# Brunel's Swivel Bridge

for

The Brunel Swivel Bridge Group



*Aerial photograph of 2016. https://maps.bristol.gov.uk/knowyourplace. Brunel's Swivel Bridge (partly concealed by the Plimsoll Bridge) is tinted red by Keystone.*

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*Fig.1. The bridge from the south west. The gabled roof is a temporary structure to protect conservation work.*




*Fig.2. The bridge looking north-west out towards the River Avon. The Clifton suspension bridge can be seen in the background.*

## Introduction

This document by Keystone Historic Buildings Consultants was first issued as an appendix to a 2020 Heritage Statement for the Albion Dock in Bristol for the ss *Great Britain* Trust, Keystone Report K 917. There were then thoughts of the bridge being moved to the Albion Dock. The plans for the Albion have changed since 2020 and moving the bridge there is no longer an option. This document, with some minor formatting changes, has been re-issued for the Brunel Swivel Bridge Group in connection with their campaign to establish a secure future for the bridge and find its continuing repair. The document has not been updated with research and analysis since 2020.

Brunel's Swivel Bridge is sometimes known as 'Brunel's Other Bridge' (to distinguish it from the much better-known Clifton suspension bridge) in the Cumberland Basin to the Albion Yard [Figs.1, 2]. The bridge, owned by Bristol City, is listed Grade 2*. Dating from 1849-1850 and visually unassuming, the wrought iron bridge is highly important as the work of I K Brunel's office and a project in which he was closely involved. It is of great technical interest, including elements that presage the Chepstow railway bridge (1852) and the Royal Albert bridge at Saltash (surveying started 1848, construction from 1853). The Bristol Swivel Bridge is beautifully made, parts of it a technical *tour de force* for the date (*pers.comm*. Geoff Wallis).

It is currently redundant, in poor condition and on the Historic England Buildings at Risk Register. Its condition is considered to represent an immediate risk of further rapid deterioration or loss of fabric and no solution for its long-term future has been agreed.

Since 2006 it has been looked after by the Brunel Swivel Bridge Group, formed in that year. Conservation work has been undertaken by a dedicated group of volunteers and, as fund-raising has permitted, contract work.

A Heritage Lottery Fund bid for the bridge, developed by the City in 2011, was unsuccessful. Since then the Brunel Swivel Bridge Group, the Bristol Industrial Archaeology Society (BIAS) and the Avon Industrial Buildings Trust (AIBT) have been working together to seek a future for the bridge that would provide the funding for all the conservation work needed, secure its future and engage people with the bridge.

## Acknowledgements

The section on 'Understanding' below draws heavily on Dr David Greenfield's seminal article of 2006, published online ('Brunel's Swivel Bridge', Cumberland Basin, Bristol, Interim Report 01', http://www.brunelsotherbridge.org.uk/bob_pre2013.html ). Jo Cox is very grateful for his generosity in sharing additional research. Thanks are also due to Geoff Wallis for a very informative guided tour of the bridge. Brian Murless, the author of a summary biography of George Hennet (who fabricated the bridge) in the Institute of Civil Engineers' *Biographical Dictionary of Civil Engineers in Great Britain and Ireland: Volume 2: 1830–1890* (2008) is currently preparing a more comprehensive publication on Hennet, and has also generously shared material. Other published sources used have been *Graces Guide* (www.gracesguide.co.uk/Cumberland_Basin_Bridges_(Bristol), the engineering timeline (www.engineering-timelines.com/scripts/engineeringItem.asp?id=45) and additional material, including a summary history of the bridge since 2006, published on the website, http://www.brunelsotherbridge.org.uk. The forthcoming publications by Greenfield and Murless will significantly advance the understanding of an important structure in I K Brunel's *opus* and the history of bridge engineering.

Thanks are also due to Professor Bill Harvey for patiently answering questions about 19th century bridges. Some research was undertaken by Jo Cox in the Bristol Record Office and Brunel Institute following in the footsteps of the authors of the published material. Any errors are hers.

**A Note on Names**

Documents sometimes name the south entrance lock 'Brunel's Lock' sometimes 'Lock B'. After 1871 the north entrance lock is sometimes called 'Howard's Lock'. After the complete closure of the south lock the north entrance lock seems sometimes to have been called 'the Lower Entrance Lock' (i.e. below Junction Lock) or just 'the Entrance Lock'.

# UNDERSTANDING

## *Summary*

*The wrought iron swivel bridge was part of a project designed by I K Brunel to enlarge and rebuild Jessop's c.1809 south lock at the west end of the Cumberland Basin, the entrance to the City's Floating Harbour from the tidal River Avon. The enlargement was needed to accommodate the increased size of shipping using the Bristol Docks since the completion of Jessop's Floating Harbour. This included north and south entrance locks to the Cumberland Basin. The bridge across the rebuilt south lock was designed as part of a route carrying traffic and pedestrians from the Bristol district of Hotwells, on the north side of the Cumberland Basin to Bedminster, on the south side. As Dr David Greenfield's research has established, the bridge drawings were produced in Brunel's office and he was closely involved in its design and in its fabrication by George Hennet.*

*Discussions about the rebuilding of Jessop's south lock can be traced back to a report to the Bristol Docks Company Committee by I K Brunel in 1836, but nothing was done until 1844, when Brunel provided another report. Construction of the new lock may have begun in that year, or perhaps later. The earliest mention of the bridge found to date by Keystone is January 1849 which records Brunel's intention to pay for the difference between his first design (for a rolling bridge) and his preferred solution of a swivel bridge.*

*The bridge opened and closed from a hand-cranked pivot on the south side of the lock. Its design and operation must have been satisfactory because a similar bridge, clearly derived from Brunel's design, was designed in 1863 by Thomas Howard, the Bristol Docks Engineer from 1855, to cross Jessop's north lock. Only five years later extensive improvements to the whole of the entrance to the Floating Harbour included the construction of a new, wider north lock, sometimes known as 'Howard's Lock'. The bridge designed in 1863 was removed, being too short to span the new north lock. The improvements to the Floating Harbour were formally opened in 1873 and in c.1874 Brunel's bridge was moved to Howard's new north lock and truncated to fit. It was swivelled off the dam between the south and new north lock. A third swivel bridge, similar in design to the others, was installed over the south lock in c.1875, completed 1876.*

*Very little documentation for Brunel's bridge in its secondary position has been found to date by Keystone, although it is suspected that there is more to be discovered in the very extensive holdings of the Bristol Record Office, which are not all helpfully-catalogued.*

*In 1962-65 the construction of the 'Plimsoll' swing bridge, carrying motor vehicles and pedestrians across the west end of the entrance to the Cumberland Basin, rendered the bridges over the north and south locks functionally redundant for vehicles. Brunel's bridge was left in place in the open position. It was neglected until 2006 when the Brunel Swivel Bridge Group was formed, dedicated to much-needed conservation, a better understanding of the bridge and seeking a solution for its long-term future. A Heritage Lottery Fund bid of 2011 by the City Council, associated with Sustrans, failed. There are historic links between the bridge, the history of the ss* Great Britain *site and the history of the Albion Yard (leased to the ss* Great Britain *Trust). A c.2020 scheme to move the bridge to the Albion Yard has been abandoned.*

## The Primary Phase of the Bridge: 1849-50

In the 1830s and 1840s I K Brunel was working as the consulting engineer to the Bristol Docks Company, advising on and designing improvements to Jessop's 1809 Floating Harbour. Changes were made to improve the flow of water through the harbour, to prevent its silting up and deteriorating into a semi-stagnant Bristol sewer. Changes were also needed to Cumberland Basin, the entrance to the Floating Harbour, separated from the tidal river Avon by Jessop's two entrance locks. The increase in the size of ships using the harbour relative to the size of the locks was a problem, as was maintaining land-based access across the locks between Hotwells, on the north bank and Bedminster on the south when Junction Lock, between the Basin and the Floating Harbour was open and its bridge unusable.

In 1836 Brunel provided the Docks Company Committee with a report on the smaller of Jessop's two entrance locks [Fig.3], the south lock, then in a poor state of repair, recommending its rebuilding. Nothing was done at the time and in 1842 he was asked again for his advice, this time with specific reference to the bridges over Jessop's entrance locks:

'The Board 'have directed that you will consider and report whether in your opinion any improvement can be made in the Bridges over the locks at Cumberland Basin by means of which the necessity for removing the bridges for the passage of large steamers may be obviated and inconvenience and expenses incurred therein saved to the Company' (Bristol Archives, PBA/Corp/CO/1/4).

Brunel provided a report that was discussed by the Committee at a meeting on the 15 July 1844 (Bristol Archives, 45235/15/6/3). He had sent one of his assistants to Sunderland, to check the lock he had designed at the docks there in 1834 and which had held up well to heavy use. This influenced his recommendations which were comprehensive rebuilding and enlargement of the south lock without mentioning a bridge. The poor condition and inadequate width of the entrance locks must have been sharply felt by Brunel at the time of this meeting, given that the ss *Great Britain,* then the largest ship in the world, was moored in the Floating Harbour for completion and needed to exit the harbour for her sea trials. As a report of the meeting in the press recorded, the discussion included a reprise of how Brunel came to be asked for the 1842 report. Discussions between Brunel and the Docks Company about how the ss *Great Britain* was to exit the Floating Harbour pre-dated her floating out of the dock in which she was fabricated in 1843. In the course of those discussions Brunel had 'trusted' that the north lock was, in fact, as wide as had been dictated by the Act of Parliament for the construction of the Floating Harbour. Jessop's north lock was duly measured and it was found that subsidence had rendered it slightly narrower than the Act required. In the course of widening it, it was noted that the masonry was in poor condition; this led to examination of the south lock masonry and prompted the Committee to ask Brunel for a report (*Bristol Mercury*, 20 July 1844).

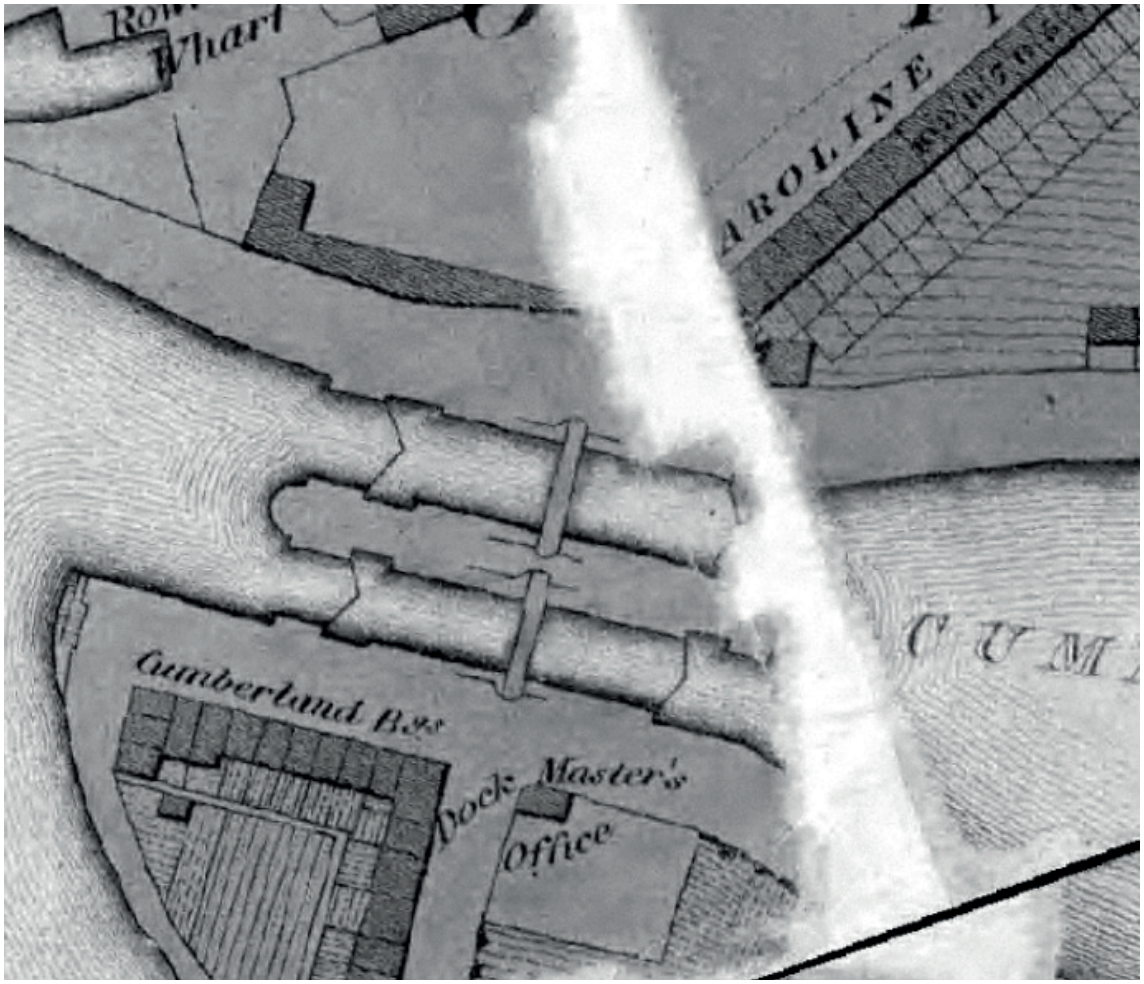



*Fig.3. Jessop's two entrance locks shown on an extract from Ashmead's map of 1828. https://maps.bristol.gov.uk/knowyourplace.*

Malpass and King describe the rebuilding of the south lock as 'a prolonged and unhappy experience for Brunel' (*Bristol's Floating Harbour: the first 200 Years*, 2009, 55). Work is said by them to have begun in 1844 but the completed project was not handed over to the dock master until October 1849. The project spanned the 1848 acquisition of the Floating Harbour by the Bristol Corporation, who purchased it from the Dock Company.

