SPORTS AND ENTERTAINMENT SECTOR PORTFOLIO
CAN ENGINEERING IMPACT THE ATMOSPHERE OF A VENUE?
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HERE ARE FIVE EXAMPLES OF HOW IT CAN

(and 30 more for you to explore)
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A LOW CARBON LANDMARK FOR LONDON

LUCKY 8
LONDON 2012
OLYMPIC STADIUM

LOCATION: London, UK
CLIENT: Olympic Delivery Authority
ARCHITECT: Populous
To meet sustainability targets and recycle where possible the compression truss for the roof was constructed from 4000 tonnes of unwanted gas pipeline.

The dismountable structure, employs an innovative lightweight, cable-supported roof that allows the stadium to be reconfigured changing the capacity from 80,000 to a more intimate 25,000 without any loss of atmosphere.

In 2003 we provided the strategic engineering advice and design that would enable a setting for the Games to be realised. This meant planning approvals from the four local London Boroughs and providing a compelling masterplan for a successful bid to the International Olympic Committee. Our work delivered on the ambition to be the ‘greenest Games ever’ and the ‘most accessible Games ever’.

The London 2012 Olympic Stadium forms the centrepiece of the largest new park created in Europe for a century. Designed with an 80,000 capacity for the Olympic and Paralympic Games, the Stadium is elegant, bold, inspirational, efficient and sustainable, reflecting the Olympic principles of respect, friendship and excellence.

Bringing the story up to date, the venue has a reconfigured, gravity-defying roof, comprising 3,000 tonnes of new steelwork suspended from the existing supports. This achieves the largest open stadium roof span in the world, whilst reusing the 2,000 tonnes of original pipeline steelwork.

Now in the final stages of its transformation, the reconfigured stadium in the Queen Elizabeth II Olympic Park is the proud new home of West Ham United, UK Athletics, and several community sports clubs. After completion in 2016, the stadium will also host rock legends, both codes of rugby and the World Athletics Championships in 2017.
It’s been conceived, designed and constructed in five years. That’s half the typical timescale for a stadium of this size.”

Ian Crockford
ODA Project Sponsor

The 14 lighting towers not only provide the optimal lighting levels calculated for the different arena sizes and sight lines, but have become an instantly recognisable aesthetic feature of the stadium.

KEY FACTS:
• Two year planning and land assembly with two major planning applications
• 3km² development site, 240 buildings demolished, 7km of waterways rejuvenated, 12km of new highway
• Infrastructure to support a future population of 25,000
• Completed in budget and within schedule
• Outstanding safety record.
Our Enginuity solution for the London 2012 Olympic Stadium focussed on Efficient and Green Design. Click to see the range of BuroHappold specialisms that collaborated to make the vision viable.
ENGINUITY™ PROCESS

EFFICIENT AND GREEN DESIGN

- Sustainability
- Structural engineering
- Building services engineering (MEP)
- Lighting design
- Bridge engineering and civil structures
- Infrastructure and utilities engineering
- Ground engineering
- Environmental consultancy
- Fire engineering
- Inclusive design
- Security and technology
- Computational analysis

LONDON 2012 OLYMPIC STADIUM | LONDON, UK
A BUILDING WITHIN A BUILDING
THE O2 ARENA

LOCATION: London, UK  CLIENT: Anschutz Entertainment Group  ARCHITECT: Populous
PERFECT PERFORMANCE

The 23,000 seat O2 Arena was designed to be the most technically and acoustically advanced concert and sporting arena in Europe. Today, it is one of the most popular arenas in the world, selling over 1.8 million tickets in 2015.

KEY FACTS:
- Over 70% of visitors arrive via public transport limiting environmental impact
- Host to London Olympics 2012 gymnastics tournaments
- Venue also accommodates a range of sports modes, including tennis and basketball and ice hockey
- The O2 Arena has an overall diameter of 365 metres, an internal diameter of 320 metres, and a circumference of a kilometre.

Our structural steel design of the roof supports up to 120 tonnes of lighting and rigging, required for the world’s top touring rock, pop and performance artists. To this day we regularly review rigging requirements for shows from the Brit Awards to touring legends - the Rolling Stones.
We ran 13 detailed computer simulations of fire scenarios across the site. This ensured that 60,000 people can safely evacuate the arena and The O2.

