Panel for Historical Engineering Works Newsletter

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Hayhurst Swing Bridge Refurbishment

by Frances Littlewood

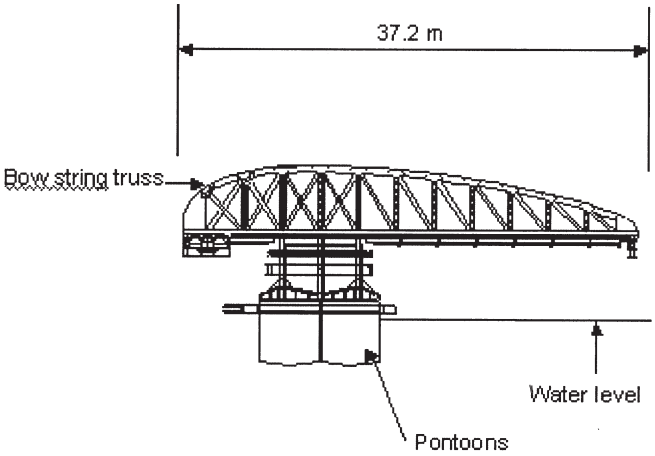
Built in 1898, Hayhurst Swing Bridge is believed to be the first electrically operated swing bridge constructed in Britain. The bridge is situated centrally within the town of Northwich in Cheshire and carries an 'A' road over the River Weaver. It comprises a three span (tail, pintle and nose) swing bridge and two independent approach spans. The bridge rotates on roller bearings with semi-submerged pontoon buoyancy chambers under the central pintle that afford a significant uplift to counter the dead load of the structure.

The bridge was constructed from wrought iron throughout with the exception of the pontoons and the refurbished elements of the structure that are of mild steel (see photograph 1 – Notation).

The bridge superstructure comprises a 1976 steel longitudinal trough battle deck on the central pintle span and longer nose span supported by 2004 welded mild steel girder transverse beams hung at each end from the twin main wrought iron truss girders. The shorter original tail span is constructed of wrought iron transverse box beams and deck plates supporting a concrete deck for counter-weight. Further counter-weight is provided below this deck in the form of transverse cast iron beams carrying cast iron kentledge blocks.

The pintle roller bearings run on a cast iron track fixed to the top surface of a 'star' shaped riveted wrought iron box girder. The girder is open in the middle with the supporting girders from the pontoons passing through. The seven points of the girder are supported by 762mm diameter cast iron bearing piles screwed into the sand and gravel layers below the bridge. Outside the main bearing piles are three similar additional stabilising piles and all ten piles are connected together with a circular lattice girder. The tops of the bearing piles have pile heads incorporating four adjusting screws and ball and socket bearings to allow the bridge to be realigned in the event of any settlement. Significant long term settlement resulted in some of the piles being extended by approximately 600mm in the 1920s and a 610mm rolled steel joist square girder being installed between piles and star girder. Since the 1920s further re-levelling of the structure has been carried out using the adjusting screws.

The structure is Grade II Listed subject to Listed Building Consent control issued by Vale Royal Borough Council (see photograph 2 – Pre-refurbishment).



being ideally positioned on Madras' south beach. It was then known as the Kalsamahal, or domed palace. Future additions neatly blended into the original design; no doubt the Nawab had a keen eye for good taste and symmetry. Modelled on the Indo-Saracenic style of architecture, the sea face of the college was over 300ft long, being described as "the most commodious building of its class in India," by an English traveller.

The Roorkee College was established in 1847 under the auspices of Hon. James Thomason (1801–1853), Lieutenant-Governor of the Northwest Provinces, to which the college's name was subsequently changed in 1854 to the Thomason Civil Engineering College of Roorkee. It was created to give theoretical and practical instruction to both Europeans and natives alike. In this policy it excelled, making mockery of the American journal's comments when native civil engineers were working alongside British expatriates, especially in the design and construction of canals that had exceeded 22,000 miles in length by the end of the century. (In stark contrast, America never constructed one canal in South or Central America; states that Washington tenaciously held at the barrel of a gun).

