Brogan MacDonald

As head of sustainability across Ramboll's building structures division, Brogan MacDonald has made impressive progress in her short career so far. A year into the role, she talks to Helena Russell about how she got here, where she's going, and the importance of positive role models.

FROM ASPIRING FASHION DESIGNER to building sustainability champion is quite a jump, but Brogan MacDonald is accustomed to choosing her own way and making it work. While regular presenting to camera has given her confidence in spades, she is genuinely modest about her most recent promotion, putting it down to being in the right place, at the right time, with the right level of knowledge and a passion for the cause.

Structural engineers often follow family members or friends into the profession, but MacDonald was the first in her family to go into higher education, and didn't know anyone working in the construction sector. She loved painting and admits that until her mid-teens she had aspirations to be an artist or a fashion designer.

'But then I started getting the practical questions of what I was going to do with an art degree. I always loved old buildings; I'm from Aberdeenshire, which has the most beautiful castles, and I was inspired by the fact that you could conserve these historic buildings that had been there hundreds of years.

'When I was about 15, my careers counsellor suggested that with my enjoyment of drawing and love of buildings, the obvious route was architecture.' Having no knowledge of what it involved, she had to do her own research, attending college open days. It was at one of these events that she witnessed an architectural crit that stopped her in her tracks. 'It seemed brutal!' she recalls, 'and it led me to question if this was the career I wanted.'

At the same time, she was fascinated by the mechanics of structures and wanted to know how they worked. 'But maths and sciences weren't my strong points at school and I always struggled to keep up with them,' MacDonald admits. 'Someone suggested structural engineering with architecture, so that I could combine my artist's eye with the problem-solving aspects.'

The fact that she wasn't studying any science Highers was initially a barrier; MacDonald had to take an Open University 'introduction to engineering' course, equivalent to two Highers, which happily unlocked her route to a degree course in structural engineering with architectural design at Edinburgh's Heriot-Watt University. She struggled in the first year, finding the jump to academic teaching methods a steep learning curve that only additional tutoring could overcome.

But the next year she got A grades in most of her subjects, allowing her to continue onto the five-year MEng course from which she graduated with a 2.1 in 2018. 'I didn't find it easy, I had to get a lot of support for my mental health as well as my academic work,' she admits. She is open about this in her STEM outreach, wanting young people to know it's OK to ask for help, and fondly recalls working on Steuart Padwick's 'Talk to Me' sculptures **(Figure 1)** in Kings Cross, London, which highlighted mental health.

CAREER MILESTONES

2018 Graduated from Heriot-Watt University with MEng Structural Engineering
2018 Joined Ramboll as graduate engineer
2020 Promoted to project engineer
2020 Best Young Woman Engineer at the Women in Construction and Engineering Awards
2022 Achieved ICE chartered status
2023 Appointed head of sustainability for building structures at Ramboll
2023 Became Chartered Environmentalist

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↓FIGURE 1: Working on Steuart Padwick's 'Talk to Me' sculptures struck a chord with MacDonald after initially struggling at university

