2nd CIC-HKU International Consultation Forum

Shaping a More Productive Construction Industry

Forum Proceedings

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About the Forum

The construction industry makes a significant contribution to securing a sustainable future of Hong Kong. Productivity measures the output to input ratio and provides valuable insights into the long-term potential of an economy. Therefore, construction industry productivity has long been an important issue for Hong Kong. However, the industry faces severe challenges including cost escalation and labour shortage. This 2nd international consultation forum was part of a study funded by the Construction Industry Council (CIC) and led by The University of Hong Kong (HKU), which aimed to enhance the productivity and efficiency of the Hong Kong construction industry by conducting a comprehensive and rigorous investigation on the practices, procedures and standards adopted in the industry.

The forum aimed to shape a more productive construction industry by exploring strategies and measures, both locally and internationally, for improving construction industry productivity in five strategic areas, namely, policy formation; regulatory requirements; planning and design; project management and administration; and site construction. The forum featured renowned international and local speakers to share latest knowledge and practices of enhancing construction productivity.

Dr Wei Pan
Principal Investigator and Project Director
Organisers and Supporting Organisations

Organisers

Special Supporter

Supporting Organisations
Forum Rundown

1:30 – 2:00pm  Registration

2:00 – 2:05pm  Welcome Speech
  Mr Ka-kui Chan, Chairman, Construction Industry Council

2:05 – 2:15pm  Opening Speech
  Mr Eric Siu-cheung Ma, Secretary for Development, HKSAR Government

2:15 – 2:25pm  Photo Session

2:25 – 2:50pm  Key Performance Indicators and Productivity in the UK Construction Sector
  Mr Don Ward, Chief Executive, Constructing Excellence, UK

2:50 – 3:15pm  Advanced Construction Technology and Productivity
  Prof Jennifer Whyte, Director of Centre for Systems Engineering and Innovation, Imperial College London, UK

3:15 - 3:40pm  Advancing Construction Productivity: The Case of Gammon
  Mr Thomas Ho, Chief Executive, Gammon Construction Limited

3:40 – 4:00pm  Refreshment Break

4:00 – 4:25pm  High-rise Volumetric Modular Buildings: The Case of Wembley London
  Mr Rory Bergin, Partner, HTA Design LLP, London, UK

4:25 – 4:50pm  Global Construction Cost and Industry Productivity Enhancement
  Mr William Waller, Market Intelligence Lead, Arcadis, London, UK

4:50 – 5:15pm  Future of Building Today: Artificial Intelligence and Robotic Construction
  Ir Conrad Tin-cheung Wong, Vice Chairman, Yau Lee Holdings Limited

5:15 – 5:30pm  Systematic Construction Industry Productivity Enhancement in Hong Kong: Strategies and Measures
  Dr Wei Pan, Project Director, CICID, The University of Hong Kong

5:30 – 5:50pm  Plenary Session
  Mr Ward, Prof Whyte, Mr Waller, Mr Ho, Mr Bergin, Ir Wong and Dr Pan;
  Moderated by Prof Sam Chan, Associate Director, CICID, The University of Hong Kong

5:50 – 6:00pm  Closing Remarks
  Prof Mohan, M. Kumaraswamy, Founding Director, CICID, The University of Hong Kong
Executive Summary

On 25 April 2017, the 2nd International Consultation Forum themed “Shaping a More Productive Construction Industry” was held at HKU with the purposes to validate the identified strategies and measures for enhancing construction industry productivity in Hong Kong and to disseminate the findings of the study to a wider audience of the local and overseas construction industry for synergies and sharing. The forum was co-organised by the Centre for Innovation in Construction and Infrastructure Development (CICID) of The University of Hong Kong (HKU) and Construction Industry Council (CIC), with special support from Development Bureau of the HKSAR Government. A wide range of government departments and industry organisations also supported this forum.

Over 250 participants registered and over 220 attended, from the Hong Kong SAR Government, the construction industry, institutions and academia. At the forum, renowned international and local speakers shared the state-of-the-art knowledge and practices of enhancing construction productivity at industry, project and activity levels, and all engaged in the plenary session for an in-depth discussion.

The forum included several sessions. First of all, Mr KK Chan, Chairman of CIC, welcomed all participants, followed by Mr Eric Ma, Secretary for Development of the HKSAR Government, who delivered Opening Speech to draw attention to a
strategic view of construction productivity enhancement in Hong Kong. Dr Don Ward, Chief Executive of Constructing Excellence, UK shared key performance indicators (KPIs) and productivity enhancement strategies used in the UK construction sector. After that, Prof Jennifer Whyte, Director of Centre for Systems Engineering and Innovation, Imperial College London, UK examined how advanced construction technology impacted the UK projects and their implications across the whole production system. Later Mr Thomas Ho, Chief Executive, Gammon Construction Limited presented his organisation’s approaches to enhancing construction productivity.

After the break, Mr Rory Bergin, Partner, HTA Design LLP, London UK, provided case summary of Wembley London for applying offsite prefabrication and volumetric modular building. This was followed by the presentation given by Mr William Waller, Market Intelligence Lead, Arcadis, London UK, who shared Arcadis research on global construction cost and reviewed the issues surrounding construction productivity. Ir Conrad Wong shared case study of Anderson Road Site A & B and some new construction technologies to be used for other projects. Dr Wei Pan, Principal Investigator and Project Director of the study underlying the forum, disseminated research findings about the strategies and measures to construction productivity enhancement in Hong Kong.

The proceedings were furthered via a plenary session moderated by Prof Sam Y.S. Chan, Associate Director, CICID. Finally, Prof Mohan M. Kumaraswamy, Founding Director, CICID gave closing remarks at the end of the Forum, to summarise the key learning points shared by the speakers and highlighted that construction technology and innovation enhances construction productivity.
Welcome Speech
(In the same order as in the forum rundown)

Mr Ka-kui Chan, BBS, JP
Chairman
Construction Industry Council

Biography

Mr CHAN is the Chairman of the Construction Industry Council. He is a quantity surveyor with over 40 years of experience in the construction field. Previously, he was the Chairman of the Construction Industry Training Authority and Vice-President of Hong Kong Construction Association. Mr CHAN is a Fellow Member of the Hong Kong Institute of Surveyors. He is an Adjunct Professor of the Hong Kong Polytechnic University, an Honorary Fellow and a Court Member of the City University of Hong Kong.

