

# The Maintenance of Pontcysyllte Aqueduct

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*The date of this Journal coincides with the 200th anniversary of the opening of Pontcysyllte Aqueduct. The story of its design and construction is well-known, but its history did not stop there: the story of its maintenance is also of interest.*

## The first two decades

Although the aqueduct at Pontcysyllte was finally opened in November 1805, the minutes of the Committee of the Ellesmere Canal Company (which became the Ellesmere & Chester Canal Company in 1813), indicate that building work on the aqueduct continued sporadically into the 1820s. In November 1806 Telford was ordered to give directions for the construction of two graving docks at the north end of Pontcysyllte Aqueduct and for the building of small houses at the wharf of Pontcysyllte 'to accommodate persons who superintend the shipping of coals at the said wharf'.

On 25 November 1807, it was reported to the Committee that 'the difficult works upon the Water Line from Pontcysylte to Llantisilio were nearly completed' and a 'bank tender' was appointed with responsibility for the maintenance of the Pontcysyllte aqueduct. At the same time, the Committee also ordered that 'the Aqueduct at Pontcysylte be painted at a proper season in the manner pointed out by Mr Telford's report of this day'.

Unfortunately, this particular report of Telford's, recommending the painting of the aqueduct (evidently meaning the ironwork) has not survived.<sup>1</sup>

However, it appears that Telford's recommendation to paint the ironwork of the aqueduct had still not been carried out five years later, for in another report of 5 January 1813, he advised that 'that the Iron work at Pontcysylte Aqueduct should receive a proper coating to preserve it from the actions of the Atmosphere'. On 19 July 1813, the Committee appears finally to have acted on Telford's recommendation, ordering that 'such part of it, as now wants such coating, be immediately done, either with coal tar, or such other coating as may be thought proper and effectual and attended with the least expense'.<sup>2</sup>

The sheer scale of the ironwork to be coated at Pontcysyllte, and the considerable time and cost which such a task would take, may well be the reason why the Committee's order of 1807 was not carried

out earlier. This is hinted at in the statement of the Committee that 'if the whole of the Aqueduct cannot be coated in the present year, then, that such part only as most requires it be done the present year, and the remainder as early as possible in the ensuing year'. The surviving minutes and reports of the Ellesmere & Chester Canal Company make no further reference to the painting of the aqueduct at Pontcysyllte, which suggests that the Committee's order of July 1813 was carried out. However various building works and repairs continued to be carried out to the aqueduct until the 1820s. In his report to the Committee of 27 August 1821, Telford stated that he found the aqueduct 'to be in the most perfect state; excellent wing walls have been erected to secure the banks, at the north abutment, and an effectual cure has been made of the troublesome and expensive leakage through this bank'.<sup>3</sup>

The problem of differential settlement of piers and abutments appears to have been a particular cause of 'much trouble and vexation' at both Pontcysyllte and Chirk aqueducts. In April 1818, Telford wrote to George Moncrieff, the Secretary of the Edinburgh & Glasgow Union Canal Company, concerning plans for the building of an iron trough aqueduct at Slateford. Telford discusses the problem of differential settlement of piers, remarking that 'even with the best sort of gravel at Pontcysylte and Chirk managed in the most careful manner, tho sinking has not yet, after 12 years, entirely left off; we have had much trouble and vexation and some accidents'.<sup>4</sup>

Shortly afterwards, on 1 May 1818, Telford wrote to James Thomson, the general manager of works at Slateford Aqueduct, telling him to visit the iron smelting works of William Hazledine (responsible for making the iron trough of Pontcysyllte) at Calcutts (at Jackfield, in the Severn Gorge) and Hazeldine's iron foundry and forge at Shrewsbury, and then to examine the aqueduct at Pontcysyllte and learn the details of the ironwork there, and compare it with the drawings for the proposed aqueduct at Slateford.<sup>5</sup>

James Thomson's inspection report on Pontcysyllte

aqueduct, dated 8 May 1818, is the earliest detailed account we have of the ironwork of the aqueduct.<sup>6</sup> Thomson commented that 'the whole of the iron work is in as good condition as when completed, and without the least appearance of a drop of water having passed at any part'. He paid particular attention to the material used to secure the joints of the iron trough, stating that 'the jointing is done with very coarse flannel in the state it comes from the loom, cut into pieces to suit the flanges and well covered with white lead of the usual consistency for jointing, and more or less of these pieces are put in according to the inequality of the joints which come together. They are also cut a little narrower than the flange so as to leave a space on both sides to be caulked firmly up with good hemp rolled in tar, and being well caulked and pitched over.' Frustratingly, Thomson does not mention whether the ironwork of the aqueduct had been painted or not, but this may simply be because the coating of the ironwork was not part of his brief, as specified in Telford's letter of 1 May.