A passion for existing buildings

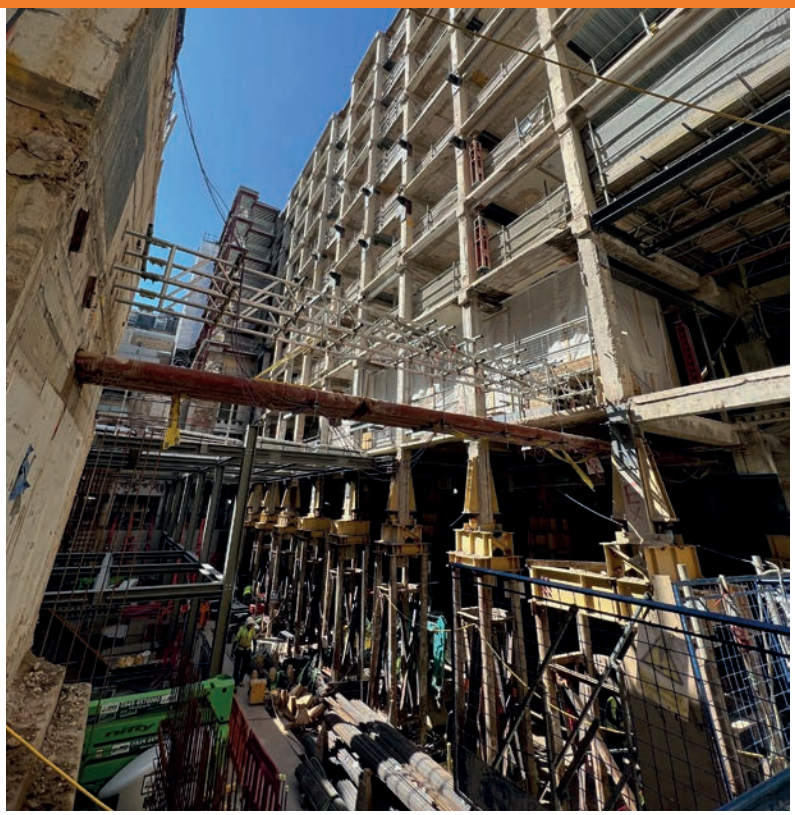
Summer-break internships shaped MacDonald's desire to pursue a certain route, so when she graduated, she had a clear idea of the type of firm she wanted to join. Her successful application for a Saltire Foundation scholarship had been built around the cultural and sustainability benefits of retaining buildings, and although she wasn't able to pursue this during her placement in the USA, the interest endured.

While Ramboll ticked the boxes of a global presence and interesting projects, MacDonald was also attracted by the Danish-based organisation's values and foundation ownership.

She joined the London office in 2018 and was set to work in the building structures division. 'I was working with director Martin Burden in the existing buildings team. He chucked me in at the deep end and within two weeks I was going to meetings on my own,' MacDonald recalls. 'These things are terrifying when you are a graduate, but he leads from the back, lets you learn from your mistakes but is there to help you get out of tricky situations and allows you to grow.' Burden proved to be 'a fantastic ally and mentor' whom she credits for her own development.

Within a short time, MacDonald was Ramboll's lead for a couple of really big 'cut and carve' projects in central London. For Burberry's store on New Bond Street the scheme involved the removal of 11 columns and construction of new transfer structures, to facilitate the addition of two new floors.

She was also resident engineer on the Westbury Hotel – literally next door to Burberry – where the owner wanted to increase the room count as well as expanding back and front-of-house areas. The original intention was to demolish the entire 1950s concrete-framed building and build a new structure. 'Through complex calculations and load balancing we found it was possible to extend above and justified that we could retain a lot of the building,' says MacDonald.



➔FIGURE 2: Westbury Hotel project was complex introduction to reuse of existing structures

But that didn't create enough extra space, so the whole building was jacked up to allow the basement to be extended **(Figure 2)**. 'It was the most complex engineering that I've ever done! There was a massive amount of sequencing – we did top-down, bottom-up construction, and horizontal extension, so there was lots going on at the same time,' she recalls.

'I got to work very closely with Martin and he taught me so much. He would sit in a meeting with the client, who was upset that programme was behind schedule, and would get out paper and pencil and work out how to get back the lost time. Just watching that problem solving on the spot was amazing.'

A six-month stint in Singapore followed, with MacDonald taking the opportunity to learn about new-build design at a small design practice that had just been acquired by Ramboll.

One of the projects she worked on was the Zaha Hadid-designed Singapore New Science Centre, which with its 'crazy long spans' went against the grain for MacDonald. 'I was already thinking about carbon calculations as a graduate and have always been passionate about reuse and the circular economy. When I got to Singapore, I realised that, culturally, they had a very different view; biodiversity was really important, but embodied carbon was not so much in their vocabulary.' What's more, it was not considered appropriate for engineers to challenge the brief, as MacDonald was used to doing in the UK.

