BRUNEL's OTHER BRIDGE NEWS

April 2023

This wonderfully atmospheric early 20th century photograph shows the gas lamps at the end of the Replica Bridge being lit on a wet evening. Note also the numerous gas lamps in the distance on the Tongue, and the walkway on the right of the Bridge, now lost.
The signs warn that only private vehicles and pedestrians may use the Bridge, and that it is 'One Way' from north to south.

The Bridge was shortened in the mid 1960's and the cast iron lamp-standards were scrapped. However, one still survives at the north end, so it would be great to see the pair there reinstated and the Bridge restored.

Image from HE Archives, supplied by Jerome Tait

OUR AIMS

- To preserve and restore the structure to working condition for use as a crossing over the Entrance Lock for pedestrian s and dismounted cyclists.
- To explain the significance, history, and technology of the structure in the context of the Floating Harbour and Brunel's other works.
- To develop the site's educational and amenity value for all.
- To inspire interest in engineering and technology amongst people of all ages

Dear Supporter,

Historic England resurveys Listed Structures in Cumberland Basin

With a grant from the West of England Combined Authority, (WECA) Historic England has carried out a thorough review of the heritage structures in readiness for the preparation of the Western Harbour Master Plan, due to start this year.
EH consulted our volunteer John Willis's website *Heritage Assets in Bristol Western Harbour (*https://bwhha.wordpress.com/) and their Listings Advisor for the South West Jerome Tait toured the area with John and Geoff Wallis in March, scrutinizing details. Some discrepancies in the existing descriptions will be corrected, and for the first time the hydraulic jiggers and their pits on the Tongue will be Listed.

Another internationally important feature of the Bridge is revealed.

Our long-time supporter Andrew Smith, MA CEng MIStructE, is Convenor of the History of Structural Engineering Study Group of the Institution of Structural Engineers. Andrew has taken a particular interest in Brunel's novel use of tensioned rods on the Bridge, and recently submitted his findings to Historic England's Relisting Panel. He has given permission for it to be made public, so I have reproduced it verbatim. Thank you Andrew.

'The research carried out by David Greenfield, Robert Watkins and others has revealed a great deal of new information about the bridge, has clarified its place in the development of wrought iron plate girders for bridges and, remarkably, revealed that its girders were, in modern terminology, 'prestressed'. (That term didn't come into use until it was reinvented by Eugene Freyssinet for his long span concrete arch bridges in the 1920's. See Sutherland, James, 'The Birth of Prestressing? Iron Bridges for Railways 1830 to 1850', The International Journal for the History of Engineering & Technology, 79.1 (2009), 113–30 <https://doi.org/10.1179/175812009X407213>)

Brunel's Swivel Bridge of necessity had a long cantilever, originally of 87'-9" from its centre of rotation, to reach across the lock when closed, but also needed to be shallow and smooth so as not to impede the handling of ropes from ships using the lock and to be kept as light as possible. Alongside the other engineers who were developing wrought iron girders for bridges after the Chester Dee bridge collapse in 1847, Brunel devised the swivel bridge's lightweight structure, using remarkably thin plates, and its unusual circular tube top chord. To balance this long cantilever but fit within the restricted space available alongside the lock, a shorter back-cantilever, of 34'-0" from the centre of rotation, was designed to carry a massive cast iron counterweight. Though of adequate strength, due to its shallow depth and light structure, the long cantilever was unusually flexible and would have deflected significantly under its self-weight, leading to its tip binding on the dock edges, preventing it being turned. To overcome this, the long cantilever was firstly fabricated pre-cambered and secondly wrought iron bars, anchored into the counterweight and reducing in area along the cantilever, were installed within its tubular top chord. These bars were then successfully tightened up during and after the bridge's erection to counter the self-weight deflection of the long cantilever. This is the first known use of what we would now term 'prestress' in any structure and has proved effective for the whole of the bridge's life.

Because it was mounted internally and unreported at the time, Brunel's pioneering use of prestress in the bridge, which only came to light as the bridge's history, nature and restoration was pursued by the authors of the papers cited above and others, is of great significance. Shortly afterwards, the Stephenson/Wild Arno bridge of 1850, discussed in James Sutherland's paper mentioned above, was also successfully prestressed, externally this time. It was similarly without any known successor structures despite being published in the justly celebrated Report of the Commissioners Appointed to Inquire into the Application of Iron to Railway Structures ..., xviii, 435 p., Text and Plates vols (London: Printed by

William Clowes and sons, 1849), Text <//catalog.hathitrust.org/Record/002026597>. In that bridge, prestress was used to overcome the tensile deficiencies of girders comprised of several lengths of cast iron bolted together, but avoiding the misconceptions that had contributed to the Dee bridge's collapse: it too was successful and seems to have survived until it was destroyed during World War 2.

Brunel's use of pre-stress in the Swivel Bridge to counter its deflection is quite simply both unprecedented and, for many decades, without successor structures. I consider that this hitherto unknown aspect of its inventiveness makes this bridge of national and international significance and should be reflected in the revision of its listing to Grade 1.'

Three Papers on the Swivel Bridge Published

Three very informative new papers have just been published in the International Journal of *The Newcomen Society for the Study of the History of Engineering and Technology,* an international learned society that publishes peer-reviewed papers on important engineering subject worldwide. Julia Elton of Clevedon Court edited the papers and arranged for them to be published together in one volume of the International Journal accompanied by an introductory paper by Andrew Smith. (See Andrew's report above).

The titles are: *History and Heritage* by Dr. David Geenfield.
Inspection, Survey, & Renovation by Robert Watkins
Preservation Practicalities by Geoff Wallis

See www.newcomen.com to join the Society and download the papers.

Reporting Graffiti

Although we remove some graffiti, much remains outside our area, and Bristol City want to know about it.. Please submit your report on:
https://bristolcouncil.powerappsportals.com/Waste/reportgraffiti-41461400/

Bristol City Council By-Election

Patrick McAllister was elected to represent the Hotwells and Harbourside Ward on 2nd February. He represents the Green Party who now hold a majority on Bristol City Council. At the hustings in January he spoke positively about the Swivel Bridge project and we look forward to Patrick's support, and that of the Green Party.

Association for Industrial Archaeology Conference in Bath

The Association for Industrial Archaeology (AIA) will be holding its 50th anniversary conference over six days, which will include some interesting visits to places not open to the general public. Based at the University of Bath, it will run from 1st to 6th September 2023,.

To book see: https://industrial-archaeology.org/conferences/service001/

Vols Workdays 2023

We meet monthly, nominally on the third Saturday, but please check our website for changes: www.brunelsotherbridge.org.uk Dates for your diary:
April 15th May 20th. June 17th. July 15th. August 19th.. September 16th, October 14th

Remember the Clean Air Zone is now in place so go to the government's clean air zone pages to check if your vehicle will be charged. https://www.gov.uk/clean-air-zones

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