

Bridge of the Month April 2013

Moor Street Undercroft



If you have been sent this email by a colleague and would like to receive your own in future, sign up at: <http://eepurl.com/ccAyl>.

A pdf version can be download from www.obvis.com

News

The OBVIS web site has the latest version of Archie-M, 2.5.1. This is largely a bug fix sorting out problems with activation which now seems to work properly. If you need a version for mounting on a server, contact bill@obvis.com who will give you a link. We thought for a long time that we would be able to use a single version but it seems not. The version on the web site should work as a fully functioning demo program for 30 days after which activation is needed.

Network Rail's level zero assessment programme is now in full swing. Our planned tools to assist with this have been somewhat delayed by the arrival of the next generation. (Arthur Magnus William was born on 7th Feb and has proved to be difficult to keep fed). We do, though, have tools in development for follow up work, allowing more automated running of Archie (not something we would normally encourage) for large batches of bridges. We plan also to include multi spans in this automated process. A particular development, though, is the ability for "Autorun" to make sensible use of backing. That involves making the backing work truly as part of the arch.

Two papers from Bill in the ICE bridges journal. The first, though printed second, (A spatial view of the flow of force in masonry bridges, ICE Proceedings, Bridges March 2013) about the generality of force flow in arches is a gathering together of thought from the past two decades. The second (Stiffness and damage in masonry bridges, ICE Proceedings, Bridges, Sept 2012) looks at the vexed issue of "spandrel cracks" in arches.

Forthcoming presentations.

14th May, Archie Seminar Motherwell, Full Day £100, contact Philip@obvis.com

18th July, ICE Poole: How Designs go Wrong

30th August, Scottish Lime Centre, Charlestown, details to be agreed.

Links

www.obvis.com

www.billharveyassociates.co.uk

www.moiretelltale.com

Moor street station (<http://goo.gl/maps/eeutA>) was built in the early 1900s as a terminus serving commuter lines into Birmingham from Leamington and Warwick. It is built on the side of a hill and though the station entrance is at ground level, the tracks are elevated on a blue brick viaduct.

The space beneath was occupied by goods facilities with traversers and lifts. The piers of the viaduct have large arches to deliver clear space. That space is now a car park, and therefore readily accessible.



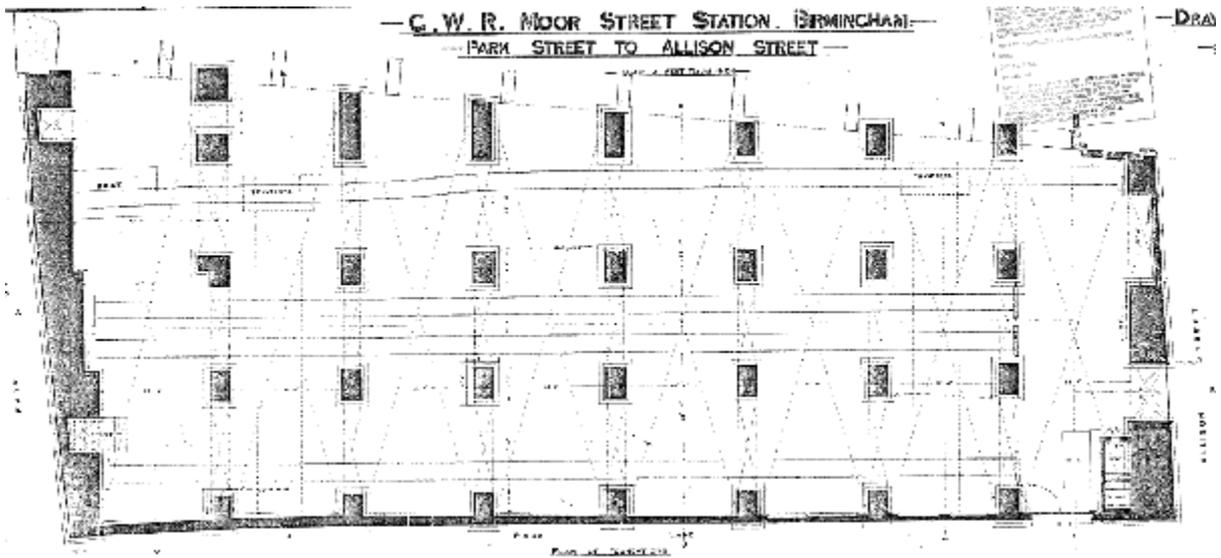
The inner arches in the piers are different. 27ft span instead of 30ft. Note the oval void at the crown of the main arch. These were light wells in the old dispensation.



The concrete beams support a new carpark. The piers taper as is visible here.



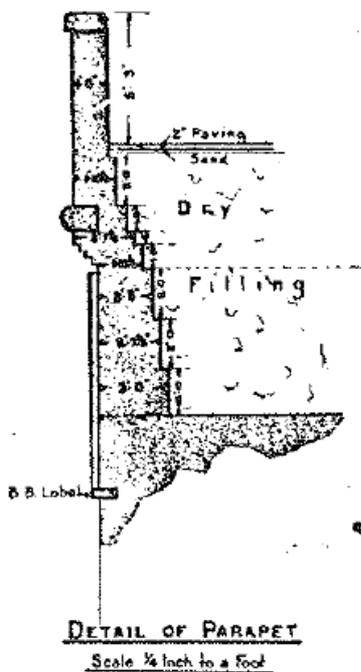
The goods sidings ran this way, parallel to the tracks above. There was a traverser at the end and a wagon hoist in the corner.



