PILLARS

We shape a **safe**, **high quality**, **sustainable** and **friendly** built environment | JULY 2016

CENTRE FOR LEAN & VIRTUAL CONSTRUCTION
THE INNOVATIVE WAY TO GREATER PRODUCTIVITY

ENGINEERING FEATS
ENERGY-EFFICIENT SOLUTIONS

ADVERTISING SIGNS
KNOWING THE GUIDELINES

LEADING THE CHARGE

Building and Construction Authority

CONTENTS

PUBLISHER

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52 Jurong Gateway Road
#11-01 Singapore 608550
Contact centre: 1800-3425222
For overseas calls: +65 6534 0219
Fax: +65 6334 4287
Website: www.bca.gov.sg

BCA EDITORIAL COMMITTEE

Editorial Advisor
Leong Ee Leng & Kong Yuqi

Editors
Hafiza Yussaini & Rena Pang

Contributors
Nurhadhinah Osman, Victor Tan, Tracy Toh, Cameron Ng, Ryan Hong

PUBLISHING AGENT
ThinkFarm Pte Ltd

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Building and Construction Authority

DEAR READERS,

Last year marked a decade of sustainability efforts by the built environment sector since we first launched the BCA Green Mark scheme in 2005. We commemorated this milestone with a limited edition Green Mark 10th Anniversary book, titled "Realising Singapore's Green Building Dream: Towards a Future-Ready Built Environment". Today, over 31 per cent of our buildings have been greened in terms of gross floor area, making Singapore one of the greenest cities globally.

Apart from driving the green building agenda in Singapore, BCA is also playing an increasingly critical role in transforming the built environment. To drive innovation and the research agenda in the built environment sector, BCA formed two new research and innovation centres, namely the Built Environment Research and Innovation Institute and the Built Environment Technology Centre. Read our cover story to find out more about what these centres do.

Another initiative that we have rolled out to boost innovation in the built environment sector is the launch of the Centre for Lean & Virtual Construction. The centre aims to provide a training ground for the sector to test out latest technologies, including Virtual and Augmented Reality tools, that would save time and boost efficiency at construction sites. Earlier this year, our sector achieved a significant milestone in construction productivity as Singapore's first public Prefabricated Prefinished Volumetric Construction (PPVC) project was officially announced. We were able to witness how building construction can be done with less manpower on-site and within a shorter time, with less noise and dust generated at the same time.

BCA is also focusing on building up the talent pool within the industry through education and training. The BCA-Industry Built Environment ITE Scholarship is in place to provide a structured development path as well as on-the-job-training for the students. This is coupled with attractive starting salaries and clear progression paths after graduation. We hope that this scholarship, which is given out in partnership with industry firms, will attract more young people to join the built environment sector which is transforming into an advanced and progressive sector.

Dr John Keung
Chief Executive Officer

BUILDING THE FUTURE

Youth explore exciting new career options in the built environment sector at the recent BCA Academy Open House.

Above: The BCA Academy's new Academic Tower.

On 15 January, the BCA Academy welcomed close to 500 students from local secondary schools, Institute of Technical Education, and members of the public keen on pursuing an education and career in the rapidly expanding built environment sector.

It was eye-opening for the students who engaged in activities in different parts of the premises. Visitors were offered a glimpse into student life at the basketball court on Level 6, while levelling and drone flying demonstrations were performed at the pavilion.

The tour also included stops at the design studios and the Centre for Lean & Virtual Construction (CLVC), where the industry can utilise the latest technologies including virtual and augmented reality for early identification of issues with the proposed building plans. The students also got to see, touch and experience 3D printing at the Construction Productivity Gallery (CPG).

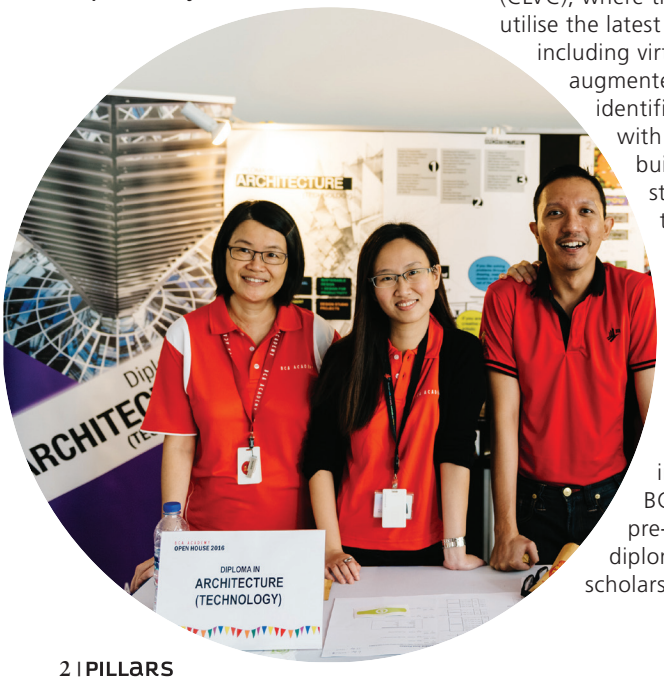
During the Open House, the students were introduced to the BCA Academy's pre-diploma and diploma programmes, scholarships and options for further studies. Lecturers also interacted with the students and answered their queries during the talks and at the course consultation booths.

Particularly interested in Diploma in Design (Interior and Landscape), was Boon Lay Secondary School student Conrad Lim,17, who shared, "I took D&T (Design & Technology) in school. I didn't know there are design courses in BCA. It will definitely be one of my choices."

The BCA Academy, the education and research arm of Singapore's Building and Construction Authority (BCA), works closely with industry players and keeps updated with trends and changes in the trade. It focuses on a practice-oriented curriculum which ensures its students are not only equipped with theoretical knowledge, but also practical expertise.

Today, new developments and advancement in technology are slowly changing the public's

BCA Academy staff at the open house introducing the programmes and courses provided by the school.



Visitors were greeted with big smiles from BCA Academy's student councillors and student guides.

The BCA Academy houses both modern learning facilities (left) and leisure amenities (below).

perspectives about the work environment of the construction industry. Jobs that did not exist a decade ago are now available and in strong demand.

Find a new calling

For example, due to the increasing awareness of environmental sustainability, there are great job opportunities for professions such as Sustainability Officer, Green Mark Manager, Energy Auditor and Facilities Consultant.

An increasingly ageing population in Singapore also means that there is a greater need for Universal Design (UD) in buildings – that is, to incorporate a wide range of user-friendly features that cater to the needs of people of all ages and abilities, including the young, elderly and persons with disabilities.

One of the students who participated in the tour, Fasihah,17, said, "The diplomas offered at the BCA Academy are very interesting and are comparable to the polytechnics. I only knew about the courses and the shortage of manpower in Quantity Surveyors today!"

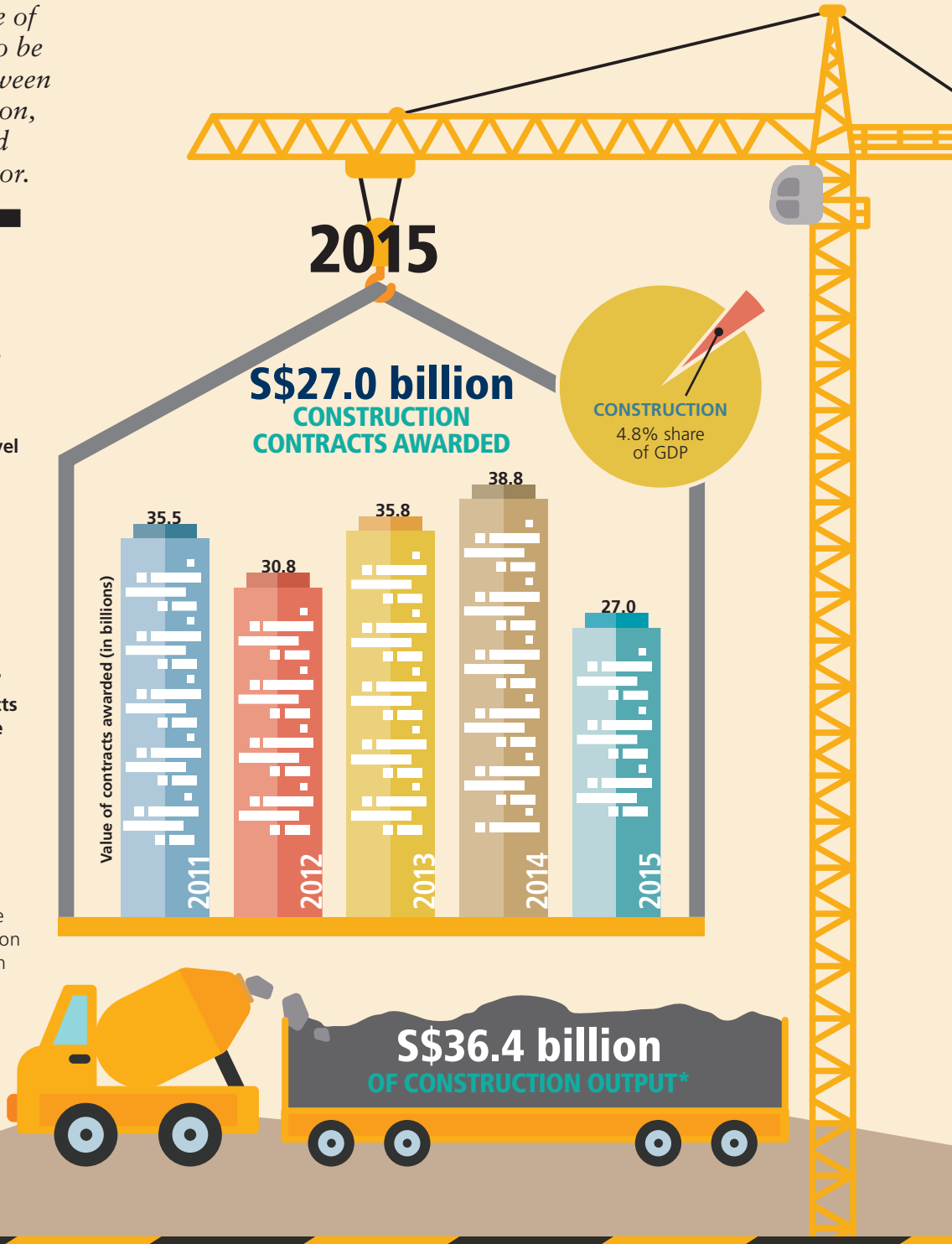
Bottom left and right: Students' queries were answered by lecturers during talks and at the consultation booths.

