Editorial

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The introduction of steel into bridge building some 150 years ago allowed structures with larger dimensions to be built. From that, time spans could be achieved that were hardly dreamt of only a few years before. Rather less obvious is that this development also revolutionised the technology of bridge bearings. A distinct generation of bearings with a highly-individual design emerged. Bolts, pivots and rollers, originally elements of mechanical engineering, were being appropriated for bearings.

However, during the 20th century this generation of bearings lost its significance, first in research and development and subsequently, in the second half of the century, in the realm of application as well. Iron and steel bearings were gradually disappearing, first from the fields of structural engineering, then from the specialist literature and design and construction standards, and finally from public perception altogether. So why then do we publish a themed issue especially dedicated to historic bearings?

Civil engineers have had to deal with what is now a historic generation of bearings for quite some time. The tasks of refurbishing and strengthening existing bridges by necessity have to include assessments of the bearings since they have to perform vital functions in the bridges with respect to mechanical operation as well as structure and design. However, in the absence of reliable fundamental knowledge there are still many questions to be answered. This concerns, first and foremost, essential issues such as the load-bearing capacity and serviceability of the bearings; there are also special issues like the possibilities of using non-destructive in-situ inspections. Replacing the old bearings with new ones may appear attractively simple. However, realising this often proves to be complicated and expensive.

This is why a research focus area was established at the Chair of Construction History and Structural Preservation at Brandenburgische Technische Universität in Cottbus, Germany, in 2004 to investigate the historic fundamentals of constructing bearings. The initial phase of the project was finalised in 2010 with a doctoral dissertation by the author (Wetzk, 2010). These insights then served as the basis for the research project ‘Historic iron and steel bridge bearings – history and options of preservation’ funded by the German Research Foundation and performed in cooperation with the Bundesanstalt für Materialforschung und -prüfung in Berlin. The results of these experiments were subsequently published in order to provide engineers with guidelines for their

practical work (<http://www.tu-cottbus.de/fakultaet2/en/construction-history/research/projekte/historical-bridge-bearings.html>). A second doctoral dissertation – focusing on the realistic calculation of historic bridge bearings – has been written by a member of the research group and is currently in its final stage of revision.

As yet, an international exchange with researchers from beyond the German-speaking scientific community has not materialised. Thus, in 2013, *Engineering History and Heritage* called for papers for a themed issue on bridge bearings hoping to inaugurate this communication. The initiative began in a promising way, when the editorial board received nine abstracts from many countries. In the end, however, only three of these have resulted in papers ready for publication in this issue:

‘Hinges in historic concrete and masonry arches’ by Stefan M. Holzer and Karen Veihelmann, the first paper, describes the history of the hinged vaulted bridge, from the first suggestions by the French Jules Dupuit up the early twentieth century. Particular attention is given to temporary and ‘imperfect’ hinges that may be neither visible nor active in the finished state of the bridge and to the historic development and design of permanent hinges, outlining the full range of structural solutions engineers may encounter today, when assessing the state of a late nineteenth century vaulted bridge (Holzer and Veihelmann, 2015). Engineers of today may be surprised that the hinged arch, while increasingly common in steel bridge structures from the 1860s onwards, was introduced into masonry and concrete bridge building only much later and rather reluctantly.

This is where the second paper, ‘Concrete hinges in bridge engineering’ by Gregor Schacht and Steffen Marx, continues. It explains the further development of hinge design for reinforced-concrete bridge structures in the 20th century. Special attention is given to hinges designed by Freyssinet and Mesnager; common features and differences are compared in detail (Schacht and Marx, 2015). The reader may be impressed by the simple design, the high load-bearing capacity and the durability of those types of hinges.

The third paper, ‘Thomas Telford’s saddle bearings for Menai Suspension Bridge’ by William Day, addresses bearings made of cast and wrought iron. It describes the bearings used by Telford in the early 1820s in detail, which were a very early and sophisticated example of metal bridge-bearing technology. The paper conveys the form in which bridge bearings were conceived

and built nearly two centuries ago (Day 2015). In addition the reader learns that the careless attitude towards maintaining bridge bearings, often complained about today, dates back to the early period of employing iron and steel bearings. Apparently owners of bridges have not been aware about the nature of bearings, which like any other ‘machine’ require regular monitoring and at least some form of cleaning and maintenance.

The three papers provide an overview of the development and design of historic bridge bearings with regard to the range of materials commonly used for these devices. Knowing about these fundamentals will help to pave the way for appropriate structural assessments of historic bearing technology which, together with a ‘sustainable development’ (Addis, 2014) of entire bridge structures may help to preserve them, regardless of any ‘heritage’ significance.

With only three papers on the subject of the themed issue, they are complemented by ‘James Newlands and the origins of the municipal engineer’, a portrait of this Victorian engineer by Sally Sheard. I must admit that before reading Sheard’s paper, Newlands had been unknown to me. Thus I am happy to include it here. Newlands demonstrated what can be achieved under the duress of financial stringency and local ratepayers, as well as government opposition to public investment. As Sheard points out, the engineering profession can still learn a lot from him (Sheard, 2015).

I want to express my gratitude to the editors of *Engineering History and Heritage* for giving the opportunity to dedicate an issue to the subject of existing historic bridge bearings as well as to the authors for their commitment in producing their papers.

However, the theme has not been exhaustively dealt with yet. Many of the subjects proposed in the Call for Papers have not been addressed. We look forward to future papers on these topics such as ‘The experiences of bridge owners with bearings still in use’ and ‘The experiences of engineers in structural preservation works’. There are surely many examples of practical experiences of bearing conservation, since engineers have been dealing with historic bridges – and thus with historic bearings too – for quite some time. Furthermore, the present issue has not really succeeded in triggering off an international exchange of experiences and knowledge. Therefore, we look forward with anticipation to receiving more papers on this subject and returning to the idea of a themed issue on historic bearings in a few years’ time.

REFERENCES

- Addis W (2014) Editorial. *Proceedings of the Institution of Civil Engineers – Engineering History and Heritage* **167(1)**: 1–3.
- Day W (2015) Thomas Telford’s saddle bearings for Menai Suspension Bridge. *Proceedings of the Institution of Civil Engineers – Engineering History and Heritage* **168(2)**: 77–83.
- Holzer S M and Veihelmann K (2015) Hinges in historic concrete and masonry arches. *Proceedings of the Institution of Civil Engineers – Engineering History and Heritage* **168(2)**: 55–65.
- Schacht G and Marx S (2015) Concrete hinges in bridge engineering. *Proceedings of the Institution of Civil Engineers – Engineering History and Heritage* **168(2)**: 66–76.
- Sheard S (2015) James Newlands and the origins of the municipal engineer. *Proceedings of the Institution of Civil Engineers – Engineering History and Heritage* **168(2)**: 84–90.
- Wetzk V (2010) *Brückenlager. 1850–1950*. Dissertation at BTU Cottbus. urn:nbn:de:kobv:col-opus-20692.