

## A Business History of the Clifton Suspension Bridge

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### Introduction

This paper is concerned primarily with the history of the Clifton Suspension Bridge as a funding and management project rather than being a dissertation on its design and construction. It concentrates on the financial aspects of the enterprise and its ultimate, if very belated, success as a business.

### The Background

During the late eighteenth century Clifton was developing as a residential suburb of Bristol. This continued during most of the nineteenth. The professional and business classes migrated from places such as Queen Square and Hotwells to what became a highly desirable residential district overlooking the city. It was virtually free from any taint of business, commerce or industry beyond what was needed to meet its immediate needs. The bourgeoisie ceased to live “over the shop” or in close proximity to it. This divorce of workplace and residence was not unique to Bristol: it was occurring in many other commercial and industrial centres. What demarked Bristol from like towns and cities elsewhere was the river Avon, effectively its southern boundary. There were only two bridges across the Floating ‘Bason’ (Fig. 1, Ed, Fc), two over the New River (Fd, Gd) and one ferry at Rownham Mead from east of the city centre to the Severn estuary at the beginning of the nineteenth century. Communications between Gloucestershire and Somerset were thus poor for Bristolians if they lived in Clifton. To cross into Somerset the residents had to use the Rownham ferry at Hotwells (Ad) or, more likely, if wheeled traffic was involved, the bridges in the city centre where the hubbub of the docks and markets was near at hand, an environment which the middle class residents of Clifton were seeking to avoid.

### A Bridge across the Clifton Gorge considered

For those wishing to travel into Somerset a bridge across the Clifton Gorge to join the turnpike running from Bristol towards Abbots Leigh and Portishead (Ac) was thus desirable. But it was a development which required the support of the Smyths of Ashton Court if such a project was to progress smoothly. This family of Somerset grandees had once been Bristol merchants but in 1830 this was long past. Since the early seventeenth century they had been subsumed into the county gentry.

The Smyths could see no benefit accruing to themselves should a bridge be built across the gorge. It would just give easier access to their bailiwick, something which they saw as highly undesirable. So the construction of the bridge at Clifton had two problems to overcome, the opposition of the Smyth family and the need to demonstrate a commercial need for it. Some money was available, not sufficient to build a meaningful structure, but enough to “prime the pump.” William Vick, a wine merchant and alderman of the City of Bristol, in his will dated 1st December 1753 left £1,000 to the Society of Merchant Venturers (the Society)<sup>1</sup> to construct a bridge over the gorge from Clifton

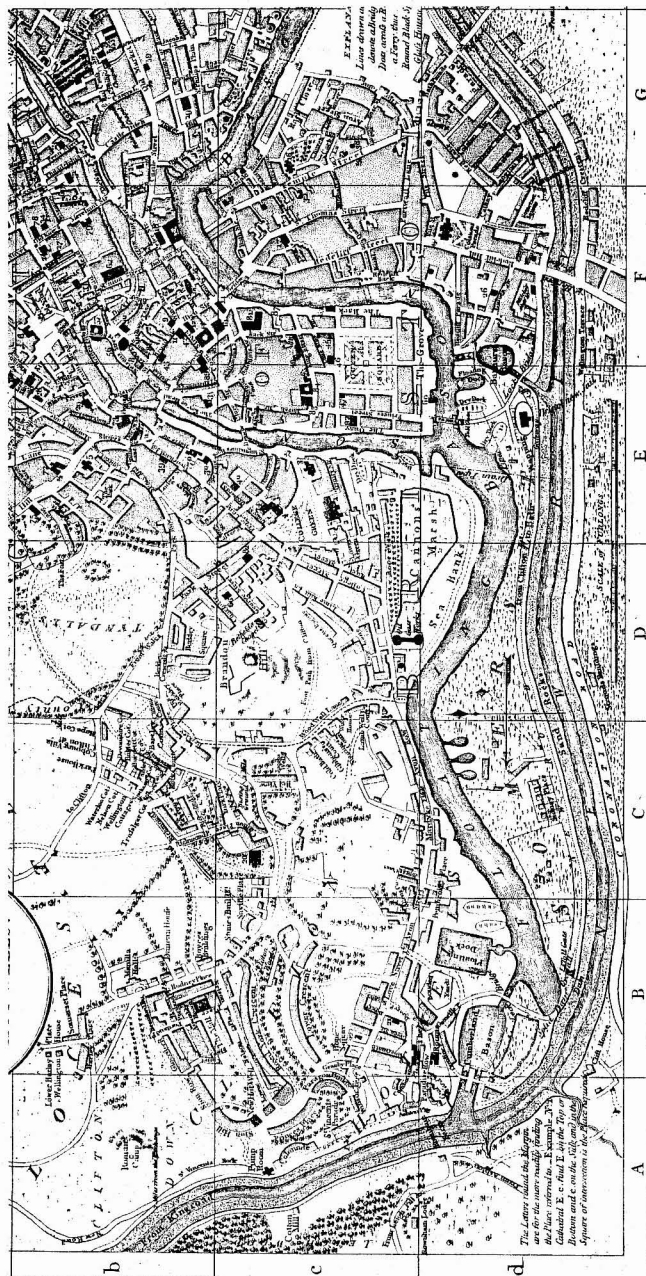


Figure 1. The City of Bristol, including Clifton, in 1825. The site of the suspension bridge was just north of the building marked 'Pump Room' (reproduced with permission of the Director of Information Services, University of Bristol).