CONSTRUCTION PROSPECTS AT A GLANCE

The total projected value of construction contracts to be awarded this year is between $27 billion and $34 billion, with 65% of the demand driven by the public sector.

This year, construction demand from the private sector is expected to slow down from previous years due to less favourable economic conditions and an increased supply of completed private housing projects and offices. However, this is supported by a higher level of construction demand from the public sector, largely due to an increase in civil engineering projects. If the forecasted estimates for 2016 are met, this will be the highest proportion of construction demand from the public sector since 2002. Last year, the total construction demand was approximately $27 billion, with public sector projects accounting for about half of the total construction demand.

The average construction demand is expected to sustain between $26 billion and $35 billion in 2017 and 2018, and $26 billion to $37 billion in 2019 and 2020. BCA estimates public sector construction demand to be between $16 billion and $20 billion annually from 2017 to 2020, with about 60% of the total demand coming from building projects and the remaining from civil engineering projects.



2016
S$27-34 billion
WORTH OF CONSTRUCTION CONTRACTS TO BE AWARDED

CIVIL ENGINEERING
S$10.7-12.9b
Both public and private sector demand to increase, supported by major infrastructure projects

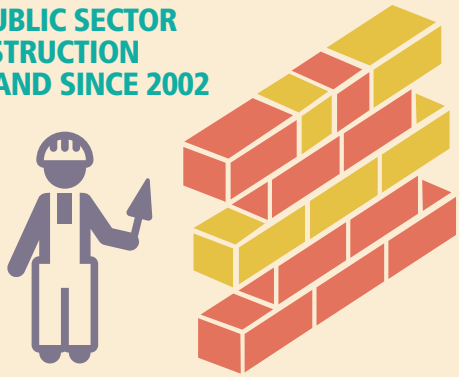
RESIDENTIAL
S$6.6-8.1b
Increase in public housing demand due to ramp-up in Home Improvement Programme to offset slowdown in private residential demand

INDUSTRIAL
S$4.0-5.4b
Private sector demand to moderate due to uncertain economic outlook but supported by an increase in public industrial projects

INSTITUTIONAL & OTHERS
S$3.9-5.2b
Total demand to moderate, with the bulk of demand coming from the public sector

COMMERCIAL
S$1.9-2.5b
Remain subdued but supported by upcoming asset enhancement projects and construction of mixed developments

HIGHEST PROPORTION OF PUBLIC SECTOR CONSTRUCTION DEMAND SINCE 2002



PRIVATE SECTOR
35%

PUBLIC SECTOR
65%

CONSTRUCTION OUTPUT* TO MODERATE BETWEEN
S$32-34 billion

Key projects

- Home Improvement programme for HDB flats
- New National Cancer Centre
- State Courts' new building
- JTC's Integrated Logistics Hub
- PUB's water reclamation and sewerage projects
- Changi Airport's 3-runway system
- Improvement works to PIE and KJE
- Remaining Thomson-East Coast MRT line contracts

2017-2018
S$26-35 billion

AVERAGE VALUE OF CONTRACTS TO BE AWARDED EACH YEAR

2019-2020
S$26-37 billion

*Construction output is measured in terms of certified progress payments for work done

LIFE-SIZE LEGO LAND

Prefabricated Pre-Finished Volumetric Construction (PPVC) will play an instrumental role in the future of the built environment sector.

In January, Deputy Prime Minister Tharman Shanmugaratnam visited the construction site of Nanyang Technological University's (NTU) new residential halls at North Hill to witness Singapore's first public high-rise structure erected using a new "Lego-style" building method.

Known as PPVC, this method enables prebuilt rooms – complete with interior fixtures – to be stacked into a building on-site. With PPVC, manpower can be cut by 25 to 40% and construction time by 15 to 20%.

The North Hill halls, formed by six blocks of 13-storey residential units, will house more than 1,850 students. Slated to open in mid-2016, the complex has been recognised with the Green Mark Platinum award, the highest-tiered honour for sustainable building design awarded by BCA.

Although PPVC is 18% more costly than conventional concrete construction, DPM Tharman, who is also the chairman of the National Productivity Council (NPC), said costs could be curtailed over time as more suppliers come on board. "The public sector is taking the lead in building up demand. The process involves more high-tech jobs in manufacturing the rooms and fewer low-tech jobs on the construction site. We are going to be short of manpower for the long term; we want to offer higher quality jobs and this is the way to go," he added.

BENEFITS OF PPVC

- **Boosts productivity and shortens construction time. Construction cycle of each floor usually takes 14 to 21 days. With PPVC, the duration was shortened to just four days for the NTU project.**
- **Workplace safety is improved as most of the mechanisation and prefabrication processes will take place in a factory controlled environment.**
- **Less vehicular trips to the site; and less noise and dust to the surroundings.**

Guest of honour Tharman Shanmugaratnam, Deputy Prime Minister & Coordinating Minister for Economic and Social Policies, visiting the construction site of the North Hill halls.

Future of PPVC

MND and BCA set up the Building Innovation Panel (BIP) together with other statutory boards to assist firms in receiving multi-agency evaluation of innovative design, new construction methods, processes (including PPVC) and materials that will improve project productivity.

ASSEMBLY OF PPVC MODULES ON SITE


1


2


3


4

LEADING THE CHARGE

The BCA has recently undergone organisational restructuring to step up efforts in maintaining building safety and creating a future-ready built environment in Singapore.

Left: Mr Chin Chi Leong, Acting Deputy CEO for Building Control

Right: Mr Neo Choon Keong, Acting Deputy CEO for Industry Development

With effect from 1 April 2016, there have been several changes to the organisational structure and management appointments in the Building and Construction Authority (BCA). These changes will enhance BCA's drive towards leading change in the built environment sector.

Mr Chin Chi Leong, Acting Deputy CEO for Building Control

In his new role as Acting Deputy CEO for Building Control, Mr Chin will oversee the regulatory functions and building control policies pertaining to the life cycle of a building, from design and construction to maintenance. Mr Chin is also Commissioner of Buildings and Commissioner of Amusement Rides Safety.

"Building safety will continue to be the priority. As our built environment becomes more dense, we will adapt by building taller and deeper. Thus, it is important for us to remain vigilant and ensure that the works do not affect buildings in the vicinity. Some of the main priorities include safety of lifts, inspection of facades, greater coordination among approving agencies for building plan submissions, and enhancement of the Building Maintenance and Strata Management Act," says Mr Chin.

Mr Neo Choon Keong, Acting Deputy CEO for Industry Development

As Acting Deputy CEO for Industry Development, Mr Neo will provide strategic direction to transform the sector into a future-ready one. He will also examine factors essential for the continued growth of the sector, such as environmental sustainability, construction productivity, firm capabilities and industry workforce competence.

"In the last decade or so, we have stepped up our concerted efforts in championing the advancement of the built environment sector. Going forward, we need to double our efforts to reduce the built environment's carbon footprint through overcoming challenges in greening buildings and increasing end-user engagement. We will also transform the sector and change the way we build by achieving higher construction productivity, while maintaining high workmanship quality. At the same time, we are raising the professionalism and competency of the industry firms and workforce." reiterates Mr Neo.

