Design for Reuse: Post Occupancy of Olympic Stadiums

by
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Submitted to the Department of Architecture
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**OLYMPICS**

**DESIGN for Reuse: Post Occupancy of Olympic Stadiums**

**PROMOTERS / BENEFICIARIES**

- Politicians
- Security
- Construction companies
- Media companies
- Corporations
- Athletes

**OPPORTUNITY COST / PAYERS**

- Education
- Health care
- Affordable housing
- Tax payers

* Community Involvement / Unity

**Bird’s Nest’s usage**
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ABSTRACT

On the surface, the spirit of Olympic Games is about the competition for medals. Underneath the surface, however, lies a series of political, economical, social agendas. Individual Olympians represent their Nations. Rising modernity, stabilization of economy and social cohesion of nations are represented by the contemporary Architecture of the games. Every Olympic game has resulted in a significant change in the host city and presented the host country with a unique opportunity to shed a new light on itself in front of a global audience. In anticipation of presenting a brilliant, dynamic image to the world, Olympic cities often build contemporary sporting arenas that follow similar design patterns of generating iconic and autonomous buildings with relatively fixed programs. In order for a city to accommodate such a large number of newly constructed sporting venues, a trend has emerged whereby cities shift the games from the urban core to outlying peripheries, scattered throughout the suburbs. After the 17 days of international use, the venues return to serve the host city’s needs. But the stadiums are largely freestanding objects that compete with pre-existing residential fields for the occupancy of local teams. These local teams often favor smaller arenas that are less maintenance-intensive and are more widely accessible due to their greater proximity to the city core. As a result, Olympic stadiums become underused, labeled as white elephants and even in some instances abandoned.

The next Olympics will be held in Rio, which has the 5th largest economy in the world while also having one of the world’s lowest GDP per capita. This thesis explores the possibility of exploiting the flamboyant nature of the Olympics to create a dual purpose field hockey stadium, the design of which is flexible enough to adapt to a post Olympics transformation into a vocational school.
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Design for Reuse:
Post Occupancy of Olympic Stadiums

Image Credit: Robert Saiget/AFP/Getty Images
PREFACE

In 2008, the Chinese government saw the Olympics as a chance to firmly establish its identity as an established economy in the world. The architecture, however, is often deprived of human cultural and regional identity and remains forever alien to the locals. Hutongs are traditional courtyard houses that date back as old as 800 years. In the last decade in Beijing, modernization has removed nearly 70% of hutongs while displacing 1.5 million inhabitants in preparation for the latest skyscrapers and 18 new 2008 Olympic summer games venues. Peng Peigen, an architecture professor at Qinghua University in Beijing, describes the games as an opportunity where “[international] architects are doing things in China they wouldn’t dare do at home. They’re using China as their testing grounds.” The fact is that many Olympics stadiums around the world are designed by international architects: Calatrava (Spain) for Athens, Roger Taillibert (France) for Montreal, Herzog and de Meuron (Switzerland) for Beijing, HokSport (USA) for Sydney, and the list goes on. Designs are bold and built fast to meet the tight schedule of generally 7 years between announcement and opening. While some argue that China has provided the best opening and closing ceremony yet, the games only lasted 17 days. When the games end, the athletes and architects go, and after the doors close, it is the host city and its inhabitants that are left to deal with the foreign carcass left behind. Almost every sports arena has similar design patterns of generating iconic autonomous buildings with relatively fixed programs.

2 http://www.china.org.cn/china/features/content_17458714_2.htm
3 http://blogs.reuters.com/china/2008/08/24/beijing-2008-were-these-the-best-games-ever/
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Appendix
In the games, nations are represented by individuals...

Design for Reuse:
Post Occupancy of Olympic Stadiums

The Olympics
Rising modernity, stabilization of economy and social cohesion of nations are represented by the contemporary Architecture of the games.
“Olympic Stadium With a Design to Remember”
Nicolai Ouroussoff, NY Times, August 5, 2008

Beijing 2008: Were these the best Games ever?
By Kevin Fylan, Reuters, August 24, 2008

“All Form, No People: Why the architectural icons Beijing built for the Olympic Games stand empty”
Newsweek Intl., Volume 153, Number 14, 6 April 2009

“Beijing’s Olympic building boom becomes a bust”
Barbara Demick, LA Times, February 22, 2009

“After Summer Olympics, Empty Shells in Beijing”
Michael Wines, NY Times, February 6, 2010

Image source: http://raxacollective.files.wordpress.com/2012/12/beijing_olympic_opening_ceremony_wallpaper.jpg
Athens—Stadiums abandoned & closed off to public

photo source: http://www.theblaze.com/stories/a-mere-8-years-later-athens-olympic-venues-in-decay/
Beijing Bird’s Nest - 3 events in 3 years

1.1 THE NUMBERS

1964 represented the year when the Olympic Games were first broadcasted internationally. Since then, the Olympics has become bigger; more athletes, more nations represented than the United Nations, and ever rising costs. Currently, it takes at least $14 billion dollars to host the Olympics, not including the application fees [refer to diagram in appendix]. The cost shadows the GDP of some nations such as Iceland, Senegal, or Haiti. Every city attempts to outdo the last. When it comes to mega events, there is nothing greater in a span of just 17 days. During the Games, nations are represented by individuals. And rising modernity, as well as the stabilization of economy and social cohesion of nations are represented by the contemporary Architecture of the games. Every city that hosts an Olympic game hopes to shine a new light on its nation’s image. While every city is placed into a serious debt after the Olympics, the public is still easily misled to support the hosting of the Olympic Games with perceived benefits of increased jobs⁴ (often in reality just temporary and affected by volunteers) and subsequent increased tourism [statistically not supported⁵].

