Olympic Stadium London 2012

Amanda Kight
ARC 5824 Advanced Design Studio 2
Case Study

PROJECT DATA:

Client: ODA, Olympic Delivery Authority
Architect: Populous
Structural and services engineers: Buro Happold
Main contractors: Sir Robert Mc Alpine

Construction period: May 2008 - March 2011
Opening: 5 May 2012
Cost: £ 498 million
Seats: 25,000 permanent and
55,000 temporary places

Dimensions: 310 x 260 m
Stadium height: 62.7 m
Pre-cast units in stadium bowl: 8,000
Reinforced pre-cast concrete within
stadium bowl: 9,250 m³
Roof area: 24,500 m²
Length of cable in roof: 6,000 m
Weight of steel construction: 10,000 t
Stadium entrances: 56
Rooms and spaces in stadium: 700

Source: detail-online.com/architecture

Image Source: Flickr (Keyword "Olympic Stadium London")

"The stadium, and the master plan as a whole, have taken a new, sustainable approach to temporary architecture – we use only the materials, structure and operational systems needed for the event, then transform it for a long-term future use. This is part of our broader thinking on legacy: it's not something that can be retrofitted. The Games themselves must be spectacular, but we believe to be truly successful you have to consider the long-term impact right from the start,"- Populous

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2012 OLYMPIC VENUES:

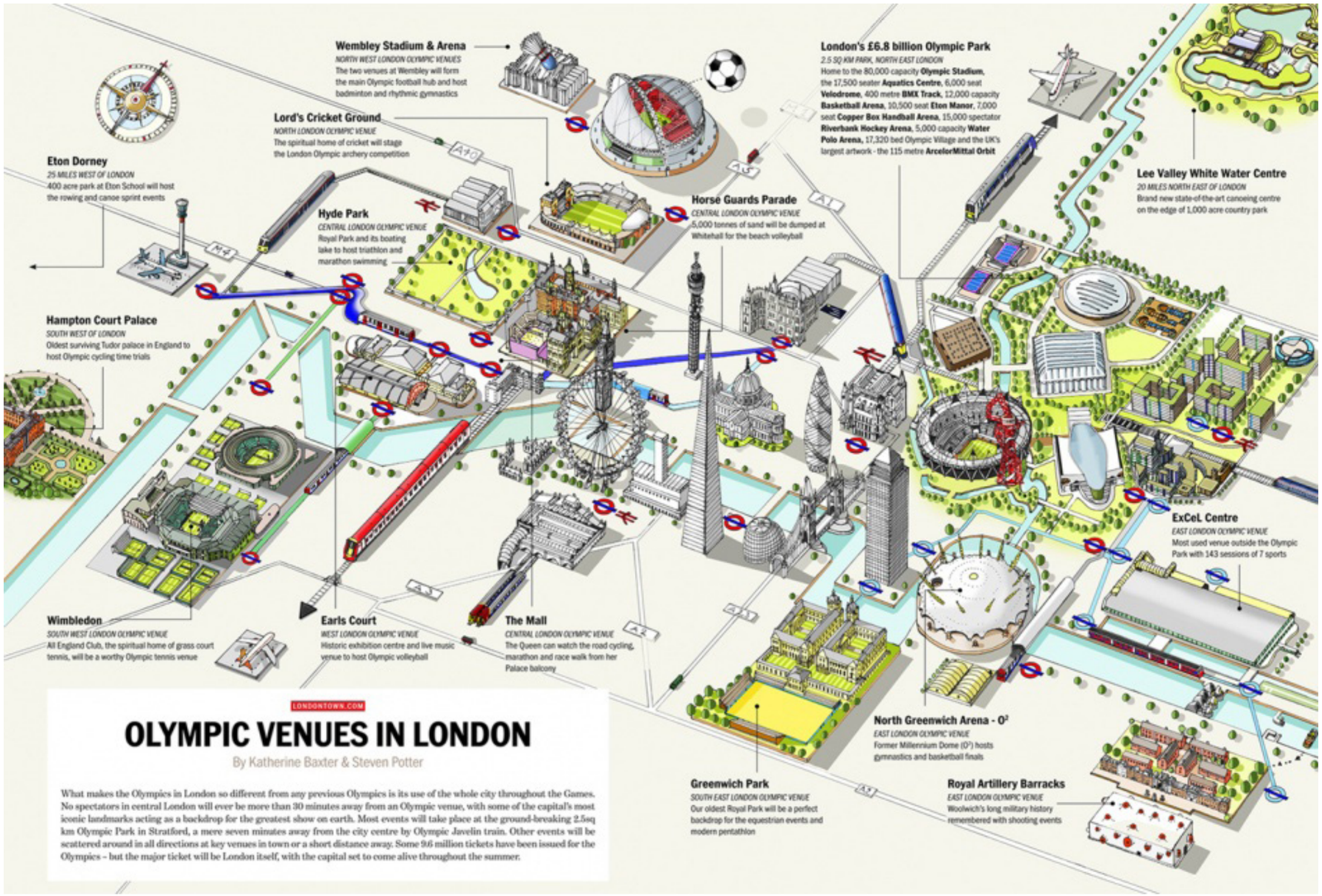

Image Source: www.londontown.com

GOALS & ACHIEVEMENTS:

- Imbed sustainability from the start
- Make Olympic Park a "blueprint for sustainable living"
- Establish transferable applications and future event planning
- Build upon the Thames Gateway project to grow, develop and transform East London
- Encourage low-carbon living
- Host a successful and sustainable games
- Showcase innovation and new sustainable services, products, and technologies

- 20% of electricity to be generated by renewable sources
- Low-emissions standards for vehicles
- 97% of the material from demolition was reused for the construction of Olympic Park (goal was 90%)
- 60% of construction materials were transported by rail or water
- Venues are designed use at least 40% less water

- New venues were brownfield sites
- 60% of venues were existing
- More than $10 billion in commuter transportation improvements
- Restored 115 acres of wetlands habitat
- Increased affordable housing
- 1,000 people required to vacate the site (425 from residential dwellings)

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URBAN CONTEXT:

Image Source: Detail Magazine

Image Source: Flickr (Keyword “Olympic Stadium London”)

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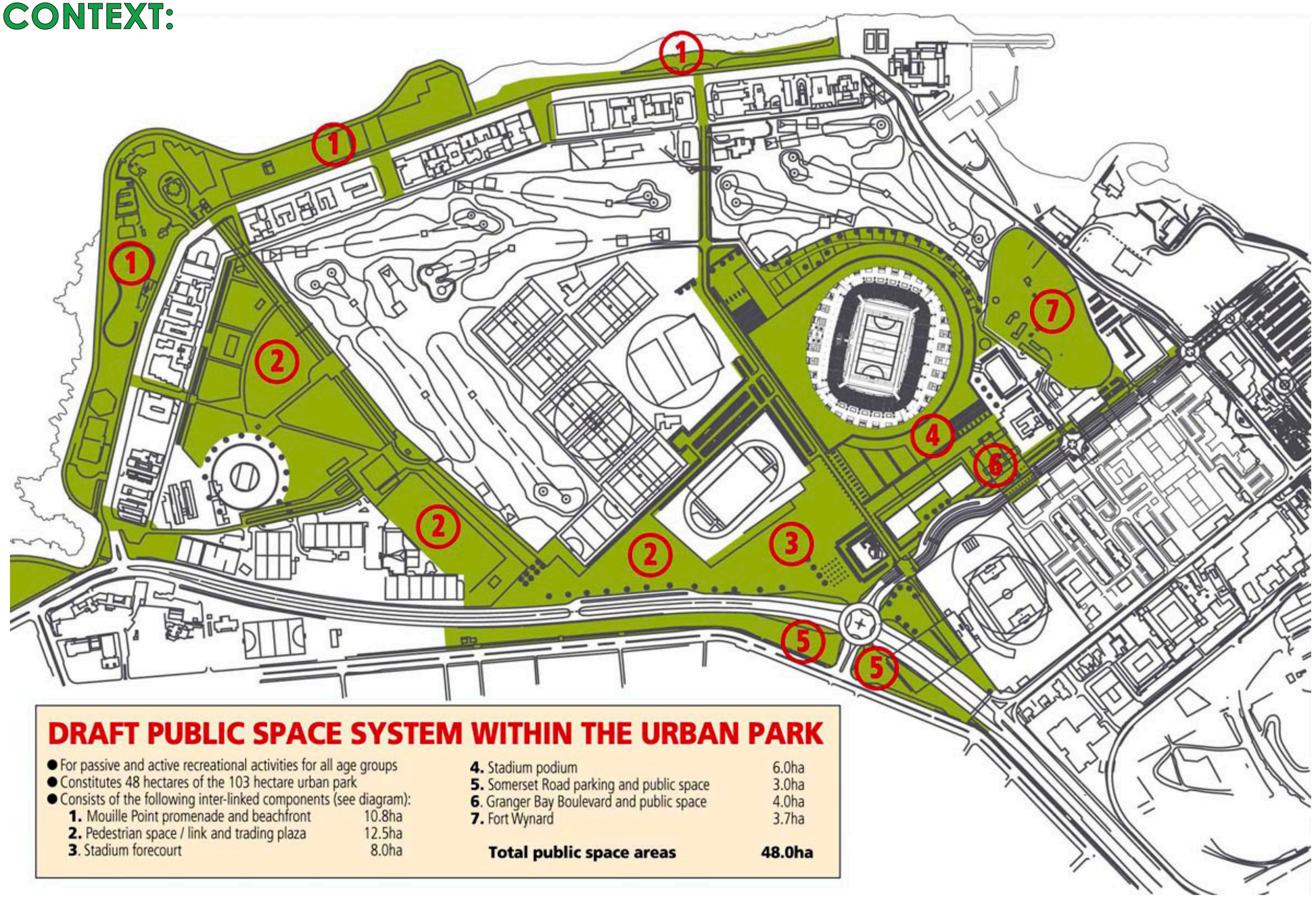