Down to Leigh Woods. Vick thought this could be done for £10,000 and, when finished, would be "of great public utility". The will provided that part of the legacy could be used to procure an Act of Parliament enabling the bridge to be built. It also allowed the funds to be applied to "making satisfaction to the Proprietors (the Dean and Chapter of Bristol Cathedral) of Rownham ferry or for purchasing such ferry."<sup>2</sup>

In the late eighteenth century and continuing into the nineteenth Bristol was losing ground to more go ahead ports such as Liverpool and Glasgow. The construction of a bridge at Clifton was seen by some as a contribution to the alleviation of this problem. John Cosmo,<sup>3</sup> for one, urged the Society to act in the matter. If Vick's legacy was insufficient, which undoubtedly it was, the Society should solicit further subscriptions "for one of those bold and animating schemes of improvement which would have given a spur and activity to the present parilized and torpid energies of the Citizens of Bristol." The Chamber of Commerce pressed the Society to act in 1828 and again in 1829, drawing attention to the Charity Commissioners' report on the state of Vick's legacy which had grown significantly over the years.<sup>4</sup>

The Society responded. A Committee was set up to raise money and to prepare a Bill for submission to Parliament. It judged that the project was best managed by Trustees. The submission to Westminster was based on a suspension bridge. The estimated cost was £52,000. The sum available from Vick's legacy was about £8,000.<sup>5</sup> Realising that the proposal was probably beyond their resources, the Committee considered the possibility of a cheaper scheme while the Bill was going through Parliament. The Bill received the royal assent on the 29th May 1830.

The first full meeting of the Trustees, who numbered 31 by the end of the year, took place in the Merchants' Hall on the 22nd June 1830. Jeremiah Osborne, a solicitor, one of the two Clerks to the Trustees, reported that £22,007 10s. had been pledged. Of this, £19,750 was in loans and £2,257 10s. in donations.<sup>6</sup> The subscribers were largely local merchants, business men and other entrepreneurs. Very few of the county gentry of Somerset or Gloucestershire had put their names forward. Significantly, 90 per cent of the money was lent, not given. Presumably those lending expected repayment in due course. To be added to Osborne's figure was £8,339 9s. 4d. from Vick's legacy, giving a total of £30,346 19s. 4d. To be deducted from this total was £800 due to the Society as the Trustees' contribution to the expense of obtaining the Act of Parliament. This left £29,546 19s 4d. to meet the costs of acquiring the land needed and constructing the bridge and approach roads.<sup>7</sup>

A good start had been made, particularly bearing in mind that the Trustees had not chosen a design, let alone appointed an engineer. Although money continued to be pledged, the rate at which subscribers came forward slowed greatly following the death of George IV. The result was that the sum available to the Trustees when they met on the 9th October was £30,500, little more than it had been in June. The Trustees became cautious and resolved that a "bridge to an inferior or contracted scale cannot be recommended." Reference was also made to the "Credit and honor of the undertaking" and to the "beauty and magnificence of the situation". The consensus among those present at the meeting was that a bridge "conformable with the foregoing Resolutions" could not be achieved for less than £40,000, exclusive of the approaches and incidentals which were put at £5,000, £45,000 in all. So at least another £14,500 was needed before the venture could be put in hand.<sup>8</sup>

The Trustees judged that a scheme such as they envisaged would "bring forward subscriptions". They made further attempts to raise money. Various locations at which loans and donations would be accepted were named. These included the Bristol Institution, the Clifton Pump Room, Birtles Hotel, the Bath Hotel and the New Pump Room at Hotwells. The places chosen indicate the class of person to whom the Trustees were appealing: the well-to-do middle classes.<sup>9</sup>

### The Project Starts to Move Forward

By November 1830 bills were arriving. The cost of securing the Act of Parliament was £1,486 2s. 2d., part of which was met, as mentioned earlier, by the Society. In January 1831 the Society paid the balance of Vick's legacy, £4,705 13s. 10d. into the Trustees' bank account, so discharging its obligations under the will.<sup>10</sup>

In parallel with their money raising efforts, the Trustees were seeking a bridge design which satisfied their ambitions. It was put out to competition. Thomas Telford, who had designed and built the Menai Suspension Bridge, appraised 22 submissions on behalf of the Trustees. He found them all to be unsatisfactory.<sup>11</sup> The Trustees decided to put the design out to competition again, asking Telford to put forward his own proposals. This time 12 designs were submitted. The Trustees short-listed five, including Telford's.<sup>12</sup> Davies Gilbert, a past president of the Royal Society, who had been closely involved in the later stages of the engineering of the Menai Bridge, and John Seaward, an iron founder of Millwall, were appointed by the Trustees to judge the short-listed schemes. Telford's proposal, although it had been used in the submission to Parliament, along with three others, was set aside as being inappropriate for the site and too expensive.<sup>13 14</sup>

The design submitted by Isambard Kingdom Brunel (Fig. 2) was chosen and he was appointed Engineer to the Trustees on the 18th March 1831 on the understanding that the proposal was modified to satisfy Gilbert's concerns.<sup>15</sup> Essentially he was insisting that the design was brought into line with what he saw as established good practice at Menai. The only major departure was that at Clifton each bar of the chain was joined directly to the next without a short intermediary link. Brunel and his father, Marc, spent much of the following months meeting Gilbert's requirements.<sup>16</sup> Probably Marc Brunel made a much greater input to the design of the Clifton Suspension Bridge than did his son (Figs. 3-4).

### Contractual Matters

For the purposes of Brunel's contract the Trustees assumed that the bridge and its approaches would cost £50,000 to construct. He was allowed 5 per cent of this as his professional fees, £2,500, plus £500 to cover the preparation of drawings, plans and surveys and his personal travelling expenses. The total due to him was thus £3,000. As the appointment was effectively a consultancy

agreement, he was not expected to be available or on site all the time so the contract made provision for the "constant services of a competent resident engineer." £800 was allowed for this. The contract contained a "catch all" clause. The sums of money were to include "every possible charge" irrespective of the actual cost and time. If the money to complete the bridge was not forthcoming, the Trustees were entitled to Brunel's drawings, surveys and calculations. If the bridge was completed, the £500 already allowed to him for preparatory work was to be set against the £2,500 professional fees.<sup>17</sup>



Figure 2. Isambard Kingdom Brunel in middle life, portrayed by John Horsley, his brother-in-law (reproduced with permission of the Director of Information Services, University of Bristol).