Opposite Top:
Events, Athletes, and Countries in Olympics vs countries in UN

Opposite Bottom:
$ Estimates, Cost and Revenues

⁴ http://www.ajc.com/opinion/beware-promise-of-sports-608689.html
⁵ 54, Perryman
PROCESS TO HOST OLYMPICS

IOC Headquarters
Lausanne
Switzerland

City visit by IOC members

Introduction of Candidate Cities

Application Fee $150,000

5 Candidate City

Voting/Elimination

Legibility Report: Potential of City by visiting IOC members

IOC Voting

Acceptance Fee $550,000

TOTAL COST FOR APPLICATION $13 MILLION

Next Olympic Host

Top:
London Application Process
Source: http://www.olympic.org/
1.2 WHO HOSTED

Looking at the last 50 years, Australia is the only country south of the equator to host the Summer Olympics. The next Summer Olympics will be held in Rio de Janeiro in Brazil. While Brazil’s GDP is the 5th largest in the world, it’s GDP per capita ranks 75th. Among host countries, Brazil happens to have one of the lowest GDP per capita, directly behind China. That fact demonstrates there is a large difference in wealth between the many impoverished and the few wealthy.

Top:
GDP/Population/GDP per Capita Comparison
Source: http://www.en.wikipedia.org/
1.3 THE VENUES

And while Rio de Janeiro’s residents live active lifestyles and the city already has many existing venues from hosting the Pan American Games (2007) and soon the World Cup (2014), there remain a large number of sports venues to be built, some of which are for sports that are generally unknown and yet un-established within Brazil. Among them, the largest venue to be built in Rio de Janeiro will be the field hockey stadium. There are currently no field hockey teams in Rio de Janeiro.
Design for Reuse: Post Occupancy of Olympic Stadiums
1.3 STADIUM FINANCING

Building stadiums is relatively straightforward in Brazil. Sports clubs finance them and subsequently profit from the sales of tickets and merchandises during the games. However, clubs cannot raise the level of funding required to build and maintain Olympic stadiums, because they often require seating capacities that are significantly larger than those required for typical stadiums built for normal usage. The governments of host countries therefore offer up land, and public money is used to build and maintain the stadiums. If a stadium is built for a particular mega event and the government is hosting the event, they cannot deny aid if the stadium is low on funds to complete construction. It has become a trend that projects often run over budget and government aid becomes required. In one controversial instance, a team used this knowledge to take advantage of an upcoming 2014 World Cup as an opportunity to build a new stadium for the team. According to Virual-Brazil.com’s article about São Paulo’s Itaquera Stadium:

In the 1980s, the Government had granted the use of a large piece of land in Itaquera (a poor district in the suburbs of the city), provided that Corinthians built a stadium right then. Since then, Corinthians had been trying to raise funds to build the stadium, but always failed. The first option of stadium to host matches of the Cup in Sao Paulo was Morumbi, which belongs to Sao Paulo FC. Sao Paulo FC, however, didn’t agree to make the investments demanded by FIFA. The then President of Corinthians, Andre Sanchez, is a very close friend of the President of the World Cup Local Committee, Ricardo Teixeira.

By threatening to exclude Sao Paulo of the Cup, FIFA and Teixeira convinced the Federal Government to accept Itaquerao as the venue, and to help Corinthians get the funds necessary to do the works.

FIFA still maintains Sao Paulo as a host (excluding Sao Paulo from the World Cup Brazil would be like excluding Moscow from the World Cup Russia), Corinthians will build an stadium with cheap or free money; and Ricardo Teixeira keeps his friend happy. The problems: the Federal Government will provide funds to a private party to build a private stadium; the new stadium will be in the distant suburb of Sao Paulo, lacking much infrastructure; it is uncertain whether or not the stadium will be ready for the World Cup.

Because of their size and distance from the city, not to mention their function for sports unpopular within the host city, many Olympic stadiums become white elephants, and even subsequently empty or abandoned in the extreme cases. Examples are ample. In addition, the Olympic park and venues account for roughly 40% of total Olympic spending, and 95% of the funding for stadiums is from public money [diagram in Appendix]. Stadiums by nature are not public, and so a big question remains - If public money is spent to build and maintain stadiums, why isn’t the architecture designed to serve the people who pay for it in the form of public space? Ideally a stadium should be flexible enough such that it can accommodate additional programs beyond its initial Olympic sporting requirements.

