

Panel for Historical Engineering Works Newsletter

Number 138 June 2013

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The Historic Bridge and Infrastructure Awards 2012 by David Greenfield

Barry Clarke, President of the ICE, made the presentations at the 15th annual Awards ceremony in Great George Street, celebrating innovation, sustainability and good practice in civil engineering heritage conservation. Grateful thanks are again due to English Heritage, Network Rail, the River and Canal Trust, ADEPT Bridges Group, NCE and ICE PHEW for their continuing support.

The judges selected four outstanding projects for **Awards**:

- **Forth Bridge** restoration
- **Linlathen East Bridge** restoration
- **Charles I Bridge** repair
- **Holt Fleet Bridge** strengthening

Two other projects received **Commendations**:

- **Mottram Viaduct** strengthening
- **Reigate Hill Footbridge** refurbishment

In addition, a Special Mention was awarded to Clifton Suspension Bridge hanger repair.

PROJECT DESCRIPTIONS – AWARDS



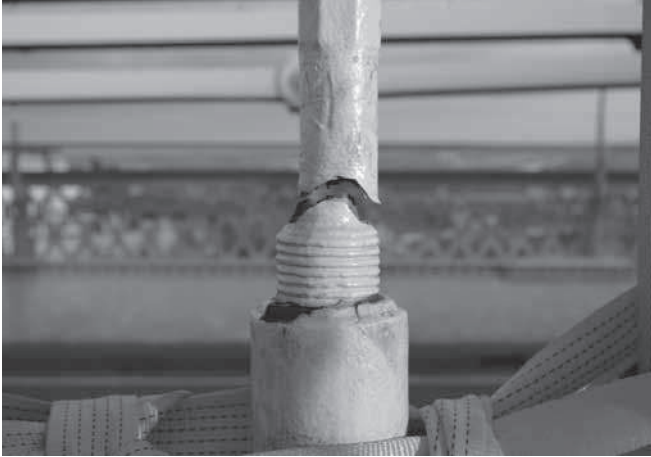
Forth Bridge Restoration

A decade-long repair and repainting project on the 123 year-old bridge concluded in December 2011; the client was Network Rail, consultant Pell Frischmann, and contractor Balfour Beatty. The restoration works featured innovative scaffolding and encapsulation techniques, replacement of corroded steel, and the application of a high-tech three coat protective system, finished off in the bridge's signature red oxide colour. Materials handling was a major link in the logistics chain, supported by road / rail vehicles capable of towing and unloading rail wagons. Extensive trialling established that a combination of traditional tube-and-fitting scaffolding, supplemented with "system scaffolding" at specific locations, provided the best option and ensured repeatability of major scaffold layouts. Pads and support points, welded to the bridge steelwork, formed the "foundations" of most of the scaffolds, which were then built up, constructed from the top down, or suspended from steel wire ropes. The opaque white encapsulation units which were attached to the scaffolds, and which became a land mark feature of the project, permitted the steel repairs, blast-cleaning and painting to be carried out within a climatically-controlled environment.

The three-part coating system was developed from systems used on off-shore structures. A holding primer containing zinc phosphate was followed by a stripe coat of high-build epoxy glass-flake paint applied to the rivets and sharp edges. Further coats of the epoxy paint were sprayed on to all areas, before the final top-coat of acrylic urethane paint was applied – coloured to match the signature "Forth Bridge Red". Independent trials gave confidence that the topcoat will last at least 25 years.

Judges' comments: A massively complex logistics and technical exercise has ensured that this most recognisable icon of Victorian engineering can continue to serve into the 21st century.

PROJECT DESCRIPTION – SPECIAL MENTION



Clifton Suspension Bridge Hanger Repair

In April 2009 a passing pedestrian reported a broken hanger on the bridge, prompting the urgent installation of temporary structural support. Virtually all the hangers are wrought-iron originals, dating back to the early 1860s. They consist of a lower eye connected to the deck; a bottle screw for adjustment; a solid rod of variable length; and an upper eye connected to the suspension chains. Under asymmetric traffic loading, the bridge deck moves longitudinally relative to the chains – movement should be accommodated by rotation in the top and bottom pinned connections. It was clear that in this case the upper eye had become unintentionally clamped, and the rod had failed in bending fatigue just above the bottle screw.

An interim replacement solution was adopted, using a steel bar, pinned top and bottom, to create time to consider investigation and refurbishment options. A programme of non-destructive examination was instigated, based on order of perceived vulnerability, and followed up by an investigation of hanger articulation. Ten hangers were identified as being in need of replacement, which was effected by machining replicas from grade S355 J2 steel. The work was carried out by Dorothea Restorations, R&R Site Services Limited, and PLANSIS Limited. An in-situ trial of a self-lubricating hanger-eye bearing is on-going. The Clifton Suspension Bridge Trust and their retained consultant Flint and Neill are now formulating an extensive programme of further investigation, testing and assessment.

Judges' comments: The judges acknowledge the success of the rapid response to the hanger failure, and wish to recognise and support the ongoing efforts being used to extend the working life of this landmark bridge.

