THE INSTITUTION OF CIVIL ENGINEERS

PHEW NEWSLETTER

Panel for Historical Engineering Works

DECEMBER 2000 no.88

CONTENTS

The Panel has been notified of the death on Saturday 18 November 2000 of **Thomas Bryan O'Loughlin**, who was former Vice-Chairman and Technical Secretary. Our sympathies are with his wife Eileen and family. A fuller appreciation of his contribution to the Panel will be in the next issue.

Mike Chrimes

HISTORIC BRIDGE AWARDS 2000
by David Greenfield

Thirteen projects were nominated for the 3rd annual Awards scheme which, as in previous years, was open to all repair, strengthening and conservation projects affecting bridges and aqueducts over 30 years old, in England and Wales, which had been completed during the previous two years.

Professor Roland Paxton again chaired the panel of judges, who were:

- Terry Girdler, Chief Structural Engineer of English Heritage
- Mike Winney, Editor Emeritus of NCE
- Andrew Leadbeater, ex-Chairman of the County Surveyors' Society Bridges Group

The judges were impressed by the high quality of all the submissions, and by the innovative techniques employed in many. They decided to give Awards to four outstanding projects, and Commendations to a further two.

The four projects which received **Awards** are:

- Seven Arches Aqueduct stabilisation, Leeds
- Hythe Bridge strengthening, Oxford

Historic Bridge Awards 2000

- Force Gill Aqueduct restoration, Yorkshire Dales National Park
- Tickford Bridge strengthening, Milton Keynes

The two **Commendations** went to:

- Slattocks Canal Bridge strengthening, Rochdale
- Ouse Valley Viaduct restoration, West Sussex

Each project is briefly described below.

On 16 November Mr Joe Dwyer, President of the ICE, presented framed certificates to representatives of all parties directly involved in the six projects, at a ceremony in the Council Room at the ICE in London.

Grateful thanks are again due to English Heritage, Railtrack and British Waterways for their continuing financial support which covered running costs. Support-in-kind was again provided by ICE and the CSS Bridges Group.

A reception was held on Monday 6 November 2000 at the Institution of Civil Engineers to celebrate the publication of William Mackenzie's diaries.

Dr David Brooke has, over recent years, patiently transcribed the diaries which provide fascinating insights into the personal and professional life of one of the nineteenth century's most influential railway contractors.

The work represented the first major publication related to the extensive collection of Mackenzie papers acquired by the Institution of Civil Engineers in 1990.

The Diary of William Mackenzie is available from the ICE/TTL Bookshop at Great George Street, priced £29.95. Tel. 020 7665 2019.

The West Highland Railway's Investigation at Loch-nan-Uamh Viaduct, Lochailort

by J S Shipway

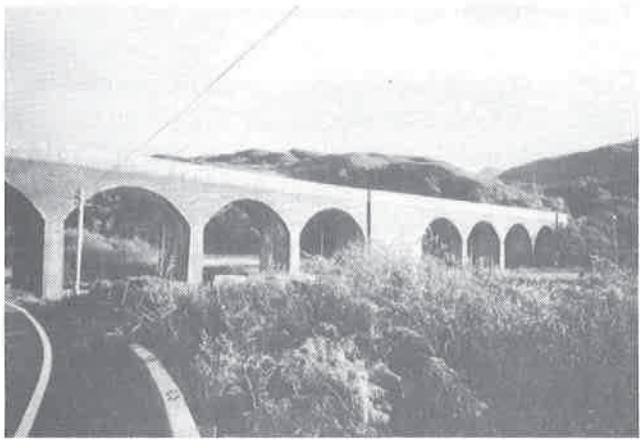
The West Highway Railway (WHR) Mallaig Extension was constructed in 1897-1901 by Sir Robert McAlpine & Sons, and for some years a legend persisted that when they were building the Glenfinnan viaduct in 1898, a horse and cart fell down inside one of the hollow piers. Owing to the difficulty of extricating the (dead) horse, it was left entombed. However, this legend was disproved in the 1990s by drilling holes in the walls of the piers at Glenfinnan and using a borescope camera. No sign of a horse skeleton or cart were found.

The legend then shifted to Loch-nan-Uamh viaduct on the WHR west of Lochailort. A retired farmer at Arisaig remembers meeting a former McAlpine labourer when he was a boy. The labourer, by then an old man, said the horse and cart mishap took place at Loch-nan-Uamh viaduct, which has a massive 40ft high hollow abutment at its centre.