Figure 3. Clifton Suspension Bridge as designed by Brunel, March 1831 (reproduced with permission of the Director of Information Services, University of Bristol).

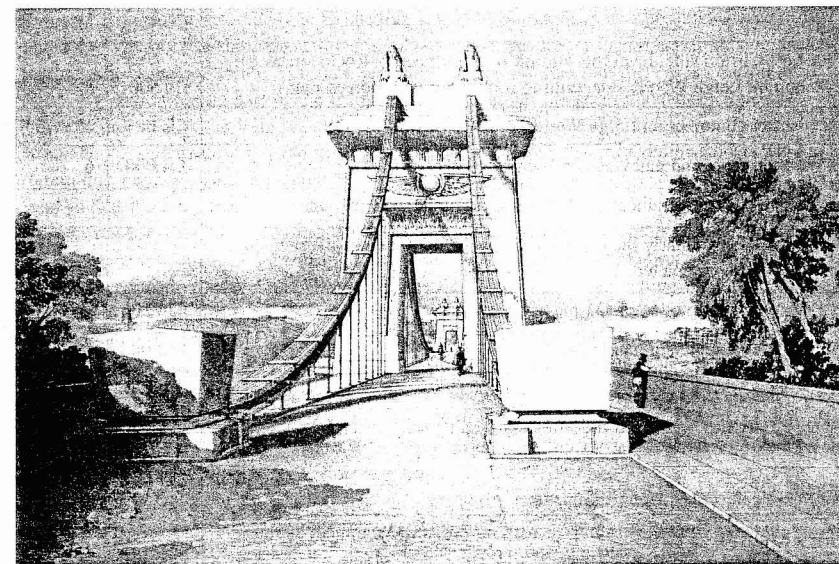


Figure 4 Clifton Suspension Bridge portal as designed by Brunel, 1831 (reproduced with permission of the Director of Information Services, University of Bristol).

This was a tight contract designed to protect the Trustees' interests. But as Brunel was not an employee, the final success of the venture depended on his commitment and good faith. From his point of view it was an excellent contract. It gave him the opportunity of establishing himself as a civil engineer in his own right, distinct from his father. When appointed, Brunel was three weeks short of his 25th birthday. The Trustees knew, however, that if their young engineer stumbled or slipped they could look to Marc Brunel to support his son.

### Cost Estimates, Funding Problems and Indecision

When the Trustees signed Brunel's contract they had no firm idea of how much it would cost to purchase the land needed, let alone the overall cost of constructing the bridge. Two weeks after his appointment Brunel gave an indication of how much could be involved, £57,000. So a further £25,000 over what was already available was needed, not £14,500.<sup>18</sup>

Despite the funding shortfall, the Trustees were determined to make a start. A Committee was appointed to superintend the management of the works. It met for the first time on the 20th June 1831.<sup>19</sup> The cost of acquiring the land and building the bridge had been, by then, re-estimated at £54,200. If the ornamental features such as the Egyptian embellishments to the piers were omitted, this figure became £45,000. As £30,800 was now available, the deficiency was about £14,000. Encouraged by these figures, the Committee decided to start preliminary work at a cost of £500.<sup>20</sup> This led to a curious ceremony taking place. After a public breakfast at the Bath Hotel on the 20th June 1831 Lady Elton, the wife of Sir Abraham Elton of Clevedon Court, was presented with a stone taken up by Brunel from St. Vincent's Rocks before "a multitude". The Dragoon Guards' band played "God Save the King", Sir Abraham toasted "success to the undertaking" and the crowd dispersed.<sup>21</sup>

The Trustees then asked Brunel what could be achieved for £35,000.<sup>22</sup> The reply was:

Item	Cost	Months
Rail off Clifton side, level the summit of St. Vincent's Rocks, mark off ground on Leigh Woods side, cutting rock for foundation of pier	£ 500	3
Construct abutment on Leigh Woods side	£ 8,000	12 / 15
Construct piers and gateways on both sides of river	£ 4,000	6
Purchase of land, engineers' salaries and administrative expenses incurred	£ 2,000	
Iron work, particularly the chains to be put in hand before the piers and gateways are completed	£10,000	
Total expenditure over 20 / 24 months	£24,500	
Assemble, stretch and hang chains	£10,000	6 / 8
Engineers' salaries and administrative expenses	£ 1,000	
These activities exhausted the sums allowed by the Trustees	£35,500	26 / 32 say 36
Fitting the deck	£ 6,000	
Painting the completed structure, finishing out, site clearance, engineers' salaries and administrative expenses	£ 3,500	12
Total	£45,000	48

The grand total was thus £45,000 spread over four years. Brunel added that, except for the £500 allowed for preparatory work, everything else would be done by contract so the cost of each task would be known before it was put in hand.<sup>23</sup> This argument was sound as far as it went but it is not known to what extent Brunel's figures were founded on estimates backed by quotations and so possibly credible. The Committee decided not to "nit pick." It accepted the figures at their face value.

Further funds were required if the Trustees were not to run out of cash towards the end of the third year. The Committee tried to raise more money again: lists of prospects were prepared, district committees were formed, collection points set up and canvassing was put in hand. The Mayor, the Sheriffs, the Recorder, the Town Clerk, the Dean and Edward Protheroe, M.P. were singled out as potential subscribers.<sup>24</sup> None had offered money so far.

