University of Cincinnati

Date: 3/27/2015

I, Sarah Smith, hereby submit this original work as part of the requirements for the degree of Master of Architecture in Architecture (Master of).

It is entitled:
Flexible: defining Olympic legacies through dynamic buildings

Student's name: Sarah Smith

This work and its defense approved by:

Committee chair: Michael McInturf, M.Arch.

Committee member: Aarati Kanekar, Ph.D.
Flexible
Defining Olympic legacies through dynamic buildings

A thesis submitted to
the Graduate School of
the University of Cincinnati
in partial fulfillment of the requirements for
the degree of

MASTER OF ARCHITECTURE

in the School of Architecture and Interior Design
of the College of Design, Art, Architecture and Planning

March 2015

by:

SARAH SMITH
Bachelor of Arts in Architecture
Clemson University, 2012

Committee Chair:
Michael McInturf

Committee Member:
Aarati Kanekar, Ph.D
Selection as an Olympic host city represents the opportunity to showcase one’s culture and city at one of the most highly anticipated international events. Unfortunately, the games’ transitory presence often leaves host cities in Olympic ruins. Post-game challenges are mainly due to the growing size and expense of the Olympics, the difficulty of balancing Olympic architectural expectations with regional needs, and the great population shift on Olympic sites before, during, and after the games. We live in a dynamic society, but our buildings are designed to be static. An innovative Olympic planning and design strategy, combining world class design with flexible structures, will leave host cities with a positive Olympic legacy and create a catalyst of positive urban growth for the city.

Precedents of modern-day Games, such as the 2004 Athens and 2012 London Olympics, provide insight into the successes and failures of former games and are the key drivers in the design of a new successful park. Awareness of the expectations and requirements of grandiose Olympic architecture, in conjunction with flexible and sustainable design ideas, will serve as a guide to an effective Olympic plan. Implementing a new thought process in Olympic design, specifically looking at flexible architecture, or architecture that responds to changing populations, seasons, and programs, will mitigate the burden placed on host cities. Flexible design strategies that adapt, transform, move, and have temporal capabilities, will give Olympic structures the ability to transition post-event, while also maintaining their proud Olympic legacy. An innovative natatorium design exploring the techniques and advantages of flexible mega structures, will test these ideas for transient events such as the Olympics. From this model, an architectural formula will be established for mega-event structures, in order to lessen the environmental, cultural, and economic impact these mega-events have on host cities, and to solve the problem of architectural latency associated with Olympic structures.
# TABLE OF CONTENTS

3 abstract  
8 list of figures & illustrations  
22 introduction  
24 olympic history  
38 flexible: adapt, transform, temporary, move  
66 site  
74 proposal  
100 bibliography
LIST OF FIGURES & ILLUSTRATIONS


FIG 10 - Diagram by Author.

FIG 11 - Diagram by Author.


FIG 27 - Diagram by Author.


FIG 29 - Diagram by Author.

IMAGES A-Q (left to right)

A - http://www.buildingcentre.co.uk/project/aquatics-centre-london
C - http://www.paralympic.org/news/final-london-2012-test-events
D - http://www.archdaily.com/255557/london-2012-basketball-arena
H - http://helmofthepublicrealm.com/2012/08/
J - http://www.independent.co.uk/arts-entertainment/architectu
L - http://www.collectionofurbanstudies.com/newsletter_071412.html
M - http://www.archigram.org/design/archigram
FIG 1
Abandoned Sarajevo bobsled course

FIG 2
Abandoned German Olympic Village
FIG 3  Abandoned Sarajevo ski jump

FIG 4  Helsinki Stadium

FIG 5  Athens Venue
FIG 6
Decrepit Beijing volleyball venue

FIG 7
Beijing Velodrome
FIG 8
Locked up Olympic venue, Athens

FIG 9
Abandoned training pool, Athens
“Human beings are flexible creatures. We move about at will, manipulate objects and operate in a wide range of environments. There was a time, not too long ago in evolutionary terms, when our existence was based on our capacity for movement and adaptability; indeed it is to this that we owe our survival as a species. Most cultures now lead a more or less sedentary life, but it could be that flexibility is once again becoming a priority in human development and that technological, social and economic changes are forcing, or at least encouraging, a new form of nomadic existence based on global markets, the world wide web and cheap, fast transportation.”

-Robert Kronenburg
INTRODUCTION

In the modern, technologically-driven world, our built environment, designed to test time, is being left behind. Cities come in and out of existence based on the most recent inventions, and buildings are often abandoned as a result. Flexibility is a basic function of life, but it is not yet a function of our cities and the buildings we design. “[W]e are part of a much longer-lasting process of urbanization. It’s not the last word [we are] adding, but the first word of the next stage. What we leave behind on site has to be capable of absorbing new things, rather than being the end of the line.”2 Flexible architecture allows a building to alter its shape, occupation, or location, and gives our structures and architecture the freedom to adapt alongside our cultures.

Despite the fact that the modern Olympic games is perhaps the most highly anticipated international event, it is fleeting in nature and frequently leaves host cities with unwanted or unmanageable structures. The exponentially growing expense and size of the Olympics, the enormous shifts in a host city’s population before, during and after the games, and the difficulty of balancing Olympic expectations with regional needs are all factors contributing to host cities’ post-olympic stress. Olympic architecture is commonly criticized for the economic, environmental, and cultural toll it takes on a host city. Billions of dollars are invested in the infrastructure and design of buildings to showcase the world’s top athletes for two weeks on an international stage. Unfortunately, after these two weeks, only well-designed parks and architecture will be of benefit to the future of these cities. Images from previous Olympic hosts show overgrown sports fields, abandoned subway lines, and buildings now used only for tours to show off where the world’s top athletes once competed for two weeks. Too often, these large grandiose designs, meant to surpass international standards of design and technology, are abandoned by a city unequipped to handle such facilities, leaving them in disrepair.