1.4 WHAT, WHERE & WHY

With 7 million visitors and 3.4 million sq meters of venue space, it is apparent why the games are located so far from the city core and in the suburbs. A location with the ability to absorb large crowds and large venues are expensive and hard to find in cities. The financial gains, however, are at best temporary. The scale and experimental architectural systems of stadiums results in higher cost of operation and maintenance. Coupled with their distance from urban centers, Olympic stadiums often times lose the competition to smaller city stadiums for permanent tenants. It is incredibly hard to fill stadium meant for 90,000 people. The Birds Nest hosted 3 events in four years after the Olympics. In a more macro level, stadiums are usually largely freestanding objects located next to a field residential housing. As a result, they become underused monuments that stand out from the crowd.

In the last half century there are emerging trends. They can be categorized as Urban Clusters, Sprawl, and Exodus. But generally, the Olympic parks are moving further and further away from the core of the city. In order for Rio de Janeiro’s Olympics to have significant impact on its urban transformation, the games must be brought back into the city core.
CORE CLUSTER

1964 Tokyo

1972 Munich

1992 Barcelona

SPRAWL

1968 Mexico City

1980 Moscow

1984 Los Angeles

EXODUS

1976 Montreal

1988 Seoul

2000 Sydney

2008 Beijing

2012 London

2016 Rio de Janeiro
Opposite:
2016 Olympic Venues categorized by recent trends.
Core Cluster—Most major functions in the city core
Sprawl—Olympic Village and Park in city, other venues spread outside
Exodus—Most major functions outside city core

Top:
Moving the games back to the city
Rio de Janeiro, 2016 Olympic host city, is built on 7 mountains with an important man overlooking it...
Design for Reuse:
Post Occupancy of Olympic Stadiums
Rio de Janeiro
low highrises and high lowrises.
Informal housing known as Favelas dominate the vertical segments of the city.
[ A city with EXTREME edge conditions... ]

Image source: http://gfx07.radified.com/gfx1/inequality_south_america_rio_dejaneirio.jpg
URBAN/RURAL

70% URBAN ENVIRONMENT
30% NATURAL VEGETATION

MEDIUM INCOME

WITH EXCEPTION TO ROCINHA
BEACHES ARE PRIME REAL ESTATE

POP. DISTRIBUTION

DENSITY
2.1 RIO AND THE GAMES

Rio de Janeiro will host the next Olympics. It is home to 6.5 million people of which 27% live in high density sums known as favelas. Favelas occupy steep hillside of areas with high economic activities. While favelas are impressive characteristic and identity of Rio de Janeiro, the Olympics Delivery Authority (ODA) of Rio ignores them and tries to paint a new picture of Rio. In its efforts to display a dynamic image to the world, Rio is desperately trying to gentrify\(^7\) hide the ongoing violence and lack of infrastructure in it poverty stricken favelas.

The games will be located in 4 clusters: Barra, Copacabana, Deodoro and Maracanã connected by a high-performance transport ring. Copacabana, and Maracanã will be hosting events in existing venues while Deodoro is using its open fields for the equestrian events. Majority of the new venues will be built in the Olympic park in Barra in the periphery of the city. The renderings show the venues next to beautiful mountains to the north and oceans to the south. However, the ODA chose to overlook the Olympics as an integrated effort to address Rio de Janeiro’s long standing issues of urban poverty and social exclusion. Evidently the site chosen for the park is far from the city center, and closest to the richest inhabitants that live near the south in the beaches of Barra. The legacy plan is to let the Olympic park become a residential community in the form of a sports city. The sporting facilities will be beneficial to about 13% of the population that live close by. There are possible alternatives that can be more beneficial to more of Rio’s residents.

SPRAWL TO WEST

Top:
Favela migration/ sprawl to the periphery of the city
Alternatively, stadiums can be used to provide public space throughout Rio de Janeiro. Distributing the Olympic Games on government land to create public space near favelas can result in the similar infrastructural upgrades as other models, but it will allow more residents to have access to the venues.
2.3 PUBLIC SPACE

Public space in Rio de Janeiro is very limited, and relatively inaccessible to those living in favelas. Rio de Janeiro ranks third when comparing the amount of public space per capita against Manhattan and Hong Kong. Both metropolitan cities are denser than Rio de Janeiro.
2.4 LOCAL PRECEDENT

Works of Brazilian architect Lina Bo Bardi reveal interesting insights of Brazilian public spaces. She reveals that Brazilians enjoy spaces that are shaded but outdoor; her designs often have enough flexibly to allow for an assortment of uses through time. Both the SESC and the MASP are projects that incorporate reuse in the public spaces. Not only do they provide access to views, they are porous and allow the circulation to cut across the site. While the design is specific, the programs that spawned in these spaces are usually indeterminate. These large circulation spaces have been used for mass gatherings, political movements, beach party and rock concerts. One can speculate that if stadiums are design with these intentions, then the spaces created can attract varies groups of people depending on the program of the day. Subsequently, it lowers the project’s probability of becoming a white elephant. 


