



THE INSTITUTION OF
CIVIL ENGINEERS

PHEW NEWSLETTER

Panel for Historical Engineering Works

MARCH 2001 no.89

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SALTIRE AWARDS 2000

by Professor Roland Paxton

At the Saltire Awards for Civil Engineering ceremony for the year 2000 in Glasgow, ICE President Joseph Dwyer and Mr Kenneth Collins, Chairman of the Scottish Environment Protection Agency, awarded Bilston Glen Viaduct, Midlothian, the Society’s prestigious ‘Conservation Commendation’, the only award made in this category.



(1) Bilston Glen Viaduct – view from north end
© Geoff Mather

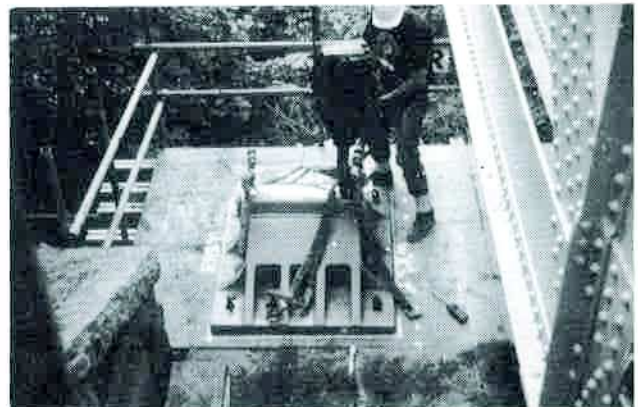
The award was made on the advice of the Scottish Group of PHEW, ‘for skill in conservation of the 1892 structure together with a modern deck to ensure long-term usefulness’.

The Commissioning Authority for the project was Midlothian Council – lead official, Senior Project Officer Mr Geoff Mather. Its sponsor was Edinburgh Green Belt Trust, who now own the viaduct, and its designers were Blyth & Blyth, Consulting Engineers – lead engineer Mr Alan Heatley. After the



(2) Bilston Glen Viaduct – Old rocker/roller bearing in-situ
© Geoff Mather

presentations, Professor Paxton, on behalf of the Panel, congratulated all concerned on an outstanding achievement. The Panel also commends the enthusiastic support and essential financial contributions of Historic Scotland and the Railway Heritage Trust towards the total cost of £1.373m.



(3) Bilston Glen Viaduct –
New bearing ready for positioning
© Geoff Mather

This project, previously referred to in *Newsletter* No.81 involving the rehabilitation for cycleway/footpath use of one of Scotland’s tallest and most historically significant viaducts has now made an impact at Heriot-Watt University. When it became known that the viaduct’s unique bearings were to be replaced, the Department of Civil & Offshore Engineering via the ICE East of Scotland’s Museum Committee, through the good offices of Professor Paul

yard in 1769. Chepstow bridge is mentioned on page 118.

The Reverend Mr Thomas Chest minister of Chepstow, gave the following account of the effects of the storm in his neighbourhood. Friday November 26, 1703, in the evening, the wind was very high, but at midnight it broke out with more than wonted violence, and continued till break of day. The loudest cracks were about four o'clock. The inhabitants suffered the common calamity of houses flattened and trees blown down.

The wind throwing the tide very strongly into the Severn, and so into Wye, on which Chepstow is situated; and the fresh in Wye meeting with rampant tide, overwhelmed the lower part of the town: it came into several houses above four foot high. The damage to salt makers was about two hundred pounds.

The bridge was a strange sight! It stands partly in Monmouthshire and partly in Gloucestershire, and is mostly built of wood, with a stone pier in the midst, the centre of which divides the counties: there are stone platforms in the bottom of the river to bear the woodwork: over these there are wooden standards framed into piers forty two foot high, besides groundsils, cap-heads, sleepers, planks, and, on each side of the bridge, rails which make about six foot more; the tide came over them all. The length of the wooden part of the bridge in Monmouthshire is sixty yards, about the same in Gloucestershire; the Gloucestershire side suffered little; but in Monmouthshire side the planks were most of them carried away, the sleepers (about a ton by measure each) were many of them carried away, and several removed: it is not doubted that the wooden piers would have gone too, but the outward sleepers on each side were pinned or bolted to the cap-heads, and so kept them in their place.