As a result of globalization and increased travel between countries, the Olympics have become more competitive not only in sport, but in the architecture and spectacle Olympic host cities produce. Each Olympics seems to surpass the previous Olympics in scale, grandeur of facilities, and its overall experience. This escalation has invited questions regarding an architects role in a host-city’s legacy. Can architects design spectacular structures to meet the needs and demands of the world audience as well as the city within which the structure resides? Can flexible architecture provide a solution for our Olympic architectural needs, reducing stress on host cities after the Olympics?
The modern Olympic games, introduced by the founder of the International Olympic Committee, Pierre de Coubertin in 1896, was designed “to foster the goals of competitive sport; to provide a legacy of facilities that would simulate athletic development which would not otherwise be possible; and to raise the profile of the sports involved by providing better opportunities for training as well as sites for national and international competition.” The revival of the modern Games in Athens, Greece provided a foundation for the games of the following century. According to Adrian Pitts and Hanwen Liao, authors of *Sustainable Olympic Design and Urban Development*, the modern Olympics began as an event of “small scale, poorly organized and not necessarily involving any new development.” By the middle of the twentieth century, the scale of the Olympics had increased and mass media and commercialization became a larger part of the Olympics. Currently, the Olympics can be described as an overly materialistic era of grandiose twenty-first century design, in which the word ‘legacy’ spearheads many Olympic bids.

The 1992 Barcelona, 2004 Athens, and 2012 London Olympic planning strategies all revolved around the proposed legacy of the event and used decrepit areas of their cities as the main sites of development. The IOC states that “The Olympic Games have the
power to deliver lasting benefits which can considerably change a community, its image and its infrastructure. As one of the world’s largest sporting events, the Games can be a tremendous catalyst for change in a host city with the potential to create far more than just good memories once the final medals have been awarded." While many cities propose a post-games legacy, the intensive planning and execution needed to achieve this proposal is often difficult for cities to reach albeit the immense benefits.

According to the IOC, tangible and intangible legacies are both critical to the post-event success of Olympic sites. Tangible legacies, including new infrastructure, public transportation, sport and non-sport facilities and new parks, all add to the beautification and appeal of the city, attracting new residents and visitors, which ultimately stimulates the economy of Olympic host cities. Intangible legacies are often just as important as they bring an increased sense of national pride and the creation of new jobs, among many other benefits.

As stated by Jon Coaffee, professor of Urban Geography at the Centre for Interdisciplinary Methodologies, throughout the history of the modern Olympic Games, “the emphasis of regenerative impacts has shifted away from purely physical construction or renovation towards more holistic notions of renewal and environmental sustainability becoming de rigueur. These have been seen to focus on the economic, social, cultural and environmental benefits and legacy that hosting Olympic Games can bring to cities and surrounding regions.” Although a well-rounded ‘legacy’ has recently become more important in Olympic proposals and planning, these recent Olympic plans have also been taken to new levels of architectural grandeur. The untested scale and magnitude of recent Games results in either reinvigorated or crippled cities, and the success of each host city’s legacy is, in fact, open to conjecture and ultimately determined through time.
BARCELONA 1992

Barcelona’s master plan for the 1992 Olympics, coined by many as the “Barcelona Plan”, was a successful Olympic planning model which left a rich legacy with the city. This legacy ultimately promoted Barcelona as one of the world’s greatest cities. Leading up to its bid in the 1970s and 80s, Barcelona was in a severe urban growth crisis due to the de-industrialization of the time; hosting the Olympics became the perfect catalyst to rejuvenate and bring life back into the city. Taking a city that was in an urban crisis such as Barcelona, and accelerating its growth through the development of a mega-event such as the Olympics, provided the opportunity to rejuvenate an international power, and brought the city’s rich culture to the world’s attention.

As scrutinized in *Olympics Cities* by Francisco-Javier Monclus, a renowned urban planning author and professor, the obsessive concern to “improve the image of the city”, can result in the “trivialization process of urban methods and certain loss of its historic identity. Rem Koolhaus (1995) pointed out that a unique city like Barcelona could be a “generic city”, by oversimplifying its identity.” Fortunately, urban development plans prepared before the games, were accelerated and adapted to a larger scale to maintain some of the organic development which would have occurred had the Olympics not been in Barcelona.10 Capital improvement projects such as new roads and railways, green spaces, the regeneration of the coastline, as well as the restoration of existing sporting facilities, all contributed to the lasting image of Barcelona as a culturally, economically, and environmentally rich city. The “Barcelona” model remains a significant example of how a mega-event can renew a city and enhance the existing culture, leaving a positive legacy in its wake.
ATHENS 2004

Athens hoped to mirror the success of the 1992 Barcelona games, while also using the event as an economic, environmental and social catalyst for a city in need of regeneration. In Olympic Cities, Jon Coaffee states that organizers planned for the Athens 2004 Olympics to “be the first Olympiad using 100% green energy” and that “all projects [would] be realized with the use of environmentally friendly technologies and materials.” The organizer’s initial aspirations for sustainability ultimately fell short of their goal and environmental considerations seemed all but invisible upon the completion of their Olympic facilities.