Mr Ka-kui Chan, Chairman of the Construction Industry Council, delivered the Welcome Speech.

Introduction

Good afternoon, Ir. Eric Ma, Professor Norman Tien, distinguished guests, ladies and gentlemen. It is my great pleasure to welcome you today to this second international forum co-organised by the Construction Industry Council and HKU. Perhaps some of you may have joined the first international forum on 21 March in which our Singapore guests shared their productivity enhancement strategies. Today, we are pleased to have invited prominent speakers from the UK and also colleagues from Hong Kong to share their experience in shaping a productive construction industry.
Challenges to UK and Hong Kong

The construction sector is one of the main pillars of the world economy. According to a recent publication by McKinsey Global Institute\(^1\), the global construction industry employs 7% of the world’s working population, with US$10 trillion spent on construction-related activities each year, accounting for 13% of the world’s GDP. Unfortunately, it is a global problem that our industry has a very low productivity. Labour productivity growth in construction is only 1% a year over the past two decades, compare with 2.7% for the entire world economy.

The Global Construction Perspectives and Oxford Economics in 2016 anticipated that the UK’s construction market would become the largest in Europe, and the sixth in the world by 2030. For Hong Kong, our construction volume will remain at a high level for the next 10 years, mainly because of housing demand. Both UK and Hong Kong will be enjoying high construction demand, but facing the same problem of shortage of skillful workforce.

Measures to enhance productivity – 3 “I”

The McKinsey Global Institute advocates that the construction productivity can be significantly boosted with the improvement in three areas started with letter “I”. The three “I” stand for “Infuse technology and innovation”, “Improve procurement and supply chain” and “Improve site execution”. Let me share in more details.

1st “I” - Infuse technology and innovation

All of you should have heard of Artificial Intelligent Autopilot Driving System\(^2\). It is said that the system can interpret its surrounding environment and control the vehicle that can avoid human errors, reduce travelling time and carbon emissions. Appears that there is no limit to the power of science and innovation.

To be fair, we have some emerging technologies bringing benefits to construction, for example 3D printing for casting building parts, drones for aerial surveying, virtual reality for safety training, robot automation for manual lifting and welding, etc. We need many many more.

To spearhead the development of the Hong Kong construction industry, the CIC has set up the Construction Innovation and Technology Application Centre. It will come in operation later this year to facilitate technological and digital development of the industry.

We are also organising the 2\(^{nd}\) CIC Construction Innovation Award this year to encourage international, local and young practitioners to invent new technologies and enlighten our stakeholders. The deadline for application is 15 August 2017. Please join us.

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1\(^{\text{McKinsey Global Institute’s “Reinventing construction: A route to higher productivity” published in February 2017}}\)  
\(\text{https://goo.gl/5jXXAK}\)

2\(^{\text{http://readwrite.com/2016/12/20/ai-driving-future-autonomous-cars-til4/}}\)
2nd “I” - Improve procurement and supply chain

New technologies could deliver not only innovativeness, but also improvement in supply chain management.

This is the second “I” – Improve procurement and supply chain. As we all know, BIM facilitates project co-ordination, improves works quality, and reduces construction visualization in real time. To drive for wider use of BIM, the CIC has recently set up an industry-wide Committee on BIM with industry leaders to direct its application in Hong Kong.

Over the years, UK has driven the evolution of the New Engineering contract (NEC) with successful examples like Heathrow Airport terminal 5 and the 2012 London Olympics. A key feature of this collaborative partnering procurement is to save cost and time – hence the efficiency of work. In Hong Kong, we are also yielding some good results from NEC pilots, which set a good start to promote its wider adoption.

3rd “I” - Improve site execution

The third “I” is Improve site execution. The heart of the issue is to move from relying on process control towards a more holistic production and operating system. In the last forum, Singapore BCA has introduced the adoption of modular Prefinished Volumetric Construction (MPVC) which demonstrates “plug and play” design for manufacturing and assembly.

I look forward to learning more from our UK friends and local colleagues, to guide us formulating a development path for the Hong Kong Construction Industry. Particularly, I thank our overseas guest speakers³, Mr Don Ward, Professor Jennifer Whyte, Mr Rory Bergin, and Mr Will Waller, for travelling a long way to help us.

Wish you all a very fruitful afternoon.

Thank you.

³ Mr Don Ward - Chief Executive, Constructing Excellence; Professor Jennifer Whyte - Director of Centre for Systems Engineering and Innovation, Imperial College London; Mr Rory Bergin, Partner, HTA Design LLP, London; and Mr William Waller, Market Intelligence Lead, Arcadis, London.
Opening Speech

Mr Eric Siu-cheung Ma, JP
Secretary for Development
Development Bureau
HKSAR Government

Biography

Mr Eric MA was appointed Secretary for Development on 13 February 2017.

Mr MA is an engineer by profession with over 30 years of experience in the construction industry. He is a fellow member of a number of professional bodies including the Hong Kong Institution of Engineers, the Chartered Institution of Highways and Transportations, and the Institution of Structural Engineers, United Kingdom. He also served as Hong Kong Branch Chairman of the Chartered Institution of Highways and Transportation.

Mr MA was appointed Under Secretary for Development on 6 January 2014, and Acting Secretary for Development on 16 January 2017. Before joining the Government, Mr MA held a number of senior positions in large consulting firms and contributed to the planning and implementation of various development projects in Hong Kong.

Mr Eric Siu-cheung Ma, Secretary for Development, HKSAR Government, delivered the Opening Speech.
Good afternoon. It is my great pleasure to join you at this International Consultation Forum. Last month, the Construction Industry Council (CIC) and the Centre for Innovation in Construction and Infrastructure Development (CICID) of the University of Hong Kong hosted the 1st part of the Forum with great success. Singapore experts shared their experience in formulating strategies for enhancing construction industry productivity. Today, the co-organisers have invited renowned experts from the UK together with our local fellows to furnish us with their valuable views and insight in “Shaping a More Productive Construction Industry”.

