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Message by President



It is my great pleasure to welcome you to the Hong Kong Concrete Institute Annual Seminar 2020.

The theme of this Seminar is "Modular Integrated Construction – Issues and Solutions". The seminar will address a wide variety of topics covering the regulations, design, use of concrete materials, and the development of specialized and advanced types of concrete for MiC as well as DfMA.

This seminar provides an excellent platform for professionals, stakeholders, Government Body in the field to share knowledge, exchange views and strategies on maintaining the Advanced Technology of reinforced concrete in the construction field.

We are honored to have Mr. Yu Tak-cheung, JP, Director of Buildings Department, HKSAR Government as our Guest of Honor, Keynote Speaker and many prominent speakers from Institutions and Government Departments here today. I would like to take this opportunity to convey my sincere thanks to them for sharing and exchanging invaluable experience with our practising engineers, construction professionals and under-graduates. Special thanks also go to the sponsors. Without their support, this seminar would not be so successful.

My sincere thanks also go to the participants of this seminar and the Organizing Committee for their time and selfless dedication to this event. Finally, I sincerely wish you all the best for an enjoyable, fruitful and memorable seminar. Once again, thank you for your thorough support and looking forward to seeing you in our future seminars.

Ir Prof. Adam CHOY Siu Chung President of The Hong Kong Concrete Institute



Message by the Seminar OC Chairman



It is our honour to welcome you to The Hong Kong Concrete Institute Annual Seminar 2020.

The theme of this Seminar is Modular Integrated Construction (MiC) – Issues and Solutions. The concept of MiC is to fabricate free-standing prefabricated integrated building modules in a factory and transport them to site for assembly/installation. This construction method would enhance construction productivity, quality, safety and environmental sustainability. In 2018, the first two-storey MiC demonstration building project was completed in Hong Kong. Since then, several high-rise MiC multi-storey building projects are under construction. As this is a relatively new construction method adopted in Hong Kong, issues have been raised for difficulties and constraints in design, prefabrication, transportation, installation and inspection for compliance, and some of these issues have been satisfactorily resolved by the local designers and construction practitioners.

In this seminar, we are honoured to have Mr. YU Tak Cheung, JP, the Director of Buildings Department of the Government of the HKSAR as our Guest of Honour to provide an Opening Speech, and distinguished speakers from local/non-local Institutions and professional engineering experts to share their invaluable experience in identifying issues and offering solutions for better understanding of MiC in Hong Kong. Special thanks also go to the sponsors. Without their supports, this seminar would not be so successful.

Our sincere thanks also go to the participants of this seminar and the Organizing committee for their time and dedication to this event. Finally, we sincerely wish you all the best for an enjoyable, fruitful and memorable seminar. We are looking forward to your continuous supports and seeing you in our future seminars.

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Ir Prof. WONG, Yuk Lung Chairman of Organizing Committee of The Hong Kong Concrete Institute Annual Seminar 2020



Seminar Programme

8:30 - 9:15	Registration	Session Chair
9:15 - 9:25	Welcoming Speech Ir Professor Adam Choy President of Hong Kong Concrete Institute	
9:25 - 9:40	Opening Speech – Guest of Honour Mr. YU Tak-cheung, JP Director of Buildings Buildings Department, The Government of the HKSAR	
9:40 – 9:55	Presentation of Souvenirs to Sponsors Ir Professor Adam Choy President of Hong Kong Concrete Institute	
9:55 - 10:05	Photo Guests and /or Sponsors	
10:05 - 10:35	Mic: New Era of Building Construction Professor Tarek Zayed The Hong Kong Polytechnic University	
10:35 - 10:50	Break	•
10:50 - 11:20	Material, Methodology and Inspection Technology for Structural Joints in Modular Integrated Construction Dr Ma Xu Guangdong Provincial Academy of Building Research Group	Ir Alex Lai
11:20 -11:50	Challenges for MiC Application in Rank and File Quarter for FSD at Pak Shing Kok Ir Richard Lee Yau Lee Construction Co. Ltd.	
11:50 - 12:10	Q & A	
12:10 - 14:00	Lunch	
14:00 - 14:30	Manufacturing of Pre-decorated MiC Units: A Global Perspective on Trends, Standards and Performance Solutions for Waterproofing, Tiling and Flooring Dr Jan Kalkühler and Dr Andreas Oberecker Ardex Hong Kong Limited	
14:30 - 15:00	The New Technology of Reinforced Concrete – Structural MiC Ir Professor Albert KH Kwan and Mr. Calvin Wong The University of Hong Kong and Flexcrete (Hong Kong) Limited	
15:00 - 15:15	Break	
15:15 – 15:45	Development of Prefabricated RC Buildings-Case Study on Seismic Damages in 512 Wenchuan Earthquake Professor Wang Yayong China Academy of Building Research	Dr Shelley Zhao
15:45 - 16:15	Opportunities and Risks in MiC Construction Ir Alcohol Mok Hip Hing Construction Co. Ltd.	
16:45 - 16:55	Closing Speech Ir Professor YL Wong Chairman of Organizing Committee of the HKCI Annual Seminar 2020	