There were innovative features to the design of the rebuilt south lock. Instead of timber gates the lock had single caisson gates at either end. These seem to have been the second only caissons in the Bristol docks, the earliest being the c.1843 caisson at the Great Western Dock. This had been installed after the mouth of the dry dock had been broken through in 1843 for the ss *Great Britain* to be floated out. Presumably the caisson gates at the rebuilt south lock were considered more efficient than timber gates operationally but seem to have caused trouble from early on. The main contractor for the south lock work was Rennie and Co. The on-site contractor was George Hennet.

The earliest mention of the bridge found by Keystone is in a record of a Docks Committee meeting on 20 January 1849:

'Mr Brunel also stated that in consequence of difficulties principally connected with the foundations which he had experienced in carrying out his original design of constructing it as a rolling bridge he now contemplated altering it to a Swing Bridge the plans of which he should be prepared to submit to the Board on Monday the 19th inst. He also intimated his intention of sustaining the expense of the proposed alteration himself.' (Bristol Archives, PBA/Corp/M/2/1)

Brunel's offer to pay for the difference between the cost of a rolling bridge (to be opened by retraction on wheels on rails) and his second design was recollected much later in a newspaper report of 1862 (*Bristol Daily Post,* Wednesday 5 February 1862) which may not be wholly reliable, but implies that his first design was quite advanced (including a model?) before it was abandoned. The published records of the Dock Company's receipts and payments for the year ending 30 April 1848 included, under the title 'By the repairs and enlargement of the south entrance lock' a payment on account to 'contractors of £2,000 and a payment on account 'to Contractor' for new lock gates, £1,750 and 'for rolling bridge' £1,500 (*Bristol Times and Mirror*, Saturday 24 June). The bridge that was built was called the Swivel Bridge.

## The Primary Design of the Bridge as Built [Figs.4-5]

Dr Greenfield, who has researched the bridge in depth, states:
'...The bridge design was carried out in Brunel's office, 18 Duke Street, Westminster, and drawings and instructions were sent from there to William Bell, Brunel's 'assistant engineer' (resident engineer in all but name) at Bristol docks. The first rough tracing of the proposed 'Swivel Bridge' (so called from then on by Brunel's office) was sent down on 16 February 1849, so that the wrought-iron plates could be ordered. As the design and fabrication advanced, drawings were sent to amend, clarify and refine the details'. A written specification (so far not located) was not produced until 3 April 1849, by which time there were only minor design details still to be decided.

The earliest drawing so far located is dated 16 March 1849, showing the plan and elevation of 'Swivel Bridge 76ft Opening'; a copy letter of the same date in Brunel's letterbook refers to this tracing having been sent to Bell that day. The overall length of the bridge as drawn is 121ft 9ins; 87ft 9ins main span plus 34ft for the 'overhanging end' or 'tail' (so called). This and

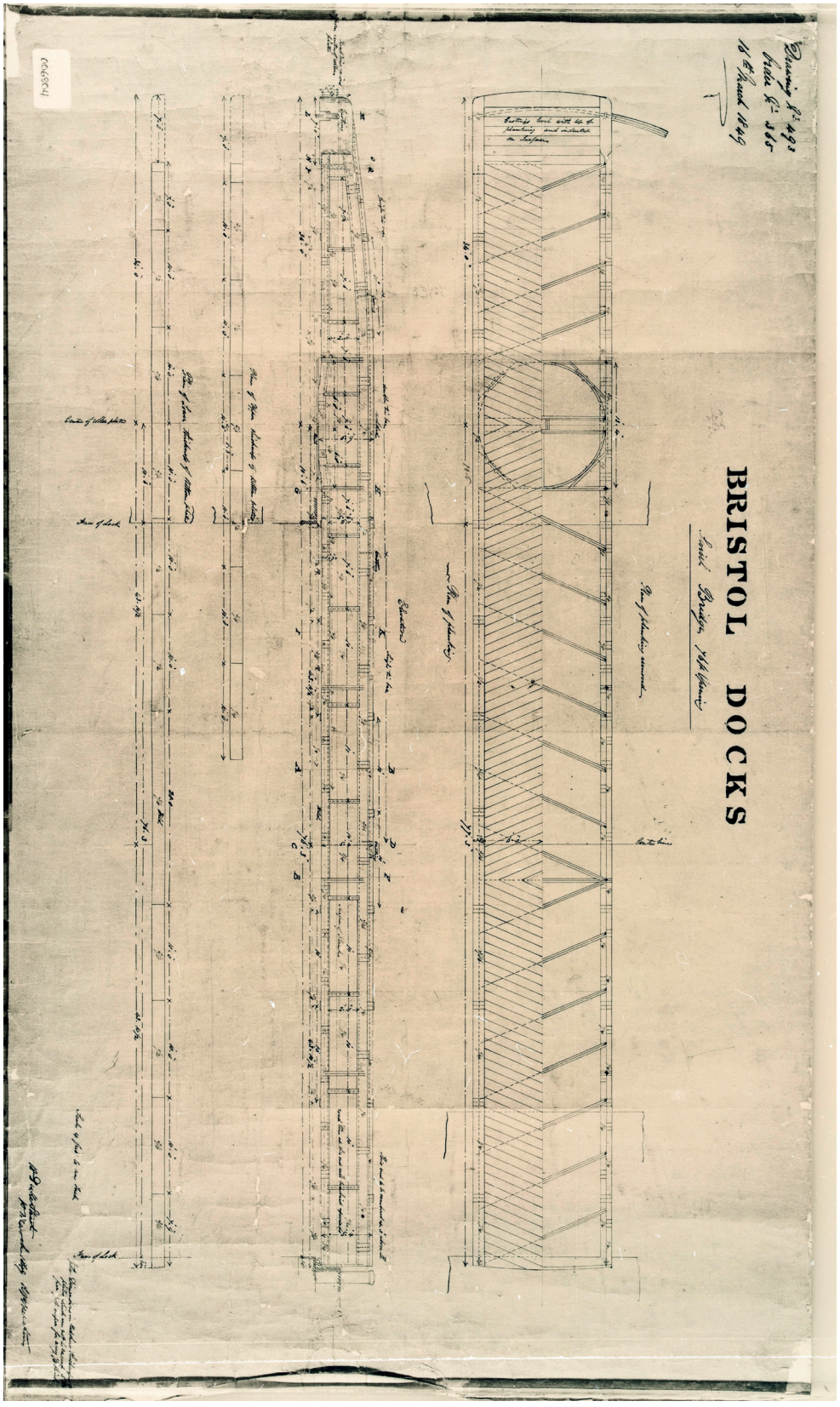



*Fig.4. Drawing of the bridge from Brunel's office, dated 16 March 1849. Bristol Archives, 45054.C.Drawer 6/07624.*

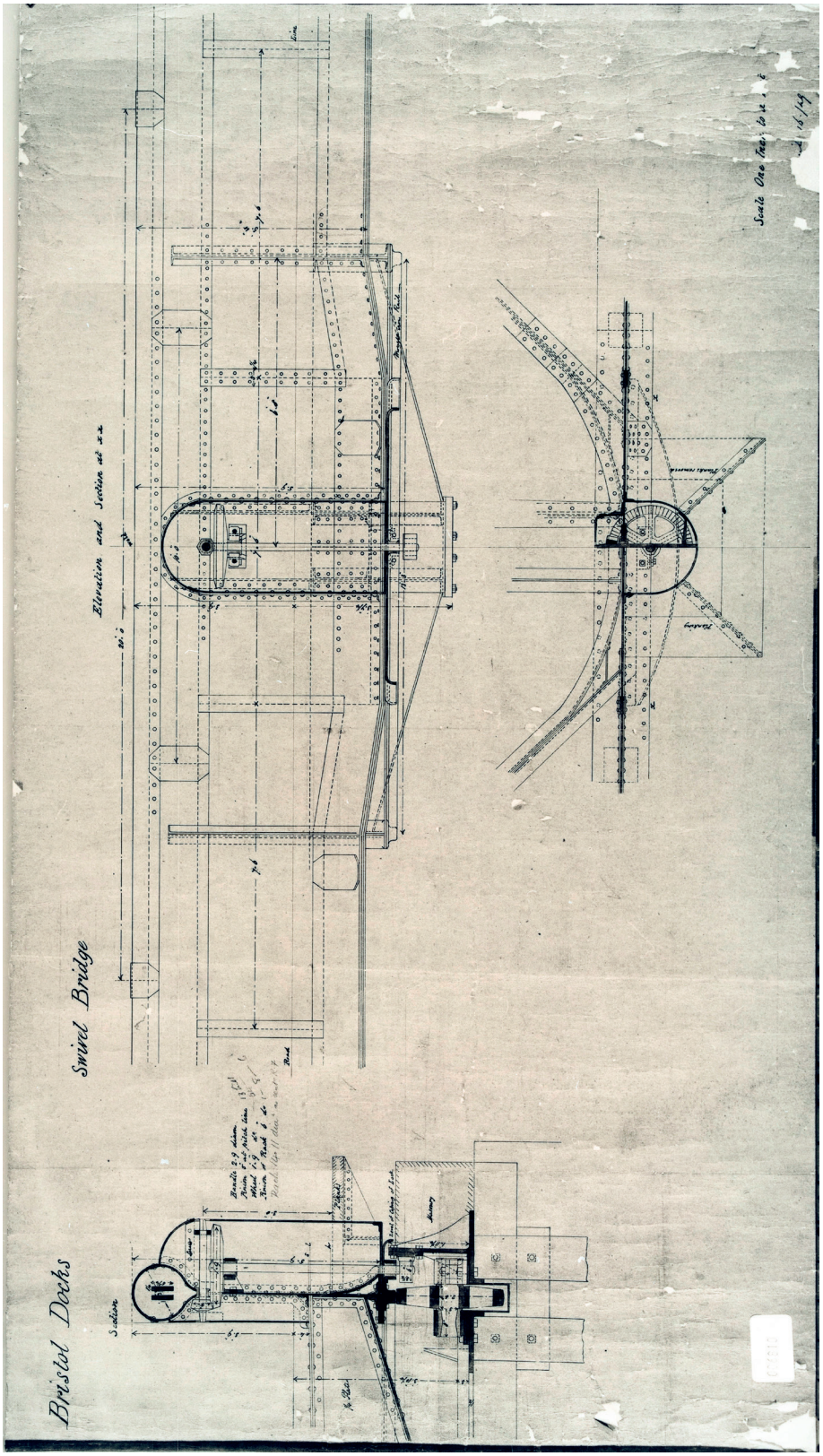



*Fig.5. Drawing of the bridge from Brunel's office, dated 16 April 1849. Bristol Archives, 45054.c.Drawer 6/07630.*

subsequent drawings highlight two areas of particular interest in historical civil engineering terms:

1. the use of wrought iron plate girders with tubular flanges - the top flanges being cylindrical (or, more accurately, inverted pear-shaped), and the bottom triangular; and

2. the use of longitudinal pre-stressing 'tie' rods within the top flanges.

No drawings or correspondence have been found to suggest there were subsequent alterations in the leading dimensions and details.

Robert Brereton, Brunel's chief assistant, signed off the drawings and letters, and was probably responsible for the detailed design. However, it seems likely that Brunel closely monitored progress both in the design and its execution - for example, in April Brereton wrote to Bell that one of the detail drawings was ready and that 'as soon as Mr Brunel has looked at it, it shall be sent'. From time-to-time Brunel's opinions and preferences were forwarded to Bell for action. When it was near time to cast the main bearing wheels in April 1849, Brereton told Bell, 'Mr Brunel likes generally to see these things in the patterns [i.e. before casting], you had better get Jones [probably Hennet's works manager] to ask him to look at them when he is in the yard.' In July Brunel himself wrote to Hennet, instructing him to make some alterations; presumably Bell was not authorised to give such instructions.

The bridge was sufficiently complete by 8 October 1849 for it to be swung open and shut. Following some final adjustments, on 29 October the Dock Master reported to the Committee that the bridge had been handed over to him, complete and fit for use. The following day Brereton instructed Bell not to apply the final coat of paint 'till Mr Brunel sees the bridge'. It is not known when Brunel made his inspection, but Brereton told Bell that he intended to make his own inspection during a proposed visit to Bristol on 10 December.