Despite their best efforts, the Committee had little success. Nevertheless, it decided to purchase the land upon which the bridge was to be built. That on the Clifton side belonged to the Society and so presented no difficulty. That on the Somerset side of the gorge was part of the Ashton Court estate and so belonged to Sir John Smyth. The Trustees needed not only an area sufficient to accommodate the bridge pier and anchorages on the south side of the river, but also a strip of land to carry a road from the bridge to a junction with the turnpike which ran up Rownham Hill and on towards Portishead. Smyth knew he had to sell sufficient land to allow the bridge to go forward but there was room for argument: the position of the bridge and the line of the road differed slightly from that which was provided for in the plan annexed to the Act. There was also the matter of price. Smyth was determined to frustrate the Trustees. The outcome was eventually decided by a jury. The value put on the land was £1,007 plus £100 damages, £1,107 in all. In addition to this there were the legal expenses, £497 14s. and the cost of entertaining the jury, witnesses and "followers", £126 14s. This last sum was payable to the proprietor of the Failand Inn where the jury had met.<sup>25</sup>

Additional funds were not coming in well, so the Trustees decided to apply for a loan to bridge the gap. Brunel recommended the Exchequer Loan Commissioners as a possible source of funds. He knew a number of the personalities involved so he was able to approach the Commissioners direct. After speaking to the Assistant Secretary, Brunel thought that there was "reason to expect every disposition on the part of the Commissioners to grant the accommodation requested". The Trustees judged that the tolls which would accrue to them, once the bridge was open to traffic, would be fully adequate to pay the 5 per cent interest on the loan that the Commissioners were likely to require. Further, that there would be sufficient income available to pay 5 per cent into a sinking fund so that the debt would be paid off within 20 years.<sup>26</sup>

The Trustees' solicitors, Osborne Ward, drafted the text of an application to the Commissioners which was approved by a General Meeting of the Trustees on the 8th February 1832. When this decision was made the total sum available was £28,745 0s. 6d after netting off all the liabilities incurred to date except for £250 due but not settled. As the total needed to finish the bridge continued to be £45,000, the deficit became £16,000. The Committee was nervous about borrowing so much money and was anxious to avoid "any inconvenient embarrassments from a too extensive resort to the power of borrowing given under the Act".<sup>27</sup>

The Committee's financial concerns did not inhibit Brunel's activities. He continued to work on the detail of the bridge design and to prepare specifications "for those parties who might present Tenders for the various parts of the intended works."<sup>28</sup> The following June the Committee, heavily influenced by the Bristol riots, expressed its worries in a resolution which confirmed a decision made twelve months earlier that no start was to be made on major works until £45,000 or £50,000 was available. While policy was not changing, the Committee's resolution was weakening. Up to this date it had proceeded as though it would put the full construction in hand and rely on its ability to raise the balance of the money before the cash ran out. The Exchequer Loan was seen only as a



bridging facility, not a source of long term finance. Now the Committee was not so certain it could get by without a long term loan. Nevertheless it decided to appeal for money again.

The circular, when the Committee eventually issued it, pointed out that £34,000 had been subscribed. It would take four years to complete "an almost imperishable memorial to the liberality of the present generation and entitle them (the Subscribers) to the warmest gratitude of their posterity". The authors sweetened the pill by assuring potential subscribers that the money would be drawn down in easy instalments, adding that small donations could be "not an inconsiderable source of assistance". The "Address" was put in Felix Farley's Bristol newspaper, "The Bristol Gazette," and "The Bristol Mirror."<sup>29</sup> Although it expressed confidence publicly, privately the Committee acted as though it did not expect the appeal to succeed. There was no quorum at the meetings of the 1st and 8th August and the 5th October. In the three and a half months after the circular went out, only £1,483 7s was offered, of which £833 7s was in donations, with the balance of £650 in loans. The application to the Exchequer Loan Commissioners made no progress, despite the high hopes when the approach was first made. The Committee despaired and adjourned sine die on the 1st March 1834.<sup>30</sup> This decision may have been influenced by the decreasing amount of time Brunel had to devote to the bridge. He was busy elsewhere with the Great Western Railway and a scheme to improve the floating harbour in Bristol.

### The Impasse is broken

So by the time the Committee met again on the 31st January 1835 Brunel's world was changing fast. The meeting was called to receive a report from William West<sup>31</sup> of the Clifton Observatory. During a visit to Switzerland he had studied a wire suspension bridge at Freiburg. As the description suggests the bridge deck was carried by cables rather than chains. The possibility that a wire bridge could be cheaper than a chain construction prompted the Committee to re-open the possibility of other designs. It approached Brunel and asked him to consider what West had reported. He responded constructively. After dismissing the possibility of a wire bridge, he tabled a proposal for a chain bridge which he estimated could be built for £35,000. This was a figure tantalising close to the sum that the Trustees had at their disposal. It retained the principles of the original design but as the width of the carriageway was reduced, two not four chains were needed, also the number of laminations in the chain links was reduced. This lightened the whole structure so the chain anchorages could be less substantial. Further, the Egyptian embellishments to the piers were omitted. Brunel asserted that even this bridge would have "a character very superior to suspension bridges hitherto erected". He asked the Trustees to give him authority to proceed in the "present Spring."<sup>32</sup>

A General Meeting of the Trustees took place on the 28th March 1835. After Brunel had explained his ideas, Thomas Richard Guppy referred to a resolution passed on the 28th March 1832 prohibiting the commencement of work until the subscriptions totalled the sum needed to complete the bridge. Guppy then read out a resolution revoking this decision. It was discussed at length. Some Trustees held that "any alteration to its (the bridge's) character and construction would be at variance with the Resolutions of the Trustees and the inducements held out in the printed Prospectus to the Public". Another group insisted that "the Statements in Mr. Brunel's report are well founded" and was concerned at "The unfavorable impression which its (the project's) long protraction has made upon the public mind". Further, it was argued that a rigid interpretation of the resolution concerning the full availability of the funds needed to complete the bridge before work started would be "a virtual abandonment of the Undertaking". That Brunel's modified design could be upgraded to the full specification, should money become available, was not discussed. No decision was reached and the meeting was adjourned.<sup>33</sup> The Trustees re-convened on the 10th April. Guppy's motion was carried by ten votes to eight.<sup>34</sup>

On the 10th December 1835 the Trustees decided unanimously to proceed with the bridge on the basis of Brunel's plan of the 27th February 1835. Of the estimated cost of £35,000 they had £32,992 14s. 10d at their disposal.<sup>35</sup> This was a sound decision as the shortfall was limited. It could be made up during the four years it would take to complete the structure.