The working layout is quite compact, 4 sidings with room between for road vehicles.



The long section shows brick backing to the same width as the pier then concrete and "dry filling" on top to make up levels.

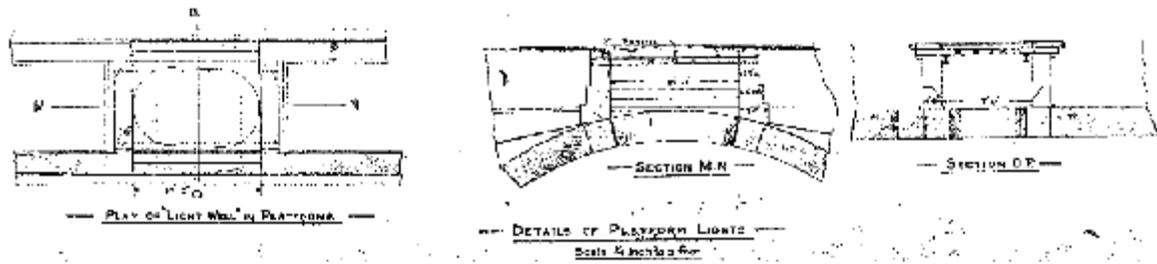


The section through the parapet is somewhat enlightening. What modern engineer would create something with such a cantilever? It has been there for over 100 years now so one would be hard pressed to say it was wrong.

The dimensions are difficult to read because this is a pdf created from a microfilm then grabbed of a screen. Thickness step down in half brick units. 3'0", 2'7.5" 2'3". The parapet at the top is 1'6" so the base below will be 1'10.5".

The narrow neck at the base of the corbel is also 1'10.5" and there are 4 steps on the back to the back of the wall so 1'6". Then the face of the wall is 3'0" beyond the back of the corbel section giving a corbel of 1'1.5" in 4 steps. So steps of 3-3/8". That is a little over a third of a brick length, which seems adventurous.

The reader is invited to consider the equilibrium of this system under dead weight alone. I don't have time this morning and the BoM is 2 days late already.



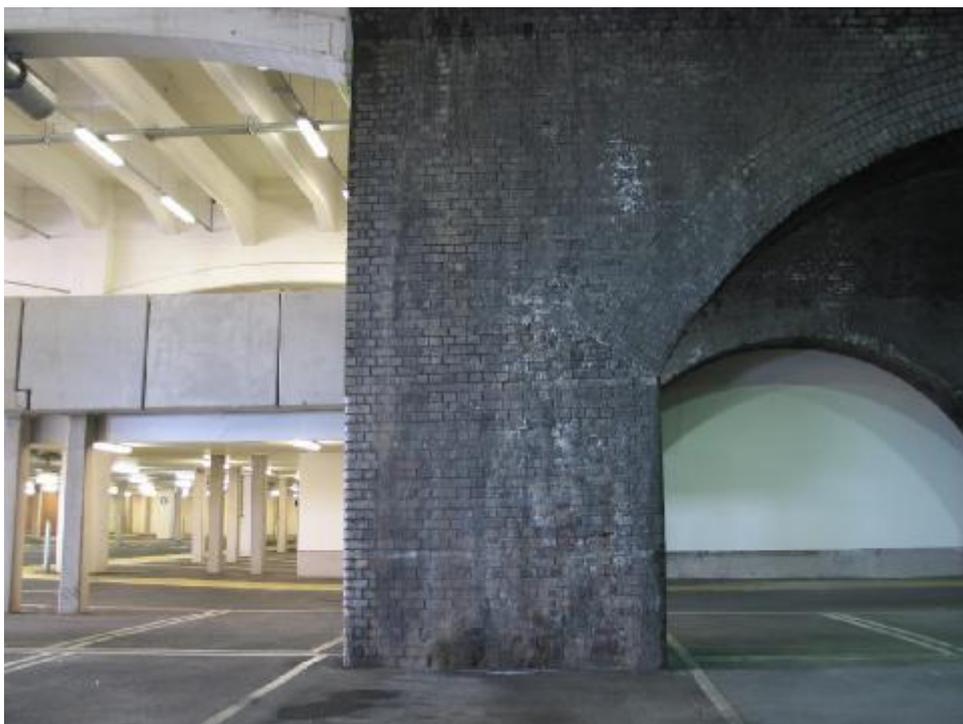
The detail of the light well shows that they were paved, presumably with glass blocks. Not a lot of light through there, though with a canopy over the platform.



The natural spread of the arch on decentring creates an upward shift in thrust at the crown and in this case, a slight spread and crack at the intrados.



A closer look shows the crack penetrating perhaps three courses. Remember, though, that the arching action is not constrained to stay within the brick rings.



I am pretty much certain that the back edge of this pier/abutment is curved. It is the natural thing, the arch pulls the force to the right near the springing but the total thrust then travels outwards and hits the foundation well to the left. There is therefore a tendency to rotate at the foundation and bend at the springing level. The bricks are pretty stiff but the mortar and soil will creep allowing the pier to slowly bend. You will see a more pronounced version of this in many cathedral columns.

I did my best to show that this could work with full railway loading above. In the end, I couldn't. I am sure that the bricks don't know that.



Interesting that rounded corner bricks were used at working level but hard square corners above.



The old station viewed from the top of the adjacent car park. When the photo was taken it was being refurbished ready for re-opening.