Unlike the Barcelona games which showcased a strategic plan for the location of the Olympic park sites, Athens’s aimed to redevelop a portion of the city that was not heavily used. The site of the Athens Olympics was an area that tourists do not generally travel, and an area that had no interest in new Athletic facilities. While the two weeks during the Olympics were generally a success, the billions of dollars Athens spent on new facilities and infrastructure now has a history of being vandalized, locked up, or redundant. Despite the fact that the Athens Olympics proposed a ‘plan’ for a future legacy as an Olympic bid strategy, the aftermath of their games clearly shows that their superficial plans and unsubstantiated words provided an unstable base for the city’s Olympic legacy. A local Athenian interviewed on BBC commented that Athens “had a fantastic Games but no plan for the day after.”

FIG 18
Athens Olympic Promenade

FIG 19
Athens sand volleyball venue during the Olympic Games.

FIG 20
Eight years later, the same volleyball venue sits in ruins.
LONDON 2012

London’s Olympic bid was dominantly based on the legacy of the event, focusing on how the event can influence future development in the city. According to Graeme Evans in *Olympic Cities*, their “regeneration legacy was not reliant upon the Olympics; this would be the icing on the cake and provide the international cachet, even to an established world city and cultural capital. London’s bid therefore rested pragmatically on both broader regeneration and legacy plans, including explicit ‘with’ and ‘without’ Games scenarios.” Environmental improvements were emphasized in London’s Olympic legacy proposal, while improvements in economic and social realms were also critical to the under-developed East London site.

The London Olympics included many new facilities in its plan, however temporary and flexible structures were incorporated where a lasting legacy could not be guaranteed. Additionally, the London Olympics looked to further avoid future problems by lessening the complexity of its structures and allowing a “less striking” venue appearance than Olympics in previous host cities. Although the London Olympics nearly doubled their estimated budget as many Olympic parks do, the legacy plan was an integral part of the overall strategy, and plans for the future of this site would have been implemented nonetheless, justifying the increase in budget. It is too early to determine if London’s planning strategy, which focused primarily on the park’s legacy, will be viewed as a success.

FIG 21
London Bridge during 2012 Olympics

FIG 22
Aerial of London Olympic Park

FIG 23
Opening ceremony at London Olympics
SOCHI 2014

While the Winter Olympics are generally considered the smaller, less expensive games, Sochi, Russia invested more money than any previous Olympics, coming in at fifty-one billion dollars. While these games were intended to showcase the power of Russian President Vladimir Putin, they may have instead showcased the corruption, crime, and disorganization of the country. As a host country, Russia aimed only to provide a spectacular game, with little consideration to what would happen with the Olympic developments after the event.

While few of the country’s top leaders have given the issue much thought, President Putin and Prime Minister Medvedev have been constantly changing the concept for the post-olympic city, from ideas for a new capital in southern Russia, to dismantling the facilities and taking them to more developed cities in the north. While some are now considering the future of the park, a successful Olympic strategy would have implemented a plan for the future concurrent with the Olympic plan. The massive influx of people to Sochi during the games as opposed to after the games has created a huge discrepancy in the accommodation needs of the city, and Sochi would need to double its flow of visitors to keep the hotels in the area full and functional. As New York Times journalist David Segal states, “Sochi is at risk of becoming a gold-rush town that just ran out of gold.”

Similar to London, time will determine the overall effect of the Olympics on Sochi’s social, environmental, and economic prosperity.
The IOC has set “legacy” as one of the dominant criteria of Olympic bids and proposals. Many cities, such as Athens and Sochi, failed to meet their envisioned future, resulting in a bankrupt city with unwanted or unmanageable facilities and infrastructure. How can Olympic planning strategists ensure that the future they plan and design for will come to realization? Inherently flexible architecture, designed within a framework accepting of future changes, will provide cities with the ability to accommodate different populations, different seasons, and different programs. The ability for Olympic facilities and parks to adapt post games will lessen any adverse impacts these events have on host cities.

Flexible design strategies can provide a solution for our Olympic architectural needs, mitigating stress on host cities after the Olympics. Architecturally, how can these mega structures be inherently flexible to changing needs after the Olympics, leaving a positive legacy with host cities?

FIG 27
Olympic/Post-Olympic
Flexible planning and building strategies are fundamental in the discussion of legacy. It is an inherent flexibility which allows buildings to accommodate the changing needs of a city. Through mega events such as the Olympics, flexible design solutions can aid in overcoming the architectural latency often associated with stadiums. Adrian Pitts, professor of sustainable architecture at the University of Huddersfield in the United Kingdom states that one strategy to promote post-Olympic usage of venues is to “improve the adaptability and transformability of the venues for new functions in the future.”

New developments at the building and urban scale should be designed by first considering any changes that will occur in the future, and by finding solutions to the problems that might arise as a result of these changes.

According to Robert Kronenburg, “flexible buildings are intended to respond to changing situations in their use, operation, or location. This is architecture that adapts, rather than stagnates; transforms, rather than restricts; is motive, rather than static; [and] interacts with its users, rather than [inhibiting]” them. These concepts can work individually or alongside each other to validate the idea of flexible architecture as a “response to contemporary problems associated with technological, social, and economic change.” Kronenburg explains that a building designed to respond to change could, through its lifetime, “be moved from one place to another or changed in shape or structure – the walls might fold; floors shift; staircases extended; lighting, colours and surface textures metamorphose. Parts of the building could extend or even leave the site completely, or the entire facility could roll, float, or fly to a different location.” The possibilities for flexible architecture to acknowledge present-day issues are inexhaustible and should be incorporated in modern buildings to respond to future change.

