

Profile

Sarah Williamson came to structural engineering a few years later than most, but since starting her career she has forged her way to being one of the key minds responsible for delivery of the multibillion-pound main civils work contract at Hinkley Point C nuclear power plant. Jackie Whitelaw went to meet her.



Figure 1 Site progress showing construction of nuclear island



Sarah Williamson is currently overseeing the start of the main civil engineering works on site at Hinkley Point C, Britain's first new nuclear plant for a generation. Currently under construction are the nuclear island (Figure 1), housing the reactor building, technical galleries comprising 7km of service tunnels, and the pumping station. Williamson is construction technical director for BYLOR – a joint venture between Bouygues and Laing O'Rourke – which will deliver the main civil engineering work on what is the biggest construction project in Europe. It's not a role for the faint-hearted.

Her job covers all aspects of the engineering and technical delivery of a contract worth £2.9bn that includes placing of 1.3M cubic metres of concrete, with 250 000t of steel reinforcement (Figure 2) and tens of thousands of embedded items. 'We are only just starting and there are already eight tower and eight crawler cranes (Figure 3),' she says with some joy. 'We'll eventually have more than 50 tower cranes plus the biggest crane in the world – 150m high and able to lift 1000t at 100m.'

'This job', she says, 'is such a big beast. You have to treat it with respect – there is nothing you can be nonchalant about.' For a structural engineer who likes a challenge and enjoys dealing with the mind-expanding numbers of major projects, this is perfection.

Nuclear experience

Williamson has been involved in the Hinkley project since 2012, when she joined Laing O'Rourke. Originally part of the Laing O'Rourke Engineering Excellence

team, she quickly found herself involved in the planning, bidding and preconstruction strategy for the Somerset power station. This was not least because of her six years' experience at Atkins, where she was chief engineer in its nuclear business.

'Engineering Excellence seemed like a perfect fit when I was approached. I had both academic and design experience and my roots were in construction. But as I joined, I discovered we were bidding for Hinkley and I thought, 'Hang on a minute!' she says grinning.

Williamson, now 48, loved her time with Atkins, where she had the opportunity to work on most of the operating and decommissioned nuclear power stations in the UK. Her passion was decommissioning at Sellafield – the perfect opportunity for an engineer from Cumbria to do exciting head office-type work but from the far (very far) provinces. It gave her a chance to be part of the solution to significant decommissioning

challenges of the more historic parts of the plant and to stay close to her family. But Hinkley offers a totally different and unique opportunity. It is a massive step change from anything done previously.

'This is the biggest, most exciting thing I have ever done,' she says. 'Without really planning it, my whole career has been building towards this job – I've certainly done all the leg work, I understand the nuclear context, and have had a career-long focus on reinforced and prestressed concrete – materials, design, assessment, construction, research – everything!'

Finding her way

Williamson is a bundle of energy, very clear-sighted about what she is doing and where she is going, so it is a surprise to find that was not the case at the start of her working life. When she left school at 18 she drifted.

'My dad was a builder, so I knew about construction, but it took me a long time to figure

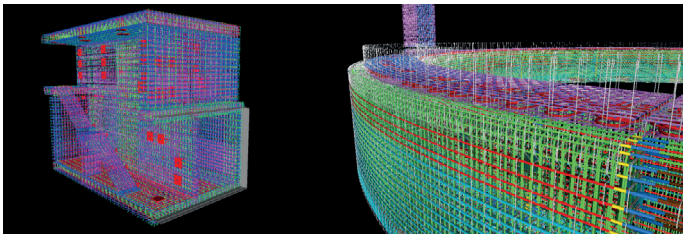


Figure 2
Reinforcement model

out it could be a career or even what a career was,' she says. 'My background is working class, I was brought up in a council house in Workington – a steel town that was a bit depressed. No one in the family had ever been to university, so there was no example to draw from, which is why it took me a while to realise that is what I wanted to do.'

'A levels didn't go well, so, to take stock, I did what I knew and went to work on site with my dad.'

Being a woman on site wasn't ever an issue. 'I grew up on building sites, so being different is normal for me. That doesn't make it right though; now I want to be part of the change that makes civil and structural engineering and construction careers options that are seen as exciting, creative, technical and attractive to everyone regardless of gender, ethnicity, sexuality – whatever.'

After one brutally cold winter and another round of festivities, 'I decided I might be ready to stick the toe back into the world of study,' she says. So, she looked for a more structured way into a career.

Williamson went to college in Preston for a year crammed with maths, mechanical, electrical and other engineering, but decided civils was for her. 'I'd had advice that civil engineering was vocational, so don't bother with university, and I went to Liverpool Polytechnic. After getting a very sound education, a very good degree and a basket full of prizes, I failed to get the job I wanted because I didn't go to the right school. There is an industry-wide skills shortage and I still believe that we are overlooking talent due to degree snobbery.'

Having failed to get the dream job, Williamson reconsidered and the next thing to pique her interest was a PhD at Birmingham University, where she studied the behaviour of reinforced and prestressed concrete. By the age of 30, she had a PhD and was both a Doctor and a lecturer. Her next desire was to go into industry as a structural engineer. 'So, I sat my Institution Part 3 exam. I'd had the site experience, I had design experience and, with the PhD and lecturing practice, was all over the theory, so I was ready to go.'