2.5 FOR THE VERY MANY

The future of the Olympic sites of Beijing and Athens are uncertain and they missed their opportunity to integrate into the urban fabric once the design phase was over. Both were spectacular host for Olympics, but the resulting buildings have little purpose afterwards. They could have been designed for re-habitation, and all the public spaces to revitalize the social and economic potential of large high traffic. We have to accept the fact that a nation’s pride will never allow the use of generic and temporary buildings. Designing venues with purpose of moving it would also defeat the purpose having the Olympics as most of the money already spent on the Infrastructure, not the site specific architecture. It seems very likely that under the current scenario, Rio de Janeiro will suffer similar ‘ates. Much like other Olympic Cities, it will miss the opportunity to improve its lack of infrastructure, urban poverty, and social exclusion. Could it be possible that in a parallel universe, Rio de Janeiro’s Olympic are venues be located and design close to the city core? Rather than gentrify the favelas, why not use this opportunity to create flexible stadiums that can reused to provide additional program(s) and infrastructure to fill in what is lacking within different neighborhoods of the city?

Because of the relationship of favelas to the city, creation of public spaces adjacent to favelas would allow a diverse range of social and economic classes to benefit from them. If public space becomes the key driver to where Olympics stadiums should be located, then the 2016 Olympics in Rio de Janeiro can result in an infrastructural upgrade that creates a network of public spaces connected by public transportation. Rather than being accessible to only 13% of its inhabitants, the proposal can now be accessible to a wide range of its inhabitants.
SMALL POCKETS OF PUBLIC SPACE NEW INFRASTRUCTURE FOR WATER

EXISTING GOLF COURSE/FIELDS

CHACRINHA

LACKS CIRC. QUIETO CATRAMBI

CASA BRANCA TIJUCA

CITY OF GOD FLAT/DENSE FLAT/DENSE

DECOMMISSIONED AIR STRIP

HILLSIDE

ROCAINA DA RODRIGO DE FREITAS

IGUAIBA

NEW Venues

PUBLIC TRANSIT/PUBLIC SPACE NETWORK

MARIA LENK AQUATIC CENTER

BARRA DA TIJUCA -EXISTING GOLF COURSE/FIELDS

RIO DAS PEDRAS FLAT DEN

STADIUMS FOR RIO

KEY

(E) Rail Line

(N) Rail Line

(E) Highway

(N) Highway

(E) Roads

(N) Roads

(E) Metro Line

(N) Metro Line

Public Bus Route

New Bus Route

Public Tram Route

New Tram Route

Top:
Design for Reuse Olympic Venue Layout
Top:
Estádio Urban Plan
2.6 SÃO CARLOS

Morro(mountain) São Carlos is in a cluster of favelas located in the Estácio district of the city. It is east of downtown, west of the Maracanã stadium, world’s largest soccer stadium by capacity, and adjacent to the Sambradrome by Oscar Niemeyer. It is culturally significant because that is where Samba was invented. The community is composed of industrial workers, their families, and many artists. The adult population work either directly north of the site in the industrial district, the government center, or elsewhere via the subway or bus. In this thesis, this site has been selected for the Olympic field hockey stadium. Currently it sits empty but for the last 30 years it has been a prison; creating a barrio between where people work and live. Even though the prison has been demolished, its walls remain. As a result São Carlo lacks access to amenities such as transportation, public space, and schools. While the inhabitants live fairly close to their work, they are forced to take non-direct routes to get to the industrial factories, bus, rail or subway stations. Because of such isolation, unemployment and illiteracy are high and therefore resulting in a higher crime rate than the rest of Rio de Janeiro.

Left: Morro São Carlos
Image Source: http://www.rioeduca.net/admin/_m2brupload/_fck/usadas/20110724155542.jpg
Estácio Station

Estácio Industrial Area

Power Sub Station

Bus 77

Bus 65

Bus 415

Favela São Carlos (informal housing)

Formal Housing

Hospital

Baptist Church

Praça Onze Station

Estácio Station
INFRASTRUCTURE

FAR FROM PUBLIC TRANSIT

LAND USE

ELEVATION

AMENITIES ON MAIN ROADS

LACK OF SCHOOLS

SAO CARLOS ILLITERACY RATE 5.6%
RIO DE JANEIRO CITY AVERAGE 4.02%
Source: http://noticias.universia.com.br

SITE MIXED USE RESI PARK GOV

0-25 25 50 60 75 100 125M
The design of the stadium will use circulation and program flexibility to resolve the issues of the site. It will answer the São Carlos need for more jobs, school, and public space.
Top: Postcards from the Olympics

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Design for Reuse:
Post Occupancy of Olympic Stadiums

Design for Reuse

Top: Postcards after the Olympics
After Christian cult was legitimized by Constantine Edict, the Council of Arles, 314, imposed a ban on the circus charioteers, banning the pagan practice of chariot racing and converted the circuses into non-sports public facilities. Similarly in 394 in Greece, an edict promulgated by the emperor Theodosius abolished the Olympic Games, which were regarded as a pagan rite contrary to religious rites. Stadium were unbuilt for fifteen centuries

Built in 330-329 BC. “Panathinea” or Panathenaic Stadium means “stadium of all the Athenians.” It measures 210 m long and 120 m wide. It had the seating Capacity of 50,000 people. Restored in 1896 and used for the first Modern Olympics held in Greece.

Developed over centuries, Circus Maximus was the Roman form of the stadium. Its height was during the time of Julius Caesar around 50 BC. Circus differ from Hippodrome as they are wider and longer. Circus Maximus measures at 600 m long and 200 m wide with the seating capacity of 250,000. The 4th side was usually capped with a building and they were an integral part of the city.