Constrained by the 50m height limit of the existing dome canopy and unable to use cranes, we had to find a way to raise the roof from within the building. To do this the roof was assembled on trestles at ground level and then lifted by jacking, into place.
Our Enginuity solution for The O2 Arena focused on Inspirational Design. Click to see the range of BuroHappold specialisms that collaborated to make the vision viable.
ENGINUITY™ PROCESS

- Structural engineering
- Infrastructure and utilities engineering
- Ground engineering
- Facade engineering
- Fire engineering
- Inclusive design

THE O2 ARENA | LONDON, UK
A SHOWPIECE STADIUM FOR THE 2014 WINTER OLYMPICS AND RUSSIA
CENTRAL STADIUM FOR THE WINTER OLYMPICS 2014

LOCATION: Sochi, Russia CLIENT: Olympstroy/Engeocom ARCHITECT: Populous
Due to the shape and height of the roof, lights attached to its main trusses would not adequately illuminate the field of play. To overcome this, we incorporated a dedicated lighting gantry into the design to optimise the experience for athletes and audiences.

Two spectacular half-shell structures covered with translucent polycarbonate tiles were created to mimic the surrounding mountainous region.

KEY FACTS:
- Main stadium for 2014 Winter Olympics and Paralympics
- Sustainable design that sets a benchmark for Russia
- Specialist lighting design creates ultimate viewing experience.
Using our Smart Move software we tested the design to ensure the 40,000 spectators could get in and out of the stadium comfortably and on time to keep the sporting schedule on track.

Our specialists worked on the design of the acoustic environment within the bowl to make sure all spectators have an exceptional experience when visiting the arena.
Our Enginuity solution for the Central Stadium for the Winter Olympics 2014 focussed on Inspirational Design. Click to see the range of BuroHappold specialisms that collaborated to make the vision viable.
HOW GAME CHANGING DESIGN CREATED A CATALYST FOR COMMUNITY REGENERATION
BAYLOR UNIVERSITY
MCLANE STADIUM

LOCATION: Waco, TX, USA
CLIENT: Baylor University
ARCHITECT: Populous
IMAGES: Christy Radecic Photography
The asymmetric design is rendered in lightweight materials which were carefully analysed to ensure they could withstand the wind loads and Texan sun.

Located on a 93 acre site, this vast new stadium provides flexible seating for 45,000–55,000 spectators. As well as linking to the university campus via a bridge, the project also connects to the wider community with the view to stimulating further riverfront development by revitalising downtown Waco and bringing jobs to the area.

**KEY FACTS:**
- Exemplar project which includes river bridge
- 45,000 spectator capacity
- High performance design solution tailored to tight design budget
- 90ft long cantilevered canopy over seating bowl

Supported along its outer edge by 100ft tall columns, the canopy is composed of 25 cantilever trusses. The final canopy weighs in at 12lbs per ft², far lower than the typical stadium at 20lbs per ft² - a significant factor in reducing costs.
A BIM model was built to reflect the sequence of construction and draw out material quantities to make sure the project remained on budget.

Using parametric modelling we were able to optimise the size of the roof trusses, and incorporate the fabricator’s requirements for shipping and on-site erection.
ENGINUITY™ PROCESS

Our Enginuity solution for the Baylor University McLane Stadium focussed on Effective Design for Construction and Fit Out. Click to see the range of BuroHappold specialisms that collaborated to make the vision viable.
ENGINUITY™ PROCESS

- Structural engineering
- Facade engineering
- Lighting design

EFFECTIVE DESIGN FOR CONSTRUCTION AND FIT OUT

BAYLOR UNIVERSITY MCLANE STADIUM | WACO, TX, USA
HOW THE PITCH OF A ROOF HELPED TO CREATE ONE OF THE BEST PLAYING SURFACES IN THE WORLD
EMIRATES STADIUM, ARSENAL FOOTBALL CLUB

LOCATION: London, UK     CLIENT: Arsenal Football Club     ARCHITECT: Populous
Opening in 2006 the Emirates Stadium garnered rapturous reviews from players and fans alike. BuroHappold Engineering’s work on the building and surrounds required high level co-ordination and teamwork to meet the needs of this modern football club. This meant delivering optimum solutions for crowd comfort and views, atmosphere, facilities and media access, all within a small triangular site in a dense part of London.

