

Editorial: Use of remote non-destructive methods

Richard Henley CEng MICE

Engineer and Designer; NT Volunteer Specialist, UK

We are increasingly giving more attention to being responsible custodians of what we built in the past. A major spur for this is the necessary response to climate change, which develops into seeking to make the most of existing assets and the increasing threat to those assets from the changing climate; we seek to reduce overall carbon footprints and make what we have more physically resilient. When reflecting on these matters and the appropriate responses it tends to put our existing assets under a different light and their cultural value starts to feature as much as the “cold” physical characteristics. This has become expressed in the concept of looking to outcomes.

To be a responsible custodian requires a thorough understanding and appreciation of the physical nature of an asset and be able to assess it as cost effectively as possible.

Over the last two decades or so we have seen methods and tools emerging from the laboratory (real and virtual) into the “field” and from one sector into another.

We can handle huge amounts of digital data at reasonable cost and aspects of AI will greatly improve the speed and quality of data interpretation.

Civil Engineering has always been at the leading edge of technological developments and that knowledge, experience and skill is now being brought to bear on a wider range of built elements which traditionally have been considered the province of others. Application of the United Nations Sustainable Development Goals (the basis of the ICE Enabling Better Infrastructure: 12 guiding principles (2020) shows that successful outcomes are realised by the intelligent collaboration of equal cross-discipline partners. In that context this themed issue gives a flavour of the breadth and depth of what is available in the field of remote non-destructive techniques and promising aspects being developed as it applies to fulfilling the role of responsible custodian.

The paper by Challis *et al.*, 2024 reports on how digital scanning tools combined with robotics can collect data for a large site with very difficult access. The accessibility of an historically significant site of the cold war is challenging not only for the purpose of survey, condition assessment and curation but also because it restricts close-up public access and the conventional means of interpretation.

The paper by Professor Olaf Huth (Huth, 2024) presents a charming, delightful and rigorous example of the use of digital data to help re-engineer the construction and structure of late Gothic stone net vaulting. Net or star vaults present a challenge when it comes to determining which of the ribs are carrying the weight and which are being carried. Mediaeval stone vaulting did follow a set of design rules. Those rules would have been written down at the time but the Master Builders would have been protective about wide distribution of their knowledge and for this and other reasons there is little or no substantive record. This paper also addresses the conundrum that in practise individual elements may have deviated from the “rules”.

The ceiling of the Institution library has provided the means for applied research into remote monitoring of historic ceilings to make management of them easier.

The paper by Cacciola and Mayfield (2024) reports on the potential use of laser Doppler vibrometers for rapid screening of condition. There are many historic ceilings and access for close-up inspection is often the most time consuming and costly part of a survey. Equally safe access to the rear surfaces, sometimes impossible, can be very challenging.

The paper by Zuo *et al.*, 2024 reports on the possibility of acoustic emissions to gage the state of the connections of the plaster surfaces to the supporting structure. Acoustic emission will be familiar to those managing and maintaining suspension bridge cables. The potential application for constructions not usually considered as civil engineering structures illustrates the benefit of cross-discipline knowledge and experience.

This themed issue aims to give a good flavour of the range of the art of the possible for remote non-destructive methods to not only share the knowledge gained but also to encourage others to share their knowledge and experiences in this growing field of engineering application.

REFERENCES

- Cacciola P and Mayfield RS (2024) Rapid screening of fibrous plaster ceilings health status using a laser Doppler vibrometer. *Proceedings of the Institution of Civil Engineers – Engineering History and Heritage* **177(4)**: 132–146, <https://doi.org/10.1680/jenhh.24.00002>.

-
- Challis K, McLaughlin L, Pearce G et al. (2024) Unsafe building: documenting heritage at risk through robotic and semi-autonomous survey. *Proceedings of the Institution of Civil Engineers – Engineering History and Heritage* **177(4)**: 109–119, <https://doi.org/10.1680/jenhh.24.00005>.
- Huth O (2024) Reconstruction of design principles of a late Gothic net vault in Eisleben/Germany. *Proceedings of the Institution of Civil*

- Engineers – Engineering History and Heritage* **177(4)**: 120–131, <https://doi.org/10.1680/jenhh.24.00012>.
- Zuo J, Mayfield S, Sheil B and Acikgoz S (2024) Acoustic emission failure detection and localisation in historic fibrous plaster ceiling. *Proceedings of the Institution of Civil Engineers – Engineering History and Heritage* **177(4)**: 147–159, <https://doi.org/10.1680/jenhh.24.00004>.