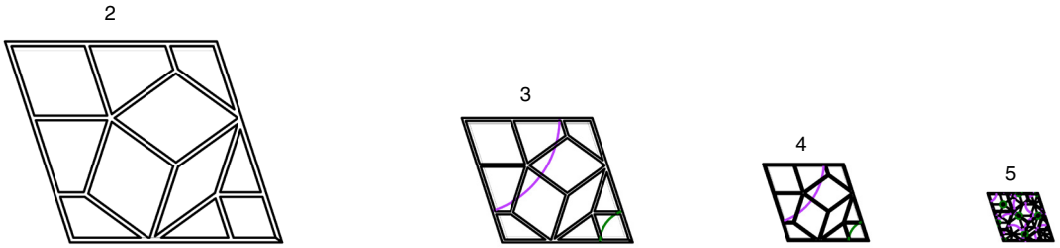


NORTH SOUTH SECTION

1/4” = 1’-0”

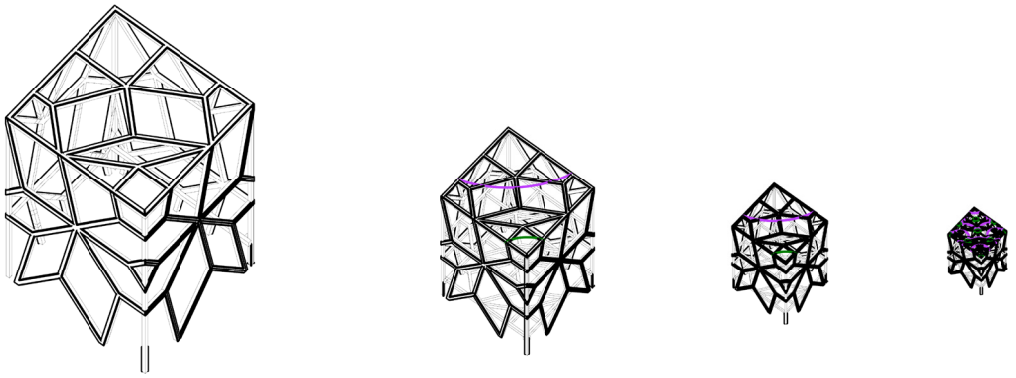


FINAL DESIGN PRESENTATION



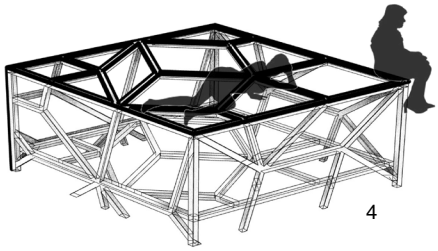
PLAN

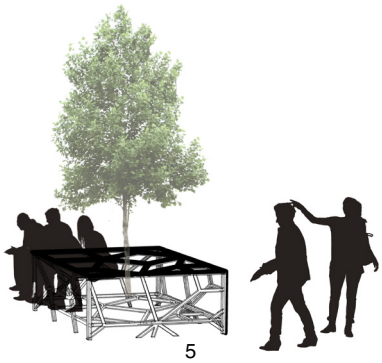
1/4” = 1’-0”

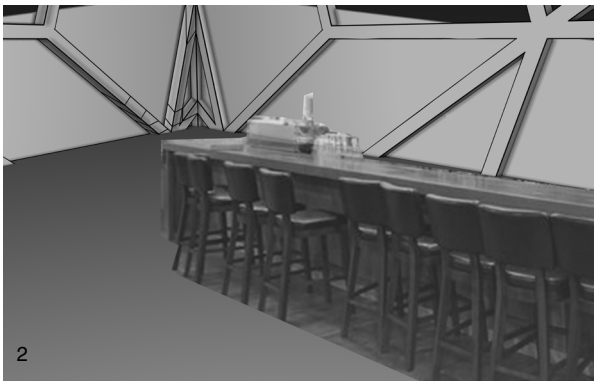


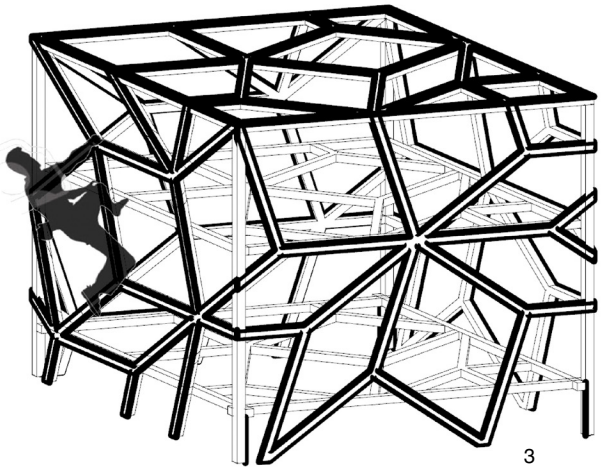
AXONOMETRIC

1/4” = 1’-0”









FINAL DESIGN PRESENTATION - PHOTOS