An investigation of this viaduct was set up and took place in September of this year. The investigation was funded by Sir Robert McAlpine & Sons Ltd., and cost just under £3,000. A Glasgow contractor, Weeks Technical Services, bored holes at different levels in the 40ft high central abutment. (A drawing from Railtrack showed this abutment to be hollow with concrete walls 5ft thick).

The bores penetrated the 5ft of concrete in about 2.5 hours, but found the abutment had been backfilled with rubble. Rock filling apparently exists between ground and rail level. This was somewhat of an anti-climax, but it seems quite possible that the horse and two-wheeled cart could have been backing into position to tip the rubble when the wheels of the cart went over the platform edge and took the horse with it. It could have taken the carter too but he must have had the presence of mind to let go of the bridle.

Since it is impossible to bore rock-fill, the mystery must remain. However, our Chairman Roland Paxton, has a friend with radar apparatus who is of the opinion that it could pick up iron-rimmed wheels in the rock-fill, if they are there. So keep watching this space!



The Loch-nan-Uamh Viaduct (view from west)
© The Author

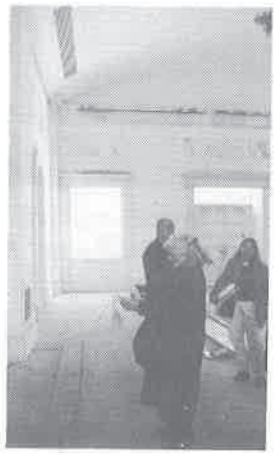
The Chairman's Column

by Professor Roland Paxton

Fairmont Waterworks, Philadelphia (1812-1911)
with Museum of Art behind.
Note entrance tunnels to waterwheels (c.1821)
and engine house (1812-1815) on right
© The Author

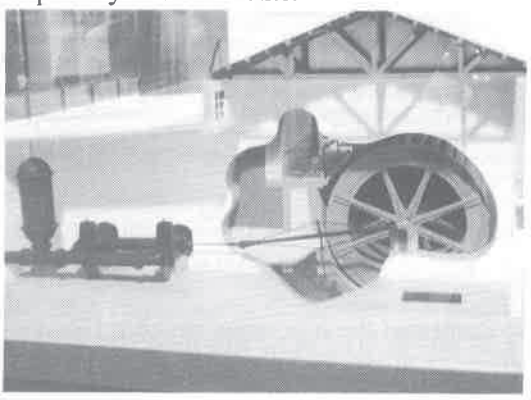
Whilst in Philadelphia recently at the invitation of the Association for Preservation Technology International to lecture on *Conserving Historical Engineering Works* at a conference on building preservation (organiser Dr Tom Taylor - see http://www.apti.org), I managed to achieve a long-standing ambition. Through the good offices of Charles Peterson, Conservationist, Ed Grusheski, General Manager of Public Affairs, Philadelphia Water Department (PWD) and Drew Brown PE (PWD), I was able to follow in David Stevenson's footsteps of 1837[1] and visit the River Schuylkill sites of the city's legendary Fairmount Waterworks and adjoining Upper Ferry timber bridge 'Colossus' of 1812-1814 (arch span 340ft.).[2]

Wernag's remarkable bridge was burnt down in 1838 but at the waterworks numerous historic buildings and an impressive 9ft. diameter Jonval turbine and Morris pump of 1851 have survived. For many years these waterworks have been and are still undergoing authentic, high-quality conservation and are due to open as an 'Interpretative Center' in 2002 – overall cost $26m. Few historical engineering works attract this degree of commitment and the PWD and its supporters and advisers are to be congratulated on their fine achievement to date. In addition to the above I was also delighted to discuss details with Gail Tomlinson, Director of the new 'Center', Ursula Reed, fund-raiser, Claire Donato, architect and Jane Mork Gibson, technological historian.



Renovated engine house showing north flywheel pit (covered). Claire Donato, architect, on right
© The Author

The earliest waterworks building, the 1812-1815 engine house, originally contained two steam engines operating vertical double-acting force pumps to pump water from the river to reservoirs on the hill behind (now the site of the massive neo-classical Museum of Art built c.1920). From these reservoirs, at about 100ft. above river level, water was distributed by gravity throughout the city's system of spruce, yellow pine and, from 1819, cast iron pipes. The steam engines, one low-pressure with a 24ft. beam and the other a high-pressure 'Columbian', operated from 1815 until 1822 when they were replaced by a much more economical and safer system by damming the river and using its water to power the pumps by means of breast waterwheels of 15-18ft. diameter and 15ft. width. The 400yd. long dam from the end of the supporting stone pier at the north end of the works was achieved in up to 30ft. of water by the ingenious expedient of sinking into position and tying together hickory log cribs filled with stone. The backwater created by the dam, still used for boating and skating, and the attractive-looking buildings continue to make an essential contribution to one of the world's most picturesque city environments.