Olympic architecture should be designed around these flexible principles of movement, adaptation, transformation, and temporality, with the notion that these facilities need to be useful and impressive both during the Olympics for the Olympic city, and after the Olympics for the host city.
FIG 29 (A-Q)
Precedent Diagram

London Basketball Arena, Wilkinson Eyre Architects, 2011
Walking City, Ron Herron, 1964
Tessellate, ABI & Zahner, 2010
London Olympic Natatorium, Zaha Hadid, 2011
The Floating Pool, Jonathan Kirschenfeld, 2008
Packable Dome, Chuck Hobermann, 1992
Prada Transformer, Rem Koolhaus, 2008
Bike The Floating Stadium (Concept), Quentin Perchet & Gabriel Scerri, 2012
Instant City, Peter Cook, 1968
Dynamic Tower (Planned), David Fisher, 2008
Markies, Eduard Bohtingk, 1985
Arizona Football Stadium, Populus/Peter Eisenmann, 2006
UK Millennium Dome, Richard Rogers & Buro Happold, 1999
London Olympic Master Plan, AECOM, 2011
Richmond Olympic Oval, Cannon Design, 2010
Watercube, PTW Architects, 2008
Similar to human beings, adaptable buildings adjust to their given resources to perform specific tasks and functions. Kronenburg states that "architecture that is designed for adaptation recognizes that the future is not finite, that change is inevitable, but that a framework is an important element in allowing that change to happen." Adaptable architecture allows the current user of a building to create a space within a framework that is suited for their specific needs. When a building design is inherently ready to adapt, there is a greater capacity for different layouts and programs from the inception of the building through its changing needs in time.

The ability of architecture to adapt is a concept that seems simple, however multi-use spaces that can adapt often pose difficult design challenges. Common problems associated with adaptable buildings often deal with issues related to the environmental technology of the building, such as lighting and air quality. According to Robert Kronenburg, "this often leads to multi-use spaces becoming bland, enclosed volumes without architectural character or personality." Designing an adaptable building for an event such as the Olympics requires investigation into the needs of the area. A proper balance between iconic Olympic architecture and the architecture of the everyday, will allow a framework that can change through time.
The Richmond Olympic Oval, by Cannon Design, served as the facility for indoor long-track speed skating at the Vancouver winter Olympics in 2010. According to ArchDaily, long-track facilities are very large and these buildings often face significant operational challenges post-games. In response to these issues, Cannon designed a building that can be converted into different sport and non-sport amenities. It can be host to basketball, volleyball, or convention gatherings, among many other uses. Additionally, this building will serve as a catalyst of a new urban waterfront development and an outdoor destination for recreational activities. These new civic amenities will attract new residents, business owners, and additional public amenities to this area.¹
The UK Millennium Experience Dome by Richard Rogers and Buro Happold for the 2000 Millennium Experience Event was designed to be a semi-permanent structure, however new users continue to inhabit and adapt this space. Made of PTFE-coated glass fiber fabric, this building has become a durable and weather-resistant concert, sporting, and performance venue, as each program is capable of inhabiting the plastic shell. The large shell is also able to accommodate many activities occurring simultaneously.
Transformable architecture can intrinsically change its form to accommodate the different and changing needs of a building. According to Kronenburg, "a transformable building is one that changes shape, volume, form, or appearance by the physical alteration of structure, skin or internal surface, enabling a significant alteration in the way it is used or perceived. This is architecture that opens, closes, expands, or contracts." The transformable nature of a building often comes from a mechanical addition, allowing roofs, floors, and stairwells to move, ultimately leading to the versatility of the building as a space for various activities. These significant alterations to the building’s form and function fundamentally change the way the building can be used without major modifications to its overall structure.

Successful transformable design provides a flexibility that can be reverted back to the original or different states of being to allow a constant flux of programmatic needs. Furthermore, transformable architecture “must enable a dramatic alteration in the character of the whole architectural environment,” increasing the usability of a structure through time.

**FIG 35**
Olympic/Post-Olympic Transform Scheme
THE HOBERMAN ARCH

Chuck Hoberman is an engineer and architect who is famous for designing both temporary and permanent transformable structures. His work often involves pavilions or installations for major events. Hoberman’s work “explores transformable kinetic geometries that define space and structure, with deployable structures”\textsuperscript{11} that serve as inspiration for larger transformable structures. His best-known work is the Hoberman Sphere, a globe that folds and expands from a small form to a larger form in an uninterrupted action due to the geometrically-designed, linking components. The Hoberman Arch, another of his more famous pavilions, served as the centerpiece and backdrop of the 2002 Salt Lake City Olympic Games.

FIG 37
Hoberman Arch detail
The Arizona Cardinals Football Stadium is an example of a large scale building taking advantage of transformable technology to increase the features and amenities generally offered in a building of this scale. Designed by Populus and Peter Eisenmann in 2006, the football stadium’s roof and field are retractable, allowing the stadium to be indoor or outdoor depending on the weather. The retractable field also allows the stadium to have real grass that is grown outside and brought indoors for games. Additionally, due to its transformable nature, this venue has been used for motor sport events, trade shows, and concerts. According to Populus, the transformability of this stadium was one the first of its kind at this scale, and it allows cities to re-evaluate what large-scale facilities can provide for their communities.12
Temporary structures allow the land the structure sits on to be flexible and change its purpose through time. Temporary structures generally leave traces of themselves, but allow new activities to inhabit a space that a completely different activity previously inhabited. According to Robert Temel in his book *The Temporary in the City*, “even after the temporary use has ended, the location of temporality remains a projection screen onto which new projections can be made. The identity of this location is thus not fully determined; it can still be shaped.”

