



James Norman

James Norman is excited about the future of structural design, believing that engineers will be freed up to explore new materials and pursue regenerative strategies by increased automation. As his latest book is published, he talks engineering, education and ethics with **Helena Russell**.

A long-term advocate of practice-based engineering education, James Norman now argues for a stronger emphasis on design from first principles. James, who is professor of sustainable design at the University of Bristol and has spent his professional life straddling industry and academia, is convinced that a thorough understanding of how to work from first principles will be a key component of the future engineer's toolkit.

James wasn't immediately drawn to engineering; a school visit to Sizewell B nuclear power station inspired him to think about becoming a nuclear physicist. And despite being brought up in a family of teachers, it was even longer before he gravitated to education.

As a sixth-former, he had the opportunity to participate in a Model United Nations initiative at a neighbouring school. 'It was mostly attended by private schools, but they invited a few teens like me from the local comprehensive to join the event, and I found it quite impactful,' he recalls. 'It made me realise I wanted

to do something positive in the world. Someone said to me that the number one impact you can have is to provide clean water and sanitation for people. I really leaned into that and decided to do a civil engineering degree.'

He studied at Nottingham University and his undergraduate research project was water-related, but ultimately James discovered that his forte lay in structural engineering. 'I found that I was good at it, and I got more enjoyment out of it,' he admits. On graduation he went to work at Whitby Bird (now Ramboll) in Bath – one of the three local companies he applied to, wanting to stay in his home city, rather than move elsewhere for work.

At that time, James admits, he was not really aware of the wider impact that civil engineers have on the world. 'I was certainly less conscious than I feel my 17-year-old self would have wanted me to be. I loved engineering, I loved structural engineering and I loved doing design work; I probably got carried away with that!' All the same, he recalls that

CAREER MILESTONES

2000	Graduated from University of Nottingham with first class MEng in Civil Engineering
2000-03	Graduate engineer at Whitby Bird, Bath
2000-06	PhD at University of Bristol
2006	Engineer at Ramboll, Bath
2007-13	Part-time associate at Ramboll, part-time lecturer at University of Bristol
2008	Became a Chartered Member of the Institution of Civil Engineers
2012-15	Associate at Integral Engineering Design, Bath
2015-19	Senior teaching fellow at University of Bristol
2015	Became a Fellow of the Higher Education Institute
2019-21	Associate professor of sustainable design, University of Bristol
2020	Awarded a UK National Teaching Fellowship (only the second civil engineer ever to receive one)
2021	Professor of sustainable design, University of Bristol
2024	Became a Fellow of IStructE



FIGURE 1: James' innovative approach to teaching saw him introduce a module in which students worked for a pretend company, Just Timber

his very first project used precast planks as passive cooling, quite progressive for the early noughties. 'We were already concerned about the climate emergency, but were much more focused on operational carbon than embodied carbon.'

A love of teaching

Just a few years after graduating, he returned to academia at the University of Bristol, for a PhD on structural dynamics of bridges. 'I didn't find it as collaborative as working in industry and working with other people,' he admits. 'But the big win for me was that I started to teach.'

In his first year, James helped his supervisor teach steel and concrete design and by the second was teaching steel design himself. From this point on, education became part of his professional life – after finishing his PhD he worked part time as a lecturer and part time as an engineer at Whitby Bird for a year, and even after going back to full-time engineering he negotiated unpaid leave to allow him to continue teaching.

'I did that for about eight years; four days a week in industry and one day a week teaching students how to design steel and concrete. I enjoyed the blend of industry with the challenge of teaching,' he says.

James says it made sense for him to bring his experience from one into the other. 'I often pulled together the photos from a site visit I'd done that week to use as part of my teaching, so the students were getting exposed to what was going on on site, and there was a richness for them,' he explains.