### **William Baker's inspection, 1866**

There is little evidence of significant repairs to the aqueduct at Pontcysyllte until the mid 1860s, when detailed inspections were made of both Chirk and Pontcysyllte aqueducts by William Baker, Chief Engineer of the London & North Western Railway. Both aqueducts seem to have been in a relatively good state of repair, although both had certain faults in the masonry and ironwork in need of urgent attention.

In his report on Pontcysyllte, dated 9 August 1866, Baker reported that, 'after carefully examining the whole of this magnificent structure', he found 'every part of it in a thorough state of repair, with the exception of the South Abutment, and Southerly Pier, and the arch between these'. Baker described the faults in detail, stating that 'the face stones of the south abutment from the springing of the arch to the underside of the trough (a height of about 9 feet) have in some places slightly moved forward, and in others have pressed against the iron ribs, causing the stone to chip away; the iron ribs are in several places broken, showing that an undue pressure is acting upon them; there is also a considerable quantity of water finding its way through the masonry.'<sup>7</sup>

Having examined the aqueduct and hearing the evidence of the foremen and workmen on the spot, Baker ascertained that the cause of the movement in the stone work, and the fractures in the iron,

'proceeded from the swelling of the material at the back of the abutment, and wing walls, caused I have no doubt, by a leakage between the end of the trough and the embankment'. To remedy these faults, he recommended that 'the material at the back of the abutment be removed, the abutment strengthened, and a water tight joint made by puddle or otherwise, at the end of the trough, in doing which, it may be found advantageous to slightly lengthen the trough itself.' Baker further recommended that 'the broken joints of the iron ribs should be fished (strengthened by supports) or repaired by some simple method', at a cost not exceeding £300 or £400. (The final cost amounted to £396.)

Baker also made some curious observations regarding the painting of the ironwork of Pontcysyllte, remarking that 'the iron work of the aqueduct does not appear to have been painted since its erection 70 years ago, some oxidation has taken place but not to the extent that I could recommend your incurring the cost of repairing at present'. It is not clear whether he means that the ironwork had remained unpainted since the completion of aqueduct in 1805, or whether it had not received a fresh coating since that time. If the ironwork had been completely unpainted since its erection, this would seem to imply that the orders of the Committee in 1813 to paint the aqueduct had been ignored. However this seems improbable, and one cannot doubt that an engineer of the calibre of Thomas Telford would have reiterated his recommendation that the ironwork be painted in later reports, had it not been done.

### **Repainting, 1886**

Twenty years later another survey was taken of Pontcysyllte aqueduct, this time by George Jebb, Chief Engineer of the Shropshire Union Railways & Canal Company, who recommended that the whole structure needed to be scraped and painted at a cost of £500.<sup>8</sup> Jebb's recommendation was accepted by the Executive Committee of the Company on 24 March 1886, and a staff of painters was hired from the Britannia Tubes company of Bangor to undertake the work. Unfortunately, the 1886 order does not specify what type of coating was to be used, merely stating that the 'least expensive materials' were to be employed.

Although the Committee's order does not explicitly refer to the repainting of the aqueduct, the fact that the structure was to be scraped (suggesting the removal of the original coating) and painted strongly

suggests that this was indeed the case. If this interpretation is correct, then this order provides concrete evidence that the aqueduct was painted at some point before 1886. No further references have been found in the minutes of the Ellesmere & Chester Canal Company or the Shropshire Union to the painting of Pontcysyllte Aqueduct between 1813 and 1886.

### Twentieth century

There are only a few documented references to the maintenance of Pontcysyllte Aqueduct during the first half of the 20th century. In December 1914, a slight landslip occurred in the embankment at the north-east end of the aqueduct, causing an old leakage to break out. Repairs were carried out to the embankment a month later, which involved emptying the canal, repairing and rebuilding the walls, and installing some stone drains in the embankment where the slip occurred.<sup>9</sup>

In January 1923 the London, Midland & Scottish Railway Company assumed responsibility for the maintenance of Pontcysyllte. The minutes of the Works Committee contain very few references to repairs or other works carried out to the aqueduct.

On 28 October 1936, the LMS accepted a tender from W G Beaumont & Sons for the tarring of Pontcysyllte Aqueduct, at a cost of £397.<sup>10</sup> Unfortunately the tender does not supply very much detail about the nature of the work done, and omits to mention whether the external and internal elevations of the aqueduct trough were coated. Nevertheless, this is an important reference, as it provides definite evidence that coal tar was used as a coating for the aqueduct (although, as mentioned above, it was recommended by Telford as early as 1813).