On 2 February 1850 Brunel's chief clerk, Joseph Bennett, sent Hennet's final account to the Docks Committee's secretary, Edward Hinton, for payment. Two days later Bennett wrote to Hinton asking what form of completion certificate the Dock Directors wished Brunel to provide. The construction phase was effectively complete' ('Brunel's Swivel Bridge', Cumberland Basin, Bristol, Interim Report 01', http://www.brunelsotherbridge.org.uk/bob_pre2013.html.

The engineering timeline describes the bridge as shown in the drawing of 10 March 1849: '37.1m long overall and swivelling about a pivot — a main span of 26.75m plus 10.35m for the "tail" (counterbalance) end. The pivot is placed centrally across the width of the structure. The bridge is of riveted wrought iron plates. It consists of two main girders with tubular flanges. The top flange is almost cylindrical, taking an inverted pear shape, the bottom one is near triangular and 394mm deep. The top flange follows an upward curve, resulting in a maximum girder depth of 1.75m over the pivot. Vertical plate web stiffeners are spaced at about 5.9m on the inner sides of the main girders.

The transverse distance between main girders is 4.05m, centre to centre. Connecting cross girders of 305mm x 6mm web and 63mm x 63mm x 10mm angles are spaced generally at 3.1m centres, set at a slight skew in plan. The cross beams support bridge decking of 127mm timber, sheathed diagonally at 38mm.

Twin wrought iron, pre-stressed tie bars run longitudinally inside the top flange, providing

rigidity. They are anchored at the tail end and some 10.5m from the pivot at the opposite end. The counterbalance weights that form the tail end are of cast iron.

The wall and base of the pivot pit are of cast iron. The roller path, attached to underside of the bridge, rests on four cast iron rollers, each 762mm in diameter with 102mm cambered treads, running in bearings fixed to the pit bottom. Originally the bridge was operated by hand through vertical pinions engaging in a rack cast into the inner edge of the pivot pit wall' (www.engineering-timelines.com/scripts/ engineeringItem.asp?id=45).

In addition to having discovered the drawings of the bridge from Brunel's office in the Bristol Record Office, Dr Greenfield has researched Brunel's journals and letterbooks for 1849 and 1850 and transcribed all the correspondence relating to the construction of the bridge (*pers. comm.*). These are mostly letters from Brereton to Bell, some including sketches.

In the same period, notably in May and June 1849, Brunel was preoccupied with the design of the Chepstow Bridge over the River Wye (*pers.comm*. Dr David Greenfield) and personally wrote several letters to Bell instructing him to undertake experiments to establish girder deflection.

The construction progress of the south lock, including the bridge, was slower than had been hoped and the reports of the Docks Committee meeting record pressures on Brunel to complete the work:

'The bridge for the new lock at Cumberland Basin was being vigilantly proceeded with and that he has promised that in a week or ten days one half of the Fender would be entirely framed up' (21 May 1849, BRO PBA/Corp/M/2/1) and 'Mr Bell reports that the bridge and platform were proceeding as fast as is practicable' (26 May 1849, BRO PBA/Corp/M/2/1).

Published histories state that Brunel signed the bridge off in February 1850, but Keystone has been unable to find any reference to this in the documentation searched. Brunel certainly certified the lock fender as complete in January 1850 and the caisson gates in March of that year. Some elements of the completion of the bridge were specified in-house by the client at the end of the project, e.g. laying the wooden deck (February 1850) and the final painting of the bridge (October 1850).

**Contractors**

In addition to Brunel's own staff, Brereton in London and Bell in Bristol, both Greenfield and Engineering Timelines (www.engineering-timelines.com/scripts/engineeringItem.asp?id=45) identify the main contractor for the south lock as Rennie or Rennie and Co. In April 1849 Brunel estimated that the amount due to Rennie and Co for the new lock was £4,500.

The on-site contractor was George Hennet (1799–1857) a railway engineer and contractor, who had first worked with Stephenson, then with Brunel on several GWR projects: surveying, track-laying, bridges, viaducts and stations. He later went on to provide and lay the pipes for Brunel's atmospheric railway and built the atmospheric railway engine houses. By c.1848 Hennet had an iron works in Bristol. The site was just off Cumberland Road, adjacent to the Great Western Steamship Works, where the ss *Great Britain* had been designed by Brunel and the other members of the Great Western Steamship Company design committee, fabricated and fitted her engines fitted. Hennet's iron works was on land on the south side of the Floating Harbour that had been acquired by James Hilhouse and Sons, ship-builders in c.1820 and on which they developed the shipyard later known as the Albion [Fig.6]. They leased out portions

of this substantial property from time to time. Hennet's ironworks later became the site of an industrial scale malthouse and then McArthur's warehouse. Murless has researched an unrelated matter between Brunel, Hennet and Thomas Guppy (on the Building Committee of the *ss Great Britain* and the 'virtual founder' of the GWR Company, according to Rolt) during the construction of the swivel bridge.

At the south lock, Cumberland Basin, Hennet was responsible for making the innovative caisson gates of the lock, the 'platform next to the lock', and the 'fender' as well as the bridge. At the same time as he was working on these, he was also producing, at Bristol, the ironwork for Brunel's bowstring girder railway bridge carrying the Windsor/Slough line over the Thames. Geoff Wallis reports that the Swivel Bridge was constructed by Hennet to a very high standard including some very difficult technical features (*pers.comm.).*

An historic photograph dated 1858 (Bristol Culture, P3219) taken from the east, shows Brunel's bridge over the south lock and a conventional box girder bridge over Jessop's north entrance lock [Fig.7]. Ashmead's map of 1855 clearly shows the rebuilt south lock wider than its north lock partner [Fig.8].

## 1863-1875

Brunel's bridge must have been an operational success as in 1863 the Docks Committee decided to install a similar bridge over Jessop's north entrance lock. An advertisement was placed in the *Bristol Times and Mirror*, Saturday 08 August 1863.

'BRISTOL, DOCKS. THE DOCKS COMMITTEE are prepared to receive TENDERS for the construction and fixing IRON SWIVEL BRIDGE over the north lock, Cumberland and Plans may seen at the Office of Mr. HOWARD, Docks Engineer. Cumberland Tenders, addressed to the Secretary, 18, Queen Square, must be delivered before noon, on MONDAY, the 24th Inst. The Committee do not bind themselves to accept the lowest or any Tender.'

Drawings of the bridge for Jessop's north lock, signed by Thomas Howard (docks engineer from 1855), are dated 26 August 1863 and annotated as 'drawings referred to in the contract between Bristol Docks Committee and Messrs Hennet, Spink and Else, Bridgwater, for swivel bridge, north lock, Cumberland Basin'. George Hennet had been declared bankrupt in 1853 and died in 1857 but his Bridgwater foundry, established c.1845 was carried on by his second son, Follett Charles Hennet, with Daniel Spink and Richard Charles Else. This bridge over Jessop's north lock was shorter than Brunel's bridge over the enlarged south lock, 77 feet compared with Brunel's 122 feet. Although visually a match for Brunel's bridge, some of the technical details of the shorter north lock bridge were different. The curious tie rods through Brunel's balloon flanges were omitted.

The Hennet, Spink and Else bridge did not last long in its primary location. Jessop's north lock, like the south lock before Brunel's enlargement, was proving too small for the increased size of ships and many of the other primary arrangements at the Cumberland Basin needed updating to accommodate the large steamers using the Floating Harbour. An Act of Parliament for the improvement of Cumberland Basin was passed in 1865. A photograph of that year shows the entrance to the Cumberland Basin shortly before alterations [Fig.9].

The Act was followed by a comprehensive scheme from c.1868-c.1874 to upgrade the entrance to the Floating Harbour to the designs of the Docks Engineer, Thomas Howard. Obstacles to shipping in the Avon were removed. A new Junction Lock, the lock between the Cumberland

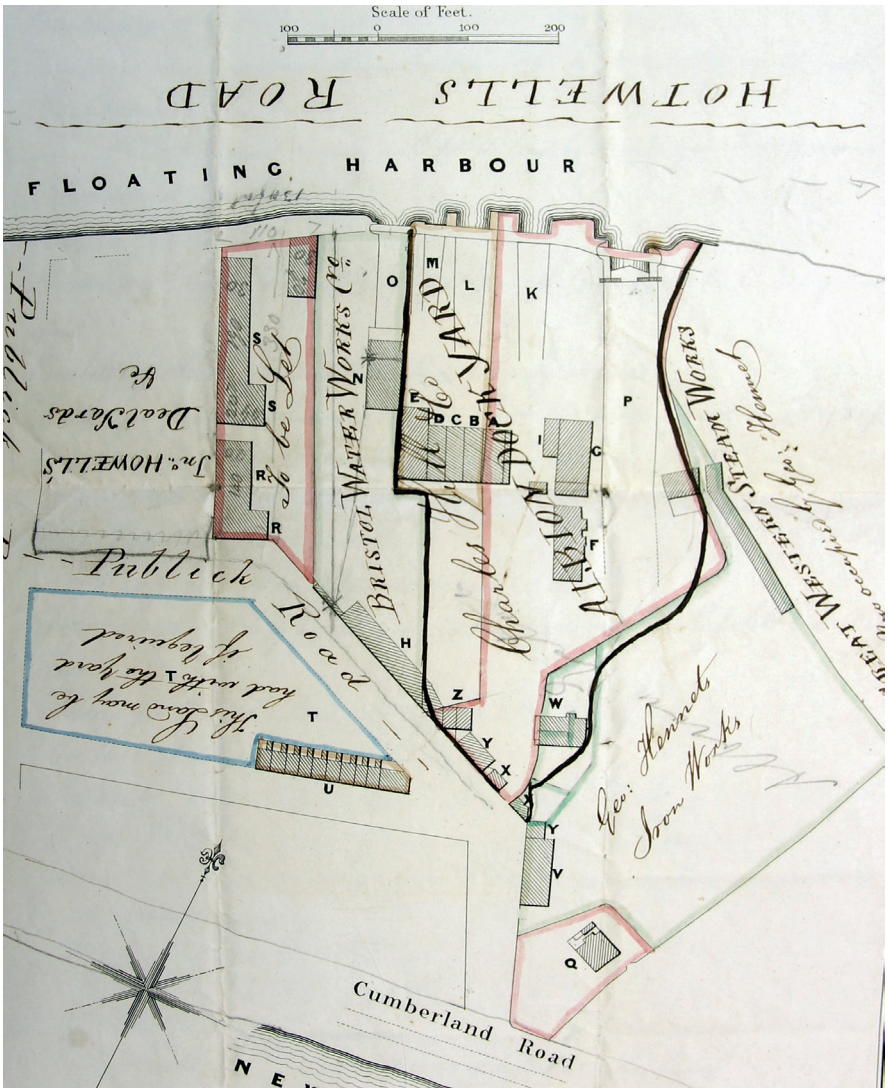



*Fig.6 George Hennet's iron works shown as a c.1848 annotation on an earlier plan of the Hilhouse family shipyard, later Charles Hill's Albion dockyard, on the south side of the Floating Harbour, next to the Great Western Steamworks where the ss* Great Britain *was built. NMM HIL/82/6.*



*Fig.7. 1858 photograph looking east into the Cumberland Basin. Brunel's south lock with the swivel bridge is shown on the right, wider than Jessop's north lock on the west. Bristol Culture,P2319.*

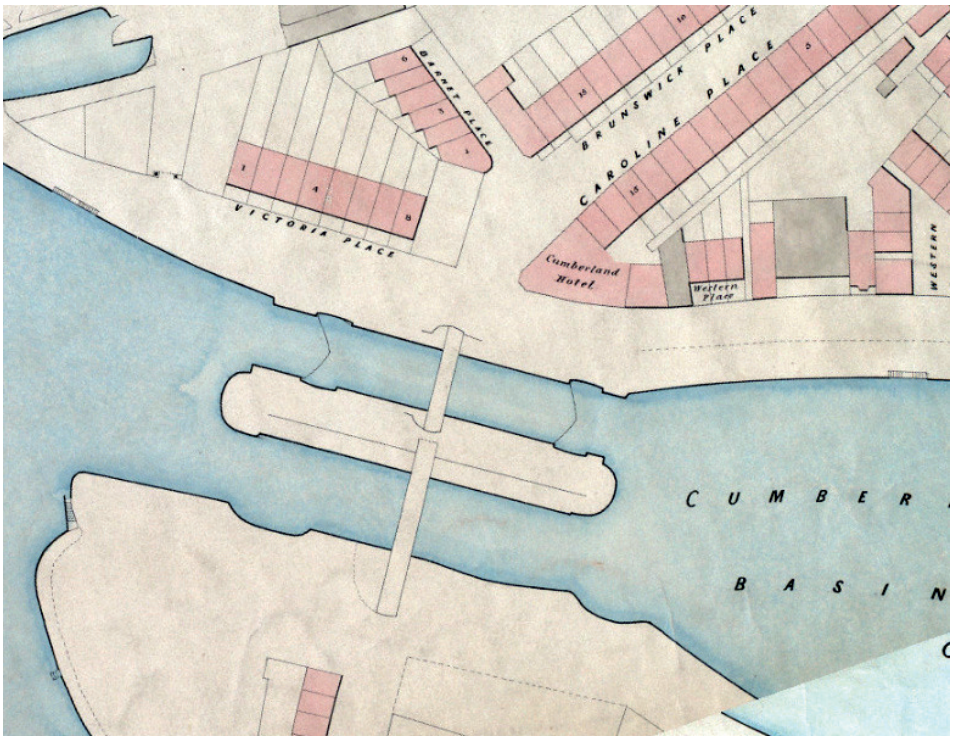



*Fig.8. Extract from Ashmead's 1855 map of Bristol showing Brunel's south lock and bridge and Jessop's north lock. https://maps.bristol.gov.uk/knowyourplace.*



*Fig.9. A photograph looking east into the Cumberland basin, taken between 1865 and 1867 shows the entrance locks before Thomas Howard's massive works of improvement. Brunel's south lock on the right is shown with its west end caisson gate closed. Bristol Culture, P10912*

Basin and the Floating Harbour, was built with a new swing bridge by the Avonside Engine Company, Bristol. Roadways on the Hotwells side of the Basin were redeveloped, new quays built and a new, larger north entrance lock was built, north of Jessop's original. It survives and is sometimes known as 'Howard's Lock'. In 1871 a hydraulic engine house was opened on the north side of junction lock. The shell of this survives as 'The Old Pump House' [Fig.10].
The machinery was by Sir William G Armstrong and Co. of Newcastle and hydraulic power used to open and close the Cumberland Basin lock gates, swing bridges and capstans, massively reducing the time and manpower that had previously been required for shipping to enter and exit the Floating Harbour. The new works were formally opened on 19 July 1873, a date especially chosen to match the launch of the on the 19th July, 1837 of the *Great Western* steamship and the floating out of the *ss Great Britain* in 1843 (*Western Daily Press,* Monday 21 July 1873).

