

DEAN BRIDGE, EDINBURGH

by

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1. ORIGIN

The origin of the bridge can be considered to have stemmed from a proposal for a residential development of large villas on the estate of Sir John Nisbet (d. 1827) at Dean in, or just before, the year 1823. As part of this scheme it was proposed to build a bridge across the Water of Leith to connect the development with the New Town (Fig. 1).

The scheme began to crystallise in the summer of 1825 when a formal approach for assistance in building the bridge was made by Sir John Nisbet's agents to the Cramond District Road Trust. The Nisbet submission, which was considered by the Trust on 3 August, stated '*It has been suggested by gentlemen of the first talents that if a bridge were built over the Water of Leith, and the public road carried from the Drumshough Tollbar by that bridge through the Dean grounds, it would be one of the most splendid, imposing and useful improvements . . . It would render the approach from the north much easier than at present . . . in point of magnificence the bridge shall not be inferior in design or execution to any bridge in the kingdom . . . should the Trust give us their aid . . . in removing all the obstacles that stand in the way, we pledge ourselves to have the plans prepared instantly and commence building the bridge forthwith . . . we will find security for the erection of the bridge, which is to be 10 feet wider in the roadway than the Waterloo Bridge, London and to be erected in the most secure*

*and handsome manner under the direction of eminent professional men . . . will cost at least £20,000 . . .*²

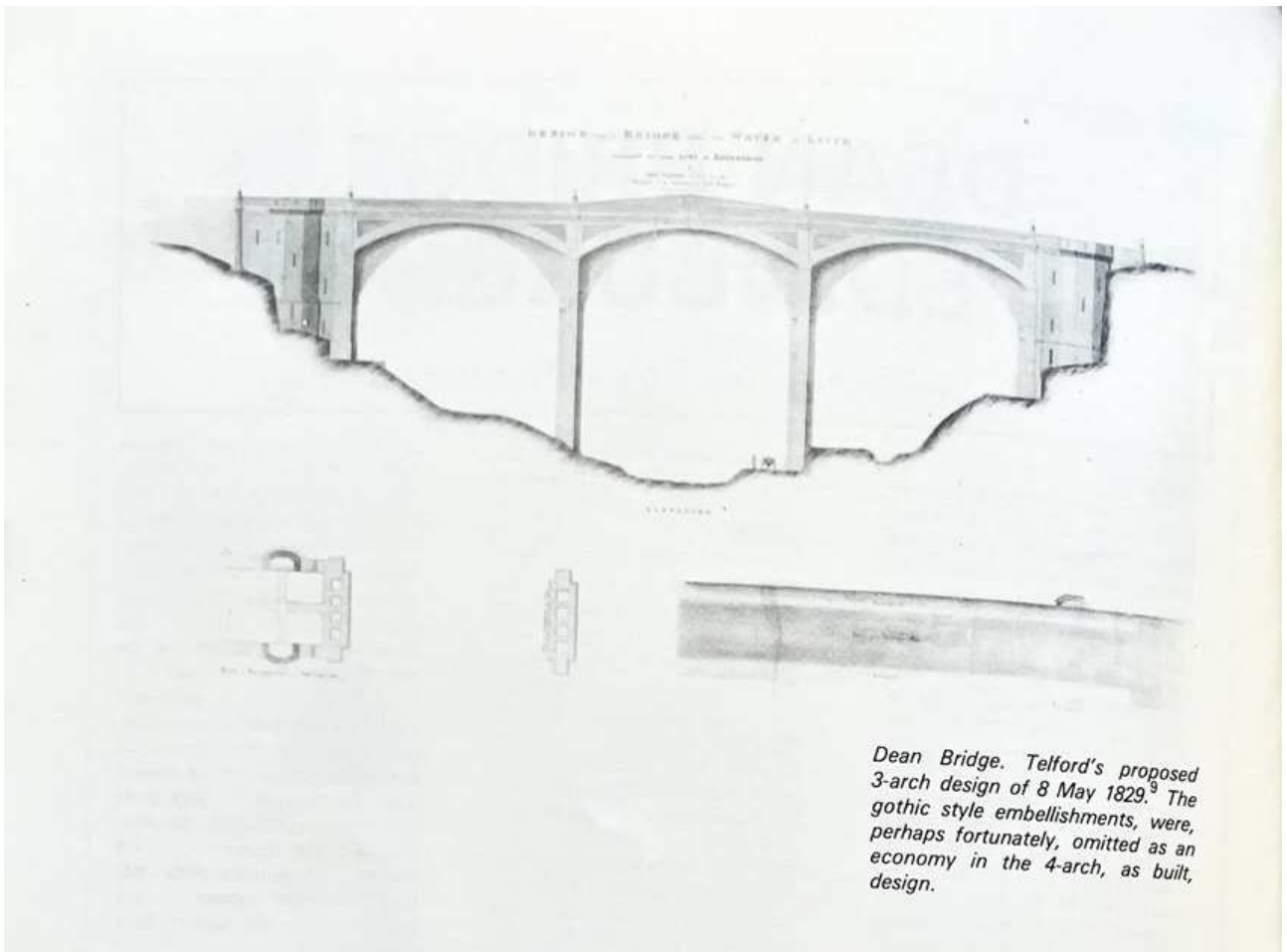
The Cramond District Road Trust agreed to support the scheme and James Jardine, an Edinburgh civil engineer and close associate of Telford was instructed to survey and report on the matter. Early in 1826 he reported back that '*. . . the proposed road through the Dean grounds is all an easy ascent and is 140 yards shorter than the present dangerous abominable hilly road*³ (via Bell's Mills bridge and what is now Belford Road and Queensferry Terrace). At their meeting on 9 February the Road Trustees agreed to make and metal the road to a width of 60 ft. and to pay £3,000 towards the cost of the bridge,³ a figure that was subsequently increased. The Trustees insisted that the bridge was to be free of toll.⁴