During the 1950s and early 1960s, extensive repairs were carried out to the trough sides, which occasioned the temporary closure of the aqueduct towpath. The original cast iron buckle plates were replaced by trench sheet pile sections spanning between the cast-iron legs in the waterway, and a new steel angle was bolted to the top of the east trough wall plate. The cast iron standards supporting the trough, which had corroded badly, were replaced by new ones, while the iron parapet railing adjacent to the towpath was also replaced by a replica of Hazeldine's original.<sup>11</sup> In 1965, the outside elevation of the trough wall plates and outer arched girders was repainted with 'Wales Dove Bitumastic Super Service Black Solution'.<sup>12</sup>

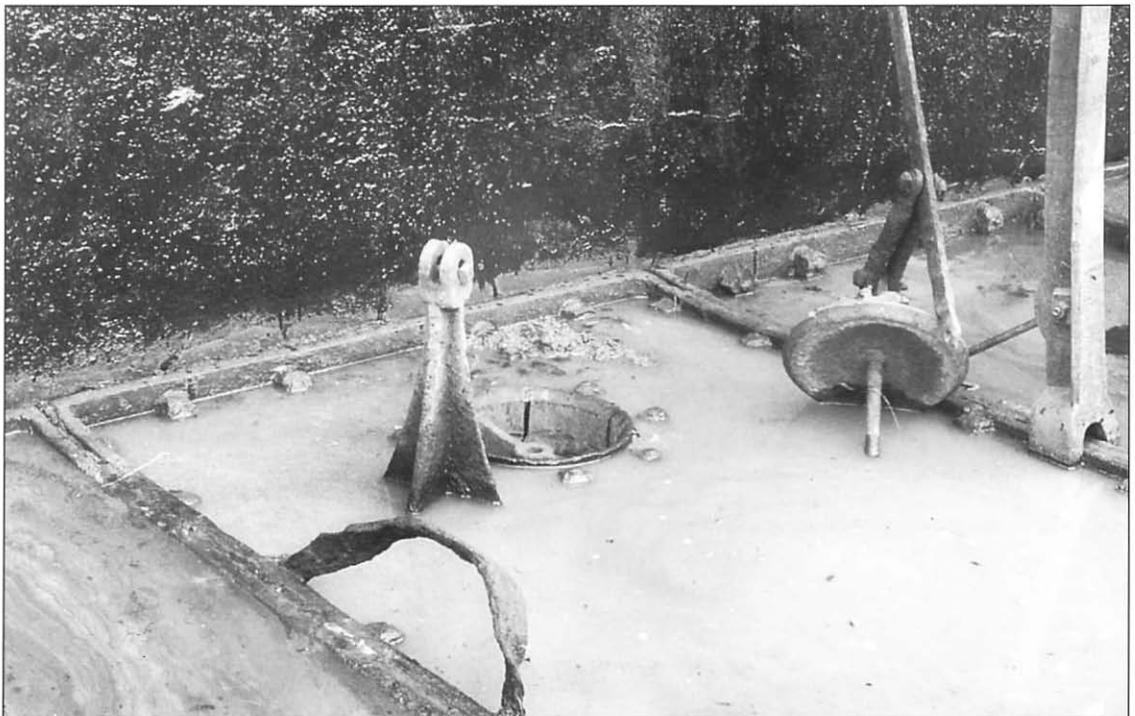
In 1975, a routine inspection of the aqueduct revealed that the masonry of the south abutment had spawled, and, more seriously, the two internal cast-iron arched girders supporting the southernmost span of the aqueduct had failed, while the two external girders had buckled badly. It was concluded that 'none of the four cast iron arches was carrying any substantial load and that the trough itself was spanning from pillar to abutment'.<sup>13</sup> A detailed engineering survey was carried out, which showed that these problems were caused by a slight shift in the south abutment. The British Waterways Board took immediate action to remedy the problems identified in the 1975 survey, closing the aqueduct and draining the water out using the gigantic 'plug' in the trough to reduce the weight on the tank. The southernmost span was supported in a timber truss while the abutment was shored up and the original cast iron girders replaced with new steel ones. Further repairs carried out to the aqueduct included the installation of 'fish plates' and a tie bar at the springing point at the north abutment. The consultant engineers responsible for the work, Husbands Consulting Engineers, who had previously restored the Britannia Bridge, apparently believed that 'had they not stepped in to take emergency action, the piers might have collapsed one after another like dominoes'.<sup>14</sup>

In 1988, British Waterways commissioned Arup Associates to undertake a detailed engineering assessment and preliminary inspection of Pontcysyllte Aqueduct.<sup>15</sup> No major defects were discovered, although it was recommended that remedial works should be carried out to the south embankment, which was moving around the abutment and adjacent pier, causing damage to those structures. The supporting masonry elements were described as being in good condition, although 'isolated areas show initial signs of deterioration'. It was further concluded that the ironwork of the trough and the arched girders supporting it were in good condition except for bolt corrosion in two places along the length of the aqueduct. Regarding the condition of the surface coating of the aqueduct trough, the Arup report noted that 'the bitumastic compound used in 1965 for the exterior elevations is still performing well'.