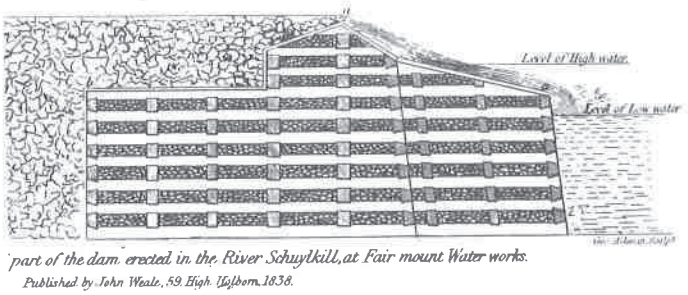


Working model of iron waterwheel and pump as installed from c.1831 (PWD Offices)
© The Author

By 1843 eight waterwheels were supplying 5 million gallons/day to 28,000 tenants. The original three wheels were designed by T Oakes and made by millwright D Bromley, both of whom had worked with Smeaton. The superintendent for these works, including the neo-classical buildings, undoubtedly influenced by B H Latrobe (1764-1820), was Frederick Graff (1774-1847). From 1851-1872 under the direction of his son of the same name the waterwheels were replaced by large turbines. River pollution became an increasing problem by the turn of the century and the works were eventually closed, becoming an aquarium in 1911.[3,4]

Ed Grusheski and Jane Mork Gibson with weir in background
© The Author

Drew Brown acted as my cicerone on a pilgrimage to several historic bridges upriver from the Waterworks including the first pre-stressed concrete bridge in the USA at Walnut Lane (1950) and Falls Bridge, a unique double-decker steel truss bridge of 1895 for which G S Webster was the engineer and Filbert Porter & Co. the contractors. Its total length is 1171ft. with river spans of 187ft.



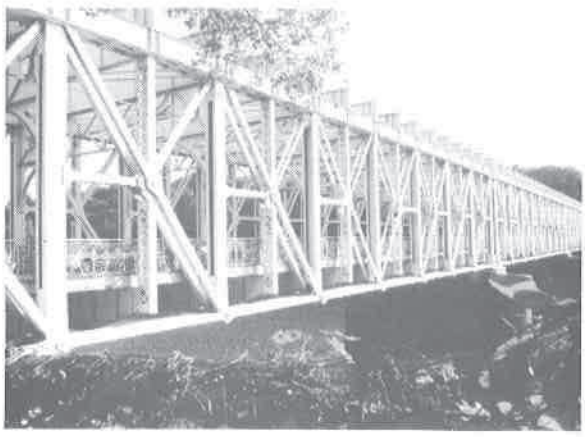
Downstream elevation and cross-section of 1821 dam.
From Stevenson[1]

I also examined the ingenious structural load transference measures adopted to preserve the city's historic Carpenters Hall 1770 (roof and basement) and massive clock tower of Independence Hall (1732-56) where the *Declaration* was signed on 4 July 1776. I managed to stretch over the rim of the Liberty Bell's replacement (definitely not on the hour!) and found its Troy foundry mark. These measures were devised by and implemented under the direction of structural engineer Nick Gianopulos PE of Keast & Hood with whom I much enjoyed a tour of the firm's offices, meeting the partners, examining drawings and seeing Charles Peterson's 1854-1856 'I' beam slivers. I was also impressed by the delineation treatment adopted for Benjamin Franklin's house (visible from the offices) which was also the work of the firm. [4]

[1] David Stevenson, *Sketch of the Civil Engineering of North America.* 1838.
[2] Lee H. Nelson, *The Colassus of 1812: An American Engineering Superlative.* ASCE, 1990.
[3] Jane Mork Gibson, 'The Fairmount Waterworks'. *Bulletin Philadelphia Museum of Art,* 84, 1988.
[4] HABS/HAER data on the above HEWs is on the web at http://lcweb2.loc.gov/ammem/hhhtml/habshome.html. This admirable facility is not yet available for Panel HEWs but, courtesy of Tom Martin of Motherwell Bridge plc, I can close with a simulation of the Tay Bridge collapsing at http://www.tts1.demon.co.uk/tay.html NB: The lst '1'is a number and not a lower-case 'L'.

View from central pavilion (1872) towards engine house. Note condition of columns prior to restoration and the skilfully repaired timber portal on right
© The Author

The delineation of Benjamin Franklin's house, Philadelphia
© The Author



Falls Bridge, Philadelphia (1895).
Note, only the lower deck is in use
© The Author