CONTENTS

SPONSORS II

FOREWORD - WELCOME MESSAGE III

CONFERENCE COMMITTEES IV

SESSIONS AND SESSION CHAIRS VII

REVIEWERS X

KEYNOTE ABSTRACTS 1

New Technology Opportunities for Construction: the Case of 3D printing 2
Miroslaw Skibniewski

A Framework and Research Initiatives for Urban Resilience Studies 3
Dongping Fang

Prospective of Smart Semiconductor Facility in Taiwan & China Regions 4
Luh-Maan Chang

ACADEMIC PAPERS 5

BIM & COMPUTATIONAL INTELLIGENCE 5

While loop Algorithm to Enhance the Efficiency of Work Sampling Method in Performance Measurement 6
Hassan Farooq, Payam Rahnamaviezekavat and Sungkon Moon

Employing Outlier and Novelty Detection for Checking the Integrity of BIM to IFC Entity Associations 14
Bonsang Koo, Byungjin Shin and Thomas F. Krijnen

Decision Support Tool for Multi-Criteria Analyses of the Quality of Large Building Stock 22
Alberto Giretti, Alessandro Carbonari, Alessandra Corneli, Valentina Villa and Giuseppe Di Giuda

Safety Regulation Classification System to support BIM based Safety Management 30
Rahat Hussain, Do Yeop Lee, Hai Chien Pham and Chan Sik Park

Automated Clash Resolution of Steel Rebar in RC Beam- Column Joints using BIM and GA 37
Mohit Mangal, Jack C.P. Cheng and Qian Wang

CONSTRUCTION ROBOTICS (I) / FABRICATION 44
Dimensional variability analysis of construction assemblies using kinematics chains and building information models
Mohammad Nahangi, Christopher Rausch, Carl Haas and Jeffrey West

Development of a BIM-Based Integrated Model for Cad-To-Cam Production Automation
Xiaoxi Li, Ahmed Qureshi and Mohamed Al-Hussein

Towards cloud informed robotics
Sven Stumm, Sigrid Brell-Cokcan and Peter Neu

First monitoring and analysis of the manufacturing and installation process of timber based 2D modules for accomplishing a future robotic building envelope upgrading
Kepa Iturralde, Thomas Linner and Thomas Bock

Bottom-up Cognitive Analysis of Bionic Inspection Robot for Construction Site
Thomas Bock, Alexey Bulgakov, Sergei Emeliannov and Daher Sayfeddine

SENSING & MONITORING

Developing a Low Cost Capacitive ECG via Arduino and Single-Board Computer Interfaced with Capacitive Electrodes for Prevention and Security Aspects
Jörg Güttler and Thomas Bock

Improving Indoor Location Tracking Quality for Construction and Facility Management
Matthias Neges, Mario Wolf, Markus Propach, Jochen Teizer and Michael Abramovici

Evaluation of Crane Operators’ Performance and Situation Awareness during Lifting Operations
Yihai Fang and Yong Cho

A High-Resolution Intelligence Implementation based on Design-to-Robotic-Production and-Operation strategies
Alexander Liu Cheng, Henriette Bier, Galoget Latorre, Benjamin Kemper and Daniel Fischer

Flexible management for concrete curing at low temperature based on learning from cases
Karol Andrzejczak, Andrzej Karlowski and Jerzy Pasławski

INTEROPERABILITY

Linked Data System for Sharing Construction Safety Information
Akeem Pedro, Do Yeop Lee, Chan Sik Park and Rahat Hussain

FEA in Road Engineering Applications?
Filip Fedorik, Tomi Makkonen and Rauno Heikkilä

Integration of Structural Health Control in BIM for Current and Future Residential Buildings
Filip Fedorik, Rauno Heikkilä, Tomi Makkonen and Antti Haapala

IFC-based cut & bent rebar supply chain integration
Alex Maciel and Fabiano Correa
Classification of objects and their properties defined in Korea Building Act to translate into KBimCode
and their application
Jinsung Kim, Jin-Kook Lee, Jaeyoung Shin and Hayan Kim