DRAFT PUBLIC SPACE SYSTEM WITHIN THE URBAN PARK

- For passive and active recreational activities for all age groups
- Constitutes 48 hectares of the 103 hectare urban park
- Consists of the following inter-linked components (see diagram):

1. Mouille Point promenade and beachfront	10.8ha	**4.** Stadium podium	6.0ha
2. Pedestrian space / link and trading plaza	12.5ha	**5.** Somerset Road parking and public space	3.0ha
3. Stadium forecourt	8.0ha	**6.** Granger Bay Boulevard and public space	4.0ha
		7. Fort Wynard	3.7ha
		Total public space areas	**48.0ha**

Image Source: www.skyscrapercity.com

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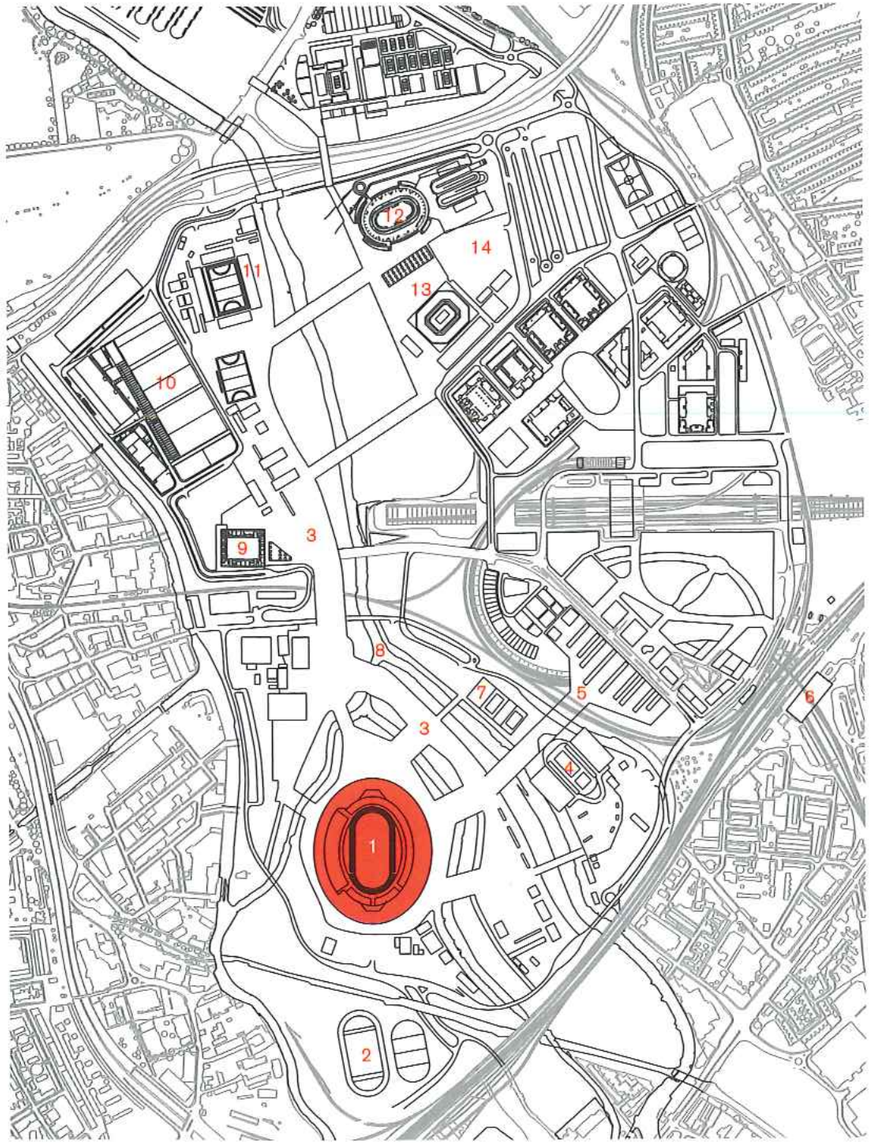
SITE:

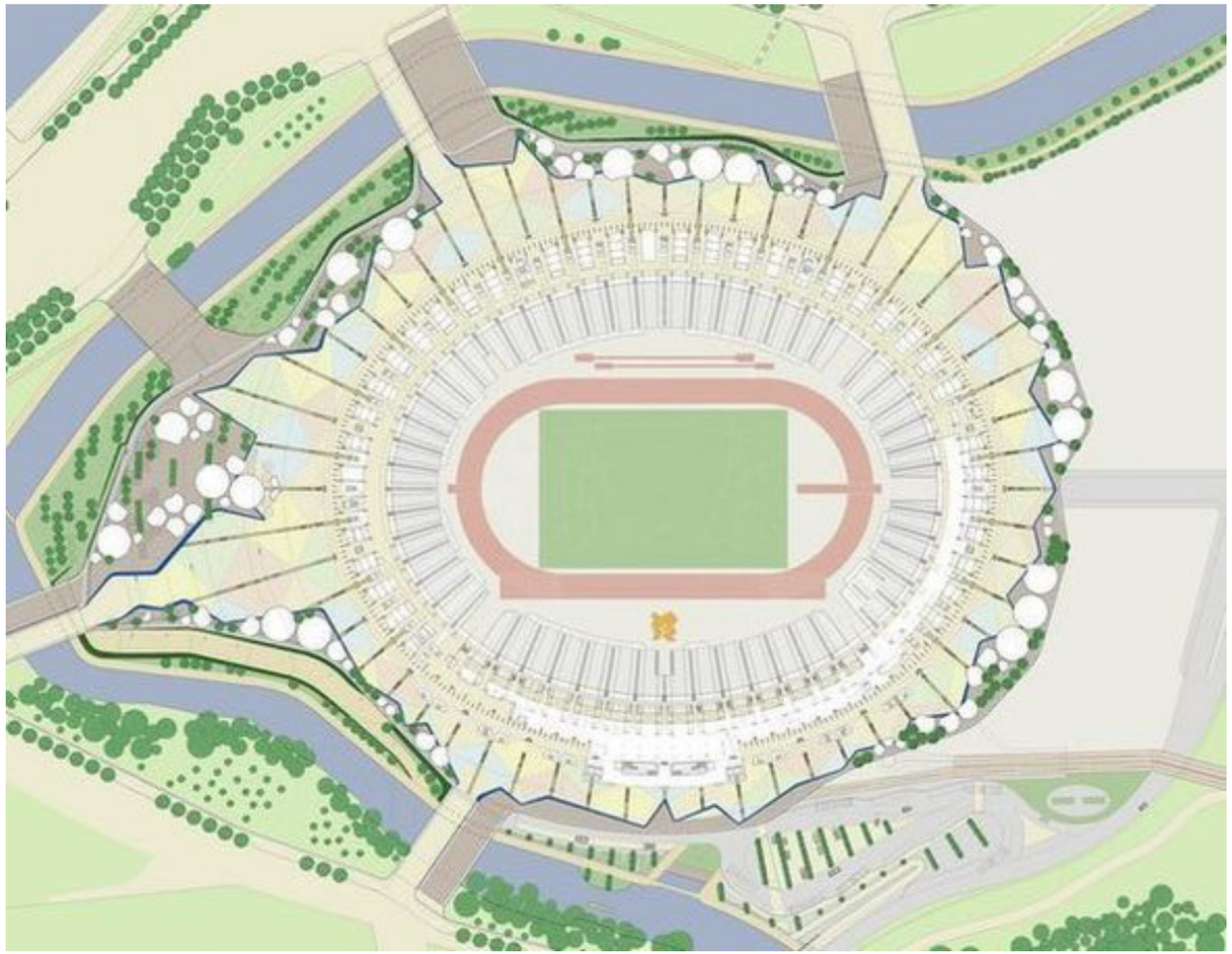


Site plan

0 100m

1. Olympic Stadium
2. Warm-up area
3. Public concourse
4. Aquatics Centre
5. Entrance
6. Stratford Station
7. Water Polo
8. River Lea
9. Handball
10. Main press centre
11. Hockey
12. Velodrome
13. Basketball
14. LOCOG back of house areas