50 AD, Flavian Amphitheatre or more commonly known as the Colosseum was a 50,000 spectators capacity stadium. The Colosseum was used for gladiator fights, mock sea battles, animal hunts, executions, re-enactments of famous battles, and dramas based on Classical mythology. During and after the medieval era, it was reused for housing, workshops, quarters for a religious order, a fortress, a quarry, and a Christian shrine.

Stadium
noun, plural sta·di·ums, sta·di·a
1. a sports arena, usually oval or horseshoe-shaped, with tiers of seats for spectators.
2. an ancient Greek course for foot races, typically semicircular, with tiers of seats for spectators.
3. an ancient Greek and Roman unit of length, the Athenian unit being equal to about 607 feet (185 meters).
4. a stage in a process or in the life of an organism.
5. Entomology. stage [def. 11b].

Origin: 1350–1400; Middle English < Latin < Greek stádion unit of distance, racecourse
1964 Olympics in Tokyo was the first internationally broadcast Olympics. Kenzo Tange designs Tokyo Aquatics center later reused as Tokyo Gymnastics Center. One of the largest suspension roof of its time.

During the Medieval ages, stadiums were represented in public forms. Piazza del Campo is a plaza paved in 1349. Palio di Siena is a horse race that is held twice each year, on July 2 and August 16, in Siena, Italy.

Designed by the German architect Günther Behnisch and the engineer Frei Otto, the Olympiastadion was considered revolutionary for its time. This included large sweeping canopies of acrylic glass stabilized by steel cables that were used for the first time in a large scale.

Designed by Roger Taillibert, the Montreal Olympic stadium has no main tenant. It has a history of structural and financial issues. It cost 700 Million to construct and took 30 years of public money to repay the cost.

1972-73 Kansas City. Stadiums become single purposed. Baseball Parks no longer shared stadiums with football but remained built close to each other to share parking lot.

2008 Beijing Olympics. Designed by Herzog de Meuron. 400 Million to construct. 4 events in the venue after the Olympics. Lack of use is primary due to its scale. 80,000 seat capacity is hard to fill and embarassing for teams to have matches when usually only 1/8 of the seats are filled.


2012 London Olympic Stadium seats 80,000. After the games, it will be converted down to a 60,000 seat permanent stadium.

Top: History of Stadia
**PRECEDESNTS**

- Clover Park, Copenhagen, Denmark
  - Housing in an existing Park
  - Final Design reduces park size

- Piazza del Campo
  - Siena, Italy
  - Public Space in the center of Siena

- Osaka Stadium
  - Naniwa-ku, Osaka, Japan
  - Opened in 1950
  - 30,000 Capacity

- Highbury Stadium
  - Highbury, London, England
  - 1932-1993
  - 38,000 Capacity
  - Home of the Arsenal, FA

- Madison Square Garden
  - Midtown Manhattan, New York
  - Opened 1968
  - Located in the heart of the city
  - Hosted about 320 events a year
  - Home of New York Rangers (NHL), New York Knicks (NBA), and New York Liberty (WNBA)
  - Also used by Ringling Brothers and Barnum and Bailey Circus

**ANTI-PRECEDESNTS**

- *only as example, original designs for Crystal Palace did not include parking or subway...*

- Crystal Palace by Joseph Paxton was originally erected in Hyde Park for the Great Exhibition of 1851. It was then later moved to Sydenham Hill which later burned down in 1934. Movable architecture is not recommended for Olympic stadia because it is both specific to site and costly, and it is difficult to fill the stadium to capacity. The designer was a major loss of money. The second stadium, the stadium was not successful and the architect was asked to create a new design.

- *only as example, never built in such configuration.*

- Geodesic Dome was first design by Walther Bauersfeld after World War II. Buckminster Fuller later developed the intrinsic mathematics of the dome and patented it. While the Geodesic Dome is incredible as creating large enclosed spaces, it is also extremely generic. No nation would take pride in creating replicable designs.

- Seed Cathedral is a UK pavilion for the Shanghai Expo in 2010. The structure was designed by Thomas Heatherwick and it cost 25 Million British Pounds. It was open to over 7 million public visitors during the expo, but was shortly dismantled after 6 months. It would not be in the best interest of developing nations to spend so much money on Olympic structures only to demolish it after 17 days.
3.1 HISTORY OF STADIUMS

Stadiums over the last 2 Millennia have always incorporated multiuse. For example the Colosseum in Rome was built as a gladiator stadium in 80 AD. It hosted mock sea battles, public executions, re-enactments of battles, and plays. In the Middle Ages, it was used as a fortress for a few centuries and ultimate suffered severe damage in the earthquake of 1349. Throughout the 16th and 17th century, the city sought to convert it into a factory but the plan was unsuccessful. 6 centuries later, it has become one of the most visited tourist destinations in Italy. Unlike the Colosseum, stadiums built today lack such versatility.

