



Naeem Hussain

Clocking up half a century in the international bridges sector, and instrumental in the establishment of Arup's highly regarded bridges department, IStructE Gold Medallist **Naeem Hussain** has worked on some of the world's most high-profile structures. He reflects on his career in conversation with Helena Russell.

GOOD PRACTICE FOR SUCCESSFUL PROCUREMENT,

the perils of badly conceived design competitions and the importance of aesthetics and durability in the bridge design process will be key themes for 2022 winner Naeem Hussain when he takes to the stage at IStructE later this month to give his Gold Medal address. All are central to his professional practice; some have even been influenced by him.

His modest, quietly-spoken manner belies his high-flying career, but seems entirely at home in the Arup stable where he has remained since stumbling across his professional 'soulmates' five decades ago.

Fresh perspective

From a young age, Hussain was fascinated by architecture and engineering – his father was a bridge and trackwork engineer for Pakistan Railways and he recalls the enjoyment of going with him on inspections. He has always been interested in architecture, and could easily have followed a different career path were it not for the lack of architectural schools in Pakistan at the time. 'I chose civil engineering as the next closest thing,' he says.

After graduating from West Pakistan University of Engineering & Technology in 1962, he joined Associated British Consultants as a structural engineer, and within two years his request to transfer to sister company Kenchington Little and Partners in London was granted.

Despite having a civil engineering degree and with several years' work as an engineer under his belt, Hussain

still had a nagging curiosity about architecture. At that time he was working on projects comprising Euston Tower and the Shaw Theatre, so he was dealing with architects on a regular basis. 'I thought to myself – hang on, I could do that! So I applied to the Architectural Association School of Architecture in London for a design studies course, and I was quite surprised that I was accepted!' he recalls.

The course exposed him to a very different approach to design, and new ways of thinking, and in retrospect Hussain acknowledges it had a significant impact on his own methodology. 'I was used to the engineering way of thinking about

calculations and so on, but this was about space and perspectives. It changed my outlook on how to design things,' he adds.

'It's always hard to look at a new project afresh – we all have baggage whether we like it or not,' he says. 'But you really have to make an effort to consider what the client wants, what are the issues and constraints, and what is the budget,' he says.

Bridging the gap

Gaining site experience with contractor Christiani & Nielsen, he came into contact with bridges for the first time, sparking a fascination that he pursued after completing his site work, applying



↑ **FIGURE 1:** Medway Bridge, part of the Medway Viaducts, links London to the Channel Tunnel



↑ **FIGURE 2:** Hulme Arch Bridge in Manchester by night

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for jobs at all the well-known bridge firms. But at interview his short foray into architecture was regarded suspiciously: 'It was almost as if they saw it as something of a sin,' he laughs.

Ironically, Arup was not on his target list, as the firm had no particular reputation for bridges at the time. But his interest was piqued by the company's role on the dramatic shell structures of the Sydney Opera House.

'One of my interviewers was Jørgen Nissen,' he says, 'and I soon realised that he was more interested in architecture than I was! And then the conversation opened up – I had suddenly found people who were also talking about aesthetics and bridges and so on. Looking back now it seems as if I had found my soulmates – and in a way I count myself lucky to have been turned down by the other companies.'

With only a dozen staff in the bridges group, Hussain found himself joining at a propitious time. 'The biggest bridge span that Arup had designed was about 40m,' he recalls. 'But we had people like Povl Ahm and Bill Smyth, who were interested in the aesthetics of bridges, and simple designs with clean, clear lines which blended into the environment.'

For Hussain, the step change came when Arup won an Asian Development Bank-funded project in Malaysia and he was offered the chance to head up the bridge design in Kuala Lumpur. 'They weren't very big bridges, but the project enabled us to expand outside the UK.' Returning to London after a couple of years did not suit him, he soon had itchy feet and before long was on his way to Nigeria for five years. Here he set up a bridge team with local engineers to take advantage of the country's boom in road-building activity, including a bridge over the Benue River to open up the northeast of Nigeria.

Soon after, Arup established itself in Hong Kong with projects such as the Hopewell Centre and work on the mass transit system. Ultimately, this was the long-term game-changer for Hussain, who went straight out there from Nigeria in 1982. His first trip was just a short stay after the announcement of handover plans prompted the economy to nosedive, but it gave him a taste for the region.

Growing ambitions

The next decade was a busy time for Hussain and his bridge colleagues in the UK; a feasibility study into reconfiguring Ludgate railway viaduct in London to an underground station turned into a six-



↑FIGURE 3:
Cable-stayed
Stonecutters Bridge
in Hong Kong

year project that had to be redesigned in the wake of the King's Cross fire in 1987. This prompted a full review of fire regulations for underground station design, and Arup's fire team led on the code rewrite.

The design of the Channel Tunnel Rail Link – with Hussain as engineering manager for all the civils and bridge structures – and a bid for the massive Øresund Bridge project to create a new road and rail connection between Sweden and Denmark came shortly afterwards. 'My main motivation for taking on the role at the Channel Tunnel Rail Link was the chance to design the Medway Bridge,' (Figure 1) recalls Hussain. 'I thought it would be an opportunity to do something unique and different.'

But it was his colleagues' success on the Øresund bid in 1994 that really changed the landscape for the company; 'I was just a member of the team on this one,' Hussain admits. 'At the time we had still only designed bridges with spans of around 100m – winning this was a major breakthrough and our team was successful because they proposed a double-deck cable-stayed bridge and marine viaduct as an alternative to the single deck of the concept scheme.'