Often compared to architecture that moves, temporary structures may also have the ability to relocate to a new location. Generally, in this situation, the structure is completely dismantled and reassembled elsewhere. Temporary structures are often made of lightweight materials such as plastic and lightweight steel to allow for easy construction and dismantlement. These light materials and structure also provide a more economical solution for a project that is not meant to withstand time.

For large scale events such as the Olympics, temporary structures are great solutions for facilities in which a legacy cannot be assured, providing an economical solution for the event that will have little impact on a host city after the event.
The London Basketball Arena, built for the 2012 London Olympic Games, is one of the largest temporary structures ever built. As one of the most iconic and visible dramatic venues of the London Olympics, this stadium was made of robust, lightweight materials, and erected in just six weeks. The lightweight components, dominantly comprised of reusable or recyclable materials, allow the structure to be easily dismantled and moved elsewhere for reuse. Currently, the dismantled stadium is for sale for 2.5 million dollars, a price Rio de Janeiro considered to pay for their upcoming Olympics. The idea of re-using temporary event facilities such as this Basketball Arena is a paramount concept in working towards the success of an Olympic structure and its legacy after an event.
The ability of architecture to move is perhaps the most radical form of flexible architecture, yet it has also been around the longest. Similar to ideas surrounding temporary structures, one must relinquish the idea that architecture is inextricably bound to a plot of land. According to Kronenburg, “the concept of a movable building appears at first to be an oxymoron. The very idea that the most substantial objects created by human beings can be designed to relocate from place to place seems almost to be a contradiction - buildings are the most permanent of our artefacts, but mobility is transitory.” In fact, movable buildings are very common and critical to the way many people around the world live their lives. Mobile homes and house boats are examples of the most common and simple form of movable structures.

From the beginning of Architect Santiago Calatrava’s career, he was fascinated with the idea of movement and began exploring ways architecture could accommodate movement. In Calatrava’s eyes, “movement, both explicit and implied, redefines, reconfigures, and revives static form and, ultimately, the long-standing norms of structural elements and building types.” In event planning and architecture, movable structures have the opportunity to serve as poetic devices, signifying the ever changing conditions within a city.
The most ubiquitous form of a moving structure is the mobile home. Numerous examples of mobile dwelling units incorporating various flexible features, allow this building to not only move, but transform and adapt as well. Eduard Bohtlingk’s Markies is a mobile dwelling unit capable of moving and transforming to allow all of the comforts of a holiday home to fold up into a mobile caravan. This mobile home has the capability to move and expand from a 2.2 x 4.4 m area to a 4.4 x 6.6 m area. Markies was developed under the principle that “temporary homes are mobile homes”, and has been part of a traveling Vitra exhibition called ‘Living in Motion’.19
FLOATING POOL

The Neptune Foundation’s Floating Pool, completed in 2006, was built within an existing steel deck barge of 80 feet by 260 feet. The facility includes locker rooms, bathrooms, a spray pool, and a snack bar, and of course the main pool, which can accommodate 170 swimmers at a time. Based upon a thesis by Anne Buttenweiser in the 1970s, the hope was for this pool to be the beginning of a new generation of public floating pools. Construction on the project took place in New Orleans, and the pool was floated to New York to a new home at the Brooklyn Bridge Park in 2007.26
The ability of a building to adapt, transform, move, or have temporal qualities will allow it to successfully move forward in our ever-changing, technologically-drive society. These precedents show a building’s capability to be flexible to different populations, different seasons, and different programs. Many structures test more than one of these flexible strategies to achieve the effect needed in their particular situation. These are the examples that suggest many flexible methods can be applied to achieve a desired result. Applying flexible architecture to our Olympic structures is the most valuable move designers can make in ensuring a positive legacy for our Olympic host-cities post event. The possibilities of flexible architecture to alter the life a building are inexhaustible and can be designed to meet the needs of monumental Olympic architecture.

3. Ibid.
03 SITE

Cincinnati’s front door is its riverfront. As an old industrial city with a love of sports, a mix of coal sites and world class stadiums can be found along the riverfront. Major highway arteries travel across the river through the city of Cincinnati, exposing travelers to the grit and glamour of this historic city. East of Interstate-71 is a well-planned river-front park, housing three major sporting venues and a pedestrian friendly waterfront. West of I-71 is industrial and disconnected from the city. This industrial area, inhabiting prime real estate along the river, begs to be developed into an inviting cultural center. As a relatively open and flat site, the continued development of a pedestrian area along this portion of the river will be well received and begin to expand the central activities of the city westward. A new Olympic development and natatorium, testing flexible design ideas for mega-events, will be located on this site west side of I-71. This development will strengthen the gateway into Cincinnati, connecting the existing riverfront with the west side of the city, ultimately inviting people to access and use a previously industrial site.