It is thought that the 1860s bridge fabricated by Hennet, Spink and Else, too short to span Howard's new north lock, was moved to Bathurst Basin [Fig.11], although documentary evidence for this has not been found by Keystone.

Primary and secondary sources that refer to bridging the new north lock are puzzling. In April 1872 Howard was 'authorised to adapt the present bridge at the Entrance Lock Cumberland Basin for the purposes of the new works' (Bristol Archives, PDA/Corp/M/2/7). This has been plausibly interpreted as permission to adapt and move Brunel's bridge to span Howard's new north lock. However, over a year later a newspaper report covering the formal opening of the new works implies that the question of the bridge had not been settled ... 'The bridge near the clock-tower is, we understand, to be transferred to the new lock [presumably this means the new north lock?], where it will face the street leading from Hotwell Road; another will be put in its place, but whether any alteration will be made to the gates on that side of the lock has not been finally settled' (*Western Daily Press,* Monday



*Fig.10. The tower of the former 1871 hydraulic engine house just north of Junction Lock.*

21 July 1873). The location of the 'bridge near the clock-tower' has not been identified by Keystone. Ashmead's map of Bristol, published in 1874 (date of survey uncertain) shows no bridge over the north lock and a swivel bridge over the south lock [Fig.12]. No documentation has been found to date by Keystone recording the transfer of Brunel's bridge from the south to the north lock but there are indications that it had been removed from the south lock by June 1874, but was perhaps not installed over the north lock until later in the year. As Greenfield notes, the bridge was shortened by 10 feet to fit (Greenfield, 2006).

Earlier in the 1870s, in 1872, the Docks Committee had had plans to convert the south lock into a public graving dock, estimated cost £11,000, as part of the Cumberland Basin improvements (*The Port of Bristol 1849-1884*, Bristol Record Society, vol.36, 29 June 1872). The masters of steam vessels objected to this in a memorial to the committee in November 1873, preferring the south lock left open to allow a one-way system for steamers in and out of the Floating Harbour. The memorial was discussed in June 1874 and Thomas Howard was instructed to estimate the minimum cost of placing Brunel's rebuilt south lock, then in a neglected state, in repair, distinguishing between the cost of a new bridge and the necessary repairs to the Lock 'omitting the hydraulic apparatus'. It is not clear whether this means that Brunel's bridge over the south lock had been adapted from hand-cranked operation to hydraulic operation along with the other moving infrastructure of Cumberland Basin from c.1871, or whether it had remained hand-cranked before it was moved.

The abortive plans to close the south lock and the removal of Brunel's bridge in expectation of closure explain what otherwise seems an odd and costly procedure: moving his bridge from the south to the north lock, and then commissioning a new bridge over the south lock. In the same month as the memorial, June, Howard estimated that the cost of a new bridge over the south lock would be about £4,000 and repairs to the 'caisson gates timber dolphin etc.' £3,500 and he was instructed to prepare plans for a new bridge (*The Port of Bristol 1849-1884*, Bristol Record Society, vol.36). The contract for making the new bridge, very similar to Brunel's bridge, was won by Messrs Edward Finch and Company Limited, Bridge Works, Chepstow on an estimate of £1,955, cheaper than Howard had expected. The Bristol Record Office holds a set of seven contract drawings for the bridge, dated 1874, and it was reported as 'about to be delivered' in July 1875 (*The Port of Bristol 1849-1884*, Bristol Record Society, vol.36, 5 August 1875) and completed in August 1876. It was a near copy of both its 1849-50 predecessor and Hennet,

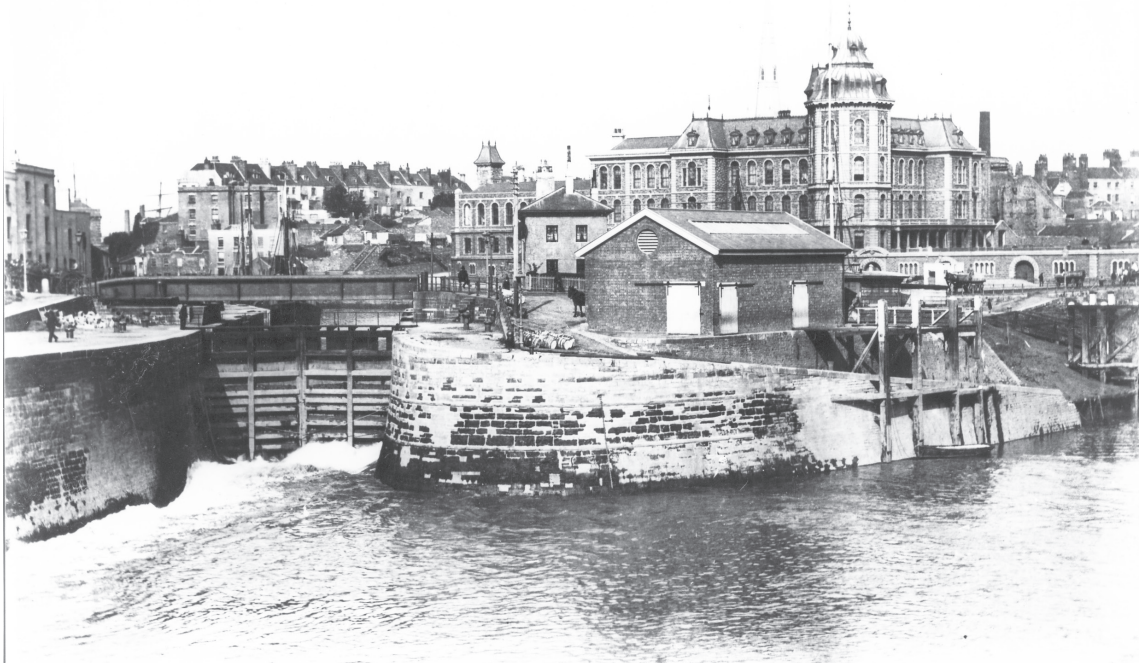


*Fig.11. An undated photograph showing centre left what is probably Thomas Howard's 1863 near copy of Brunel's swivel bridge, moved from its primary position over Jessop's north entrance lock to the Bathurst Basin after the north entrance lock was rebuilt. Bristol Culture, PD10255.*




*Fig.12. An extract from Ashmead's map of 1874 (date of survey unknown) shows no bridge over Howard's new north entrance lock and the Brunel Swing Bridge still in place over the south entrance lock. Compared with Fig.3 this shows the scale of demolition and reconstruction associated with the new north entrance lock. The stub of Jessop's north entrance lock can be seen adjacent to the west end of Brunel's lock. https://maps.bristol.gov.uk/knowyourplace.*

Spink and Else's 1863 north lock bridge and survives over the south lock, listed Grade 2*.

## 1875-c.1968

To date little documentation has been found by Keystone about Brunel's bridge after the move to the north lock.

The increase in motor traffic across the Cumberland Basin prompted plans to provide footways to keep pedestrians safe. Footways inside the parapets of Brunel's bridge were proposed in 1901 although it is not known whether these were executed.

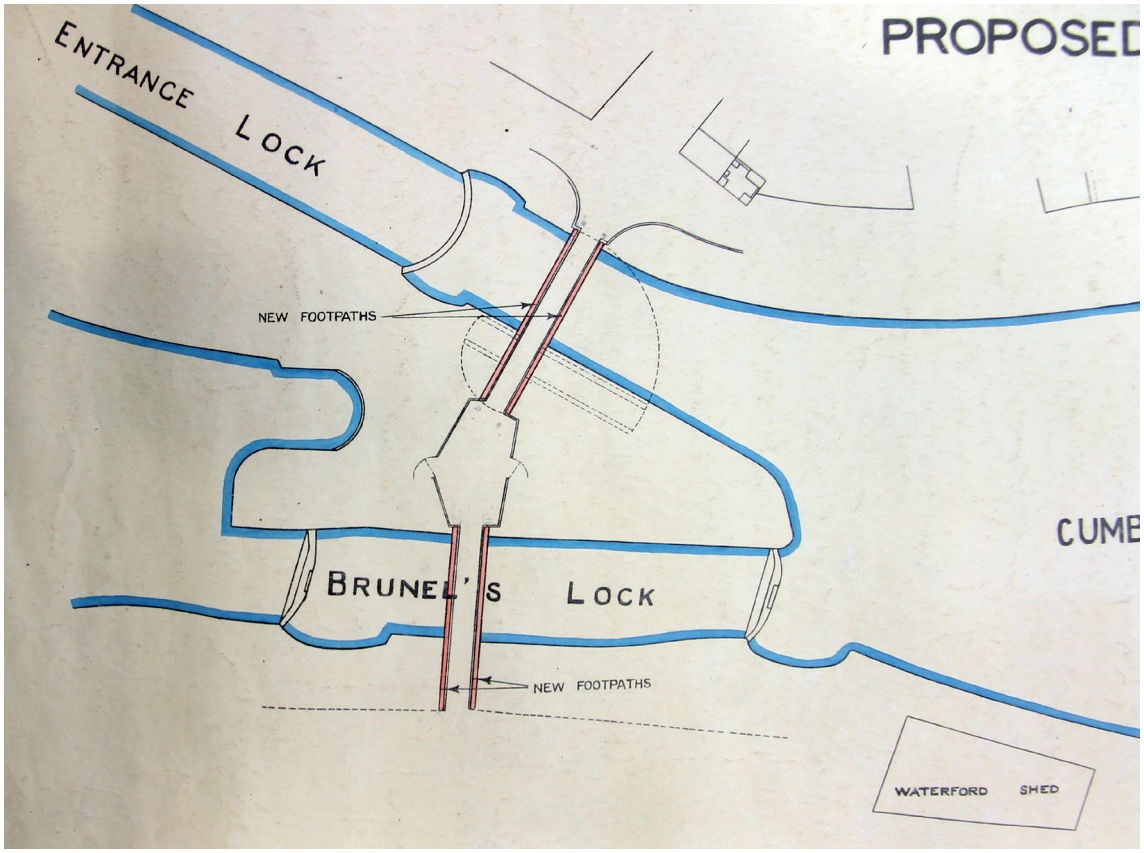
Drawings of hydraulic turning gear by Armstrong and Whitworth in the Bristol Record Office are dated 1902 and 1903, one entitled 'Bridge over Entrance Lock'. These most likely represent a renewal rather than an introduction of hydraulic power for opening and closing Brunel's bridge. In 1887 John Girdlestone, the Docks Engineer who succeeded Howard in 1882, had designed a new hydraulic engine house in the Bristol docks works yard, the Underfall Yard, on the south side of the Floating Harbour. This engine house with Simpson and Co. machinery was complete by 1889. By 1895 it is documented as providing power for the Corporation Granary (on the site of M-shed) and for the lock gates of Junction Lock but the north entrance lock is not mentioned. It is not clear to the author of this report if the 1902-03 Armstrong and Whitworth drawings relate to a transfer of hydraulic power from the north hydraulic engine house to the engine house in the Underfall Yard. A plan of the known routes of hydraulic pipework through the City Docks shows that the north lock has been connected to both hydraulic engine houses (Fisher and Powell, 1979). The pipework remains have not been dated.