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MiC: New Era of Building Construction



Prof. Tarek Zayed The Hong Kong Polytechnic University

Brief Biography

Prof. Tarek Zayed, has a Ph.D., M.Sc., and B.Sc. in Construction Engineering and Management. He has 30 years of professional experience working in the construction industry training and in academic posts in USA, Canada, Hong Kong, and abroad. Prof. Zayed research focuses on infrastructure/asset management, simulation and artificial intelligent applications in construction, modular construction, asset performance, scheduling, life cycle cost (LCC) analysis, budget allocation, and risk assessment for construction and rehabilitation of highways, oil and gas pipelines, water and sewer systems, subway system, and bridges. Recent developments include condition rating, deterioration, LCC and technology-based models for buildings, bridge superstructure; water, sewer, oil and gas pipelines/systems; and tunnels and metro stations. Prof. Zayed published around 400 journal and conference articles and performed research with significant amount of funding from government and private funding agencies. He is serving as associate editor of ASCE's Journal of Pipeline Systems - Engineering and Practice as well as the Canadian Journal of Civil Engineering. Prof. Zayed is also a fellow of the American Society of Civil Engineers (F.ASCE) and the Canadian Society for Civil Engineering (F.CSCE).

Abstract

The Housing Authority targeted to build 460,000 units in the coming ten years in order to reduce the gap between supply and demand in housing. This target is very challenging without the wide adoption of innovative construction solutions, such as Modular Integrated Construction (MiC). The prefabricated/precast components of buildings will not cope with such demand to meet the intended target. The MiC is a promising technology that will expedite the construction of building units, minimize interference to the adjacent services, facilities and businesses, as well as improve productivity and safety. However, the use of MiC also poses many challenges, particularly in Hong Kong weather conditions and environment, which add more challenges to the design of MiC module connections and alignment, the construction sequence, and the optimal crane location. The adoption of several advanced and innovative technologies to MiC will be discussed. Lessons learned from other countries, such as mainland China, Singapore and North America, will also be presented.

Material, Methodology and Inspection Technology for Structural Joints in Modular Integrated Construction



Dr Ma Xu Guangdong Provincial Academy of Building Research Group

Brief Biography

Dr. Ma Xu obtained his PhD degree from Delft University of Technology in 2018 and then started to work in Guangdong Provincial Academy of Building Research Group. He focuses on the researches regarding concrete durability problems, microanalysis and characterization, micromechanics and Lattice modeling for fracture, and prefabricated concrete structures.

Abstract

Prefabrication of structural units for Modular Integration Construction developed rapidly in China in the past five years. Being one of the most important issues, studies have been carried out by both academia and industrial practitioners on structural joints between prefabricated and cast-in-situ elements. In this presentation, practical problems of structural joints, solutions currently adopted and inspection technology are discussed.

Challenges for MiC Application in Rank and File Quarter for FSD at Pak Shing Kok



Ir Richard Lee Yau Lee Construction Co. Ltd

Brief Biography

Ir Richard Lee is a Fellow member of HKCI and HKIE in structural engineering discipline. He is currently the General Manager of Yau Lee Construction Co., Ltd. and he is serving as a Council Member of Hong Kong Construction Association.

