Penny Gowler

What sort of person would put a significant amount of time into developing an indispensable structural carbon calculation tool, then give it away for free? Helena Russell finds out.

IN A WORLD WHERE COMMERCIAL pressures are high and intellectual property is fiercely guarded, it makes a refreshing change to come across altruistic deeds in the midst of all the corporate hustling.

The individual in this particular spotlight is Penny Gowler, director and head of sustainability at Elliott Wood, who created the open-source carbon calculator tool that can be downloaded free of charge from the IStructE website.

Currently working on a guide to the circular economy, and having last year co-authored the *Full Circle to Reuse Guide*, she practises what she preaches in continuously pushing to reduce and reuse materials rather than relying on recycling. She is passionate about the responsibility engineers hold for pursuing carbon reduction in the construction industry: 'The earlier we are involved, the bigger the impact we can have as structural engineers,' she says.

Early missteps

Gowler was around the building industry from an early age – her father worked as a building services engineer and she recalls weekends with him, driving around looking at buildings he had worked on. She enjoyed maths and physics at school, but knew that she didn't want to study pure sciences, being more interested in their practical application. 'I didn't really care whether two lines would meet or go on to infinity, that was too conceptual for me,' she says candidly. 'I wanted to have something tangible at the end.'

In fact, she initially decided that she wanted to be a pilot, only being diverted from this path when her sixth-form tutor suggested – quite astutely, she now admits – that she would find it a bit boring.

At Oxford, Gowler did a master's degree in engineering, economics and management, but although an industrial placement in her final year took her to Westland Helicopters, her subsequent career path was not straightforward. 'I lost my way at graduation,' is how she describes it.

Through a combination of peer pressure and personal circumstances, she took a job in management consulting close to her family home. Despite being involved in technical consultancy and operational research, she was frustrated at the lack of any obvious career path. Moving into statistics and analysis in the insurance sector did not help; 'I wasn't happy with my work, couldn't see how I was changing things for the better, and it didn't really sit well with my personal values.'

↓FIGURE 1: Redevelopment of 27 Poultry – The Ned – was key project for Gowler

Finding her feet

'After a lot of soul searching, and talking to my dad, I decided to start again and look for a graduate structural engineer role.' As well as a significant change in career path, it was a hefty drop in salary, but Gowler decided that it was the right thing for her, and sought a post close to home.

Interviewed at the Guildford office of Thomasons by director Nick Russell – who in 2014 became president of the IStructE – she recalls him asking whether she got bored easily. Her honest response ensured that she was kept busy with a variety of work after accepting the offer of a job.

Consequently, when a recruitment consultant rang in 2010 to sound her out about a new opportunity at Elliott Wood, she was taken aback. 'To this day, I don't know why they rang me; I wasn't actively looking for a job,' Gowler explains. But it was a serendipitous moment; changes were afoot at Thomasons, with partners due to retire, and Gowler was just about to sit her chartership exam.

What's more, the firm had an office in Wimbledon, which meant minimal commuting from her Surrey home, and where she is still based 12 years on. 'I didn't interview anywhere else before I made the move,' she says; 'I wanted to join them because they had a much wider range of work, with bigger and more interesting projects – they had just won their first £50M scheme – and they could offer me a London job without the commute.'

She rose quickly through the ranks from project to senior engineer, becoming an associate at a time when restructuring of the firm enabled Gowler and her fellow associates to take on direct responsibility for running the teams.

Influencing the brief

She highlights 2012 as a key point in her professional career, being the year she got involved in the redevelopment of 27 Poultry in the City of London. This Grade I listed building **(Figure 1)**, designed by Edwin 'Ned' Lutyens and dating from the

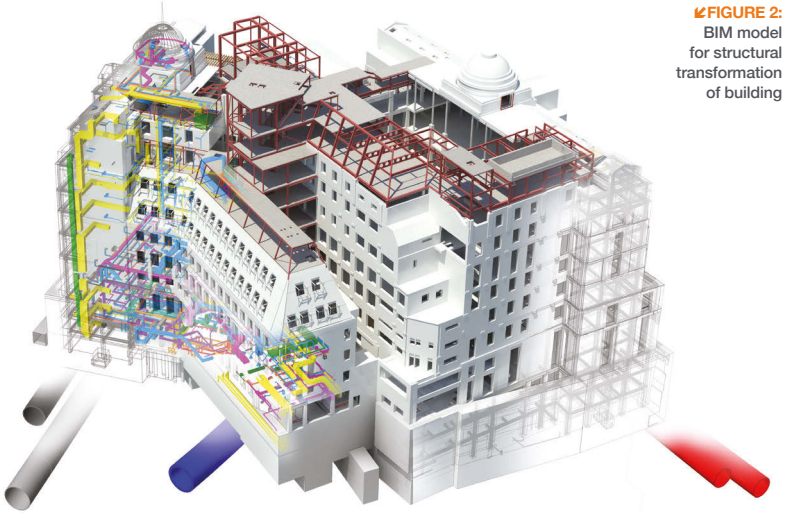


FIGURE 2: BIM model for structural transformation of building

1920s, was formerly the headquarters of Midland Bank.