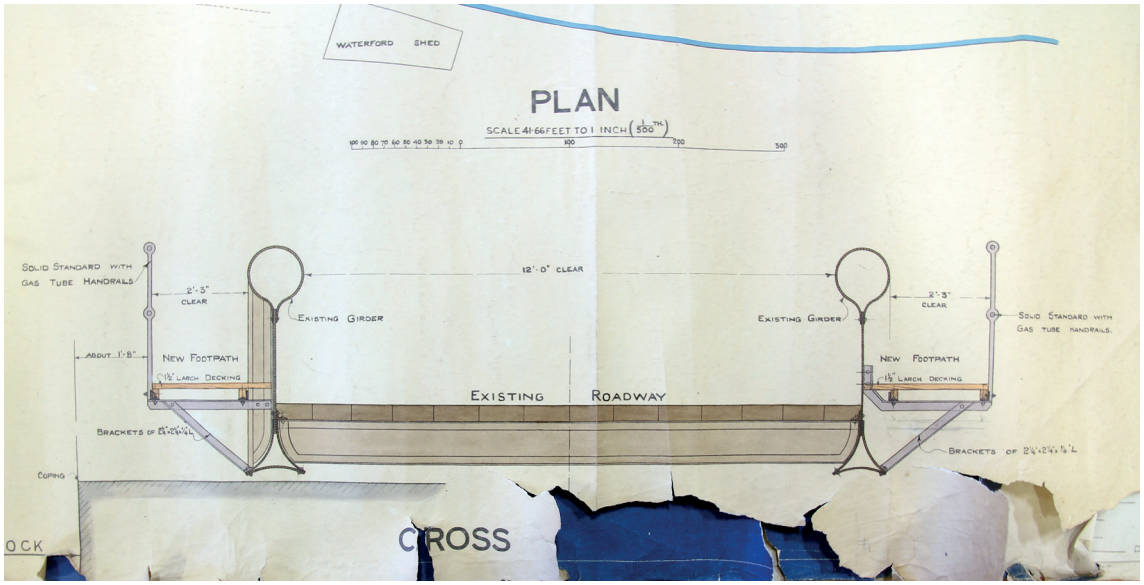
In 1905-06 the 2-tier Ashton swing bridge (rail below, road above) across the Avon was built. It was part of the GWR Bristol Harbour lines from the Portishead branch to Canon's Marsh and Wapping Wharf. It substantially increased the road traffic across the Cumberland Basin and notices were erected on both the south and north lock bridges stating that each had a safe limit of 8 tons. In 1924 drawings [Figs.13,14] show external footways were added to both the north and south lock bridges, cantilevered off the outside of the parapets. These appear to have been executed and were not removed from the Brunel bridge until 1985 (Bristol Archives, 42054.G.Drawer 1/01435).

An extract from a 1934 plan of the Floating Harbour shows the entrance arrangements with five swing bridges: the north and south entrance lock bridges, junction lock road and rail bridges and the Ashton railway/road bridge [Fig.15].

Traffic congestion at the west end of the Floating Harbour became chronic by the mid 20th century and in 1962-65 another massive improvement scheme was implemented, this time to roads at the west end of the City [Fig.16]. Road traffic was taken across the mouth of the City Docks just east of the two entrance locks on a swinging bridge, called the 'Plimsoll Bridge' with two traffic lanes in both directions and a pavement for pedestrians. The bridge was designed by Oleg Kerensky working for Freeman Fox and Partners. The Plimsoll Bridge rendered Brunel's bridge over the north lock redundant. It was left in place, fixed in the open position since 1968, its east end sheltered by the Plimsoll Bridge [Fig.17].

The 1870s restoration of the south lock and the Hennet Spink and Else bridge over it was wasted, as it turned out. The south lock was simply not used after the new north lock was opened. Thomas Howard would have liked to abandon it altogether but the Docks Committee thought otherwise. In 1894 a steamer landing was built in the entrance (Lord and Southam,




*Figs.13, 14. Extracts from a plan of 1924 showing proposed footways across both the south and north entrance locks. These were cantilevered off the outside of the parapets of the bridges to retain maximum width for traffic. Bristol Archives, PBA/Mgt//P1/9/7/6 (2).*

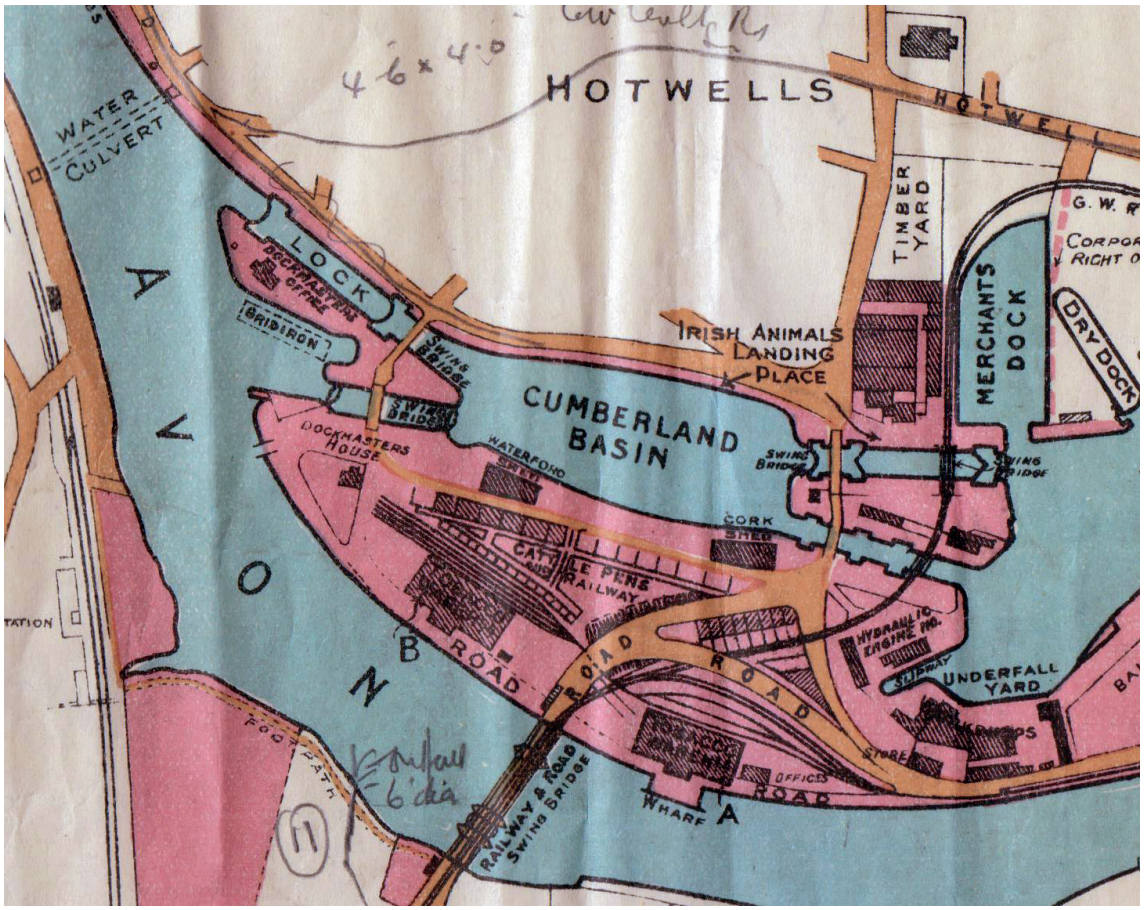



*Fig.15. Extract from a January 1934 plan of the Floating Harbour showing the entrance arrangements at that date. Photographed by Jo Cox in a collection of plans at the Underfall Yard in 2013.*

1983, 47) and in 1929 the caisson gates (probably replacements of the originals) were put up for sale (*Western Daily Press* - Monday 16 September 1929). In 1962 the bridge was truncated (BRO aperture card 42054.G.Drawer4/18823).

## 1968-2019

After 1968 there was little motive for maintaining the bridge, although one drawing of 1985 in the Bristol Archives proposes minor repairs and repainting, as well as the removal of the cantilevered footways [Fig.18]. Geoff Wallis reports that while the footways have been removed the blast-cleaning, painting, and insertion of wax from Dinol Protectol into the top tubes of the girders was not carried out (*pers.comm.*) The bridge is in a context of an unlovely, noisy and complex road system above and beside the entrance to the Cumberland Basin.

After 1965 the importance of Brunel's Other Bridge was overlooked. The 1971 Act of Parliament for closing the City Docks to commercial traffic prompted a listing survey of the structures of the Floating Harbour and the bridge was listed Grade 2* in 1972. However it was physically neglected until 2006 when the Brunel Swivel Bridge Group was formed. By this date there was some uncertainty about which of the bridges at the south and north entrance locks was Brunel's. Dr Greenfield's interim report of that year authenticated the north lock bridge as Brunel's. Research and a phased programme of conservation works followed, both



*Fig.16. An undated aerial photograph looking north east taken shortly before the construction of the new road system and Plimsoll bridge.*



*Fig.17. Part of the swivel bridge is sheltered by the Plimsoll Bridge, opened in 1965.*

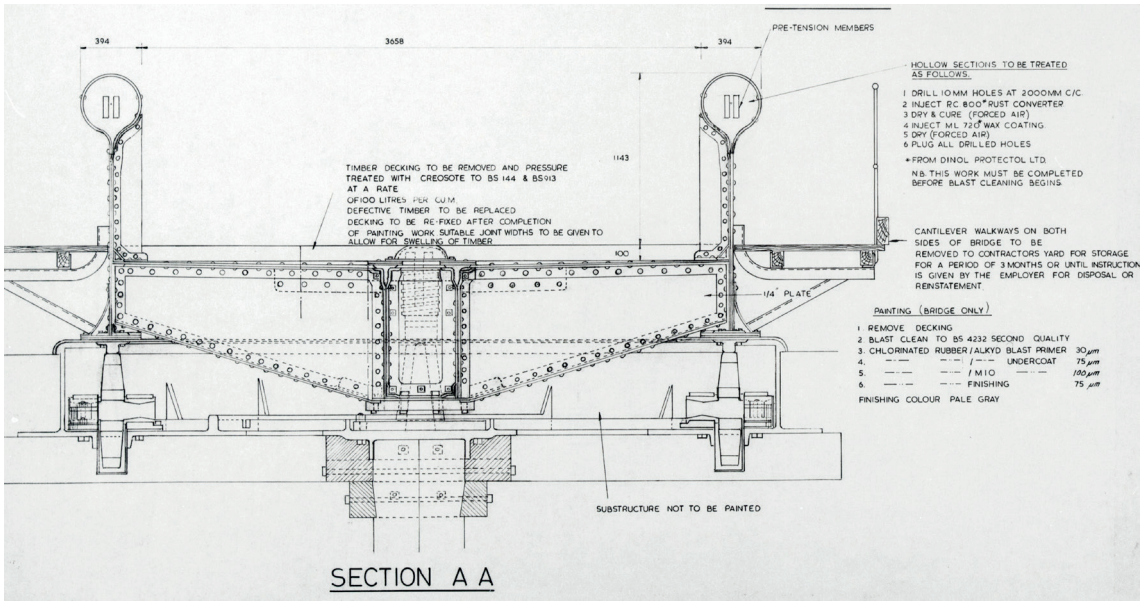



*Fig.18. Extract from a maintenance worksheet for Brunel's bridge, dated Feb 1985. BRO 42054.G.Drawer1/01435. This appears to be the date when the c.1924 footways were removed but much of the proposed work was not done.*



*Fig.19. Accurate replacement of part of the swivel mechanism, one element of the conservation work undertaken since 2006.*

by dedicated volunteers overseen by Geoff Wallis and contractors, and are ongoing [Fig.19]. The contracted work has been funded by grants from Historic England, the Bristol Visual and Environmental Group and the Co-op Local Community Fund.

A Heritage Lottery Fund bid of 2011/2012 by the City Council, associated with a Sustrans cycle route, failed. This included expensive and controversial proposals to dismember the bridge, move it to a repair site, possibly on the south quayside of the Cumberland Basin, and to return and reassemble repaired components. After the failure of the bid it was decided that the combined efforts of the Brunel Swivel Bridge Group, the Bristol Industrial Archaeological Society (BIAS) and Avon Industrial Buildings Trust (AIBT) could move this forward independent of the Council, but with their agreement and co-operation (www.brunelsotherbridge.org.uk).

Since 2017 ideas for a major Bristol development have been discussed. This is known as 'the western harbour' and could include a large-scale road scheme, the replacement of the Plimsoll Bridge, extensive house-building and changes to the Cumberland Basin. It is not known whether or not this might include a solution for, or a risk to the bridge. The ambitious character of the ideas discussed suggests that nothing will be done in the near future.

As noted above, there are now no plans to remove the bridge to the Albion Yard, which was considered as a possibility in 2020.

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# SIGNIFICANCE

The assessment of significance below is based on the recommendations in James Semple Kerr's *The Conservation Plan* (1996) and Historic England's guidance in their 2008 publication, *Conservation Principles, Policies and Guidance for the Sustainable Management of the Historic Environment*, adapted for this site.

The statements of significance are divided into three categories.
**Material/Evidential** (what can be deduced from the fabric of the structure).
**Historical** (importance that results from historical associations that are not evident in the fabric).
**Community** (the meaning of a structure for some of the people who relate to it, acknowledging that a place means different things to different people).