VIRTUAL REALITY / AUGMENTED REALITY

Mobile Point Cloud Assessment for Trench Safety Audits
Jochen Teizer, Adam M. Gerson, Thomas Hilfert, Manuel Perschewski and Markus König

Augmented Reality (AR) based approach to achieve an optimal site layout in construction projects
Abhishek Raj Singh, Vinayak Suthar and Venkata Santosh Kumar Delhi

Assessing the Effectiveness of Augmented Reality on the Spatial Skills of Postsecondary Construction Management Students in the U.S.
Jeff Kim and Javier Irizarry

AR(Augmented Reality) based 3D Workspace Modeling for Quality Assessment Using As-Built On-Site Condition in Remodeling Construction Project
Song Yi Lee, Soon-Wook Kwon and Tae Kyu Ko

A study on the effect of the use of Augmented Reality on students' quantity take-off performance
Sung Joon Suk, George Ford, Youngcheol Kang and Yong Han Ahn

BIM & FACILITY MANAGEMENT

Location-based Facility Management System Framework Using 3D-BIM on Commercial Office Buildings
Jonghan Yoon and Heesung Cha

A Study of the Campus Facilities Maintenance System with Building Information Modeling Application
Lee-Kuo Lin, Yen-Yu Hu and Si-Yu Chen

Kuoichung Wen and Wunbin Siao

Modular vs Conventional Construction: A Multi-Criteria Framework Approach
Ahmed Hammad and Ali Akbarnezhad

Utilizing Building Information Modeling and Radio Frequency Identification in Recording and Preserving Historic Buildings
Kemo Sima and Tsung-Juang Wang
Constructing a MEP BIM Model For Different Maintenance Scenarios — A Case Study of Air Conditioning  
*Po Cheng Wu and Chung Wei Feng*

**CONSTRUCTION ROBOTICS (II) / 3D PRINTING**

Effect of Delay Time on the Mechanical Properties of Extrusion-Based 3D Printed Concrete  
*Taylor Marchment, Ming Xia, Elise Dodd, Jay Sanjayan and Behzad Nematollahi*

Applications of Additive Manufacturing in the Construction Industry – A Prospective Review  
*Daniel Delgado Camacho, Patricia Clayton, William O’Brien, Raissa Ferron, Maria Juenger, Salvatore Salamone and Carolyn Seepersad*

Autonomous Big-Scale Additive Manufacturing Using Cable-Driven Robots  
*Ilija Vukorep*

Current Progress of 3D Concrete Printing Technologies  
*Behzad Nematollahi, Ming Xia and Jay Sanjayan*

Optimisation of Different Concrete Mix Designs for 3D Printing by Utilizing Six Degrees of Freedom

**BIM & FACILITY MANAGEMENT**

Industrial RobotBIM & FACILITY MANAGEMENT  
*Pshtiwan Shakor, Jarred Renneberg, Shami Nejadi and Gavin Paul*

Automation of robotic concrete printing using feedback control system  
*Biranchi Panda, Jian Hui Lim, Nisar Ahamed Noor Mohamed, Suvash Chandra Paul, Yi Wei Daniel Tay and Ming Jen Tan*

**MACHINE LEARNING / COMPUTATIONAL INTELLIGENCE**

Comparison of Single Classifier Models for Predicting Long-term Business Failure of Construction  
*Hyunchul Choi, Hvojoo Son, Changwan Kim, Hyeonwoo Seong, Hyukman Cho and Sungwook Lee*

Vision-Based Safety Vest Detection in a Construction Scene  
*Hyeonwoo Seong, Hvojoo Son, Changwan Kim, Hyunchul Choi, Hyukman Cho and Sungwook Lee*

Mass Estimation of On-road Construction Equipment Based on Operational Parameters  
*Khalegh Barati and Xuesong Shen*

Decision Support System for Modular Construction Scheduling  
*Ahmed Hammad, Ali Akbarnezhad, David Rey and Hanna Grybowska*

Multilevel Computational Model for Cost and Carbon Optimisation of Reinforced Concrete Floor Systems  
*Stathis Eleftheriadis, Philippe Duffour, Paul Greening, Jess James and Dejan Mumovic*

