Cameron Archer-Jones

A fascination for structural engineering and a commitment to spreading the net-zero message across the bridges sector are key drivers for **Cameron Archer-Jones**. Helena Russell finds out more.

In common with engineers the world over, Cameron Archer-Jones spent his first decade in the bridge industry hungry for ever bigger, more challenging and more complex projects. So why does he now cite his ideal job, and the one he most wants to add to his CV, as one that involves no physical intervention at all?

'I mean, no one has ever won an award for doing nothing, have they?' he laughs. But while he acknowledges the irony of shifting from some of the world's mega-projects to helping colleagues find ways to minimise the work that is required, or even eliminate it altogether, he also points out that doing nothing is not always the right solution.

Archer-Jones was responsible for the design of the longitudinal steelwork for one of the orthotropic bridges on the Mumbai Trans-Harbour Link **(Figure 1)** as part of the COWI team working for contractor L&T-IHI. The 22.8km long, six-lane expressway viaduct will be the longest sea bridge in India when it is completed at the end of this year. It includes both precast concrete and steel spans up to 180m long and will connect Mumbai with its satellite city Navi Mumbai, offering a new route that cuts journey times considerably.

'This bridge can save up to two hours on travel time; it will only need to be open for a fraction of its design life for the carbon to be offset,' he predicts. 'At a network level, we need to be confident such savings exist if we are going to be building on that scale; but we still need to make sure we're using the minimum amount of material necessary.'

His work as an associate at COWI is split 50-50 between the bridge engineering team, and his new role as carbon management lead. In the early days of his career, he confesses he might not have been so comfortable spending so much time away from detailed technical design and analysis, having no interest at all in the managerial aspects of engineering when he was at university.

Steps into engineering

Born and brought up on Australia's Gold Coast, Archer-Jones describes his route to structural engineering as 'a fairly standard trajectory' which was helped by having a carpenter father and several other family members in the same trade. His high school maths teacher was a former engineer, 'so all the applied maths questions were "check this truss" or similar. I fell quite naturally into that.'

It was an obvious step to study civil engineering at the University of Queensland in Brisbane, and despite not really having much of a grand plan, even by his own admission, he gravitated towards structural engineering. 'You could choose economics, or management, but I kept well away from those subjects, I wasn't really interested in them,' he recalls.

His innate curiosity and desire for something novel and stimulating almost took him off on a different career path in the wake of his fourth-year thesis. 'I had a look at the subjects on offer and I wasn't really enthused by them. So I found a research group doing work on a biomedical device called the Nanopatch, led by Professor Mark Kendall. I was still enjoying engineering at that time, but there weren't many interesting jobs around and I guess I was thinking about other options I could transition to.'

His research involved assessing the microneedles on the Nanopatch to see if vaccine delivery could be improved by changes to the alignment, diameter or length of the 400µm long needles.

Archer-Jones would apply the patches to pigs' ears and then examine how and where the needles had broken, to investigate whether a different alignment or thickness could improve the efficiency of the drug delivery.

Neither was his segue into bridge engineering part of any grand plan; when he graduated in 2012, Archer-Jones hit a downturn in the infrastructure sector. 'In Australia, there was a serious belt-tightening process going on. There were highly paid jobs for engineers in mining, but I didn't think they would be fulfilling.' He'd been considering doing a PhD to follow on from his research thesis, so when a job came up in the bridge

↓FIGURE 1: Archer-Jones cites Mumbai Trans-Harbour Link as example of project whose embodied carbon emissions will be offset by savings in transport emissions

CAREER MILESTONES

2012 Graduated from University of Queensland, Australia, with Bachelor of Engineering degree
2013 Joined GHD in Brisbane
2015 Moved to UK
2016 Achieved chartered status with Engineers Australia in structural engineering
2017 Graduated from Imperial College London with Master's degree in structural engineering
2017 Joined COWI as senior bridge engineer
2021 Promoted to principal engineer
2021 Achieved chartered structural engineer status with IStructE
2021 Joined Net Zero Bridges Group as representative for COWI
2023 Became carbon management lead at COWI

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engineering team at consultant GHD, he was faced with a dilemma.

'My mum gave me really good advice; she said that if I took the PhD and said no to the job, it would be quite difficult to change my mind later. But if I took the job, it would be quite easy to go back to the PhD if I wanted to.'

He worked for GHD in Brisbane for two and a half years, designing a lot of short-span, concrete-girder bridges for the bypass schemes that were being revived, but eventually a desire to broaden his experience led him to apply to Imperial College in London to do a Master's degree part time.

Passion for bridges

Emigrating to London, he continued working for GHD while completing his Master's in structural engineering, and by now had a clearer idea of what he wanted to do long term.

'I had my mind set on joining a bridge specialist firm and was aware of Flint & Neill through industry publications. I reached out to them when I first came to the UK, to see if they would take me on part time, but they didn't have any openings.' But once he graduated, Archer-Jones tried again – the firm had by now taken the name of new owner COWI – and he recalls the 'real step change' in the pace of his work and the type of projects he was working on.