The college awarded gold medals to their best students and it is documented that native engineers excelled to such a degree of proficiency that a Cautley gold medal was additionally presented to the best mathematician in the college. Silver medals in the upper-subordinate-classes were equally coveted. Money prizes up to the value of £85 were awarded to the most distinguished student, with a further prize in books for the best physical science graduate. It was then the pinnacle of steam power complemented by the rise of electrical technology.

Cooper's Hill College, Surrey

The phenomenal increase in India's public works programmes at one time was all but advanced ahead of the education facilities and engineering expertise required to train and equip those youthful engineers to undertake the tasks at hand. Civil and water engineering up to around 1830 encouraged a host of barely qualified but fully enthusiastic young men to seek their fortunes with "the largest company and trading empire the world has known," according to *The Times*' assessment of the EIC. Bright young sparks from well-heeled backgrounds certainly did not lack passionate zeal, but India was far different in every aspect from placing a waterwheel or digging a ditch on an Englishman's stately home's great expanse of land.

The India Public Works Department had expanded rapidly from 113 senior men in 1840 to 545 in 1863. These servants now of the Crown, increased to 896 in 1870, as the Crown had taken over from the EIC after 1857. Of those 896 engineers, 363 were officers from the Royal Engineers or Indian Army. Strangely, in Britain there was then no establishment dedicated to train men for Imperial service. All were forced to indenture their apprenticeships on the Indian sub-Continent itself.

The universities and colleges throughout Britain, whose bias was mainly towards domestic railway or public works and harbour construction service, supplied the profession of civil engineering. The need for a separate college solely to train for the Indian Public Works Department was never in dispute. In 1870, the decision to establish a college in Surrey was taken and Colonel Chesney RE was requested to search for a suitable site. A property at Cooper's Hill, Surrey, was deemed satisfactory for the creation of a college.

The *Illustrated London News* of 25 November 1871 gave some particulars on the site and founding of the 'Indian Engineers' College', along with an illustration of the main building. The article also referred to Cooper's Hill as having classical renown in English literature as far back as 1671.

On 5 August 1872, the Secretary of State, the Duke of Argyll, opened Cooper's Hill. The entrance examination comprised English, Maths (which gained the highest marks), Latin, Greek, French, German, Inorganic Chemistry, Heat and Light, Electricity and Magnetism, Mechanical Drawing and freehand. Only maths and English were compulsory. The course lasted three years and cost £50 per term, which included board, lodgings, laundry but not wine, beer or medical attendance. An obviously parsimonious member of the duke's council was recorded as saying: "I cannot come, the occasion is too sad; each one of these young men is going to cost India (meaning England) a million pounds."

Cooper's Hill at Egham, Surrey, was the property of one Baron Albert Grant, alias, Gottheimer, a notorious financier. At the height of his fortune he built a residence in London named Kensington House and owned Leicester Square, which he sold to the nation for £30,000.

Queen Victoria, who always took a keen interest in her Indian Empire, fully approved the Indian Civil Service College at Cooper's Hill. She bestowed the title "The Royal Indian Engineering College" on the establishment on 4 January 1875.

The emphasis on practical training was accentuated in 1877 when a fourth year was added to the course. That same year saw the foundation of Honorary Fellowships at Cooper's Hill. In due course the initials FCH became a coveted distinction won by some 75 of the alumni. The entrance examination was stiffened up in 1902, obviously due to the rapid changes in technology that were permeating India virtually as quickly as they were being empirically proven throughout Western Europe. The college tutored not only native Indians sent to Britain who later distinguished themselves in public service, but some Egyptians and Siamese were then actively training for their respective governments.

The college closed down on 26 July 1906 when the last prizes were presented. It has lasted for fifty-three years. The place was thought about as an annex to Holloway Sanatorium or an overflow for Sandhurst. In 1939, the London County Council acquired the estate and put in the Shoreditch Training College. Currently it is part of the London University Institute of Education.

Teaching Engineering History at Heriot-Watt

by Roland Paxton

When the Panel visited Heriot-Watt University Edinburgh in 2003, members heard from Professor Swaffield, Head of the School of the Built Environment, of the high value he placed on having an historical perspective in the School's curriculum. In 2004 it was decided, on a trial basis, to give the engineering history and conservation lectures to the whole School rather than just the civil engineering students.