On the 23rd January 1836 a further General Meeting of the Trustees took place. The Committee reported that it had learnt that a group of subscribers proposed to challenge the decision to proceed with the bridge. The burden of the case was that the full design agreed upon in 1831 should be built and that work was not to proceed until all the money needed was available. A General Meeting of Subscribers was called for the 4th February 1836 in the Merchants' Hall. A Committee was appointed to assist the Trustees to raise more money.<sup>36</sup> Brunel submitted plans for the Leigh Woods abutment, based on his 1831 proposal, on the 7th May.<sup>37</sup> Two weeks later a General Meeting of the Trustees revoked the decision to proceed with the cost reduced design and "Resolved that the Committee be directed to take the necessary measures for the construction of the Bridge on the basis of Mr. Brunel's design approved by the Trustees". It was a rash decision as, although a further £10,000 had been raised, the funds available were well short of what was needed.<sup>38</sup>

### A Start is Made on Site

Work started on the Somerset side. The foundation stone of the Leigh Woods abutment was laid by the Marquis of Northampton on the 27th August 1836. It was a splendid occasion with a procession, banners, music and a huge crowd of "not less than 60,000". Marc Brunel was there to support his son. It was the first time he had visited the site.<sup>39</sup>

By April 1837 Brunel was reporting delays. Orton & Paxton, the contractors constructing the abutment, ran into financial difficulties and went bankrupt.<sup>40</sup> Work stopped. The completion of the Leigh Woods pier was put out to tender. Four offers were received. The new contract was awarded to William Williams and Philip Northam (Williams & Northam) on the 16th August 1836.<sup>41</sup> These contractual problems and building delays were aggravating what was already a difficult situation. Not only had insufficient money been pledged, the Trustees were having problems in collecting what was due from some of those who had already subscribed.

Further, the Committee was finding Brunel increasingly hard to deal with. Even though he was in Bristol on the 23rd June 1838 a meeting he was due to attend had to disperse without seeing him.<sup>42</sup> The following month he failed to attend a meeting convened to open tenders for iron work in the pier. The Committee was forced to appraise the quotations itself. This was fraught with risk as it absolved Brunel from his engineering responsibilities. Also Williams & Northam were continually in arrears to programme.<sup>43</sup> The bridge was consistently losing out to the Great Western Railway.

Although only fitful progress was being made on the Leigh Woods abutment, the Committee turned its attention to the approach road on the Clifton side and the construction of the St. Vincent's Rocks pier at the turn of the year, 1838 - 1839.<sup>44</sup> Brunel did not provide the specification for the pier until mid-February. The tenders for the pier ranged from £3,150 for Brown & Son to £9,890 for Gould & Taylor. Brown & Son were awarded the contract. They started work immediately.<sup>45</sup>

### The Enterprise comes to Crisis

The next General Meeting of the Trustees was held on the 30th July 1840. Brunel was not present so the Meeting was adjourned until the 6th August. The purpose of the gathering was to receive a report from the Committee. It comprised a narrative statement, a detailed financial review, estimates of the Trustees' ways and means and a revised estimate of the total cost of building the bridge. The sum required to construct the bridge was £74,876 12s. 4d., not £57,800 as previously estimated. The total funds due from subscriptions, donations and other sources was £48,332 12s.

11d. This was reduced by £2,875 19s. judged to be uncollectable, leaving £45,456 13s. 11d. net. The deficit was therefore £29,419 18s. 5d. This assumed that the actual cost incurred in finishing the works would be contained within the figures being put forward, a large, and probably unrealistic, assumption.

The narrative report was optimistic, given the Trustees' dire situation. The Leigh Woods abutment was complete and the pier was well in hand. The pier on the Clifton side was finished. The suspension chains were on order from Sandys, Carne & Vivian of Hale, Cornwall (Sandys). The Committee confirmed that the bridge was to be completed to the original design, including the ornamental features which were deemed necessary to give "that Character of beauty and magnificence which led to its (the design's) adoption". If adequate funds were forthcoming, the bridge would be finished in two years. The £30,000 needed could be raised through further subscriptions or by borrowing the money from the Exchequer Loan Commissioners or private individuals. The disparity between the original and the revised cost of building the bridge was dramatic. The detailed figures were:

Item	Cost
1. Bridge without ornamental work	£ 57,800 0s 0d
2. Ornamental work - from £3,000 to £5,000. Say	£ 5,000 0s 0d
3. Land purchased from Sir John Smyth, less timber sold	£ 926 6s 2d
4. Swiss Cottage, more than included by Brunel	£ 350 0s 0d
5. Acts of Parliament and all other legal charges	£ 3,183 2s 2d
6. Engineering, including the late Mr. Telford's charge	£ 3,392 1s 6d
7. Cost of the iron bar after deducting revenue	£ 632 11s 0d
8. General disbursements in the management of the undertaking	£ 1,417 12s 7d
9. Further Act of Parliament	£ 300 0s 0d
10. Due to Brunel	£ 1,575 0s 0d
11. General disbursement on management activities	£ 300 0s 0d
12. TOTAL	£74,786 12s 4d*

\*The actual total is £74,875 12s 5d <sup>46</sup>

These figures are substantially opaque. There is no record of the original estimate for each item, the "spend" to date against it and, if not complete, the further sum needed to finish that item. Items in the original estimate are not identified. The total forecast consisted of a mixture of budget figures, items 1, 2, 9, 10 possibly and 11 and the actual cost of work completed, items 3, 4, 5, 6, 7 and 8. The purpose of the analysis seems to have been to demonstrate that the bridge could be built

for £57,800 and that the balance of the £74,786 12s. 4d. was either omitted from, or was additional to the original estimate. Looked at from any point of view, the Committee and Brunel were guilty of gross mismanagement. Neither party had been diligent in their responsibilities. Attendance at Committee meetings had been poor, Brunel was often not available. He was not even there when these appalling figures were put in front of the Trustees.