**PROJECT MANAGEMENT**

XIV
Comparison of Bridge Inspection Methodologies and Evaluation Criteria in Taiwan and Foreign Practices
Hsien-Ke Liao, Mustapha Jallow, Nie-Jia Yau, Ming-Yi Jiang, Jyun-Hao Huang, Cheng-Wei Su and Po-Yuan Chen

Evaluating modularisation tools in construction
Tanawan Wee, Marco Aurisicchio and Ireneusz Starzyk

Integration of RFID, Web-Based, and Artificial Intelligence Techniques in Facilities Management
Chien-Ho Ko

Performance assessment of residential buildings management utilizing network data envelopment analysis
Wei Tong Chen, Pei-San Tan, Nida Fauzia and Chao Wei Wang

Condition-Based Building Maintenance Strategy Selection Using Constraint Programming
Shu-Shun Liu and Gilang Ramadhan

A study of BIM based building facilities online repair system
Nai-Hsin Pan

VISUALIZATION

A Framework for Using Advanced Visualization Tools for Residential Property Management
Mehrafarin Takin, Jinghan Peng, Samad Sepasgozar and Hamidreza Ebrahimi

Displaying Earthquake Events in Serious Game Platforms Using Semantic Rules and Fragility Curves
Chang-Yuan Liu and Chien-Cheng Chou

Developing a BIM-based Visualization and Interactive System for Healthcare Design
Chao-Yung Huang, Huey-Wen Yien, Yen-Pei Chen, Yu-Chih Su and Yu-Cheng Lin

Automated Ergonomic Risk Assessment based on 3D Visualization
Xinming Li, Sanghyeok Han, Mustafa Gul and Mohamed Al-Hussein

A Visualization System for Improving Managerial Capacity of Construction Site
Ye Han, Yuichi Yashiro and Fumio Hatori

Immersive Virtual Environment (IVE) as a potential tool for interior colour study in office environments
Shaojie Zhang, Jeonghwan Kim, Shan-Ying Shih, Choongwan Koo and Seung Hyun Cha

BIM & VISUALIZATION
A Study of Developing the Fire Investigation System with Building Information Modeling
Lee-Kuo Lin, Yu-Huai Hsu and Sung-Wei Hung

Flexible Earthwork BIM Module Framework for Road Project
Hassnain Raza, Waqas Tanoli, Seungsoo Lee and Jongwon Seo

The Implementation of Civil Information Modeling for Constructability Review in Highway Project
Yick Hong Liau and Yu-Cheng Lin

Visual Language-based approach for the Definition of Building Permit related rules
Hayan Kim, Jin-Kook Lee, Jaeyoung Shin and Jinsung Kim

Study on BIM Family Self-create for Steel Reinforcing Bar Detail Construction Design and Information Extraction
Li-Chuan Lien, Pan-Cheng Zhang, S.B Chen, Z.C. Liao and Y.N. Liu

Automating the Generation of Indoor Space Topology for 3D Route Planning Using BIM and 3D-GIS Techniques
Will Y. Lin, Pao H. Lin and H. Ping Tserng

CONSTRUCTION ROBOTICS (III) / CONTROL & MECHANISMS

Velocity Control Mechanism of the Underactuated Hammering Robot for Gravity Compensation
Yusuke Takahashi, Satoru Nakamura, Yasuichi Ogawa and Tomoya Satoh

Development of UAV Indoor Flight Technology for Building Equipment Works
Hiroyuki Tomita, Takuya Takabatake, Shintaro Sakamoto, Hitoshi Arisumi, Shin Kato and Yuji Ohgusu

Force-regulated impact control of a reinforced concrete box culvert chipping robot
Jaek Cho and Seungeo Lee

A method based on C-K Theory for fast STCR development: The case of a drilling robot design
Thomas Zedin, François Guéna, Olivier Marchand and Louis Vitalis

A Study on the Modeling of Independently Driven Quadruped Crawler System for Posture Control of Special Purpose Machine for Disaster Response
Sang Keun Lee, Ji Woo Ha, Sang Ho Kim, Yong Seok Lee, Dong Ik Sun and Chang Soo Han

