Editorial

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This themed issue of *Engineering History and Heritage* is devoted to the role played by international exhibitions as a showcase for the architecture and engineering of buildings and, more specifically, an opportunity for experimentation with new materials and types of structure. Although the 1851 Great Exhibition of the Works of Industry of All Nations, in Hyde Park in London, for which the Crystal Palace was built, was not the first international exhibition, it has now been accorded this status retrospectively by the Bureau of International Expositions, and has certainly gained a fame that few others have been able to match (see Wikipedia (2012) entries on 'list of world expositions' and 'list of world's fairs'). While most of the early exhibitions were showcases for manufacturing and agricultural industries some had other purposes: the 1876 exhibition in Philadelphia celebrated a century of American independence, the 1888 exhibition in Brussels celebrated 50 years of the Belgian nation and the 1889 exhibition in Paris celebrated the centenary of the French Revolution. All world exhibitions have nationalism at heart – both that of the host nation and in the pavilions now provided by participating countries – and this gives rise to the stimulus to show off the best that a country can do. The pavilions can, of course, also give an insight into a national psyche, not always favourably. The 1939 New York World's Fair was the first to have a visionary theme – 'Building the world of tomorrow'. This idea has become the norm since that time, for example: 'A more human world' (Brussels 1958), 'Man and his world' (Montreal 1967), 'Progress and harmony for mankind' (Osaka 1970), 'Leisure in the age of technology' (Brisbane 1988) and 'Water and sustainable development' (Zaragoza 2008).

The buildings for exhibitions present special challenges. At the start they are usually expected to be temporary, with a life of just six to eight months, and they are designed and built with this idea in mind. However, these intentions, and more besides, have often changed! Some buildings were conceived to be retained in situ and enjoy a new life – the Palace of Industry at the British Empire Exhibition (Wembley, London 1922) was still in use (albeit only as a carpet warehouse) in 2006. Many are designed for easy erection and disassembly, comprising a kit of parts – the Crystal Palace set a bold precedent but, it has to be admitted, mainly because the organizing committee approved the final design with only a few months to the opening – there was not time to build any type of more permanent structure! Some have been built to be reassembled in another location and have a

second life – the UK pavilion at Expo '92 in Seville was sold and returned to England, but never re-erected; on the other hand, even though not part of the original plan, the Crystal Palace was re-erected, after significant enlargement and modification, and remained in use for over 80 years. Many have been built as lightweight structures using membranes, struts and cables and there have even been a few air-inflated structures (e.g. the Fuji pavilion at Osaka 1970). Relatively few have been built of concrete (the Perret Tower discussed in this issue is a rare example). And many have paid limited attention to heating, ventilation and air conditioning, on the basis that visitors come only once and only for a few hours at most. Before they have opened, many exhibitions have also given rise to local controversy about their cost and location – the entire exhibition in Seville (1992) was castigated by the local population for its flagrant use (and waste) of water for fountains in mid-summer while much of the surrounding area was suffering severe drought. Yet afterwards the exhibitions are usually remembered with universal affection, and this has led to so many buildings being retained – the Eiffel Tower (1889) and the Atomium (Brussels 1958) are two of many such 'temporary' structures.

Although the various committees involved in selecting designs for exhibition buildings have sought innovation, there are many examples where time and financial constraints have been an equally significant stimulus for highly innovative structures – the Crystal Palace being early contender! While no exhibition has had 'imaginative buildings' as its driving theme, most of them have included at least a few spectacular structures and a few – Paris 1889, Novgorod 1896, Brussels 1958, Turin 1961, Montreal 1967, Osaka 1970, Seville 1992, Hannover 2000 and Shanghai 2010 – featured several buildings which have become architectural and engineering icons.

This issue of *Engineering History and Heritage* cannot do justice to the many thousands of interesting buildings that have been constructed for international exhibitions; nor, consisting as it does, of eight different authors writing on different themes, can it fully test the thesis that exhibitions have been a significant force in stimulating innovation in building. Nevertheless, the papers bring to light some unfamiliar stories which, taken together, do address the enduring fascination with exhibition buildings and, in several cases, the challenges faced when reusing or restoring buildings that were planned to have very short lives.

The first paper, by Knut Stegmann looks at how the German concrete industry used international exhibitions to transform the image of concrete in the late nineteenth and early twentieth centuries, from a material used for rather mundane purposes, such as foundations, pipes and water tanks, to a material capable of out-performing traditional materials in terms of daring, versatility and beauty – one 16 m concrete span was even tested to destruction at an exhibition to demonstrate its strength (Stegmann, 2012).

André Guillerme tells a fascinating tale of how exhibitions were used as venues for several competitions in the 1870s and 1880s to find the most effective demountable buildings for use as army field huts and hospitals, with models and, sometimes, full-size buildings being erected and dismantled against the clock in front of the public and judges (Guillerme, 2012).

Quentin Collette and his colleagues at the Vrije Universiteit Brussels have favourably compared the large ‘Galérie des machines’, built for the 1888 exhibition in Brussels, and still in use as an aircraft museum, with similar buildings at the time, including the better-known building by Contincin at the Paris 1889 exhibition (Collette *et al.*, 2012).

Cédric Avenier and Anne Coste have demonstrated the historical importance of the reinforced-concrete observation tower built by Perret for the 1925 exhibition in Grenoble which, miraculously, has survived, even though it was built very cheaply and quickly (Avenier and Coste, 2012). We can but hope that this will help the case for its restoration and reopening to the public.

The Italians’ love of exhibitions is reflected in two papers. Laura Greco argues that, despite many international exhibitions from the 1880s to the present day, it was only after the Second World War that they were used to show off the strengths of Italian building engineering, particular in the hands of famous names such as Riccardo Morandi, Pier Luigi Nervi and Gino Covi (Greco, 2012). Cristiana Chiorino looks in greater detail at the spectacular 1961 Turin Exhibition and the not altogether happy story of the life of some iconic buildings since the exhibition (Chiorino, 2012).

Without a doubt, the Brussels Expo in 1958 was one of the most outstanding for its innovative structures – it really captured, and put on show, the optimistic spirit of the time and the spirit of adventure in the world of structural engineering with thin concrete shells, space frames and hyperbolic paraboloid shells of timber. Rika Devos and Bernard Espion, fresh from writing a wonderful book on the whole exhibition (see the references in their paper), assess the importance of the hanging roofs that were used in pavilions from a number of countries (Devos and Espion, 2012).

Finally, Henrik Schoenefeldt provides a fascinating insight into an aspect of the Crystal Palace that has remained hidden for over a century and a half – the internal climate of the building (Schoenefeldt, 2012). He has scoured the contemporary press for the almost daily reports about the exhibition and, then as now, the journalists’ tendency to report any bit of bad news, about the conditions inside the building. He contrasts these with some more scientific reports of contemporary tests on the building and the truly extraordinary engineering used to moderate the solar gain and ventilation, and with his own analysis of the environmental performance of the building. The results confirm that this building is even more deserving than ever of its remarkable, iconic status.

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