Bridge of the Month No73, January 2017
Christchurch, Arches and Earthquakes

So, here we go with year 7. In a month's time I turn 70 and remain encouraged that I have several friends who have worked enthusiastically into their 90s. It does seem appropriate, though to say a bit about life at the start of a fresh year.

The first thing to say is that I still wake most mornings thinking about bridges. I fully realise what a blessing that is, and also that I have never had anything to dampen my enthusiasm. I still pretty much learn something new every day, and that is a blessing too.

Keeping life together is becoming more difficult, though. Sue has had MS for 42 years and is becoming progressively less physically able. A year ago she was diagnosed with Vascular Dementia and that, too, is taking its toll. I don't know how much longer I will be able to do the travelling I so much enjoy. Meeting people, especially young lively engineers, is always a joy and, of course, travel fuels this monthly note.

Another of life's pleasures is working with Hamish. Our skill sets are very different and he is building his own thread in the business while helping drag some of mine (like Archie, for example) into the 21st century. By this time next year I expect to have a completely new Archie, not directly programmed by Hamish but done under his direction and by that time The future of Archie will be secure for a generation. In parallel with that we are researching real working load behaviour of both arches and viaducts with the aim of truly safe (and economic) predictions of capacity to carry loads over long periods. Naturally, the monitoring threads will continue and help to drive that as the new data acquisition systems he is building fuel the gathering of understanding and are pushed out into the market for others to use.

And now there comes another generation. Young Magnus (4 next week) sat in the Cathedral crib service, looked up and said "How did they build that?" You will understand why I am smiling as I remember that.

I have a number of bookings to talk about Moco already. The Bridges conference in Coventry on 16th March and Engineers Ireland in Dublin on 22nd March.

Many of the photographs here and all of the 3D modelling were contributed by Hamish. If you are into arch bridges you should read his piece on hidden details.

I was talking about Viaduct behaviour at IStructE History Group Last Night 7thFeb. I will try to turn that into a webinar in the next few days.

Anyway, onwards.

As many of you know I have been working with some precasters in New Zealand on developing modern arch bridges for the market there. One issue that is always raised is earthquakes. Usually on the lines of "we can't build those, they will just rattle down in a 'quake."

Well they don't. There are good reasons why they don't. I knew there were a few arches in Christchurch, but the only way to find out how they fared in 2009 is to go and look and back in November I finally got the chance. Till then, all I had seen was this picture of a little bridge where a

fault line through the middle had allowed the abutments to move 300mm closer. It did some damage but the bridge is still there.

What has happened here? The crown has lifted and crushed somewhat, the spandrel walls have hinged upwards causing tears along the bed planes and the loss of compression in the parapet has allowed stones to rattle loose from there. Despite all that, I would be happy to drive a truck over it. I never located this one and presumably it is now long gone.

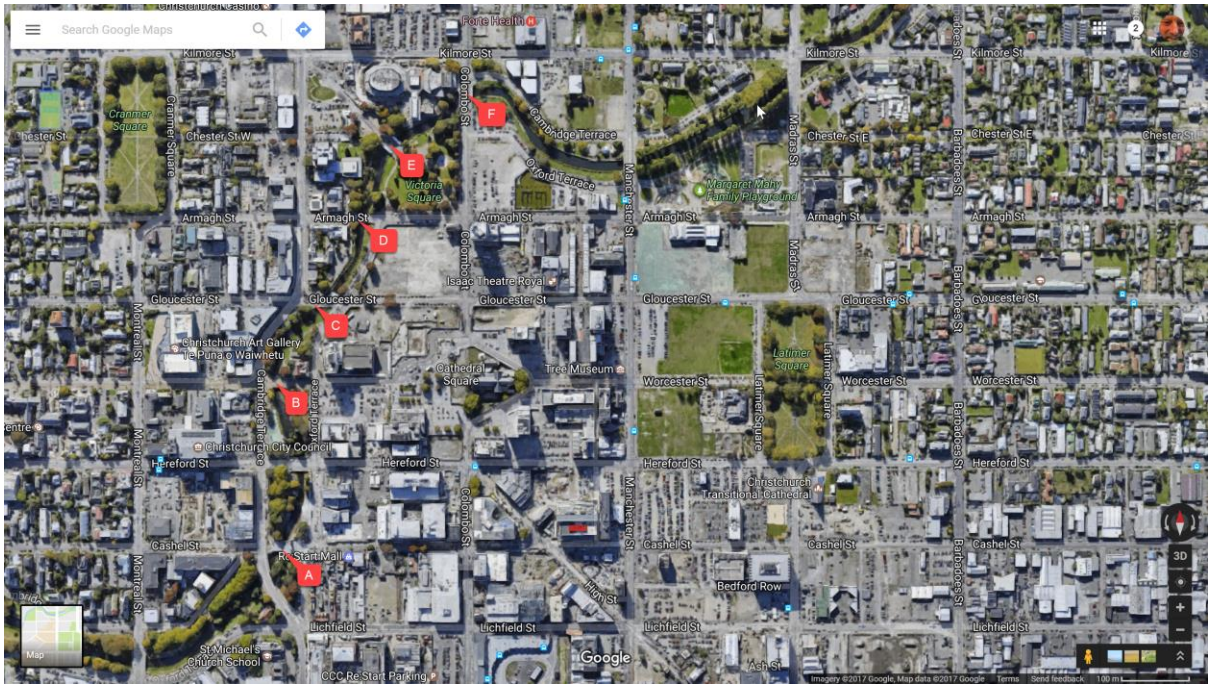
Christchurch after the earthquake.