COMPUTER VISION

Deeper Networks for Pavement Crack Detection
Leo Pauly, Shan Luo, David Hogg, Raul Fuentes and Harriet Peel

A Study on Pre-processing Methodology of Image Compensation using Histogram Equalization for Generating Point-cloud of Construction Environment
Daeyoon Moon, Soon-Wook Kwon, Suwan Chung, Song Yi Lee and Tae Kyu Ko
Thermal 3D modelling
Gregory Clarkson, Shan Luo and Raul Fuentes

Detection of Nearby Obstacles with Monocular Vision for Earthmoving Operations
Hyojoo Son, Hyunwoo Sung, Hyunchul Choi, Sungwook Lee and Changwan Kim

Development of Smartphone Application for Real-Time Steel Rust Recognition
Wei-Tsun Liu, Bo-Sheng Bai and Po-Han Chen

Evaluating the Performance of Convolutional Neural Network for Classifying Equipment on Construction Sites
Mohammad Soltani, Seyedeh-Forough Karandish, Walid Ahmed, Zhenhua Zhu and Amin Hammad

PROJECT MANAGEMENT

A Risk-based Critical Path Scheduling Method (I) : Model and Prototype Application System
Hsien-Kuan Chang, Wen-Der Yu and Shao-Tsai Cheng

Hsien-Kuan Chang, Wen-Der Yu and Shao Tsai Cheng

Value Engineering Decision Making Model Using SMART
Ahmed Montaser and Ali Montaser

An Empirical Study on Analyzing Schedule Delays of Construction Project in Indonesia
Zetta Rasullia Kamandang, Jyh-Bin Yang and Indradi Wijatmiko

An Analysis Using Game Theory on the Investment Incentive of PPP Projects
Shiau-Jing Ho, Sheng-Lung Lin and Hui-Ping Tserng

Building Carbon Footprint (BCF) Evaluation for Social Amenities and Education Center in Taipei
Ting Chiao Chiu and Po Han Chen

CONSTRUCTION ROBOTICS (IV) / DESIGN

Kite-Powered Design-to-Robotic-Production for Affordable Building on Demand
Henriette Bier, Roland Schmehl, Sina Mostafavi, Ana Anton and Serban Bodea

Derivation of Technology Element for Automation in Table Formwork in a Tall Building
Junhuck Lee, Dongmin Lee, Hunhee Cho and Kyung-In Kang

Unmanned Ground Military and Construction Systems Technology Gaps Exploration
Eugeniusz Budny, Piotr Scynkarczyk and Józef Wrona

Immersive virtual environment as a promising tool for the elderly-friendly assistive robot design
Jeonghwan Kim, Seung Hyun Cha and Choongwan Koo

