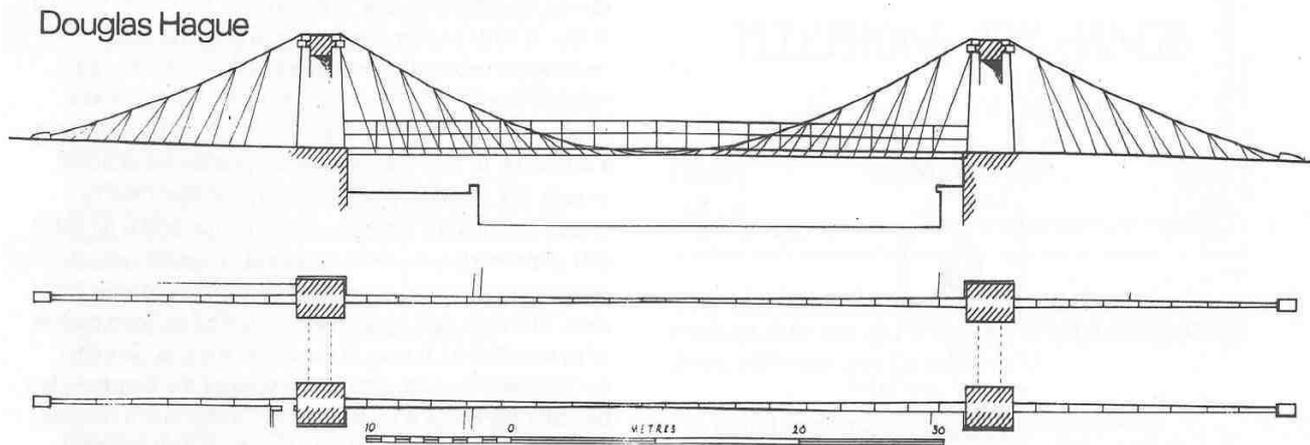


## Victoria Bridge, Bath



*Any reference to a suspension bridge within the County of Avon inevitably brings to mind the famous span of Avon Gorge at Clifton. The competition for its design, the vicissitudes of construction, modification and eventual completion are essential facts in the history of bridge construction. The modern Severn Bridge brings design development up to date and augments local interest in suspension bridges. But what of the lesser known features of this interest in our area? Brunel succeeded in competition for the Clifton Bridge design against opposition from Telford and other eminent engineers, but also against the lesser-known men, Thomas Motley and James Dredge, both of whom later constructed examples of their designs at Bath. Only the Dredge bridge now survives, as a foot-bridge known as the Victoria Bridge at East Twerton, (ST 741 650) linking the Upper and Lower Bristol Roads by spanning the River Avon.*

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The Victoria Bridge in Bath is a good and interesting example of the ingenious design for a suspension bridge exploited in the second quarter of the nineteenth century by the Bath engineer James Dredge. Erected in 1836, some four years after his first construction at Balloch Ferry near Loch Lomond, the Victoria Bridge is, nevertheless, earlier than his other surviving bridges at Oich in Inverness-shire, two foot-bridges in the town of Inverness and a very attractive foot-bridge over the Ken net and Avon Canal near Pewsey. (SU 145 615).

Little is known about James Dredge except that he was a Bath brewer who turned his attention and ingenuity to the design of suspension bridges. At the time he became quite well known, some might say undeservedly so, and largely because he was a controversial figure with an aptitude for writing to the technical press. In the early days of civil engineering it was not uncommon for an 'engineer' to rely on a more secure and mundane means of earning a living. Thomas Motley, the rival of Dredge's who also submitted designs for the Clifton Bridge and subsequently built an example at West Twerton in 1837, was described as 'a grocer, tea-dealer and bridge designer'.

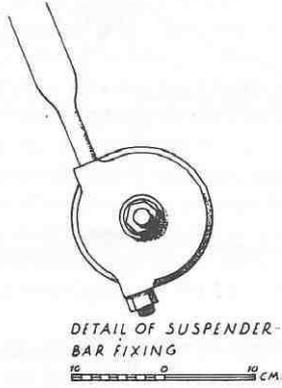
One of the many problems facing the designers of suspension bridges is that of movement. Most civil engineering projects involve static structures, but the light-weight span of the suspension bridge has often made an attractive, if

animated, alternative to the multiple arches of the traditional 'compression' bridge of stone or brick. The two basic types of 'western' suspension bridges have a common ancestor in the rope or chain bridge, of which the earliest-known British example was the Winch Bridge over the Tees built in 1741. In its first development, the links of the chains forming the main curve, or *catenary*, became elongated into rigid flat bars forged wider at the ends and pierced with an eye through which they were secured to the next link. This eye-bar chain was, it seems, invented simultaneously by Thomas Telford and Captain Samuel Brown around 1820 and the most famous example of this method of construction is Telford's Menai Bridge completed in 1826. One advantage was that the links could be taken out and replaced and, it was also possible to reduce the thickness or number of links in places where the stress was least which, as we will see, was the main point of Dredge's patent of 1836. Other inventive engineers working with eye-bars were R W Ordish and W Tierney Clark. With the exception of a few very late American examples, the last major nineteenth century 'chain' bridge was the completion in 1864 of the Clifton Bridge started by I K Brunel in 1830.

In the second development of suspension bridges, the chains were replaced by iron, and later steel, wires which were bound together to form wire ropes. This method was first used in France and then Switzerland, the most remarkable example being the famous Fribourg bridge, designed by M Chaley, which was 88 m longer than Menai and opened in 1834. In early examples these cables were hoisted up in position as were the eye-bar chains. The situation was completely changed by the invention of a means of spinning cables in situ, which made possible the vast spans of modern constructions as exemplified by the Severn Bridge.

In this country, at Dredge's time of activity, the earlier eye-bar chain suspension bridge was prevalent, and included Dredge's own constructions. Some ideas presented in his patent had, in fact, been put forward in 1826 by Davies Gilbert, an assessor in the Clifton competition. Dredge's Patent, No 7120, taken out on 14 December 1836 embodied the following points: a) the number of links in the eye-bar suspension-chain catenary should lessen towards the centre of the span, thus saving weight; b) the suspension bars should incline from the catenary towards the centre rather than hang vertically; c) a specially designed

transverse beam should be placed beneath the deck;  
 d) a ball and socket bearing should secure the ends of the  
 suspender rods.



At the smaller 23.25 m long Pewsey foot-bridge the number of links at the centre of the catenary is, in fact, reduced to one, illustrating a later phase of Dredge's design where he carried his ideas to greater extremes. For the earlier Victoria Bridge at Bath, Dredge used chains with twelve links flanking the substantial stone piers, and then these were reduced consecutively, one by one on each set of links, until seven remained. Three sets of six links follow and then a central set of five. Two inclined suspenders are attached to each link junction, providing thirty-six nearly evenly spaced supports for the deck. At the anchor points on either side of the bridge, the main chains with a similar reduction in links meet the ground anchorages about 18 m outside the piers. The clear span of the roadway is 42.6 m; from centres of pylons 46.5 m; the sag in the chains is 6.6 m. The deck surfaces have been renewed as has some of the ironwork, but basically the bridge is as designed by Dredge and it remains a lasting monument to a native of a city so well endowed with monuments of an earlier era.