Despite the revelations of August 1840, the Trustees continued to conduct their affairs as usual. They called down more money while taking no steps to raise additional funds. A new Bill was introduced into Parliament to extend the time allowed for the completion of the bridge.<sup>47</sup> In early April 1841 it received the royal assent. Only then was an application to the Exchequer Loan Commissioners prepared.<sup>48</sup> By the end of November, the Trustees were insolvent. Their liabilities totalled £17,202 15s., of which £15,000 was due to Sandys for the chains and other iron work when these were completed. Their assets totalled £15,142 7s. 10d. after account had been taken of uncollectable subscriptions and donations so the enterprise's liabilities exceeded its assets by £2,060 7s. 2d., assuming there were no further "surprises."<sup>49</sup>

The Trustees continued to procrastinate. It was a further six weeks before they considered the draft text of an appeal for more money. It was not until the 5th February 1842 that the wording was agreed.<sup>50</sup> On the 5th March the Committee accepted the seriousness of its situation. No further expense was to be incurred, except for "hauling the chain Iron from the vessels to the site of the Bridge."<sup>51</sup> Brunel showed little interest in the Trustees' dilemma. He added to their difficulties by reporting in June that £36,348 were required to complete the bridge. This figure included the chains already on order but excluded the "ornaments on the piers". Belatedly, the Committee instructed Brunel to prepare an application to the Exchequer Loan Commissioners.<sup>52</sup> The Trustees learnt when they met on the 25th July 1842 that their request for a loan of £30,000 had been submitted. Over four and a half months had passed since work had stopped on the site. The Commissioners responded in late October saying that, should they advance the sum requested, they would require the Trustees to give personal security to the Exchequer for half the sum involved. A meeting of Subscribers and those "favorable to the completion of the bridge" was called at the Bristol Institution for the 2nd February 1843.

The Trustees reported that the abutments and piers on both sides of the river had been completed, except for the ornamental features (Fig. 5). The tunnels and chambers in the rocks for securing the

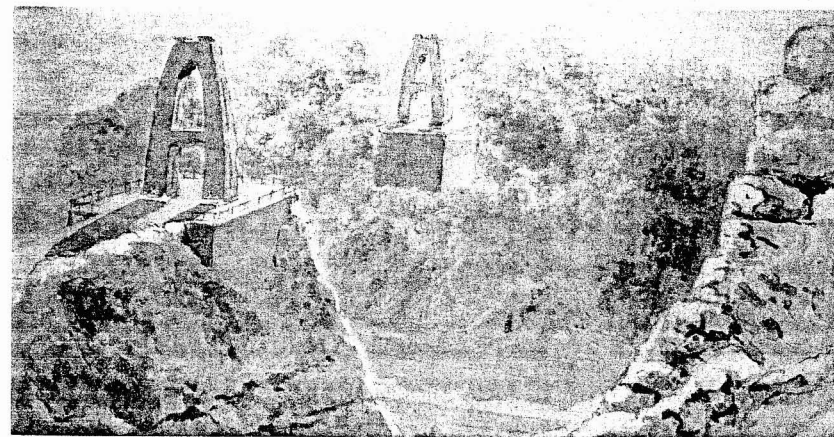


Figure 5. The abutments and piers of Brunel's uncompleted bridge (reproduced with permission of the Director of Information Services, University of Bristol).

chains had been finished. The excavations for both approach roads were complete. Half the suspension chains, rods and flooring were available on site. £45,000, including Vick's legacy, had been contributed, a further £30,000 was needed to meet liabilities already incurred and to finish the bridge. The Commissioners were willing to lend the money, the loan was to be secured by a mortgage on the bridge and the tolls. The interest rate proposed was 5 per cent and the principal was to be repaid in annual instalments. The Commissioners required the Trustees, or other interested parties, to guarantee the interest due and the capital repayments. The Trustees said they were prepared to give such a guarantee if the subscribers advanced £15,000 to part indemnify them from the risk they were taking. Thomas Kington, the Chairman of the Trustees, told the meeting that if the money was not forthcoming, there would be no alternative but to abandon the enterprise. Those present did not offer to underwrite the Trustees' endeavours.<sup>54</sup> So the Clifton Suspension Bridge project was abandoned.

### Dealing with the Creditors

The principal creditor was Sandys. Part delivery of the chains had been taken in February 1842. In November 1845 Sandys was becoming extremely impatient and pressing the Trustees for the full sum outstanding of £2,885 12s. 1d., comprising those chains which had been completed, together with the work in progress at their workshops in Hale.<sup>55</sup> Impatience did not bring payment. In April 1848, five years after work had stopped on the bridge, no settlement had been reached. Sandys offered to accept £2,780 12s 7d. if the dispute could be closed quickly. The Committee tried to buy more time by suggesting that the Portbury Pier and Railway Company would have a use for the chains. This railway, of which Brunel was the Engineer, did not proceed so the debt remained unpaid.<sup>56</sup>