Survey of the line of sight characteristics of construction machine operators to improve the efficiency of unmanned construction
Mitsuru Yamada, Kenichi Fujino, Hiroki Kajita and Takeshi Hashimoto
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Review of Automated System Application to Earthworks in Australia</td>
<td>594</td>
</tr>
<tr>
<td>Nayab Ahmed, Abraham Hong, Hyeonggyun Ku, Sungkon Moon and Sungwoo Moon</td>
<td></td>
</tr>
<tr>
<td><strong>BIM &amp; AUTOMATION</strong></td>
<td>602</td>
</tr>
<tr>
<td>Internet of Things (IoT) for Integrating Environmental and Localization Data in Building Information Modeling (BIM)</td>
<td>603</td>
</tr>
<tr>
<td>Jochen Teizer, Mario Wolf, Olga Golovina, Manuel Perschewski, Matthias Neges and Markus König</td>
<td></td>
</tr>
<tr>
<td>Using BIM to Automate Scaffolding Planning for Risk Analysis at Construction Sites</td>
<td>610</td>
</tr>
<tr>
<td>Chung-Wei Feng and Szu-Wei Lu</td>
<td></td>
</tr>
<tr>
<td>Using BIM to Automate Information Generation for Assembling Scaffolding - A Material Management Approach</td>
<td>618</td>
</tr>
<tr>
<td>Chung Wei Feng and Tzu Fang Hsu</td>
<td></td>
</tr>
<tr>
<td>PAD Based 3D Earthwork BIM Design Module for Machine Guidance</td>
<td>626</td>
</tr>
<tr>
<td>Wagas Tanoli, Hassnain Raza, Seungsoo Lee and Jongwon Seo</td>
<td></td>
</tr>
<tr>
<td>Towards life cycle complete BIM</td>
<td>632</td>
</tr>
<tr>
<td>Sven Stumm, Elisa Lublaser, Ralf Becker, Jörg Blankenbach, Dirk Vallée, Linda Hildebrand, Sigrid Brell-Cokcan and Philipp Schwan</td>
<td></td>
</tr>
<tr>
<td>BIM for the Steel Fabrication Industry Robotic Systems</td>
<td>639</td>
</tr>
<tr>
<td>Pedro Tavares, Carlos Costa, Pedro Malaca, João Silva, Luís Rocha and Germano Veiga</td>
<td></td>
</tr>
<tr>
<td><strong>CONSTRUCTION ROBOTICS (III) / INSPECTION &amp; MONITORING</strong></td>
<td>646</td>
</tr>
<tr>
<td>Simulating and Executing UAV-Assisted Inspections on Construction Sites</td>
<td>647</td>
</tr>
<tr>
<td>Henk Freimuth, Jan Müller and Markus König</td>
<td></td>
</tr>
<tr>
<td>Autonomous Robotic System with Tunnel Inspection Tool Positioning</td>
<td>655</td>
</tr>
<tr>
<td>Elisabeth Menendez, Juan G. Victores, Roberto Montero and Carlos Balaguer</td>
<td></td>
</tr>
<tr>
<td>An improved robot for bridge inspection</td>
<td>663</td>
</tr>
<tr>
<td>Harriet Peel, Anthony Cohn, Raul Fuentes and Shan Luo</td>
<td></td>
</tr>
<tr>
<td>The Variable Guide Frame Vehicle for Tunnel Inspection</td>
<td>671</td>
</tr>
<tr>
<td>Satoru Nakamura, Yusuke Takahashi, Daisuke Inoue and Takao Ueno</td>
<td></td>
</tr>
<tr>
<td>Shape Control of Variable Guide Frame for Tunnel Wall Inspection</td>
<td>675</td>
</tr>
<tr>
<td>Fumihiro Inoue, Kwoon Soonsu, Takuya Uchiyama, Satoru Nakamura and Yoshitaka Yanagiha</td>
<td></td>
</tr>
<tr>
<td>High Level Framework for Bridge Inspection Using LiDAR-equipped UAV</td>
<td>683</td>
</tr>
<tr>
<td>Neshat Bolourian, Mohammad Mostafa Soltani, Amin Hammad and Ameen Albahri</td>
<td></td>
</tr>
<tr>
<td><strong>COMPUTER VISION</strong></td>
<td>689</td>
</tr>
<tr>
<td>A Cascaded Classifier Approach to Window Detection in Facade Images</td>
<td>690</td>
</tr>
<tr>
<td>Marcel Neuhausen, Alexander Martin and Markus König</td>
<td></td>
</tr>
</tbody>
</table>
Comparison of hand held devices for 3D reconstruction in Construction
Madhumitha Senthilvel, Ranjith K Soman and Koshy Varghese

Low-latency Vision-based Fiducial Detection and Localization For Object Tracking
Ansu Man Singh, Quang Ha, David K Wood and Mark Bishop

Photogrammetric Models using Oblique Aerial Imagery for Construction Site Surveying
Anoop Sattineni and James Hindman

Developing the GIS-expert system for investigating land use designations
Petcharat Limsupreeyarat, Suriya Kaewkeaw and Phatsaphan Charnwasununth

Experiment of Mobile Light-section Device for Automatic Crack Inspection on Actual-size Tunnel Lining
Concrete
Daisuke Inoue, Takao Ueno and Satoru Nakamura

