BIM/VDC

(Building Information Modelling/Virtual Design & Construction)

for the Built Environment

Brought to you by:

Building and Construction Authority

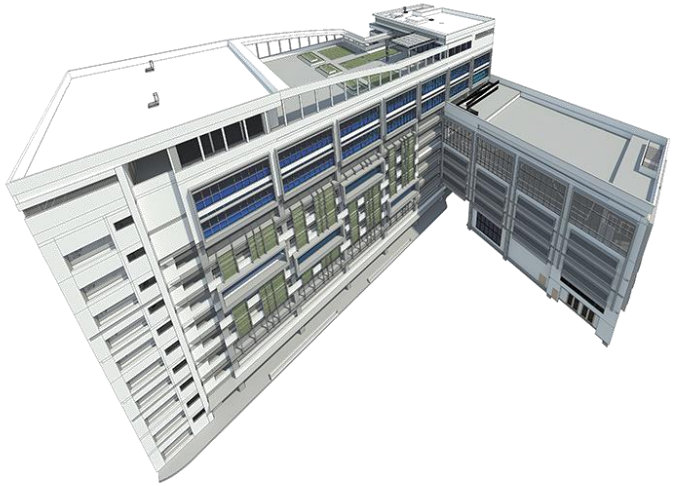
What is BIM/VDC?

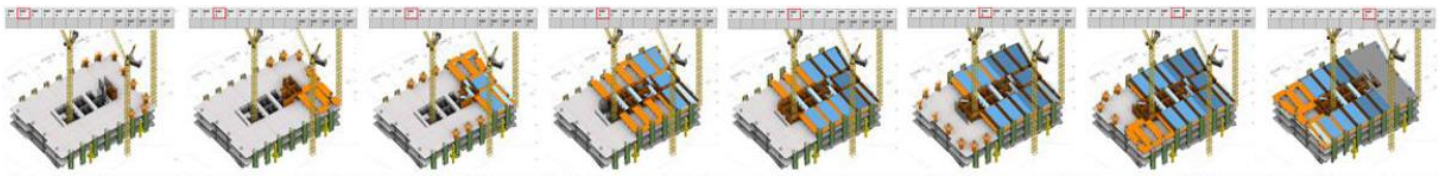
What is BIM/VDC and what are the benefits of doing BIM/VDC?

What is BIM/VDC?

Building Information Model/Modelling (BIM):

- Digital representation of the physical and functional characteristics of a product
- Enables digital simulation and planning among different stakeholders

