### **Preface**

The International Conference on Civil Engineering, Architecture and Building Materials provides a forum for accessing to the most up-to-date and authoritative knowledge from both industrial and academic worlds, sharing best practice in this exciting field of Civil Engineering, Architecture and Building Materials. The first CEABM was successfully taken place in Haikou, China, June 18-20, 2011 and the second CEABM was in held in Yantai, China, from May 25 to 27, 2012. After the very successful previous issues, the 3rd CEABM was successfully held in Jinan, China, from 24 to 26 May 2013.

All papers included in this collection had undergone the careful peer-review by the experts of international and domestic of China before it is selected for publications. This book covers the subject areas of Architectural Design and Its Theory, Architectural Environment & Equipment Engineering, Ecological Architecture, Traditional Construction Materials, Advanced Construction Materials, Control of Quality Engineering, Urban Planning and Design, Landscape Planning and Design, Project Management in Building, Engineering Management and Engineering Education, etc. We hope that this collection of papers will contribute in stimulating debate among scholars, researchers and academicians and we aspire that you find them interesting and thought-provoking.

We would like to thank the authors for their valuable contribution and we are grateful to our general chairs, session chairs and the reviewers for having read and commented on the papers. Our most sincere thanks go to all keynote speakers who shared with us their expertise and knowledge. We are grateful to all the sponsors for their technical and financial support. We would also like to express our gratitude to all the members of the Organizing Committee for the efforts they have made before and during the conference.

We look forward to meeting you all in the next CEABM conference.