The main *raison d'être* for Dean Bridge was therefore a private building speculation. On the west side of Edinburgh the recently completed buildings in Moray Place, Ainslie Place and adjacent streets had extended the New Town to the deep ravine of the Water of Leith. But, as *The Scotsman* reported, '*the westward march of improvement is not to stop here. A spirited individual has purchased the extensive range of ground known by the name of the Dean . . . nearly 140 acres . . . The buildings to be erected here may be considered as forming a third New Town . . . the streets will run south and north or east and west, as in the Old New Town. Near the middle of the ground*

*will be occupied by two squares and a Circus . . . the finest feature of the plan is the Terrace . . . along the high bank of the river following its windings from St. Ann Street to Bell's Mills. The houses to be built here will generally front the south . . . the situation will be one of the finest in Europe . . . such a splendid suburb will require a new communication with the town . . . a handsome bridge is to be thrown over the ravine . . . will cost £30,000 . . . parapets 80 feet above the river . . . its length . . . not less than 300 feet . . . these details . . . we believe . . . to be substantially correct . . .*⁵

The spirited purchaser was undoubtedly John Learmonth, a coach-maker of 3 Prince's Street⁶ and later Lord Provost (1831-3). He had feued the land from Sir John Nisbet and as part of the agreement had bound himself to erect '*a handsome and sufficient bridge over the Water of Leith which was to be designed, executed and completely finished to the satisfaction of Mr. Gillespie Graham, Architect*'.⁷ Gillespie Graham had also made out a development plan for the Dean lands³ which may have been that described above in the Scotsman.

For further details of the origins of the project and the circumstances under which Telford came to be associated with it the reader is referred to the most useful paper by Skinner.⁷ Briefly, between 1825 and Telford's acceptance of the remit to design and build the bridge in April 1829, there were many discussions between the various par-



Dean Bridge. Telford's proposed 3-arch design of 8 May 1829.⁹ The gothic style embellishments, were, perhaps fortunately, omitted as an economy in the 4-arch, as built, design.

ties. Jardine made out a plan for the bridge which was acceptable to the Trust but not to Gillespie Graham, who decided to make out his own design. In 1828 matters came to a head and the Road Trustees decided not to accept any scheme unless it had Telford's approval. Telford was brought in as a referee and, not being satisfied with Gillespie Graham's design, was requested to make out one of his own.

