
SPECIAL SECTION: SELECTED PAPERS FROM CIB WORLD BUILDING CONGRESS 2016

Editorial

Disaster resilience: building the jigsaw

Disaster resilience deals with strengthening a system's capacity and reliability so that it withstands major external forces and does not fail. Resilient systems are those that have the ability to "absorb" any shocks they receive during their day-to-day operation. This means that resilience has to deal with the complexity and interconnectivity of the different components of the system and their external connections as part of a fluid day-to-day operating system. In the case of buildings, resilience applies not only to the building's structural components but also to the systems that allow it to operate such as roads, electricity, water and gas networks.

Modern buildings provide more than just shelter. They are expected to address a set of socio-technical criteria that will enable occupiers to be comfortable, safe and develop a sense of belonging to the local environment. A typical modern building is a combination of intertwined systems which depend not only on each other but also on external systems such as power, water and gas supplies, road and internet networks. It must have strong structural and non-structural components that will support day-to-day activities and withstand hazards to continue operating during a disaster. The design and operation of buildings are now developed by multidisciplinary teams including owners/occupiers, designers, suppliers and managers. Their role is to draw together the bigger picture using their detailed knowledge and expertise. Modern buildings therefore resemble a jigsaw with complex pieces that need to fit and work as a cohesive whole, an issue that we try to address in this special issue.

This guest-edited issue promotes this resilience philosophy by selecting relevant papers from the CIB World Building Congress 2016 – *Intelligent built environment for life*, Theme 5 – *Advancing Products and Services* – and complement them with some regular submissions to cover issues that have not been covered at the Conference.

The Conference was held in Tampere, Finland, between 30 May and 3 June 2016. It attracted over 400 papers from academic and professionals from 50 countries. Theme V aimed at exploring the various needs of modern construction and offering new ways and techniques to address them. More than 200 authors have contributed to the 98 papers included in this volume. The vast majority of this research work is led by academicians (70 papers) who discuss problems from a theoretical background and suggest solutions, whilst the remaining is led by industry researchers (28 papers) who provide an insight on real life through case studies. Researchers from 28 countries contributed to this Theme representing east and west and north and south of the globe. Papers were classified into seven categories depending on their topics. Two major lessons to be learned from this body of international research outputs: the need to better integrate design, construction and post-occupancy management in a construction life cycle, specifically with advancement of technology and



availability of BIM tools and the increasing acknowledgment of resilience and sustainability as a major part of modern construction.

In total, 13 papers were included in the “Risk mitigation, resilience and health and safety” category. Amongst these, six were about disaster resilience, whilst the remaining were about health and safety. Four papers were chosen to be part of this issue:

- (1) *“An Investigation on Fire Hazard and Smoke Toxicity of Epoxy FRP Composites”* by Saeed Bakhtiyari, Leila Taghiakbari and Masoud Jamali Ashtiani. They investigated fire hazard and smoke toxicity of epoxy FRP composites. Their results suggest that FRP products exhibit dangerous behaviour in fire and potentially contribute to fire growth, and thus a higher level of fire protection might be needed.
- (2) *“The Experimental behaviour of CFRP-Strengthened Reinforced Concrete Slabs with Fire Protection Systems Subjected to Standard Fire Exposure”* by Saeed Bakhtiyari, Arsalan Kalali, Leila Taghiakbari and Farhang Farhbod. This paper continues the discussion about fire resistance of concrete slabs to highlight that the lack of CFRP fire resistance concrete slabs will potentially fail and that the fire-protective coating is more likely to protect flat and large surfaces for longer periods.
- (3) *“New Demountable Seismic-resistant Joint to Improve Industrial Building Repairability”* by Margherita Pongiglione, Chiara Calderini and George Bradley Guy. This paper searches the continuity of social and economic post-earthquakes by ensuring that steel warehouses withstand seismic activities by exploring the design for disassembly (DfD) approach to complement seismic design and to find a compromise between the two approaches. The study suggests that a compromise between seismic design and DfD is possible and that a metric for assessing DfD steel connections is possible.
- (4) *“A Built Asset Management Climate Change Adaptation Model”* by Keith Jones, Api Desai, Noel Brosnan, Justine Cooper and Fuad Ali. The authors search asset management adaptation to the climate change through a case study from the UK Social Care sector. The outcome is a ten-point framework for social care landlords to guide them developing a better adaptation plan for their assets.

