A life cycle approach to sustainable Olympic architecture

THE DUTCH DELTA GAMES 2028

ROTTERDAM
OLYMPIC STADIUM
Fleet

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Problem Definition

- How can you *reuse* different stadium elements into a floating *residential* quarter after the Olympic Games?

- How can you minimise the waste in a post-Olympic *stadium conversion* strategy?
Problem Definition

- How can you reuse different stadium elements into a floating residential quarter after the Olympic Games?

- How can you minimise the waste in a post-Olympic stadium conversion strategy?

- How can you construct a large floating stadium?

- Can you make a floating stadium with permanent and temporary components where the question of sustainability is incorporated from the overall design to the final detail, minimising the adjustments necessary for the post-Olympic usage?
Olympic Impact

Netherlands: The Randstad

Great-Britain: London
With the model ‘three times a city’, different scenario’s are given for presenting the 2028 Olympic Games.

Amsterdam

Randstad

Rotterdam
Port Extension to the West
During The Games

After The Games
The Life Cycle Approach

1. Scenario

2. Assessment Center

3. Strategy
1. **Scenario**

- flexible
- long-term
- short-term
- specific

2. **Assessment Center**

- economy
- environment
- value of use

3. **Stadium Strategy**

- temporary
- modular
- conversion
- floating
- multi-purpose
- facade
- installations
- openings
- build-in
- structure
When it comes to stadia, the embodied energy far outweighs the operational energy used over its lifetime. Most stadiums are designed to last 50 years, but are used for only 18 months of those 50 years.

The London 2012 Olympic Stadium is responsible for a carbon footprint of 129 tonnes carbon dioxide.
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Combining these principles in one overall sustainable stadium concept
Floating Stadium

“From Stadium Ship towards Stadium Fleet”
Floating Stadium

“From Stadium Ship towards Stadium Fleet”
Floating Stadium

“From Stadium Ship towards Stadium Fleet”
Floating Stadium

“From Stadium Ship towards Stadium Fleet”
Floating Stadium

“From Stadium Ship towards Stadium Fleet”
Stadium Fleet

“From Stadium Ship towards Stadium Fleet”
Stadium Geometry

“Design by Research”

Characteristics of a liveable reusable stadium
The rings are horizontally linked to the C-value (angle of view) and housing grid.
The maximal viewing distance is combined with the maximum height of 11 floors to create an elips-shape ending. 5% of the stadium bowl can be located outside the distance.
The size determining factor for the grandstand elements is the distance towards the end of the housing element, so single-orientated apartments are possible.
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To increase the form-stability of the total structure, the elements are triangular in shape to lower the center of gravity.
The volumes are modelled to increase the suitability for housing and creating extra space for the visitors on the stadium deck ring.
The **stadium deck ring** is placed on the pontoon structures of the housing elements to create a homogeneous stadium structure.
The head volume consists of a linked series of elements.
The single unit is the basic element of the stadium
The catamaran unit links the head volume with the basic elements
The complete configuration: 1 head volume, 6 catamaran units and 14 basic units

The Stadium system is divided into 2 principles
The stadium elements are linked by temporary stands which are connected with the stadium pontoons.
The stadium bowl is finished by extending the stands over the units, creating a kind of forelock.
The stadium is linked to the urban fabric by two landscape arms.
Smallest element

original length: 24.5 m
rotation in x-BGT: 0.905 degrees
rotation in x-UGT: 1.258 degrees

new length: 26.27 m
rotation x-UGT/BGT 0.00 degrees

largest element

original length: 24.5 m
rotation in x-BGT: 1.166 degrees
rotation in x-UGT: 1.143 degrees

new length: 34.40 m
rotation x-UGT/BGT 0.00 degrees

To stable the structure in the x-direction, the pontoon structure is lengthened to form a new equilibrium.
To stable the structure in the x-direction, the pontoon structure is lengthened towards this calculated ring.
To stabilize the structure in the y-direction, the pontoon structure is balanced by a number of possibilities: ears and catamaran attachments.

**Ear attachment**
- Original size ear: 13.38 x 7.5 x 3.0 m
- Rotation in x-BGT: 1.156 degrees
- Rotation in x-UGT: 1.637 degrees

**Catamaran attachment**
- Original size catamaran: 26.76 x 2.0 x 3.0 m
- Arm: 2 m
- Rotation in x-BGT: 1.749 degrees
- Rotation in x-UGT: 2.598 degrees

**Catamaran attachment 2**
- Original size catamaran: 26.76 x 2.5 x 3.0 m
- Arm: 10 m
- Rotation in x-BGT: 0.905 degrees
- Rotation in x-UGT: 1.258 degrees

**Catamaran attachment 3**
- Original size catamaran: 26.76 x 2.0 x 2.5 x 3.0 m
- Arm: 2 m
- Rotation in x-BGT: 0.992 degrees
- Rotation in x-UGT: 1.388 degrees
To stabilize the structure in the y-direction, the arm and width of the catamaran element should be within the 8.0 m range because of the stadium gaps.
Pontoon

Top Structure
Pontoon | Top Structure
Pontoon | Top Structure
Pontoon  Top Structure
Pontoon | Top Structure
Pontoon & Top Structure
Material Life Cycle

“The Grandstand”
See You In 2028......