

Profile

 **Technology will free up structural engineers to be more creative and challenge standardisation as the route to efficiency, says AECOM Director for Buildings and Places, Jon Leach, who is also the new chair of the Institution of Structural Engineers Panel on Digital Workflows and Computational Design. He talks to Jackie Whitelaw.**



If Jon Leach is not regularly surfing in Cornwall, then he should be. The AECOM Structural Engineering Director for Buildings and Places has had a knack in his career of catching a wave just at the perfect time.

He started his professional life as a boom was developing in the UK after the 1990s recession which had decimated the industry of young engineers. This meant that, as one of the talented members of the fresh cohort emerging from university, he was given early responsibility for running projects. And he followed his instincts to build multidisciplinary knowledge for himself and his team, which was precisely what was needed when a new wave of opportunity came his way in the form of multiple venue design for the Rio 2016 Olympics.

Now, at 39, he finds that he is old enough to have developed his intuitive structural engineering skills, but young enough to embrace all the new technology just as it is about to bring another cycle of revolution to the sector.

Digital evangelist

At AECOM, Leach has helped introduce software that pushes the limits of computational analysis and documentation

not just for large-scale, challenging projects like the iconic long-span roofs he and his team are designing for Hong Kong Airport's Terminal 2, but also for more everyday schemes. These can also benefit from the design optimisation that cutting-edge technology allows.

'My role with the Institution's Panel on Digital Workflows and Computational Design is to do something similar,' Leach says. 'We want to encourage people to use advanced technology on more straightforward projects and we are starting to get traction on that.'

'It definitely makes you more efficient. On the big projects, it is the difference between whether we can deliver or not. On simpler projects, it is about marginal gains, but that is equally important and creates a culture where you are freed up to be more creative, with the added benefit that it really enthruses younger graduates.'

'Engineers should always bring value and something more creative to buildings, not just size the beams. Computers should be doing the repetitive, monotonous tasks now, although it is still very important to ensure graduates understand first principles – what the software is doing and what its limitations are,' he says.

'Technology is also allowing us to move away from the mindset where standard design and repetitive elements are the most efficient way to produce structures. The focus in the future should rather be on using less material. Looking a couple of decades down the line, robotics and additive fabrication will take most of the labour out of the equation, so the need for repeat forms will be less.'

'We should be pushing the boundaries now to test what will be possible.'

Universal engineer

Leach has achieved a great deal in the 17 years since he left university after a degree in civil engineering with architecture at The University of Sheffield. He joined Oscar Faber

(now part of the 100 000-strong AECOM organisation) in 2000.

'There was a whole group of common-sense, pragmatic engineers to learn from, including Steve Prichard and Phil Benson in St Albans and Peter Ayres (of Halley VI fame),' Leach recalls. 'They gave me a breadth of experience on schools, residential, rail, commercial and healthcare schemes, and I was quickly managing multiple teams.'

His interests lay in more than the typical steel and concrete structures – also timber design, facade engineering, performance-based design and fire engineering to name a few. 'I never wanted to be solely a structural engineer,' he says. 'I think of myself more broadly – just as an "engineer". That means I have an interest in everything. And although we can call in experts in various fields, I believe that, as an engineer, I should be informed about those areas so I can talk to those experts and understand what they are doing. That way I can guide what is going on and bring value to each project.'

Olympic ambitions

After a decade in the St Albans office, and just as Leach was getting itchy feet, an Olympic-sized opportunity presented itself, one that needed a team which had a broad understanding of all the elements that go into creating new venues.

'AECOM had won the Rio 2016 masterplan work off the back of what we had done for London 2012, and when the Brazilians said they needed help with venue design, we were in the perfect position. A colleague and I had been tracking the opportunity and when it kicked off, I moved part of my team to London. It was perfect timing for me.'

Leach was building engineering lead for the Barra Olympic Park site (Figure 1), including scheme design for the masterplan engineering, the 5000-seat velodrome, three tennis venues, the 18 000-seat fully demountable aquatics venue, three multi-

sport arenas and the International Broadcast Centre.

'Most of the work was done in 2012 – it was a real buzz to be designing the next Olympics during the London Games,' he says.

Rio was where Leach's willingness to embrace new technology came into its own. 'A couple of the team realised we had to use more complex software if we were to deliver all those venues, so we could do rapid prototyping, quick manipulation of geometry and move models between different software packages to test them.'

He had to push hard in terms of getting top-level support for the investment – again being ahead of the curve. But it is paying back. Leach and his team moved on from Rio to the Al Wakrah Stadium for the FIFA World Cup 2022 in Qatar, where Leach was engineering team leader for the 45 000-capacity venue, which includes a 230m span stadium roof, and from there to Hong Kong's Terminal 2 and Third Runway Concourse.

Embracing technology

Along the way, the technology has kept developing. 'We are writing very specific software to link our workflows, which makes everything parametric – geometry, loads, supports, restraints, as much as is appropriate for each project. Many practices use a specialist geometrist. I say, as an engineer, you need to understand how the geometry and fabrication works yourself. So, it follows, understand the software and you are more engaged with the whole process.'

Not surprisingly, Building Information Modelling (BIM) is part of the IT effort, though not necessarily the most favoured by everyone. 'BIM can be rather misunderstood,' Leach believes. 'There is a lot of resistance to it out in the industry because it is regarded as a directive – other people telling you how to do things. And some consultants find it hard to see the benefits; yes, they can see value in 3D modelling, but a lot of the data and asset management information is geared to clients and there are a lot of people at our end of the supply chain who are wondering why they are being told to do all this work for no benefit to themselves.'

'We need to explain more forcefully that we are positioning consultants to use technology so they can make themselves more efficient and creative. It's a positive thing, but we need to

manage this period of change carefully.'

Virtual reality (VR) and augmented reality (AR) are relatively new tools in Leach's armoury. 'Sometimes all a client wants is a really cool fly-through, and we can do that, but we are now looking to see how you can use these technologies as a collaborative design tool for multiple users in remote locations.'

'The technology is getting so good, it makes you wonder whether we really need the building – maybe we'll all be watching sport at home via VR rather than going to the stadium – quite a frightening prospect, but I think what would be missing is the atmosphere, the other people.'

Human touch

And for all the benefits of modern technology, Leach is adamant that you can't do away with meeting people face to face to really understand what is wanted, how to work

together and to enjoy the process.

'I have a six-week rule. I need to see the people I am working with every six weeks to be able to communicate properly, to learn from the body language. There's a lot of pressure to work solely by video conference, but it doesn't work if that's all you do. And it takes the pleasure from the job.'

'I want the exciting projects, I like the technical challenges, but what I enjoy most are the people – working with very talented people from around the world who I would never have met if not for my career.'

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Figure 1
Barra Olympic Park
site, Rio de Janeiro



SERPENTINE PAVILION DESIGN – AT THE HEART OF THE ENGINEER

Jon Leach may be leading the way with technology and enjoying the high-profile projects that make up the bulk of his work, but there is a small annual scheme that gives him just as much pleasure. That is the Serpentine Pavilion in Kensington Gardens, London (Figure 2). The 2017 structure – at the heart of which will be a steel-and-timber tree canopy – is by the architect Francis Kéré.

'The pavilion is very valuable work, really unique. It gives you the opportunity to be involved in all the detail, even down to the paint colour. It taps into the artistic element in all of us. And in my team, I try to mix up the big projects with some smaller-scale ones to balance the workload and give my graduates more opportunity. The Serpentine Pavilion is very much part of that plan – they can work with the architect and contractor and have real ownership. I want to give them the start that I had.'



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