Engineering History and Heritage
Volume 170 Issue EH1

Book review
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Proceedings of the Institution of Civil Engineers
Engineering History and Heritage 170 February 2017 Issue EH1
Page 39 http://dx.doi.org/10.1680/jenhh.16.00023
Paper 1600023
Received 12/12/2016 Accepted 12/12/2016

ice | **proceedings**

ice Institution of Civil Engineers publishing

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Persian Architectural Heritage: Structure

Mehrdad Hejazi and Fatemeh Mehdizadeh Saradj. Wessex Institute of Technology Press, Southampton, UK, 2014, ISBN 978-1-84564-882-4, £90·00, 180 pp.

This book is part of a series of three books by the same authors, who are based at the University of Isfahan and the Iran University of Science and Technology, respectively. The other two volumes cover architecture and conservation. There is a rich legacy of buildings and structures in what is now Iran, and hopefully these will become more accessible and better known as the diplomatic thaw with the Islamic republic continues. The book does not cover the role played by Iran and its neighbours in keeping alive the tradition of arcuate construction and how this knowledge was reintroduced to Europe during the Renaissance. Perhaps this is covered in the first volume on architecture? If it is, I hope it also looks at how this knowledge and constructional expertise spread east to the Indian subcontinent to create a unique synthesis of Hindu and Islamic architecture. After all, the first major tomb of the Mughal dynasty was set is within a Persian-style garden for the emperor Humayum and was designed by a Persian architect.

The first chapter, a short introduction, is followed by 'Construction materials of architectural heritage structures'. This briefly covers stone and brick, has more detail on earthen materials and includes useful information on the structural properties of adobe. Bricks and mortar, and how they are combined, are also covered at length with information on uniaxial and biaxial behaviours. There is also information on the properties of clay bricks and clay–gypsum mortar from two eleventh-century buildings. The last section on metal is limited to three sentences, the first being 'During the times of the Sassanians, buildings with metal (iron) skeletons were built in Aden'. This sounds intriguing and there is a reference to three documents from the early twentieth century – the bibliography throughout is extensive – but surely this deserves more explanation?

The next chapter, 'Construction technology of traditional structures', is divided into sections on adobe, brick, stone and wood. As well as describing the use of adobe for foundations, walls and surface coatings, it also covers potential damage from water, wind, insects and vermin. Examples of tying walls and foundations with cane are illustrated, and there is an interesting sequence of photographs, rather too small, that shows the construction of a barrel vault without the need for centring. Chapter 4, 'Structural analysis of architectural heritage', includes material by Jacques Heyman from *The Stone Skeleton*, together with short sections on a range of modern methods of analysis. The final three chapters on arches, vaults and domes include information that is available elsewhere, together with more specific sections, such as those on the effects of bricklaying methods on the structural behaviour of Persian arches and the structural analysis of Persian domes.

The authors' emphasis on appraising these structures is set out with the first sentence of chapter 4: 'Sophisticated simulation and modelling of structural behaviour is a fundamental, and generally complex, task for design, conservation and restoration of masonry structures'. Observation and interpretation, essential for works to existing structures, is not mentioned. Also missing is how these types of structures were traditionally designed and constructed, interesting as a topic in itself and vital when it comes to working on these historic buildings. The authors hint at this with 'Architects in older times used geometric design rules, or equilibrium approach for the analysis and design of masonry structures', but unfortunately this is not explored further. What were these rules? Did they prepare drawings or models, and do these survive? Is there a Persian equivalent of the Akbarnama, the sixteenth-century Mughal miniature paintings from India that include images of lime being slaked, stones being lifted in place and masonry domes being constructed without centring?

There is some repetition of information between chapters, although most readers will probably 'dip in' to specific sections. The large number of illustrations also detracts from the enjoyment of reading as, in many cases, the references in the text are often several pages away. More importantly, some of the information is very basic, such as '… the remedy of water-related problems include use of a water-tight roof with proper drainage …'. Elsewhere in the same chapter, a groined quadripartite vault can, as told, be built on a square or rectangular plan and does not need centring. The only other advice is that the adobe brick courses are laid parallel to the walls. It would be interesting to give the raw materials and this information to students and see the results!

Presumably the traditional methods of design and building were lost in Persia with the introduction of modern – that is, Western – methods of analysis and construction during the twentieth century. If this is the case, has the tradition been revived and how? Is there an equivalent in Iran of the work by, say, Hassan Fathy, who designed using traditional mud brick construction in Egypt in the mid-twentieth century? Since then, sustainability and the reuse of materials have become important design considerations. In this respect new buildings formed with domes, vaults and arches and using traditional materials tick all the right boxes: low energy to produce the materials, high thermal mass to help control the internal environment and materials which can be reused at the end of the building's life. All questions for, perhaps, a second edition at a more affordable price.

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