

A geometric progression, touch wood

A new bridge uses a natural material in a way thought only possible with steel and concrete. By Jay Merrick

BLACK DOG Hill, an otherwise unremarkable dell through which the A4 dips and rises languidly between Chippenham and Calne, has become a marvellous niche in the Wiltshire countryside where a cat's-cradle of geometric daring has produced a bridge that has pushed the boundaries of what can be done with wood to the absolute limit.

It was designed by an excitable 41-year-old who dropped out of school, did a bog-standard engineering apprenticeship, got a place at Salford University, went on to become a director of one of the country's big-name design engineers – and then downsized to create a small, family-style practice “where we live locally and can walk to work in the morning, and explore things in a joyful way”.

Mark Lovell, an engineer with the design instincts of a radical architect, isn't falsely modest. He knows that he and his team – tucked into the oak-beamed eaves above an Italian deli-cum-restaurant just off the high street in Devizes – have created something unique. There has been nothing like it before in Britain, and almost certainly not in Europe.

The uncluttered beauty and purity of the bridge's look-no-hands form conceals Lovell's brass-necked front in pulling off a kind of Euclidian three-card trick. For this is a

“live” structure, fixed to concrete bases at either end – but, essentially, held up by nothing more than the dynamic interplay of tension and twisting torsional forces that lock the structure together.

In effect, the 40m-long deck is poised on the counter-forces between the canted main arch and a run of simple struts. If those were the only things to consider, the bridge would still be notable, but not so remarkable. The real showstopper, in design terms, is that Lovell has produced a span in which every aspect is curved: the main beam, and the layout, arch and camber of the deck. He has pulled off with glue-laminated wood something that has only been possible with steel or reinforced concrete.

The £225,000 *tour de force* was possible for three reasons: the local authority's desire to create a stunning new landmark in the countryside; half-cost millennium funding; and the Lovell factor.

“There's always something odd going on here,” he says, “because we believe in the intellectual change process.” An example was his temporary employment of an electronics consultant to add to the mix: “He knew nothing about design, but we liked the way his mind worked.

“We're trying to say that there's lots of ways of doing things,” he says.

“And we believe that beauty is in the details. It's all about touchability. A lot of modern buildings look fine from 50m, but when you get up close they're banal. They are too brittle. There should be more kinetic structures – the tuning of buildings.

“Most people pay lip-service to nature,” he adds. “If you apply wind forces to trees, they shouldn't stand up. But they do because they dissipate energy. If engineers thought more about flexibility, there could be lighter structures.”

The explanation, and the philosophy underlying it, is significant. When Lovell and his wife set up the practice two years ago, they were ex-directory. Yet, from the start, they were sought out by alternatively minded clients and so-called “signature” architects involved in unusual projects – Michael Hopkins, Nicholas Grimshaw, Alsop & Störmer, to name a handful.

As a result, this otherwise low-profile practice has a considerable strike-rate in delivering engineering solutions that have successfully walked the tightrope for challenging projects: the David Mellor Cutlery factory in Derbyshire, with its wide-spanning conical roof; a glass walled house with a plywood-skinned aerofoil roof “in the spirit of Alvar Aalto”; tensioned “stick-and-wire” bridges for furniture designer Richard

Latrobe-Bateman; and the half-buried ammonite shaped Earth Centre at Doncaster, which will feature a self-supporting gridshell roof made of end-buttressed Victorian floor joists.

The bridge at Black Dog Hill, whose structure is “tuned” rather like a harp by the tensioned cables connecting the laminated wood elements, was developed from thumbnail sketches. It was an instinctive approach that reveals Lovell's engineering confidence.

But there was something else at play, even at that early stage. It was as if Lovell couldn't resist making the design concept as hard as possible to refine. “We did a series of sketches,” he says, “and because of the bend in the road there was a strong desire to respond to the curve – and we wanted to respond provocatively. It had to be asymmetric because the site was not a balanced site. So we put the deck on one side: we were trying to make it unbalanced. We were trying to merge elegance, function and form – technically, that was very complicated.”