Alongside large-scale bridges, Hussain recalls the fun of brainstorming with architects at Wilkinson Eyre for a concept for the Hulme Arch Bridge in Manchester (Figure 2) – resulting in a competition-winning entry and a world first in bridge design. 'We went round to Jim [Eyre]'s office and there was a fair bit of wine involved,' he admits. 'Jim came up with the idea of a diagonal arch, and we had to establish whether it was feasible in engineering terms.'

The concept has been replicated many times since then, but often with no

CAREER MILESTONES

- 1962** BSc (Eng) from West Pakistan University of Engineering & Technology
Joined Associated British Consultants Bangladesh (East Pakistan) as a structural engineer
- 1964** Transferred to Kenchington Little & Partners UK as a structural engineer
- 1967** Joined Christiani & Nielsen Contractors UK as a section engineer
Design Studies, Architectural Association School of Architecture
- 1968** Became a Member of the Institution of Civil Engineers
- 1969** Joined Arup as a bridge engineer
- 1971** DIC MSc (Concrete Structures) Imperial College, University of London
Became a Member of the Institution of Structural Engineers
- 1973** Promoted to senior bridge engineer
- 1986** Promoted to associate director
- 1994** Promoted to director
- 1998** Relocated to Hong Kong
Became a Fellow of the Hong Kong Institution of Engineers
- 1999** Became a Fellow of the International Association for Bridge & Structural Engineering (IABSE)
- 2010** Stonecutters Bridge won Supreme Award at IStructE Structural Awards
Became a Fellow of the Hong Kong Academy of Engineering Sciences
- 2012** Awarded the Prince Philip Medal for Exceptional Contribution to Engineering by the Royal Academy of Engineering
- 2013** Chair of IABSE Working Group 3, publishing *Guidelines for Design Competitions for Bridges*
- 2020** Became a Fellow of the Royal Academy of Engineering
- 2022** Awarded IStructE Gold Medal

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logic for using this form, says Hussain. In Hulme, the bridge crosses a main road in a cutting; the client was very clear that it should be a landmark bridge, and our design is viewed as an arch by drivers travelling in both directions. 'The architecture and engineering came together for a reason, not just to create a fancy shape,' he says.

As the number of open design competitions increased, there was a corresponding trend for winning designs not to be built, often for budgetary or feasibility reasons. The lack of guidelines for competition organisers was identified as an issue. Hussain led a working group within the International Association for Bridge and Structural Engineering to develop a set of guidelines that was published in 2013 and has been instrumental in improving the way such competitions are run.

Milestone project

When Arup won the bid for Hong Kong West Rail in the late 1990s, and financial issues put the Channel Tunnel Rail Link on hold, Hussain found himself back in Hong Kong – just as one of the region's most exciting bridge projects – the Stonecutters Bridge (Figure 3) – was coming to life. 'We won the design consultancy for the new expressway, and part of this was to examine the feasibility of building a cable-stayed bridge with a main span of more than a kilometre.' (The world's longest at that time was Tatara Bridge in Japan, with a main span of 890m.)

It was a difficult location for a cable-stayed span, being subject to typhoons, but Arup's studies confirmed that it was possible. An open design competition in 1999 that Hussain's team was not permitted to enter attracted huge

international attention, and was won by Flint & Neill (now Cowi), Dissing & Weitling, Halcrow and SMEDI, who proposed a dramatic monopole concept with twin decks. Ironically, Hong Kong Highways' procedure was to pay the winners a fee, retain the copyright for the concept, and bid the detailed design package separately – a bid that was won by Arup.

Hussain acknowledges that the outcome ruffled some feathers in the bridge community, but is clear that the award was made on more than just a technical and fee basis; their bid included a number of proposed improvements, the team was already working on the Øresund Bridge, and Arup was established in Hong Kong. 'We did as much as possible to preserve the design concept, but we did have to change many things, which is inevitable when you are going from concept to detailed design,' he says.

Going forth

At around the same time Stonecutters Bridge was reaching completion in the late 2000s, the idea of a new bridge over the Forth Estuary in Scotland was being floated in response to the suspension cable deterioration identified on the Forth Road Bridge. Hussain's team joined with Jacobs, Flint & Neill and Dissing & Weitling to pitch for the design work, and the group's track record in cable-stayed bridges was a key factor in its success. The resulting multi-span bridge (Figure 4) with its unconventional arrangement of crossed cable stays was opened to traffic in 2017.

'Queensferry is probably the first time I can actually say that it was personally my design, the thinking behind it,' Hussain reveals. 'I suggested using the



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FIGURE 4: Queensferry Crossing over Firth of Forth, Scotland

FIGURE 5: Temburong Bridge across Brunei Bay

crossed cables, which stabilised the central tower and allowed us to keep it very slender.' A crucial point that made it possible to implement this solution was the support of Transport Scotland, whose engineers raised questions about the risks, but were open to being convinced by evidence and expert advice. 'For any unique bridge you need to have a good, knowledgeable client,' says Hussain.

Since then, his team has continued to build its portfolio, adding projects such as the Gerald Desmond replacement bridge in California and the Temburong Bridge in Brunei (Figure 5), opening an office in North America, and now numbering some 400 staff around the globe.

Hussain notes that despite his many years in the sector, his ambition to design a big suspension bridge remains unfulfilled. Happily, this is likely to change very soon, with the announcement earlier this year that an Arup/Aas-Jakobsen team has been appointed to design Norway's 2km-long Julsundet crossing on the E39 highway.



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Watch Naeem Hussain's Gold Medal address

If you'd like to find out more about Naeem's career and perspective on bridge engineering, don't forget to sign up to watch his Gold Medal address on 20 October – either in person or online.



Register at www.istructe.org/events/hq/gold-medal-address-2022.