The building had stood empty for eight years before Soho House founder Nick Jones fell in love with it, and hatched a plan to transform it into The Ned, a luxury hotel and members' club. Elliott Wood was brought on board to assist with due diligence for the development deal, and Gowler led the structural engineering team that subsequently worked with EPR Architects to design the scheme **(Figure 2)**.

The project was challenging from the off: the building had three basement levels, with the original bank vaults and their 1m thick walls and coiled reinforcement still intact, and eight storeys above. The structure was an early steel-frame construction encased in concrete **(Figure 3)**, with compound columns made of steel plates and angles, and every piece of steel different. 'We couldn't make any assumptions at all,' she says.

The only available drawings were for the 1970s extension at the rear, and with the listed status of the banking hall and its 92 verdite-clad columns putting tight restrictions on any invasive testing, a certain amount of structural gymnastics was required, Gowler recalls.

Key to the successful delivery of the project was that the engineering team was able to influence critical decisions at the start, she says, and to agree some fundamental 'rules' to de-risk the project as much as possible. These included not cutting into the lowest basement slab at all, as they had such limited information about the existing foundations.

'We believed it was a heavily reinforced raft, but there was no easy way of establishing how it was designed; the original plan to build a swimming pool at the lowest level would have been a huge risk and could have led to significant costs. We felt it was better just to reconfigure the plans so that we eliminated this risk altogether, so we agreed to move it up one floor where we could design a system to support it.'

This is a good example of how Gowler believes structural engineers can add value for clients, but also affect wider change. 'Sometimes there is a tendency for engineers to take on the challenge rather than considering whether it is actually necessary, or whether there is a different solution that would de-risk the project for the client and improve the sustainability of the project,' she says.

FIGURE 3: Exposed structure during jacking of dome

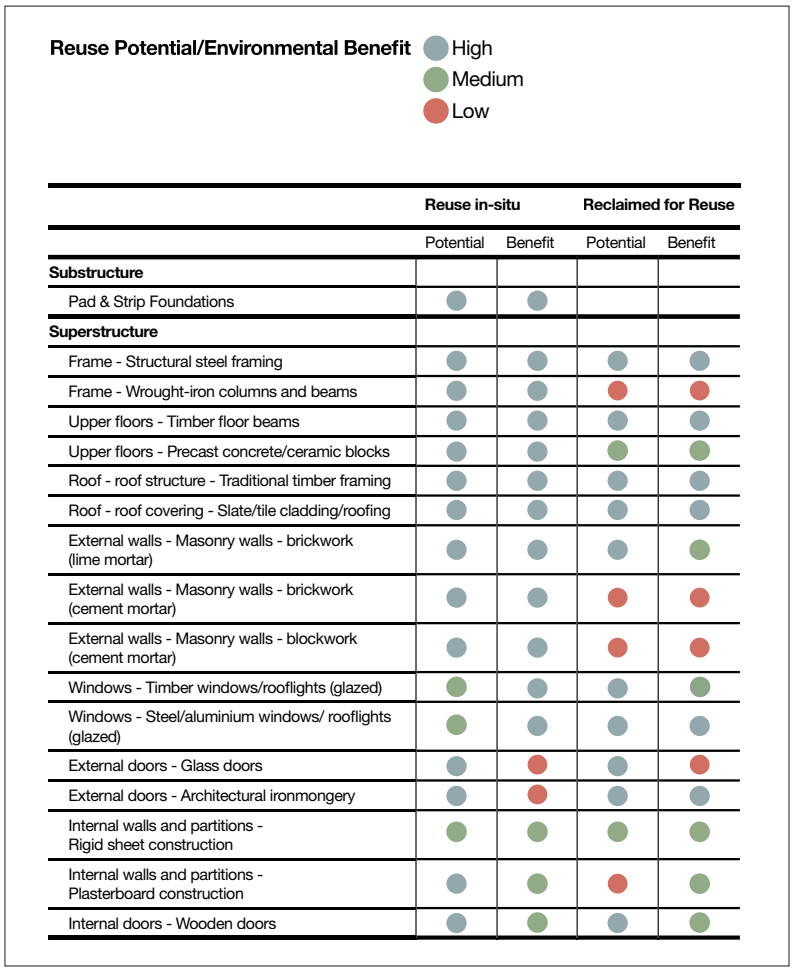
Carbon advocacy

As a business, Elliott Wood has always pursued a strong sustainability agenda, Gowler explains, even before RICS

CAREER MILESTONES

2003	MEng (Hons) Engineering, Economics & Management, Brasenose College, University of Oxford
2006	Joined Thomasons as a graduate structural engineer
2008	One of five engineers shortlisted for the IStructE Young Structural Engineer of the Year Award
2010	Became a chartered member of IStructE
2010	Joined Elliott Wood as project engineer, then senior engineer, associate and associate director
2012–16	Led structural engineering team on 'The Ned', London
2013	Regional RIBA award for Oaklands College, Hertfordshire
2013–16	Served as an elected member of IStructE Council
2017	Shortlisted for IStructE Award for Structural Heritage – 'The Ned'
2018	*The Telegraph*/Women's Engineering Society Top 50 Women in Engineering (Returners & Transferrers) Award
2021	Appointed director & head of sustainability at Elliott Wood
2022	Shortlisted for Women in Construction & Engineering Award for Environment & Sustainability