Once chartered, Williamson chased down the work she wanted. 'I wanted to go home to Cumbria and be part of the decommissioning of the high-hazard areas at Sellafield; and I decided not to take no for an answer from anyone. I found out who had offices there and announced to Atkins that I would be joining them!'

It was a sound move. 'I did some of the most satisfying engineering work of my career,' she says. 'The work was an exciting mixture of design and assessment in an environment where the consequences of

getting it wrong would be really environmentally significant, so we had to be sure of the solutions we proposed and be able to defend them in a whole host of reviews. The ongoing review and scrutiny can be demoralising or intimidating, but I love the challenge.'

The decision to transfer to Laing O'Rourke six years later was a big one. 'I'd resisted the southeast until I was 43, but the Laing O'Rourke opportunity made me decide to give it a go.' It turned out to be a very good time and place, but after three years living in Rochester, Kent to be close to the contractor's headquarters in Dartford, Williamson and her husband, Dave, moved to Bristol and touching distance of Hinkley. Once again, she is working in a rural economy geared round a big local employer in the nuclear power industry.

Digital innovation

Williamson is an advocate of industry change and how digital technology can be used to change both the productivity and culture of the construction industry and the experience of the people working in it. The nuclear power plant, where quality and tolerances are of the highest level, is a good place to prove its worth.

'We have to be able to demonstrate that the materials we used and what we have built is as per the specification

and drawings,' she says. 'In this respect, Hinkley is no different from any other construction projects; however, mega projects are highly complex, continually changing and, according to the statistics, difficult to deliver to the desired targets of safety, quality, programme and cost. Here we have the opportunity to use data and digital engineering to plan and manage our works in a way that will give certainty in all of those key criteria.'

Designs are built first on computer, with the digital model also used to plan logistics as areas of the site are handed over, so that the whole project – the whole site – can be visualised before it is built.

'Ideally, the build would be an assembly of pre-manufactured standard components, but the complexity of the structures precludes that. However, we do componentise as far as possible, so that final construction is about assembling pre-planned elements,' she says.

'Efficient production is all about efficient assimilation of production information; rather than spending time poring over drawings, it is much more efficient for our teams to be briefed using an animation of a construction sequence and then use the drawings and model to complement this and fill in the detail. The teams in the field love the new way of presenting design information.'

Reshaping the industry

'The other great thing about where we are moving to is that the teams working with the models can come from a variety of backgrounds. They don't need to be engineers; in fact, one of our best senior technology integration engineers started life as a steel fixer. The breadth of talent in the team is strengthened by the diversity of where people have come from. This is good learning for our industry.'

That said, there are areas where engineering knowledge and experience are paramount. Engineers working in construction are responsible



Figure 3
Cranes will play key role on project

for structural stability during the temporary state, which Williamson believes can often be as challenging – if not more so – than coming up with a scheme that will work in the permanent state. 'I really believe that the Institution should be doing more work with construction organisations to communicate the benefits of having chartered structural engineers both in the field and in temporary works design offices. This is something that I really care about with my own team. We are lucky to have a number of very good structural engineers and we work hard to develop the understanding of structures in our construction engineering team.'

One of the bigger challenges industry faces is culture, however, Williamson says. 'Technology can only do so much. At Hinkley Point, we will have 350 engineers at peak and a workforce of over

3000. Getting everyone in the right mindset and adopting the right behaviours means communication has to be a massive part of what we do. But it's not the skill the construction industry is best known for.

'Communication and leadership are skills – just the same as the technical skills that we all expect to develop. Degree courses are rammed as it is, but I really think there is merit in getting some psychology, art and communications in the mix – engineering is the 'art and science', after all...'

The other part of the construction culture that needs to change is long hours; Williamson, at Hinkley, is on a mission to deal with that. 'We have to organise ourselves better, maintain higher energy levels over shorter periods, rather than reverting to the industry norm of flatlining – working hard for long hours

but never reaching peak performance.

'To start to break the presenteeism culture, we are setting an hours budget for one of the teams and we monitor the hours worked. The idea is that we want to understand if it is possible to achieve the work planned with the hours budgeted – rather than rely on unplanned overtime. So far, it's working. The engineers get off site and have a life, the work gets done and we are moving towards the world of construction that we want to live in,' she says with a smile. 'Building this flexibility into how we work is so important to encouraging diversity by focusing on what people can do rather than the hours people can be around for.'

Williamson sits on the Institution's Council and the single and simple reason that she does this is that she is excited by how much the Institution

has to offer to construction professionals outside the structural engineering design sphere, and specifically in the world of construction where she now resides.

'We need to do two things: first, make the construction industry an exciting and welcoming place to work; and second, look for the reservoir of untapped talent out there. Stop focusing so much on graduates and favoured universities, and give young people from all backgrounds the chance they deserve – the chance that the industry needs to give them if any meaningful change is going to be effected.'

HAVE YOUR SAY

To comment on this article:

► email Verulam at

tse@istructe.org

► tweet @IStructE

#TheStructuralEngineer

The Institution
of Structural
Engineers

Design Conference: Risk Management

23 October 2018
Institution HQ, London

This conference focuses on the practicality of getting a design built – looking at examples of how things can go wrong, what we can learn from these failures and how to design out the risks. As well as talks from industry experts, practical group work will explore how to resolve issues in the design office.

Essential for early career engineers and those looking to take the Institution's Chartered Membership Exam.

Find out more and register:

www.istructe.org/designconference