The Institution of Civil Engineers

Panel for Historical Engineering Works

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Thirlmere Centenary ...

Norman Hoyle

On 12 October 1894, water from the new Thirlmere reservoir in Cumberland (Cumbria) was with due ceremony admitted into an aqueduct for its 100-mile journey to Manchester. Next day, welcoming celebrations took place around a fountain outside Manchester Town Hall for water which had come the longest distance to any British city.

The enabling Act of Parliament in 1879 was probably original in that it contained clauses for the protection of scenery and its enjoyment, and required 'bulk supplies' of water to be made available to water undertakings along the route of the aqueduct. Prior to depositing their Bill before Parliament, Manchester took the unprecedented step of buying up the whole of the catchment area to reduce the opposition to the Bill but also with the longer term objective of controlling activity and pollution, a measure which Government some twenty-five years later was advising water suppliers to adopt.

J Frederick Bateman was the promoting Engineer but the surveys, planning and estimates were clearly the work of his principal assistant, George Henry Hill. In due course Hill, one of the strong, quiet waterworks engineers, was appointed by Manchester's Waterworks Committee to be Engineer for the construction of the Thirlmere Dam (HEW 607) and Aqueduct (HEW 1022).

It was no mean feat to convey water entirely by gravity to a terminal reservoir at Prestwich, four miles north of the city centre, through an aqueduct comprising 14⅛ miles of free flowing tunnel, 36¾ miles of 'cut and cover' conduit and 45 miles of (inverted) 'siphon' pipes.

The 22 tunnels, ranging in length from a few hundred yards to 5188 yards under Dunmail Raise immediately south of Thirlmere, are rectangular in finished section with arched soffit, 7ft wide and 7ft 3in. high and have a gradient of 20 inches per mile (1 in 3168). The concrete conduit has the same internal dimensions and gradient as the tunnels, the longest continuous length of conduit being 4⅜ miles. It is carried over minor valleys as a built-up structure but spans one valley near Chorley on a tall masonry arched bridge.

The 30 multiple pipe siphons consist of three or four pipes in parallel, the original proposal having been to have five 40in. diameter pipes; the first single pipe was of this diameter in most of the siphons, but subsequent pipes of 48, 48, and 54in. diameter precluded the need for a fifth line. The Act however required that the first and subsequent pipelines in the Lake District be over-sized to defer or remove the need for further disturbance of the land. The Act does in fact contain one of the earliest statutory definitions of the Lake District, being the land crossed by the first twenty-three miles of aqueduct; the narrow and steep-sided valleys within this length had, with specific exceptions, to be traversed entirely by buried pipes and not by bridges or embankments.

Each individual siphon pipe was equipped at its 'north well' entrance with a float-operated emergency self-closing valve to limit escape of water through a burst,

bridge, but some indication may be had from the fact that some fifty masons, quarrymen and labourers were at one time employed by Simpson to construct the five-span Commissioners' bridge at Ballater twenty miles further up the river. It can be supposed that a somewhat smaller number of men might have been employed at Potarch, and that all of them could have been employed on the task of turning the arch, or that the workforce could have been augmented at the critical time.

It was customary, at this date, to use a temporary timber access bridge during construction, and there is no reason to believe that Potarch bridge was constructed without one. The timber bridge would have acted as an access platform on which voussoir blocks could have been stored before they were lifted into place. It was customary in Aberdeenshire for the actual processes of bridge building to take place during the months April-May until October. Before and after these months, provided the weather permitted, stone was quarried, dressed and transported to site to await use. It is natural to assume that sufficient dressed stone for the completion of an arch would have been prepared and stored close to the bridge, and that it would have only been necessary to move it a short distance and hoist it into place.

Such description tends to minimise the extent of the physical labour required to raise and position the voussoir blocks and mortar the joints between them. In carrying out these operations in summer maximum artificial illumination would have been required.

Having considered the reports of Minto's achievements and other criteria which affected construction of similar bridges a doubt still remains about the veracity of the reports. It is unlikely that any further information regarding these bridges will be found, and it would be interesting to receive either comments on these observations or details of any other masonry arches, of like dimensions, being constructed so quickly.

Thomas Brassey, Railway Builder and Canada Works (Birkenhead) ...
The Editor

This is the title of a book written by John Millar and published by John Millar (UK) Limited, Rallim House, Carham Road, Carr Lane Industrial Estate, Hoylake, Wirral L47 4FF, at £4.45 net.

The book describes the early life of William Heap, who was Thomas Brassey's Manager at Canada Works from 1853 to 1866 and later a Director. The Canada Works was set up to build locomotives, wagons and bridges for the Grand Trunk Railway of Canada, but many other contracts were also taken on. Thomas Brassey undertook railway building all over the world. The book is well illustrated, and describes some of Brassey's great structural work, including the Conway, Britannia and Drogheda Bridges, and his railway work in the Crimean War.

The Chairman's Column ...
Roland Paxton

During the summer the Panel's contacts with the Japan Society of Civil Engineers have developed with visits to Edinburgh and London by Mr Hiroshi Isohata of NKK Steel and Dr Yoichi Kubota of Saitana University. Dr Kubota is in Britain on a fact-finding mission connected with a major railway conservation research project which he is conducting under the auspices of JSCE for the Japanese government. Recently Japan has taken a major step forward in recognising its engineering heritage by designating 13 brick viaducts and 17 tunnels on the superseded section of the Usui Pass Railway 100km north-west of Tokyo as 'national cultural treasures'.

Interesting features of the Usui Railway, constructed in 1891-92 to the design of British engineer Charles Pownall, were that it climbed 1830ft over a distance of 5 miles as the crow flies by means of an early Abt rack system. All the bridges and viaducts were built with brick arches rather than girders as it was feared that girders would be forced downhill by the action of the pinion-wheel. The largest viaduct has 4 arches over the 109ft deep gully of the Usui River and its piers were designed to resist earthquake shocks.