- 40 acre island
- Previous brownfield urban landscape
- Surrounded by canals and railroad lines
- Contained landfill areas with toxic and radioactive materials
- Contained 192 existing buildings



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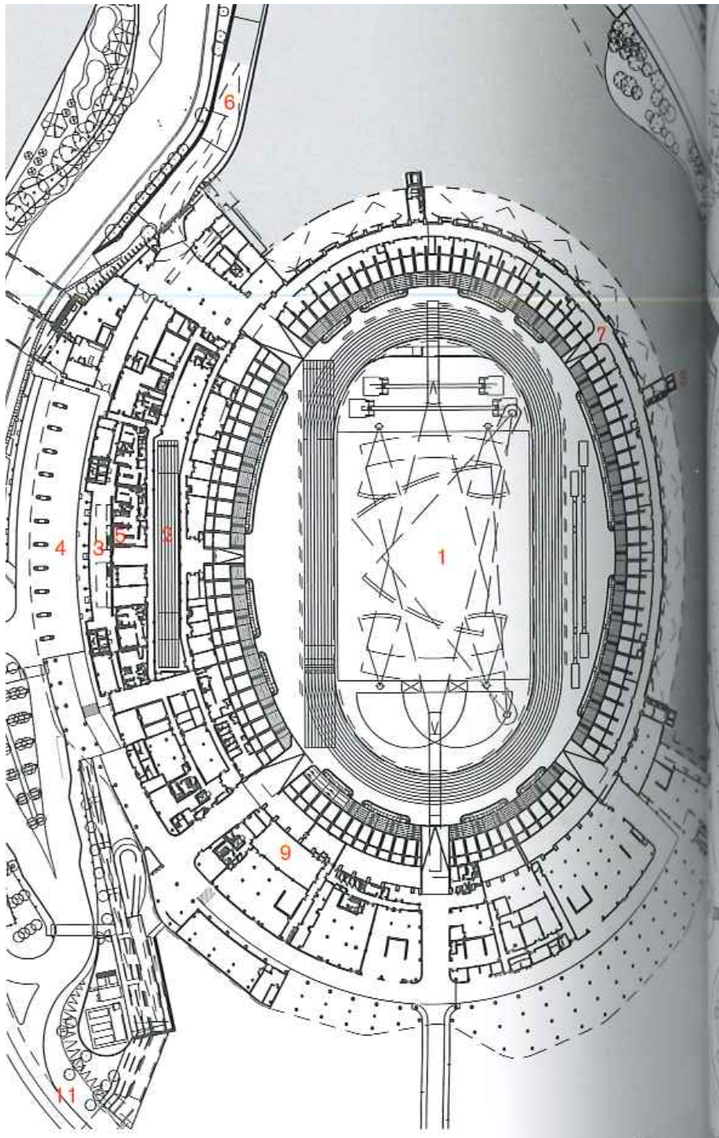
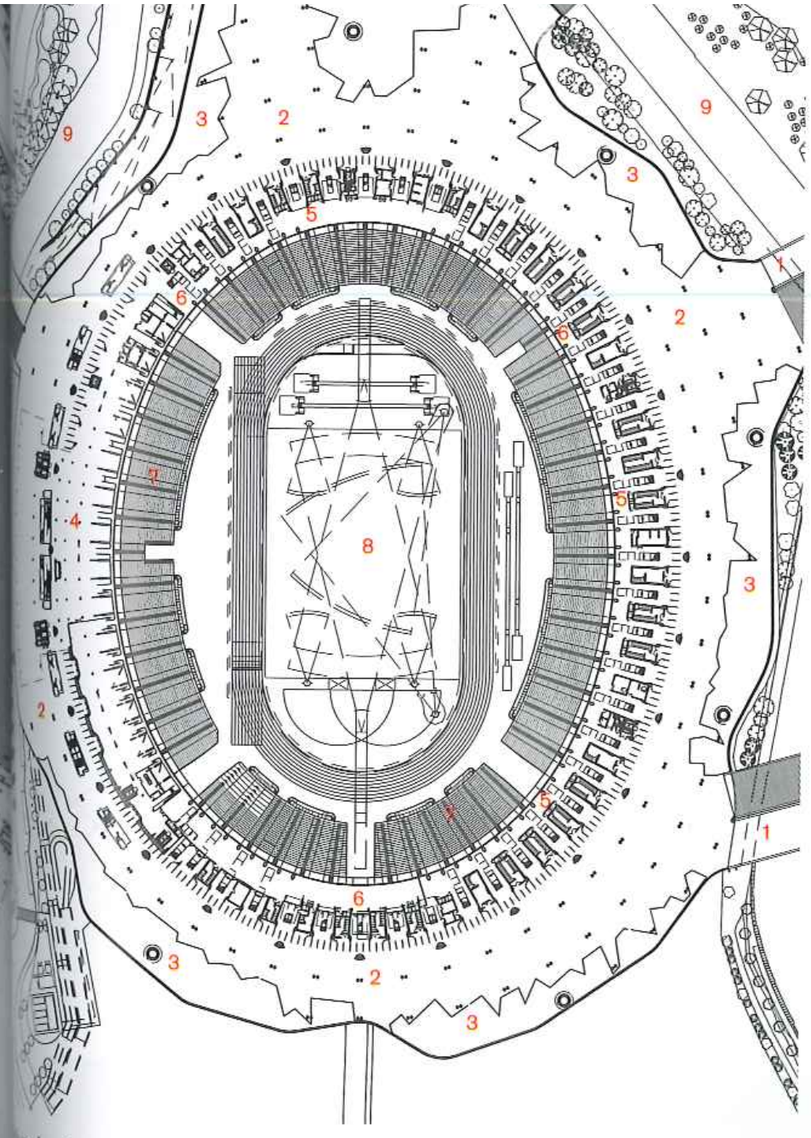
FLOOR/ROOF PLANS:



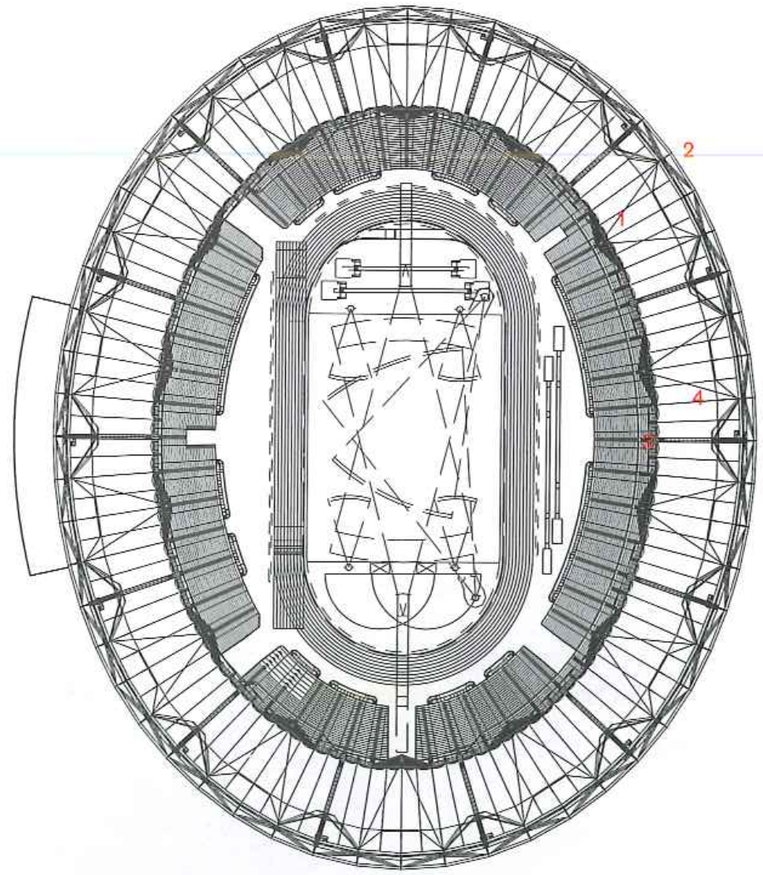
Lower-ground floor plan

1. Field of play
2. Call track
3. Olympic Family entrance
4. Drop-off area
5. Changing rooms
6. Athletes' parade route
7. Buggy route
8. Service lifts
9. Press conference room
10. River Lea
11. Loop road



m-level plan

1. Bridge access
2. Circulation podium
3. 'Pod' villages
4. Hospitality concourse
5. General admission concourse
6. Wheelchair-user viewing
7. Lower tier
8. Field of play
9. River Lea