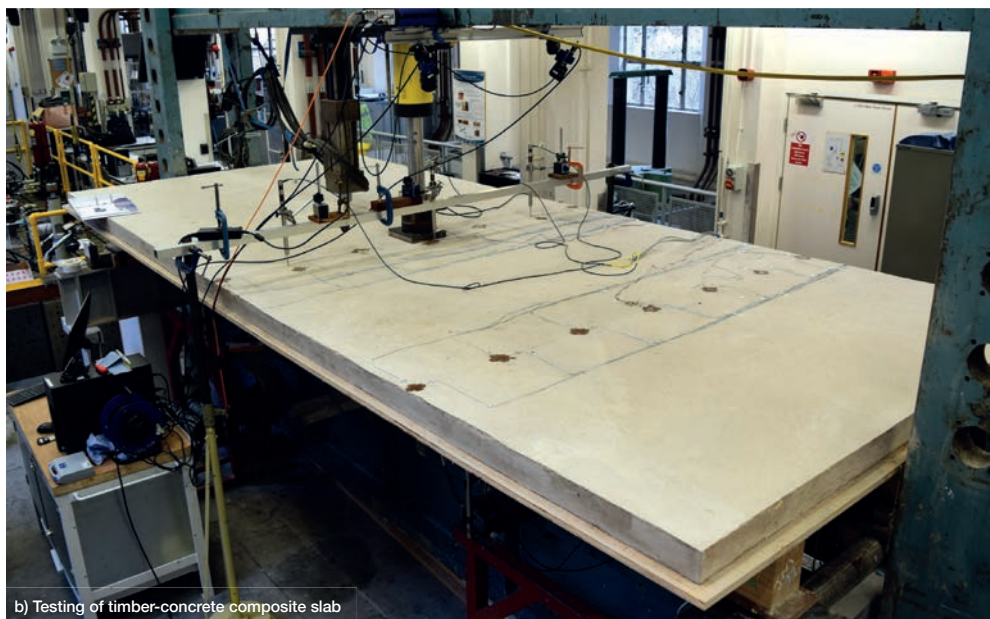
His shift in mindset towards sustainable, regenerative design practice was gradual. In 2012 he moved to Integral Engineering Design – a practice recognised for its strong sustainability ethos – and at the same time he started teaching a unit on sustainable construction, including straw bale and rammed earth design. 'It began as a timber engineering unit, and I stepped in as the person who taught it was unwell,' he recalls. 'I thought, "it's all very well to teach timber but why are we not teaching all this other stuff as well?"'

By 2015, James was ready to make a choice between the two professions; he applied for a full-time role at Southampton University – keen on the job but not the commute – and was happy to be offered a similar teaching-only contract at the University of Bristol, where he has remained. He

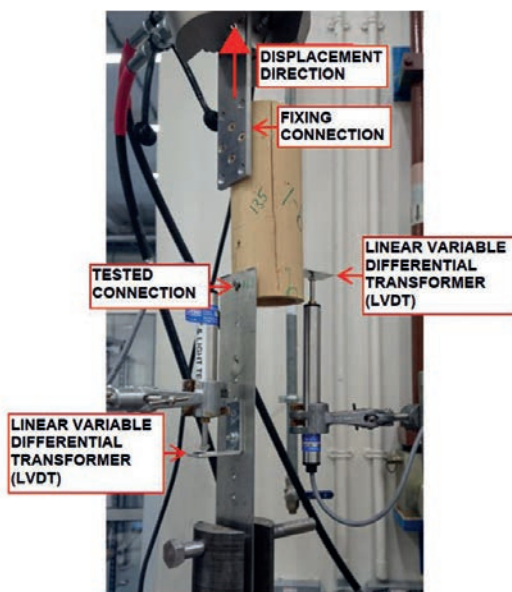
FIGURE 2: James' views on sustainable, regenerative design have evolved through an interest in natural and bio-based materials



a) Lee Sixth Form Centre at the Ralph Allen School, Bath used cross-laminated timber and glulam, while also incorporating a rammed earth wall



b) Testing of timber-concrete composite slab



c) Test rig for nailed bamboo connection

MALKOWSKA D. ET AL. / CC BY 4.0 / [HTTPS://DOI.ORG/10.1016/J.CONBUILDMAT.2022.127971](https://doi.org/10.1016/j.conbuildmat.2022.127971)

quickly rose to senior tutor, taking on pastoral care for the civil engineering department, then on to programme director and school education director, holding the latter post overseeing the civil, mechanical and aerospace engineering students through Covid.

'It was probably the most turbulent time of recent educational history,' he says, admitting that although it was incredibly stressful, he found it fascinating. 'I had to oversee all the changes to how we were delivering education – it was a very creative time in terms of trying to bring forward a lot of the innovations that we'd been working on.' The main challenges were managing people – many overseas staff went home to be with their families – and making sure everything was robust.

Once fully embedded in teaching, James was awarded a teaching

DAVID GRANDORGE

JOSHUA MUDIE

fellowship to explore the scholarship of his methods, enabling him to identify the academic context of his practice. 'I had some pretty strong views on how to teach, but it was very much based on my own observations and the feedback I was getting from students. It made sense to create spaces and environments which felt like the place where they were going to end up working.'

