

Now that the games are over, London can sit back and say “a job well done”

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Introduction

When the London 2012 delegation travelled to Singapore in 2005 to bid for the 2012 Olympic and Paralympic Games, the vision to use the power of the Games to inspire lasting change was laid out. In his address London 2012 Chairman Sebastian Coe stated:

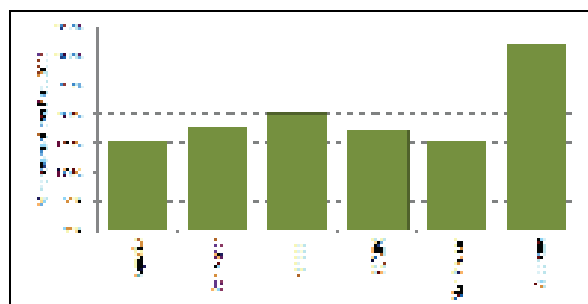
“First, we want to deliver a magical atmosphere. An electrifying experience for competitors and spectators. To provide the uplifting spirit which distinguishes the Olympic Games from other sports events. And that magic begins with the venues. Which is why we have carefully selected them in line with the needs of the IFs, and the recommendations of the Olympic Games Study Commission: Existing world-class venues. Spectacular city centre locations. And, most importantly, our decision to create an Olympic Park. A park containing nine state-of-the-art venues.. All just seven minutes from central London. Our Park will also contain the Olympic Village. We will put athletes Olympians and Paralympians at the heart of our Games. They will live within sight of the Olympic Flame. Our second principle is to be your best partners. We have listened and learnt. We are a better bid as a result. Thank you to all of you who have helped us in our quest. We established our own Athletes Commission. We worked just as hard to understand the needs of all those upon whom the athletes depend. IOC members. The NOCs. The IFs and technical officials. Sponsors and the media. Every single member of the Olympic Family. For example, we know it is much harder to negotiate hotel room rates after the Host City has been selected. So, we already have legally-binding agreements which guarantee low, fixed prices for all Olympic Family rooms. With no minimum stay. This alone will save you millions of dollars in accommodation costs. Our third principle is to deliver a lasting sporting legacy. We know the Games must offer more than just 17 days of world-class sport and celebration. So, in London every sport will have a legacy.”



So when London was announced as the winner the challenge began to deliver on this commitment and produce the most sustainable games with a legacy going forward. A large industrial wasteland site to the east of London was regenerated to form parkland setting for both new and temporary venues. 220 buildings were demolished, 2 million tonnes of soil cleaned and reused, 30 new bridges constructed, and it was the first UK construction site to have a permanent environmental team looking after the ecology of the site.

The London 2012 Olympics has given the UK a unique opportunity to show off its best in design and technology. It has also raised the bar as far as safe construction is concerned as in the whole of the construction program there wasn't a single fatality. The challenge was to make these the most sustainable games ever with a strong focus on the legacy after 2012. Given that contracts for the venues were let over 6 years ago we had to make sure that what was installed wasn't outdated by the time it came to be installed. For example the park wide external lighting was originally planned to be discharge lamps but during the procurement stage a number of lanterns were updated in the design to be LED with photovoltaic panels to provide part of the power. Each column has its own unique identification and as the park is re-modelled will be reused in different locations.

In 2006 when the buildings were designed they all exceeded the existing energy regulations by 15% with the Velodrome exceeding by 30%.



Many sports used existing facilities that were already world famous, others used iconic London locations. In the Olympic park the permanent buildings were the Stadium, Velodrome, Aquatics, Handball, Athletes Village and the park infrastructure. Within the park temporary venues were created for Basketball, Hockey and Water polo. Each of the permanent buildings had a plan for its use after the games before construction was started.

One of the highlights is the ArcelorMittal Orbit which is a 115-metre-high observation tower. The steel sculpture is Britain's largest piece of public art which allows visitors to view the whole Olympic Park from two observation platforms.