SHAPING THE FUTURE

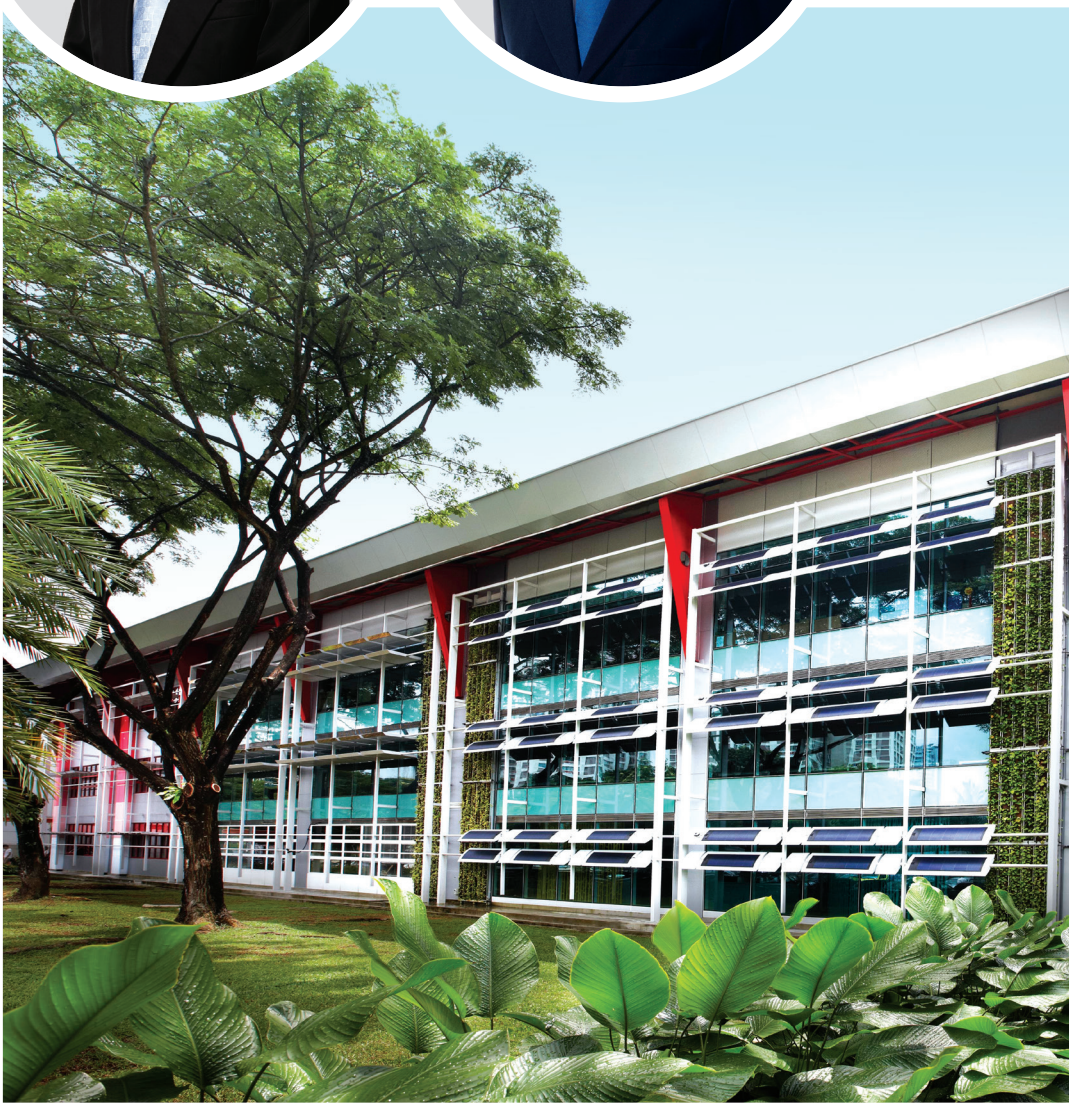
BERII and BETC, BCA's research and innovation centres, are gearing up to devise technological and innovative solutions for a future-ready built environment.

From left: Managing Director of BERII, Er. Lam Siew Wah and Managing Director for BETC, Er. Ong See Ho.

As Singapore looks at establishing a future-ready built environment, research and innovation are vital in driving these efforts. In order to spearhead this, BCA has instituted two new research and innovation clusters, the Built Environment Research and Innovation Institute (BERII) and the Built Environment Technology Centre (BETC).

As Managing Director of BERII, Er. Lam Siew Wah will be leading the team to drive the planning and implementation of research and development in the areas of green building, construction productivity and quality as well as construction information technology. Previously, Er. Lam led the development of the Green Mark scheme and the three Green Building Masterplans, which is continuing the growth of green buildings in Singapore.

BETC will be headed by Er. Ong See Ho, the former Commissioner of Building Control. He will undertake research for the Geological and Underground Projects Department, the Coastal Protection Department, the Projects Management Department and the Smart Nation programmes.



Left: With the introduction of Prefabricated Prefinished Volumetric Construction (PPVC), there will be less noise and dust at construction sites as more activities are done off-site.

The rooftop garden and solar panels at the Zero Energy Building.

Left: The Zero Energy Building (ZEB) at BCA Academy will be further upgraded and enhanced to test-bed more advanced technologies.

Below: The BCA Skylab will be the world's first high-rise rotatable laboratory for the tropics, where energy-efficient technologies could be tested at any orientation to the sun and wind.

Green Building Solutions

Driving green solutions in the industry will be a big part of BERII's agenda. BERII will look into researching more energy-efficient solutions.

It will also study building occupier well-being parameters and incorporate suitable findings into the Green Mark scheme. On top of that, BERII will draw up specific plans to implement positive energy low rise, zero energy medium rise and low energy high rise buildings.

Construction Productivity

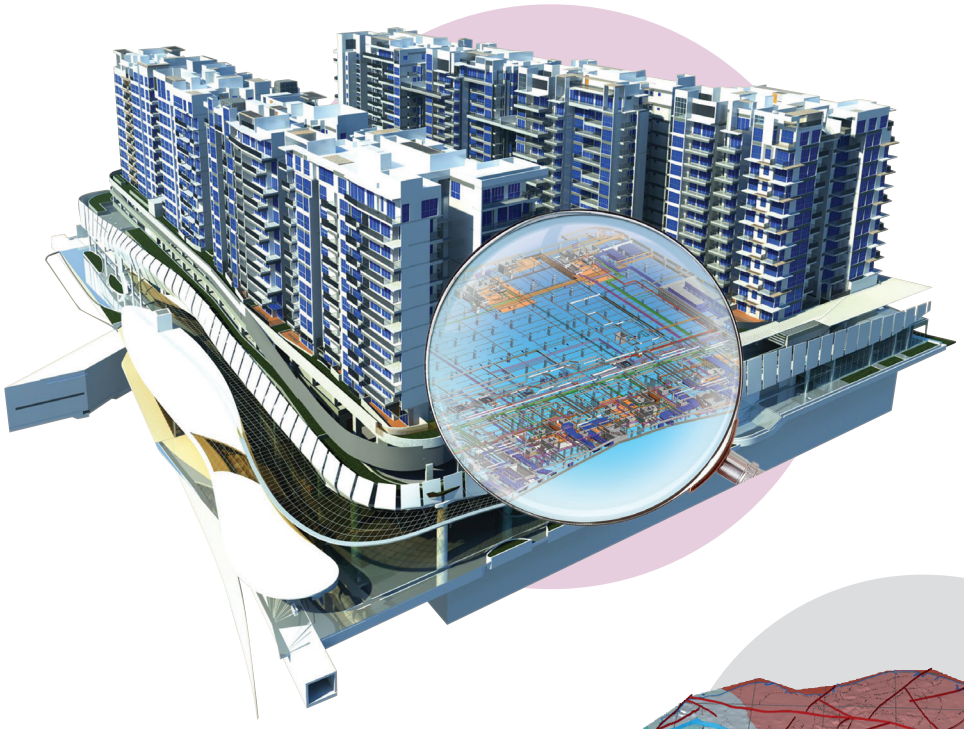
Another R&D area BERII will focus on is construction productivity and quality. Advanced new methods, materials and technologies are being introduced which will substantially reduce manpower; however, these solutions need to be adapted to our dense, high-rise and tropical built environment.

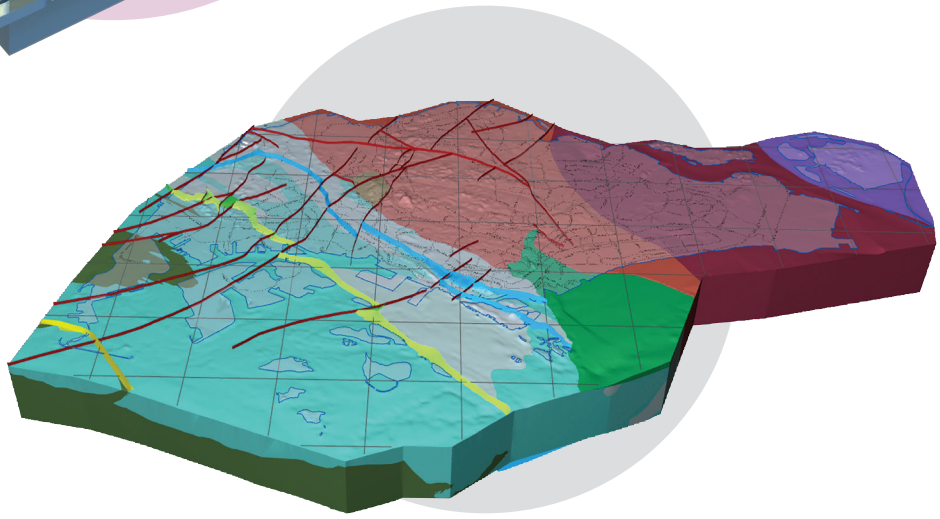
BERII will partner with industry and research institutes to meet challenges in these areas and enable new solutions to be found, developed and piloted. It will carry out tests and test bedding, so that the industry has more assurance and confidence in adopting new technologies and systems in order to achieve both the green building and productivity objectives.

IT Solutions

A third key objective is harnessing information and communications technology to promote a more integrated approach towards building projects.

The institute has initiated research projects to address current challenges in adopting new technologies and systems such as high strength concrete or steel hybrid structure, improved corrosion protection for steel-framed Prefabricated Prefinished Volumetric Construction (PPVC), feasibility of tropical timbers for cross-laminated timber, and the performance of current cross-laminated timber for fire and termite attack.





Left: Building Information Modelling (BIM) is a three-dimensional modelling computer technology that facilitates digital exploration of the building project and earlier identification of issues before actual construction.

Below: The Singapore 3D geological model is a tool which is used to better understand the general distribution of Singapore's geology and underground rock condition.