Dr Kubota is considering measures for the conservation of this viaduct. His visit to Edinburgh was prompted by the recent local authority conservation of a tunnel and bridges designed by James Jardine on the former Edinburgh & Dalkeith Railway opened in 1831. Dr Kubota expressed particular pleasure on inspecting these structures together with the preserved 1846-7 brick arches of Dalhousie Viaduct and discussing their construction with the eminent restorationalist and architectural historian Charles Peterson of Philadelphia who was able to join us.

Improving the quality of historic-building listings of historical engineering works is an important function of the Panel and it is pleasing to report that Historic Scotland under the beneficial influence of its new Chief Inspector of Historic Buildings, John Hume has proved receptive to our cases for upgrading to Class A the recently conserved Glenesk Bridge, Dalkeith (Newsletter no.61) and Neidpath Viaduct, Peebles. It is appropriate to mention here that the Panel has played a catalytic role in the publication of a most attractive booklet by the Peebles Civic Society on *The Bridges of Peebles*, a copy of which has been sent to the ICE Library.

On conservation, Telford's fine suspension bridge of 1826 at Conway, which still has its original wrought iron chains, is being caringly considered for restoration and pedestrian use by the National Trust. It may prove possible to restore the original appearance of the deck by

removing the heavy steel trusses it acquired in later life. Regarding the Carron Bridge (over the River Spey) Public Inquiry (Newsletter no.58), the initiative of Historic Scotland, supported by the Architectural History Society of Scotland and the Panel, in opposing Grampian Regional Council's proposal to replace the historic cast-ironwork of the bridge with steel, led to an adjournment of the Inquiry on its first day at GRC's request. Eventually, without the Inquiry reconvening, our efforts have resulted in a welcome change of plan. After a careful inspection of the original ironwork for flaws, it is understood that it is now acceptable to GRC and that the ironwork will be retained to support a new deck. To all who played a part in achieving this most acceptable outcome, in particular, Historic Scotland; Babtie, Shaw & Morton; Brian Foot; Professor Arthur Bolton; and, not least, to Ted Ruddock, the Panel extends its thanks. An outstanding bridge will now be conserved for the nation.

It is now becoming well-known that the Panel encourages organised inspections of historical engineering works and the *Scottish weekend visits* arranged in conjunction with the Local Associations, which include a dinner and overnight stay, continue to prove popular. The visit in June to the Crinan Canal, constructed from 1793-1808 to the design of John Rennie, was very ably organised by Jim Bowie and Sandra Purves. It was fully subscribed, with 54 attendees and proved an outstanding success. Wet weather on the first day barely dampened spirits and enabled the canal's automatic control water 'waster' system, designed by canal engineer John Groves, to be fully appreciated in full spate. The canal continues in full operational use and among the engineering features, inspected from the Panel's chartered boat (see photograph) and from the bank, were the sea-locks at Ardrishaig and Crinan with their hydraulically operated gates, swing-bridges dating from 1871 and Dunardry rolling cantilever bridge of 1900. All were noticeably well-maintained and lovingly operated. Living history!

The Crinan Canal near its north-west end
Photo: © by courtesy of Roland Paxton

HEWs in the News ... Brian George

The completion of the Bristol to Exeter Railway by I K Brunel (HEW 1072) and its opening on 1 May 1844 was celebrated in Exeter on 1 and 2 May 1994 by an extensive Rail Fare promoted by Inter City Great Western and supported by Exeter City Council, Devon County Council, Network SouthEast and Regional Railways.

The Riverside Goods Yard, north of St David's Station, was the exhibition centre. Steam locomotives 6024 King Edward I, 34105 Swanage and 35005 Canadian Pacific led the steam age, supported by diesel locomotives ranging from early diesel hydraulics to General Motors class 59 and electric locomotives class 83 and class 85. There was also a complete travelling post office and a civil engineer's track maintenance train.

For the enthusiast there were stalls in abundance stocking a variety of books, videos and railway memorabilia. The sense of occasion was dramatised by the arrival at and the departure from St David's station of steam-hauled excursions from up-country, hauled by King Edward I or double headed by standard tanks 80079 and 80080. The latter also pushed and pulled trains to Barnstaple and Exmouth. The presence of 13-coach trains was reminiscent of 40 years ago, but once again the platforms at St David's were just long enough!

The coinciding of the Sunday and the Bank Holiday Monday with the 150 years of Exeter's link with railways helped to ensure an attendance of 40,000 people over the two days.

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The completion of the construction and fitting out of the Channel Tunnel was marked by the opening on Friday 6 May 1994 by HM The Queen and President Mitterand at the terminals at Coquelles and Cheriton (Folkestone), which was reported in *NCE* 5/12 May.

NCE and Transmanche Link cooperated in the publication by Thomas Telford Limited of a chronicle of the financing, design and construction of this fixed link between Britain and France between 1985 and 1994. Edited by Ty Byrd, recently Editor-in-Chief of *NCE* and titled 'The Making of the Channel Tunnel', this superb record runs to 196 pages and is profusely illustrated.

The use of the tunnel is steadily building up as rolling stock is received and tested by the operators. The commencement of the running of through passenger trains by Eurostar between London, Paris and Brussels is now scheduled for the autumn.

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May 1994 has seen the opening of the Channel Tunnel, one of the most remarkable feats of civil engineering ever undertaken. But 100 years ago Queen Victoria opened probably the greatest project constructed during her long reign. *NCE* 19 May contained an article by David Hayward on the building of the Manchester Ship Canal (HEW 88).