2. DESIGN AND CONSTRUCTION 1829-32

For an authoritative description of the bridge and its construction it is impossible to better Telford's account. He wrote,

'I declined entering upon the business unless the several parties interested signed a missive letter, stating that my plan should be adopted, and the bridge built under my direction. These preliminaries being settled, I furnished a plan, elevation and section, with detailed specifications; and a contract was entered into with Mr. John Gibb of Aberdeen . . .

The arches are 90 feet in span, and edifice 106 feet in height

from the bed of the river to the surface of the roadway; the breadth of the carriageway 23 feet, with a footpath on each side of 8 feet; so that the whole breadth between the parapets is 39 feet; the total length is 447 feet.

My design originally consisted of three arches (Fig. 2), but on commencing the excavation for the foundations on the south side, the rocks were found to be so much dislocated that no security could be obtained . . . prudence, therefore, induced me to change the design into four arches . . . whereby the south abutment is placed upon solid rock . . . The piers are 31 feet in length . . . built internally with hollow compartments; the side walls are three feet in thickness; the cross-walls two feet. Projecting from the piers and abutments are pilasters of solid masonry. The main arches have their springing at 70 feet from the foundations, and rise 30 feet;

and at 20 feet higher, other arches, of 96 feet span and 10 feet rise are constructed, and the

face of these, projecting before the main arches and spandrels, produces a distinct external soffit of five feet in breadth; and this, with the . . . piers, are the distinguishing features of this bridge. Inside the external spandrels are longitudinal walls, and the interstices are covered with flat stones, to support the roadway. The whole of the masonry of this bridge consists of square sandstone, of excellent quality . . .⁸ (Fig. 3).

The resident engineer Charles Atherton in an early account of the bridge⁸ emphasised the advantages of its hollow construction for inspection (Fig. 4) and economy in labour and materials. Telford continues,

'It remains to be explained by what method the ascitious or external arches were executed, so as to allow of their subsiding freely upon the centering, without obstruction from the lower spandril-walls . . . The course pursued, was, by striking the centres of the lower arches as soon as the arch-stones were laid, and immediately proceeding in like manner with the turning of