CONSTRUCTION MANAGEMENT

Method of Optimal Machine Selection for Construction Processes from the Point of Its Energy
Consumption Minimizing with Software Support
Jozef Gašparík, Lucia PauloviČovÁ, Sylvia SzalayovÁ and MariÁn Gašparík

Collaborative Advanced Building Methodology toward Industrialization of Informal Settlements in Cairo
Camilla Follini, Rongbo Hu, Wen Pan, Thomas Linner and Thomas Bock

Control and optimization tools for the incorporation of innovative technologies in Net Zero Energy settlement design
Slava Shubin, Shabtai Isaac and Gad Rabinowitz

Application of Configuration Management for Engineering Information Management in Pipeline Projects
Doyun Lee, Seokyung Won, Choonghee Han, Moonyoung Cho and Junbok Lee

Leading safety indicators and automated tools in the construction industry
Rita Yi Man Li and Tat Ho Leung

BIM & PROJECT MANAGEMENT

Integration of offsite and onsite schedules in modular construction
Tarek Salama, Ahmad Salah and Osama Moselhi

Development of the Process Information Modelling in the construction project: A case study of the ZERO-PLUS project
Wen Pan, Katharina Langosch and Thomas Bock
Employing Ontology and BIM to Facilitate the Information for Subcontractor’s Payment Requests and Ledger Generation
Chung-Wei Feng, Yi-Jao Chen and Hsin-Yi Yu

An Integrated Methodology for Construction BIM & ERP by using UML Tool
Yen-Ray Chen and H. Ping Tserng

Empirical Research on BIM Application for Cost Estimation of HVAC System in Buildings
Sy-Jye Guo, Li-Wei Chiang, Jyun-Yu Chen and Un-On Chong

Integrated Activity Scheduling and Site Layout Planning
Shabtai Isaac, Yi Su and Gunnar Lucko

CONSTRUCTION ROBOTICS (VI) / UAV APPLICATIONS

Automatic Generation of 3D Models from UAV-captured Image Data for Immersive VR Applications
Nei-Hao Perng, Bo-Sheng Bai, Po-Han Chen, Jen-Yu Han, Ming-Yi Jiang, Jyun-Hao Huang, Cheng-Wei Su and Po-Yuan Chen

Adaptive Second-order Sliding Mode Control of UAVs for Civil Applications
Van Truong Hoang, Ansu Man Singh, Manh Duong Phung and Quang Ha

Automatic Crack Detection in Built Infrastructure Using Unmanned Aerial Vehicles
Manh Duong Phung, Van Truong Hoang, Tran Hiep Dinh and Quang Ha

Vision-based 2D Map Generation for Monitoring Construction Sites using UAV videos
Seongdeok Bang, Hongjo Kim and Hyoungkwan Kim

Investigating the accuracy of 3D models created using SfM
Kosei Ishida

Construction Inspection through Spatial Database
Ahmad Hasan, Ashraf Qadir, Ian Nordeng and Jeremiah Neubert

LASER SCANNING / BIG DATA

Developing a Pattern Model of Damage Types on Bridge Elements Using Big Data Analytics
Soram Lim, Sehwan Chung and Seokho Chi

Prediction of Concrete Compressive Strength from Early Age Test Result Using an Advanced Metaheuristic-Based Machine Learning Technique
Doddy Prayogo, Min-Yuan Cheng, Janice Widjaja, Hansel Ongkowijoyo and Handy Prayogo

An Investigation of Google Tango® Tablet for Low Cost 3D Scanning
Mark Froehlich, Salman Azhar and Matthew Vanture

Building element recognition with thermal-mapped point clouds
Pileun Kim, Jindao Chen and Yong K Cho
Optimal placement of precast bridge deck slabs with respect to precast girders using LiDAR
Seongheum Yoon, Qian Wang and Hoon Sohn

Using SLAM-based Handheld Laser Scanning to Gain Information on Difficult-to-access Areas for Use in Maintenance Model
Tomi Makkonen, Rauno Heikkilä, Filip Fedorik and Pekka Tölli