Ir Richard Lee has been engaging in structural design, project co-ordination and construction practice involving geotechnical instrumentation, pre-stressed concrete and high-rise building structures in Hong Kong. Ir Richard Lee has been joining Yau Lee Holdings Limited over 30 years. He has been actively involved in the development of semi-precast construction technology in particular for the design of formwork systems, construction cycle planning and design of precast components for building construction since 1993. He was the team leader to develop the application of volumetric precast concrete bathroom construction for public housing in 2000. He is also taking lead in developing the concrete modular integrated construction system of Yau Lee Construction Co.,Ltd.

Abstract

The ArchSD's project for Rank and File Staff Quarters for Fire Services Department at Area 106 Pak Shing Kok, Tseung Kwan O is the first concrete high rise MiC project in Hong Kong. The project started in Aug 2018. It is planned to have 4 to 5 months shortening compared with original contract duration of 30.5 months. The presentation will include the challenges in implementing MiC construction during design, manufacturing, transportation, assembling on site, and follow on site works. A general project review on performance with respect to quality assurance and control, construction site safety precautions, environmental issues and productivity will be discussed.

Pre-decorated MiC units: A Global perspective on trends, standards and performance solutions for waterproofing, tiling and flooring



Dr Jan Kalkühler Ardex Hong Kong Limited



Dr Andreas Oberecker Ardex Hong Kong Limited

Brief Biography

Dr Jan Kalkühler is the Global Head of Modular and Pre-fabricated Construction Systems at ARDEX.

He holds a PhD in Civil Engineering. Prior to joining ARDEX in 2016, he worked for more than 15 years with HOCHTIEF AG, Germany, a leading international General Contractor, as a Project Manager in major International Projects.

Dr Andreas Oberecker is the Regional Managing Director North Asia at ARDEX. He held various positions at ARDEX in Asia since 2005 and was based in Singapore, Shanghai and Hong Kong.

He has profound knowledge of the construction and decoration industry in Asia, including prefabrication and modular construction.

Abstract

As an alternative to conventional construction, offsite manufacturing ensures quicker, safer, more sustainable and more efficient construction. However, in Modular Integrated Construction (MiC), the finishing works (floor and wall installation, including waterproofing) represent a high degree of complexity in the manufacturing process. This particularly applies to pre-finished modules where two key challenges arise: First, interior finishing works oftentimes create a bottleneck in the production process due to long installation and drying times in floor and wall systems. Second, the transportation from factory to the site poses additional requirements to the pre-finished floors and walls such as an increased resistance to mechanical vibration during the transport. Therefore, irrespective of the type of structure – timber, steel, concrete or GRP – the finishing works materials have to be easy to apply, fast drying, durable and yet competitively priced.

This presentation will give a global perspective of trends, challenges and its solutions regarding waterproofing, tiling and flooring.

Introduction to New Technology of Reinforced Concrete – Structural MiC



Ir Prof Albert Kwan The University of Hong Kong



Calvin Wong Flexcrete (Hong Kong) Limited

Brief Biography

Ir Prof Albert Kwan is a civil, structural and materials engineer. He works as an academic at The University of Hong Kong but is actually a practitioner. He advocates the use of powder technology to develop high-performance concrete, ultra-high-performance concrete, high-durability concrete and low-carbon concrete for sustainable development. His packing density and water-paste-mortar film thicknesses theories are gaining popularity as reflected by the increasing citations of his papers (more than 1200 Google Scholar citations per year).

Mr Calvin Wong is a multi-talent, multi-skill, dreamer-thinker-practitioner. He is a design architect with an R & D aptitude. He is also a digital technologist pioneering in the development of RFID and BIM in Hong Kong and Singapore. Very unexpectedly, he is also a material specialist in chemical admixtures, star-shaped polymer superplasticizers, PCM for heat control in concrete, composite construction, precast construction, UHPC joints for precast concrete elements, and structural MiC. In actual fact, he is the boss of two construction materials companies.