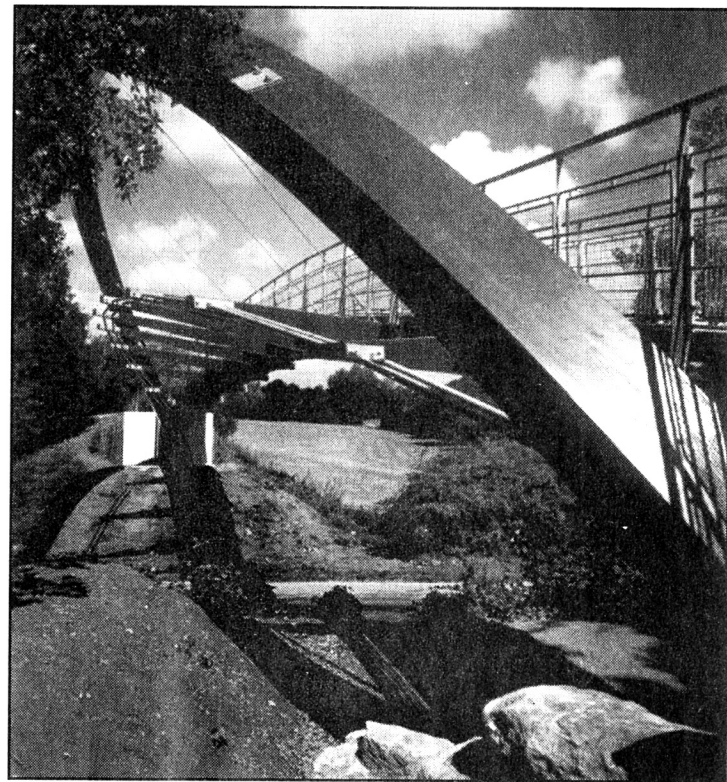
The design was based on the 2.1m-wide Kerto plywood deck and the main 675 x 675mm beam acting as compression arches. The rocker beams under the deck, tied to the beam by cables, reduce and stabilise the torsional forces. “Because it's two statically indeterminate

compression arches with a tied arch, we had to utilise the deck to take some of the torsional force out. But it stands there,” says Lovell. “It's like a ballet dancer – very finely balanced. It took us months and months to develop the elegance. We haven't been too whimsical and gone into pure engineering.”

Solving the design problems was one thing; hitting budget was another. When the detailed design went out to tender, the feedback was alarming: the cost overshoot by the best part of £100,000, essentially because potential contractors were alarmed by the radical design and wanted to cover all eventualities.

In the end, costs were trimmed back to target by setting up a three-part contracting system involving a foundation specialist, a builder and a laminated wood supplier, Cowley Structural Timberwork. Plan-B worked a treat: once the concrete piers were in place, the rest of the structure went up in 13 weeks.

But there is no doubt that the multi-faceted aspects of Lovell's geometry has pushed the bridge's main material right to the edge of the structural twilight zone. The laminated softwood, in 30mm lamellae, was prefabricated in France by Weisrock, probably the most technically advanced manufacturer in Europe – and even it was hard-



Mark Lovell's bridge at Black Dog Hill, Wiltshire Ian Smith

pushed to meet specification perfectly: some of the elements had to be tweaked on site.

On one level, the challenges posed by the form and details of the bridge at Black Dog Hill were based on a desire to take risks; but they, in turn, were informed by something quite fundamental to Lovell's nature. He is proud of his family's long history in the timber business – it is documented from 1560 – and in his bred-in-the-bone practicality. Even more noticeable is his love of

materials, a relationship that flowered when he worked as a teenaged engineering apprentice.

“Materials,” he muses, standing at the apex of the bridge as a chill wind sweeps through the tensioning cables. “All of us like to smell materials, touch them. But we've become a visual culture. We don't listen to objects in the wind or smell them. You should also be able to enjoy objects with your eyes shut.”

At Black Dog Hill, wide-eyed wonder is probably a better bet.