KEY FACTS:
- The shape of the roof allows the maximum amount of sunlight to reach the soccer pitch
- Computer modelling of crowd behaviour informed our design
- Column-free views for all 60,000 spectators.
- Spaces for wheelchair users and all seating levels are fully accessible.

Smooth cladding underneath the upper tiers gives an uncluttered appearance and helps reflect sound, building the atmosphere by capturing the roar.

The sloping roof maximises sunlight and helps reduce shadowing on the pitch which can hamper television coverage and improves crowd comfort.
The Emirates stadium has possibly the best pitch in the world, certainly in the country. The pitch benefits hugely from its roof design which allows in as much natural light as possible for such a big stadium. Coupled with the pitch construction and grow lights this pitch has been the envy of the world for its consistency and quality for many years.

Ryan Hewitt
Hewitt Sportsturf

The Arsenal pitch is like the carpet in my living room. Always fun... Well, only if you win.”

Thomas Müller
FC Bayern Munich
Our Enginuity solution for the Emirates Stadium focussed on Site, Campus and Portfolio Development. Click to see the range of BuroHappold specialisms that collaborated to make the vision viable.
ENGINUITY™ PROCESS

- Structural engineering
- Bridge engineering and civil structures
- Ground engineering
- Security and Technology
- Fire engineering
- Infrastructure and utilities engineering
- Facade engineering
- Building services engineering (MEP)

SITE, CAMPUS AND PORTFOLIO DEVELOPMENT

EMIRATES STADIUM | LONDON, UK
HOW DOES OUR PLANNING AND INNOVATION HELP OUR CLIENTS FINANCIALLY?

Get the fan experience right
The first measure of success is when fans love the atmosphere and look forward to returning. This is our guiding star.

Structural and mechanical engineering innovation opens up many possibilities
We are working with one client to create a two level sliding pitch. The top tier (UK soccer) slides out revealing another code pitch which has USA appeal and potential TV rights. It will directly impact their bottom line.

For another iconic stadium, the roof opens and closes like a camera lens, creating better acoustics and climate control. Not yet opened, it is already successful until 2018 with forward bookings.

Sustainability isn’t just about feeling good about the environment – it has financial benefits
It’s possible to save huge sums on heating, cooling, ventilation, lighting and recycling. But it can also come down to the exact material chosen for cladding and insulation.

Multi-purpose stadia – one key to profitability, many ways to achieve it
With movable seating and a new roof we moved the London Olympic Stadium from purely athletics to allow soccer, rugby and rock concerts, changing the business model entirely.

On a smaller scale, The Royal Commonwealth Pool in Edinburgh, UK, required a sensitive restoration to bring it’s Grade A listed structure bang up to date for today’s swimming superstars, converting its three old tanks into state of the art pools for international swimming, diving, water polo and synchronised swimming competitions.

New life from old stadia – rebuild or renovate? Let us help you decide
As host to FIFA World Cup, Abu Dhabi’s Sheikh Zayed National stadium, built 30 years before, wasn’t fit for purpose. Glare and pitch lighting didn’t conform to modern broadcast requirements. With careful planning and design, a world-class facility with seating for 40,000, was completed within months of site work starting.

In another instance, a new build meant matchday revenues for one UK football club almost tripled, compared to their old ground, plus the boost of high revenue rock concerts has helped to make it one of the most financially successful businesses in the industry.

Unlocking difficult sites – we love the challenge. Here’s a few ways we’ve made a difference
We know how to deal with extremes, such as the speed skating stadium in Italy subject to heavy winter snow and hot summer sun.

We know how to handle seismic zones prone to earthquakes, such as the Winter Olympic Stadium in Fisht, Russia and the Philippine Arena in Bulacan, the Philippines.

Our ability to manage the flow of crowds via our SMART technologies means fans arrive, enjoy and leave in comfort despite the site location.

Planning the build for a stadium for 15,000 on a tight site bordered by live rail tracks either side is no small feat. We delivered it three weeks early.
OUR SPORTS AND ENTERTAINMENT PROJECTS WORLDWIDE
CLICK TO DOWNLOAD PROJECT SUMMARIES