Working with the design team from the beginning was an essential part of meeting the challenges of lighting the venues. Another challenge was the lack of a specific Broadcasting brief for London with most venues designed on the specifications used in Athens and Beijing. Whilst this was acceptable in principle, production techniques had moved on in the last 4 years with more focus on High Definition, Slow Motion replays and the beginning of 3D. All of these impacted on the lighting.



Olympic Stadium

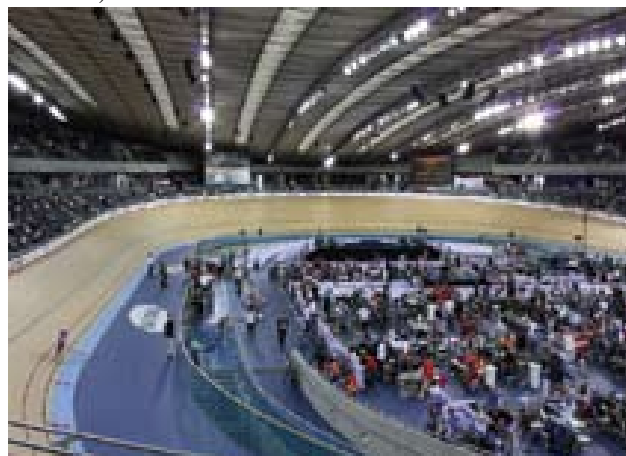
The main stadium considered lighting at a very early stage in its design to ensure that the correct aiming angles would be achieved for broadcasting. Early models of the stadium show it to have a smaller and lower roof that the final design. This early design was shown to be too low if the lighting was to be suitable for broadcasting and so the optimum position of the lighting was given as a point in the air, and the structural designers given the challenge of filling in the gap. So we can say that it was the lighting that created the iconic design that we saw for the games. The stadium uses 536 2kw floodlights on 14 towers achieving 2000lux average on the vertical. Half of these were hot restrike so would come on instantly in the event of a power failure.

Access to floodlights was high but well designed which made the commissioning easier. We used GPS positioning to set the aiming points out which significantly reduced the time to complete compared to traditional tape measures. All towers were aimed within 4 working days which we believe is a record for a stadium of this size. To meet the requirements of super slow motion (SSM) broadcasting the effects of the 100 Hz flicker produced by discharge lamps had to be minimised. This was done by making sure that each point on the field of play received the same amount of light from floodlights on 3 phases. This meant that the distribution of load over the phases was determined by the lighting calculations and not the electrical ones. In legacy mode the roof will be extended to cover extended seating and the lighting towers moved and lowered with the view that the structure retains its iconic appearance. This will make the stadium more suitable for Football where spectators like to be close to the action. Currently 2 clubs are bidding to make this their new permanent home and in addition the lighting will be reconfigured to make it a multi-purpose arena venue for both sporting and other events.

Olympic Velodrome

The Velodrome presented its own challenges with its low roof that hugs the side of the venue. The floodlights were attached to a

suspended containment from the roof. But there wasn't sufficient height or load capacity to use a walkway, so floodlights were set to the correct angle before being hoisted into the air by riggers on ropes. All floodlights are standard with the facility to run them from a UPS in the event of a power failure. A total of 356 1 kW floodlights are used to achieve 2000lux average on the vertical. As this building will stay after the games the design had to provide 8 different switching steps (2000lux, 1000lux, 2x750lux, and 4x300lux)



The multiple steps at lower levels were to extend lamp life, so no floodlight could appear in more than one switch mode. After the games roof lights will be uncovered so the venue can operate for training without any artificial lighting during hours of daylight. To eliminate the Super Slow Motion flicker electronic control gear was used. This gives constant light output and even at camera speeds of 1000 frames per second no flicker was detected. This is the first complete venue to be equipped with this technology and has set a new benchmark for stadia lighting where fast action takes place. The Velodrome track geometry is a closely guarded secret which is known only to the track designer so the lighting design was based on similar tracks elsewhere. Following the games no further changes will take place and the venue is ready to operate in its legacy mode.