The Organizing Committee of CEABM 2013

# The 3<sup>rd</sup> International Conference on Civil Engineering, Architecture and Building Materials (CEABM 2013)

## Organized by:

Shandong University, China

## **Conference Organization**

#### Chairman

Prof. Hongnan Li, Dalian University of Technology, China

#### Co-Chairmen

Prof. Shucai Li, Shandong University, China

Prof. Chaohe Chen, South China University of Technology, China

#### **International Scientific Committee**

Prof. Longsheng Bao, Shenyang Jianzhu University, China

Prof. Tai Bao, Guizhou University, China

Prof. Wenbo Bao, Shenyang University of Technology, China

Prof. Chaohe Chen, South China University of Technology, China

Prof. Wanlin Cao, Beijing University of Technology, China

Dr. Mingjin Chu, Yantai University, China

Prof. Changyu Cui, Harbin Institute of Technology, China

Prof. Chung-Che Chou, National Taiwan University

Prof. Zhiheng Deng, Guangxi University, China

Prof. Shengguo Ding, Guizhou University, China

Prof. Xiuli Du, Beijing University of Technology, China

Prof. Ping Feng, Tianjing University, China

Dr. Peng Feng, Tsinghua University, China

Prof. Yaojun Ge, Tongji University, China

Prof. Linhai Hang, Tsinghua University, China

Prof. Yong Huang, Guizhou University, China

Prof. Zhihong Huang, Guizhou University, China

Prof. Weiliang Jin, Zhejiang University, China

Prof. Guoqiang Li, Tongji University, China

Prof. Qiusheng Li, City University of Hong Kong

Prof. Hongnan Li, Dalian University of Technology, China

Prof. Zhengliang Li, Chongqing University, China

Prof. Zhengnong Li, Hunan University, China

Prof. Lijuan Li, Guangdong University of Technology, China

Prof. Aiqun Li, Southeast University, China

Prof. Hui Li, Harbin Institute of Technology, China

Prof. Shirong Li, Yangzhou University, China

Prof. Guangfan Li, Hainan University, China

Prof. Feng Liu, Guangdong University of Technology, China

Prof. Tianqing Ling, Chongqing Jiaotong University, China

Prof. Xinzheng Lu, Tsinghua University, China

Prof. Jianguo Nie, Tsinghua University, China

Academician Prof. Wei Sun, Southeast University, China

Dr. Yongbo Shao, Yantai University, China

Prof. Yongjiu Shi, Tsinghua University, China

Prof. Yaozong Shi, Highway Survey and Design Institute of Hainan Province

Prof. Jinfeng Wang, Huaqiao University, China

Prof. Bo Wu, South China University of Technology, China

Prof. Hong Wang, Guizhou University, China

Prof. Lai Wang, Shandong University of Science and Technology

Prof. Yan Xiao, Hunan University, China

Prof. Shilang Xu, Zhejiang University, China

Senior Engineer. Jianxin Xu, China Communications Water Transportation

Planning and Design Institute Co.,Ltd

Prof. Shanhua Xu, Xi'An Univ. of Architecture and Tech., China

Prof. Youzhi Wang, Shandong University, China

Prof. Guangyue Wang, Shandong University, China

Prof. Tao Xie, Guizhou University, China

Prof. Zhixin Yan, Lanzhou University, China

Dr. Zhenjun Yang, The University of Manchester, UK

Prof. Lieping Ye, Tsinghua University, China

Prof. Tiejun Zhao, Qingdao Technological University, China

Prof. Xingang Zhou, Yantai University, China

Prof. Jiru Zhang, Wuhan University of Technology, China

Prof. Chuangbin Zhou, Wuhan University, China

Prof. Xuejun Zhou, Shandong Jianzhu University, China

Dr. Ahmed Sarhan, Malaya University, Malaysia

Dr. Gui Wang, The University of Queensland, Australia

Dr. Scott T. SMITH, Hong Kong University, Hong Kong

Dr. Sreenivasan M, SR Technical University, IN

Dr. Tianjian Ji, The University of Manchester, UK

Prof. Abdul Amir H. Kadhum, Malaysia

Prof. A. Kaveh, Iran University of Science & Technology, Iran

Prof. Aftab Mufti, University of Manitoba, Canada

Prof. Antoine E. Naaman, University of Michigan, USA

Prof. Ayman Mosallam, Univ of California Irvine, USA

Prof. B. H. V. Topping, Heriot-Watt University, Edinburgh, UK

Prof. Chao Hsun Haung, National Taipei University of Technology, Taiwan

Prof. Chiew Sing-Ping, Nanyang Technological University, Singapore

Prof. Carlos Aquino, Ritsumeikan University, Japan

Prof. David Hui, University of New Orleans, USA

Prof. Hamid Ronagh, The University of Queensland, Australia

Prof. Han-Bin Ge, Meiju University, Japan

Prof. I. E. Harik, University of Kentucky, USA

Prof. J. H. Bungey, University of Liverpool, Liverpool, UK

Prof. Jian-Fei Chen, the University of Edinburgh, UK

Prof. Jongwook Park, Sungkyunkwan University, Korea

Prof. Katsuyuki Kida, Kyushu University, JP

Prof. Ken-ichi Manabe, Tokyo Metropolitan University, Japan

Prof. Kum-Gil Sung, Inha University, Korea

Prof. Kyung-Man Moon, Korea Maritime University, Korea

Prof. K. J. Bathe, Massachusetts Institute of Technology, USA

Prof. Kang Seok Lee, Chonnam National University, South Korea

Prof. Lau Hieng Ho, Curtin University of Technology, Malaysia

Prof. Luciano Feo, University of Salerno, Italy

Prof. Lawrence C. Bank, University of Wisconsin-Madison, USA

Prof. Marcus M.K. Lee, the University of Southampton, UK

Prof. Mark G Stewart, The University of Newcastle, Australia

Prof. M. N. Soutsos, University of Liverpool, Liverpool, UK

Prof. Nangkula Utaberta, The National University of Malaysia

Prof. Ramiro Sofronie, University of Bucharest, Romania

Prof. R. Sri Ravindra rajah, University of Technology, Australia

Prof. Tim Ibell, University of Bath, UK

Prof. Tamon UEDA, Hokkaido University, Japan

Prof. TAN Kang-Hai, Nanyang Technological University, Singapore

Prof. Tan Kiang Hwee, National University of Singapore

Prof. Wen-Hsiang Hsieh, National Formosa University, Australia

Prof. Zhi-Shen Wu, Ibaraki University, Japan

Prof. Zong Woo Geem, Gachon University, South Korea

# **Conference Secretary**

Dr. Li Tian, Shandong University, China