However, a report written prior to British Waterways' proposed refurbishment of the aqueduct in 2001 concluded that the life span of the existing paintwork had expired and that the structure required repainting. It was recommended that 'a modern, long



*Pontcysyllte Aqueduct drained for maintenance in 1964  
(RCHS: Weaver Collection)*



life paint protection system is applied, with the maximum life to first maintenance of approximately 30 years'.<sup>16</sup>

## Conclusions

Although the documentary evidence for the painting of Pontcysyllte Aqueduct during the 19th century is inconclusive, it is the author's opinion that the iron trough was painted in 1813, in accordance with Telford's recommendation and the order of the Committee of the Ellesmere Canal Company. The coating originally used was probably coal tar, as recommended by Telford himself.

We have definite evidence that the aqueduct was repainted in 1886, so it must have been painted at

some point previously, in spite of the observation in the inspection report of 1866 that 'the iron work of the aqueduct does not appear to have been painted since its erection 70 years ago'. Although we do not know what type of coating was used to paint the structure in 1886, the fact that the 'least expensive material' was recommended, suggests that it may well have been coal tar. Coal tar is definitely known to have been used to paint the aqueduct in 1936, though it is not known whether the external and internal elevations were both painted. The repainting of the external elevation of the trough in 1965 with 'Wales Dove Bitumastic Super Service Black Solution' appears to have been the first time that a bitumastic application was used at Pontcysyllte.

## Notes and references

The author was commissioned to write the Historic Research Report which accompanied the application to English Heritage in 2003 for scheduled monument consent for the restoration works at the Pontcysyllte Aqueduct. This section is reproduced by permission of British Waterways.

1. Minutes of the Committee of the Ellesmere Canal Company, 25 November 1807; Public Record Office (PRO), RAIL 827/3
2. Minutes of the Committee of the Ellesmere Canal Company, 19 July 1813; PRO, RAIL 827/3
3. Bridgewater Papers: Bundle of correspondence and papers re holdings on the Ellesmere Canal; Shropshire Archives, 212 / Box 366
4. Edinburgh & Glasgow Union Canal Papers, 264; Institution of Civil Engineers
5. Edinburgh & Glasgow Union Canal Papers, 308; Institution of Civil Engineers
6. Edinburgh & Glasgow Union Canal Papers, 306 Institution of Civil Engineers
7. British Waterways Archives, WM 75/90. A copy is given in the Appendix to the Minutes of the Executive Committee of the Shropshire Union Railways & Canal Company; PRO RAIL 623/14.
8. Minutes of the Executive Committee of the Shropshire Union Railways & Canal Company (PRO RAIL 623/22 no.16585). This entry is quoted by Quenby, who states that the Aqueduct needed to be scraped and pointed. However, after careful examination of the original document, this seems to be a misreading, especially in view of the fact that the entry is clearly titled 'Painting of Pontcysyllte Ordered', and no mention is made of other workmen being contracted for the work, apart from painters.
9. PRO RAIL 623/27 (24 Feb 1915); RAIL 623/29 (14 April 1915)
10. PRO RAIL 418/97, 4188 (28 Oct 1915)
11. R Quenby, *Thomas Telford's Aqueducts on the Shropshire Union Canal*, 1992, 113; C Harris, S Chewins & I Statham, *Pontcysyllte Aqueduct: Engineering Assessment*, Arup Associates, 1989, Part I, Introduction
12. C Harris, S Chewins & I Statham, *Pontcysyllte Aqueduct: Engineering Assessment*, Arup Associates, 1989, Part I, Introduction
13. B P Haskins, 'Report of Damage to Pontcysyllte Aqueduct' (17 June 1975), printed in C Harris, S Chewins & I Statham, *Pontcysyllte Aqueduct: Engineering Assessment*
14. R Quenby, *Thomas Telford's Aqueducts on the Shropshire Union Canal*, 1992, 113-6.
15. C Harris, S Chewins & I Statham, *Pontcysyllte Aqueduct: Engineering Assessment*
16. S B Dennis, *Report on the Trial Refurbishment of Pontcysyllte Aqueduct*, British Waterways, 2001