The need for a productive construction industry

I would like to start with a question: Why does a highly productive construction industry draw more concern and become more pressing in recent years? The answer in fact is very obvious: It is because the demand for construction services is growing rapidly around the world. The National Infrastructure Delivery Plan in the UK and several major economies announced their determination to invest trillions of dollars in infrastructure development in coming decades. Even more, we have great opportunities in the Belt and Road initiative. It is probably the biggest infrastructure development programme in human history. The programme has made marked progress and about 30 heads of state will attend the Summit in Beijing next month to discuss the way forward on various fronts. One more example that most concerns all of us is the newly launched development of Guangdong-Hong Kong-Macao Bay Area. Last week, I joined the government delegation to visit the Bay Area and I was impressed with ample opportunities for infrastructure development there. You can imagine, only a highly productive industry can effectively handle such tremendous workload.

In Hong Kong, the community also has great demand for public facilities for enhancing the quality of living. In response, the Government has a host of projects to be implemented in the decades to come. They include the initiatives to boost land supply; 10-year housing supply target of 460,000 residential units; the East Lantau Metropolis, new railway lines; the $200 billion 10-year Hospital Development Plan and many other community and welfare facilities. The public works expenditure will exceed $80 billion this year and we anticipate that it would approach $100 billion in the next few years.

In terms of the value of construction output and contribution to the economy, our construction industry is definitely a productive sector. Under the portfolio of my Bureau, I am overseeing a major sector of the economy providing total construction output of more than $240 billion each year and contributing some 5% to our GDP. The total construction output is forecast to maintain at the high level of $240 billion to $320 billion in the next 10 years. According to the Global Competitiveness Report released by the World Economic Forum, Hong Kong has been ranked first in infrastructure for 7 years consecutively. This is a
remarkable achievement of every one working in the construction industry. To continue to provide more high-quality deliverables for the community in future, we need a very productive construction industry.

**Challenges of Construction Industry in Hong Kong**

5. Despite the tremendous demand and hence opportunities in infrastructure development, we are facing the challenges of high construction costs and shortage of skilled labour which have caused detrimental implications to the industry’s productivity. As costs inflated, we built less with the same budget compared to past years. We are also seeing signs of decline in productivity as measured by the construction output per unit manpower, i.e. each school classroom, public housing flat or gross floor area of commercial building etc. has required more manpower to build. It is really high time for every one of our industry collaborated together to makes timely changes by maximizing our output with less financial and manpower resources. As a key industry stakeholder, the Government is taking the lead to adopt a multi-pronged approach to enhance the productivity of the construction industry.

**Government’s initiatives in enhancing productivity**

*Strengthening cost management*

6. First, we need to address the cost issue. We set up the Project Cost Management Office (PCMO) in the Development Bureau in June last year to strengthen cost management of public works projects. We are now taking the lead to implement cost management initiatives to enhance the cost-effectiveness of the public works projects and spearhead a cultural reform in the industry for pursuing high cost-effectiveness and productivity.

*Addressing shortage of skilled labour*

7. As regards the labour issue, many economies admire very much that Hong Kong could maintain an experienced, highly skilled and sizable local construction workforce. Such a local workforce pool does not only provide stable manpower supply but also maintain skills transfer. However, it is never an easy task to maintain or even uplift the productivity and delivery capacity of the workforce without more new comers. Despite the joint efforts of Government and CIC to increase manpower supply, shortage of skilled workers remains a headache to us. It is foreseeable that the labour supply can hardly be increased significantly in near future due to a contraction of the school leaving population. We do hope the concerned parties can put aside steadfast views to work with us together to seek a practical solution.

8. Given the constraints in expanding labour supply, we have all along been promoting the reduction of manpower requirements, for example, by adoption of 3“S” concept, namely standardization, simplification and integrated single element, pre-fabrication and mechanicalisation. We are now also devising
a buildability index for assessing the buildability performance of construction projects which will encourage design proposals and construction methods with less manpower input.

**Innovation and Technologies**

9. The challenge of construction manpower supply is not unique to Hong Kong. Undoubtedly, the use of innovation and technologies will become indispensable to augment productivity and delivery capacity of human workforce. In fact, the construction industries in the economies such as UK, US and Singapore have initiated to embrace innovation by launching volumetric construction in building projects. They borrowed the idea from the production mode of the manufacturing sector and enjoyed the advantages of globalization. It is foreseeable that modular, pre-furnished volumetric building units produced in factory environment will be a new global direction of the construction industry. Given the challenges that Hong Kong is facing, volumetric construction for high-rise buildings has the potential to be one of the future directions for Hong Kong. We are now starting to look into whether it is viable for Hong Kong’s environment especially in the aspects of technical consideration, procurement arrangements, regulatory framework, supply chain, etc.

10. About 30 years ago, segmental launching technology was a breakthrough for bridge construction in Hong Kong and has drastically escalated the productivity in this aspect. At the onset, many people harboured reservations and only permitted its use in the stitching of straight sections. Nowadays, this launching method has become the main stream for bridge construction. This again demonstrated how “one small step” could result in “one giant leap”.

11. With the collaborative effort of all the experts and stakeholders today, I am sure we will have the courage, aspiration and determination to spearhead advancement in construction technologies.

**Filibustering in LegCo**

12. While Government and the construction industry are trying their best in boosting productivity, the “productivity” of LegCo in vetting the funding proposals of public works projects is a great worry to us all. You may have noticed that we have experienced an unprecedented situation that no new projects have been approved for eight months since last July. Now, we still have around 40 new projects totalling about $100 billion pending for approval in the remaining 3 months before the end of this legislative session in July. For the sustainability of the construction industry, I appeal to your highest attention to the issue and continue to take appropriate action to impress the community on the need of continuous implementation of public works projects.

**Concluding Remarks**

13. Ladies and Gentlemen, the construction industry is the propeller for
the long-term development of Hong Kong. The more productive the propeller, the further miles that Hong Kong can travel. I would like to call for the collaboration and support of every industry practitioner and LegCo Member to step up the productivity of the industry for delivering our projects in the pipeline to meet the needs of society.

