



Robert Benaim

Robert Benaim is recognised as one of Britain's greatest modern bridge builders, an achievement that was underlined when he collected the Sir Frank Whittle Medal last year from the Royal Academy of Engineering, awarded to someone who has had a profound impact on their discipline. Jackie Whitelaw talked to him about his career.

THE PROSPECT OF A BRIDGE

between Britain and Northern Ireland has been in the news of late, accompanied by varying degrees of scepticism about whether it could ever be constructed. But if you ask Robert

FIGURE 1:
Byker Viaduct



Benaim, who broke the mould of bridge building in the UK when he promoted the French innovation of prestressed concrete construction in the 1960s, whether a crossing to Ireland can be done, he's in no doubt.

'As engineers, that's what we do,' he says. 'If someone says build a bridge to Ireland, we say, "let's go".' To build a drilling platform in the North Sea was an incredible challenge at the time, but engineers did it. I've discussed designs for a bridge across the English Channel; that could have been done. Engineers make things possible; our urge to innovate is essential. My advice is always to ignore the naysayers.'

Prestressing pioneer

Benaim is 82 in April and has been retired from engineering for 20 years, but you get the sense that the idea of solving engineering conundrums is still irresistible.

Certainly, the drive to understand something new and change the way construction delivered its bridges was what encouraged him to go and work in France in the early 1960s with the Freyssinet company, which had been refining the development of prestressed concrete construction at pace.

Benaim was fresh from a degree at Imperial College in London and had already worked his summers in France, learning the language.

The 1960s were all about breaking the mould, trying the new and Benaim was entranced by the refinements, efficiencies and elegance that could be achieved using prestressed concrete. 'The technology was relatively new

– Freyssinet had been promoting the technique since the 1930s, but it was post war that things really progressed – and prestressed concrete is very much an engineer's material. You can control the way it resists forces. And it is so material-efficient that it gives rise almost automatically to slender structures.

'To find out more, I thought I should be adventurous and find a job in Paris,' he recalls. 'I started work, as a foot in the door in the city, with a petrochemical firm as a drafter, but was sacked for being too chatty!' He found a role with the Somhaco construction firm, but all the while was stalking Freyssinet.

'I got the number of then head of the organisation, Yves Guyon. I don't know how I had the nerve to use it, but that got me a job where I wanted to be,' he says.

Benaim was in France for seven years, soaking up knowledge of prestressed concrete and understanding how the right construction approach could produce much cheaper and better designs than a traditional concept.

At that point, he decided the skills he had made him a very attractive prospect for UK employers and he returned home to join Ove Arup. And it was at Arup that Benaim was able to start to show off his abilities as a ground-breaking bridge designer.

'Arup gave me a huge amount of freedom and I have always been really grateful for that,' Benaim says. In all, he designed eight bridges in the 11 years he was at the firm, with two standout structures being the 815m long Byker Viaduct in Newcastle for the Tyne and Wear Metro (**Figure 1**) and the 140m long New Runnymede Bridge over the River Thames in Surrey.

Both used prestressed concrete and Byker, apart from becoming an icon for the northeast, has the accolade of being the first major glued segmental bridge structure in the UK.



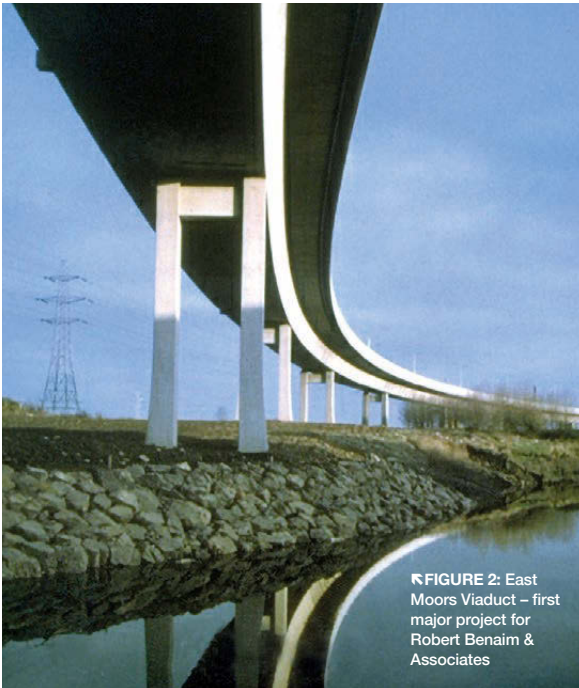
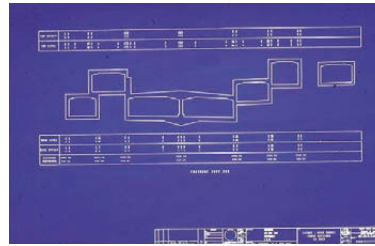


FIGURE 2: East Moors Viaduct – first major project for Robert Benaim & Associates



a) Automatic drawing

FIGURE 3: Singapore Central Expressway



b) Crossing Singapore River

New approaches

What the work confirmed for Benaim was the importance of the consultant working with the contractor to develop the design and construction approach for a structure in tandem.