On the 7th February 1849 the Trustees met to discuss a writ which had been served on George Jones, one of their number, demanding the payment of £3,285. Jones did not respond so a writ of execution was served for £3,349 8s., a figure which included legal costs.<sup>58</sup> Notwithstanding the parlous legal position of the Trustees, the Committee continued to try to negotiate. Nothing came of this. Eventually the Trustees borrowed £2,750, Sandys had agreed to accept this somewhat smaller sum, from Miles, Hartford & Co.. This was guaranteed by the members of the Committee. Brunel, possibly struck by his conscience, offered to participate as a guarantor. On the 16th July 1849, seven years after work had stopped, the Trustees finally settled with Sandys.<sup>59</sup> The chains were eventually sold to the Cornwall Railway for incorporation into the Royal Albert bridge across the Tamar at Saltash.<sup>60</sup>

### The Bridge is Revived

Brunel died on the 15th September 1859 at his home, 18 Duke Street, Westminster, aged only 53 years. John Hawkshaw was appointed Engineer to the London Bridge and Charing Cross Railway the same year. The Hungerford Suspension Bridge, which Brunel had designed, had only been completed in 1845 and was due to be removed to make way for a railway bridge to carry the tracks of the London Bridge and Charing Cross Railway over the Thames to a new rail terminal on the north side of the river. The chains of the Hungerford Bridge were very similar to those intended for Clifton. Further, they had been made at the same time and by the same firm, Sandys. Hawkshaw realised that they could be used for finishing out Clifton. The chains could be sold on at a price in between their scrap value and the cost of making new chains. It would be advantageous to both the new railway company and a revived Clifton Suspension Bridge enterprise if this could be done. At 59 years of age Hawkshaw (Fig. 6) was at the apogee of his career. He

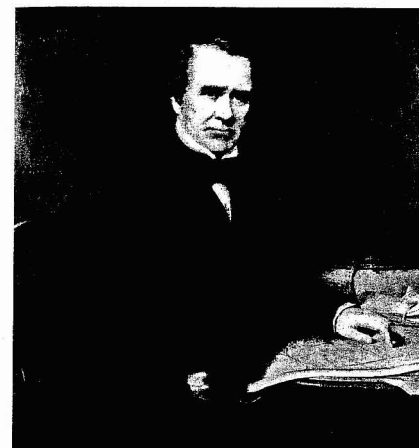


Figure 6. John Hawkshaw (Institution of Civil Engineers).

was to become the President of the Institution of Civil Engineers in 1861.<sup>61</sup> He decided to use his professional connections to complete the bridge over the Avon gorge.

Hawkshaw and his colleagues realised that no sound business case could be made for a bridge built *ab initio* at Clifton,<sup>62</sup> even less for the grandiose scheme that Brunel had designed for the Trustees. The abutment and piers were, however, complete and in good order so a bridge to a lower specification could probably be constructed with some chance of commercial success, if the trustees were to write off the money they had spent). The availability of the Hungerford chains at a knock down price could help persuade them it was worthwhile taking this action. Further, the completed bridge could be represented as an appropriate memorial to Isambard Kingdom Brunel.

On the 22nd May 1860, just over eight months after Brunel's death, Hawkshaw and William H. Barlow met at 19 Great George Street. They were joined by a group of eminent civil engineers and contractors. Charles Edward Ward, a partner in Osborne Ward, the solicitors to the Clifton Suspension Bridge Trustees, was also there. At their next meeting on the 22nd June they were joined by George Parker Bidder, the incumbent President of the Institution of Civil Engineers and J. W. Miles, the Bristol banker. They decided to proceed with the enterprise.

Hawkshaw and Barlow were appointed Engineers to the Company they proposed to form. Hawkshaw told the meeting that the Directors of the London Bridge and Charing Cross Railway had decided to sell the chains and all but the piers of the existing Hungerford Bridge. It was reported on the 27th June that the asking price was £5,000. This offer was accepted. Further, the Trustees of the Clifton Suspension Bridge, Ward was to report later, had agreed to sell their assets, the land and piers at Clifton and Leigh Woods for £2,000 in shares in the new Company.<sup>63</sup>

When the Committee met on the 4th July 1860 the Directors, as they were now styling themselves, instructed their solicitors, Osborne Ward, to prepare the heads of a Bill to be submitted to Parliament to form a company to complete the bridge. The Directors were already canvassing for financial support for the enterprise when they took the decision to proceed. The cost of finishing the bridge was initially put at £30,000.<sup>64</sup> The design differed from Brunel's proposal of 1831 in numerous respects. It was a minimum cost scheme.

Sir Greville Smyth, the great nephew of the Sir John of 1831, took an entirely different view of the prospect of a bridge from his predecessor. He planned to sell part of his estate for commercial and residential development. For this to be viable, good and easy access to Clifton and Bristol was essential. As initially proposed the bridge was to be only 24 feet wide, consisting of a 16 foot wide roadway and two footpaths, one on each side, 4 feet wide. The roadway was too narrow for two carriages or other horse drawn vehicles, when travelling in opposite directions, to pass each other comfortably at speed. Smyth agreed to meet the cost, £5,000, of widening the carriageway from 16 to 22 feet, by buying shares to the value of £2,500 and donating £2,500 in cash on the day the bridge was opened to traffic.<sup>65</sup> The estimated cost of completing the bridge thus became £35,000.