14. I wish you all a very fruitful discussion today. Thank you.
Key Performance Indicators and Productivity in the UK Construction Sector

Mr Don Ward
Chief Executive
Constructing Excellence, UK

Biography

Don Ward is the Chief Executive of Constructing Excellence, the UK industry think tank and best practice organisation which is now part of the BRE Trust group of companies. He has over thirty years’ experience of best practice in the building, engineering and construction industry, specialising in policy making, industry change, supply chain integration, collaborative working and sustainability across all sectors from housing to infrastructure.

Don is closely involved with many UK government and industry bodies, including the Strategic Forum for Construction, the Infrastructure and Projects Authority within the Cabinet Office, where he chairs a committee on new models of procurement for construction, and the British Standards Institution (BSI), where he is secretary to the committee on construction procurement. Also, he is currently a Simon Industrial Fellow at Alliance Manchester Business School to support research and industry engagement activities in the infrastructure sector.

Don was a guest of the Hong Kong government’s Sponsored Visitors Programme in February 2017.

Mr Don Ward, Chief Executive, Constructing Excellence, delivered a keynote speech.

Later he provided KPIs of the Egan Report. He also provided UK construction sector statistics about safety, cost and time predictability, profitability and productivity of the past 17 years. He further shared that the UK Government has achieved cost reduction during austerity era. Mr Ward also shared learning from mega projects in the UK which include T5 Heathrow, London 2012, Crossrail, Thames Tideway, Nuclear power and HS2. He also shared the UK Government Industrial Strategy 2025 which set targets for achieving 33% low costs, 50% reduction in carbon emission, 50% faster delivery of projects and improvement in export of skills by 50%. He then highlighted the findings of the report titled “Collaborative working: the principles”9. The report highlighted three overriding principles of collaborative working which include 1) common vision and leadership, 2) collaborative culture and behaviours, and 3) collaborative processes and tools. The report also suggested six critical success factors for collaborative working. These are 1) early involvement, 2) selection by value, 3) aligned commercial arrangements, 4) common processes and tools, 5) performance measurement, and 6) long-term relationships. Finally Mr Ward presented guidance report titled “New models of construction procurement”10. The report suggested three modern methods of procurement. These are: 1) two-stage open book, 2) cost-led, and 3) integrated project insurance.

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4 https://www.designingbuildings.co.uk/wiki/Latham_Report
6 http://constructingexcellence.org.uk/resources/never-waste-a-good-crisis/
Advanced Construction Technology and Productivity

Prof Jennifer Whyte
Director
Centre for Systems Engineering and Innovation
Imperial College London, UK

Biography

Professor Jennifer Whyte is the Laing O'Rourke/Royal Academy of Engineering Professor of Systems Integration at Imperial College London. Her research addresses the new opportunities and challenges of the digital transformation of major infrastructure projects. She is Director of the Centre for Systems Engineering and Innovation at Imperial and a Fellow of the Institution of Civil Engineers (ICE). She has sat on external BIM advisory panels for Crossrail and HS2 and before re-joining Imperial to take up her current role she was Shimizu Visiting Professor in the Department of Civil and Environmental Engineering at Stanford University in 2015.

Prof Jennifer Whyte, Director, Centre for Systems Engineering and Innovation, Imperial College London, UK, delivered a keynote speech.

Prof Whyte delivered the keynote speech based on some of her research projects' findings about advanced construction technology and productivity. After short introduction about herself and her college Centre for Systems Engineering and Innovation, she started her talk by providing the background information about
production systems. She quoted an internationally renowned Prof Joan Woodward of Imperial College London words about production systems from her book titled “Industrial organization: Theory and Practice”\textsuperscript{11}, that there is no single ‘right way’ of managing organisations. Firm performance is contingent on the technologies of production. Successful firms’ organisational structure is near the middle of their category i.e. Unit production, Mass production and Continuous process production. She provided an overview of construction as an advanced manufacturing process. She provided generic approaches and housebuilding examples from Barlow et al. 2003 article titled “Choice and delivery in housebuilding: lessons from Japan for UK housebuilders”\textsuperscript{12}. She also shared the example of Crossrail about how digital asset information system was used as a deliverable to owners and operators. Prof Whyte also shared her research experience with Heathrow Terminal 5, London 2012 Olympics and Crossrail projects.

At the end, Prof Whyte provided future directions for research and practice i.e. 1) complex projects as long-term projects; 2) innovation in production systems; 3) changing relationship between operation and delivery; and 4) how we think about system boundaries; how we evaluate success.

Advancing Construction Productivity: The Case of Gammon

Mr Thomas Ho, JP
Chief Executive
Gammon Construction Limited

Biography

Mr Thomas Ho, JP, is the Chief Executive of Gammon Construction Limited, a Hong Kong based construction group with operations throughout China and South-East Asia, jointly owned by Jardines and Balfour Beatty. Gammon has a turnover of around USD 1.8 Billion and employs over 5000 professional staff. Thomas possesses over 30 years of experience in contract, project management and general management. He is very active in community services and professional institutes’ services and is recognized by the Industry as the figurehead in promoting Excellence in Construction Management and Quality Construction. His passion and commitment in pursuing safety in the workplace, as demonstrated in the series of CEO Safety Forum for which he pulls together the efforts of government officials and industry leaders, is applauded by all stakeholders.

Mr Thomas Ho, Executive Director, Gammon Construction Limited, delivered a keynote speech.

Mr Ho presented very comprehensive overview of the industry and shared his personal and organisation’s experience. Mr Ho started his presentation by providing an overview of the report titled “Modernise or Die”13. ‘The Farmer Review of the UK Construction Labour Model’ was commissioned in February 2016 by the Construction Leadership Council at the request of the government.