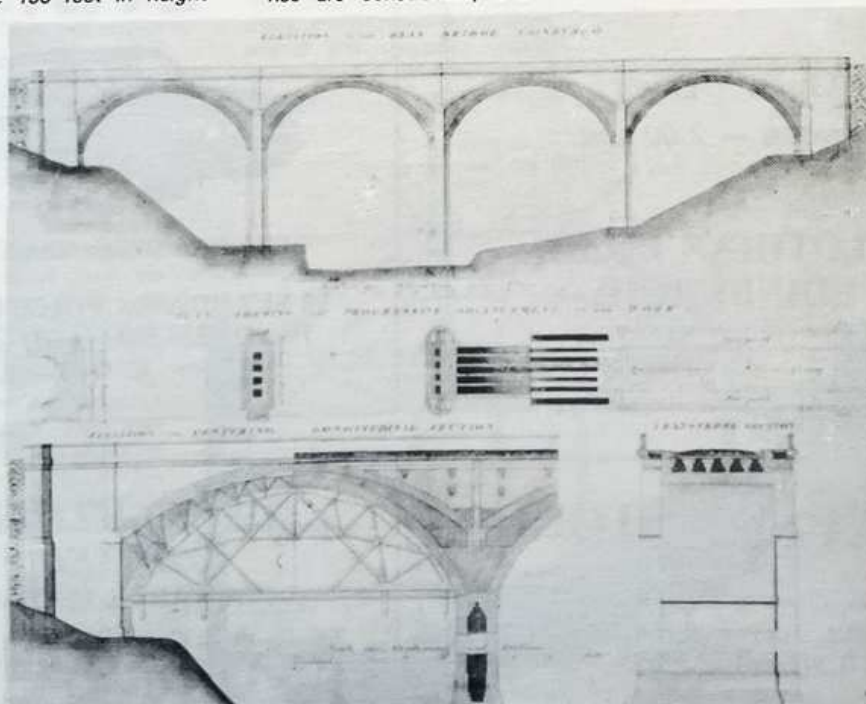


Fig. 3 — Dean Bridge as built. Drawing by the Resident Engineer, Charles Atherton in April 1933.⁹ Note the hollow piers and spandrels.



Fig. 4 — Dean Bridge. Workman standing inside the hollow spandrel on the extrados of a 96 ft span asciticuous arch. Note the stone cross-tie and the good quality of the internal masonry work. The cavities interconnected transversely by means of access holes.

the upper arches, and also striking their centres previously to the completion of the lower spandrels. This was a delicate operation and is understood to have been unprecedented; for the four upper arches of 96 feet span each were supported solely upon their pilasters of five feet projection from the main piers, and five feet wide, being only one-nineteenth part of the arch span. To accomplish this, it was evidently necessary that all the four arches should be struck as gradually and equally as possible never allowing the slack-blocks to be driven out more at one time than sufficient to let down the centre a quarter of an inch. It was found that these external arches subsided equally and gradually, during a month, by which time they had acquired permanent stability, and their total subsidence amounted to four inches and a half at the crown, while the lower or main arches subsided about three inches at the crown. . . . After having allowed the external arches to attain permanent stability, a portion of their spandril-wall was built, and the centering removed, and the masonry of the lower spandrels was then made good up to their soffits . . .

Telford emphasised the necessity for cranes, or other

mechanical contrivances in heavy masonry work ' . . . for it will frequently be found, upon setting a stone in its place, that its bed is too full or too lean, or that from some other cause, the stone must be lifted, examined and re-set. If this can be readily done, the fault will be rectified; but if this operation creates much trouble, the masons will slight it . . . The entire success

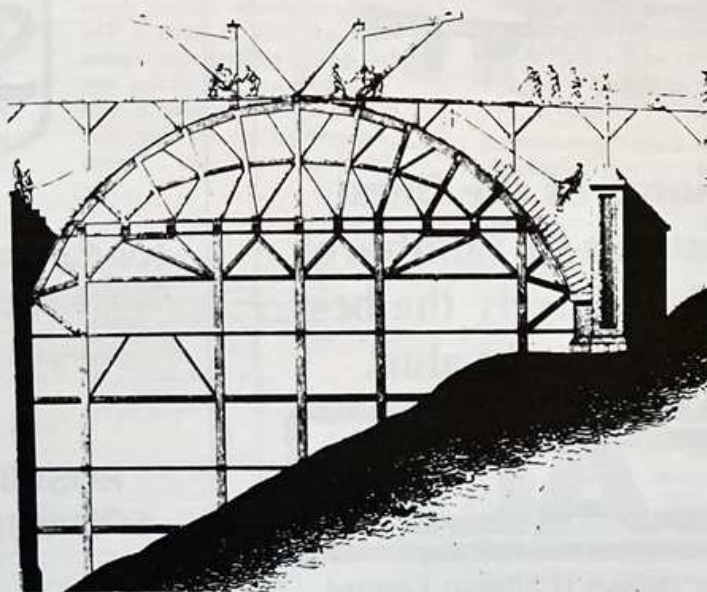


Fig. 6 — Dean Bridge — Forming arches. Note machinery, scaffolding and modus operandi.¹¹

which attended the execution of the Dean Bridge, and the expedition with which the work was carried on, in a great measure attributable to the judicious manner in which the machinery and scaffolding were constructed (Figs. 5 & 6). The bridge was commenced in October 1829 and completed (with the exception of the parapets) in December 1831, without any accident whatever — the cost being £18,556, inclusive of making roads of approach'.⁸