The state of the city might be exemplified by its cathedral

Note the bent steelwork here where walls have fallen despite the attempt to support them.

And here is a street scene with vast open spaces and much new build.

In fact the CBD reminded me of Bristol as I first knew it in the 1950s with vast areas of desert. Or indeed Dresden in the 1980s which still looked like that.



Google Maps actually shows the level of devastation pretty well. This says 2017 imagery. I think I saw buildings on some of these empty patches. Our main interest today, though is the river Avon meandering though the picture with many bridges. The ones we will look at appear from A to F running downstream.

A is the war memorial, and as such probably the newest. Elegantly built of stone with a stone memorial arch above.

Sorry about the rain spots on the lens, it was a very wet day.

As you can see here, it is moderately skew. The rain always runs under the edge and then down the steepest slope.

The banding here is interesting. If I am honest, by the time I got here I was running out of time and feeling quite wet. That looks like a chamfered edge but I cannot remember.

Worcester Street next:

That gentle hump is a giveaway for an arch and look how close that propped building is.

Sure enough, look underneath and we find stone voussoirs and a brick arch.

Banding again here. I am pretty sure that part of it is caused by backing but if the arch leaks at the top of the backing why would the water run so far then stop.

Looking from down stream, it is obviously quite a flat arch. Scaled by pacing and counting (those parapet panels are 6ft long) it looks like 8:1 at 48ft span and slightly over 6ft rise. I think the truth is probably 50ft radius, 48ft span which gives 6ft 1.64in rise. The Rankine rule of thumb would say 2.5ft

thick and the smaller of those voussoirs is roughly 1ft square so I imagine that the true ring goes up to the rendered bead.

These really are elegant things and the engineer should be congratulated, though he will be long dead. Of course, it is the Mayor who gets the credit. Good to have a clear date, though.

Bridge C is different Presumably a similar age but this one is metal, though still an arch.

Lots of temporary works there, still holding it up.

Bit of a mess there behind the plinth. Is that earthquake damage?

Behind that fence is some more damage in another corner.

Bridge D is another brick arch and this one is skew.

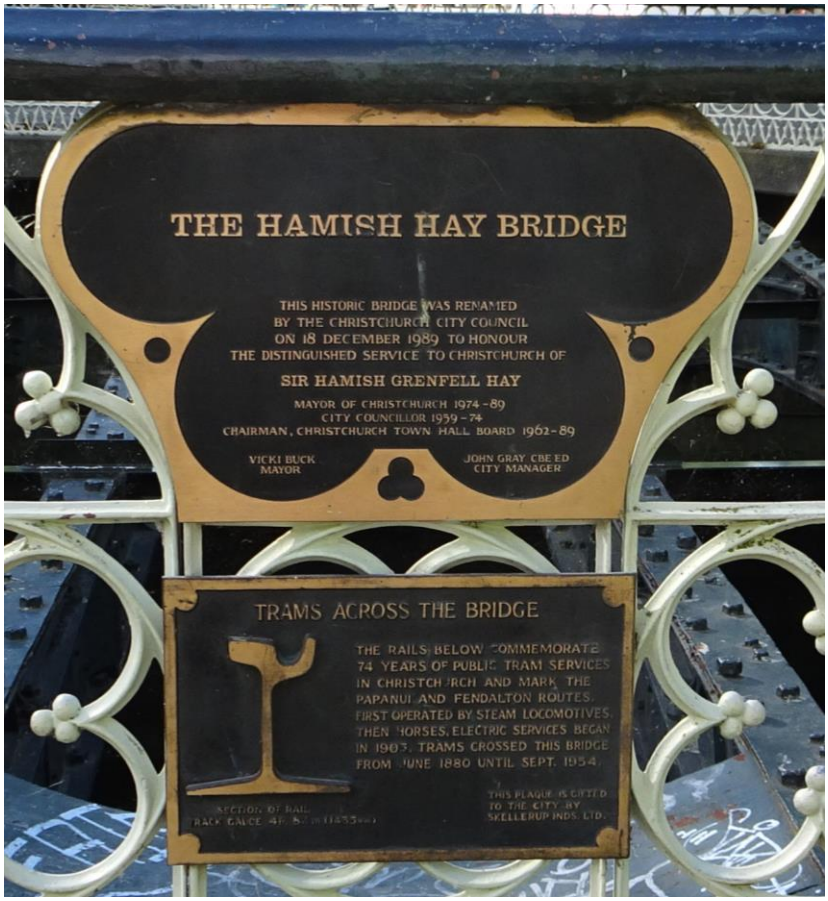
A closer look suggests that the brick has dropped a bit below the stone voussoirs.

