



“Civil Engineering Innovation for a Sustainable Future”



The 5th Euro Asia Civil Engineering Forum Conference (EACEF5)
Surabaya, Indonesia, 15-18 September 2015

Editors:

Antoni

Ima Muljati

Djwantoro Hardjito

PREFACE

Papers published in this edition of Procedia Engineering have been presented in The 5th Euro Asia Civil Engineering Forum (EACEF-5) at Petra Christian University, Surabaya, Indonesia, from 15-18 September 2015. The theme for EACEF-5 is **‘Civil Engineering Innovation for a Sustainable Future’**. The conference was jointly organized by Petra Christian University, Surabaya, Universitas Pelita Harapan, Jakarta and Universitas Atma Jaya Yogyakarta, Yogyakarta, Indonesia.

Civil engineers and researchers in the field are challenged to play important roles and responsibilities in constructing a sustainable future. EACEF-5 conference provided a platform for sharing ideas and findings, as well as the challenges involved. Publication of all of the aforementioned papers in Procedia Engineering enables a wider circulation of the valuable thoughts contained in the papers.

The Editors would like to express their highest gratitude to all of the contributing authors of the papers published in this volume, as well as to the Organizing Committee and other parties involved.

The Editors

COMMITTEES

STEERING COMMITTEE

Benjamin Lumantarna, *Petra Christian University, Indonesia*
Hariato Hardjasaputra, *Universitas Pelita Harapan, Indonesia*
Yoyong Arfiadi, *Universitas Atma Jaya Yogyakarta, Indonesia*
Timoticin Kwanda, *Petra Christian University, Indonesia*
Manlian A. Ronald, *Universitas Pelita Harapan, Indonesia*

INTERNATIONAL SCIENTIFIC COMMITTEE

Worsak Kanok-Nukulchai, *Asian Institute of Technology, Thailand*
B.V. Rangan, *Curtin University, Australia*
Koji Sakai, *Kagawa University, Japan*
Takafumi Noguchi, *The University of Tokyo, Japan*
Tamon Ueda, *Hokkaido University, Japan*
DongUk Choi, *Hankyong National University, South Korea*
Tawatchai Tingsanchali, *Thailand*
Piti Sukontasukkul, *King Mongkut University of Technology, Thailand*
Nguyen Van Chanh, *Ho Chi Minh City University of Technology, Vietnam*
Chan Weng Tat, *National University of Singapore*
Susanto Teng, *Nanyang Technological University, Singapore*
Mohd. Warid Hussin, *Universiti Teknologi Malaysia*
Prabir K. Sarker, *Curtin University, Australia*
Drajat Hoedajanto, *HAKI, Indonesia*
Robby Soetanto, *Loughborough University, United Kingdom*
Iswandi Imran, *Bandung Institute of Technology, Indonesia*
Tavio, *Institut Teknologi Sepuluh Nopember, Indonesia*
Sholihin As'ad, *Sebelas Maret University, Indonesia*
Han Ay Lie, *Diponegoro University, Indonesia*
Gideon Hadi Kusuma, *Australia*
Sugie Prawono, *Petra Christian University, Indonesia*
Wimpy Santosa, *Parahyangan Catholic University, Indonesia*
Ade Sjafruddin, *Bandung Institute of Technology, Indonesia*

EDITORS

Antoni, *Petra Christian University*
Ima Muljati, *Petra Christian University*
Djwantoro Hardjito, *Petra Christian University*

ORGANIZING COMMITTEE

Chairman

Djwantoro Hardjito, *Petra Christian University*

Vice-Chairman

Rudy Setiawan, *Petra Christian University*

Members

Ima Muljati, *Petra Christian University*

Antoni, *Petra Christian University*

Gogot Setyo Budi, *Petra Christian University*

Jack Widjajakusuma, *Universitas Pelita Harapan*

Wiryanto Dewobroto, *Universitas Pelita Harapan*

Anastasia Yunika, *Universitas Atma Jaya Yogyakarta*

Johanes Januar Sudjati, *Universitas Atma Jaya Yogyakarta*

Daniel Tjandra, *Petra Christian University*

Wong Foek Tjong, *Petra Christian University*

Cilcia Kusumastuti, *Petra Christian University*

Sandra Loekita, *Petra Christian University*

Pamuda Pudjisuryadi, *Petra Christian University*

Paravita Sri Wulandari, *Petra Christian University*

Effendy Tanojo, *Petra Christian University*

Ratna S. Alifen, *Petra Christian University*

Indriani Santoso, *Petra Christian University*

Irwan Tanuadji, *Petra Christian University*

Sri Megawati Hermanto, *Petra Christian University*