Within the three categories significance is ranked as follows:
Highly significant
Significant
Some significance
Neutral
Detrimental to significance

## Material Significance

The bridge is **highly significant** for incorporating innovative design features. According to Greenfield 'the use of tubular-flanged wrought iron girders, such as were utilised here, was in its infancy. Initial research indicates it is highly likely that the bridge is the earliest and oldest-surviving example of such a Brunel-designed structure'. Also 'initial research suggests that the use of longitudinal pre-stressing 'tie bars' running through the top flanges, as used here, was an innovation'. In addition to its design innovations it is a well-made structure, showing considerable skill by George Hennet and his workforce, for example there was a high degree of technical difficulty in the riveting of the top tubes and how this was done is not known for certain. The curved platework is beautifully executed (*pers.comm.* Geoff Wallis).

In a Bristol context the bridge is materially **significant** as the prototype for two other known Floating Harbour bridges, one of c.1863 (lost) and one (the 1870s bridge over the north lock) surviving.

It is materially **significant** as a surviving element of the 19th century urban waterscape of the Floating Harbour. This includes the Clifton Suspension Bridge.

***Detrimental to material Significance***
*The bridge is in poor condition; it has been truncated and a section of one of the balloon flanges has been replaced in steel. It is no longer operational. In spite of good quality interpretation boards, its post-1965 setting is discouraging for visitors.*

## Historical Significance

The bridge is **highly significant** for the involvement of IK Brunel in its design and construction. Brunel was described by Rolt as 'one of the greatest figures of the Industrial Revolution, [who] changed the face of the English landscape with his groundbreaking designs and ingenious

constructions' (Rolt, 1957, 245). The bridge reflects his enthusiasm for wrought iron and includes features which relate to some of his later and better-known, bridges.

The bridge is **significant** as a surviving element in the narrative of 19th century amendments to Jessop's Floating Harbour. These were needed to keep pace with the increasing size and developing design of ships moving in and out of the Floating Harbour. The City's efforts (and eventual failure) to keep pace with these changes and how the City Docks have been managed since are an important part of the history of Bristol.

The bridge is **significant** for its associations with the thriving community of engineers and contractors working in Bristol in the 19th century. Rennie Junior, a partner of the main contractors, is well-known but George Hennet deserves to be better-known.

### Community Significance

The bridge is **highly significant** to historians of engineering and historians of Brunel.

The involvement of local groups with the Brunel Swivel Bridge Group is proof that there is already **significant** community enthusiasm for the bridge.

Given Brunel's status and associations with Bristol the community significance of the bridge has a high potential for development

## Links with the ss *Great Britain* site

- I K Brunel, responsible for Brunel's Other Bridge, was part of the design team that created the engineering masterpiece, the ss *Great Britain.* The heritage site centred on the ship is also the location of the Brunel Institute, which includes his letter books and journals on loan from the University of Bristol: these are key documents for understanding the bridge. The 'Being Brunel' museum on site includes an extensive collection of Brunel artefacts as well as an immersive display of Brunel's creative imagination. Ship, institute and museum are all designed to celebrate Brunel and to make him and his works engaging and widely accessible. There would be advantages both for the bridge and the ss Great Britain site If the bridge were moved to the Albion Yard.

- It was inevitable that Jessop's entrance locks would have to be rebuilt to accommodate larger ships, but the catalyst for the project to enlarge the south lock, including providing a bridge, was the size of the ss *Great Britain*.

- Both the hull of the *ss Great Britain* and the construction of Brunel's Other Bridge illustrate Brunel's enthusiasm for and innovative use of wrought iron.

- Brunel's Other Bridge was fabricated in George Hennet's Ironworks, sited on land that had been acquired by James Hilhouse for a shipyard, later called the Albion Yard, neighbouring the ss *Great Britain* site and now leased by the ss *Great Britain* Trust. Hennet had a longstanding professional relationship with Brunel, and provided ironwork from his Bristol ironworks for at least one other of Brunel's bridges: his bowstring girder railway bridge carrying the Windsor/Slough line over the Thames. Hennet also provided some of the infrastructure of Brunel's atmospheric railway, but this was produced in his Bridgwater ironworks.

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Bristol Archives, PBA/Corp/M/2/1
Bristol Archives, PDA/Corp/M/2/7
Bristol Archives, PBA/Mgt/P1/9/7/6 (2)
Bristol Archives, 42054.G.Drawer 1/01435
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NMM HIL/82/6

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Sandi Ellison of Keystone for proof-reading

## Timeline of selected sources

**1842** Bristol Archives, PBA/Corp/CO/1/4 p.30
Letter to Brunel 7.03.1842
Board 'have directed that you will consider and report whether in your opinion any improvement can be made in the Bridges over the locks at Cumberland Basin by means of which the necessity for removing the bridges for the passage of large steamers may be obviated and inconvenience and expenses incurred therein saved to the Company'.

**1844** Bristol Archives, 45235/15/6/3
Docks Committee meeting. References in 1844 to Brunel's report on the south lock and various resolutions/ communications e.g. 'Resolved that this Council feel the importance of having the entrance of the Port of Bristol sufficiently capacious to admit of the largest class of steam packets and hope that the dock directors will seriously consider the propriety of increasing the dimensions of the new lock beyond those necessitated in the report read this day from Mr Brunel'. Report included. It covers the reasons why the lock needed rebuilding rather than repair. No reference to the bridge.

**1846?** n.d. NMM, HIL/82/6
Plan of the Albion Yard, with c.1846/1848? annotations. Shows 'Geo Hennet's Iron Works' on a large plot of land adjacent to the Albion Yard and to the GWSSC Yard.

**1848** *Bristol Times and Mirror* Saturday 24 June
Payments by Bristol Dock Co for one year ending 30 April 1848.
Includes:
'By repairs and enlargement of the south entrance lock, Cumberland Basin, viz. –

| | |
|---|---|
| Paid contractors on account | £2,000 |
| Paid contractor on account for | |
| New Lock Gates | £1,750 |
| Rolling Bridge | £1,500 |
| | £3,250 |

Paid Engineering expenses, viz.-
J [sic] K Brunel for professional services from 1st Jan 1842 to 30th June 1846 £225

**1849** 20 January 1849 Bristol Archives, PBA/Corp/M/2/1
Docks Committee meeting. 'Mr Brunel attended the committee and entered into an explanation of many particulars with reference to the progress of the new lock from which it appeared that the lock might be brought into use so soon as the subsidence of the freshes would admit of the removal of the mud and stones now preventing the working of the gates. He also stated that he had determined on the design of the platforms for the recesses plans of which he should be prepared to submit to the Committee on Monday 29th inst.

In reference to the bridge across the lock Mr Brunel also stated that in consequence of difficulties principally connected with the foundations which he had experienced in carrying out his original design of constructing it as a rolling bridge he now contemplated altering it to a Swing Bridge the plans of which he should be prepared to submit to the Board on Monday the 29th inst.

He also intimated his intention of sustaining the expense of the proposed alteration himself.'

**1849** 26 February 1849 Bristol Archives, PBA/Corp/M/2/1
Docks Committee meeting. 'A certificate from Mr Brunel in favour of Mr Hennet on account of his contract for the caisson gates was read'. It was ordered that the same should be paid and Mr George Hennet is recorded paid £1,000 for the gates.

The following aperture card drawings are only some of the 1849 Brunel office drawings discovered by Dr Greenfield

*1849 n.d. Bristol Archives, 42054.C.Drawer 6/07625*
*No title. Three cross sections. Probably part of a larger original drawing.*

*1849 n.d. Bristol Archives, 42054.C.Drawer 6/07629*
*'Bristol Docks. Swivel Bridge'. Cross section at pivot.*

*1849 n.d. Bristol Archives, 42054.C.Drawer 6/07636*
*No title. Plan and section of centre.*

*1849 10 March 1849 Bristol Archives, 42054.C.Drawer 6/07646; 07647*
*'Bristol Docks. Swivel Bridge'. Drawing of elements of long and cross sections and bed showing rivets and ties. This has been photographed in two overlapping images on two aperture cards.*

*1849 16 March 1849 Bristol Archives, 42054.C.Drawer 6/07624*
*'Bristol Docks. Swivel Bridge. 76ft opening'*

*1849 3 April 1849 5 April 1849 Bristol Archives, 42054.C.Drawer 6/07632*
*Cross section at pivot, shows foundations*

*1849 5 April 1849 Bristol Archives, 42054.C.Drawer 6/07645*
*'Bristol Docks. Working Gear for Swivel Bridge'*

*1849 16 April 1849 Bristol Archives, 42054.C.Drawer 6/07630*
*'Bristol Docks. Swivel Bridge. Elevation and section at pivot.*

*1849 17 April 1849 Bristol Archives, 42054.C.Drawer 6/07638*
*'Bristol Docks. Swivel Bridge'. 'Transverse Section' and 'Elevation'*

*1849 23 April 1849 Bristol Archives, 42054.C.Drawer 6/07627*
*Plan of bedplate and plan of timber platform or piles under bedplate.*

**1849** 26 March 1849 Bristol Archives, PBA/Corp/M/2/1
Docks Committee meeting. Noted that the platform next to the lock was also being built by Hennet.

**1849** 23 April 1849 Bristol Archives, PBA/Corp/M/2/1
Docks Committee meeting. Brunel estimated that the amount due to Rennie and Co. for the new lock was £4,500.

**1849** 26 April 1849 Bristol Archives, PBA/Corp/M/2/1
Docks Committee meeting. George Hennet paid £61 8s 6d for castings.

**1849** 30 April 1849 Bristol Archives, PBA/Corp/M/2/1
Docks Committee meeting. Tender from Hennet for the construction of the pontoons for the platform of the new lock.

**1849** 7 May 1849 Bristol Archives, PBA/Corp/M/2/1
Docks Committee meeting. Hennet's tender for construction and fixing of pontoons accepted, £675.

**1849** 21 May 1849 Bristol Archives, PBA/Corp/M/2/1
Docks Committee meeting. Secretary reports 'The bridge for the new lock at Cumberland Basin was being vigilantly proceeded with and that he has promised that in a week or ten days one half of the Fender would be entirely framed up'.

**1849** 26 May 1849 Bristol Archives, PBA/Corp/M/2/1
Docks Committee meeting. Mr Bell reports that the bridge and platform were proceeding as fast as is practicable.

**1849** 25 June 1849 Bristol Archives, PBA/Corp/M/2/1
Docks Committee meeting. Committee are informed that Hennet had carried 'casting of extraordinary weight' across the Bathhurst Basin [these were for another contract, Brunel's GWR bowstring girder bridge over the Thames at Windsor/Slough].

**1849** 2 July 1849 Bristol Archives, PBA/Corp/M/2/1
Docks Committee meeting. Mr Brunel's letter stated that in three weeks the Bridge and Fender of the new lock would be completed and certifying in favour of Mr Hennet for £500 for the Bridge and the like sum on account for the Fender.

**1849** 9 July 1849 Bristol Archives, PBA/Corp/M/2/1
Docks Committee meeting. Hennet attended a committee meeting to ask if he could carry more heavy loads across the Bathhurst Bridge if he supported it. Agreed. [These were loads of ironwork the GWR bridge across the Thames]

**1849** 11 July Bristol Archives, PBA/Corp/M/2/1
Docks Committee meeting. Hennet attended meeting, stated that the bridge was nearly completed and that he should be prepared to deliver and commence putting up a part in the coming week. One half of the Fender had been delivered.

**1849** 23 July 1849 Bristol Archives, PBA/Corp/M/2/1
Docks Committee meeting. Ref to Mr Hennet's 'timber yard' in Cumberland Road (in connection with a nuisance).

**1849** 8 October 1849 Bristol Archives, PBA/Corp/M/2/1
Docks Committee meeting. Hennet pricing up for supplying wrought and cast iron for the platform for the bridge over the feeder lock, which needed restoration.

**1849** 29 October 1849
Docks Committee meeting. The dock master reported that the bridge across the new lock in Cumberland Road had been handed over to him as complete and fit for use. Capstans, mooring posts and gas lights were wanted for the south side.

**1850** 21 January 1850 Bristol Archives, PBA/Corp/M/2/1
Docks Committee meeting. Brunel certified that the Fender was complete. Hennet to be paid £400.

**1850** 25 February 1850,*The Port of Bristol 1849-1884*, Bristol Record Society, vol.36
Docks Committee meeting. Brunel had settled accounts with Hennet for the caisson gates but was unable to send final costs in time for the meeting. Superintendent ordered to prepare specification and estimate for covering the new bridge across the new lock with planks and produce tenders.

**1850** 11 March Bristol Archives, PBA/Corp/M/2/1
Docks Committee meeting. Caisson gates certified by Brunel.

**1850** 25 March 1850 Bristol Archives, PBA/Corp/M/2/1
Docks Committee meeting. Hennet to be paid balance of £2397 13s for caisson gates.