History of Site:

Early maps of the Queensgate site from 1904 show that the area has been industrial since the early 1900s and was previously a railway thoroughfare. Through time, as the city expanded out, industrial areas were abandoned and the city now faces the challenge of reinvigorating these areas. The surrounding site and built environment is currently zoned as light-industrial and local businesses include a UPS distribution center, Duke Energy, and historic Longworth Hall. Longworth Hall, which has a rich history and is an iconic building for this section of the city, will remain, while the majority of the other businesses surrounding the site will be relocated. This will allow for a clean and inviting environment for Olympic guests and help ensure the future development of the area. Located between industry and major highways, this site is exposed to many threats and intrusions. The relocation of industrial businesses will alleviate the harsh industrial noises, sights, smells, and contamination.
FIG 49
Ste Analysis / Planning Diagrams

- Cincinnati Sites
- Olympic Park Sites
- Natatorium Site
- Industry
- Environment
- Flood Plane
- Transportation / Access

68
Environment:

Cincinnati is located in a generally moderate climate with extreme cold as well as extreme heat and humidity. According to climate consultant, hot and humid summer months pose challenges, but the winter seems to pose larger design challenges for buildings in the area. More challenging than the climatic environment are the forces of the Ohio River. The Ohio River’s flood plain encompasses the planned site for the Olympic park development and natatorium. With an average river height of 27 feet, the Ohio River is at its flood stage when the water reaches 52 feet.

Although the flood plain presents challenges, building a plinth several feet above the 52 foot mark will serve as a solution and prevent major flood damage within the natatorium. The remainder of the master plan within the flood plain will be comprised of parks and parking which will only have minor damage as the result of a flood. While the river brings flood issues, it also brings with it the opportunity to use the transient nature of water as a poetic device in the development of the natatorium. Using the river as a tool for the flexibility of the natatorium design will open the door for a framework that can be altered through the life of this building.

Circulation around site:

The major interstates adjacent to the site are elevated and block many of the views in and out of the city. Although the lack of a visual connection poses challenges, the location of these thoroughfares is ideal for the further development and access to the site. While a new I-71 bridge, planned to be built adjacent to the current bridge, will further separate these two areas, this also provides the opportunity to reroute some of the access ramps directly to the site. Although the site is walkable, it is not a desirable place to walk. A new, intriguing connection below the I-71 bridge and between the two disparate sides of the highway will encourage further pedestrian growth.

In the past, the site was part of a major railway system running through Cincinnati which is still partially in service today. As the railway system demand decreased in this part of the city, the number of active tracks also decreased. One active railway track, located on a raised bridge running through the middle of the park, creates another barrier between the site and the city. The site’s industrial history, however, invites this piece to stay as a connection to the past.

The site for this new urban development faces many challenges dealing with the existing industrial surroundings, the barrier formed by I-71, and the floodplain which fully encompasses the proposed Olympic master plan area. Addressing these issues in a new urban plan and swimming venue, will create a solid foundation for the Olympics as well as its legacy. The Barcelona model provides significant ideas for Olympic urban planning which can be adapted by future hosts such as Cincinnati. In a city such as Cincinnati, spreading out the Olympic park ‘areas’, will increase the osmotic effect and work to connect parts of the city which are currently isolated. Additionally, the use and restoration of existing facilities along the waterfront and at local universities will enhance what is already available in the city. While Cincinnati is not a huge city, its distinct history and identity will provide a solid base in the development of its future. To accomplish this, Olympic park plans will use the existing urban development plans and ideas to accelerate the organic development already in motion. Ultimately, each design needs to be sensitive to the needs of the city, it’s image altering Olympic games, and the legacy left behind after the games.


FIG 51 - 54
Photographs of the site and surrounding buildings

FIG 55-58
Aerial Photographs of the site buildings
In a medium sized city such as Cincinnati, planning a mega-event has more implications than in a city of a larger scale. Critical awareness of the needs and expectations of an Olympic facility as well as the needs and expectations for a city after the Olympics will help guide designers in planning a more holistic Olympic development. While medium size cities have a need for most facilities associated with the Olympics, the scale of these Olympic facilities are generally overwhelming. Furthermore, not only are individual facilities important in the discussion of mega-event legacy, but just as critical is the overall event park.

The successful transformation of a building and event master plan depends not only on spatial changes, but on how these flexible acts affect the overall experience of the city. Mega events, hosted in large scale, world class buildings and event parks, not only have large spatial requirements, but the atmosphere of the place must be unprecedented. After these mega events, the demands of the area dramatically decrease, and the everyday use of the space warrants an everyday environment. Questions concerning the transformation of a building and master plan after a mega event need to be addressed and designed for before the event, not years after the completion of the event.

Implementing a new Olympic design strategy that creates a flexible framework for the future will lessen the burden placed on host cities such as Cincinnati. Encouraging positive and sustainable urban growth will ultimately help Cincinnati achieve widespread and lasting benefits. As a result of this thesis project, an architectural framework will be tested for a hypothetical Olympic Games in Cincinnati, aiming to lessen the events’ environmental, cultural and economic impacts, and to create a catalyst of positive urban growth in host cities.
DESIGN AIMS