THE CHAIRMAN'S COLUMN

by Professor Roland Paxton

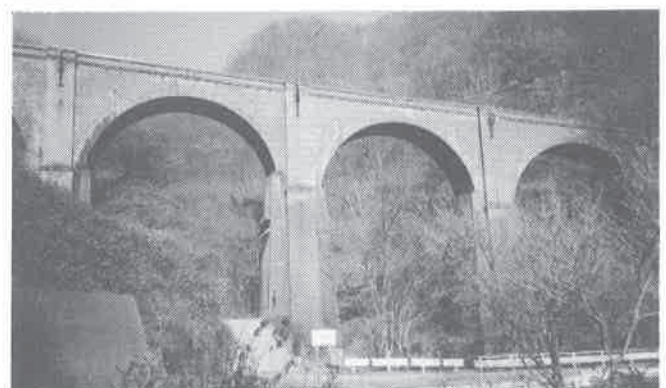
Readers may recall my taking up an invitation in 1996 from the Japan Society of Civil Engineers to visit Japan to lecture on the conservation of Laigh Milton Viaduct and develop a link with members of their Committee for Historical Studies. At the time, among many other activities, this Committee was engaged on a feasibility study for preserving the largest viaduct and other structures on the Usui Pass, single track, 1 in 15 gradient, rack-railway and considering how the project might best be managed and funded, previously referred to in *Newsletter* No.71.

Since then, in funding and management terms, the project has progressed on more or less similar lines to that for Laigh Milton viaduct, except that the JSCE project engineers had a greater design involvement in the work put out to contract. I am delighted to be able to report that the project's first phase is now complete and due to open in April. It has involved the preservation of two viaducts, three arched culverts and five tunnels as part of a 5.5km length of the 'Abt Walking Trail' – named after the German Abt rack-railway system that became operational on the Usui line in 1893.



Professor J Konishi [left] and Dr S Onoda at water tank Columns, c.1893 Yokogawa Station
© Professor Paxton

The total cost of this phase was 450,000,000 yen (£2.6m) and it was funded by Matsuida Town and a grant from the Japanese Ministry of Construction. The necessary preservation and repair work was identified and specified by a project sub-committee of JSCE's Historical Studies Committee led by Professor Junichi Konishi assisted by Professor Yoichi Kubota, Dr Shigeru Onoda and others.¹ Regarding finance, JSCE received a small amount of working funding from Matsuida Town and reimbursed its members on an expenses basis. The project was managed by Matsuida Town who ordered the work from a local contractor.



3rd Usui Viaduct elevation
© Dr Onoda

Basically the structures were in reasonably good condition, and the 112ft high 3rd Usui Viaduct although exhibiting some cracking¹ was considered safe to use pending very careful consideration of any possible remedial work because of the viaduct's earthquake reinforcement measures. The tunnels have been pointed in lime mortar. At the viaducts, 1.2m high side railings were installed to comply with safety regulations. They were made to an economical design in stainless steel not only to minimize maintenance but, because its light colour and reflective properties enabled it to blend in well with its surroundings. The photographs show details of track surfacing, tunnel lighting, drainage and user prohibitions – including cycling (because of the steep gradient), lighting fires and feeding monkeys!



User prohibitions sign and masonry tunnel façade
© Dr Onoda

A second phase of the project, a 1.5km extension of the trail from the 6th tunnel to the former Kumanotaira Station part-way up the incline (where a short length of level double track enabled trains to pass) has been identified but is not yet committed for funding and implementation. This phase would involve the preservation of the station area – an important operational feature of the railway, another five tunnels, four bridges and two arched culverts and provide a more appropriate end to the trail than at present.



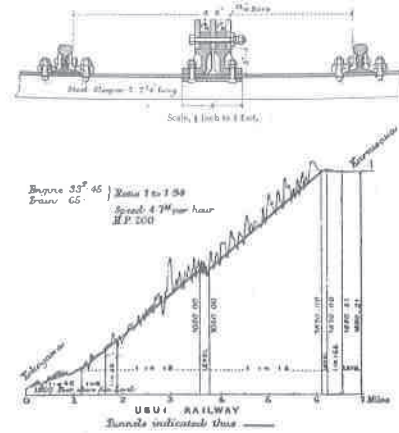
3rd Usui Viaduct finished deck
© Dr Onoda



