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I have known of the Wakefield bridges (<http://bit.ly/wakebridge>) for many years but a mix up over train tickets saw me with an hour to kick my heels so I finally had chance to have a look for myself. The main bridge crosses the Calder and was first built about 1342. It has pointed arches and was only wide enough to carry a single cart. It has been widened twice on the upstream side with segmental arches. It is a grade 1 listed structure (<http://list.english-heritage.org.uk/resultsingle.aspx?uid=1273508>). As is the chapel seen here (<http://list.english-heritage.org.uk/resultsingle.aspx?uid=1258242>).



Here are 4 spans of the 9 spans. There is another hidden behind the tree and four north of the chantry chapel which actually partly blocks one span. These five arches have flat soffits whereas the four northern ones have ribs (see below). This surely indicates an element of reconstruction of even the earliest parts.

The chantry chapel was built between 1342 and 1356 and is one of only 4 left in England. The charter that was supposed to provide for prayers to be said in perpetuity has probably long been forgotten.

I wasn't able to take any dimensions on my visit, having broken (again) my rule of always carrying my Disto. The spans seem to be about 20ft which suggests piers of 5 to 6ft, much smaller than most southern bridges of this period. (That raises the question of what is Northern? I know it includes Yorkshire and Lancashire but south of there I am unsure at the moment). The full present width seems to be about 25ft. The two widenings (1758 and 1797) look to be the same width so I guess the original bridge had a 12ft carriageway and perhaps 1ft parapets and the widening arches are either 5ft or 6ft wide, though more likely the latter.

This shot shows the ribbed arch which is likely to be original. It is also quite badly distorted and seems to me to be suffering from neglect of the structural elements.



The ribs seen here are chamfered on the outer edge but square in the middle. If the ribs and gaps are equal (as they appear) the width of each will be 18in (450mm) with a 9in edge (225mm) corbel chamfered by 6in(150mm). The other dimensions then suggest that both the ribs and the arch are 9in thick.

It seems likely that the arches were originally two circular curves, meeting at a point. The picture above shows that there has been considerable movement in some arches. This one is very flat at the quarter point and the erosion has concentrated mortar loss where the curve is minimum. Some repointing is needed to avoid loss of stone in the next flood.

Reconsidering the span dimensions and juggling for round numbers it seems possible that the span is 21ft, the rise 7ft and the radius of the arcs also 21ft.

This picture also shows the beds in the spandrel wall sweeping upwards towards the crown of the arch. This is a very unusual shape but fits with the sag seen in the half span of the arch itself. It is perhaps worth stepping back for a wider look.



Here, there are obvious signs of earlier distress, and also of previous basic configurations. The original stonework is coursed making use of different bed thicknesses in the quarry and carrying each bed through the whole bridge. This was typical of the imported cathedral kits that were brought over from Caen. Tracing the courses through this picture we can see:

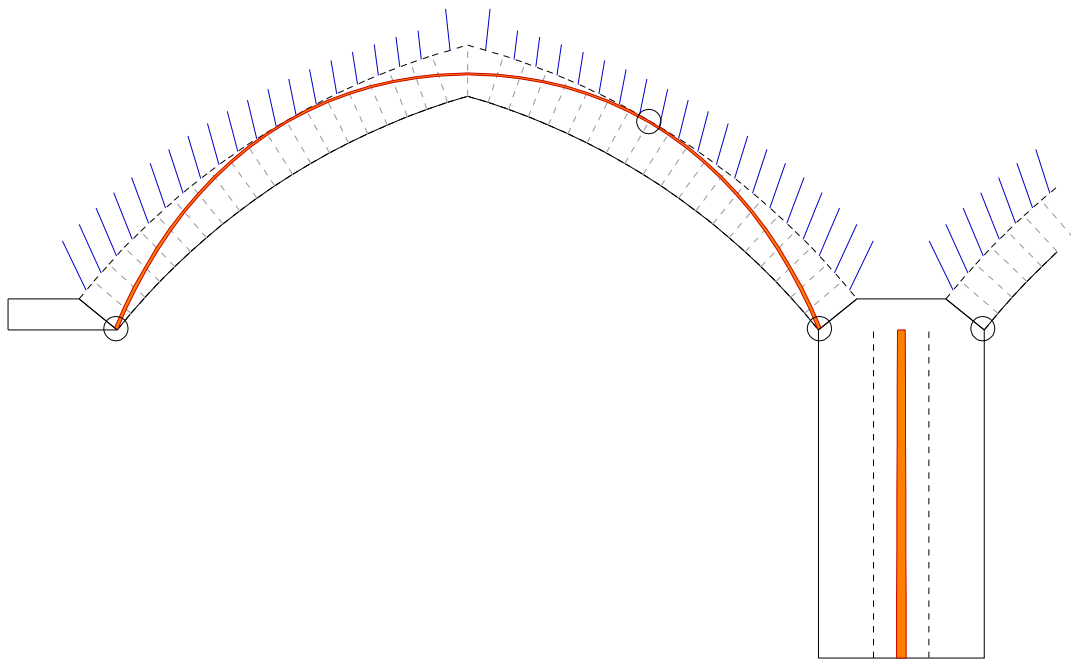
Below the parapet, a hard edged string course that almost certainly dates from the 18th century widening.