Roof plan

1. Lighting rig
2. Compression truss
3. Tension ring
4. Access gantry

0 50m N

Image Source: Architect's Journal, July 2011)

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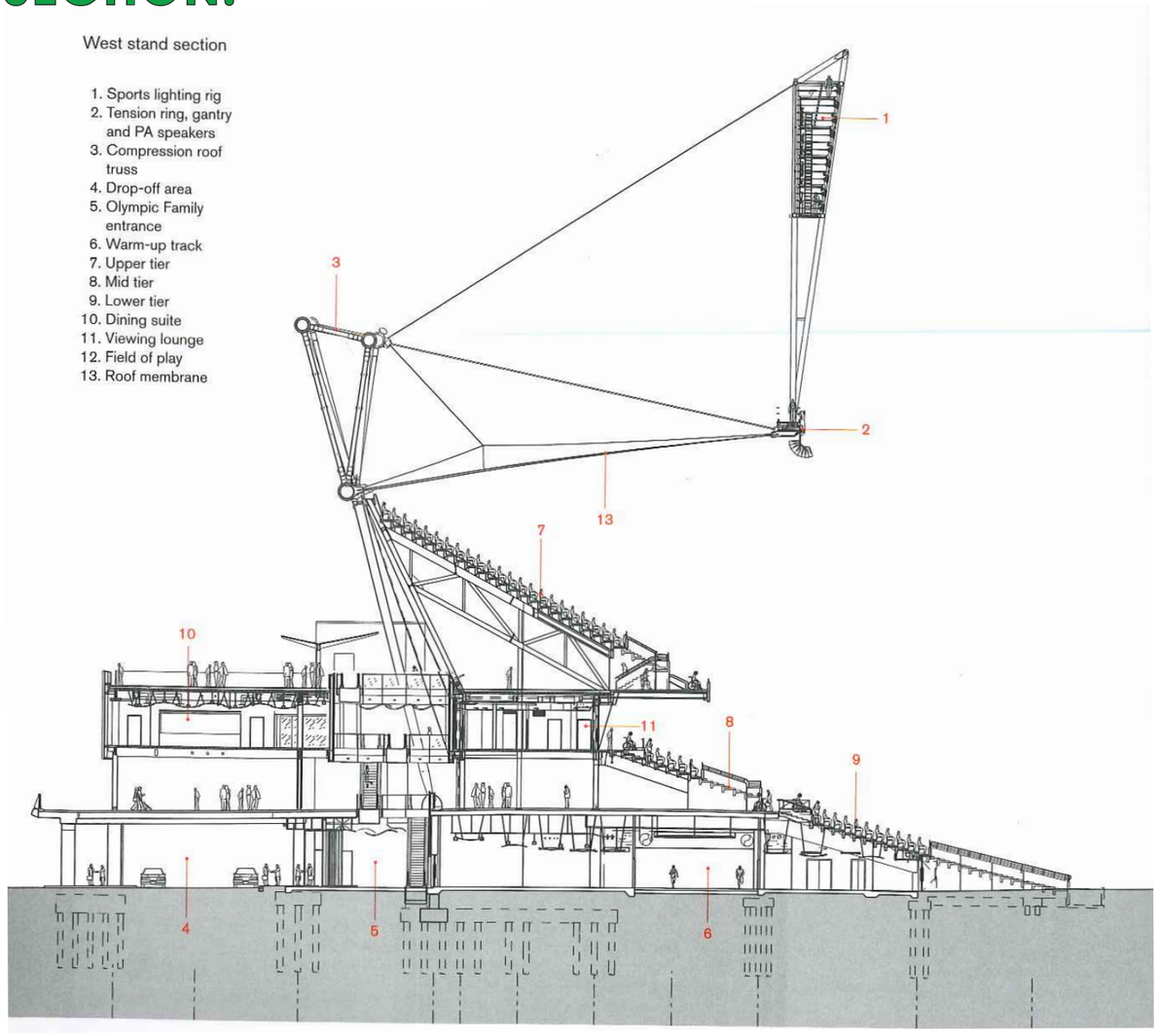
SECTION:

West stand section

1. Sports lighting rig
2. Tension ring, gantry and PA speakers
3. Compression roof truss
4. Drop-off area
5. Olympic Family entrance
6. Warm-up track
7. Upper tier
8. Mid tier
9. Lower tier
10. Dining suite
11. Viewing lounge
12. Field of play
13. Roof membrane



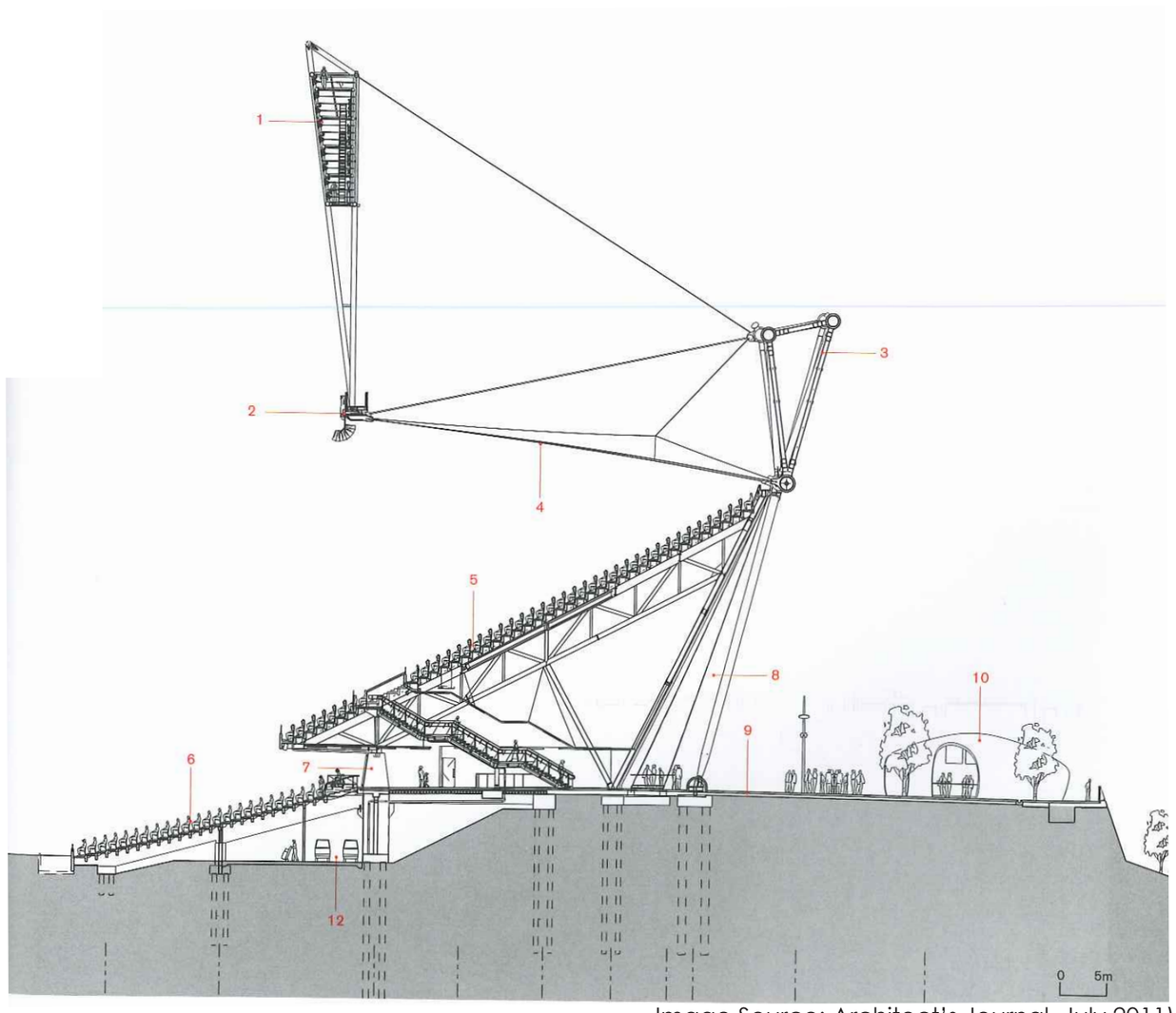


Image Source: Architect's Journal, July 2011)

MATERIALS:

1. Stainless steel wire mesh infill for podium rim-edge balustrade
2. Laminated glass panels with digitally printed coloured interlayer to stair balustrades and wheelchair platform barriers
3. Resin-bonded podium floor finish with 2mm copper slag aggregate
4. Silicon-based thin-coat render with 1mm textured finish
5. Powder-coated aluminium with wayfinding graphic transfers
6. Insitu and precast-concrete with GGBS and recycled aggregate
7. Aluminium composite rainscreen cladding panels with gloss and matt finishes
8. Glass reinforced concrete enclosures to roof column bases
9. Stud-resistant carpet to athletes' areas
10. Structural steel paint finish
11. 1.5mm-thick PVC-coated polyester tensile roof fabric
12. UV-curable ink printing tests on the wrap: lightweight polyester fabric with a polyolefin elastomer-based coating
13. Cable net roof fork end connection with galvanized spiral-bound steel cable

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INTERIOR:

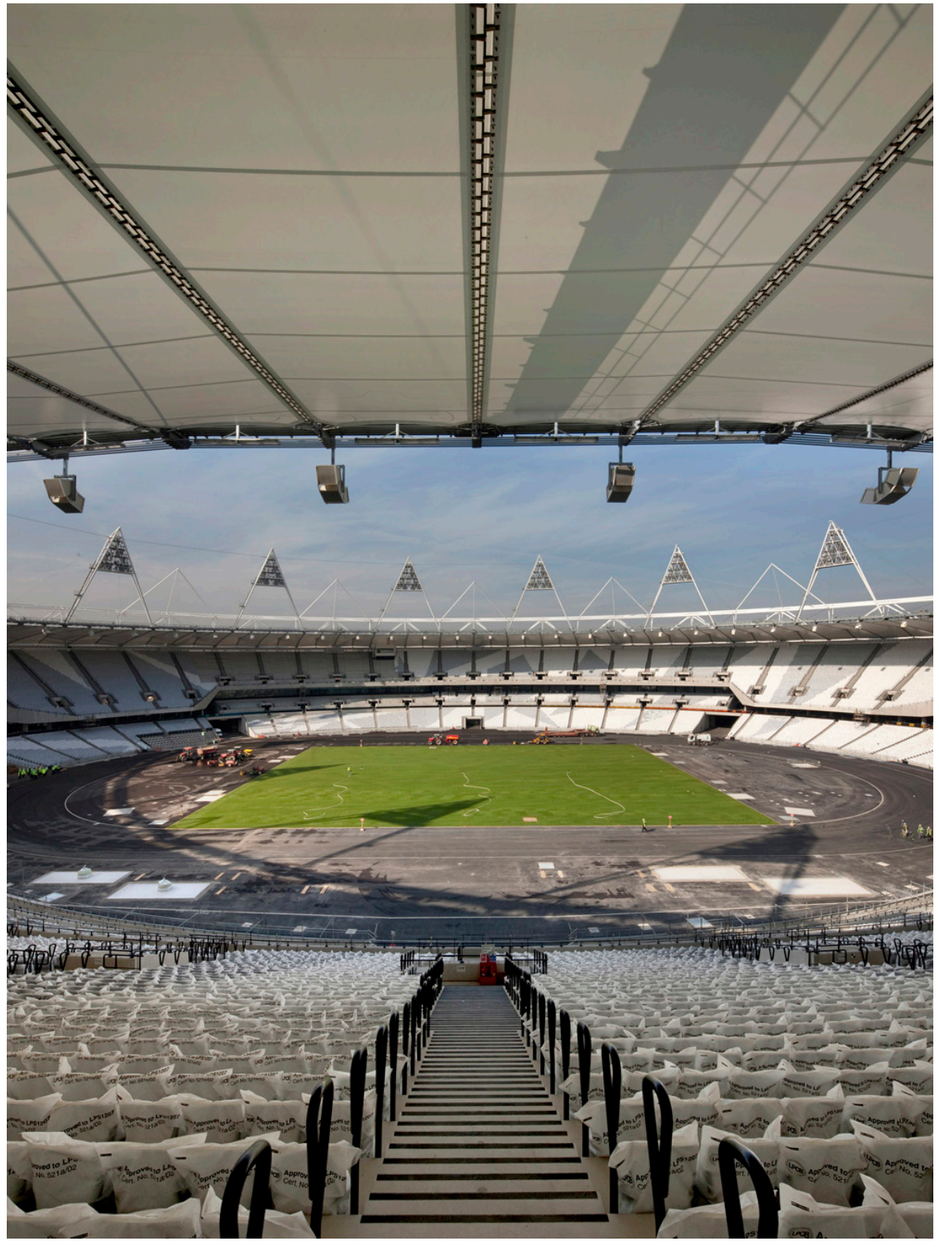

Image Source: Detail Magazine

Image Source: Flickr (Keyword "Olympic Stadium London")

Permanent Seats	25,000
Temporary Seats	55,000
Total	80,000

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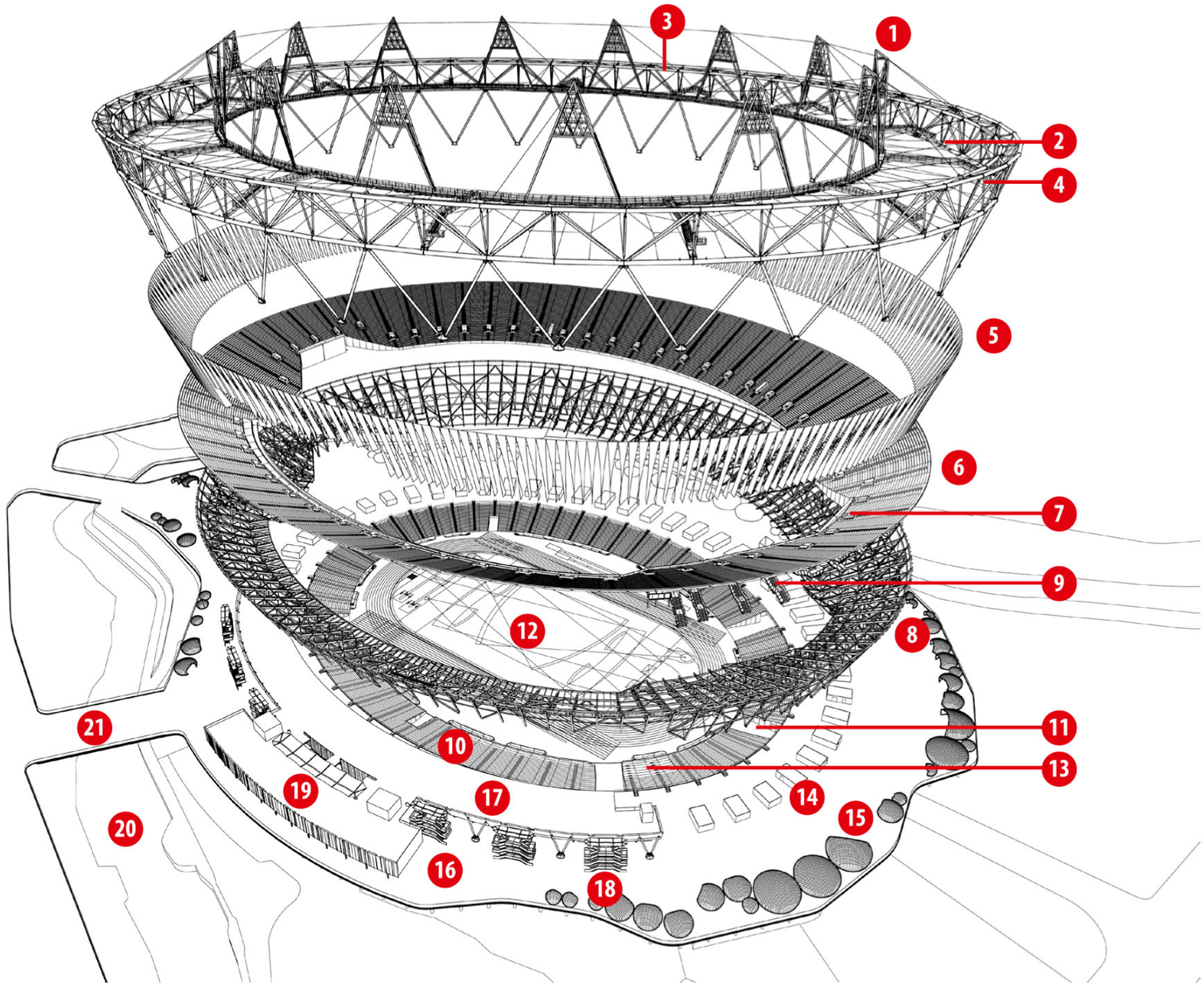
STRUCTURE:



1 Sportslight towers
2 Access gantries over roof fabric for access, maintenance and ceremonies activities
3 Roof tension ring
4 PVC coated polyester fabric membrane roof supported by cable net structure
5 336 Wrap fabric panels, each 25m high and 2.5m wide twisted by 90º
6 Upper tier, gross capacity: 55,000
7 Large format video screens and scoreboards
8 Upper tier supporting steel structure
9 Stairs to the upper tier from concourse level
10 Lower tier, gross capacity: 25,000
11 Field of play access tunnels for athletes, officials and ceremonies
12 Athletics field of play
13 Head-on photographers' platform
14 Internal toilet pods
15 External 'Pod Village' for spectator concessions, being developed by Locog
16 Public circulation podium
17 Level 02 concourse and hospitality terrace
18 West stand external escape stairs
19 Tensile fabric canopy over the escalator void areas for hospitality and VIP
20 River Lea
21 Venue entrance bridge

Image Source: www.newsteelconstruction.com

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STRUCTURE:

- lightest olympic stadium ever
- 25,000 permanent seats are sunk into the ground, eliminating a significant amount of steel and reducing the overall height of the structure
- 55,000 temporary pre-cast concrete seats are supported by lightweight steel structure of 112 rakers (black structure)
- standard steel sections were used to reduce time and cost
- connections are bolted rather fastened for easy dismantling
- An outer compression truss composed of 28 steel sections transfers the weight of the roof system into the ground (white structure)

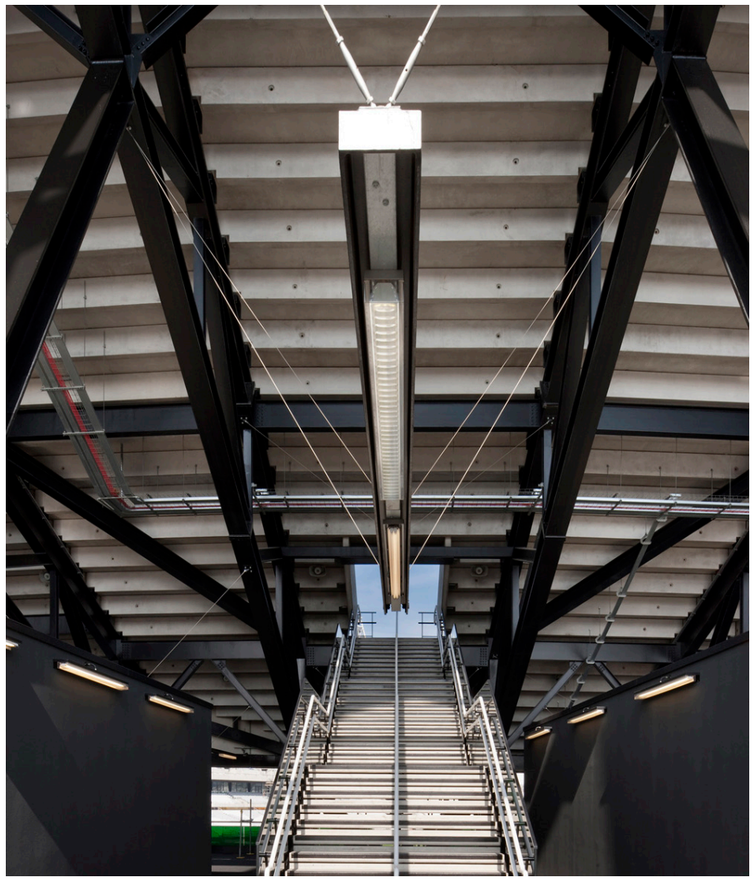

Image Source: Flickr (Keyword "Olympic Stadium London")

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ROOF STRUCTURE:

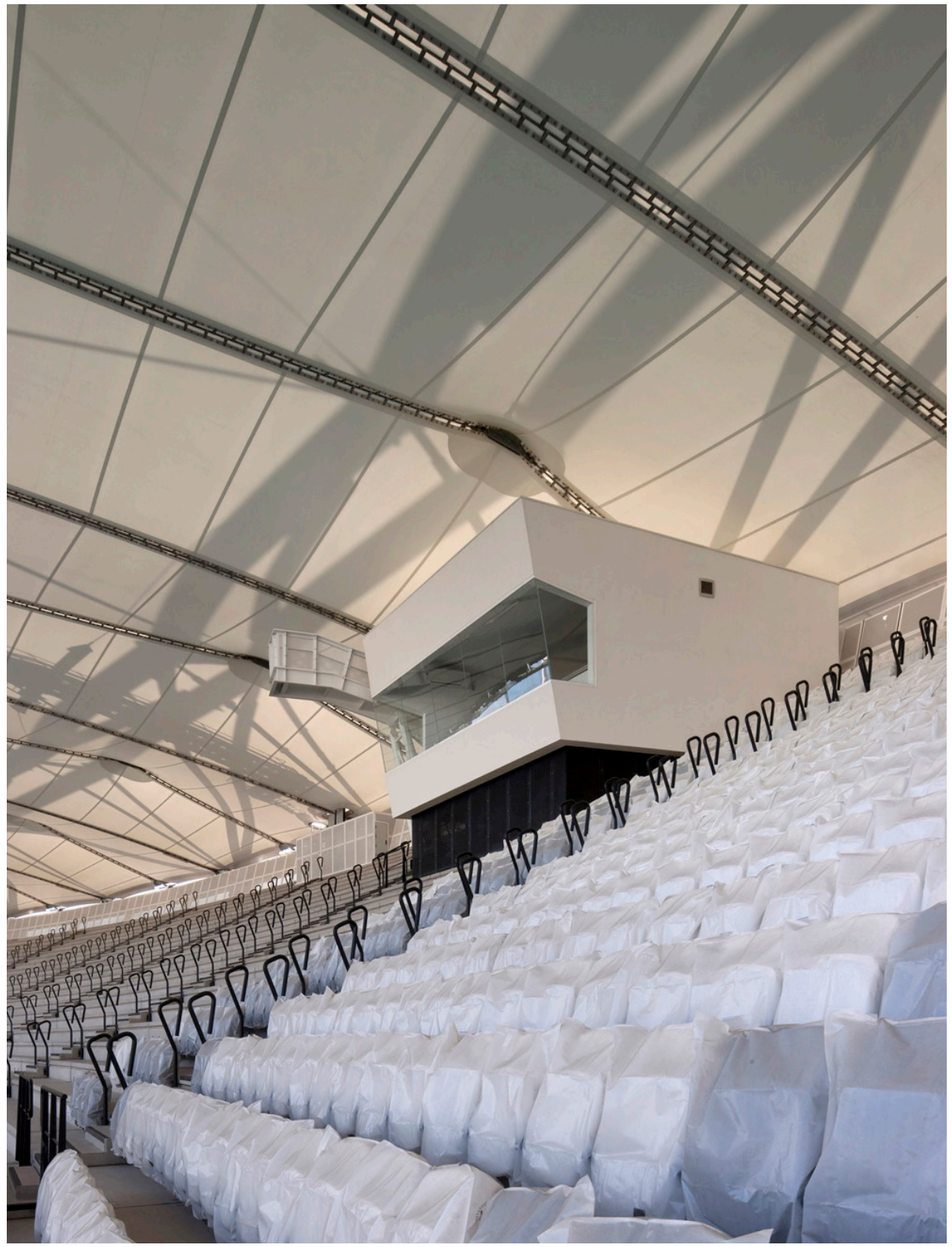
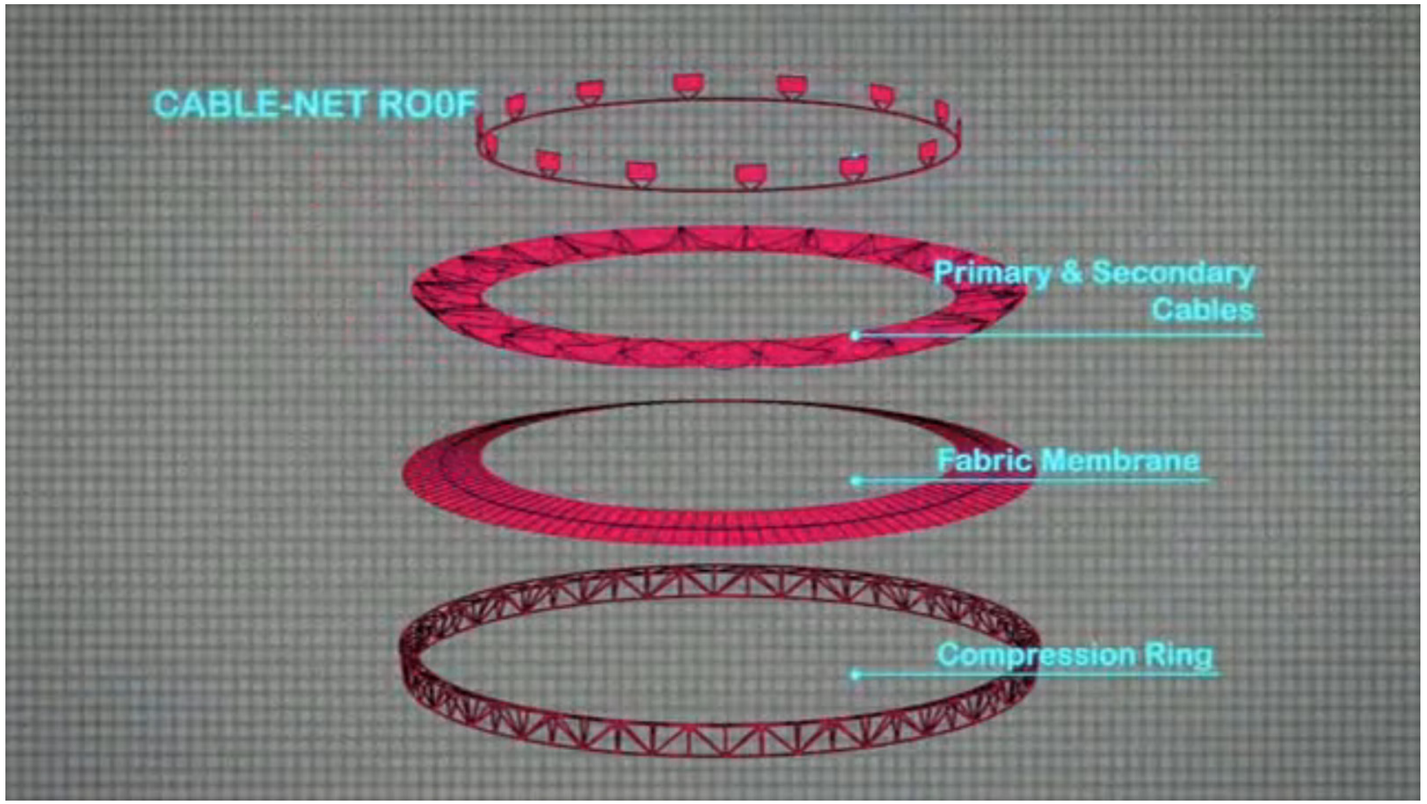


