SUSTAINABLE DEVELOPMENT OF CRITICAL INFRASTRUCTURE

PROCEEDINGS OF THE 2014 INTERNATIONAL CONFERENCE ON SUSTAINABLE DEVELOPMENT OF CRITICAL INFRASTRUCTURE

May 16-18, 2014
Shanghai, China

SPONSORED BY
The International Cooperation & Exchange Committee of the China Civil Engineering Society (CCES)
The Council on Disaster Risk Management of the American Society of Civil Engineers (ASCE)

EDITED BY
Xila Liu
A. H-S. Ang

ASCE Council on Disaster Risk Management
Monograph No. 8

ASCE AMERICAN SOCIETY OF CIVIL ENGINEERS

Published by American Society of Civil Engineers
1801 Alexander Bell Drive
Reston, Virginia, 20191-4382
www.asce.org/bookstore | ascelibrary.org

Errata: Errata, if any, can be found at http://dx.doi.org/10.1061/9780784413470

ISBN 978-0-7844-1347-0 (CD)
ISBN 978-0-7844-7835-6 (E-book PDF)
Manufactured in the United States of America.

Preface

This volume contains the selected papers presented during the International Conference on *Sustainable Development of Critical Infrastructure* (IC-SDCI2014) held in Shanghai, China on 16-18 May 2014. All the papers were reviewed and approved by at least two reviewers. The Conference is the first event jointly sponsored by the China Civil Engineering Society (CCES) and the American Society of Civil Engineers (ASCE).

The publication of the Proceedings Volume is intended to widely promote and review the technologies necessary to support the engineering development of sustainable infrastructure systems in China and elsewhere. The Volume consisted of four keynote papers and 51 contributed papers on various topics dealing with these technologies, including namely the fields of impacts and adaptation to a climate change, reliability engineering and risk management, life-cycle performance and cost, and new developments of traditional construction materials such as reinforced concrete and steel. Specific applications of sustainable engineering systems include buildings, bridges, transportation systems, electric power systems, and nuclear power plants.

The technical and scientific programs of the Conference were organized under the leadership of the respective committees of the two sponsoring societies – namely, the Committee for International Cooperation & Exchange of the CCES and the Council on Disaster Risk Management (CDRM) of the ASCE. The Technical Council on Life-Cycle Engineering (TCLC) of the Institute of Structural Engineering (SEI) and other groups of ASCE also contributed to the technical program of the conference.

Financial supports for the Conference were provided by the Shanghai Jiao-Tong University and the construction industry of Shanghai; these financial supports are highly appreciated and gratefully acknowledged. The efforts of the faculty and staff of the University were essential in managing the organization and operation of the Conference; many thanks are due to their tireless assistance.

Finally, the efforts of all the authors and presenters of papers at the Conference are acknowledged with thanks and appreciation; the success of the Conference is a credit to the contributions of each and every author.

Editors

Xila Liu,
Professor, Shanghai Jiao Tong University

and

A. H-S. Ang
Research Professor, University of California, Irvine

Conference Organization

Honorary Chairs:
Yun Chong Guo -- President, China Civil Engineering Society
Randy Over – President, American Society of Civil Engineers
Jie Zhang – President, Shanghai Jiao Tong University

Steering Committee

Conference Chairs
Xila Liu, Shanghai Jiao Tong University
Alfredo Ang (co-Chair), University of California, Irvine

Members
Erik Vanmarke – Princeton University
Dan Frangopol – Lehigh University
Bilal Ayyub -- University of Maryland
Geoffrey Mills -- Institution of Civil Engineers (UK)
Zhi Quan Jiang --Shanghai Construction Group
Wen Bo Zhou -- Shanghai Urban Construction Group
Hua Zhang -- Shanghai Xian Dai Architectural Design (Group) Co.， Ltd.
Jin Ke Sun -- Shanghai Research Institute of Building Sciences (Group) Co., Ltd
Shao Pei Lin -- Shanghai Jiao Tong University

International Scientific Committee

Alfredo Ang, Chair – University of California, Irvine
Xila Liu, co-Chair – Shanghai Jiao Tong University
Paul Chang -- Hong Kong University of Science and Technology
Hitoshi Furuta -- Kansai University, Japan
Yan Gang Zhao -- Kanagawa University」ヤJapan
Sang-Hyo Kim -- Yonsei University, South Korea
Hasan Kamal -- Kuwait Institute of Scientific Research, Kuwait
Xilin Lv -- Tongji University
Dong Ping Fan -- Tsinghua University
Jia Ru Qian -- Tsinghua University
Jian John Lu -- Shanghai Jiao Tong University
Jin Cheng Zhao -- Shanghai Jiao Tong University
Gang Wu -- Southeast University
Chao Hui Chen -- Chongqing University
Yun Gui Li -- China State Construction Engineering Corporation Ltd.
Zhi Hua Shi -- China Academy of Building Research

Hen Shen Zhang -- China Society of Electric Engineering
Hong Hui Ge -- Shanghai Nuclear Engineering Research & Design Institute
Zong YuGao -- China Zhongtie -Major Bridge Reconnaissance & Design Institute Co.

Local Organizing Committee

Hao Hu, Chair -- Shanghai Jiao Tong University
Shui Long Shen, Vice Chair -- Shanghai Jiao Tong University
Zhen Huang, Vice Chair -- Shanghai Jiao Tong University
Feng Xu -- Shanghai Jiao Tong University
Lulu Zhang -- Shanghai Jiao Tong University
Fan Wu -- Shanghai Jiao Tong University
Pei Yin Liu -- Shanghai Jiao Tong University Express
Guang Liang Li -- Shanghai Jiao Tong University Express
Ying Shi -- Shanghai Jiao Tong University
Xue Ping Wu -- Shanghai Jiao Tong University
Xiao Ning Zhao -- Tsinghua University

Co-Sponsors

The IC-SDCI2014 is also co-sponsored by a number of Chinese and international organizations, including the following:

World Federation of Engineering Organizations (WFEO)
Federation of Engineering Institutions of Asia and the Pacific (FEIAP)
International Association for Bridge and Structural Engineering (IABSE)
International Association for Structural Safety and Reliability (IASSAR)
International Association for Bridge Maintenance and Safety (IABMAS)
International Association for Life-Cycle Civil Engineering (IALCCE)
China Association of Science and Technology (CAST)
Chinese Academy of Engineering (CAE)
American Association of Engineering Societies (AAES)
American Concrete Institute (ACI)
Institution of Civil Engineering (ICE)
Institution of Structural Engineers (IStructE)
Shanghai Construction Group (SCG)
Shanghai Urban Construction Group (SUCG)
Shanghai Xian Dai Architectural Design (Group) Co., Ltd.
Shanghai Research Institute of Building Sciences (Group) Co., Ltd

Table of Contents

Keynote Papers

Workshop on Risk Management and Adaption to Climate Change

Workshop on Practical Applications of Life-Cycle Considerations

Construction Safety of Local and Overseas Projects

Collapse Control of Critical Infrastructure during Strong Natural Disasters

Robustness of Critical Infrastructure under Terror Attacks

Transportation Systems for Regional Sustainable Development

Life-Cycle Engineering of Nuclear Power Systems