To this end, following in the tradition of the late Professor Sir A W Skempton, I presented four, one-hour lectures as part of the History of the Built Environment module. They were structured to try to cater for 140 first year

undergraduates studying civil and structural engineering, architectural development, building and quantity surveying, construction programme management, estate management and urban & regional planning. With emphasis on innovation, the lectures ranged from two millennia of water engineering and Industrial Revolution communications to long span bridge development and conservation of the historic canal, road and rail environment of Scotland.

Students sat a written examination, which in respect of my teaching included the following compulsory questions, the possible marks for which were proportional to lecture time.

Outline the contribution of Thomas Telford to the improvement of communications and bridge development during the Industrial Revolution.

Brief describe and sketch the basic structural engineering principle of the Forth Bridge and indicate the basis and likely life of the ongoing maintenance work at the bridge.

In general, the highest marks were obtained by the engineering and architectural development students. The urban planning, estate management and construction programming students did as well for the first question. Overall, the surveying disciplines did less well.

Herewith a good answer to give an idea of the standard:

Thomas Telford (1757–1834) made an enormous contribution to the improvement of communications. He started his working life as a stonemason but rapidly developed his skills to become architect, town planner, consulting engineer and bridge designer.

His first major contribution was in the development and construction of thousands of masonry bridges across the country. They were often of a hollow design to reduce weight and quantity of materials and to improve access to assess condition of stonework. His bridges greatly improved communications in the Highlands of Scotland. He also developed the iron arched bridge. His designs allowed spans to be increased and the weight of bridges to be reduced. The reduction in weight took strain off the foundations. One of his finest was built at Metal Bridge on the road from Glasgow to Carlisle.

Thousands of miles of canals were constructed under the guidance of Telford. He also designed hundreds of lock systems including some very impressive series of locks such as 'Neptune's Staircase' at Fort William. As well as locks, very advanced aqueducts were built.

Arguably, Telford's finest construction is the suspension bridge of Menai. This bridge was a huge advance on anything seen before. The span of 600ft was a huge improvement on arch bridges which were limited to about 150ft. The bridge was constructed with two piers or pillars, one at each side of the river. The roadway was supported by iron links slung between the piers. The solid foundation to which the links were anchored was a vital part of the design.

Although modern suspension bridges are in many ways more advanced, they are similar to and very much based on Telford's design. The suspension bridge is still the best way today to span wide rivers and gorges. [James Gordon – Urban & Regional Planning]

Appeals for information –

1. Mystery Bridge

Sheila H Barker

I am trying to find out the location of the bridge featured in the photograph below. I bought the original at a Fair in Buxton some years ago. It was apparently taken by someone who worked on the construction or repair of the bridge. The photograph bears the words 'This, I took of the job'. There are no other clues. The date would be early twentieth century, I guess.

The photograph would be donated to an appropriate museum in the relevant county if the puzzle could be solved.

With thanks for any help you might be able to give.

Please contact the Editor (details, p.8) with any information.

2. Glazed Water Channels

Editor

The following was recently circulated via an Internet distribution list:

Subject: Queen Elizabeth Barracks

From: Alison Macallan

Dear Stephen

Following our telephone conversation on Friday I have attached some photographs of the open glazed channels and one of the sluices.

I would be grateful if you could bear in mind the following points:

- Fleet and Church Crookham is in close proximity to land used by the MoD for training purposes. It directly abuts some people's gardens and for many others it just a few hundred metres away. Recreational access to that land has been legitimately enjoyed for decades. You mentioned signs about military hazards and yes, there are a lot of warning signs, but those signs are not in place to prevent access and access is enjoyed by hundreds of people every week.
- The proposed development at QEB has been held up because of nature conservation designations of a European importance on the military land close to QEB. At the moment the development cannot move forward because of these nature conservation concerns and the increased recreational pressures that would result from such a large high density development.
- In order to try to remove some of the objections expressed by English Nature, the developer has reached agreement with the MoD to open up land