Working in Asia also opened her eyes to the challenges of global resource extraction and the global materials market. 'Most of the steel for our projects was coming from mills in China where the industry is on a huge scale and new blast furnaces open nearly every month. It really got me thinking differently about that resource extraction/embodied carbon piece. If you just focus on the UK context you are missing so much.'

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Embodied carbon champion

MacDonald's current role as head of sustainability for building structures is a new, full-time position created in 2023. It signals Ramboll's acknowledgement of the effort that will be necessary to achieve the targets it has set itself of a 30% reduction in embodied carbon by 2025 and 50% by 2030.

'They were looking for an internal candidate to fill the role; I made a case that I could take on the job, and I got it!' says MacDonald. She was not the only one who was surprised: 'I went from senior engineer to principal engineer to head of sustainability and I don't have a huge amount of

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experience – I think people found that unusual. But it was quite a tricky job description – someone who knows about structures, and can keep up with changes in the market, sustainability updates, policy planning, and is able to communicate the information back to engineers and clients who don't always speak that language.'

A lot of her work involves internal staff training and education – in April she was heading to India to train colleagues there – and preparing to launch a new carbon calculation tool that will be used for mandatory assessment of all Ramboll designs. 'We've already published some data on our CO2mpare website and we plan to relaunch it later this year with much more data in it from this tool.'

MacDonald acknowledges that embodied carbon calculations for existing buildings pose a particular challenge: 'Right now, the approach is not very robust, and risks being seen as greenwashing, so we have set out an internal methodology that assigns elements in Revit models that can be exported to our carbon calculator and categorised by existing structures, strengthening and repairs, and new extensions.'

The process will not only provide data that can be shared, it enables comparison of data. Ramboll's intention is to track progress against its own global and UK carbon targets, which are set with regards to the project's location, the local environment, the size and type of the building and so on.

She notes an increased appetite for material reuse and highlights a project in Oxford which aims to incorporate steel members from one building that is being demolished into another new building. A major factor is that both buildings are owned by the same, keen client. 'We are creating a tool that will not only stock match, but also identify how to cut it up to the relevant sizes and splice it – that's something we've not seen in the industry till now.' Colleagues are also working on EU-funded projects to examine options for reuse of precast elements, she adds, but cost tends to be more of a limiting factor.

A year in the role has consolidated her enthusiasm. 'I'm not doing calculations on a day-to-day basis anymore, but I'm happy with that because I know there's an urgent agenda that requires my attention. This is where my business and comms skills come in, and my problem solving and design thinking outside the box,' she adds.

She sees it as an exciting challenge to reject business-as-usual design and challenge the brief. 'Driving that agenda feels so natural to me,' she admits.

'I've always been a bit of a climate warrior – I've been a vegetarian since I was nine years old – but I know that makes absolutely no difference to the climate if you don't design your structures efficiently. The professional emissions of an engineer can be hundreds of times more than their personal emissions, and I feel that's where I can make a difference.'

Social outreach

MacDonald is intent on rolling this message out beyond the corporate landscape, and her profile 'Brogan The Engineer' has amassed more than 10 000 followers on TikTok. She decided to explore this platform after experiencing low levels of engagement in STEM outreach.

'I started wondering whether I could reach more people in a wider setting,' she recalls. 'I wanted to inspire young girls to go into engineering and construction, but also to inspire existing students and young engineers to find out about sustainability and its importance. I struggled at university, and I know I would have benefited from having a role model.' Although she posts educational and inspirational content, she admits that the most popular tend to be 'day-in-the-life' videos of her work on site.

She's currently taking a break from the channel: 'You have to post five or six times a week to get your content seen, and that's really hard work. I get a lot of messages from people reaching out, asking for advice, which can be tricky as I'm not an agony aunt, or there to advise if their house wall is loadbearing or not! But if it inspires people into engineering or sustainability, that's the most important thing.'

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The Drawing Board

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- hand drawn (no CAD, except for 'guided free-hand')
- from a real project or assignment
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Please also submit a short description (150 words) to put the sketch into context.

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Background sketch by Kevin Lyons (Lyons O'Neill)