Underground Development

BETC will look into three areas: underground development; coastal protection and project management; as well as smart nation initiatives.

To support the government's efforts to develop an Underground Masterplan, BETC will conduct deep borehole drilling (200m deep) to get samples for geological information and develop a 3D geological model of Singapore. This will help the industry determine suitable areas for the development of underground space.

Coastal Protection

With most of Singapore being within 15m above sea level and 30% of our island being less than 5m above sea level, any additional increase caused by climate change is an immediate threat.

Protecting our coastline is one of the BCA's efforts in dealing with the effects of climate change.

In planning for the future, BETC researches and develops Singapore's coastal engineering capabilities which will contribute to the development of appropriate coastal protective measures. For a start, the Centre is conducting a Coastal Adaptation Study (CAS), which aims to safeguard Singapore's long-term coastal protection needs and is expected to be completed by end 2017.

Smart Nation

Smart Nation is another national initiative BETC will support.

We will explore ways in which Information and Communications Technology (ICT) can be used to enhance productivity and support the dissemination of useful information, such as accessible places, to the public.

FIRST VIRTUAL, THEN REAL

The Centre for Lean and Virtual Construction is a training ground for the built environment sector to learn about the latest 3D immersive technologies.

The facilities at the Building and Construction Authority's (BCA) newly opened Centre for Lean & Virtual Construction (CLVC) resemble a gaming hideout.

However, instead of being used for games, these immersive and experiential technologies will help to improve collaboration and productivity in the built environment sector.

Officially opened on 21 December 2015 by Mr Desmond Lee, Senior Minister of State for the Ministry of Home Affairs and Ministry of National Development, the one-stop centre allows industry players and academics to test-drive new technologies. CLVC is the first of its kind in Singapore and the first large-scale learning facility for Virtual Design and Construction (VDC) in Southeast Asia.

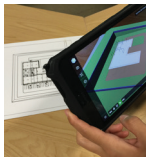
The CLVC is located at BCA Academy's Zero Energy Building on Braddell Road, and contains seven experiential zones.

Peering through the lens of the future: Guest-of-Honour, Mr Desmond Lee (second from right), together with BCA CEO Dr John Keung (in grey) and invited guests at CLVC's opening, put on 3D glasses to experience one of the immersive technologies.

INTRODUCING THE ZONES

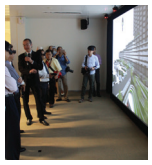
Zone 1: Dynamic Exhibition
Showcases CLVC's objectives, capability and set-up and provides a flexible space that can be used for various purposes.

Zone 2: Virtual Design and Construction (VDC)
Here, team players can congregate virtually to plan and discuss a project. High-spec computers with the latest Building Information Modelling (BIM) software are connected directly to two large Smart Boards to facilitate discussions.



Zone 3: Augmented Reality/Virtual Reality (AR/VR)
AR tools allow an intuitive control of physical plans to manouevre 3D plans while VR tools enable a virtual visualisation of building projects.

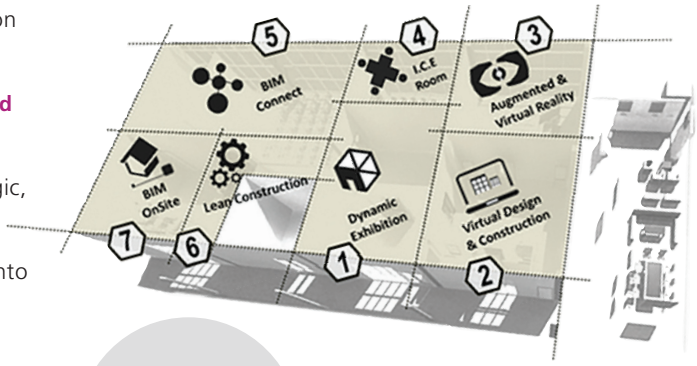
Zone 4: Integrated Concurrent Engineering (ICE)
Facilitates strategic, concurrent decision-making. 2D drawings can be translated into 3D models using instantaneous navigation and simulation on multi-touch screens. Designs are approved instantaneously electronically.



Zone 5: BIM (Building Information Modelling) Connect
Offers virtual reality on a giant screen with 3D glasses, with the immersive experience of walking through a building, which may still physically be under construction.

Zone 6: Lean Construction
Promotes the concept and benefits of lean construction, which seeks to maximise value and minimise waste.

Zone 7: BIM Onsite
Serves as a simulated on-site setting for BIM to Field and Field to BIM. From the Field to BIM, there is a 3D scanning of the physical construction site.



Overall floor plan of the Centre for Lean & Virtual Construction, showing the seven different zones.

MANAGING THE ZONES

CLVC consultants on their roles:

Jusuf Anggono, Senior BIM Consultant, conceptualised the CLVC and sourced for the new technologies installed at the centre. He organises visits to educate the industry about the centre and its capabilities.

Mr Anggono: "My role is to manage the centre, liaise with the visitors, book rooms for rentals and project meetings for those in the industry who want to use the centre."

Senior BIM Consultant Pong Woon Wei is responsible for presenting content at the Dynamic Exhibition space.

Mr Pong: "The space is open for flexible usage. Other spaces like BIM Connect also allow for a better immersive experience."

Marianne Amores, BIM consultant, manages VDC, and conducts workgroups with BIM managers to brainstorm ideas on how the zone can be fully utilised by the construction industry.

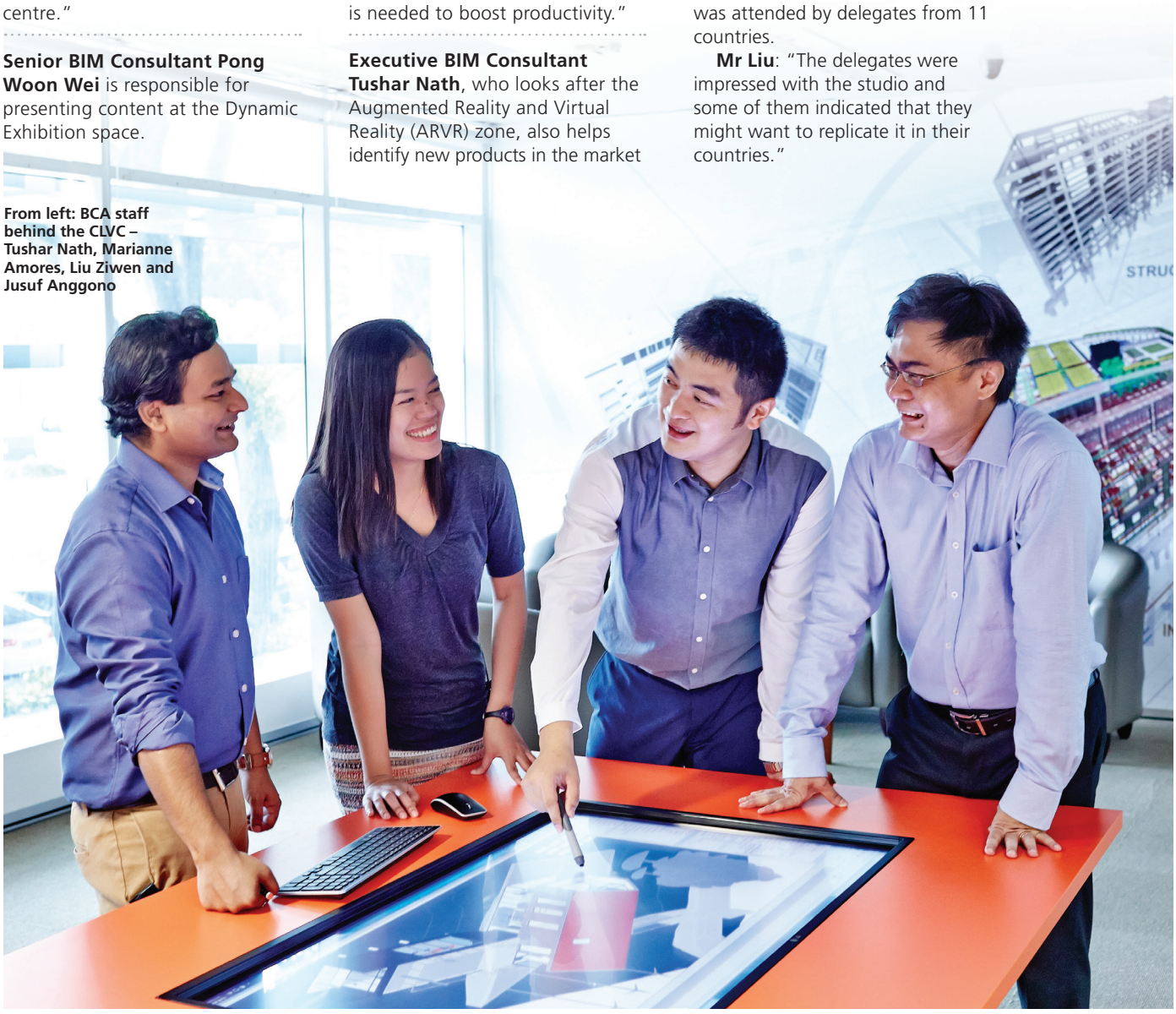
Ms Amores: "The purpose of VDC is to improve collaboration between project team members and members of the industry. This is needed to boost productivity."

Executive BIM Consultant Tushar Nath, who looks after the Augmented Reality and Virtual Reality (ARVR) zone, also helps identify new products in the market for the centre like the Microsoft HoloLens.

Mr Nath: "Not many young people are interested in joining the construction industry, so it's important to show them that there are a lot of new things out there like gaming technologies."