One of his first jobs was the Padma Bridge **(Figure 2)** in Bangladesh – a 6km long bridge for road and rail traffic on which COWI redesigned the concrete deck for the contractor. 'I was able to bring some good value into the team with my experience of precast concrete structures. We saved about 3000t of reinforcement by changing some boundary condition assumptions and the contractor was very happy, as it had been difficult to pour the concrete with such dense rebar.'

At the other end of the scale, but perhaps more fulfilling for Archer-Jones, was the Dukes Meadow Footbridge **(Figure 3)** in west London, which opened to the public in January. The bridge provides access under Barnes Bridge and eliminates a long detour on the Thames Path. 'The scheme was developed by Moxon Architects and CampbellReith and had been granted planning permission by the time I joined the project team, led by Chris Murphy, but was getting to the point that I really enjoy – planning the construction. The main span was floated in on the tide so it could be installed without interfering with the railway line.'

The arrival of the vessel ahead of schedule threw his planning into disarray, Archer-Jones recalls, but he was determined to witness this special event. 'I was having my breakfast and got a call from the contractor, Knights Brown, telling me it was two hours earlier than planned, so I jumped on my bike and cycled into town straight away. I was the only one from the whole team who got to see it coming up the river!' he grins.

'That was a huge highlight – we'd worked on the design of the permanent works but we'd also been closely involved with the temporary works, especially the features such as a restraint pin used to guide the main span into position, and the temporary supports with jacks on top that were used to adjust it, after construction.'

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↑↗**FIGURE 2:** Previous experience with precast concrete structures stood Archer-Jones in good stead on first job for COWI – design of concrete deck for Padma Bridge

(L) EZRA GROSKIN, MOXON / (R) SIMON KENNEDY

The opportunity to return to the bridge at will and witness how people use and appreciate it obviously brings him pleasure. 'That's a huge reason why a lot of us are in construction, right? So that we can improve things for people.'

Material efficiency and carbon savings

One of the client's key requirements for the Dukes Meadow Footbridge was a structure that needed minimum maintenance, but had as much resilience as possible, to accommodate future changes in river levels. Such demands chime well with Archer-Jones' responsibilities at COWI, not to mention his key role in the Net Zero Bridges Group **(www.netzerobridges.org)**, which was established in 2021.

'I had always thought carefully about efficient material use and construction effort, but the climate emergency was a funnel for that focus. I was working on the Mumbai Trans-Harbour Link with Dan Green and we were becoming frustrated about the fact that we were collectively responsible for almost 100 000t of steel, but didn't know how best to leverage the opportunity; we didn't have the tools or processes that we needed.

'Over a few beers we agreed we should set up a tool and start using it, and it was during lockdown that we had the opportunity to create it. We presented it back to senior managers at COWI, where the response was overwhelmingly positive and led to an internal budget with instructions to "crack on"!' he says.

Archer-Jones spends half his time on bridge engineering, and the rest as carbon management lead across the international business line in COWI. One project he is currently working on illustrates the range of sectors it extends to. 'We won a scope of work for Offshore Renewable Energy Catapult to develop a "how to" guide to calculate embodied carbon in the offshore wind sector to give bidders the tools needed to include these figures in tenders. The big issue in this sector is that the supply chains are incredibly global, and what is being transported can't just go in standard bulk carriers,' says Archer-Jones.

'These elements are coming across the world, and occupying half a container ship. All the site works are offshore, with everything done from specialist vessels, so one of the main factors is how long you are operating an offshore vessel for, as well as how much steel you are using.' On the other hand, the guide needs some way of accounting for the carbon benefit of early completion of such developments, in terms of having renewable energy available for use.

Minimal intervention and minimal closures

The carbon savings that come from extending the life of bridges are something that Archer-Jones is keen to underline – not just in terms of keeping an existing structure in use for longer, but finding solutions that can be implemented without closing the crossing, or even proving that no strengthening work is necessary.

↑FIGURE 3: Installation of Dukes Meadow Footbridge was highlight that Archer-Jones came close to missing

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One such example is Gade Valley Viaduct on the M25 motorway in London, where COWI was brought on board to resolve fatigue issues. 'The critical thing on Gade Valley was keeping the road open – it's the M25 and there are so many vehicles that would be impacted. Sometimes the best solution is the one that uses a bit more material if it means that you don't have to close the road. You don't need a carbon calculator to work that out.'

By establishing the structure's real stress ranges and developing a bespoke procedure for improving the fatigue life of its welds, some 35% less strengthening was required, with closures minimised and cost savings of up to £3M.

He also mentions some of the innovative work being done by colleagues at COWI and that shared by other members at Net Zero Bridges Group meetings. This ranges from using vehicle-recognition software with video monitoring to record real-time traffic for bridge-specific assessment of live load without the need for costly weigh-in-motion systems, to challenging the standard procedure for reliability assessments – in some cases, eliminating the need for any intervention at all.

'My ideal job has gone from being the big suspension bridge – although that's fine in the right place, of course – to an example in the IStructE *Design for zero* guide where, instead of building a new airport car park, the airport operator was advised that rescheduling flights would level out demand and eliminate the need to build the car park altogether!'