

In Praise of Bridges, Large and Small

By Barry Cole

We travel under or over them in our busy lives and nobody gives them a second thought. Yet, they are the cornerstone of civilization. This might sound like an exaggeration by an admitted "bridge-o-phile," but if it weren't for bridges, where would the human race be? I think you could go so far as to draw a parallel between the invention of the wheel and that of the bridge, and, in fact, the two complement each other. These two inventions were in no small way responsible for the development of civilization.

Let's backtrack to an earlier age when the very first rudimentary bridges were constructed, perhaps of a log positioned over a fast running stream or even a large stone the likes of which we see at Stonehenge. Whether these bridges were man-made or even natural accidents, they sparked a drive in early man: to see what was on the other side.

While the earliest man-made arch bridges date back to the 13th century B.C. in Greece, the Romans became the master bridge builders of antiquity, and, unfortunately, not always for the good of mankind. They were amazing engineers and used this knowledge for military conquest. The size of their empire attests to the importance of bridges. Without these spans, raging rivers kept aggressors at bay. With them, the Romans were able to dominate much of Europe.

Not only militarily were bridges important, but they aided the spread of ideas linking one culture with another.

I could muse all day about the art of bridge building, and, in fact, I'm sure you could fill the Albert Hall with what's been written on the subject. My own interest in bridges started in post WW II London, when, as a young child, the area south of the Thames with its many railways and overarching bridges was my playground. Those bridges seemed so massive and, in their own way, beautiful. And perhaps that's what caught my imagination: a bridge is not only a functional structure that allows people to go from point A to point B, but it can also be a thing of beauty! Think The Golden Gate Bridge in California, USA and the Firth of Forth Bridge in the British Isles, two fine examples in the art of bridge construction.

Still, one can't ignore the unsung heroes who have been bringing people together for centuries, well before the internet was even a fantasy! They are the civil engineers who have been pushing the envelope of structural engineering to the extreme. We can now span voids that, not that many years ago, were thought impossible.

Look at the USA as a classic example of the art of bridge construction. A mere two hundred years ago, much of that country was a wilderness. But when the first steam-powered locomotives arrived from Britain, forward-looking people saw their potential: here was a way of unlocking this vast country and exploring its seemingly endless supply of natural resources.

Engineers were brought in from all over Europe to help the fledgling American railroad companies design bridges. It was a daunting challenge, indeed, as the heavy machinery that we now employ was not available. Fortunately, the abundant supply of lumber provided the necessary raw material. And the result was the creation of the most extensive railroad system known to man. Of course, many workers died in the process; landowners and railroad men became wealthy. And America became the richest

nation on earth in large part due to the tenacious civil engineers who simply would not accept the phrase, "it can't be done!"

I guess it's not surprising that I myself became a civil engineer. Happily, my career took me to many different countries where I worked on a number of satisfying projects. Retirement, however, has taken me on a new journey.

A few years ago, a family friend, Roger Daltry, actually, invited me over to take a look at his extensive model railway layout. Together we mused about the notion of a constructed bridge that might support his trains. I immediately became interested and decided to see if I was up to the task.

Problem one: What good would an aesthetically pleasing bridge be if it collapsed under the weight of heavy freight trains? You'd be surprised how heavy two model freight trains pulled by multiple locomotives passing simultaneously on a bridge can be! There's always the temptation to create something oversized to be sure the structure is strong. But that's not what model railways are about. The bridge had to be as near to scale as feasibly possible. I had to be absolutely certain that my structural calculations were correct.

Problem two: What are the correct materials to build such a structure? As with anything in life, cost has to be part of the equation. If I built it using titanium, it could be fine and delicate and very strong. Of course, it would cost a fortune, not to mention the special machinery required to work on this space age material. I thought about contacting NASA; with the U.S. Space Shuttle program coming to a close, certainly they'd have some titanium I could take off their hands for a few quid? Probably not.

Plastic was not an option. It's fine for some modeling, but for this type of bridge, it would look too "toy-like" and not work. Brass might work but, once again, it is quite costly. Wood was my next thought. It's natural; so straightaway, that's a plus. And, after all, it was good enough for the early bridges that created the American rail system. I immediately set out to see if I could purchase the type of profiles I would need, and soon found a company that could supply exactly what I was looking for.

It's a member of the Mahogany family and can be machined down to very fine dimensions without losing its structural integrity. The company also supplies an amazingly strong glue specifically manufactured to produce a joint as strong as the wood itself. And, believe me, it's very strong! Not surprisingly, miniature precision power equipment is quite expensive, but I found that hand tools just do not do the job properly. I decided if it was a job worth doing, I ought to do it right, and bought the necessary tools.

With the purchase of a drawing board complete with dividing head as I used to use and a little more research, I was ready to begin work. (For those of you comfortable with the newfangled CAD system, that's fine. But for me, it was back to the old drawing board, converting the full size information, and then drawing the whole thing to scale.) And I was ready to build!

I've completed quite a number of bridges now. Among them you might recognize the Sitter Viaduct from Switzerland (in honour of my Swiss wife, Heidi,) and the Ludendorff Bridge, better known from WW II as the Bridge at Remagen, which spans the Rhine River. Bridge building, at least, the miniature kind, has, indeed, given me a new lease on life!