The Birds Nest did not suffer a natural catastrophe but lack of funds have revealed its rapid deterioration. Of the $9.5 Billion\(^8\) spent on the construction of the Olympic park in Beijing, $480 million was used to construct the Birds Nest. Another $11 million of which $1.5 million is in government subsidies\(^9\) is for annual upkeep. It had relied on tourist to fill in funding. But with recent decline in visitors from 30,000 a day to fewer than 10,000 visitors a day, the venues struggle to make ends meet. The stadium has no permanent tenants. It is too expensive for local sports teams and officials have refused to sell the naming rights. Generally it is difficult to plan for the post-use of such specialize buildings after the games after the fact. After 30 years, Montreal has finally finished paying off its debts for its 1976 Olympic park. Similarly, Athens suffers the same or perhaps worst fate as Beijing. Its economy shattered, the site is constant reminder to the taxpayers how their government chose to spend their money. In the end, regardless of the cost, governments only care about the image. The lesson here is to use the flamboyant nature of the games to create a stadium with a powerful image that can be occupied for programs beyond the initial Olympic use.

The Olympic stadium in this thesis will pay close attention to the intersection between temporal and permanence. Rather than creating a senseless object in a residential field, the stadium will be carefully planned for integration within the city. Instead of being more like the Birds Nest, it will be more like Madison Square Garden where sports and entertainment meets transportation. Its design strengths will lie in its flexibility to have constant supply of spectatorship like BIG’s Clover park rather than contemporary football or baseball stadiums that are empty half of the year. The stadium itself will be used reverse the exodus of jobs and population. It will be intentionally designed for synergetic programs to develop after the Olympics and ultimately create new vibrancy within the city core. This thesis will about redesigning the field hockey stadium for the 2016 Rio Olympics with intentions for it’s the post occupancy use as a vocational school and community center.

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\(^8\) [http://jsoevaluationgroup.com/id72.html](http://jsoevaluationgroup.com/id72.html)
Left:
Sydney field hockey stadium
Tower of infrastructure and area breakdown
Left:
Sydney field hockey stadium before and during the 2000 Olympics
http://www.abc.net.au/reslib/200408/r26564_65837.jpg

Right:
The stadium in 2012
Diamond Ranch High School
Pomona, CA
Public school, 1997
Student Population: 1850
Building Area: 28,000 sqm
Site Area: 53,000 sqm

Top:
Break down of the programs and adjacencies in Diamond Ranch high school,
Top Left:
The break from the spine into smaller more intimate spaces

Top Right:
Courtyards carved out of the spine of the circulation
source: http://4.bp.blogspot.com/-FWUE7lu3Fmw/UAfqRv0DFYI/AAAAAAAAlc/bvpxc1T_mo/s1600/DiamondRaanchHighSchool2.jpg

Bottom:
Side of buildings used as tiered seating and roof as occupiable space
source: http://c-monster.net/blog/2009/01/21/thom-mayne-diamond-ranch/
Opposite Top Left: maximum and ideal spectator distance regulations.

Opposite Top Right: viewing angle regulations

Opposite Bottom Left: Tiered seating options

Opposite Bottom Right: typical field hockey canopy

Top: Program spatial and requirement breakdown. All major components requires shading.
3.2 PROGRAMMING

The goal of programming is to find synergies between the programs of a vocational school and field hockey stadium. All school programs are within the red box while all stadium programs are within the blue box. The intersection shows programs that can be shared between the two and do not need unique ones of their own. Programs in blue highlight the possibility of modifying them so their initial purpose is to eventually adapt into a new program. For example, the field hockey stadium dimensions are similar to that of the smallest non-international soccer field. Such transformation allows the field for a relative unknown sport in Brazil to host the most popular sport on the planet. Rooms within the school will fluctuate in programing such that the downtime will allow it to expand into a bigger community center.
Top: Multi-use stadiums in relation to building lifespan
3.3 SCHEMATIC DESIGN

The shape of the site makes it difficult to fit two field hockey stadiums. However, the valley in the hill side is relative unused. By placing one stadium close to the favela and one closer to the industrial zone, it creates a clear distinction that one field will eventually be more private while the other is more public. In addition, such layout allows visitors to incrementally transition vertically on stairs rather than abruptly via typical switchbacks. Because of much more room there are on the sides of the field, the circulation can also become a space for large programs such as the market. From the study, 4 Schemes were developed. Please see the Appendix for individual studies. All the schemes take consideration into a stadium that is changing in topography and the circulation is has dual uses (before / after)
A series of studies were made to explore methods scaling a mountain. A tectonic model was built to identify the structural and programmatic elements in the scheme. It reveals that the roof and wall are key elements of space creation inside this stadium. The roof must be large to allow for continuous shading and is essential to flexible (re)programming. Subsequently, there needs to be field of supports but yet cannot be too porous for the security reasons. To counter that, gateways within structural walls will allow programs to be separated but occasionally intersect and connect with each other.
Top:
Olympics Stadiums since 1964

1964: Tokyo
1968: Mexico City
1972: Munich
1976: Montreal
1980: Moscow
1984: Los Angeles
1988: Seoul
1992: Barcelona
1996: Atlanta
2000: Sydney
2004: Athens
2008: Beijing
2012: London
3.4 STADIUM TECTONICS