Image Source: Detail Magazine

- Roof structure is independent of the seating bowls
- The stadium's structure of a bicycle-wheel roof, supported by a zigzagging single ring of inclined columns, used 10,000 tonnes of steel, making it the lightest ever Olympic stadium.
- Tubular steel members were salvaged from a gas-pipeline project
- 3" diameter tension cables link the perimeter compression truss to the roof's tension ring
- Two-thirds of the seating, 112 membrane sections, was covered by a lightweight PVC-coated, polyester-fabric awning that was put in place to control wind, so as not to affect the athletes' performance.



Video
http://populous.com/project/london-2012/

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FACADE:

- External wrap designed by Sophie Smallhorn
- PVC coated fabric banners stretch from the top to the bottom of the stadiums exterior, creating 300 “doorways”
- Four main colors of the olympics logo serve as wayfinding and designate entrances
- The 336 banners will be reused for a school in Uganda

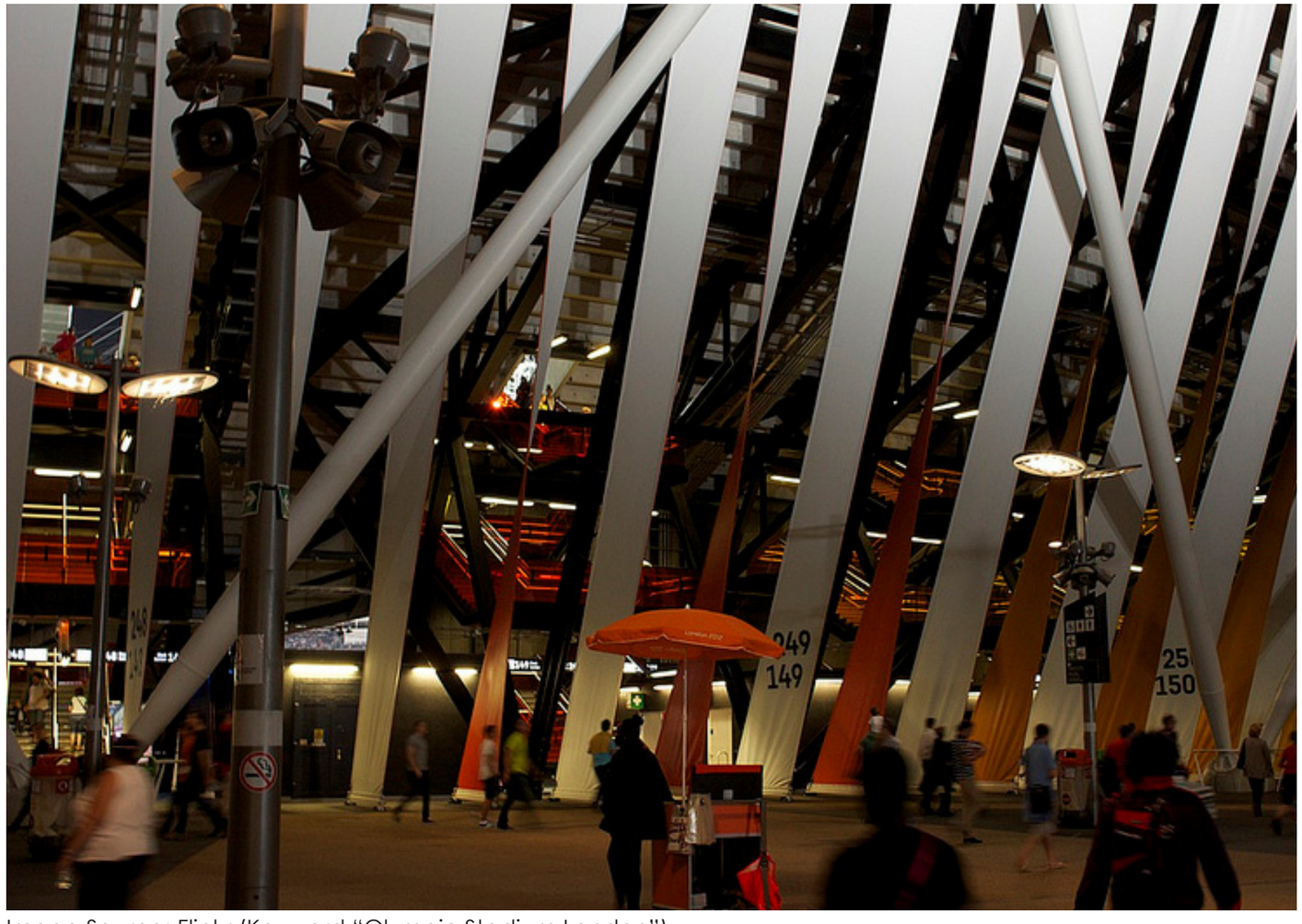

Image Source: Flickr (Keyword “Olympic Stadium London”)

Image Source: Detail Magazine

PVC

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LIGHTING:

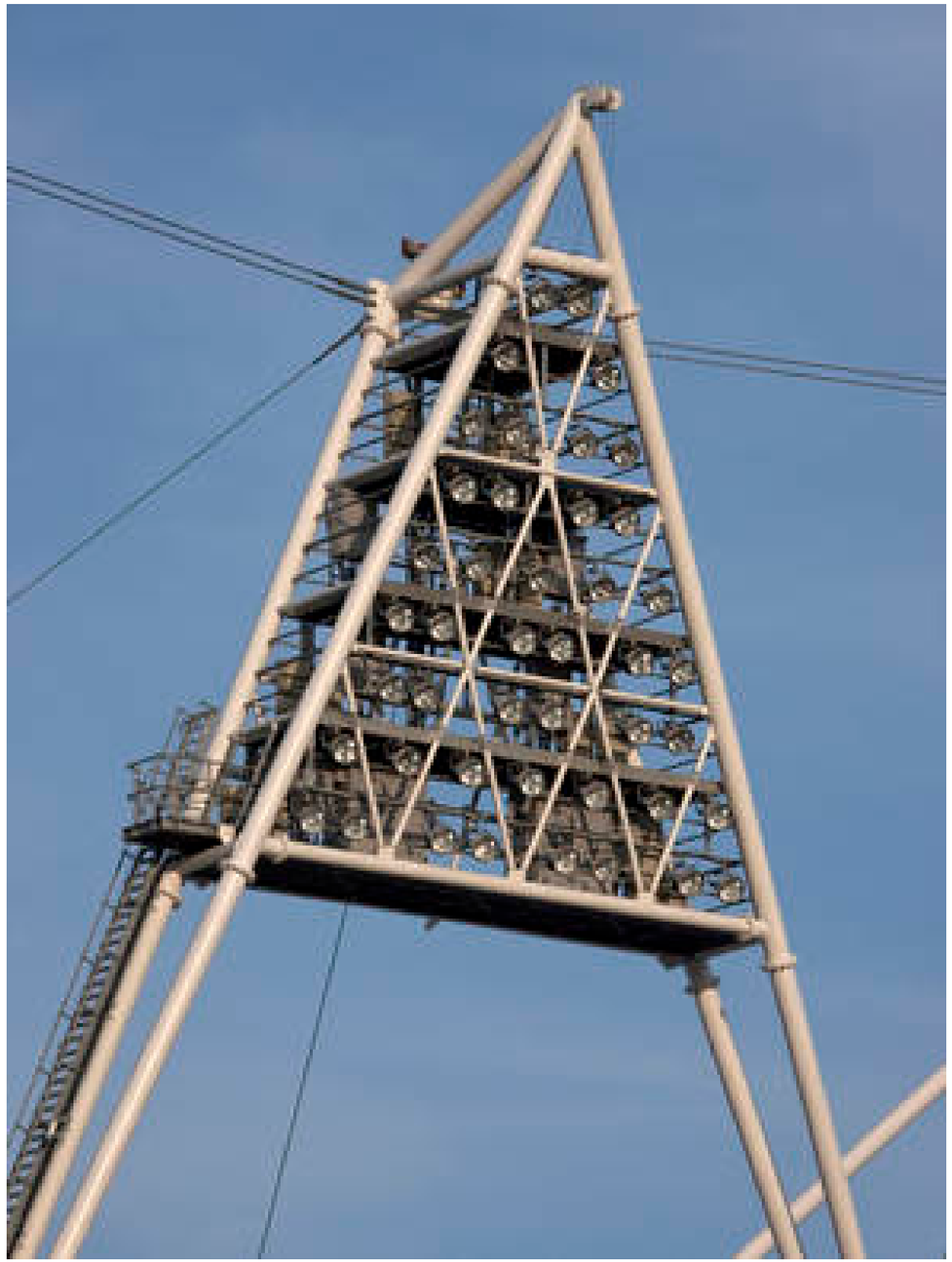

Image Source: Detail Magazine

- 532 lights on 14 towers
- 63 meters above the playing field
- Located at structural nodes
- Weigh 35 tonnes each
- Held in place by tension cables connected to the outer ring

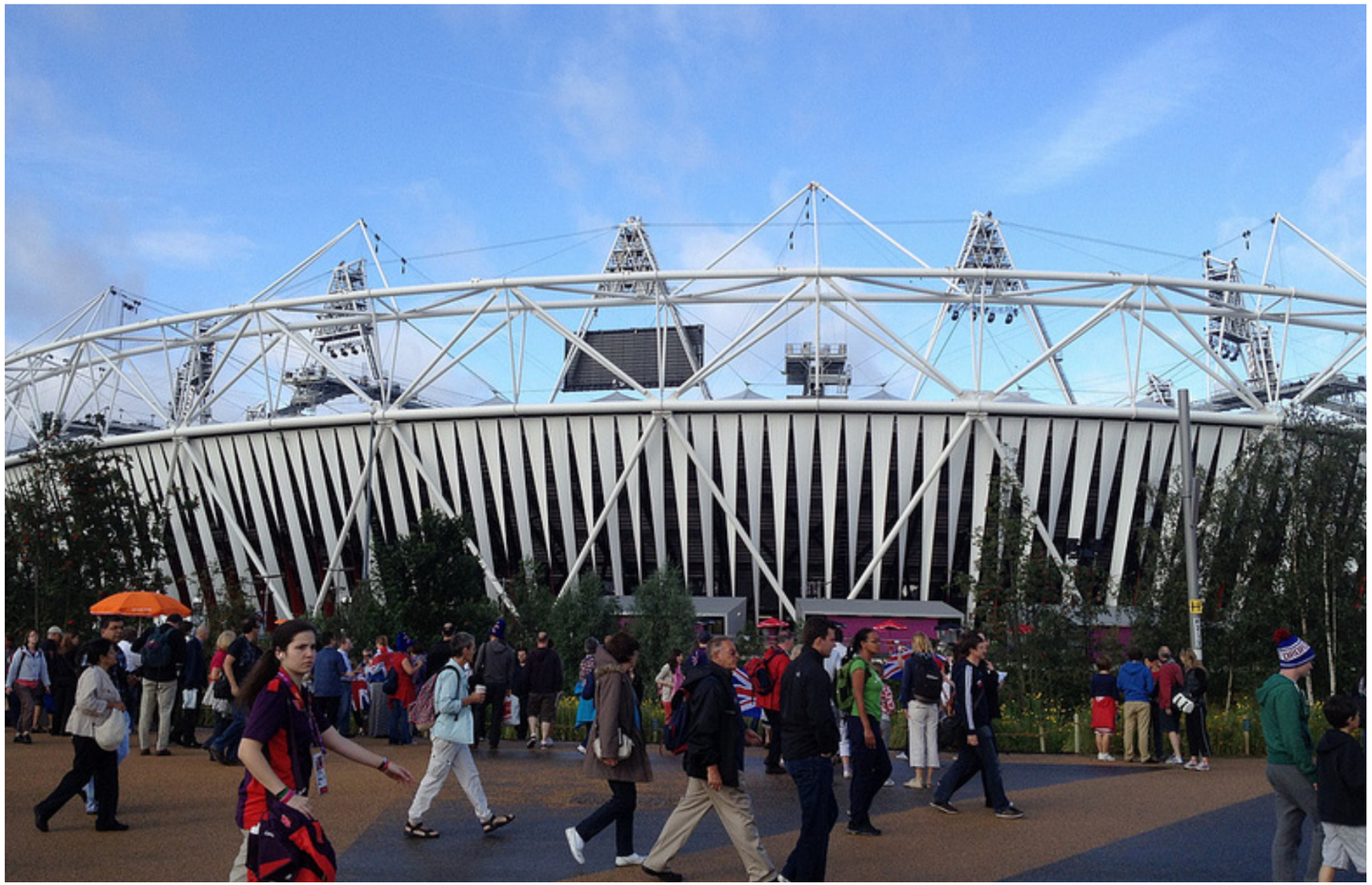

Image Source: Flickr (Keyword “Olympic Stadium London”)

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WATER & HVAC:

Image Source: Engineering & Technology Magazine "Zero Waste Olympic Games"

- Low-flow taps
- Low-flush toilets
- Waterless urinals
- Designed for water consumption of 105 liters against a standard of 160 liters per person per day
- Housing vendors within temporary pods at the stadium's periphery reduced requirements for mechanical ventilation and for fire-suppression equipment
- A biomass-fired central mechanical plant provided 75% of cooling, heating and power needs

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REFERENCES:

Douglas, Lawrie. "Zero-Waste Olympic Games." Engineering & Technology Jan. 2012: 46-47. Print.

Hartman, Hattie. "This Building Will Be Re-cycled." Architect's Journal 02 June 2011: 26-31. Print.

Hayes, Graeme, and John Horne. "Sustainable Development, Shock and Awe? London 2012 and Civil Society." Sociology 45.5 (2011): 749-64. Sage Publications. British Sociological Association, Oct.-Nov. 2011. Web. 05 Feb. 2013. <http://soc.sagepub.com/content/45/5/749>.

Logan, Katharine. "London Calling." Gree Source May-June 2012: 50-54. Print.

"London 2012- Olympic Stadium." Detail. N.p., July-Aug. 2012. Web. 05 Feb. 2013. <http://www.detail-online.com/architecture/news/london-2012-olympic-stadium-019389.html>.

Mara, Felix, and Rory Olcayto. "London 2012 Olympic and Paralympic Games Stadium." Architect's Journal July (2011): 28-39. Print.

Montgomery, Angus. "London 2012 Design Icons- the Olympic Stadium." Design Week. N.p., 26 July 2012. Web. 05 Feb. 2013. <http://ezproxy.ltu.edu:8080/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=8gh&AN=78318095&site=ehost-live&scope=site>.

Olcayto, Rory. "Olympic Stadium: Populous." Architect's Journal 11 Oct. 2012: 82. Print.

"Olympic Stadium Populous Architects." Architectural Record June 2012: 92. Print.

"Permanent Venues." Architect's Journal 04 Oct. 2012: 90-92. Print.

Seward, Aaron. "An Olympic Feat." Architect Jan. 2012: 84-94. Print.

Sullivan, Dan. "London Strives for Zero Waste Summer Olympics 2012." BioCycle Sept.-Oct. 2012: 32-34. Print.

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THE END

Image Source: Detail Magazine