Led by CEO of Cast Consultancy, Mr Mark Farmer, the report investigated the current labour model and proposed actions to safeguard the industry’s future. He presented the report’s findings which identified critical symptoms of failure and poor performance. He then presented the recommendations of this review and learning for the Hong Kong construction industry. Mr Ho highlighted some of the impending challenges faced by the Hong Kong construction industry. For example, filibustering, very high construction cost (second in the world), labour shortage, too traditional trades and poor safety performance. He then presented the Conceptual Spatial Framework for Hong Kong 2030+14. Mr Ho then shared his views about latest projection of housing demand that how to meet the long-term demand of 460,000 units for the next 10 years’ period from 2016-17 to 2025-2615.

Afterward he shared his findings to benchmark trip to London and Cambridge. He then presented 3-D to 10-D concepts. Later he showed different slides about BIM and Artificial Intelligence (AI) applications in different projects. He also shared his organisation’s design for manufacturing and assembly (DfMA) experience which has achieved 30% reduction in man-hours. He also showed how virtual reality (VR) and gaming are used for safety training in his organisation. Gammon has also developed different mobile apps. For example, they have developed apps for defect checking and traffic controlling. Gammon has also established strong research collaboration with academic institutions around the world including The University of Hong Kong for robotics. Mr Ho also showed how smart helmet could be used in the construction industry.

High-rise Volumetric Modular Buildings: The Case of Wembley London

Mr Rory Bergin
Partner
HTA Design LLP, London, UK

Biography

Rory Bergin joined HTA as an architect in 1993 and became an associate in 1999, and a partner in 2013. In 2007, he formed HTA’s Sustainable Futures unit to further his interest in sustainability and to expand the range of services HTA can offer. Rory’s role is to promote sustainable and innovative design, enabling HTA to achieve its objective of leading the field in sustainable place making.

He leads a team of specialists who are expert in subjects including SAP, BREEAM New Construction, Home Quality Mark, Code for Sustainable Homes, PassivHaus, SBEM, Post Occupancy Evaluation, Life Cycle Assessment and BREEAM Communities. He has an input into most projects, overseeing the practice’s implementation of sustainable design and appropriate sustainability tools.

Rory and his team are responsible for the sustainability consultancy on some of the UK’s highest profile housing projects including Hanham Hall, the UK’s largest zero carbon residential project now completed. Rory played a pivotal role on the project during the bid stage and has since successfully steered this ground-breaking project through the complex maze of standards that the project has met.

Rory has wide experience of Modern Methods of Construction including leading an EU funded research project into modular construction and has been involved in a number of exemplar projects including the Design for Manufacture and Millennium Village initiatives. He is actively involved in ‘retrofit’ refurbishment projects aiming to meet the 80% of CO₂ reductions that will be required across the UK by 2050.

Rory is a certified BREEAM Communities Assessor, Code for Sustainable Homes Assessor, and SAP Assessor. Project experience includes:

- Sustainability Advisor to CityWest Homes for their Standards for new construction and refurbishment and their estate appraisal methodology.
- Leading HTA’s involvement in ModCons, an EU research project into modular residential construction.
- Leading the certification of Hanham Hall, a large zero-carbon housing development by Barratt Plc.
- Sustainability advisor to Lovell on the redevelopment of Castleward, Derby – a 700-unit residential masterplan with a community centre and mixed uses.
- Sustainability Advisor to Notting Hill Homes for the Aylesbury Estate – developing energy and sustainability options for the regeneration of the estate.
Mr Rory Bergin, Partner, HTA Design LLP, London, UK, delivered a keynote speech.

Mr Bergin delivered a speech based on the real case studies of high-rise volumetric modular buildings in Wembley London. He first introduced his organisation’s services i.e. design for manufacture and assembly, provide market assessment for manufacturers, technical advice and feasibility studies etc. He then presented pros and cons of offsite construction. The pros include quicker construction, early rent returns, less disruption and more sustainable. The cons of offsite are that it requires early engagement with manufacturer, designer needs to understand the discipline of DfMA and client needs to make timely decision. He then presented different types of offsite manufacturing. He also provided comparison of traditional vs offsite design and construction methods and concluded that offsite construction has saved time and cost. He also presented how best procurement could achieve economies of scale. He pointed out that BIM integration could also help save time and cost. He later elaborated three stages of volumetric modular process. In the first stage slipform core and podium structure is constructed, in the second stage modular is delivered and in the third stage façade is delivered. He also shared benefits of volumetric modular buildings including achievement of safety, reduction in waste, productivity enhancement, shorter site time, stable cost, better quality control and teamwork. Mr Bergin concluded his presentation by presenting his organisation’s volumetric modular buildings work in progress in different parts of London.

16 http://www.hta.co.uk/people/rory-bergin
Global Construction Cost and Industry Productivity Enhancement

Mr William Waller
Market Intelligence Lead
Arcadis, London, UK

Biography

William Waller, a chartered quantity surveyor and market intelligence lead at Arcadis UK, has a decade of experience in UK construction. Spanning onsite main contracting and business advisory, William has worked with numerous investors, clients and suppliers across most key construction sectors, including highways, rail, aviation, water and commercial development.

William currently heads up Arcadis’ dedicated and industry-leading market intelligence function in the UK, providing informed hindsight, insight and foresight to clients, backed by research and practical experience. The team actively delivers bespoke and strategic market-related assignments for clients, with particular focus on providing applied and hands-on advice. The ‘productivity puzzle’ seen in UK construction is at the centre of William’s work.

William has a keen interest in wider-industry improvement and has been involved with Constructing Excellence (CE G4C), Construction Industry Council and Considerate Constructors Scheme initiatives. These have particularly focussed on solutions to the skills shortage in UK construction, as well as emergent opportunities relating to technology in the sector.

Mr William Waller, Market Intelligence Lead, Arcadis, London, UK, delivered a keynote speech.
Mr Waller presentation was about global comparison of cost and industry productivity enhancement. He started his presentation by comparing different construction reports produced in the last 20 years with Google which was also started in 1998. He then presented the findings of Arcadis report titled “International Construction Costs 2017: Cost Certainty in an Uncertain World”\(^\text{17}\).