At the macro level, most Olympic stadiums are objects because they have a difficult time fitting into their environment. There is rarely any mediation between the object and the field. The stadium itself is programmatically very different from the adjacent buildings and this is reinforced by the buffered space that contributes to its isolation from the surrounding. Additionally, on a micro scale, the material tectonics creates closed systems. It is intentionally not created for flexible as expansion is not part of the design. The stadium could not read if one piece was missing. Every piece is part of the whole. The 1972 Munich stadium, however, is the only exception. It is mediated by the park, and has a system that allows for it to expand into other sites if required. The field hockey stadium will need to develop a system of aggregation that is flexible and expandable. It will allow itself to be an object but yet function very much like it is part of the city.
1954 ST. JAKOB-PARK  

2005 ALLIANZ  

2008 BEIJING  

2015 BORDEAUX

SINGULARITY

SCALE

MATERIAL / PATTERN

SEMI-OBJECT  

OBJECT  

OBJECT  

ANTI-OBJECT

The Stadium sits in field of trees. The stadium mimics the forest by allowing the columns to appear as extensions of the forest into the stadium in the form of abstracted trees.

There are 2 types of Column sizes that help blend into the forest. The Primary are wider in diameter and supports the canopy above while the secondary holds up the tiered seating.

Bands on the under side of the tiered seating tries to break the reading of a massive surface. Colors added to add additional emphasis on extra surface area.

Top: Breakdown of H&deM’s approach to anti-object stadium
Alien object in a residential field

Object in field of objects

Alien Object mediated by park

Replicable object in a field
3.5 ROOF

According to Köppen climate classification’s Rio de Janeiro is in the tropical wet and dry or savanna climate (Aw). These climates have a pronounced dry season, with the driest month having precipitation less than 60 mm and also less than \(100 - \left(\frac{\text{total annual precipitation (mm)}}{25}\right)\). Spaces within the stadium do not necessarily need to be fully enclosed and mechanically ventilated. They are comfortable 90% of the year as long as they are shaded.

http://en.wikipedia.org/wiki/K%C3%B6ppen_climate_classification
These two tests explore the possibility of putting all the infrastructure of the games into bars that structurally support a mechanically driven moving roof. A movable roof allows the stadium to reconfigure itself to the needs of the site. However, because transformations are NOT daily, the cost of constructing an elaborate system would outweigh the benefits.

Structurally, most operable roofs are relatively heavy since loads are constantly shifting. The field needs at least 80 feet spans at the minimum. However spans over 45m results in having more than 50% of the load in self weight, therefore the structures are heavily oversized. Ideally, the roof needs to be light which suggests the use of a membrane roof.
Opposite & Top:
membrane behavior studies
The roof will organize the programs underneath. Each segment of the roof will have a different purpose during the Olympics and after. Some will collect water while allowing for exhaust ventilation. Others will take advantage of the flatter areas of the ridges to install flexible solar PV’s to harvest electricity for the market below.
OLYMPIC USE

Parking/ Manufacturing: The roof will provide for continuous shading from parking to seats. It will later serve as water collection and ventilation exhaust.

Observation/School Courtyard: Provide views to the favelas, but also serves as a courtyard providing the favela Sao Carlos views into the school.

Entrance/Market: Seats during the Olympics. Solar power station after the Olympics for the market.

AFTER USE
3.6 STRATEGY

In order for a stadium to differ from a prison, it must be accessible and porous, yet provide adequate security. The stadium will be divided and organized by the infrastructural bars. Inside the bars are circulation spaces with a few Olympic specific programs. Programs include: stairs, escalators, elevators, media recording rooms and VIP lounges/rooms. The bars will provide the infrastructure to move vast quantities of people across the site and to their seats. The bars set up the post-Olympics logic of treating the stadium as zones: Manufacturing, classrooms/lecture halls, public field, and market. The same infrastructure that allowed people to get to their seats during the Olympics will then be used to provide direct access to homes in the favela. This will create the link between the favela and the adjacent industrial area. Additionally, large open areas in the circulation will allow programs such as a market exist and provide jobs and access to food for the neighboring favela.
The bars that directly anchor into the mountain will be supported by buttresses. The buttresses will divide the temporary spaces used mainly as parking or commercial spaces during the Olympics. After the Olympics, the parking will become manufacturing wing of the school. The lower levels are used for shipping and loading, while the upper level is used for manufacturing. The commercial spaces will be infill with walls to become open air classrooms for the vocational school.

On the field side, the raked seating in the auxiliary field will be enclosed to become lecture halls. The auxiliary field will become a soccer field in the center of the school. The seating area near the rear of the field becomes the entrance to the school.
Site plan of Project during the Olympics in 2016
Site plan of Project after the Olympics in 2020
Top: Section A-A During Olympics  Bottom: Section A-A as the Vocational School
Top: Entrance during Olympics    Bottom: Market after Olympics
Top: Circulation    Bottom: Space for demonstrations
Top: Observation Area/Commercial Space  Bottom: Courtyard/open air classrooms
Appendix

Additional Studies

4.1 Design Exercise
4.2 Scheme A
4.3 Scheme B
4.4 Scheme C
4.5 Final Boards
4.6 Bibliography
4.1 Design Exercise

Rio De Janeiro Exports

- Mineral Extraction: 23%
- Metallurgical: 17%
- Transportation Equip.: 10%
- Chemistry: 8%
- Mechanics: 6%
- Rubber: 5%
- Other: 5%