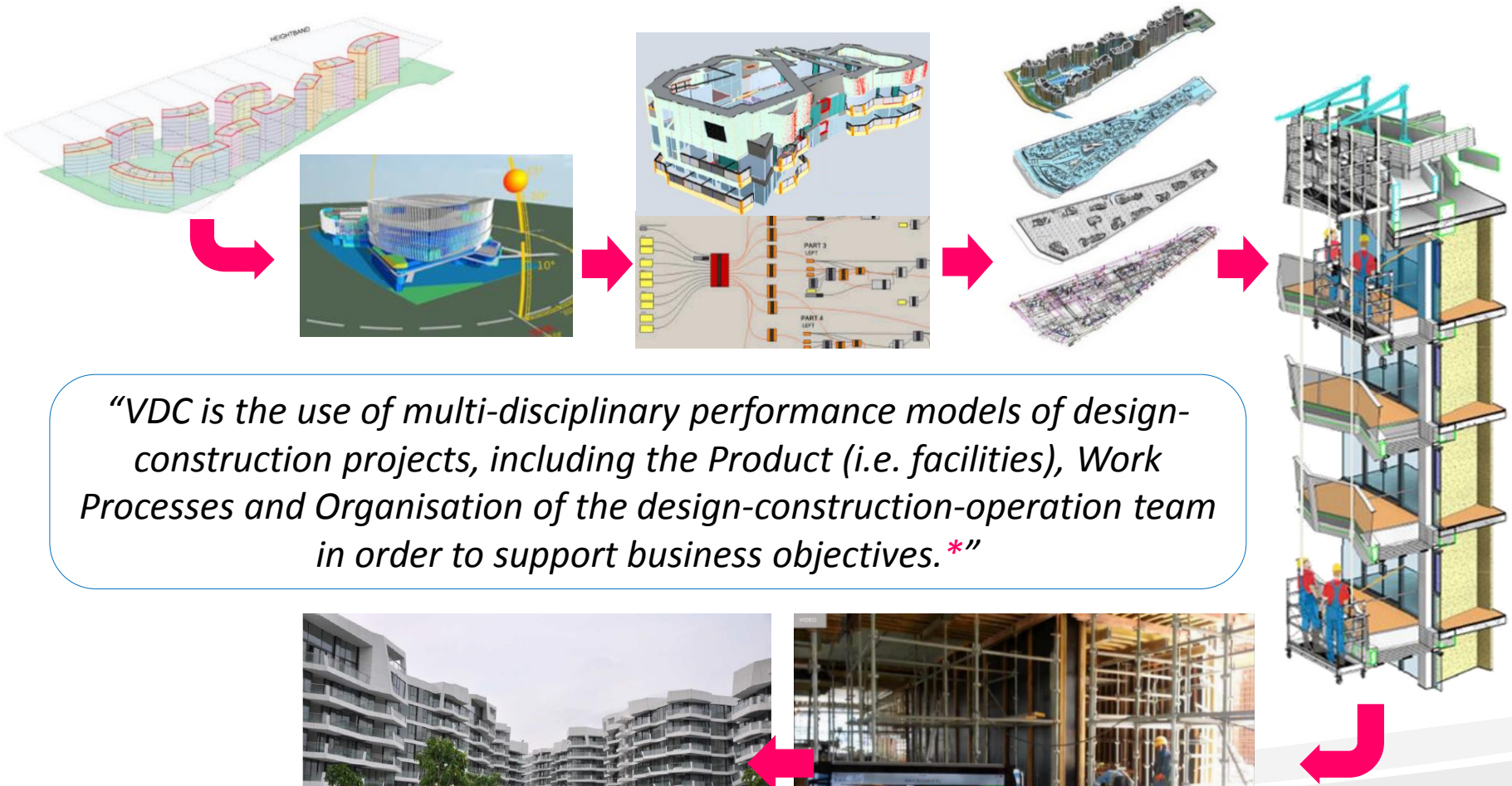




Virtual Design and Construction (VDC):

- Rehearsing the project delivery sequence digitally to uncover and resolve problems before actual construction
- Build twice: first virtual then real

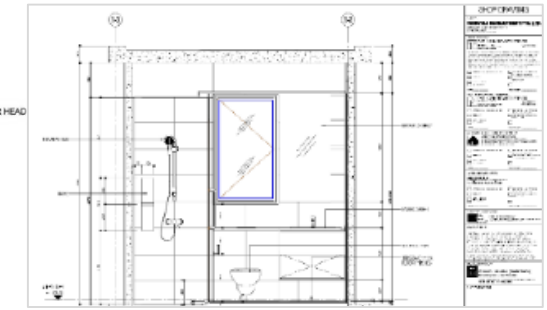
Using BIM Collaboratively

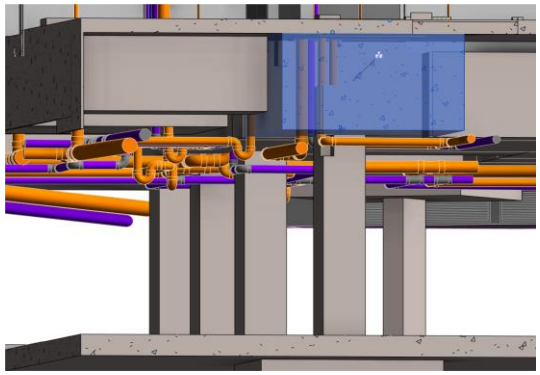


"VDC is the use of multi-disciplinary performance models of design-construction projects, including the Product (i.e. facilities), Work Processes and Organisation of the design-construction-operation team in order to support business objectives."*

*(*Source: Stanford-CIFE)*

Benefits of BIM/VDC: High Park Residences Example





Abortive works of hacking columns to embed pipes were avoided due to early detection in BIM before construction

