

Spanning *the* Centuries



An anthology of essays reflecting the influence and heritage of the

UNION BRIDGE

to celebrate its Bicentenary

1820 - 26th July - 2020



Cover illustrations:

Front: Aquatint engraving by Robert Scott of Edinburgh from a painting by Thomas Sword Good of Berwick-upon-Tweed 1822;
Scotch New Water salmon fishing shiel, *right foreground*.

Back: Report from *The Scotsman* 5th August 1820.

Spanning the Centuries

*An anthology of essays reflecting the influence
and heritage of the*

UNION BRIDGE

Berwick-upon-Tweed

to celebrate its Bicentenary

Edited by Professor Roland Paxton



THE FRIENDS OF THE UNION CHAIN BRIDGE

Berwick-upon-Tweed

2020



THE FRIENDS OF THE UNION CHAIN BRIDGE

Horncliffe, Berwick-upon-Tweed TD15 2XT

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Metric Equivalents

Imperial measurements have been adopted generally as these were the units in which the Bridge was constructed.

The following are the metric equivalents:

Length: 1 inch = 25.4 millimetres; 1 foot = 0.3048 metre; 1 miles = 1.609 kilometres

Area: 1 square inch = 645.2square millimetres

Volume: 1 cubic foot = 0.0283 cubic metre

Mass: 1 pound = 0.4536 kilogram; 1 imperial ton = 1.016 tonnes

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The Friends of the Union Chain Bridge

and their partners in the Restoration of the Union Bridge

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The Berwick-upon-Tweed Preservation Trust

The Catherine Cookson Charitable Trust

The Fallago Environment Fund

The Joicey Trust

The SSE Sustainable Fund

The Scottish Landfill Communities Fund

The Wolfson Foundation

Foreword

On Wednesday 26th July, 1820 a remarkable event took place in a sparsely populated region of the United Kingdom which would have an immense impact on the lives of millions of people around the world to the present day. Precisely one year after the foundation stone was laid, the Union Bridge was officially opened, crossing the River Tweed between England and Scotland, five miles west of Berwick-upon-Tweed. Eye-witness accounts estimate a crowd of over two thousand marked the occasion and witnessed history in the making.

This was the start of a revolution in bridge engineering. Captain Samuel Brown's radical design was to be the first transport-bearing suspension bridge in Europe and, when completed, the world's longest suspension bridge. It would enable crossings previously considered impossible to be bridged, bringing communities together and developing economies. The use of his chains (originally designed for ships' anchors) suspended from a platform, completely transformed how bridges were built. They could be erected quickly, across wider spans than a masonry bridge, at a fraction of the cost. Captain Brown's estimate for building the Union Bridge was £5000; a masonry bridge would have cost at least £20,000 and involved the erection of stone piers in the water with the obvious headaches that would cause.

The crowds thronging the river bank on that summer day, rather like the crowds who watched the launching of space rockets from Cape Canaveral 150 years later, were in awe of the events before them but also sceptical that this was possible. To win the trust of the spectators that the Bridge was safe, Captain Brown crossed the Bridge in his carriage followed by twelve double-horse carts laden with stones to prove its strength; followed by the Earl of Home and the Commissioners of Roads, preceded by the Bands of the Berwickshire and Northumberland militias playing the National Anthem. This won the trust of the crowds

who swarmed across the Bridge and so it has been in use ever since. Prominent engineers and scientists of the day, including Robert Stevenson and John Leslie, were present and a few years later, a young Isambard Kingdom Brunel visited, such was the fame of the Bridge.

Quite why this part of the Tweed was chosen for this revolutionary structure remains largely a mystery. The nearest bridge to the east was the remarkable 17th century bridge at Berwick and to the west, Smeaton's Coldstream bridge, which was completed in 1763. So a crossing at Horncliffe/Fishwick would save a round trip of 14 miles when the ford was unusable. It is likely that one of the principal drivers was to transport coal and lime from the Northumberland pits to improve the Berwickshire farmland.