The main design aims for this master plan and natatorium are to create a flexible park and facility capable of the changing needs during and after the Olympics, to create connections between downtown and the western riverfront, and to utilize the history of the site and the environment along the river. The flexibility of the master plan and natatorium will allow the design to adapt, transform, and move in response to changing programs, seasons, and populations. The master plan will also work to create a connective tissue between the downtown core and the industrial Queensgate site through new roads, park connections, and a new pedestrian thoroughfare. In a project incorporating flexibility, a site along the river provides the perfect opportunity to utilize the flowing water as a poetic resource. Additionally, the industrial nature and history of the site creates a unique opportunity to incorporate heavy duty industrial elements, which will help facilitate the flexible nature of the master plan and natatorium. This heavy industrial quality, combined with these three design aims, will work to create a cohesive solution for a lasting Olympic legacy on a challenging site in Cincinnati.
In planning the transition of an Olympic master plan through its phases of use, one must first look at the current capabilities of the city, and the desired effects post-Olympics. Once these two situations have been assessed, planning the Olympic master plan is a task of making these ends meet. By identifying all of the facilities capable of hosting Olympic events in the immediate area, one can drastically lessen new construction requirements by rehabilitating the structures that are already present. This strategy not only lowers the overall budget and scope of the master plan, but it beautifies older facilities rather than creating duplicate facilities in a city that cannot support two of the same venue. Cincinnati is a city that already values its sporting culture and has a variety of world-class facilities capable of hosting Olympic events.

Of the thirty-seven venues proposed for an Olympic Games in Cincinnati, only nineteen will require capital investment. Seven of these venues will be permanent improvements and construction, while the remaining eleven will be temporary facilities. Most of the events will take place in the greater Cincinnati area, while a few events will be in nearby cities such as Lexington, Louisville, Oxford and Dayton. Utilizing the facilities at nearby universities, as well as major parks, will ease the transition into a post-Olympic era. King’s Island, the ATP Tennis facility, UC, Miami University, and current stadiums and venues along the riverfront, all have the capability to be Olympic ready with little to no renovations. The majority of the capital investment for this project will go into the main downtown Olympic Park on the west side of the river, connecting and responding to the developed east side of the riverfront.

Cincinnati is currently home to two major sports facilities and a newly renovated park along the riverfront. Most of the activity from these existing venues occurs on the east side of the I-71 bridge. During the Olympics, the Bengal’s stadium will serve as the main soccer stadium and the Red’s stadium will remain as a baseball and softball stadium for the Olympics. The US Bank Arena will serve indoor volleyball, and parks such as Yetemen’s cove and Sawyer Point will host sand volleyball and be the finish and
start lines for road races, the triathlon and open water swimming events. Longworth Hall will also be converted into a hospitality and media center for the Olympic Games.

A flexible framework of large steel trusses, clad in a perforated metal, will allow a variety of indoor and outdoor events to occur on this site, and give this space the flexibility to host different events. The framework will be host to the new natatorium, flexible to changing needs after the Olympics, and the Olympic gymnastics facility, which will become an indoor training facility for the Bengals post Olympics. Additionally, a new park on the site will serve as a spectator retreat and guide pedestrian circulation during the games. Within the framework, the park will have the capability to host a variety of activities such as different indoor and outdoor sports fields, extensions of Longworth hall, and large outdoor events.

A smaller framework will act as a guide for pedestrian movement throughout the site. This framework will connect the new park development with the eastern riverfront as well as with downtown. A bike path, running through this smaller framework, will continue along the river towards Indiana.

One final capital investment project will be to incorporate a marina on the site. This new marina will create a water connection to the city that is currently missing. Not only will this encourage people to come into the city by boat, but it will increase the appeal of living downtown along with the new facilities along the riverfront.

The overall master plan for an Olympic Games on this site has the capability to provide a successful, world-class Olympics, while being flexible to the changing needs of Cincinnati after the Olympics. These plans will rehabilitate the western portion of city and create positive impacts on the city’s economy, environment, and social structure, providing a lasting legacy the city can be proud of.
A natatorium has three main user groups with different space requirements and comfort needs: the athletes, the spectators, and the staff. While many of these users’ needs overlap, the environment and experiential quality of the space varies for each group in their particular activity. Additionally, the environment and spatial needs of a natatorium during the Olympic Games is drastically different than the needs of a natatorium for everyday use and regional competition.

Adjacency diagrams, (fig. 69), of the different programmatic activities, explore the needs of a new world-class natatorium during the Olympics. These requirements examine how the spaces can be flexible to changing needs post Olympics. By first identifying the changes needed to appropriate a building as the population and facility needs change, the design can easily morph in to a new, well planned facility. Designing buildings to be built for a lifetime that fit into a flexible framework, will increase a cities pride in that structure and will benefit the city economically, socially, and environmentally.

Although the spatial needs and experience during the Olympics are critical to the success of the building, looking at how these spaces can transform, adapt, move, or even disappear after the Olympics is key in determining a successful mega-event design. This will be a building built for the future, ready to withstand not only wear and tear, but more importantly, changing needs in time.

FIG 71
Form Diagram

FIG 72
Flexible Traits Diagram
In an Olympic setting, the most important piece of a natatorium is the competition pool and its ancillary programs. The competition pool must be 50 meters long by 25 yards wide, and have top of the line starting blocks, lane lines, and a large pool deck. In addition, there needs to be a diving well adjacent to the competition pool. Spectator stands are also critical to the success of an Olympic natatorium. Recent precedents provide roughly 17,000 seats for spectators and have had plenty of public rest rooms, concessions, and other amenities.

While the spectators are important, athlete spaces are just as important. An additional 50 meter pool for training purposes will be located nearby the competition pool, as well as an athlete lounge, an medical area, and pool side locker rooms. Other smaller programmatic elements such as a doping control room, break rooms, and athlete ready rooms will also be incorporated into the Olympic building program.