Executive BIM Consultant Liu Ziwen, co-manages the ARVR. He points out its usefulness in the planning of a shaft, which is hard to access physically. He has also helped organise a symposium which was attended by delegates from 11 countries.

Mr Liu: "The delegates were impressed with the studio and some of them indicated that they might want to replicate it in their countries."



From left: BCA staff behind the CLVC – Tushar Nath, Marianne Amores, Liu Ziwen and Jusuf Anggono

Left: Senior Minister of State Mr Desmond Lee tries out a Virtual Reality tool at the Centre's AR/VR zone.

Right: Taking a tour without breaking a sweat – Guest of honour Mr Desmond Lee (right) "walking" into a life-size virtual model with Dr John Keung (centre) at the Centre's BIM Connect zone, to visualise the facilities and structure of an actual building-under-construction.

TESTIMONIES FROM THOSE IN THE INDUSTRY

"ICE demonstrates how, with clear graphic visualisation and simulation, good design solutions and stakeholder approval can be attained more effectively among management and heads of departments."

Vivien Heng, Director, RSP Architects, Planners & Engineers has used ICE and the BIM Connect room.

"It is helpful to have the various tools and equipment in one location – all tested and ready to use – where architects and the project team can test out collaborations and experience for themselves more accurate and reliable solutions."

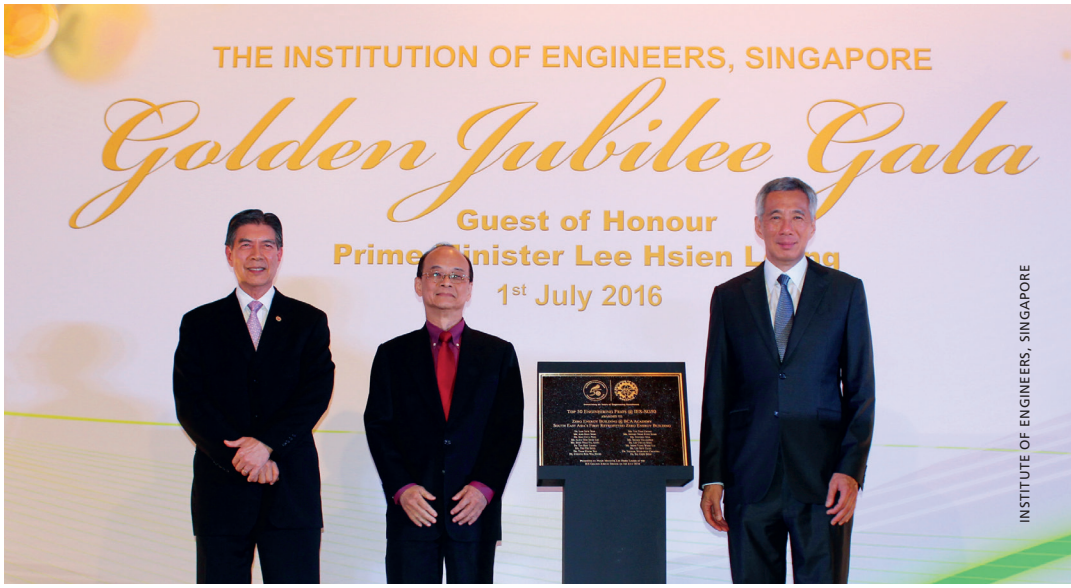
Vivien Heng, on BIM Connect.

"On-screen projection with a Smart Board stylus enables users to think, comment and draw on the go. It is less restrictive compared to paper. I plan to use Smart Boards in my organisation to improve efficiency and record comments more effectively."

Ricky To, VDC Lead from M+W Group, a project management company, has used the Smart Board to present, share and record ideas.

ENGINEERING OUR FUTURE

In the Engineering Feats @IES-SG50 contest, BCA Academy's Zero Energy Building emerged as a winner.



In July last year, the Institution of Engineers, Singapore (IES) launched a national competition to recognise the top 50 engineering achievements that have generated the biggest economic, infrastructural or societal effects on our country.

The competition – Engineering Feats@IES-SG50 – invited the public to vote for these projects, systems and products.

BCA's Zero Energy Building (ZEB) made the top 50 list of those with the highest number of votes.

The winners were announced at the IES Golden Jubilee Gala Dinner on 1st July 2016 and received awards from the guest-of-honour, Prime Minister Lee Hsien Loong.

The contest highlighted the role of engineering in the transformation of Singapore since independence and was a novel way for Singaporeans to understand the role of engineering and learn about breakthroughs in aerospace, built environment, defence and security, infrastructure, manufacturing, infocommunications, leisure, medical, marine and transport.

Top: Prime Minister Lee Hsien Loong (right) presented the award to Er. Lam Siew Wah (centre), Managing Director of BCA's Built Environment Research and Innovation Institute, at the IES Golden Jubilee Gala Dinner. Also in the photo is Er. Edwin Khew (left), President of IES. Left: The Zero Energy Building.

ZEB NAMED ONE OF SINGAPORE'S TOP 50 ENGINEERING FEATS

Zero Energy Building (ZEB) at the BCA Academy is Southeast Asia's first ZEB that was retrofitted from an existing building, marking a milestone in Singapore's journey towards a sustainable built environment. A fully functional R&D and education facility that houses more than 100 staff and students, this three-storey structure consumes as much energy as it produces by using energy-efficient and renewable technologies.

The 4,500sqm ZEB taps on natural ventilation and lighting through design features like solar chimneys and light pipes.

It is a testbedding facility for green building technologies of the future.

GREEN IS THE NEW BLACK

Graduates of BCA-UCL Master of Science in Facility and Environment Management Programme share how the course has boosted their career and confidence.

To address the threats of global climate change, there has been increased emphasis on sustainable construction in Singapore and around the world. As the demand for qualified facility management professionals to operate and maintain these green buildings strengthens, there is a growing number of career opportunities as well as broader job scopes.

Jointly developed by University College London (UCL) and the Building and Construction Authority (BCA), the Master of Science in Facility and Environment Management Programme not only allows students to enhance their skills and knowledge, but also gives them exposure to practices and technology adopted in Europe.

This programme is part of BCA's Green Building Masterplan to groom 20,000 green collar workers by 2020, so as to have a sizeable workforce to support the national target of greening 80% of all buildings in Singapore by 2030.

A Wider Job Scope

A 35-year facilities management veteran, Mr Eric Leung, 61, who currently works at ASM Technology Singapore as Corporate Facilities Director, challenged himself to take up the MSc programme two years ago. Mr Leung now oversees the operations and strategic planning of the company's building services in Singapore, Malaysia, Hong Kong and China, and is more inspired than ever to remain updated with the latest concepts of facility management.

How do you feel about being the oldest student to be enrolled in this programme?

It gave me extra motivation to perservere through the gruelling two-year period where sleep was often compromised for passion. While it was tough juggling work, life, study and family, I have no regrets about signing up for the course as it helped to broaden my understanding of facilities management and the crucial role it plays in today's world.

How has your job scope changed over the years?

In the past, the focus was only on the key facilities for daily operations such as air-conditioning and electricity supply. Now, my job includes other areas of work previously not thought to be part of facilities management. This includes introducing incentives to encourage colleagues to engage in environmental friendly behaviour.

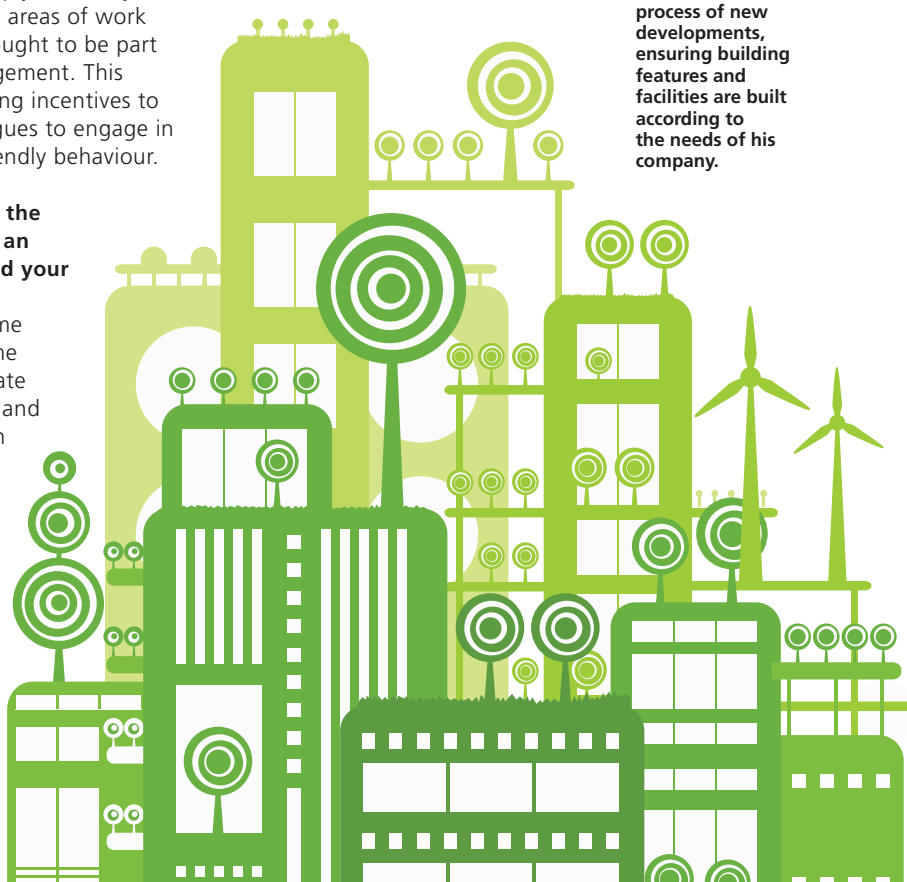
In what ways did the programme have an impact on you and your career?