**1850** 23 September 1850, *The Port of Bristol 1849-1884*, Bristol Record Society, vol.36
Docks Committee meeting. Tenders received for painting the bridge across Brunel's Lock.

**1853** *Hereford Times* - Saturday 31 December 1853
George Hennet's bankruptcy
COURT OF BANKRUPTCY. (Before Mr. Commissioner Fane. ) CASES OF THE GREAT RAILWAY CONTRACTORS. HENNET.
This was the last examination meeting in the case of George Hennet, of Duke-street, Westminster; Bridgwater, Bristol, and other places, railway contractor, shipowner, and timber-merchant. The case is the largest that has passed through the court for several years. The accounts extend over sixty-four folios.

The following is a copy of the balance-sheet:—

The balance-sheet of George Hennet, of Duke-street Westminster ; Temple Meads, Bristol; Teignmouth, and Bridgwater, railway contractor, shipowner, lime-burner, etc, a bankrupt.

From 1st January 1849 to 9th March, 1853.

| | | |
|---|---|---|
| DH. | | |
| To sundry creditors | | £343,342 7 2 |
| Liabilities | | 16,919 13 10 |
| Secured creditors – | | |
| Fully secured | | 63,843 0 0 |
| Partially ditto | | 15,352 3 0 |
| Profits on four years' business | | 37,900 0 0 |
| Ditto on French contract | | 16,000 0 0 |
| Capital, 1st January 1849 | | 146,342 4 5 |
| | | £639,820 8 4 |
| CH. | | |
| By property | | £80,780 0 6 |
| Debtors, good | | 63,521 12 10 |
| " doubtful | £3,001 15 0 | |
| " bad | 49,860 10 4 | |
| | £52,862 5 4 | |
| | | £146,307 13 6 |
| Deduct creditors payable in full | | 616 18 10 |
| | | £145,690 14 8 |

| | | |
|---|---|---|
| By estimated value of securities in the hands of creditors – | | |
| Fully secured | £73,139 0 0 | |
| Partially ditto | 13,000 0 0 | |
| | | 86,700 0 0 |
| (N.B. It is probable that, after defraying the expenses of realisation and the accruing interest on mortgages, there will be no surplus available to the estate from the property in the hands of fully secured creditors.) | | |
| By house and personal expenditure since 1st January, 1849 | | 8,800 0 0 |
| Trade expenses, including rent, taxes, salaries, journey, and all incidental charges since 1st January, 1810 | | 27,000 0 0 |
| Losses, including bad and doubtful debts | | 334,749 19 11 |
| Liabilities (per contra) | | 16,919 13 10 |
| | | £639,890 8 5 |

The list of creditors occupies 24 folios of the accounts; they are about 500 in number. The largest creditor Mr. George Hudson for £27,939 18s. 7d., on 32 acceptances of the bankrupt's of various amounts, from £500 to £2,500, which were chiefly due in March, April, and May last. Next to him Mr. A G Pooley, of Nicholas Lane, who is a creditor for £24,433 11s 2d on 25 acceptances. Mr George Wither, of Reigate, is a creditor for £16,470 and Colonel Woolridge for £15,390 Is. 2d. There are only two other creditors for above £10,000, the rest are below that amount, and most of them below £5,000...

The property is very extensive. That on which mortgages are held by the secured creditors consists of a freehold mansion house and land near Teignmouth; freehold land and houses in Devonshire, at Clifton, near Bristol and other places, ships, and policies of insurance etc. Of the unencumbered property estimated at £80,786, there is in stores, stocks and manufactured goods and materials of various kinds £36,400; plant and machinery at Bridgwater and Bristol £9,854, vessels £5,850, contract with the Great Junction of France Railway Company, sold to Josiah Wilkinson and others for £16,000; household furniture, live and dead farming stock, carriage and horses £2,456, cash, £2,371; shares in the York and North Midland Railway Company, the Bristol Waterworks Company, a French coal-mine, nine mining companies, the royal Panopticon of Science and Art, and several local companies in the west of England, £2,978; Adventure, per Harriet, to Sidney, consisting of corrugated iron, wines, spirits, &c., £2,000. Amongst the good debtors to the estate appear the Emigration Commissioners for a balance of £3,000; and the Great Western Railway Company for £3,547.

The works in progress on the South Wales, the Oxford and Rugby, the Bristol and Exeter, and the Vale of Neath Railways, are put down at £46,750. The largest bad debt is "David Leopard Lewis, £42,000;" it is not stated how this debt arose. Some heavy items appear under the head of losses; they comprise the following: - Original £50 South Devon Railway shares, fully paid (1,050 shares sold for £5), £47,250; Bartlett, loss on mining shares purchased of him £45,000; discounts on bills &c. (two years), £30,000; plant, cost about £38,600, present value £9,854, loss £28,746; Glamorganshire and Monmouthshire Banking Company, cost of 200 shares about £2,000, since paid by me on account of liabilities prior to the order of winding up £15,000, total £17,000; Holmes, loss on properties purchased of him, £17,000; Swift, loss on transactions with him, £16,300; iron contracts, £22,500; Langley Field iron works, mortgage £15,000, sold for £3,000, loss £12,000; loss on mining shares £17,057,

the principal items being £4,120 on Cassandra mine, and £4,265 on Bodmin Moor ditto; South Wales Railway shares, cost of 500 shares £6,400, sold for £3,200; Tweedale Tile Company, £3,000; South Devon half-shares, preference, 645 shares, cost £23 each, sold for £15 each, loss £5,160; law expenses, £3,147; loss on 223 South Wales Railway shares, at £18 per share, £4,014; Great Western ordinary stock, taken in payment of Windsor contract, £20,000, sold at a loss of £4,150; Clifton property, £2,500; shares bought of Swayne and Bovill, £4,000; Forest of Dean coal mine, £3,000; mosaic picture, £1,000; premiums paid on life insurances, £1,588; Gorway house, £2,000; loss on three ships, £5,200; by W. Richardson, a bankrupt, £1,500.

Mr. Lawrance, addressing the court, said he appeared for the bankrupt in this case. This was the sitting for the last examination, and he believed there was no opposition to Mr. Hennet's passing.

Mr. M'cLeod (for the assignees) : We have no opposition to offer.

Mr. Linklater, who appeared for certain creditors, concurred.

Mr. Lawrance: I believe the process of realisation is going on most satisfactorily, with the assistance of Mr. Hennet, and with the indefatigable assistance of our friend Mr. Cannan, and the result will be as satisfactory as we anticipated, if not more so.
The Commissioner: The only thing' distressing about it is that Mr. Hennet should have fallen into such misfortunes after having had so successful a career previously.
Mr. Lawrance: He has been the architect of his own fortunes, and he sees the superstructure fall by scarcely any act of his own. Your Honour, I presume, will permit the bankrupt to pass ; and, perhaps, you will be good enough to name an early day for the certificate meeting.

The Commissioner: Will it be opposed ?

Mr. Lawrance: There may be opposition; but we are not aware that there will be.
The Commissioner : The earliest day on which would be heard would be the 13th of January. I don't think I shall pledge myself to decide the matter earlier than the week following. Put it down for Saturday, the 21st of January, at 12.

The bankrupt then passed.

From an examination of the accounts this large failure appears to have arisen from a system pursued by the bankrupt, and doubtless by other contractors, of accepting shares of the several companies under whom he contracted in part payment for the works to be performed. At the time of the contracts, the shares were probably at a premium ; but they afterwards became depreciated, in some instances from 50 to 70 per cent.; and Mr. Hennet being obliged to pay his sub-contractors in full, he necessarily fell into difficulties.

There has already been dividend of 2s. 6d. in the pound paid on the estate, and another dividend of about the same amount is expected shortly to be declared.

**1858** Bristol Culture, P2319
Photograph looking east showing Brunel's lock and the north lock, tide out. Shows bridge over Brunel's lock and caisson gate.

**c.1860?** Bristol Culture, Mb6012
Photograph. n.d. Similar to the above but does not show caisson gate. Landing stage shown at west end of Brunel's lock, south side. Pre-dates Howard's Lock.

**1862** *Bristol Daily Post* Wednesday 05 February 1862
Very long account of special Town Council Meeting, including discussing various proposed railway schemes including the port railway and debating a motion on the best means of improving the port and linking shipping and railways.
In the course of the debate, FH bridges were discussed. Mr Alderman Robinson was reported saying:
'The three extra bridges which it was proposed to throw across their Floating Harbour could not be regarded otherwise than as obstructions. They had already two opening bridges, and simple as they were, they were obstructions of a very serious nature ; but now they were to have three extra bridges and it was suggested in the report of the engineer that those bridges should be open in two minutes and remain open 15 minutes. Now, it was all very well to lay down to lay down a rule but he would ask any gentlemen who had ever seen the bridges open – though he (the speaker) had every respect for Mr Howard, for, as regarded the Dock works, no man could possibly have carried them out better—whether they would not be an obstruction. He confessed he never saw a telescopic bridge work, although had seen the model of one. There had been one constructed by Mr Rennie at the Cumberland Basin, under the directions of no less a man than Mr. Brunel, but so badly did it work, and so little did he think of it after it was built, that he condemned it, and paid the expenses of making it out of his own pocket. That was a thing which very few engineers were known to do'.

**1863** *Bristol Times and Mirror* - Saturday 08 August 1863
BRISTOL, DOCKS. THE DOCKS COMMITTEE are prepared to receive TENDERS for the construction and fixing IRON SWIVEL BRIDGE over the North Lock, Cumberland and Plans may seen at the Office of Mr. HOWARD, Docks Engineer. Cumberland Tenders, addressed to the Secretary, 18, Queen Square, must delivered before noon, on MONDAY, the 24th Inst. The Committee do not bind themselves to accept the lowest or any Tender.

**1863** 26 August 1863, Bristol Archives, 42054.C.Drawer 6/9159, 9160, 9161, 9162, 9163, 9164,9165
Drawings copied on to aperture cards. Scaled. Each entitled 'Swivel bridge over north lock' and dated August 26 1863.
Each annotated 'This is one of the drawings referred to in the contract between Bristol Docks Committee and Messrs Hennet, Spink and Else, Bridgwater, for swivel bridge, North Lock, Cumberland Basin'. Signed T W Howard. No tie rods through balloon flange.
42054.C.Drawer 6/9161 includes an elevation which incorporates a tiny bit of the north end of Brunel's bridge over the south lock.

**1865** *Western Daily Press* - Wednesday 02 August 1865
Report of the Docks Committee. Reports that cost for new iron bridge over north lock was £1,123.

**1865-7** Bristol Culture, P10912
Photograph looking east showing Brunel's lock and the north lock. Shows bridges over Brunel's lock and north lock.

**1870** Hydraulic power first introduced into the City Docks to work the Cumberland Basin locks using Sir William Armstrong and Co's machinery. Power was generated by two 44h.p steam engines in what is now the Old Pump House on the north side of Cumberland Basin.

**1872** 15 April Bristol Archives, PDA/Corp/M/2/7
Docks Committee meeting. Read report from the Engineer and thereupon he was authorised to adapt the present bridge at the Entrance Lock Cumberland Basin for the purposes of the new works.

**1872** 29 June 1872 *The Port of Bristol 1849-1884*, Bristol Record Society, vol.36
Docks Committee produce various tables. Table 5 'Approximate estimate of various works suggested or required, most of which have been previously reported on and considered by the Docks Committee.
1. Conversion of Brunel's Lock into a public Graving Dock, 320 foot long £11,000'

**1873** 19 July 1873 *The Port of Bristol 1849-1884*, Bristol Record Society, vol.36
28 July 1873. Engineer's report stated that new entrance lock between Cumberland Basin and the River opened for traffic on the 19th inst.

**1873** *Western Daily Press* - Monday 21 July 1873
'OPENING OF THE NEW LOCK CUMBERLAND BASIN. The extensive works which for the last five years have been effectually changing the appearance of Cumberland Basin and that part of the Hotwells familiar to old Bristolians as the "Rownham," are now almost completed, and on Saturday last one the largest locks to a harbour in England was quietly opened to the shipping of the world. As Mr Nash in the course of his speech remarked, it was a double anniversary of a peculiarly appropriate character, for on the 19th July, 1837, the Great Western steamship, the first ever built especially to navigate the Atlantic, was launched at Bristol, and on the 19th of July, 1843, the Great Britain steamship floated out of the dock. The boarding that has for some months hidden workmen's operations from public view is now removed, and the spectator will almost fail to realise the fact that the handsome and commodious landing stage and the broad and well-lit road by the side the new lock, are occupying the place where previously the only way of access was over a little footbridge that crossed a muddy creek. ...To Mr T. Howard, the engineer of the Bristol Docks, by whom the whole of these new works have been designed, and under whose personal superintendence they have been carried out, are indebted for the following particular alterations, and especially of the new lock:— ...[very long description] ... These gates, as well as the large sluice valves, and the machines for opening the bridges and the capstans and the pier heads are all worked by hydraulic power. The power may be described as generated and conveyed in the following way in the engine house, built on the north side of the junction lock ..... The contractor for the masonry and earthwork in this extensive undertaking was the late Mr Wm. Tredwell, of Birmingham; for the iron lock gates and pontoon landing stage, Messrs Maudslay Brothers, of Cardiff; for the hydraulic machinery, Sir Wm. G. Armstrong and Co., Newcastle-on-Tyne; for the iron swing bridge over junction lock, the Avonside Engine Company, Bristol. ... The bridge near the clock-tower is, we understand, to be transferred to the new lock, where it will face the street leading from Hotwell Road; another will be put in its place, but whether any alteration will be made to the gates on that side of the lock has not been finally settled.'