Below that is a string of deep stones with a chamfered top edge. This might be the original string course or possibly the top of the original low parapet.

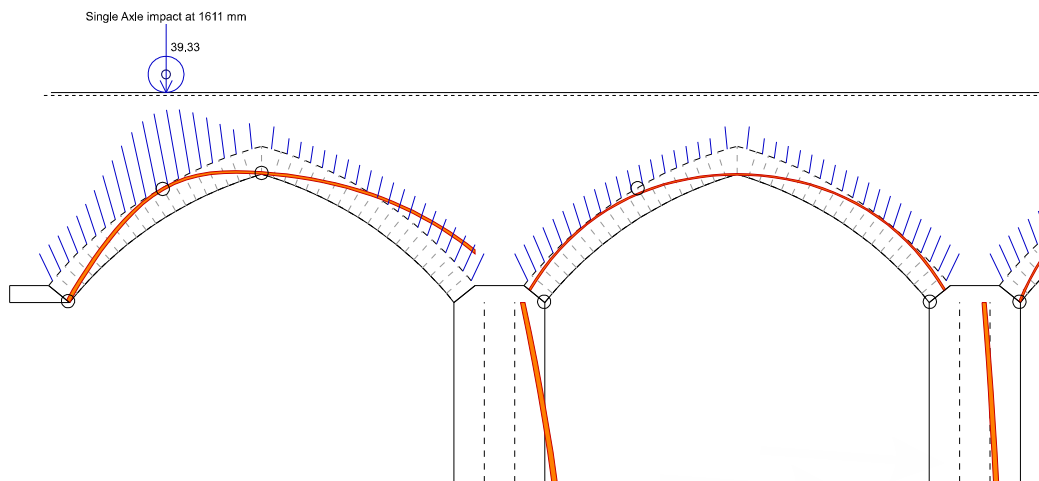
Next comes a stepped course, broken at the water spout but with a make up layer on the near side.

From there down, the courses seem to continue through the pier but break up and stagger to this side of the spout.

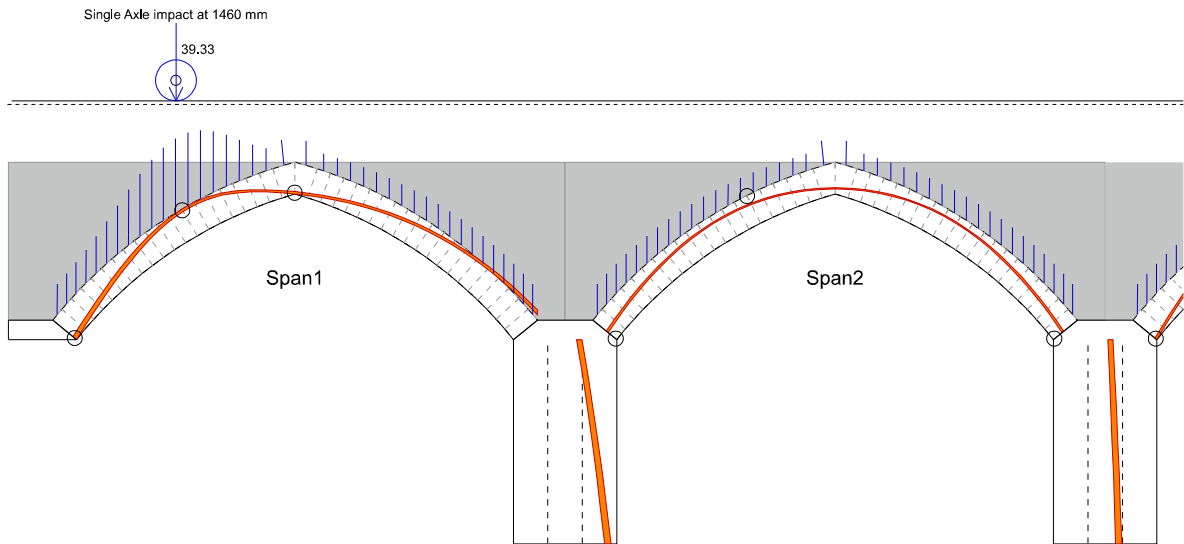
It looks very much as though this pier has partly failed and tilted a little. Whether that was caused by loss of the span or whether the span simply distorted to accommodate it, the outcome is a distorted arch and a patched spandrel. The fact that the pier does not seem to have settled suggests that the span might have been lost and the pier tilted before it was restored. However, the shape of the arch itself and the mortar loss in the ribs around the quarter point might point to the arch remaining in place but distorting substantially.