I have since become an advocate for the fight against climate change. My team and I are constantly on the lookout for energy-efficient solutions in our production processes. Our contributions may not be as significant as what is being done on the global level, but we will do our best as facilities managers to help protect the environment.

What are your thoughts on this growing sector?

I hope facilities management will become a highly sought-after career of the next generation, especially after witnessing how the profession has garnered a wider and more important scope of duties over the decades.

As Corporate Facilities Director, Mr Leung takes charge of the company's strategic development, including the construction process of new developments, ensuring building features and facilities are built according to the needs of his company.



Doing a 'Man's Job'

Ms Norfizah Selemat, 39, who was named valedictorian of the MSc programme, has over 15 years of experience in the facilities management line. Her role as Senior Regional Facilities Manager (Asia Pacific) for ICAP Management Services Pte Ltd requires her to ensure that the facilities are well-functioning at all times.

What are the challenges of your job?

A careless mistake by the facilities management team can result in serious consequences for the company. In a brokerage firm, even a power trip that lasts for only a second can give rise to a substantial loss.

Only two out of 13 graduates in your cohort are female. What inspired you to pursue a male-dominant course?

The facilities management field itself is male-dominant. It takes plenty of courage and determination to prove that I am capable of doing a "man's work". But I am glad to see more females entering this line.

What is the most important takeaway from the programme?

Facilities management is ever-changing. I have to keep improving and take steps to catch up with the latest developments. I hope to get as much work experience and academic upgrading as I can, so I can make even greater contributions in this field.

In what ways has the programme had an impact on you and your career?

Facilities management can be a fairly thankless job, but it makes me happy when the office that I maintain is doing well, and when my colleagues are satisfied with their work environment. I have also encouraged my team members to upgrade themselves.

> **"Facilities management is ever-changing. I have to keep improving and take steps to catch up with the latest developments. I hope to get as much work experience and academic upgrading as I can, so I can make even greater contributions in this field."**
>
> **Ms Norfizah Selemat**

SECURE YOUR FUTURE

The BCA-Industry Built Environment ITE Scholarship is part of the initiatives under the Built Environment Sectoral Manpower Plan, which aims to build a strong pool of local talents and raise the quality of the workforce to meet the growing needs of the sector.

The BCA-Industry Built Environment ITE Scholarship is offered by BCA in collaboration with industry firms to students pursuing full-time built environment courses at the Institute of Technical Education (ITE). Through this programme, scholars will be given financial incentives during their studies, as well as attractive starting salaries and clear career progression paths after graduation.

Mr Lawrence Wong, Minister for National Development, announced the Built Environment Sectoral Manpower Plan (SMP) at the BCA-Industry Built Environment ITE Scholarship Award Ceremony where he presented 112 scholarships to the ITE students.

Currently pursuing Higher Nitec in Civil & Structural Engineering Design at ITE College Central, Sherman Goh is thankful to be sponsored for his studies and to secure employment opportunities through the scholarship. "While many of my peers intend to pursue further studies, I see myself benefiting more from on-the-job training and being involved in the daily running of projects. This is why I am willing to forgo a fulltime diploma and kick-start my career with the structured development provided by the scholarship," said the 17-year-old.

> **This is why I am willing to forgo a fulltime diploma and kick-start my career with the structured development provided by the scholarship.**
>
> **Sherman Goh**
> **BCA-Kim Seng Heng Built Environment ITE Scholar**

One of the SMP's key strategies is to nurture and retain local talents through greater career guidance, creating high quality jobs and upgrading the skills of those already in the sector. To meet the evolving demands of the sector, the SMP has also identified emerging and priority skills, such as green building capabilities and productive technologies, to be developed with the support of the SkillsFuture initiatives. At the same time, efforts will be made to raise the quality of the foreign construction workforce.

BCA and eight key built environment sector associations that are part of the Construction Industry Joint Committee (CIJC) have also signed a Memorandum of Understanding (MoU) to mark their collaboration in driving SkillsFuture initiatives.

For more details on BCA's scholarship and sponsorship programmes, please visit **www.buildingcareers.gov.sg**.

INTEGRATED DESIGN MEETS REAL WORLD

The 3for2@UWCSEA project, which blends design and energy-efficient technologies into building structures, is the first recipient of BCA's Green Buildings Innovation Cluster – Building Energy Efficient Demonstrations (GBIC-Demo) Scheme.

Left: Exterior of completed 3for2@UWCSEA office space.

Below: Data dashboards and demonstration equipment on display at the 3for2 Grand Opening.

CREDIT: ALL PHOTOS ARE FROM 3FOR2UWCSEA, FUTURE CITIES LABORATORY, SINGAPORE-ETH CENTRE, 2016

As part of the Energy National Innovation Challenge, a Building Energy Efficiency R&D Roadmap was drawn to achieve the target of "low energy, high-rise buildings" in Singapore. The National Research Foundation (NRF) has set aside funding of S$52 million over a five-year tranche to the Green Buildings Innovation Cluster (GBIC), a one-stop integrated research, development and demonstration (RD&D) hub, to experiment, exhibit and exchange knowledge of building energy-efficient solutions with industry stakeholders.

Administered by BCA, GBIC consists of three main components: GBIC-R&D, GBIC-Demo and GBIC-Repository, to steer the national drive towards greater energy.

GBIC – Research & Development

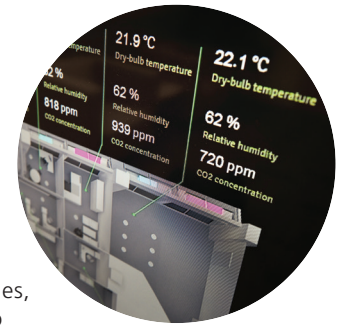
GBIC-R&D's goal is to collaborate with local and international R&D experts as well as industry stakeholders to develop innovative energy-efficient building technologies that can be more widely deployed in Singapore.

GBIC – Building Energy Efficient Demonstrations Scheme

GBIC-Demo exhibits advanced energy-efficient technologies that have not been widely implemented in both new and existing buildings. It provides a channel that enables the progression of research to larger-scale demonstration projects so as to validate the replicability and cost-effective performance of these new solutions for potential commercialisation. It is also a platform where the industry can test and showcase novel or market-proven technologies or systems that promise significant energy savings but have yet to see wider adoption or generate substantial local performance data for verification.

GBIC – National Building Energy Efficiency Repository

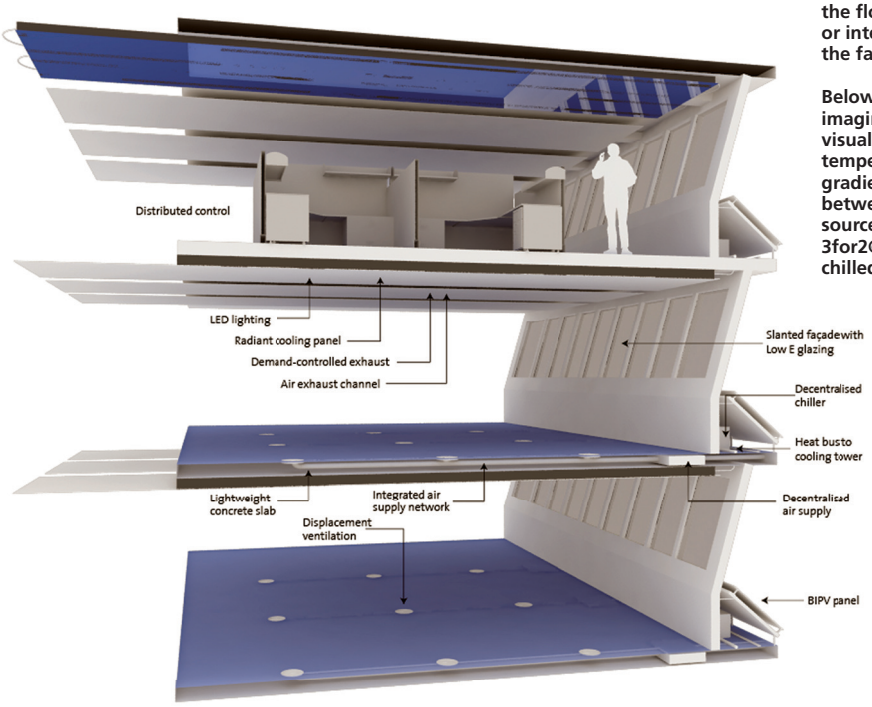
The GBIC-Repository is a central data warehouse that will be developed by BCA to collect and analyse essential building system data, operation and occupant-related metrics data that are obtained through calibrated instruments of the demonstrated technologies under GBIC-Demo. Besides monitoring and validating the performance of the demonstrated technologies, data analytics would also be carried out for trending purposes as well as the formation of intelligent and control systems which would enhance building performance. Demonstrated projects will also be shared with the public to raise greater awareness and interest from academia, industry and developers on the latest energy-efficient technologies.



3for2@UWCSEA Demonstration Project

This is the pilot implementation of the "3for2" building design concept developed by architectural and engineering researchers at the Singapore-ETH Centre, a research centre co-established by ETH Zurich (Swiss Federal Institute of Technology Zurich) and NRF. The project is led by ETH Zurich, in partnership with Siemens Building Technologies and United World College South East Asia (UWCSEA).