The full list of nominated projects:

- St James Church retaining wall stabilisation, Liverpool
- Linlathen East Bridge restoration, Dundee
- Aberbechan Bridge refurbishment, Powys

- Clifton Suspension Bridge hanger refurbishment, Bristol
- Forth Bridge restoration project, Edinburgh
- Calva Bridge repairs, Workington
- Kings Cross Station train shed roof refurbishment, London
- Oundle South Bridge refurbishment, Northants
- Tower Bridge re-lighting, London
- Charles I Bridge repair, Stamford, Leicestershire
- Teme Bridge strengthening & refurbishment, Worcestershire
- Holt Fleet Bridge strengthening & refurbishment, Worcestershire
- Reigate Hill Footbridge refurbishment, Surrey
- Mottram Viaduct strengthening & refurbishment, Derbyshire

Institution Award for Bell Rock Lighthouse by Roland Paxton



Roland Paxton with David Taylor, great-great-great-grandson of the Master of the SMEATON Tender, viewing plaque © Roland Paxton

The 202-year-old Bell Rock Lighthouse, is in service 11 miles out to sea from its former Signal Tower Shore Station (now an Angus Council Museum). The lighthouse is regarded as one of the *Seven Wonders of the Industrial World* because of the extraordinary feat of its erection, on a usually submerged rock against the action of the sea, using the limited technology of its time.

To promote knowledge of the building of this engineering masterpiece, beneficial not only to maritime safety but also as a model for Rock lighthouse erection at Skerryvore and elsewhere, the Institution of Civil Engineers in Scotland organised a commemorative plaque. In September 2012 this plaque was presented to Mrs Helen Oswald, Provost of Angus, for the Museum. Recently installed, it designates the Lighthouse and Shore Station an *HISTORIC CIVIL ENGINEERING LANDMARK*.



Close-up of plaque erected at Museum in February 2013
© Roland Paxton

The plaque wording is based on original research at Heriot-Watt University by Professor Roland Paxton FRSE of the Institution's Panel for Historical Engineering Works, set out in his recent book *Dynasty of Engineers: The Stevensons and the Bell Rock* (published by the Northern Lighthouse Heritage Trust). Whilst the plaque acknowledges Stevenson's key role in the lighthouse's creation, it also recognises for the first time in this way the roles of others including Rennie, Logan, Watt and Captain Taylor and indicates the innovative expedients employed and other detail. The attractively refurbished Museum is open daily (except Sundays). Admission Free.



The Signal Tower Museum, Arbroath. Completed in 1813 as the Bell Rock Lighthouse Shore Station © Roland Paxton

Blue Plaques in Derby

Plaque from Barry Barton

Derby is to recognise 22 of its historic figures by erecting Blue Plaques on appropriate buildings. A very wide range of human endeavour is represented including the founders of Rolls-Royce, Henry Royce and Charles Rolls, the first Astronomer Royal John Flamsteed, ironsmith Robert Bakewell, painter Joseph Wright, footballer Steve Bloomer and the inventor of the Hot Dog Henry Stevens. Included with the founder of Derby's original silk mill John Loome is the site's water engineer George Sorocold.

George Sorocold (1668-1738) was one of the finest hydraulic engineers of his time. He worked nationwide and examples of

his engineering works were to be found in many towns and cities including Exeter, London, King's Lynn, Liverpool, Portsmouth and Sheffield. Little is known of his early life except that he was born in Derby and was educated at Emmanuel College in Cambridge. By 1684 Sorocold had become a resident in Derby, where he married his wife Mary. His first employment at Derby was the re-hanging of the bells at All Saints Church in 1687.

Sorocold's Derby water supply can lay claim to being the first provincial town outside of London to have a piped water. The project, begun in 1691 took three years to complete and supplied water to the twenty-three streets whose inhabitants could afford to subscribe. It has been estimated that at least 1,000 Elm tree trunks were required to lay the four miles of Elm wood pipes that supplied the town. Sorocold erected his machinery at the old 'gunpowder mill', on the banks of the river Derwent. The machine consisted of a set of pumps, powered by a water wheel, which raised the water to a tank and cistern in St Michael's churchyard. From here sufficient pressure was derived to pipe the water to individual houses. The water falling from the tank into the cistern from which it was piped also drove the machinery that bored the Elm wood into pipes. The water supply system remained in use for 150 years.

In 1716 Sorocold surveyed the river Derwent and proposed new cuts for a scheme (that was never implemented) to make the river navigable for trade. Sorocold was also considered one of the best millwrights of his time. His engineering achievements were widely recognised by his contemporaries. Thomas Savery – engineer and inventor, lavished praise upon Sorocold when he wrote that in 'composing of such sort of engines (for supplying towns with water) no person has excelled the ingenious Mr George Sorocold'. Sir Francis Copley wrote of his London Bridge project that the engines were 'the best piece of work' he had ever seen.

The Blue Plaque recognises Sorocold's collaboration with Sir Thomas Lombe and his design of the waterworks associated with the pioneering Silk Mill built in Derby in 1720.

Sorocold Information from
<http://www.visitderby.co.uk/things-to-do/wayfinding/stories/george-sorocold>

Letter from Henry Gunston

Many thanks for publishing my article on the Old Hapuawenua railway viaduct (New Zealand) in the latest *PHEW Newsletter*.

A slight glitch. The lower photograph, showing a diesel locomotive on the old steel viaduct should have been credited to: "Norm. Daniel, photographer, and The New Zealand Railway & Locomotive Society Inc." and not to myself – mine was the upper photograph of the old viaduct from a train on the new (1987) viaduct.

Reply: My apologies to Henry and folk in New Zealand for the error in attribution. *The Editor*