ENERGY & SUSTAINABILITY

Hybrid Ventilation Potential Investigation for Small and Medium Office Building in Different US Climates Under Uncertainties
Jianli Chen, Godfried Augenbroe and Xinyi Song

Assessment of Utilizing Mobile App in Delivering Eco-Feedback Information for Building Energy Conservation
Jing Lin, Guofeng Ma, Nan Li and Junjie Zhou

Integration of Control Policies for Comfort Improvement in a Large Public Building
Massimo Vaccarini, Alessandro Piccinini, Letizia D'Angelo and Alessandro Carbonari

Mitigating High Energy Consumption for residential Buildings in The Gambia
Saikou Sonko and Tsung-Juang Wang

An Empirical Investigation on Construction Companies Readiness for Adopting Sustainable Technology
Mona Foroozanfar and Samad Ebrahimzadeh Sepasgozar

BIM APPLICATIONS

Challenges to the Utilization of BIM in the Palestinian Construction Industry
Adnan Enshassi and Lina Abo Hamra

A Methodology of Building Code Checking System for Building Permission based on BIM
Jungsik Choi and Inhan Kim

Contribution to the Study of Collaborative Working in BIM-Based Projects in the Context of Public Works
Giuseppe Miceli Junior, Andre Cruz Teixeira and Paulo Cesar Pellanda

Improving Indoor Acoustics Performance of Concert Halls Using Building Information Modeling
Yi Tan, Yi Fang, Teng Zhou, Qian Wang and Jack C.P. Cheng

Smoothing process of developing the construction MEP BIM model - a case study of the fire-fighting system
Wei-Ting Lin and Chung-Wei Feng

Changes in the BIM Service Provision of Top BIM Companies: A Five-Year Longitudinal Study
Namecheol Jung and Ghang Lee
PLANNING & POSITIONING

Cartesian-Space Motion Planning for Autonomous Construction Manipulators
Matteo Ragaglia, Alfredo Argiolas and Marta Niccolini

Attitude and Position Estimation of Dozer Blade in 3-Dimensional by Integration of IMU with Two RTK GPSs
Dong-Ik Sun, Chang Soo Han, Yong Seok Lee, Sang Ho Kim and Sang Keun Lee

Optimal Variable Speed Limit Control under Connected Work Zone and Connected Vehicle Environment
Shuming Du, Saiedeh Razavi and Wade Genders

A behaviour based architecture for excavation tasks
Tobias Groll, Steffen Hemer, Thorsten Ropertz and Karsten Berns

Modelling of industrial robotic brick system
Michal Bruzl, Vyacheslav Usmanov, Rostislav Sulc and Pavel Svoboda

COMPUTER VISION / SENSING & MONITORING

Efficient Face Recognition Using FPGA and Semantic Features for Security Controls
Ying-Hao Yu, Yu-Chen Xu, Yi-Siang Ting and Ngaiming Kwok

BIM-based Indoor Positioning Technology Using a Monocular Camera
Yichuan Deng, Hao Hong, Hui Deng and Han Luo

RTLS systems as a Lean Management tool for productivity improvement
Piotr Nowotarski, Jerzy Paslawski, Maciej Skrzypczak and Radoslaw Krygier

Sliding behavior monitoring of a deep seated landslide with differential interferometric synthetic aperture radar, mems tiltmeter and unmanned vehicle images
Kuo-Lung Wang, Yo-Ming Hsieh, Jun-Ting Lin and Ming-Hsiang Hsi

An Integration of Wi-Fi Based Locating System and GIS for Improving Construction Labour Communications
Sara Shirowzhan, Samad M.E. Sepasgozar, Izmil Zaini and Cynthia Wang

PROJECT MANAGEMENT

Web-Based Integrated Project Controls System
Ahmed Montaser and Ali Montaser

Dynamic Scheduling Framework to Overcome Deficiency of Skilled Workers
Pawan Pandey, Uma Maheswari and Ratnesh Kumar

Sharing roles and responsibilities of construction project delivery methods in Taiwan
Hsiang-Wen Li and Tsung-Chieh Tsai