**1873** *Western Daily Press* - Wednesday 06 August 1873
Town Council meeting report. Mr Naish asked if it was true that is was proposed to close Brunel's lock. Reply, 'No step would be taken to close the lock without the matter being first submitted to the council'.

**1873** 17 November 1873 Bristol Archives, PBA/Corp/M/2/7
Docks Committee meeting.. 'Read a memorial from Master of Steamers complaining of the closing of the South Lock at Cumberland Basin and thereupon it was referred to the Engineer and Dock Master to make separate reports on the subject'. Lord and Southam report that the Masters of Steamers suggested a one way system with outgoing steamers using the South Lock while arrivals used Howard's Lock (Lord J and Southam J, *The Floating Harbour*, Bristol, 1983, 47).

**1874** Ashmead map
No bridge shown over Howard's lock.

**n.d.** Bristol Archives, reference not found
**1874?** 'Bristol Docks Brunel's Bridge Proposed Shortening'

**1874** 18 May 1874 Bristol Archives, PBA/Corp/M/2/7
Docks Committee. Read a report from the Engineer on the subject of Brunel's Lock, the consideration of which was postponed.

**1874** 15 June 1874, *The Port of Bristol 1849-1884*, Bristol Record Society, vol.36
Letter dated 1st November last from masters of steam vessels asking that Brunel's Lock be left open...Resolved that the engineer be instructed to furnish an estimate of the minimum cost of placing the whole work in repair, distinguishing between the cost of a new bridge and the necessary repairs to the Lock omitting the hydraulic apparatus.

**1874** 22 June 1874, *The Port of Bristol 1849-1884*, Bristol Record Society, vol.36
'The engineer stated that the cost of a new bridge over Brunel's Lock would be about £4,000 and repairs to the caisson gates timber dolphin etc £3,500'. Ordered that the Engineer do prepare plans for a new Bridge over Brunel's Lock.

**1874** Bristol Archives, 42054.C.Drawer 6/9206, 9207, 9208, 9209, 9210, 9211, 9212
'Bristol Docks - Swivel Bridge, Brunel's Lock, 1874
Set of 7 drawings (copied on to aperture cards) each annotated as referred to 'in a certain contract between the Corporation of Bristol of the one part and Messrs Edward Finch and Company Limited Bridge Works Chepstow of the other part. Thomas Howard signs on behalf of the Corporation.

**1874** *Western Daily Press* - Wednesday 05 August 1874
BRISTOL TOWN COUNCIL. A quarterly meeting of the Council was held yesterday, the Mayor presiding.... THE PROGRESS OF THE DOCKS. The Town Clerk read the following report of the Docks Committee, the engineer's report being taken read:—
In compliance with the provisions of the Dock Act 1848 your committee now submit to the Council an abstract of the receipts and payments, credits and liabilities, of the Corporation in relation to the Docks, for the year ending 30th April, together with statement of the accounts of the river and harbour improvements...
The following was the report of the engineer, Mr Thos. Howard.
'The new junction and entrance locks with junction, entrance locks, with the hydraulic

machinery connected with them, have worked well during the last twelve months. The time and maintenance the works under the late Mr Tredwell's contract is expired and all accounts connected therewith have been satisfactorily settled up...'

**1874** 10 August 1874 Bristol Archives, PBA/Corp/M/2/7
Docks Committee meeting. 'Read the report from the Engineer. The Committee took into consideration the tenders for the iron work of the new bridge at Brunel's Lock and thereupon the tender of Finch and Co Limited of which the following is a copy was accepted.

To the Bristol Docks Committee. We Edward Finch and Company Limited of Bridge Works Chepstow do hereby undertake to execute all the work included in the contract for the Swivel Bridge, Brunel's Lock, Cumberland Basin according to all the terms and conditions of the specification for the gross sum of one thousand nine hundred and fifty five pounds (say £1,955 0 0) and we agree to the prices contained in the Schedule of Prices as those by which the value of any increase or diminution of the Contract work is to be estimated for the purpose of payment.

And we undertake to complete the contract within six months from the date of order to commence the works.

And we further undertake to execute a Contract Deed to this effect if and whenever required to do so.

Dated 8 August 1874', James Rowe signs for Edward Finch and Company Limited.

**1875** 26 July 1875, *The Port of Bristol 1849-1884*, Bristol Record Society, vol.36
The new bridge over Brunel's Lock, at this basin [Cumberland] is just about to be delivered and erected.

**1876** 5 August 1876, *The Port of Bristol 1849-1884*, Bristol Record Society, vol.36
Reports new bridge over Brunel's Lock completed. 'For new bridge, Brunel's Lock, Cumberland Basin £2,469 3s 8d'.

**n.d.** Bristol Culture, PD1025
Photograph. View of Bathurst Basin Lock from Coronation Street. Bridge similar to Brunel's

**1887** Bristol Archives, 42054.C.Drawer 7/10900;10903;10904
Contract drawings for the hydraulic engine house in the Underfall Yard. This was completed by 1889 (probably before). No hard evidence of all the equipment it worked, but assumed here to have been a more powerful replacement for the c.1870 Pump House equipment and used for the swivel bridges etc in the Cumberland Basin as well as the corporation granary.

**1894** Lord J and Southam J, *The Floating Harbour, Bristol***,** 1983, 47
A steamer landing stage was constructed in the entrance to the South Lock.

**1901** 29 November 1901 BRO aperture cards 45054.C.Drawer 6/07628
'Bristol Docks, Bristol. Cross Section of Brunels Bridge at Lower Entrance Lock

**1901** 23 October 1901. Bristol Archives, 42054.C.Drawer 7/10513
'Cross section of Brunel's bridge at Lower Entrance Lock'. Annotated 'copy sent to F B Girdlestone 29 October 1901'. This shows two alternative designs for internal footways.

**1907** 18 January 1907, Bristol Archives, PBA/Corp/Co/23/7/20
Text of advert for portions of the old Bathurst Bridge for sale.
'Portions of old swing bridge now lying on temporary packing on the north side of the entrance lock, Bathurst Basin'. What was for sale was:
Main girders
Cross girders
Stiffening girders
Balancing castings
Some broken hand rail castings

Bridge estimated to have 20 tons wrought iron and 40 tons cast iron.

Messrs Puglsey and Co offered £130

**1907** 12 October 1907, Bristol Archives, PBA/Corp/Co/23/7/20
Docks Committee meeting. Following anxieties about weight of traffic following the opening of the Ashton swing bridge, notices were to be put up stating that the bridges over Cumberland Basin Entrance and Brunel's Lock had a safe limit of 8 tons.

**1924** Bristol Archives, PBA/Mgt/P1/9/7/6 (2)
Plans for external footpaths on bridge over Brunel's Lock and over the entrance lock.

**1929** *Western Daily Press* - Monday 16 September 1929
PORT OF BRISTOL AUTHORITY. DISPOSAL AND REMOVAL OF TWO STEEL CAISSONS. BRUNEL LOCK. CUMBERLAND BASIN. BRISTOL. The Port of Bristol Authority invites TENDERS for the PURCHASE of TWO STEEL CAISSONS, situate at the Old Brunel Entrance Lock, Cumberland Basin Bristol. The Conditions of Sale and Form of Tender may be obtained at the Chief Engineer's Office, Avonmouth Dock, on and after Wednesday, the 18th day of September, 1929. THOMAS A PEACE. Chief Engineer. Chief Engineer's Office, Avonmouth Dock, 16th September.

**1946** Bristol Culture**,** PBA 1048, reproduced in Malpass and King, *Bristol's Floating Harbour: the first 200 years*, 2009, 130.
Good quality aerial photograph of the Cumberland Basin at that date.

**1960?** Bristol Archives, 42054.C.Drawer 6/7626
Long section entitled 'Brunel's Swing Bridge 1849 now working over entrance lock, Cumberland Basin the prototype of Bathurst Basin and Brunel's lock bridges'. Dated in the catalogue as 05/08/1985 but must be pre-1967/68 if it is correct that this is the date at which the Plimsoll bridge rendered Brunel's bridge redundant.

**1962** March 1962 Bristol Archives, 42054.G.Drawer4/18823
Scaled drawing 'Cumberland Basin Bridges Scheme Contract No 1. 'Brunel Lock Bridge'. 'Existing Structure and Modifications'. The diagrammatic elevation shows where curtailed. Presume date when Howard bridge over south lock was amended?

**1963-5** Construction of Plimsoll Bridge (swing) over Cumberland Basin, built to relieve traffic congestion. Bridge by Oleg Kerensky working for Freeman Fox and Partners.

**1967 or** HLF bid of 2011/12.

**1968?** Closure of the bridge over the North Lock; bridge retained in situ in an open position, but thought to have received little maintenance after closure. Some sources give the date as 1968

**1971** Act of Parliament for closing the Floating Harbour to commercial traffic.

**1972** 18 February
Bridge listed Grade 2*

**1985** February 1985. Bristol Archives, 42054.G.Drawer 1/01435
Drawing 'Brunel Swing Bridge General Arrangement Painting'.
Plan and elevation annotated with proposed works [more than painting], e.g. cantilevered walkway both sides to be removed until instructions for disposal or reinstatement.

**2006** HLF application for Heritage Grants Stage 1, 2011
March. Brunel Swivel Bridge Group formed with an application to Sustrans as part of the Big Lottery funded Connect2 Project. This would have involved the restoration of the bridge to working order proving a safe cycle and pedestrian route across the Cumberland Basin as part of a route connecting Nailsea to Bristol. This bid was later subsumed within the Local Authority partnership.

**2006** April 2006 http://www.brunelsotherbridge.org.uk/bob_pre2013.html
Greenfield, David, 'Brunel's Swivel Bridge, Cumberland Basin, Bristol, Interim Report 01'. Published online.

**2007** HLF application for Heritage Grants Stage 1, 2011
Part of the timber deck of the bridge removed as part of the visual inspection by Ove Arup to expose the turntable.

**2008** http://www.brunelsotherbridge.org.uk/bob
Brunel Bridge Plan dropped

**2010** HLF application for Heritage Grants Stage 1, 2011
Remainder of timber deck removed for inspection reasons

**2011** May. HLF application for Heritage Grants Stage 1 prepared by the walking and cycling team, Traffic Management, Bristol City Council

**2012** 11 January 2012 http://www.brunelsotherbridge.org.uk/bob
Consultation event in the Create Centre, Bristol

**2012** 12 April 2012 http://www.brunelsotherbridge.org.uk/bob
Presentation about the bridge by David Neale to the Bristol Industrial Society. This provided 'an account of a failed lottery bid mainly due to expensive and controversial proposal to dismember the bridge, move it to a repair site, possibly on the south quay-side of the Cumberland Basin, and to return and reassemble repaired components.

Afterwards it was decided that the combined efforts of the Brunel Swivel Bridge Group, BIAS and Avon Industrial Buildings Trust (AIBT) could move this forward independent of the Council, but with their agreement and co-operation'.

**2012** August. http://www.brunelsotherbridge.org.uk/bob
Following meetings with the Council, BIAS and AIBT, Geoff Wallis developed a scheme which included voluntary work on the bridge and fundraising.

**2013-2019** http://www.brunelsotherbridge.org.uk/bob
Regular conservation work undertaken on the bridge by volunteers plus contract work, grant aid provided by Historic England , the Bristol Visual and Environmental Group and the Co-op Local Community Fund.

**2017-2019** Since 2017 there have been discussions about a major redevelopment of the area around the Cumberland Basin and to its west. This would include re-designing the road system that crosses it and developing a new district that would be known as 'Western Harbour'. The impact, good or bad, on Brunel's Other Bridge is difficult to assess until there are developed plans to examine.

## List Description

ST5672 CUMBERLAND BASIN, Floating Harbour 901-1/41/1286 (West side) 18/02/72 Swing bridge over North Entrance Lock

Grade: 2*
List Entry Number: 1202186
Date first listed: 18-Feb-1972
Statutory Address: SWING BRIDGE OVER NORTH ENTRANCE LOCK, CUMBERLAND BASIN
District: City of Bristol (Unitary Authority)
National Grid Reference: ST 56828 72383

GV 2*

Swing bridge. c.1844. By IK Brunel. Wrought-iron. Tubular section long members, iron walls and timber-floored deck. Moved from Brunel's South Entrance Lock to the North Entrance Dock in 1873 (qv). The design foreshadowed Brunel's much larger Royal Albert Bridge at Saltash. (Lord J and Southam J: *The Floating Harbour*: Bristol: 1983-: 70).

Listing NGR: ST5682872383
Legacy System number: 379473

**Sources**
**Books and journals**
Lord, J, Southam, J, *The Floating Harbour,* (1983), 70

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