Olympic Aquatic Centre

The aquatic centre was a unique design by ZHA who were vigorous in defending their concept. For the games additional side wings were added to give an additional 12,000 seats. The event lighting comes through holes or 'bubbles' in the roof. These



bubbles contained between 2 and 14 floodlights but nothing could protrude below the ceiling line. In case of a power failure just under half were hot restrike, which means they would come back on instantly the power was restored (usually there is a 20min cool down period).

A total of 420 1kw and 122 400w floodlights are used to achieve 2000lux average on the vertical. Access to the floodlights was tight and only just within arms reach. To aim them a web cam was strapped to our aiming sight as it was impossible to use the eye. This enabled us to see where it was directed on a laptop. To take measurements over the pool we used a small inflatable dinghy and tethered it with long ropes so it could be pulled into place. The same electronic control gear as for the Velodrome was used for the diving pool to meet the requirements for SSM broadcasting. For legacy the two side wings of additional seating will be removed and a glass curtain wall installed to maximise daylight into the pool.



Broadcast Legacy

As part of the learning legacy, the work that was done with the broadcasters to meet their current needs is being translated into new guidance which will be published in the international lighting guides for broadcast lighting. Specifically we will deal with the correct lighting for Super Slow Motion cameras which was one of the main challenges across all the venues.

Athletes Village

The Athletes Village is where most of the competing athletes stayed. The complex is designed to transform into a range of housing types after the games and needed to have the most efficient lighting possible. All the living spaces were equipped with 88,000 7w LED lamps plus a range of compact fluorescent luminaires in circulation spaces.

The designed level was 100lux in the living spaces. In addition each block has its own private outdoor space which was provided with LED lighting to create a pleasant area for residents to relax. For the games, each apartment will have temporary walls installed to make single bed rooms for 9000 athletes. After the games these convert into 3000 apartments for mixed use, some private and some social, and of different sizes.

ArcelorMittal Orbit

The ArcelorMittal Orbit or "Orbit" as it is known by is a 115-metre-high observation tower in the Olympic Park in Stratford, London designed by Anish Kapoor and Cecil Balmond. The steel sculpture is Britain's largest piece of public art, and is intended to be a permanent, lasting legacy of London's hosting of the 2012 Summer Olympics, assisting in the post-Olympics regeneration of the Stratford area. Sited between the Olympic Stadium and the

Aquatics Centre, it allows visitors to view the whole Olympic Park from two observation platforms.



It is illuminated by 268 LED floodlights mounted within the structure. For the main structure these were all Red light apart from the 'Bell' at the base which is Orange. These are animated into a 15 minute program that see the tower come to life and beat like a heart. The viewing platform has been equipped with 40 LED lamps and the staircase which winds up the centre by 100 x Pacific LED.

Olympic Park

The Olympic Delivery Authority wanted a cohesive design across the whole park area with a 'family' of products that would provide a common look and feel across all the areas. Sustainability and environmental impacts such as light pollution were key drivers as well as future adoption by various parties and maintenance in Legacy. After the games parts of the park will be re-landscaped and so columns would have to be moved as hard areas became parkland. All the permanent columns within the park used LRD lanterns, even though at the design stage these were not available. All ballasts are future proofed if dimming and control is required in Legacy. In addition almost 100 columns within the park have been supplied with photo voltaic panels to feed electricity back into the grid. On the main southern concourse there are 7 Halos of light complete with wind turbines on top. These are 32m tall structures which are one of the highlights in the Olympic Park skyline. They not only provide the functional lighting for the concourse but they also have LEDs at the top of the Halo for dramatic lighting effects. Designers for the park lighting were Arups, Atkins, Allies and Morrison, Hargreaves, LDA design, Burro Happold, Ramboll, Speirs and Major, Sutton Vane Associates, Applied Landscape Design.

Conclusion

Now that the games are over London can sit back and say "a job well done". For the country we created an incredible pride in being on the world stage and pulling off the greatest show on earth. For the construction industry we have shown ourselves to be world class and capable of delivering on time and on budget. For engineers we have created a learning legacy so lessons learnt across all disciplines can be shared for the future. And for the lighting designers we had the knowledge that we played our own part in a great event. There were many late nights and long hours, but it was fun.