The report shows that Hong Kong is ranked number two after New York as the most expensive city to build. He divided cities into two main categories i.e. built asset rich and cash asset rich. Apart from productivity challenges the cities studies are also facing capital efficiency and resource efficiency challenges. He also presented that the construction sector is facing different challenges including higher labour dependency, low capital utilisation, economic cycles as well as 4D i.e. depressing, dirty, dangerous and demeaning. Mr Waller also stated and gave various examples of common enablers of solutions which are not aligned with common attributes of construction industries. His presentation provided a three point plan for improving productivity i.e. 1) balanced workload; 2) shared innovation; and 3) reduced casualisation. He concluded his presentation by summarising key points that the industry must change and clients must drive this change. He also suggested that resource sharing is central to the solutions and the construction sector must learn from successes and mistakes in other sectors.

Entering a new era of construction productivity: Modulation, BIM, AI and Robotic

Ir Conrad Tin-cheung Wong, BBS, JP
Vice Chairman
Yau Lee Holdings Limited

Biography

Ir Conrad Wong has over 25 years of construction project management experience. He is Vice Chairman of Yau Lee Holdings Limited. His areas of expertise include strategies planning, building construction, precast construction technologies, safety and quality management and green building technologies.

Ir Wong is active in public and community services, he has been appointed as the Chairman of the Occupational Safety and Health Council, the Deputy Chairman of Vocational Training Council, Member of the Advisory Council on the Environment as well as Member of the Panel on Promoting Testing and Certification Services in Construction Materials Trade. In the past, Ir Wong served as the Chairman of the Hong Kong Green Building Council, the President of the Hong Kong Construction Association, the President of the International Federation of Asia and West Pacific Contractors’ Associations, the Chairman of Pneumoconiosis Compensation Fund Board, the Member of Construction Industry Council and the Director of the World Green Building Council.

Ir Wong is currently a Member of Guizhou Province Committee of the Chinese People’s Political Consultative Conference. Ir. Wong was appointed Justice of the Peace (JP) in 2008 and awarded the Bronze Bauhinia Star (BBS) by the Government of the HKSAR in the year of 2013 for recognition of his outstanding contributions made to Construction Industry.
Ir Conrad Tin-cheung Wong, Vice Chairman, Yau Lee Holdings Limited, delivered a keynote speech.

Ir Wong shared his organisation’s integrated procurement approach (IPA) used in a real case project i.e. Construction of Public Rental Housing Development at Anderson Road Site A & B Phase 1 and 2. In this project 6-day cycle was maintained. Different prefabrication materials were used in this project i.e. precast façade, precast bathroom and kitchen, precast half landing, semi-prefabricated slab, precast refuse chute and precast staircase. Ir Wong also shared how BIM 4D scheduling software was used for clash detection and model based construction process simulation to enhance the planning process. Further 5D BIM was also used for quantity takeoff (QTO) and cost evaluation purpose in compliance with the Hong Kong Standard Methods of Measurement, Forth Edition (HKSM4). Ir Wong also showed his organisation precast factory located in mainland China. The factory is located in Wah Huizhou at a total land area of 182,373m² with 41 production lines and it has daily capacity of 1250 tonne. He also pointed out that their organisation is forming joint venture with mainland Chinese companies for exporting precast technology back to China. He emphasised that BIM is changing our method of construction. He shared his experience how BIM is integrated with Geographic Information System (GIS). Further he shared with audience that Holiday Inn Express SoHo is one of the smart building in Hong Kong. Later he shared advantages of AI. He also presented how construction robots have helped improved productivity and safety at construction site. He concluded his presentation by providing the idea of MBA3R which stands for Modularisation, BIM, A.I., 3D Printing and Robotics.
Systematic Construction Industry Productivity Enhancement in Hong Kong: Strategies and Measures

Dr Wei Pan
Associate Director, CICID
Associate Professor, Department of Civil Engineering
The University of Hong Kong

Biography

Dr Wei Pan is Associate Professor at Department of Civil Engineering of The University of Hong Kong (HKU) where he is also Co-Chair of Low Carbon Construction Taskforce and Associate Director of Centre for Innovation in Construction and Infrastructure Development (CICID). He is HKU Overseas Fellow to Imperial College London. Dr Pan received his BSc (Distinction) in Civil Engineering from Hunan University and MSc (Distinction) and PhD in Construction Management from Loughborough University. Dr Pan is specialised in construction engineering and management, with research interest covering zero carbon building, productivity, prefabrication, modular construction and decision making, having secured over HK$25million research fund and authored over 135 publications. He has 22 years of professional experience internationally in building design and engineering, construction project management and innovation management. He is Chartered Builder, Chartered Environmentalist, and Fellow of Higher Education Academy.

Dr Wei Pan, Associate Director, CICID, Associate Professor, Department of Civil Engineering, The University of Hong Kong, delivered a speech.
Dr Pan presented on the study funded by CIC and led by HKU, which aims to achieve systematic construction industry productivity enhancement in Hong Kong, with a focus on a better understanding of the strategies and measures. He first presented on the progress of the project and highlighted the challenges faced by the Hong Kong construction industry such as ageing workforce coupled with a lack of new entrants, a shortage of skilled manpower fuelled by requirements for new skills sets and very high construction cost with alarming cost escalation. After that, Dr Pan introduced the project aim, objectives and research methods adopted for data collection. He then reported on the 1st and 2nd round interview-based questionnaire surveys with 52 industry experts and government officials, three project case studies and five focus group meetings with a wide range of professionals and stakeholders. Dr Pan shared the initial findings of 12 major strategies, 37 operational strategies and their underpinning 77 specific measures for productivity enhancement. Dr Pan presented five most important strategies and measures derived from the 1st International Consultation Forum. He then presented real examples of medium to high rise modular buildings around the world. He also presented different terms used for offsite manufacturing in different countries and learning outcome for the Hong Kong construction sector. Later he showed that a feasibility study is commissioned by the Development Bureau led by him about adopting Modular Prefinished Volumetric Construction (MPVC) for building in Hong Kong.

At the end, Dr Pan called for participation of the attendees to the forum in a questionnaire survey to identify the level of urgency of strategies and measures for implementation for enhancing construction productivity in Hong Kong.
Plenary Session

Prof Sam Y.S. Chan
Associate Director
CICID, The University of Hong Kong

Biography

Prof Sam Chan, Associate Director of HKU Centre for Innovation in Construction & Infrastructure Development (CICID) and Adjunct Professor at the Department of Civil Engineering.