By taking an interdisciplinary approach to all aspects of design and construction, the 3for2 concept significantly changes the way sustainable high-rise buildings can be built. By integrating novel energy-efficient technologies for air-conditioning into a building's structural elements, considerable space and materials can be saved. As air-conditioning accounts for approximately 60% of energy consumption in Singapore buildings, the 3for2 concept focuses largely on technologies to increase energy efficiency.



Left: In the 3for2 concept technical systems are integrated with the structural elements of a building like the floor slab or integrated in the facade.

Below: A thermal imaging camera visualises the temperature gradients between heat sources and the 3for2@UWCSEA's chilled ceiling.

Last December, UWCSEA was selected as the first recipient of the GBIC Demonstration Scheme. In addition to co-funding the 3for2@UWCSEA project, GBIC will be able to use the project's data to ensure that the technologies are tested and best practices disseminated to the rest of the industry. "Building owners and developers can also harness the potential of energy savings and improve the quality of the indoor environment. We strongly encourage more applicants to join this scheme," said Mr Tan Tian Chong, Deputy Managing Director of the Built Environment Research and Innovation Institute at BCA.

Dr Adam Rysanek, Senior Researcher at ETH Zurich and Project Manager of 3for2@UWCSEA, is especially excited about transforming research into reality. "Not in many places in the world has it been possible for academic researchers to try so many new ideas in a real-world setting," he said.

IT'S A SIGN

Nicole Ng and Ho Yee Har of BCA's Advertisement Licensing Department hope to raise public awareness about the guidelines pertaining to outdoor signboards and advertising signs in Singapore.

Outdoor advertising signs are a major visual element in our built environment today. These signs not only possess a strong aesthetic presence, but they also create a buzz and add vibrancy to the streetscape. Hence, it is important that outdoor advertising signs are properly displayed, well-maintained and safe. Their designs should also be compatible with the overall image of the area they are placed at.

In Singapore, any form of signboards for the identification and naming of places, buildings and tenant businesses, as well as advertising signs used for promoting a brand, product, service or event must receive a licence from BCA's Advertisement Licensing Department before installation. Clearance from the Urban Redevelopment Authority (URA) is required for any signboard or advertising sign located on gazetted conservation buildings or National Monuments, in the Central Area and outside the Central Area.

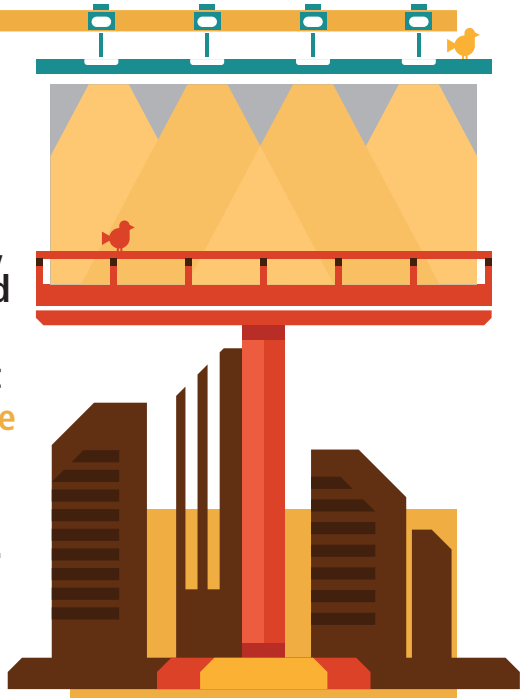
The Advertisement Licensing Department at BCA is divided into two teams: application processing and enforcement.

Processing Applications

About 25 to 30 applications are received every day, says Nicole Ng, Executive Manager of the processing team. Each application is assessed based on its compliance with BCA's regulations and URA's guidelines. Full details of submission requirements and guidelines are available on BCA's website, and applications must be done online, or via the e-kiosks at BCA's Service Centre.

> **Outdoor events have different kinds of signage... Advertisements are also getting more creative with display methods such as projection mapping.**
>
> **Nicole Ng**
> Executive Manager

> **Due to lack of public awareness, many building and business owners do not know that they need a licence before displaying signboards and advertising signs.**
>
> **Ho Yee Har**
> Senior Engineer



In addition, Nicole shared that it generally takes seven days to process an application and over 50% of applicants – especially regular applicants who are familiar with the regulations – will be granted licences. As there is no "express service", applications are attended to on a first come, first served basis. According to Nicole and Ho Yee Har, Senior Engineer from the enforcement team, the best way to obtain a licence fast and avoid hefty composition fines is to apply early and adhere strictly to guidelines. For example, there is a greater variety of signs used for outdoor events. Such cases will take more time to process and therefore should be submitted early.

"Advertising signs are getting more creative. An example is projection mapping (an object is spatially mapped onto a display surface for video projection). For some, several elements may be combined in a single sign. It's challenging to discern if the sign is a signboard or an advertising sign. It is important to draw a distinction between the two because they may raise different safety issues and are charged differently," Nicole added.

Enforcing Licensing Rules

The enforcement team consists of engineers and technical officers. Apart from monthly checks around different parts of Singapore, the technical officers also conduct regular blitzes and site inspections arising from feedback on unauthorised signboards and advertisements. On site, the officers comb the streets to take pictures of the signs. If the signs are found to be unlicensed or if the licences have expired, composition notices and removal orders will be served to the relevant parties.

For large signs, a Professional Engineer may be required to certify that the structure that holds the signboard or advertising sign is structurally safe. Besides issuing composition notices, the enforcement team is also in charge of granting temporary building permits for these structures.

"With an aim to reduce the number of enforcement actions taken, we have previously reached out to real estate agents – a big pool of people who require licences for their banners – and we hope to further educate sign makers on this," said Yee Har.

DID YOU KNOW?

- **Outdoor signs in Singapore are channelled to key activity corridors where there is high human traffic and where they can contribute to the dynamics of an area.**
- **Guidelines for outdoor signs on conservation buildings serve to protect the heritage value and significant architectural features of these structures.**
- **Outside the Central Area, there's also a set of comprehensive guidelines which provide clear requirements of a sign's location, size, height and form, to ensure that our streetscape and skyline are safeguarded from visual clutter while commercial needs of businesses for advertising space at appropriate locations are fulfilled.**

For more information, please visit BCA's website: www.bca.gov.sg/Advertisement/bca_outdoor_advertising_regulations.html

FOR A GOOD CAUSE

BCA and firms in the built environment sector are working hand-in-hand to create a sustainable and user-friendly environment for the less fortunate.

Left: Minister for National Development, Mr Lawrence Wong, CEO of BCA, Dr John Keung and the President of SCAL, Mr Kenneth Loo, installing tactile indicators on the road at the SAVH.

Below: BCA volunteers repainting the railings at SAVH.

Besides formulating and implementing policies, BCA is committed to using its expertise to enhance accessibility for the elderly and disabled, as well as to improve the energy efficiency of buildings and the living environment for the less fortunate.

As part of its Corporate Social Responsibility (CSR) efforts, BCA works closely with Volunteer Welfare Organisations (VWOs) to understand their needs. It then partners companies in the built environment sector to provide resources and organise purposeful programmes.

Since 2013, BCA has collaborated with Singapore Contractors Association Limited (SCAL) to improve facilities and infrastructure at the Singapore Association of the Visually Handicapped (SAVH). Areas that require repair (such as toilets, ceilings and drains) or upgrading works (such as enhancement of guided paths for the visually impaired) are identified, and the manpower and materials for actual construction activities are supplied by SCAL. More than 200 people, consisting of contractors and BCA volunteers, have been involved in the coordination and execution of the improvement works.

Mr Lawrence Wong, Minister for National Development, Dr John Keung, CEO of BCA, and Mr Kenneth Loo, President of SCAL, made a trip to the SAVH in November last year to tour the refurbished facilities and take part in the ongoing upgrading works, such as installing braille signs on railings. During the visit, Minister Wong also engaged in conversations with the beneficiaries and volunteers.

"Through this collaborative effort, we have seen how simple accessibility and Universal Design features such as ramps and tactile indicators can go a long way in improving the lives of others," said Dr Keung.

Minister for National Development, Mr Lawrence Wong, together with BCA volunteers, members of SCAL and SAVH beneficiaries.

SAFETY FIRST

BCA embarked on a public education drive to raise awareness of the safety precautions to observe when using lifts.

As part of its efforts to raise public awareness of the safety precautions when using lifts, BCA has produced posters in four languages that illustrate the "Dos" and "Don'ts" of using lifts. Over 140,000 posters were distributed to owners such as Town Councils, commercial building owners, and Management Corporation Strata Titles (MCSTs).

Lift owners are encouraged to display the posters prominently near the lifts at each block, such as noticeboards at lift lobbies to remind lift users of safe practices.

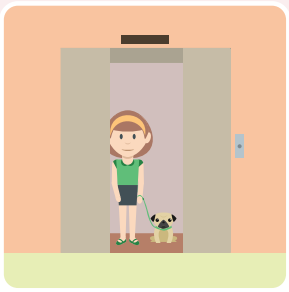
Apart from sending reminders to lift contractors and examiners to be vigilant in lift maintenance, BCA has also conducted seminars to raise awareness on good lift maintenance practices among lift contractors, Authorised Examiners (AEs) and lift owners.

Following public and industry consultations on proposed amendments to the lift maintenance regulations, BCA will complete its review of lift regulations and standards this year.