His creation of 'the office' – a classroom set up to replicate a design office (**Figure 1**) – was a case in point. 'There was no upfront teaching, the students came and worked for my pretend company. We had QA reviews, drawing issues for checking purposes and so on, and I was available in the room to answer any questions while also working on my own thing, just as a director would be in a normal office,' he says.

A critical friend

While academia and authorship are generally inseparable, James never considered himself a writer. 'It wasn't a hard no, just not something I had ever thought about,' he reveals. Simon Smith, a former colleague from Ramboll, had an idea for a timber version of the economic concrete frame guide. 'He'd sketched out what the book might look like, but didn't have time to write it and suggested I might take it on to keep me busy during the academic summer break,' he recalls.

'Book writing wasn't something I thought I had a talent for, but it has definitely added a new string to my bow, and it has given me the confidence to be a critical friend to the engineering community,' James reveals. 'I sit in that in-between space where I can say the things others can't, I can be a bit provocative.'

Having just published his sixth book in 10 years – four of them focused on sustainable design – James clearly has a lot to say. 'I came into academia thinking we need to educate students about sustainability, but over the last decade I've realised that's not enough. There is no point having graduates who can do all this wonderful stuff if their employers aren't behind them. More and more of my work now is to try and change industry, rather than waiting for the students I teach to become directors. I've leaned more towards being provocative and saying uncomfortable things to industry,' he admits. But fears that his opinions would annoy people were not realised; he found responses were generally positive.

“BOOK WRITING HAS GIVEN ME THE CONFIDENCE TO BE A CRITICAL FRIEND TO THE ENGINEERING COMMUNITY”

'When I spoke about building nothing in my earlier opinion pieces, I was anxious about how they would land. I was saying things that hadn't been said before in our space – focusing on reuse rather than building new stuff. I really felt like I was sticking my head above the parapet,' he says.

Even in a short time, much has changed – some of which has been technological and largely unintentional, he adds. 'BIM has been a massive enabler of calculating embodied carbon; something that was once seen as a huge amount of work is now almost just one click of a button away.' But there is still a long way to go, and not all of the changes relate to decision-making and priorities.

'Engineers have somehow inherited the role of the ethical or moral arbiters. For decades we've been responsible for saying whether it's *safe* to use a particular material – now I feel that engineers have to challenge whether we *should* be building with a particular material from a sustainability perspective. But I don't know whether it's fair for that responsibility to fall solely on engineers – why not the architect or the client? Engineers are stepping up, but I feel that others could be doing more.'

'It would be nice if we could feel like we are all on the same page and going in the same direction, rather than us feeling we are the ones having to make the difficult ethical decisions. There is big cultural change required.'

An exciting future

His 2024 co-authored book *The regenerative structural engineer* addresses this to an extent. 'It is intended to help engineers think about how to create the change they want to achieve. The conversation about how we can all be on the same page needs to be had outside of the heat of a live project. How do we shift the culture and the approach we take and change the projects we choose to work on?' James asks.

'Regenerative design doesn't have to mean new materials, but it can mean new materials, and that means looking

at local supply chains, what agricultural waste or bio-based materials are available – could we be harnessing those and what do we need to know about them in order to do so?' (**Figure 2**).

James has recently reviewed a forthcoming IStructE book on designing with bamboo. 'In this case the grading is not about strength, it's about wall thickness, diameter of culms and so on – the approach is radically different and requires a different mindset, which is exciting for me. Engineers need to be cognisant of methods of testing and probabilistic methods and different levels of certainty,' he says.

Probabilistic methods will be central to the future of structural engineering design, James believes, as will working from first principles. 'I'm optimistic about the future of design because I think that the most turgid and boring bits of being a structural engineer will be done by computers. Anything that's written down in design codes can be automated, and I think that time will come, leaving the structural engineer to do all the stuff that's really exciting – investigative work on existing buildings to really understand how they work and what they are made from, for example.'

'I like to think the future of structural engineering involves more testing, not less, so we can really get to grips with materials in a way that up till now we've not done. It will be more tactile, more playful in that sense, elevating our analytical skills as we overcome difficult design problems.'



tse@istructe.org



@IStructE
#TheStructuralEngineer



#TheStructuralEngineer

James Norman is lead author on the IStructE's latest thought leadership publication. Get *The future of structural design* at www.istructe.org/shop/.