3. COSTS

Lettice Rae, biographer of the Gibb family, gives the cost of the bridge as £34,000¹² but it is quite clear from the correspondence at the Institution of Civil Engineers that Telford's figure is of the right order. Gibb's contract price was just over £15,000¹³ and the work was originally to be have been finished by November 1831.¹⁴ Most of the cost of the bridge was borne by Learmonth, but the Cramond District Road Trustees, thought they 'had acted liberally in contributing between £8-9000'¹⁵ towards its construction. Due to the alteration in design from three to four spans, early in 1830, and other factors, an extra costs of nearly £4000¹⁶ was incurred which Learmonth at first refused to meet. It was only after receiving personal confirmation of an earlier assurance from his friend Telford that 'you have a good bridge and at a comparatively modern sum',¹⁷ and the instruction of James Home W. S. by Gibb to act on his behalf that Learmonth finally agreed to meet Gibb's account in full in August 1832¹⁸

4. COMPLETION 1832

It is often thought that the bridge was 'open for traffic at the end of 1831'¹⁹ but this was not so in any meaningful sense as the roadway was not formed. By 27 February 1832 nearly half of the kerbs, channels and footway pavement on the bridge had been laid and the parapets were ready for setting.²⁰ On 8 May

* Crushing of the front edges of horizontal joints.

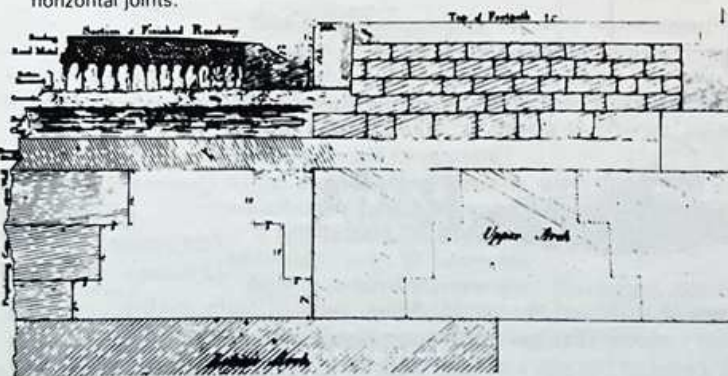


Fig. 7 - Dean Bridge - Proposed roadway construction, 8 May, 1832.⁹

1832 Atherton certified 'the bridge is now completed in a substantial manner, no cracks, skirps* or defects arising from bad workmanship being perceptible throughout...'²¹ Metalling of the carriageway by the Trust was authorized by Learmonth on the following day.²²

In constructing the carriageway the traditional Telford hand-pitched stone construction (Fig. 7) does not appear to have been adhered to as can be seen from a recent trial hole section (Fig. 8). Telford's proposed use of a 4" layer of concrete (Fig. 7) at this early date is of particular interest in the historical development of road construction on bridges. Its purpose seems to have been primarily to inhibit water penetration into the hollow spandrels.

Lettice Rae tells us that John Gibb, although a man of irascible temper was beloved of his workers. When building the Dean Bridge he had an elevated perch made from which he could survey their progress and bellow criticisms through a sort of megaphone. On occasions he descended amongst the workman 'to exchange blows, banter and snuff' to the delight of all.¹² There is a good story, which perhaps should be taken with a pinch of salt, that the bridge was finished ahead of time and its Trustees wished to take it over immediately, but Gibb said, 'Na, na, the briggie's mine... until the time specified

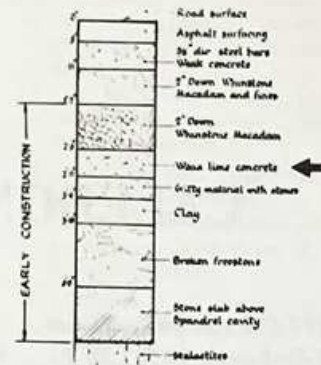


Fig. 8 - Dean Bridge - Section of carriageway²³

in the contract for its completion' and he charged a penny for every foot passenger and wheel.¹²