By November the Directors' plans were well advanced. The Board agreed the text of the Bill and instructed their solicitors and Parliamentary agent to proceed.<sup>66</sup> While the Bill was passing through Parliament Cochrane and Company were selected as the contractors. On December 6th Hawkshaw



reported to the Directors that it was in order for them to sign the contract once prices were agreed. By this date the subscribers had paid the 10 per cent deposit on 2,241 x £10 shares which were on issue. There were a further 100 shares spoken for, giving a total of just over £23,000 in all subscribed.<sup>67</sup>

The Bill was before the House of Lords in early February 1861. Lord Redesdale, the Chairman of the Committee considering the text, insisted on certain changes. The principal ones were that, in addition to the tranche of shares issued to them, the Trustees were to have a first charge of £50 on the profits of the enterprise. Further, that the dividend was to be limited and any profit remaining after 7½ per cent had been paid was to pass to the Trustees. The monies so accruing to the Trustees were to be applied to purchasing further shares in the Company and paying off any debentures on issue. The purpose of these changes and additions to the text was to ensure that the Trustees would eventually secure 100 per cent ownership of the Company, if the enterprise was sufficiently profitable. It would then be wound up and the Trustees would operate the Clifton Suspension Bridge as a toll bridge. The Bill passed into law on the 28th June 1861, with a share capital of £35,000. Further, the Directors had powers to issue debentures or borrow money to a total of £11,600 once the nominal share capital had been fully issued and 50 per cent paid up.<sup>68</sup>

The Directors prepared a list of shareholders every six months. It was not until the bridge had been completed that all the shares were taken up. For balance sheet purposes the total was shown as 3,250 shares, £32,500. The remainder of the 3,500 was made of 200 issued to the Trustees and 50 issued to Wythes, a contractor, in compensation for relinquishing his interest in the existing Hungerford Bridge. The total sum eventually received from the share issue was £32,539, the odd £39 was due to share forfeits. In addition £11,600 was raised through debentures.<sup>69</sup>

The overall share structure of the Company was unusual, 500 of the total of 3,450, 14.5 per cent, were held by the Trustees, the Society of Merchant Venturers and Sir Greville Smyth. Professional civil engineers and contractors accounted for 1,110 shares, 32.2 per cent, leaving only 1,840 shares in the hands of the general public. John Hawkshaw and Thomas Brassey, a contractor, held 100 shares each, William H. Barlow, George Parker Bidder, John R. McLean, George R. Stephenson and John Fowler, 50 shares each, all engineers who were to become Presidents of the Institution of Civil Engineers in due course. Isambard Brunel, Brunel's elder son, subscribed for five shares, his brother Henry Marc did not purchase any equity in the Company.<sup>70</sup>

Adequately financed and with Hawkshaw and Barlow as the Company's Engineers, the bridge was completed quickly and within budget. As mentioned above, the structure was very different from Brunel's design of 1831. Even though widened at Smyth's request, the road was still narrower than originally planned. There were six suspension chains, not four. The anchorages were re-positioned and the piers heightened somewhat. The bridge deck was adequately braced, the lack of stiffness was a major weakness in Brunel's design which would probably have caused difficulty if it had been built to this specification. In effect, the bridge was re-designed round two fixed features, the piers which already existed and the chains which came from Hungerford. Suspension bridge technology had moved on since 1831, not least to deal with the trail of structural problems which had resulted from lack of deck stiffness, notably at Menai.

### The bridge is opened

The bridge was opened for foot passengers on the 9th December 1864 and for wheeled vehicles on the 23rd January 1865 (Fig. 7). The cost to the Company was £44,600<sup>71</sup> and so was in conformity with the provisions of the Act of Parliament if account is taken of both share capital and debentures. The total cash cost was £89,600 if the Trustees' expenditure of £45,000 is included also. After an initial burst of activity, the long term pattern of bridge usage emerged. The toll income for the first full year of operation was £2,933 2s. 8d.<sup>72</sup> The following year, 1866, saw



Figure 7. The completed bridge, 1864 (reproduced with permission of the Director of Information Services, University of Bristol).

receipts of £2, 250 1s. 2d. The income in the early years hovered round £2,000 per annum, despite attempts by the Directors to encourage traffic by adjusting the tolls. It was not until the late 1870s that there was a clear trend upwards: in the 1890s the income averaged just over £3,000 a year.<sup>73</sup>

Much of the income came from foot passengers, largely at weekends. There was no commercial traffic of significance. This pattern was to change with the coming of the motor car. As late as 1903, the category "carriages" in the Directors' Report was unqualified. By 1907 it had become "carriages (including motors)". By 1912 motors were being reported separately. That year the income from cars was £647 19s. 0d. while that for carriages was £601 12s. 3d. The absolute increase in income was due to the motor car. Just before the First World War, 1913, the total income had reached £3,914 15s. 11d. The upward trend resumed after 1919 and by 1930 motors contributed nearly half, £3,490 17s. 3d., of the Company's total income of £7,023 8s. 1d. Carriages were down to £107 7s. 6d. and horses to £9 9s. 3d.<sup>74</sup>

The rise of the motor car from the 1920s onwards transformed the fortunes of the Clifton Suspension Bridge. Looked at as an investment, the return on the money spent on finishing the bridge was miserable until the car came to the rescue. It was not until the 1870s that a return of more than 2 per cent on the investment in the Company was consistently achieved. The dividend did not rise to 5 per cent until the early 1900s. The car enabled the Trustees to buy shares and repay debentures at an increasingly rapid rate. This process was further accelerated by inflation, particularly after the Second World War.<sup>75</sup> The Trustees completed the purchase of the shares in the Company in 1952, it was wound up and they resumed control of the enterprise on the 1st January 1953. A new Act of Parliament, which received the royal assent on the 1st August 1952 re-incorporated the Trustees in their renewed role.<sup>76</sup>

In 1831 and again in 1861 there was no economic case for the Clifton Suspension Bridge. It met no commercial need, being largely a social facility. It was just worth finishing out the bridge in 1861 if the Trustees' investment was written off and if the bridge was built to a minimum



specification on a low cost basis. The long term viability of the structure was secured by Greville Smyth's insistence that the bridge was widened to permit carriages and by extension, cars to pass each other at speed. If the true economics of the bridge were to be taken into account, in that a dividend had to be paid on the total investment, the return in the early years would have been 1 per cent, a ridiculously low figure.

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