Modelling this bridge in Archie can be accomplished using the “pointed” arch shape and juggling with input data to get a sensible shape. The spandrels are likely to have been filled



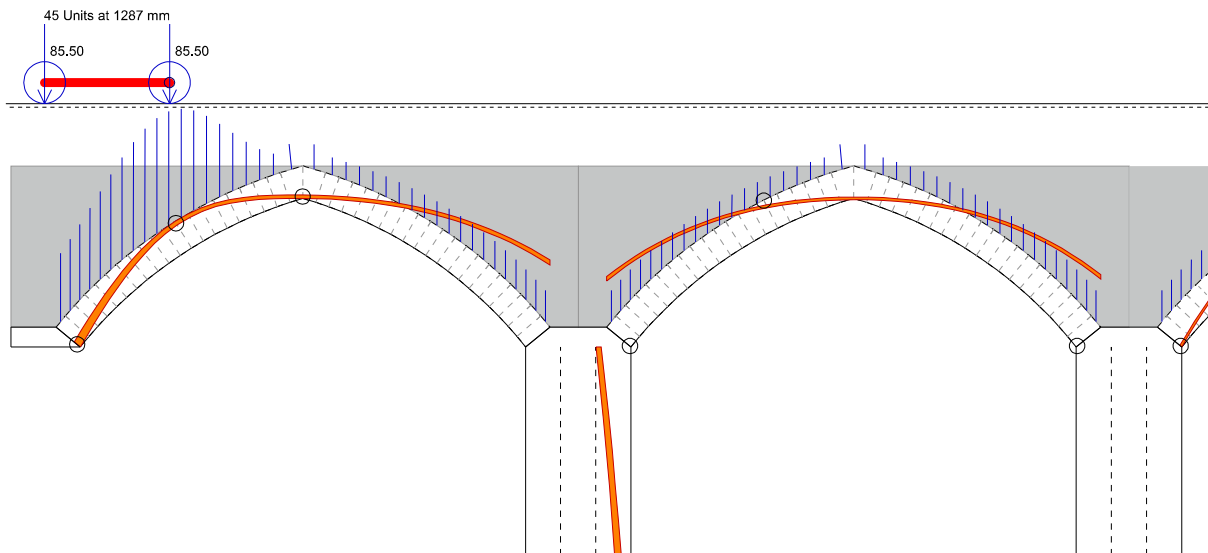
Loading with a single modern axle and balancing the thrusts as best I can shows the bridge rather weak without any backing. In this form, the left hand span would probably collapse as a result of tilting rather than collapse of the pier.



With backing, stability is much easier to achieve.

A bridge of similar construction, but rather larger span, crossed the URE at Boroughbridge. It collapsed under a heavy load in 1945, closing the A1 which was then the main road between London and Edinburgh.

Putting the larger load on the full original width of this bridge suggests that (provided it was indeed filled with concrete, it would have survived.





The picture above shows corbels (some broken off) for support of the centring, though it is hard to see why they would be necessary on such low piers. The fact that they do not line up with the ribs raises further questions! Below, it is easy to see how the widening was accomplished. On a closer look, both above and below, the river bed seems to have been paved. No doubt this would provide a good deal of protection against scour, but it would have been expensive and quite difficult. It is probably 18th Century work.





There is little to say about the rest of the bridge. This view from the North West shows almost the full length of the latest reconstruction with work going on to the parapet.



A closer look at the South West shows other aspects of 18th Century modifications. For example, in the enlarged view to the left there is clear evidence that the cutwaters used to rise to road level to form refuges. The area between the top of the cutwater and the string course is obviously a patch.

And having said Wakefield Bridges I had better include one shot of the 18th Century "Pack Horse Bridge at the south end.



#### News

Archie-M The latest version of can be downloaded from: <http://bit.ly/BillH5>  
Seminars and courses. Courses are run as a profit making concern by Bill Harvey Associates and need take £3000 to cover the costs so say 10 people at £300 each. The standard charge for Seminars, run as part of the support for Archie-M is £100 which is intended to cover costs only.

Lectures also in Zurich 19th May and Vienna 23rd. [bill@obvis.com](mailto:bill@obvis.com) for details.  
If you would like us to run a course (a full day intensive training) or a seminar (intended as an update on arch studies and Archie plus discussion between users) near you, please let [Philip@obvis.com](mailto:Philip@obvis.com) know.

Continuing thoughts about arches and Archie at <http://billharvey.typepad.com>

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