↓FIGURE 4: *Full Circle to Reuse Guide* highlights reuse potential of structural elements



	Reuse in-situ		Reclaimed for Reuse	
	Potential	Benefit	Potential	Benefit
Substructure				
Pad & Strip Foundations	High	High		
Superstructure				
Frame - Structural steel framing	High	High	High	High
Frame - Wrought-iron columns and beams	High	High	Low	Low
Upper floors - Timber floor beams	High	High	High	High
Upper floors - Precast concrete/ceramic blocks	High	High	Medium	Medium
Roof - roof structure - Traditional timber framing	High	High	High	High
Roof - roof covering - Slate/tile cladding/roofing	High	High	High	High
External walls - Masonry walls - brickwork (lime mortar)	High	High	High	Medium
External walls - Masonry walls - brickwork (cement mortar)	High	High	Low	Low
External walls - Masonry walls - blockwork (cement mortar)	High	High	Low	Low
Windows - Timber windows/rooflights (glazed)	Medium	High	High	Medium
Windows - Steel/aluminium windows/ rooflights (glazed)	Medium	High	High	High
External doors - Glass doors	High	Low	High	Low
External doors - Architectural ironmongery	High	Low	High	High
Internal walls and partitions - Rigid sheet construction	Medium	Medium	Medium	Medium
Internal walls and partitions - Plasterboard construction	High	Medium	Low	Medium
Internal doors - Wooden doors	High	Medium	High	Medium

published its professional statement on whole-life carbon assessment in 2017.

Around 2016, the firm was doing a lot of work with timber structures and was looking for a way to quantify the carbon benefits of timber so that clients could do a comparison with conventional material choices. This was not straightforward at a time when the concept of embodied carbon was not really established.

So Gowler worked with colleagues to develop a tool that the company could use internally to quantify and compare embodied carbon; a basic Excel spreadsheet was built using the knowledge and data available at the time, to enable engineers to make informed choices about which options to pursue at an early stage.

'We had got our tool to the point where we thought it was the best we could achieve, and were waiting for the publication of the IStructE's *How to calculate embodied carbon* to take it further,' Gowler recalls. 'This was a really important document as it gave us rules of thumb for how to calculate site emissions and so on, with industry standard carbon factors and data.'

Gowler approached IStructE head of climate action Will Arnold to see if there was any scope for collaboration and established that he was already discussing how they could follow up the document with a tool. 'Since ours was already about 75% of the way there, there was overwhelming agreement internally that we should donate the tool for free in the spirit of collective responsibility and collaboration,' she says.

An intense period of development followed, working with IStructE to incorporate the standardised industry carbon factors and improve its functionality. Since its launch, the open source, Excel-based tool has been downloaded more than 6000 times, and a revised version has just been made available alongside the second edition of *How to calculate embodied carbon*. Gowler says, 'We had some really good feedback on its ease of use, and that it provides a standardised tool that enables engineers to demonstrate to clients the impact their choices will have in terms of carbon.'

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In the new version, temporary works can be included in the calculation, and it also sees the incorporation of the B4 stage of the process – replacement cycles – so that the impact of choosing longer-lasting materials can be incorporated in the final figures.

Going full circle

Incredibly, Gowler has achieved all this despite working part-time since having her first child – and has only recently gone back up to four days a week from three. She feels this is important to mention, perhaps to make the point that part-time working does not – or should not – rule out a senior role or the ability to lead a team successfully.

With typical gusto, she is currently writing a guide to the circular economy and reuse of materials, to be published later this year by IStructE. This came about as a direct result of co-authoring the *Full Circle to Reuse Guide* **(Figure 4)** which was published in partnership with Grosvenor last year.

Although there are still considerable barriers to overcome before we get anywhere near circularity, Gowler cites an ongoing project which could see 14m long beams from one building being reused in another with very little adaptation required.

She admits that having the same client for both buildings is a key factor in getting it off the ground, and will be essential if timings don't align and interim storage is necessary. But she confidently foresees a time when there will be a register of – and a market for – second-hand building materials in this way.

Figures for waste in the industry are 'ridiculous' she agrees, and the fact that many people consider recycling and reuse to be interchangeable frustrates her. 'We can't continue to exploit our natural resources in this way,' she says, 'or to knock down buildings that are only a few years old. It's just not sustainable.

'I'm aware that we exist in a bit of a bubble at Elliott Wood – we measure carbon on almost all of our projects and we discuss carbon with the vast majority of our clients at the start. But in other parts of the industry – housebuilding, for example, where cost is considered the most important factor – these conversations are just not happening.'

While carrot and stick may play a part, having a truly standardised approach to measuring embodied carbon is a pressing need, she says. 'As long as there is no regulation, people can vary the data to tell the story they want, and too many people are interpreting things to suit their own agendas.'