'In steel bridges, you can have a system where the consultant defines what it wants and the contractor has to figure out how to build it. But with concrete, especially prestressed concrete, you can't separate the two functions, because the way in which a bridge is built affects its final state of stress,' Benaim explains.

Consultant and contractor working together is a norm now, but in the 1970s it absolutely was not. 'I made it happen for Byker and Runnymede, though it was not generally welcomed – perhaps because there were concerns that such a set-up could attract claims. I did it by defining in the contract documents a possible way of building, which the contractor chose to follow.

Equally, the concept of alternative contractor designs was unheard of in the UK at a time when the bridge design scene in the country was extremely restrictive. 'The Department for Transport farmed out the jobs on the basis of "Buggins' turn" which created a stultified set-up with no competition of ideas,' Benaim remembers. But he understood the value that could be created by tapping into a contractor's building knowhow from his time in France. He had also seen it be particularly valuable when working for Arup in Hong Kong on a design-and-build project with contractor Dragages for the Hong Kong Mass Transit Railway including Admiralty and Central underground stations.

'I wanted to do more of that. So,

when all those jobs came to an end at about the same time, it seemed to me the ideal moment to set out on my own and put my ideas for bridge design and for collaborating with contractors into practice,' Benaim says.

In 1980, he quit Arup, to general astonishment at the firm – 'though Sir Ove himself was very supportive; he gave me one of his chess sets and cooked me an omelette, I recall'.

Building a reputation

Robert Benaim and Associates was established on the kitchen table and he was expecting a slow start to business. But, almost within days, contractors were beating a path to his door, keen to work with a recognised designer who understood their buildability concerns. Among the first was Shephard Hill, which asked him for alternative proposals for the East Moors Viaduct in Cardiff (**Figure 2**).

From Benaim's experience, he knew contractors' alternatives could shave 30% off the cost of a design and produced a prestressed concrete option to contrast with a steel original. 'I was preparing the quantities for Shephard Hill to present its bid, and then producing the construction drawings and getting the design independently checked, all within the original contract programme. It was high-pressure engineering,' he says.

Likewise, during the building phase, 'we were precasting 50t segments on a daily basis. That had never been seen in Britain before. It's the sort of thing that had seemed impossible before we did it, rather like a Formula 1 wheel change in 2.5 seconds. That's a triumph of organisation and it's the same thing with precast bridges – the

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segments have to be designed to allow for a quick turnover.'

The 914m long glued segmental viaduct was completed in 1984 and, from then on, the Benaim business grew, as did its client list around the world.

One of the firm's most dramatic jobs was the design-and-build contract for the Singapore Central Expressway Phase II. Not only was it churning out designs for dual three- and four-lane carriageways, including 3.6km of cut-and-cover tunnels through the centre of the city and a five-slip-road underground interchange, but it was asked to produce drawings that could be quickly adapted and used by the following trades (**Figure 3**). In effect, Benaim had to invent an early form of 3D model.

It did this by working with the software designers for the MOSS highway design program and convincing the program that the tunnel was a funny sort of road. 'In the end, we created a fantastic system, using MOSS, to get a 3D picture of the tunnels, including the very complicated underground "spaghetti junctions". It worked brilliantly. Every time we had to change the highway alignment, new structural drawings appeared at the

press of a button.' The £120M contract completed in 1992.

Work followed on the value engineering of the Limehouse Link tunnel in London and the 17km viaduct on the Guangzhou–Shenzhen–Zhuhai superhighway over the Pearl River delta in China, among many others, with Benaim usually retained by contractors to produce alternative designs in order to win the jobs, or collaborating on design-and-build contracts.

He is particularly fond of the 6km of elevated twin-track railway through the centre of Kuala Lumpur – the precast, prestressed, glued segmental STAR viaduct (**Figure 4**). And back at home he's very proud of the 1.7km prestressed concrete viaduct on the A13 over the Ford works at Dagenham. 'The original was a steel design and it is so much better looking made of precast, prestressed segments. There are no joints except at either end, which minimises maintenance and gives such a comfortable ride.'

Winding down

After 20 years, Benaim decided it was time to step away from the anxiety of running the firm and sold out to a management buyout by younger colleagues. The firm has since been absorbed into AECOM.



FIGURE 4: STAR Metro, Kuala Lumpur – completed project

'We were a particular practice, a small team doing large jobs, and one project can easily dominate. It was a lot of pressure.'

'But I have missed the fun of designing and solving problems, and the whole business of building.'

He was overwhelmed to receive notification of the Sir Frank Whittle Medal, taken aback that the wider

engineering community had recognised the significance of his career working with a challenging technique and constantly looking for a better way to deliver a job. 'It's a good thing I don't have heart problems,' he says. 'I was truly shocked, but am hugely grateful that that my name will be forever associated with the great designer of the turbo jet engine.'

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