In the world before Covid-19, we had planned celebrations to mark the Bicentenary and welcome esteemed bridge engineers from around the world to deliver a series of lectures at our Symposium. Sadly, events contrived that this was not to be, but this book brings together those lectures as a lasting reminder of the significance of the Bridge in the history and development of suspension bridges around the world. I would like to thank all who have contributed to this publication but in particular, one of our Patrons, Professor Roland Paxton, in organising this fitting testimony and for all his support over many years for us to achieve our principal aim which will be the restoration of the Union Bridge. So on this day let us let us celebrate the genius of Captain Brown and his Union Chain Bridge. I look forward to welcoming you all with our project partners, sponsors and Friends, once the restoration work is completed.

Robert Hunter
Chairman of the Friends of the Union Chain Bridge
26th July 2020



*Union Bridge 1974; salmon boats moored below.
Salmon netting, which was first recorded at Scotch New Water in 1250, ceased in 1987
(© John R Hume)*

Preface

In initiating and organising the proposed Bridge Symposium at Horncliffe [see page 9], the vision was to publicly celebrate, advance knowledge, and inform the future role of Capt. Brown's innovative masterpiece on its Bicentenary. Disappointingly, the Covid-19 pandemic dictated the symposium's cancellation but, as most of our speakers had already submitted synopses of their presentations, the Friends decided to continue with their planned publication. Its launch was to have complemented a now postponed plaque unveiling by the presidents of the American and Japan Societies of Civil Engineers and Institution of Civil Engineers, designating the bridge an International Historic Civil Engineering Landmark, an outcome I undertook to the Friends in July 2014 to seek, based on previous experience in the achievement of this designation for the Forth, Menai and Craigellachie Bridges. Our carefully worded and crafted plaque is now made [see pages 8, 16].

Our book *Spanning the Centuries* focusses on diverse aspects of the Bridge. Topics include, its historical significance in long span bridge development, harnessing newly-invented remote sensing techniques to reveal its hidden anchorages, and the planned modus operandi for its impending restoration. Also, a welcome appreciation by a local inhabitant, positive proposals for its future promotional and educational role as envisaged by representatives of Historic Environment Scotland and Museums Northumberland, exciting portrayals of later developments of Capt. Brown's 'new era in bridge building' concept from North America, Japan and Norway and, closer to home, a fuller understanding of the bridge and its *Union* theme with emphasis on its significant *Welsh Link*.

A welcome by-product of the Symposium has come

from Professor John Hume, Scotland's 'father of industrial archaeology'. Although he was unable to take part in our event for health reasons, it did stimulate him to produce an illustrated booklet in celebration of the Bridge's bicentenary, based on his pioneering work in the 1970s, entitled *Union Suspension Bridge Hutton, Scottish Borders and Northumberland. Notes by John R. Hume*. Professor Hume's contribution and generosity in making copies of his booklet freely available on request from the Friends, while stocks last, is greatly appreciated.

I close with grateful thanks to my authoritative co-authors and prospective session chairs Dr Kathlie Bulloch and Ted Green of the American Society of Civil Engineers, most of whom I have known for many years in promoting and conserving civil engineering heritage, for agreeing to take part in the Symposium at their own expense and for their research and dedication in creating this extraordinary memento, which includes images and findings now first published. I also acknowledge valuable support from the History and Heritage Committees of the American and Japan Societies of Civil Engineers; the Institution of Civil Engineers' Panel for Historical Engineering Works; Heriot-Watt University; Historic Environment Scotland; the Bridge Restoration Project Board; the Royal Society of Edinburgh, Adrok Ltd, and, not least, from the Friends of Union Chain Bridge, particularly its Chairman Robbie Hunter and Secretary Edward Cawthorn, without whose enthusiasm and diligent dedication in organising this publication it would not have seen the light of day.

Roland Paxton

*Institute for Infrastructure and Environment,
Heriot-Watt University, Edinburgh*

INTERNATIONAL HISTORIC
CIVIL ENGINEERING LANDMARK
UNION CHAIN SUSPENSION BRIDGE 1820

UNITES ENGLAND [HORNCLIFFE] AND SCOTLAND [HUTTON] OVER THE RIVER TWEED USING
WELSH IRONWORK MADE BY BROWN LENOX & CO., NEWBRIDGE, THE WORLD'S OLDEST AND
THEN LONGEST SPAN ROAD SUSPENSION BRIDGE. USING 15 FT IRON EYE-BAR LINKS IT COST
ABOUT £7700, LESS THAN 40% OF A STONE BRIDGE.