The aforementioned four papers have been complemented by three papers from regular submissions which were thought to fit with the remit of this guest-edited Issue. These are:

- *“Does the Post-disaster Resilient City Really Exist? A Critical Analysis of the Heterogeneous Transformative Capacities of Housing Reconstruction ‘Resilience Cells’”* by Angeliki Paidakaki and Frank Moolaert. The authors studied advancing resilience by disentangling the contentious interactions of various parameters that define and guide resilience trajectories – such as the physical infrastructure, socio-spatial inequalities, path dependencies, power relationships, competing discourses and human agency. Their findings suggest that the recovery destiny is not predetermined according to pre-set ideas but is moulded by the various bottom-up dynamics that democratically sketch the final socially desirable reconstruction outcome(s).
- *“Analysing Community Needs and Skills for Enhancing Disaster Resilience in the Built Environment”* by Solomon Babatunde, Srinath Perera and Onaopepo Adeniyi. The authors outlined the needs of communities affected by disasters for the purpose of aligning the needs and skill requirements with the abilities of

built-environment professionals serving these communities. Their findings suggest that there are five major disaster resilience dimensions: social, economic, technological, environmental and institutional. These dimensions incorporate needs and skills to enhance communities' disaster resilience.

- “An Owner-driven Reconstruction in Bihar” by Mittul Vahanvati and Beau Beza. The authors searched the “key processes” during the owner-driven reconstruction (ODR) process, by implementing agencies, to enhance the long-term disaster resilience of housing and for community autonomy. Their findings suggest that community mobilisation is one of the key processes that lead to the success of the ODR and its effectiveness on the long-term disaster resilience in Bihar.

The issue also includes a PhD abstract from the University of New South Wales (Australia) that searched the socio-ecological resilience perspective to enhance hospital service delivery resilience to extreme weather events by Anumitra Vikash Mirti Chand. The research investigated how hospital stakeholders value their built environment as an asset or a liability in responding to extreme weather events (EWEs), how they learn about their built environment in such events and how they transfer these lessons into adaptive strategies to make the built environment more resilient to future EWEs. It promoted a proactive, holistic and systematic approach to health-related disaster and facility management planning in supporting hospital service delivery during EWEs. The study concluded by emphasising the importance of disaster experiences for building resilience and that comprehensive approaches are better ways that reflect the complexity and dynamics of hospitals.

In summary, the key message of this guest-edited issue is the need for integrating resilience in all aspects of the built environment system, whether these are part of the socio-technical, design or operational phases. This integration needs to follow an adaptive strategy that takes into consideration not only natural but also accidental hazards such as fire, which experience demonstrates can be a major cause of deaths as seen in the 1995 Kobe Earthquake where a large proportion of deaths were related to fire. Finally, it is worth remembering that resilience is similar to a jigsaw puzzle with complex pieces that need to fit and work together as a cohesive whole.

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About the authors

Dr Nebil Achour is a Senior Lecturer in Healthcare Management with 16 years of experience in studying the resilience of built environment with specific attention to healthcare infrastructure. He gained his PhD from Kanazawa University (Japan) in Earthquake Disaster Mitigation Engineering in 2007. He was awarded three international prizes in 2010, 2015 and 2016. He published over 50 scientific publications covering issues related to the infrastructure, management and planning of healthcare resilience. He was a member of several international investigation teams to Algeria, Iran, Japan and Turkey. He is a WHO Advisor and a member of the Global Expert Consultation on

Revision of the Hospital Safety Index – World Health Organisation (WHO) and has coordinated the research activities of the multi-institutional and disciplinary £11m Health and Care Infrastructure Research and Innovation Centre (HaCIRIC) between 2011 and 2013. Dr Achour served as Co-Chair of the International Scientific Committee of the CIB World Building Congress 2016.

Dr Kalle Kähkönen is a Professor of Construction Management and Economics at Tampere University of Technology. Professor Kähkönen has carried out and supervised research in numerous areas covering also the implementation of research results in companies. Such combination of several scientific disciplines is seen as a specific strength in the modern research where top-quality results are increasingly achieved in integrative efforts. With such interests, he is closely connected to several universities and has key roles in those with respect of academic teaching, course developing and research supervising. He is a board member of the Global Research Society Building Research Council. Additionally, within the CIB, he is a Coordinator of the working commission W65 “Organisation and Management of Construction”. Professor Kähkönen’s research interests and activities are about linking industrial innovations and academic breakthroughs. He served as Chair of the International Scientific Committee of the CIB World Building Congress 2016.