UIC WORKSHOP ON MASONRY ARCH BRIDGES

7-8 June 2018

Fundación de los Ferrocarriles Españoles/Madrid

PÉCSI TUDOMÁNYEGYETEM
UNIVERSITY OF PÉCS

FUNDACIÓN DE LOS FERROCARRILES ESPAÑOLES

UIC

Assessment of Masonry Arch Bridges

Railways in Europe possess more than 200.000 masonry arch bridges and culverts on their lines which represent almost 50% of their total bridge stock with an inestimable asset value. Many of them have reached the end of their theoretical service lives when judged against current codes.

Replacement of these old structures shows difficulties due to economic reasons and to the fact that many of them belong to the civil engineering heritage of the railways. Good solutions are therefore needed in optimised management and maintenance strategies and better assessing of the bridge stock.

UIC has performed the project "Masonry Arch Bridges" to respond to this requirement. The principal objective of the workshop is to present the results, i.e.:

1. Development of an assessment framework that enables bridge owners to determine the safe working load and residual life of Masonry Arch Bridges;
2. Development of tools for a predictive Life Cycle Management and Maintenance Planning of Masonry Arch Bridges;
3. Best practices, case studies and new developments regarding maintenance and repair of Masonry Arch Bridges.

The results of the project are of interest for railway infrastructure owners, asset managers, bridge engineers responsible for the inspection, assessment or repair of masonry arch bridges as also for contractors involved in masonry arch bridge projects.

Programme - Day 1 - 07/06/2018

12.30 – 13.00	**Arrival, registration**	
13.00 – 13.20	**Welcome & introduction of invited speakers**	ADIF and UIC
13.20 – 13.40	**General information on the UIC Masonry Arch Bridges project**	
	Background, organisation of work, participants, project phases, tasks, deliverables, dissemination of results	Z. Orban, project manager
	Introduction of IRS 70778-3 (Recommendations for the inspection, assessment and maintenance of masonry arch bridges)	
13.40 – 14.20	**Behaviour, inspection and assessment of masonry arch bridges**	
	General principles	W. Harvey
14.20 – 15.00	**Lunch**	
15.00 – 16.20	**Inspection and testing for assessment**	
	Damages of masonry arch bridges & Damage Catalogue	J. Martín-Caro
	Testing material properties	Z. Orban
	Non-destructive testing	Z. Orban, A. Tomor
	Load tests on arches	P. Fanning
16.20 – 16.40	**Coffee Break**	
16.40 – 18.30	**Analysis tools for assessment**	
	Simple first level tools	W. Harvey
	Archie-M	
	LimitState:RING	M. Gilbert
	Finite Discrete Element Modelling	M. Gilbert, P. Fanning
	Assessment of arches with damages	J. Martín-Caro

Programme - Day 2 - 08/06/2018

8.30 – 10.30	**Serviceability, permissible load, life expectancy**	
	Ultimate and permissible limit state behaviour	M. Gilbert
	Degradation of arches under service loading conditions	J. Martín-Caro
	Dynamic behaviour of arches	P. Fanning
	Deterioration due to fatigue & monitoring with acoustic emission	A. Tomor
	Life expectancy & SMART assessment	
10.30 – 11.00	**Coffee Break**	
11.00 – 11.45	**Maintenance and repair**	J. Martín-Caro
11.45 – 13.00	**Case studies, new developments, discussions**	All speakers
	Retrofitting of arches in Zaragoza – Alsasua line. An example of increasing the load capacity by injecting the backfill	J. Martín-Caro
	Assessment of a viaduct in Brixton	W. Harvey
	Extending the service life of arch bridges with precast load dispensing slab	Z. Orban
	Case studies on non-destructive testing of arches	
13.00 – 13.30	**Discussions**	

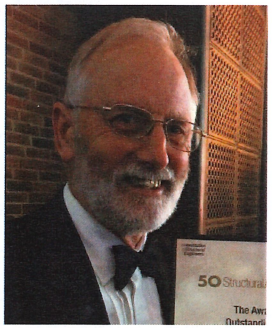
Speakers:

Speakers	Organisation	Position
Dr. Adrienn Tomor	Univ. of West of England, UK	Senior Lecturer
Dr. Jose Martín-Caro	INES Consultores, Spain	General Director, Chief
Dr. Paul Fanning	University College Dublin, Ireland	Associate Professor
Prof. Matthew Gilbert	Univ. of Sheffield, UK	Full Professor
Prof. William Harvey	Bill Harvey Associates, UK	Full Professor
Dr. Zoltan Orban	University of Pécs, Hungary	Associate Professor

Zoltán Orbán, PhD

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.

Bill Harvey, PhD



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.

Paul Fanning, PhD

Paul Fanning is Deputy Vice President for Global Engagement at University College Dublin (UCD), Ireland. He is a Chartered Engineer and Fellow of the Institution of Engineers of Ireland. He has been an active researcher in the areas of structural assessment and condition monitoring since joining UCD in 1996. A particular emphasis of his research work has been the correlation between measured responses and numerical models – this research has included multiple static and dynamic test regimes on monumental structures as well as multiple stone arch bridges.

Matthew Gilbert, PhD

Matthew Gilbert is Director of Research in 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.

José Antonio Martín-Caro, PhD

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.

Adrienn Tomor, PhD

Adrienn Tomor is senior lecturer at the University of the West of England, Bristol, UK. Her research interest is focused 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. Considering the advantages (and disadvantages) of masonry arch bridges, she is working on reintroducing masonry arch bridges for new construction in the 21st century.