

UIC WORKSHOP ON MASONRY ARCH BRIDGES

18-19 October 2018

The Mansion House, Bristol, UK



Assessment of Masonry Arch Bridges

There are over 200.000 masonry arch bridges and culverts in the European railways network that represent almost 50% of the total bridge stock in Europe with an inestimable asset value. Most of these bridges are over 100 years old and would be considered to have reached the end of their theoretical service lives if compared against current design codes. Masonry arch bridges have however stood the test of time and proved to be long-lasting structures with considerable reserve capacity and resilience. Appropriate maintenance and management are key to maintaining the bridge stock in a safe and serviceable condition.

UIC has carried out a project on 'Masonry Arch Bridges' to respond to these requirements and workshop aims to present the outcomes of the project focusing on:

- 1. Structural behaviour**
- 2. Inspection**
- 3. Assessment**
- 4. Serviceability**
- 5. Maintenance**
- 6. Case studies.**

The workshop is likely to be of interest to railway and road infrastructure owners, asset managers, bridge engineers and contractors, responsible for the inspection, assessment or repair of masonry arch bridges in the transport network.

Programme - Day 1 – 18/10/2018

10.00 – 10.30 **Arrival, registration**

10.30 – 10.50 **Welcome & introduction of invited speakers** UIC

General information on the UIC Masonry Arch Bridges project

10.50 – 11.10 Background, organisation of work, participants, project phases, tasks, deliverables, dissemination of results
Introduction of IRS 70778-3 (Recommendations for the inspection, assessment and maintenance of masonry arch bridges)

Z. Orban,
project manager

Structural behaviour

11.10 – 11.50 General principles

W. Harvey

11.50 – 13.00 **Lunch**

Deterioration, inspection, monitoring

13.00 – 14.40 Defects of masonry arch bridges & Defect Catalogue J. Martín-Caro
Testing methods and case study Z. Orban
Fatigue deterioration A. Tomor

14.40 – 15.10 **Coffee Break**

Assessment

15.10 – 17.00 Simple first level tools W. Harvey
Archie-M
LimitState:RING M. Gilbert
Finite Discrete Element Modelling N. Gibbons
Life expectancy, SMART assessment A. Tomor

Programme - Day 2 – 19/10/2018

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|----------------------|--|----------------|
| 8.30 – 10.30 | Service loading and dynamic effects | |
| | Ultimate and permissible limit state behaviour | M. Gilbert |
| | Deterioration under service loading | J. Martín-Caro |
| | Assessment of bridges with defects | J. Martín-Caro |
| | Dynamic behaviour | N. Gibbons |
| 10.30 – 11.00 | Coffee Break | |
| 11.00 – 11.45 | Maintenance and repair | J. Martín-Caro |
| | Case studies, discussions | All speakers |
| | Retrofitting the Zaragoza - Alsasua line by backfill injection | J. Martín-Caro |
| 11.45 – 13.00 | Assessment of a viaduct in Brixton | |
| | Live load damage to small bridges on the Glasgow and South West line | W. Harvey |
| | Rehabilitation of a Stockton & Darlington Railway arch bridge | M. Gilbert |
| 13.00 – 13.30 | Discussions | |

Speakers:

| Speakers | Organisation | Position |
|-----------------------------|-----------------------------------|----------------------------------|
| <i>Dr Adrienn Tomor</i> | University of West of England, UK | Senior Lecturer |
| <i>Dr Jose Martín-Caro</i> | INES Consultores, Spain | General Director, Chief Engineer |
| <i>Dr Niamh Gibbons</i> | University of Cambridge, UK | Course Leader |
| <i>Prof Matthew Gilbert</i> | University of Sheffield, UK | Full Professor |
| <i>Prof William Harvey</i> | Bill Harvey Associates, UK | Full Professor |
| <i>Dr Zoltan Orban</i> | University of Pécs, Hungary | Associate Professor |

Dr Zoltán Orbán

Zoltan Orban is Director of the Institute of Engineering and Smart Technologies and leader of the Structural Diagnostics and Analysis Research Group at the University of Pécs, Hungary. Previously he worked as a bridge engineer at Hungarian Railways and was a member of UIC's Panel of Structural Experts Group from 2000 to 2014. He was initiator and chairman of the UIC project on the Assessment, Inspection and Maintenance of Masonry Arch Bridges and has been involved in numerous international projects related to bridges and historical structures.



Dr Bill Harvey

Bill Harvey began researching arches in 1981. He wrote Archie-M, still a popular program for arch assessment in 1984, though it has been through many rebuilds since then. He set up a consultancy in 2000 where he and his son conduct analysis design and monitoring work, chiefly on arch bridges. Recent consulting work has included the Ordsall Chord and Manchester Museum of Science and Industry (The original Liverpool Road station of the Liverpool and Manchester railway). In 2016 he led the team conducting the Elevarch project which has won many awards.

After 37 years, he still gets surprises in arch behaviour and is still learning through challenging work.



Dr Niamh Gibbons

Niamh Gibbons is the Course Leader at the EPSRC Centre for Doctoral Training in Future Infrastructure and Built Environment at the University of Cambridge. Her research to date has focused broadly on the assessment of masonry arch bridges and infrastructure sensing for performance assessment and structural health monitoring. This has provided a diverse range of experience in computational modelling, instrumentation and monitoring, signal processing and data analysis. Her present research is focused on the development of structural elements with embedded sensing capabilities and the application of fibre optic monitoring techniques to railway bridges.



Prof Matthew Gilbert

Matthew Gilbert is Professor of the Department of Civil & Structural Engineering at the University of Sheffield, UK. He has had an active interest in the behaviour of masonry arch bridges for more than 25 years, undertaking both experimental and numerical research studies. He is the recipient of prizes from both the Institution of Civil Engineers and the Institution of Structural Engineers for journal papers on masonry arch bridges. He is also the originator of the RING masonry arch bridge analysis software, in use in over 30 countries worldwide.

**Dr José Antonio Martín-Caro**

Over his 20 years of experience, José A. Martín-Caro has combined teaching and research activities with a long track record of working on real world engineering projects. Taking a holistic approach, he has undertaken professional activities in the fields of structures, geotechnics and railway engineering, including monitoring, rehabilitation, repair and new works. His strong research background in infrastructure maintenance and cultural heritage puts him in a strong position to lead innovation in these areas, and to play an active role in national and international technological projects.

**Dr Adrienn Tomor**

Adrienn Tomor is senior lecturer at the University of the West of England, Bristol, UK. Her research interest focuses on the long-term fatigue assessment and monitoring of masonry arch bridges. She is leading a series of bridges inspection courses for the UK Bridge Inspector Certification Scheme. Based the advantages (and limitations) of masonry arch bridges, she is working on reintroducing masonry arch bridges for new construction.



| Information and contact: | | |
|--|--|---|
| University of the West of England | UIC | UIC |
| <p>Dr Adrienn Tomor Geography and Environmental Management</p> <p>Adrienn.Tomor@uwe.ac.uk</p> | <p>Harald Sattler Rail System Department</p> <p>SATTLER@uic.org</p> | <p>Christine Hassoun Rail System Department</p> <p>HASSOUN@uic.org</p> |

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