Finally, the media plays a large role in the Olympic experience as the majority of the world watches these events from their television. Ample space for the media to set up and store their equipment, as well as conference rooms to interview athletes and coaches will be included in the Olympic program of the building.

After the Olympics, the competition pool will remain the focal point of the building, but other civic amenities such as a new recreation area and a new event space will become important secondary programs. While spectator seating will remain, it will be drastically reduced to roughly 7,000 seats, and the main lobby will transform to host ‘everyday’ activities. Major moves will be made to relocate many of the athlete facilities including the training pool, which is not needed in the legacy plan, as well as supplementary training facilities such as the sports medicine area, training pool locker rooms, and the large athlete lounge space.

The atmosphere of the post-Olympic natatorium will remain intimidating as it will still be a world-class facility and host large swim meets as well as other events. The scale of the building, however, will change to host a smaller population of people, and to lessen operational challenges post Olympics.

This project will study how these spaces can be inherently flexible to easily adapt, transform and move within a fluid framework to provide a solution to Olympic problems associated architectural latency. In this natatorium design, the spectator seating will transform, the entry and media building will adapt, and the athlete training facilities will move.
FIG 77
Building Section

- Plinth: 62'
- Flood Stage: 52'
- Average River Height: 27'
The ability of a building to adapt is the simplest form of flexible architecture. By examining the potential needs of a building at different phases of its life, one can easily create a framework for one program to adapt into a completely different programmatic space at a later date. For Cincinnati’s natatorium, the largest Olympic space that can easily adapt into a new program is the media center and main entrance. This two story space of roughly 40,000 SF will be converted into a rec center for Cincinnatians to use. New additions to the recreation center will include a basketball court, racquetball courts, studios for group classes, an aerobic area, and a weight lifting area. With a current lack of recreational facilities in downtown Cincinnati, this facility, as well as the surrounding outdoor sporting complex, will attract many users to the transformed Olympic park after the big event.

This portion of the building, located on the north side of the complex, will adapt from a piece devoted to the spectators and their entertainment, to a piece for residents of Cincinnati to use and enjoy on a everyday basis. By maintaining the same exterior form and structure of the original Olympic building, the programmatic adaptation can occur without significant investments into the building. While permanent portions of the building will be constructed and clad in concrete, the adaptable portion of the building will be dressed in a perforated steel. This material symbolizes the permanence of the building, but blurs the changing program within.

The addition of this recreational facility in the overall master plan will serve as a catalyst for the future growth of the park master plan, encouraging this site to become an active social hub of Cincinnati.
TRANSFORM

Transformable architecture is more radical than adaptable architecture. This is architecture that often requires engineering of moving parts to create a successful transformation. In the natatorium design, one of the largest programmatic challenges post-event is the amount of spectator seating. After the Olympics, there will almost certainly never be another swimming event of this scale held at this particular facility. A transformative strategy for this portion of the building will rotate the spectator seating located on the river side of the structure, from seating facing indoors, to seating facing the river. Additionally, large folding windows can enclose or open the space to the outdoors, and the bottom of the pool can raise to be level with the pool deck to allow other events to take place in this facility.

Not only will these moves lessen the indoor seating, but they will drastically reduce the amount of indoor space that needs to be conditioned on an everyday basis. Additionally, these transformations will allow more light to come into the building, they will open views out to the river and to Kentucky, and they will create an interesting indoor/outdoor environment in which users can step down to the water’s edge. The entire facility now has the capability to easily transform for other programs and events such as a concert, a basketball game, a rowing regatta, or tennis matches among an endless list of possibilities.

For this transformation to work properly, the entire seating system will rotate along one pivot, but more importantly, the individual rows of seating will rotate to account for the appropriate rise and run. This system will allow the spectator steps to be in many different positions.

These transformative features are working to solve many of the problems associated with legacy in Olympic buildings by allowing other events to inhabit the same space as the pool.
FIG 81
Transform Options
The ability for a structure to move challenges many of the basic principles associated with buildings. When this building is located along a river, however, this movement becomes infinitely more attainable. Similar to the Floating Pool precedent, the addition of a barge element, kept within a lock, will provide the opportunity for a portion of this facility to relocate to different cities along the river.

The athletic training pool is an element of this building that is difficult to re-purpose and will not have significant value in Cincinnati post-Olympics. The barge portion of the Olympic natatorium will include this training pool, along with locker rooms and ample deck space. While these programmatic elements are not needed in Cincinnati post-Olympics, they can be extremely valuable to other cities. In working towards a positive legacy for the natatorium, the movement of this piece of the project will not only reduce the overall square footage of the Cincinnati facility post-event, but it will create opportunities for other river communities to have access to a competition size pool. Cities from New York to Mississippi will have the opportunity for this swimming facility to stop in their communities, and for their citizens to enjoy a public pool.

As the barge leaves the Cincinnati site, the lock will refill and become a reflection pool, as a reminder of what was once there. While the lock system will be empty at times and contain a reflection pool, it will also have the capability to host other barge or boat events and serve a new generation of floating buildings. This movable portion of the building will be made of a PTFE plastic membrane to express the temporality of the structure. This plastic membrane can easily be removed or altered to serve a new city or event’s needs.
In designing an inherently flexible Olympic venue, the life and legacy of a building can extend far beyond the Olympic Games. Creating a framework for the future through flexible strategies that adapt, transform, and move, will allow the building to respond to the changing needs of a city. Ultimately, the goal of this study is to lessen the environmental, cultural, and economic impact these mega-events often have on host cities.
BIBLIOGRAPHY