5. POINTS TO LOOK FOR ON SITE and POSTSCRIPT

1. The direct line and high level of the bridge which is typically Telford.
2. The impression of lightness that the external arches and pilasters give to the bridge elevation. Try to envisage the delicate operation of arch formation from the narrow pilasters before the main arch spandrels were built (Fig. 8A).
3. The high quality of the Craighleith stone masonry. The piers are particularly fine. Look for the close joints and nipper indentations on the ashlar blocks.

It seems that Telford remitted a substantial part of his own charges for the bridge and Learmonth wrote to him in October 1832... 'I deeply appreciate this mark of liberality and consideration. The concern has evinced no symptoms of being likely to improve, but certainly it is one of the most highly admired structures in the world, both in design and execution... and it must have an effect in time, you have given me that advantage...'¹³ In 1833 Learmonth requested the Road Trust to accept the future maintenance of the bridge but they refused; in the event this proved to be minimal. A road on the line of the present Queensferry Road from

near the bridge to what is now Queensferry Terrace was completed c. 1834, but it was not until about the mid-century that building commenced on the Dean lands.

Renovation work on the parapets was carried out in 1964/65 when badly spalled stonework was cut out and replaced with indents of Craigleith stone which had been salvaged from the demolition of Waterloo Bridge, London. The replacement stones were in the form of ashlar slabs 2 in. thick by 9-11 in. deep in random lengths from 8 in. to 4 ft. Over 300 indents were placed. This remarkable bridge which remains virtually as built is in good heart and now carries more than 7,000,000 vehicles per annum.

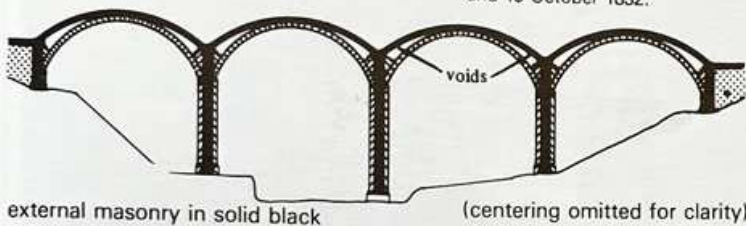


Fig. 8A — Dean Bridge — Progress of masonry work on striking upper arch centering.

REFERENCES, NOTES, AND ACKNOWLEDGEMENTS

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- 10-11. Telford, T. op-cit. P. 37 part and pl. 63 part.
12. Rae, Lettice Milne. Story of the Gibbs. 1961. 59-60.
13. MSS. Dean Bridge correspondence. I.C.E. Library. Various letters dated 22 July and 7 August 1829, 28 November 1831 and 19 October 1832.

14. *ibid.* Letter from Learmonth to Telford, 1 August 1829.
- 15 & 21 Minute Book, op-cit. March 1833 and 10 May 1832.

16. Letter from Learmonth to Gibb. 3 December 1831. Author's collection.
17. Copy letter from Telford to Learmonth, 30 November 1831. Author's collection.
18. Copy letter from Learmonth to Messrs. John Gibb & Son, 13 August 1832 with letter from John Gibb to James Hope, W. S. Author's collection.
19. Youngson, A. J. The making of classical Edinburgh 1750-1840. 271.
20. Letter from John Gibb & Son to Learmonth, 27 February 1832. Author's collection.
22. MS. Note from Learmonth to Lyon, Gibb's overseer at the bridge authorising James (of the Road Trust) to start metalling. 9 May 1832. Author's collection.
23. From a drawing made by the author in 1973.

Note: A plaque on the north parapet reads: The Dean Bridge. Completed 1832. Designed by Thomas Telford born Eskdalemuir 1757. This plaque was erected in 1957 by the Institution of Civil Engineers to commemorate the bicentenary of the birth of Thomas Telford, first president of the Institution.

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