40% Reduction in time in preparation for shop drawings

$1.3m Savings for rectifying 265 columns in BIM instead of on-site

70% Reduction in discrepancies discovered

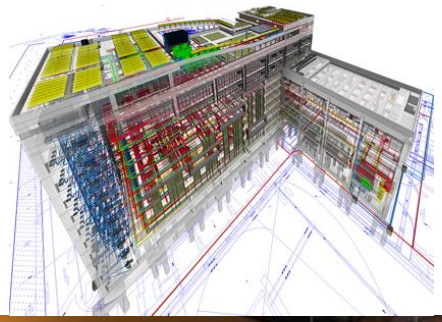
Other Benefits:

- Better efficiency and accuracy through coordination amongst all project team members
- Virtual review by stakeholders at early stage potentially avoid late design changes

(Source: High Park Residences by CEL Development)

BIM Adoption Rates

You can do it too!



Consultants

86%

PSPC Panels 1 & 2 applied for BIM Fund

Contractors

65%

BCA CRS A1, A2 & B2 Grades applied for BIM Fund

* As of Dec 2016

How to get started on BIM/VDC?

Learn from these firms and projects who have implemented BIM/VDC.

Case Study 1

Changi General Hospital Medical Centre

Project Team:

- Ministry of Health, Singapore (Developer)
- Changi General Hospital (Employer Agent)
- MOH Holdings Pte Ltd (Employer Agent)
- RDC Architects Pte Ltd (Architectural Consultant)
- Parsons Brinckerhoff Pte. Ltd. (C&S Consultant)
- Parsons Brinckerhoff Pte. Ltd. (M&E Consultant)
- Kimly-Shimizu Joint Venture (Builder)
- Deluge Fire Protection (S.E.A.) Pte. Ltd. (Fire Protection Specialist)
- Ecogen Asia Pacific Pte Ltd (Softscape Works & Automatic Irrigation Specialist)
- Fast Flow Singapore Pte Ltd (Siphonic Rainwater Management Specialist)
- Fattheng Construction Pte. Ltd. (Plumbing, Sanitary & Gas Specialist)
- Fujitec Singapore Corporation Ltd (Lift & Escalator Specialist)
- Greenlite Electric Pte Ltd (Earthing and Lighting Protection System Specialist)
- Hetat Pte Ltd (Steel and Facade Specialist)
- Hexamine Sdn Bhd (Singapore Branch) (Medical Gas Specialist)
- L & K Engineering Co. Ltd. (ACMV Specialist)
- LHL International Pte Ltd (Facade Specialist)
- Ngee Cheng Electric Co (Pte) Ltd (Electrical Specialist)
- Son Heng Interiors Pte Ltd (Interior Fit-Out Specialist)
- Stream Environment (S) Pte. Ltd.
  (Pneumatic Waste Conveyance System Specialist)

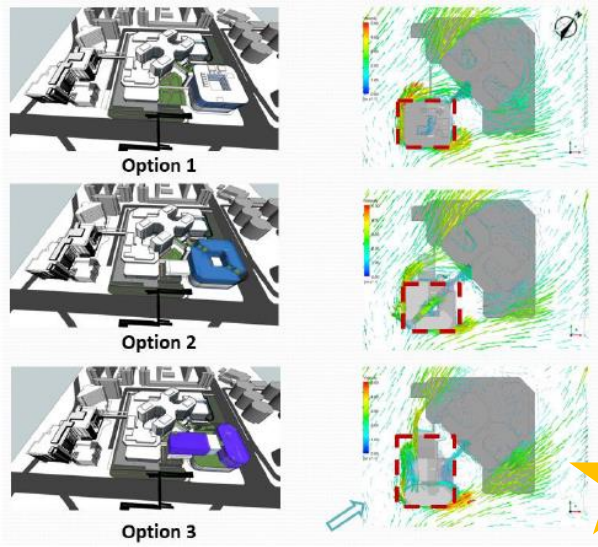
Motivation for doing BIM:

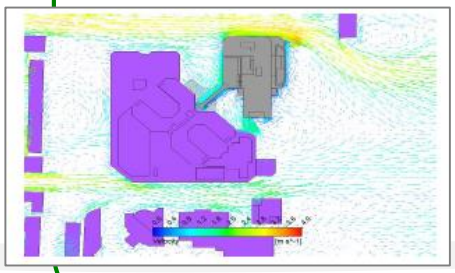
Improve quality of design solutions and enhance the accuracy of information between project team members