Prof Chan has over 40 years' experience working with clients, consultants and contractors in Hong Kong and the Mainland since graduation from the University of Hong Kong in 1973. He joined the civil service in May 1992 and was appointed Assistant Secretary in the Works Policy Unit of the Works Bureau in August 2001 on implementation of the CIRC recommendations relating to alternative procurement approaches, sustainable construction, life cycle costing, partnering, security of project payment, site supervision and project delivery. Prof Chan was posted to the Highways Department in August 2004, responsible for the planning, design and implementation of capital works projects. He served as a volunteer at the Development Bureau and provided professional advice and support to the HKSAR-funded reconstruction projects in Sichuan from January 2011 to April 2012.

As a Director of the Chinese YMCA of Hong Kong and Chairman of its Property Development and Management Committee, Prof Chan provides guidance on development projects and monitors the procurement system in facilitating the delivery of the Association's services. He also provides professional advice to church organizations and NGOs in the implementation of development projects. Prof Chan is a Member of the HKIE ADR Committee and Assessor for the HKIE Civil Discipline Professional Assessment.
Mr Ian Askew, Ir Conrad Wong, Mr Don Ward, Mr Rory Bergin, Prof Jennifer Whyte and Mr William Waller joined the plenary session moderated by Prof Sam Chan.

A number of questions and comments were raised by the audience. The following questions were asked during the plenary session.

**Q1: What do you think is the future of sensor technologies in the building sector? How we can monitor energy usage and control waste management etc.?**

Ir Wong: I think sensor technologies are getting better and cheaper. We need to know the objectives of installing sensors and how we can best use the data collected. If the data collected is not used for analytical and decision making purpose then there is no point how many sensors we have installed in a building.

Mr Askew: The technology is evolving very rapidly. The sensors are getting valued. The example shared by Mr Ho about deep excavation using sensors.

Prof Whyte: It is interesting question about generation of sensor technologies. There are some old sensors and new sensors. Again we need to know how the data collected will be used for monitoring and decision making purpose.

**Q2: Imperial College London has a new White City Campus? Would you tell us whether your department was involved within the project delivery of this new campus and to what extent?**

Prof Whyte: We were doing the research work. We were involved with student residential project. It was not built fully through modular construction but it does have quite a lot of offsite manufacturing.
Q3: We would like to learn about Modular Construction being used in the UK? Would you like to share your lessons learned and challenges faced during the construction of high rise modular buildings?

Mr Bergin: There was financial crises in the middle of the construction that has affected the projects. It is difficult to identify a particular challenge. In the UK, we have entrepreneurial culture and support which has helped a lot. We did not receive any government support. The projects were driven by private individuals. Initially we used offsite manufacturing for hotels and students hostels. Recently modular construction has been widely adopted for residential buildings. The market acceptance takes time. The construction cost has doubled during the last four to five years that has played a huge part in adopting new types of construction technologies.

Mr Waller: After the global financial crises, the clients are more interested in modular construction. Recently Legal & General Group\(^\text{18}\) has invested in modular construction. The group has built 550,000 sq ft factory in North Yorkshire and using volumetric assembly techniques. Legal & General Homes Modular works in close collaboration with clients to design and deliver precision-engineered accommodation modules, formed from cross-laminated timber panels. So there is some vertical integration.

Q3: What are the main challenges faced by your organisation for prefabrication?

Ir Wong: There are many challenges. For example, logistic issues and technical issues need to be solved. Public and private developers are still unwilling to adopt these new types of technologies.

\(^{18}\) [https://www.legalandgeneral.com/modular/](https://www.legalandgeneral.com/modular/)
Closing Remarks

Professor Mohan M. Kumaraswamy

Founding Director

CICID, The University of Hong Kong

Biography

Prof Mohan Kumaraswamy is now an Honorary Professor of The University of Hong Kong, having been based at HKU itself from 1992 to 2013. He has been a Visiting Professor at Universities in Singapore and Australia and an Adjunct Chair Professor at IIT Madras. Before joining full-time academia, he worked in the construction industry, mostly in Sri Lanka and also in Nigeria. He also led consultancies funded by international bodies.

His Civil Engineering Degree is from Peradeniya, Sri Lanka. He later earned M.Sc., Ph.D. and D.Sc. degrees from Loughborough University, UK. He contributes to many professional institutions and academia-industry-link bodies in Hong Kong, Sri Lanka and India, as well as the international research community. For example, he was Vice-Chairman of CIIOB Hong Kong in 1996-97 and Chairman of the HKIE Civil Division in 1997-98. He has served on Committees of the Hong Kong Works Branch, the PCICB and the CIC in Hong Kong. He is currently a Coordinator of the International CIB Working Commission on ‘Public Private Partnership’.

Mohan is the Founding Director of CICID, launched in 2002. Moreover, apart from serving on Editorial Boards of many international journals, he is Editor-in-Chief of the ‘Built Environment Project and Asset Management’ journal, launched through CICID in 2011.
I am not here to wind down today’s proceedings, but to wind you up for translating our discussions into action!

Yes, I invite you to ride further on the momentum from the exciting talks from our speakers and the interesting insights from the discussions at the plenary session.

After all, we are in the business of continuous improvements, and I hope today’s brainstorming will be seen as contributing to a step-change in our improvements trajectory in productivity improvements.

Reverting to today's talks, I will not dare try to summarise in a few minutes, what each speaker conveyed in their inspiring talks. What struck me is, as happens in really well-organised conferences such as this, is how these all fitted so well together in a powerful package to neatly target today’s theme of 'SHAPING A MORE PRODUCTIVE CONSTRUCTION INDUSTRY'.

Some of you may know about, or even have benefitted from attending, the previous CIC-HKU International Consultation Forum on this CIC-funded project just last month i.e. in March, where the theme was on "STRATEGIES FOR ENHANCING CONSTRUCTION INDUSTRY PRODUCTIVITY".