Abstract

Due to the rapid inflation of on-site labour cost rate worldwide in construction market, there is a growing trend to adopt prefabricated and prefinished modular components in the erection of building in particular residential highrise type apartment. This volumetric precast and assembly type construction method demand a fundamental change on the design of building construction element's weight, thickness and structural performance in order to attain equivalent strength performance achievable in the traditional cast in-situ reinforced concrete structural design for withstanding lateral wind and seismic load during the service life of building.

In order to facilitate the wider adoption of volumetric based concrete prefabricated construction, a strong demand exist in the construction market to revamp thin concrete laminate composite technology with high strength to weight ratio performance that can embrace the use of latest machine tooling technology already successfully used in manufacturing industry such as laser cutting, high pressure punching and 3D printing with high production efficient to gain the low cost benefit when construction industry migrate into the adoption of modular integrated construction technology.

This new technology of reinforced concrete is belong to the class of steel fabric grid multilayer sandwich composite hereby named as MustDo composite. By effectively exploiting the ability of the perforated isogrid steel plate act as stiff reinforcement fame to provide the composite with the necessary ductility and internal coherence. MustDo composite has structural similarities with reinforced concrete, but exhibits mechanical behaviour more favourable for load-carrying structures utilizing thinner reinforced concrete elements.

To verify the mechanical principles and process technology of the MustDo composite, a series of full scale tests have been carried out with the full scale MustDo Composite casted panels in the civil department testing laboratory of Hong Kong University of Science and Technology during this year. All the panel tests have been performed as static loading tests under Eurocode-2 requirements, with registration of forces, displacements, and strains, and observation of slipping and cracks. During the testing, related values of strains, loads, and deflection, measured at short intervals, were recorded.

The development of process technology has played a vital role in the development of MustDo composite and is a prerequisite for industrial production. MiC Volumetric version using the MustDo composite reinforced concrete technology have been successfully produced in precast yard using conventional techniques.





Development of Prefabricated RC Buildings-Case Study on Seismic Damages in 512 Wenchuan Earthquake



Professor Wang Yayong China Academy Building Research

Brief Biography

中国建筑科学研究院,研究员,博士生导师,全国工程勘察设计大师 工程抗震研究所 原所长 1967 同济大学工民建专业本科毕业 1975 清华大学土木系结构理论研究生毕业 1981~1982 美国南加州大学土木系 访问学者(联合国奖学金) 1986 日本冲绳国际中心 研修员 1990 意大利帕维亚大学结构工程系 访问学者

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Abstract

Great damages of the prefabricated RC buildings occurred in the 512 Wenchuan Earthquake in 2008. Lessons have learnt from the study on these damages. The research and technology for new types of prefabricated RC structures have developed widely and quickly since the event. An assemble of standards and regulations for the structure design, construction, quality control and assessment has issued and been executed since 2017. Large number of assembled houses has been built thanks to the encouragement from the administration's policy. The problems regarding to the quality of connection joint of RC members in construction of prefabricated RC buildings should be stressed and avoided.

Opportunities and Risks in MiC Construction



Ir Alcohol Mok Hip Hing Construction Co. Ltd.

Brief Biography

Mok Kwok Ho first joined Hip Hing Construction in 1982 and has been an Executive Director since 2011. He is a Fellow member of Hong Kong Institute of Engineers in the Civil and Building Disciplines, and Fellow member of HK Institute of Construction Manager. Mr. Mok has over 38 years of experience in various type of building construction, foundation, site formation, precast, DfMA and MiC construction. He is now in charge of the company's Construction Services Division which include Engineering Design Department, BIM Section, Planning Department and QUENSH Department (Quality, Environmental & Safety).

Abstract

Located adjacent to the Hong Kong Science and Technology Parks (HKSTP), InnoCell will be a 17-storey residential institution, providing a smart and co-living community for HKSTP's selected tenants and incubates.

It will be one of the pioneer and pilot projects in Hong Kong using Modular Integrated Construction (MiC) method echoing the Construction 2.0 development, in the concept of "Off-site factory assembly, followed by on-site installation".

Hip Hing Engineering Company Limited is the awarded Superstructure Main Contractor. Given the application of MiC method, the project is targeted to be completed in a shorter and competitive period. This approach will significantly reduce on-site construction process, and enhance building productivity, quality, safety and sustainability.

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