Case Study 1

Changi General Hospital Medical Centre

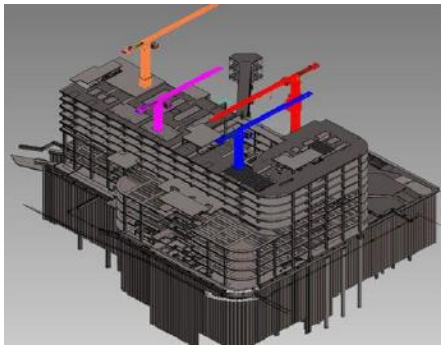
Building Performance Analysis





Extensive use of CFD to assess building performance e.g. study impact of wind-driven air movement

Site Logistics Planning

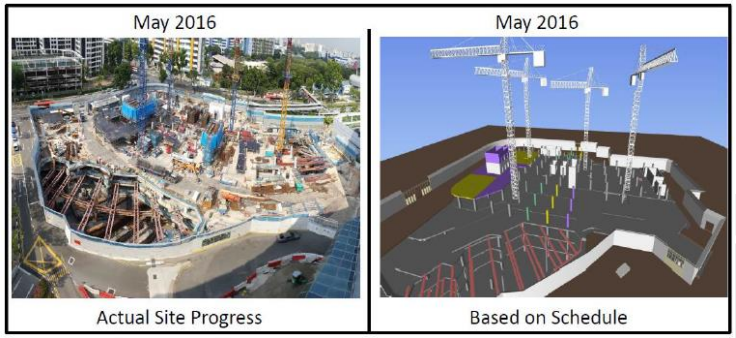


Studying the location of tower cranes using BIM

Actual installation of tower cranes on site

BIM/VDC In Action

Site Progress Monitoring



Model used for monitoring actual site progress

Case Study 1

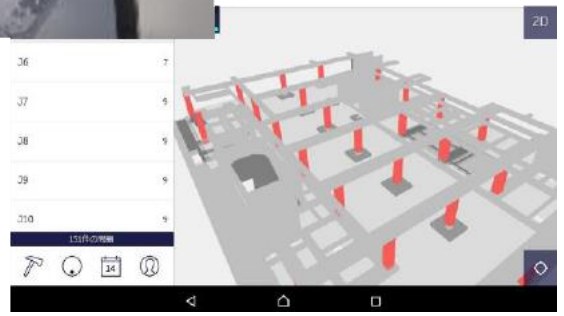
Changi General Hospital Medical Centre

Team Collaboration

Models used for communicating issues and visual coordination. Modelling and coordination also extended to the specialist contractors.

BIM for Construction

Using iPad to visually check site installation with BIM model and mark out areas for further coordination or rectification.



BIM/VDC In Action

Co-location of sub-contractors' modelers and engineers on site for better coordination

Benefits:

- Reduced abortive works on site;
- Improved communication and coordination between the project team members, particularly with the different specialist contractors.

Case Study 2

Gospel Light Christian Church

Project Team:

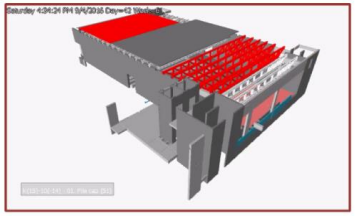
- Gospel Light Christian Church (Client)
- LAUD Architects Pte Ltd (Architectural Consultant)
- LSW Consulting Engineers Pte Ltd (Structural Consultant)
- PTP Engineers Pte Ltd (M&E Consultant)
- Hong Kiat Construction Pte Ltd (Builder)

Motivation for doing BIM:

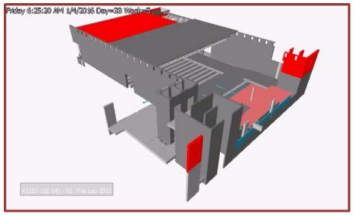
Solve complex construction problems due to site constraints