Well, to recap, today's CIC-HKU forum complements this well, with its focus on comparisons with the cutting-edge thrusts in this field in the UK, whereas we compared with the leading initiatives in SINGAPORE in the previous forum last month.
Although I am no boxer, I guess you could say that we have deftly attacked the Productivity problem with a traditional one-two punch - or a left jab followed by a right cross, or is it an Eastern jab followed by a European punch. So we may look forward to a knockout victory in the current battle of the on-going Productivity war - when we get the final report from my colleague Dr Wei Pan and his team!

In other words we look forward to a road-map for a step-change that of course must be implemented, if it is to be useful. The organisers also wish to convey that the summarised Proceedings of today's session, as well that of the March session will soon be uploaded to the CICID web-site.

I should add that we are also planning a Special Issue of an International Journal to disseminate the innovative concepts and better practices, in detailed papers that will be developed after the discussions at these two international fora. Since this is an International forum, I wish to mention two examples from elsewhere, for comparison:

1. At international level: The Global Leadership Forum in Construction Engineering & Management (GLF-CEM) is developing a set of KPIs for measuring and benchmarking performance in the Construction Industry, in Construction Research and across CEM Courses themselves.

2. In a recent exercise which I initiated when visiting University in India over the past 2 years, the ‘Construction Industry Improvement Initiative India’ mobilised six Action Teams, with the 1st one being on Key Performance Indicators (KPIs). This aims at KPIs to measure performance, including ‘productivity’. Those interested can download the Draft White Paper on KPIs from www.Ci3.in – btw Ci3 stands for what we have proposed to set up: ‘Construction Industry Institute India’.

I should add that in Hong Kong too, we have an almost completed CIC sponsored project, led by our colleague Prof Thomas Ng, on revisiting and revising the KPIs that we use here. Both of these exercises, i.e. in Hong Kong and India are contributing to the GLF-CEM initiative – where we have also proposed a Global Initiative to benchmark performance through GLF-CEM.

I conclude by conveying our sincere thanks:

- to all speakers – for generously shared their knowledge and expert & exciting insights;
- to the organisers for making this possible, specially to Dr Wei Pan who is leading this whole exercise so brilliantly, and to his Project Manager Dr Arshad Javed whose name you would have learnt from the emails we received on this forum, and of course to the rest of the team;
- to the supporters for their strong support; and
- to all participants for making this worthwhile.

Thank You!
About the CICID

The Centre for Innovation in Construction & Infrastructure Development (CICID) was established in 2002 by the Department of Civil Engineering of The University of Hong Kong. The aim is to foster continuous improvements, while targeting excellence in the construction industry in general and infrastructure development in particular, through the development of innovative strategies and techniques. The objectives include (a) to develop an internationally recognised 'Centre of Excellence' for research, discourse and dissemination of innovations in infrastructure and construction engineering & management, and construction industry development methodologies; and (b) to encourage and support interdisciplinary research into planning, implementing and evaluating construction projects including mega-project infrastructure programmes. For more information visit [http://www.civil.hku.hk/cicid/](http://www.civil.hku.hk/cicid/).

Research themes


**Construction Industry Development Thrusts** – Reviews of Overseas and Local Industry Development Strategies and Initiatives, Building Supply Chain Capacities for Sustainable Development, Formulation of Strategies and Measures for Medium and Long-term Development of Personnel, Groupings (e.g. Small & Medium Contractors) and Institutions, including Construction Organisations and Facilitating Bodies.
Research projects

HKU being a world-class institution in research has put significant emphasis on applied research and knowledge transfer. The Department of Civil Engineering of HKU has been working very closely with the construction industry to help solve practical issues. The Department of Civil Engineering through CICID has identified the key areas of research of project delivery, construction informatics and low carbon construction and set up three relevant Task Forces under CICID to address these important topics. Some examples of recent research projects are listed below:

- A comprehensive productivity appraisal of the Hong Kong construction industry
- Assessing the performance of the Hong Kong construction industry, KPI: an international comparison
- An Exploration of Lean Construction Standards and Tools for Improving Productivity in Hong Kong Construction Industry
- Implications of optimising prefabrication for the life cycle carbon emissions of high-rise residential buildings in Hong Kong
- A Possible Zero Carbon Building Policy for Hong Kong: Opportunities, Risks & Recommendations
- Carbon Emission Modelling of Energy Systems for Retrofit Office Buildings
- Hong Kong ‘Zero Carbon Building Partnership’ for Enhancing Public and Stakeholder Engagement
- Feasibility of Delivering High-rise Low / Zero Carbon Buildings in Hong Kong
- Opportunities and challenges of utilizing automated and robotic technology for sustainable building construction: scenarios, stakeholders and technology transfer
- Equipping Construction Professionals with Novel Project Delivery Concepts to Meet the Emerging Challenges of Construction Development in Hong Kong
- Review of Performance on the Use of New Engineering Contract (NEC) in Drainage Services Department (DSD) of HKSAR Government
- A Dynamic Balanced Scorecard / Gap Analysis Model for Subcontractor Appraisal
- Fuzzy Case-Based Reasoning Approach Applied to Subcontractor Registration
- A Comprehensive Policy Framework for Public Private Partnerships Schemes in Hong Kong
- Public Private Partnerships in Infrastructure Development
- A Social Network and BIM Enabled Collaboration System for Residential Building Refurbishment
- A Strategic Smart Dynamic Decision Model for Major Infrastructure Development Projects in Hong Kong
- An Agile Big Data Centered Inter-network Infrastructure Asset Management Platform
- An Ensemble Framework for Improving the Resilience of Built Environment in a Community
• An Image-Driven Integrated Approach to Construct IFC-based As-Is Building Information Models of Existing Buildings for Operations and Maintenance and First Response
• Development of Green Building Product Labelling Scheme in Hong Kong
• Establishing an Accreditation Framework for Qualifying Skilled Workers for Hong Kong Construction Industry
• Forecasting the Demand and Supply of Site Supervisory Personnel, Technicians and Professionals in Hong Kong Construction Industry
• Integrated Smart High-rise Building Energy Modelling
• Sustainability Information Modelling for Project Lifecycle Environmental (SIMPLE) Appraisal in Construction

Photographs are courtesy of Sanyuan Niu and Long Chen