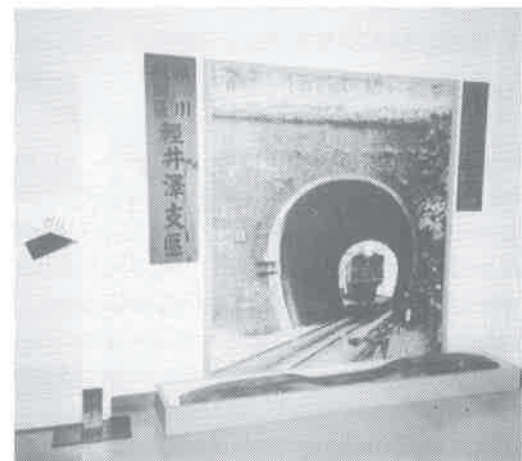
3rd Usui Viaduct deck with surfacing and stainless steel safety rail
© Dr Onoda



Tunnel interior – lighting fixtures, track and stone-filled side drains
© Dr Onoda



Usui Railway – longitudinal section and track cross-section
© Pownall²



Museum display showing the Abt railway system in operation c.1900
© Dr Onoda

Historical information. The Usui Pass is in the mountainous central part of Japan north-west of Tokyo. By 1888 railways had developed to the bottom and top of the pass respectively from the east coast to Yokogawa and from the west coast to Karuizawa. Although these points are only about five miles apart, the vertical difference between them is 1,830ft thus requiring the very steep railway gradient of 1 in 15 (see section). An English engineer Charles A W Pownall was engaged to connect the lines and the Usui Railway was built under his direction by Japanese engineers in 1891-1892.

For bridge construction, brick arches were used in preference to iron girders as Pownall thought that the latter might be displaced downhill because of the force exerted by the pinions of the steam locomotives on the central rack-bars fixed to the steel sleepers (see section). The line was electrified in 1912, but the German-built locomotives continued in operation until 1921. The steam locomotives pulled loads of 60-70 tons at 4.7mph². In future it is also hoped to preserve the 90-year-old Maruyama transformer station which has been temporarily strengthened to prevent its collapse. The trail complements the recently created Usui Railway Park and Museum.

In conclusion, the Panel congratulates JSCE, Matsuida Town and the Japan Ministry of Construction on a fine achievement in tastefully preserving for posterity major elements of an outstanding engineering work. It is hoped that the conserved structures, which in their context are of international civil engineering landmark status in the eastern hemisphere, will attract many visitors and that Phase 2 will follow soon.

1. Tajima J, Konishi J, Onoda S, & Kanaya K 'The present condition of railway structures in ex-Usui pass line'. *JSCE Historical Studies in Civil Engineering*, No.16, 1996, 293-302.

2. Pownall C A W. 'The Usui Mountain Railway, Japan'. *Min.Proc.ICE*, CXX, 1895, 43-53.

NOTICES –

Kew Bridge Steam Museum – Exhibition and Seminar

by The Editor

We have been advised of a forthcoming exhibition and seminar at Kew Bridge Steam Museum:

Seminar

- Maudslays and the first Kew Engine
- Thursday 26 July 2001

Exhibition

- Maudslay, Sons and Field – Engineering Pioneers
- 27 July – 30 September

Although the Maudslays were mechanical and marine engineers, the seminar and exhibition will look at the influence Henry Maudslay had on contemporaries such as I K Brunel, including the former's reputation as the father of the machine tool.

For further details please contact:

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Forthcoming American Historic Bridges Conference (repeat notice)

by David Simmons (Ohio Historical Society)

The seventh Historic Bridges Conference, Cleveland, Ohio, USA, sponsored by the Watson Bridge Book Collection, Cleveland State University Library has been arranged for 19-22 September 2001. It will include field demonstrations, paper sessions, and tours.

Further information may be obtained from:

Bill Barrow, Special Collections Librarian
CSU
1860 E. 22nd St.,
Cleveland,
OH 44112

tel: (216) 687-6998

email: w.barrow@csuohio.edu

website: <http://web.ulib.csuohio.edu/7hbc/>

BOOK REVIEW

by Brian George

Benjamin Outram by R B Schofield. Published by Merton Priory Press at Whitchurch, Cardiff, CF14 1DD. 2000, 340pp, 24 plates, 32 figures. £24.95. ISBN 1 898937 42 7.