Safe Use of Lifts 安全使用电梯

DOs: 请:

Supervising adults should always accompany young children and ensure they do not place their hands on lift doors.
请陪同小孩搭乘电梯，确保他们不会把手放在电梯门上。



Do ensure that your leashed pet stays inside the lift as the doors close.
在电梯门关上之前，请确保宠物和宠物绳索都在电梯内。

Look out for persons rushing into the lift and press the "Door Open" button to hold the doors open.
若发现有人冲向电梯，请按"开门"按钮，让电梯门保持敞开。

We use lifts everyday. Observe these Dos and Don'ts when using lifts, to keep you and your family safe.

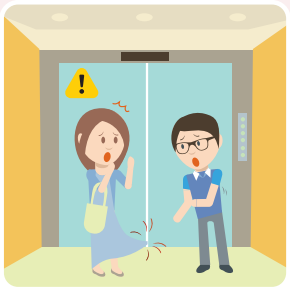
天天搭乘电梯，注意使用守则，确保人人安全。

DON'Ts: 请勿:

Do not use any part of the body (e.g. hand/leg) to stop the doors from closing. Press the "Door Open" button instead.
请不要使用身体任何部位（如手脚）阻止电梯门关闭。请按"开门"按钮，将电梯门打开。

Do not try to pry open the lift doors when the lift stalls. Press the alarm button and wait for rescue.
如果电梯停止操作，请不要试图迫开电梯门。请按警铃，等待救援。

Do not jump or play in the lift. This may cause the lift to stall.
请不要在电梯里跳动或玩耍。这可能导致电梯停止操作。



Do not stand near the lift doors. Small and thin objects like long skirts, leashes and backpack straps can get caught.
请不要站靠近电梯门边。细长的物品如长裙、宠物的绳索和背包带，可能被门夹住。

Building and Construction Authority

COMING UP@BCAA

Tap on SkillsFuture Credit, Study Award or Mid-Career Enhanced Subsidy for our courses!

JULY 2016

8 July 2016
Seminar on Building Plan and TOP/CSC Submission Guidelines 2016 NEW

11, 12, 18 & 19 Jul 2016
Certification Course for Site Investigation Supervisors (16th Run)

12, 14 & 19 Jul 2016
Application for Extension of Time - Factors for Success (5th Run)

12 Jul - 30 Aug 2016
Advanced Certificate in Construction Productivity (5th Run)

13 Jul 2016
Building Control Regulations for Site Supervisors (35th Run)

13 Jul 2016, 9am - 12.30pm
14 Jul 2016, 9am - 5pm
Understanding Building Control Regulations - Non-Structural Buildings Works (3rd Run)

13 & 14 Jul 2016
Develop A Risk Management Implementation Plan (BizSAFE Level 2) (110th Run)

14 Jul 2016
Green Mark Refresher Course (10th Run)

18 & 19 Jul 2016
Certificate in Concrete Technology (9th Run)

19 Jul 2016
Good Industry Practices (Timber Flooring)

20 - 22 Jul 2016
Certified QM/CONQUAS Managers Course (51st Run)

21, 22 & 25 Jul 2016
Solar Modelling (20th Run)

CORE Module for GMFP 2016

21, 22, 25, 26 Jul & 12 Aug 2016
Certification Course for Green Mark Manager (66th Run)

22 Jul to 24 Sep 2016
BCA-SMU Advanced Management Programme on Productivity and Leadership Development (7th Intake)

25, 26, 27 (or 28) Jul & 11 Aug 2016
Certification Course on Measurement & Verification of Central Chilled-Water Plant Efficiency (14th Run) (Core module of GMFP)

27 Jul 2016
UNIVERSAL DESIGN CONFERENCE 2016
Universal Design in Public Places

27 & 28 Jul 2016
Develop A Risk Management Implementation Plan (BizSAFE Level 2) (111th Run)

AUGUST 2016

1 Aug 2016
Good Industry Practices – Drywall Installation including Wet Areas Application (4th run)

3 Aug 2016
PSSCOC Contract Administration Essentials NEW

4 & 5 Aug 2016
Design of Steel-Concrete Composite Structures using Eurocode 4 (6th Run)

12 Aug 2016 to Apr 2017
Registration closing on 22 Jul 2016
Stanford CIFE - BCA Advanced Management Programme
Virtual Design & Construction (3rd Run)
(Incl. a 6-Day VDC Trg Course on 21 - 28 Aug 2016@ Stanford University, US)

15, 18 & 22 Aug 2016
Site Management of Precast Concrete Construction (21st Run)

16 Aug 2016
Good Industry Practices (Aluminium Window)

18 Aug 2016
Application for Temporary Occupation Permit/Certificate of Statutory Completion (4th Run)

18, 19, 25 & 26 Aug 2016
Develop a Workplace Safety and Health Management System Implementation Plan (BizSAFE Level 4) (10th Run)

22 & 23 Aug 2016
Construction Contract Administration (Re-run)

23 Aug 2016
Good Industry Practices (Painting)

23 & 24 Aug 2016
Develop A Risk Management Implementation Plan (BizSAFE Level 2) (112th Run)

24 - 26 Aug 2016
Project Management (19th Run)

26 Aug 2016
CORENET e-Submission System Training (Re-run)

26 Aug 2016
Good Industry Practices (Waterproofing for Internal Wet Areas)

31 Aug 2016
Understanding Building Control Regulations – Safe Structural Design (2nd Run)

SEPTEMBER 2016

1 Sep 2016
Programme Risk Management (12th Run)

5 & 6 Sep 2016
Managing Project Teams Effectively (54th Run)

7 & 8 Sep 2016
BMSMA for Building Management Personnel (16th Run)

8 Sep 2016
Understanding Building Control Regulations – Household and Storey Shelters (2nd Run)

8 Sep 2016
Contract Drafting - The Technicalities and Legalities (25th Run)

19 - 23 Sep 2016
Registration closing on 5 Aug 2016
IUAV-BCA Executive Development Programme 2016: Sustain and Retain NEW (Conducted In Venice, Italy)

OCTOBER 2016

6 Oct 2016
Design & Maintenance - Kitchen Exhaust Systems for Hawker Centres NEW

Starting in Early Jan 2017
Application closing date: 4 Nov 2016
Specialist Diploma in Virtual Design & Construction NEW
(5 mths lesson + 4 mths Final Project - Part-Time)

Contact
BCA Academy
Marketing & Business Development
DID: 6730 4503/6248 9824
Email: bca_academy@bca.gov.sg
Web: www.bcaa.edu.sg

Starting in Aug 2016 (Part-time)
Master of International Construction Management with major in Construction Productivity NEW (Conferred by the University of Florida, USA)

Contact
Dr Patrick Shi / Mr Yong Wee Hau
Tel: 6730 4537 / 6248 9848
Email: patrick_shi@bca.gov.sg; yong_wee_hau@bca.gov.sg

Starting on 5 Sep 2016 (Full-time)
Application closing date: 8 Jul 2016
Bachelor of Engineering (Civil) NEW (Full-time)(awarded by The University of Newcastle, Australia)

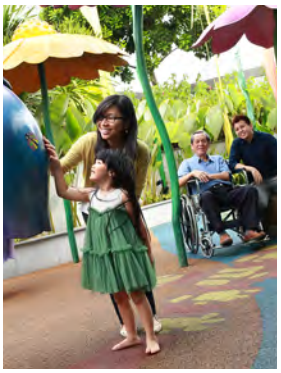
Contact
Ms Nurhadhinah / Ms Ang Geok Lung
Tel: 6730 4503 / 6248 9887
Email: nurhadhinah_osman@bca.gov.sg; ang_geok_lung@bca.gov.sg

Starting on 31 Oct 2016 (Full-time)
Application closing date: 7 Oct 2016
Bachelor of Construction Management (Building) (Full-time) (8th Intake) (awarded by The University of Newcastle, Australia)

Contact
Ms Nurhadhinah / Ms Zhuo Xiuyun
Tel: 6730 4503 / 6248 9881
Email: nurhadhinah_osman@bca.gov.sg; zhuo_xiuyun@bca.gov.sg

2016 INTAKE

BCA ACADEMY



Universal Design Conference 2016

UNIVERSAL DESIGN IN PUBLIC PLACES

27 July 2016

- Insights to adoption of UD concepts in the creation of inclusive and user-friendly public places
- Conference comprises a UD Exhibition – featuring inclusive design principles from the new UD Guide for Public Places
- Participate in a Complimentary UD Forum / UD Building Tour

UD Singapore Universal Design Week 2016

Stanford CIFE-BCA Advanced Management Program

VIRTUAL DESIGN AND CONSTRUCTION

3rd Run commencing on 12 Aug 2016 / Singapore and Stanford University, USA
21 – 28 Aug 2016: Stanford University, USA

- A 4-module program which include lectures, site visits and practicum conducted in Singapore and Stanford University over a 8-month period
- Program covers theories of Virtual Design and Construction (VDC) as well as hands-on approach in VDC implementation
- Applicable for WTU Funding / SkillsFuture Study Award

CIFE CENTER FOR INTEGRATED FACILITY ENGINEERING

IUAV-BCA Executive Development Programme 2016

SUSTAIN AND RETAIN

19 – 23 September 2016, Venice & Padova, Italy

Registration close on 5 Aug 2016 / $350 Early-bird discount by 15 Jul 2016

- Programme addresses the importance of striking a balance between the sustainability of our physical environment as well as the conservation of our cultural and built heritage
- Applicable for SkillsFuture Study Award / Productivity & Innovation Credit (PIC) Scheme

IUAV Università Iuav di Venezia

SCAN QR Code or visit www.bcaa.edu.sg for more details on above programmes