Export Destinations

- USA: 14%
- China: 10%
- Santa Lucia: 9%
- Chile: 8%
- Netherlands: 6%
- India: 5%
- Singapore: 5%
- Argentina: 4%
- Portugal: 2%
- Germany: 2%
- Other: 2%

$29.4 Billion Annually

Rio De Janeiro Imports

- Mineral Extraction: 26%
- Chemical: 15%
- Transportation Equip.: 14%
- Metallurgical: 13%
- Mechanics: 10%
- Electrical & Comm.: 9%
- Rubber: 6%
- Other: 6%

Import Origins

- USA: 21%
- China: 26%
- Saudi Arabia: 15%
- Argentina: 10%
- France: 8%
- Iraq: 6%
- Italy: 6%
- UK: 6%
- Canada: 4%
- Other: 10%

$18.9 Billion Annually

Source: firjan.org.br
Possible Olympic Venues
- Tennis
- Cycling
- Table Tennis
- Badminton
- Weightlifting
- Housing

Possible Post Use
- Sports Center
- Arena
- Concert Hall
- Community Center
- Offices, Retail, Housing
Infill

Temporary

Transformable

Temporary Reused Elsewhere

Split Access

+ Temporary

- Temporary

Re-PROGRAMED

Stadium in Urban Context

Depress Interior

Infill

+ Housing
Alternative Scheme A

2016 RIO Summer Olympics

Farvelas

25 m x 91 m

Field

16,000 - 20,000 Spectator Seating

Olympic Field Hockey Stadium

Downtown

Roof Shade
New Metal from Recycle plant

Old Cans

Stadium

Old Scrap Metal collected/traded from Farvelas

Camelô Market

Sustainable Work housing

Old Cans

Metal Recycling + Mill

Downtown

2018 RIO Recycling Center

Favelas

New Metal From Recycle plant
Self Sufficient Housing

(Added After the Games)

Circulation

Solar Heliodons

Stadium

2020 Micro City Recycling Center
Industrial + Recreational + Housing

Self Sufficient Housing

Solar Reflectors

Existing Structure

Field

Sorter and Mauler
(Added After the Games)

2016 Rio Olympics
Field Hockey Stadium

Metal Recycling + Mill

Solar Furace
Mill + Cast
(Added After the Games)
Prefab Housing

Hoisted on Location

Shipped on Site.
**Alternative Scheme B**

### OLYMPICS
- **Near By Favelas**
  - Athlete Housing
    - 2150 Units
    - (15,000 / 7 Venues)
  - Olympic Field Hockey Stadium

### POST-OLYMPICS
- **Work / Live Housing**
  - Apartments
- **Favela Assessment/Relocation**
- **Metal Recycling + Solar Furnace**

### RELOCATION AND TRAINING
- **Favela Recycle Training**
- **Recycling Economy**
- **Scrap from City**
- **Recreational/Tourist Use**

### RECYCLING ECONOMY
- **Storage 2000 sqm**
- **Ferrous Solar Concentrator 6000 sqm**
- **Non-Ferrous Recycling Education Center 500 sqm**
- **Employee Center (Lockers Toilets Lounge 800sqm)**
- **Chemical Solution 500 sqm**
- **SORT & STORE 4200 sqm**
- **Rolled & Storage 1000 sqm**
- **MELT & CAST 2600 sqm (Mirrors 10,000 sqm)**
- **SHIP Housing 12sqm x 2150 Units 25800 sqm**

### Notes
- **Steel**
- **Research**
- **R + D MicroCity Stadiums**
- **Factory / Production Stadiums**
- **Recycle Stadiums**
- **$**

- **RELOCATION AND TRAINING RECYCLING ECONOMY**
- **Scrap from City**
- **Recreational/Tourist Use**

- **Athlete Housing 2150 Units (15,000 / 7 Venues)**
- **10hrs/day**
- **Rio de Janeiro**
- **New York**
- **Barcelona**

- **An avg size Metal Recycling Plant in the US (6000 sqm) generates around $3M in annual sales / $1M profits. A Field Hockey Stadium cost around $14 Million. If this stadium cost 3 x initial cost, it would be $42 M. With the help of low cost subsidized rent $1M Total/Yr ($500/resident/yr), the stadium can be repaid in just 21 years.**
An avg size Metal Recycling Plant in the US (6000 sqm) generates around $3M in annual sales / $1M profits. A Field Hockey Stadium cost around $14 Million. If this stadium cost 3 x initial cost, it would be $42 M. With the help of low cost subsidized rent $1M Total/Yr ($500/resident/yr), the stadium can be repaid in just 21 years.
4.2 Scheme A

Prefab stadium raked chambers. The diamond shapes are based on viewing angles.
4.3 Scheme B

The stadium is made of shards in attempt to create pockets of spaces throughout the project for post-Olympic programs.
4.3 Scheme B

The stadium is made from mega structures, Circulations are through structural tubes while, spans are made of vierendeel trusses.
4.3 Scheme B

December 20th Final Review Panels
4.6 BIBLIOGRAPHY