ENGINEER: CAPT. SAMUEL BROWN R.N. (1774-1852). CONSULTANT: JOHN RENNIE C.E.

OPENED ON 26 JULY 1820 BY
WILLIAM MOLLE W.S., CHAIRMAN OF THE BERWICK & NORTH DURHAM TURNPIKE TRUST
PRESENTED TO NORTHUMBERLAND COUNTY COUNCIL & SCOTTISH BORDERS COUNCIL BY



DEDICATED 26 JULY 2020

Dedicated to all mentioned in this plaque tribute
for their respective contributions
and to the late Gordon Miller (1924 - 2018)
for his invaluable promotion of the Bridge
over many years

The Union Bridge Bicentenary Symposium

Sunday July 26th 2020

The essays in this book are synopses of talks which were to have been presented at a Bicentenary Symposium in Horncliffe Memorial Hall on Sunday July 26th 2020, cancelled under the restrictions imposed to combat the Covid 19 pandemic. The Symposium Programme is reproduced here as a record of a lost event.

MORNING PROGRAMME THEME: UNION BRIDGE, ITS INFLUENCE AND RESTORATION

Morning Chairman: Theodore ("Ted") Green,
Chair, American Society of Civil Engineers 2019

- 1015 Welcome, introduction, *Friends'* contribution to restoration
Robert Hunter, Chairman, *The Friends of the Union Chain Bridge*.
- 1030 **Union Bridge: International engineering aspects**
Dr Roland Paxton MBE FICE FRSE Hon Professor Heriot-Watt
University, Emeritus Member ICE Panel for Historical Engineering
Works, Patron: *The Friends of the Union Chain Bridge*
- 1050 **Union Bridge: Radar revelation of anchorages**
Dr Colin Stove, *Radar specialist, Chairman and Scientific Director,*
Adrok Ltd.
- 1115 **Union: The Welsh Link**
Stephen K Jones, *Wales member ICE Panel for Historical*
Engineering Works; Trustee The Friends of the Union Chain Bridge
- 1140 **Union Bridge restoration and progress to date**
Simon T Rudman BEng (Hons) CEng MStructE Technical Services
Design Manager, Northumberland County Council
-
- 1300 **International Historic Civil Engineering Landmark Plaque presentation**
Speeches by the Presidents of the Institution of Civil Engineers (UK), the American Society of Civil Engineers and the Japanese Society of Civil Engineers; and **Acceptance of the Plaque** by the Chairman of Northumberland County Council and the Convener of Scottish Borders Council

AFTERNOON PROGRAMME THEME: SUSPENSION BRIDGE EVOLUTION - UNION BRIDGE'S FUTURE ROLE

Afternoon Chair: Dr Kathlie Jeng-Bulloch PE., D.WRE CFM,
Houston Public Works, City of Houston, Texas USA

- 1440 **Brooklyn Bridge, USA: The world's longest bridge span in 1883**
Raymond Paul Giroux, Dist M ASCE Kiewit Infrastructure
West Co. Vancouver, Washington, USA
- 1505 **Akashi Straits Bridge, Japan: The world's longest bridge span today**
Dr Hiroshi Isohata JSCE Vice Chair Conservation of
Engineering Heritage, Former Professor Nihon University,
Chiba, Japan
- 1525 **Captain Brown's Influence on Norway's Iconic first suspension bridge**
Hans Seland CEng, Senior Principal Engineer (Retired),
Norwegian Public Roads Administration
- 1545 **Union Bridge's future contribution to Society**
Promotion of education, research, tourism, social evolution etc
Dr Miles Oglethorpe, *Head of Industrial Heritage, Historic Environment Scotland; President of TICCIH (International Committee on Industrial Heritage)*
Rowan Brown, Chief Executive Officer and Matt Storey,
Audience Development Manager, Museums Northumberland
- 1615 **Union Bridge and its future: A personal perspective by a local resident**
Heather Thompson, *a Director of Chain Bridge Honey Farm and a founder Trustee of The Friends of the Union Chain Bridge*