This one has modern black surfacing and it doesn’t look in perfect condition but there was no other sign of damage.

Next (E) comes another metal bridge and this one has a hole in the deck, obviously made for some clear purpose.

This looks like largely cast iron. I presume that the bolted plates are later additions.

Here is one piece of dished plate which originally would have carried the deck.



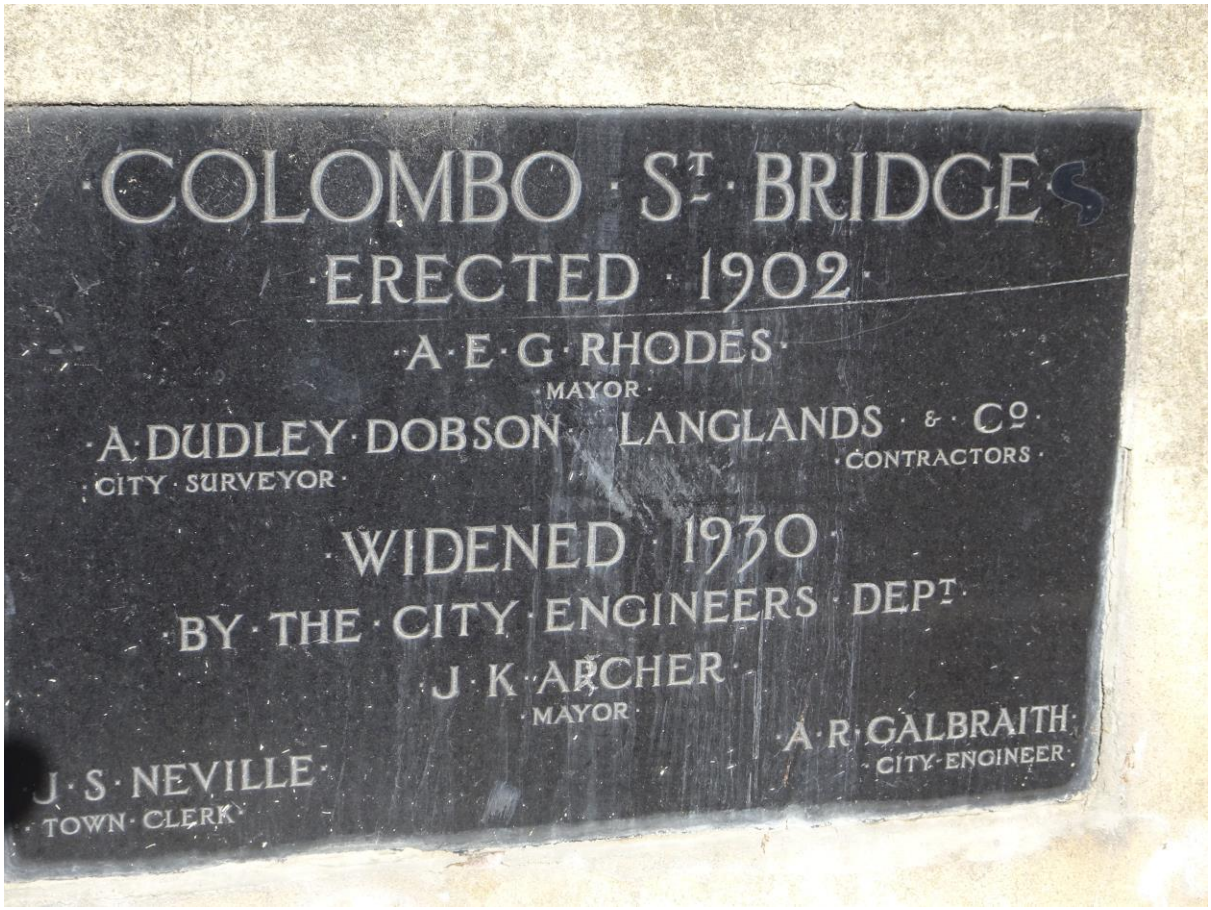
Once again, we find the officials get the credit, and no mention of the engineer.

Here it is very clearly cast iron, with quite a lot of patching. The angles would be necessary to keep the arches aligned without a deck on top.

Round the bend to Colombo Street which doesn't have a label. The bridge has been widened in steel and here we see some fairly obvious earthquake damage. That is the main reason for including it.

At least the engineers get a mention here. The council surveyor would have been an engineer too.

So, I don’t think we can say that earthquakes aren’t a problem but they are much less so for masonry bridges than people think.



The last arch I found was rather further upstream at the side of Hagley Park.