BIM/VDC In Action

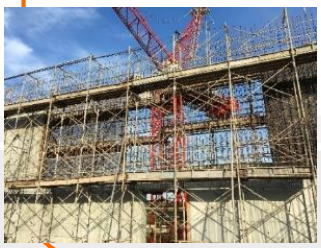
Construction Sequencing



OPTION 1

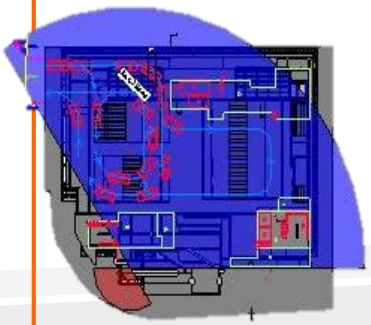


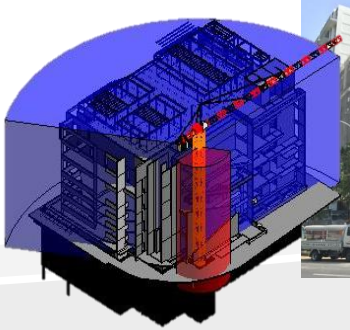
OPTION 2



Simulating various construction sequences using BIM model to find the most productive sequence.

Luffing Crane Planning





Studying the optimal lifting coverage and location of crane constrained by airspace height restrictions

(Images Credit: Hong Kiat Construction & LAUD Architects)

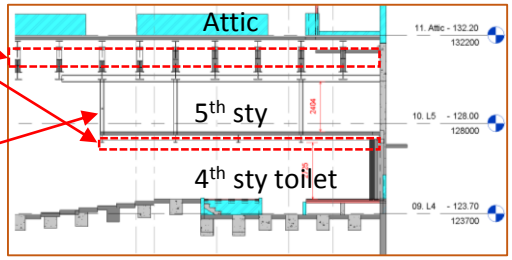
Case Study 2

Gospel Light Christian Church

Detailed Study & Coordination

Limited room for M&E services at attic & 4th sty toilet ceiling

5th sty steel structures hang down from attic trusses



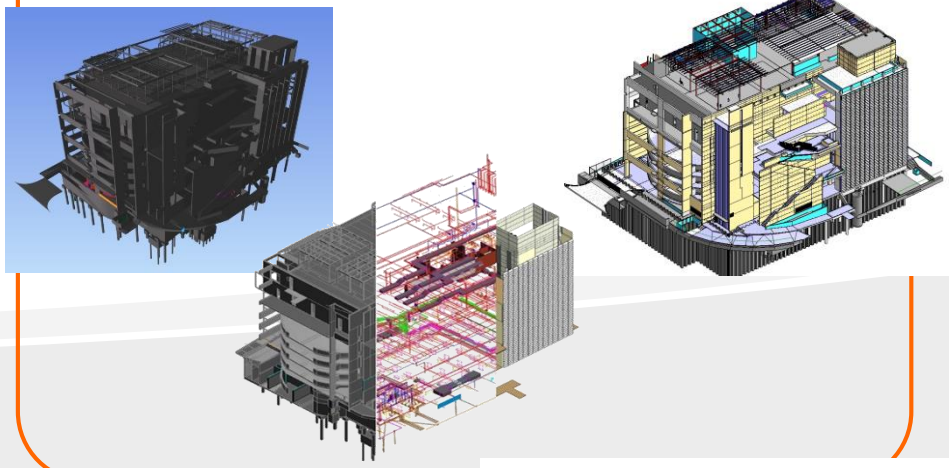
Detailed study and coordination of steel structures, M&E services and architectural finishes with BIM. Checking for clashes virtually before actual construction a necessity due to the tight headroom space available.

BIM/VDC In Action

Benefits:

- Significantly reduced abortive work;
- Faster construction works as most issues resolved before construction – 2 levels basement works completed 2 months ahead of schedule;
- Reduction in manpower by almost 30%;
- Lower project construction costs;
- Improvement in site management, resources and manpower, and communication.

Integrated Model for Upfront Collaboration



(Images Credit: Hong Kiat Construction & LAUD Architects)

BIM/VDC Implementation by a Consultant

LAUD Architects

Motivation for doing BIM:

Adopt new technologies and push the boundaries of architectural design and production

BIM Implementation:

- Strong support from management to implement BIM for all new projects;
- Comprehensive in-house training roadmap and programme and continuous upgrading of staff's skillsets;
- Established BIM manuals, libraries and templates;
- Using BIM beyond modelling and submission – simulations and analyses, project collaboration, virtual design and study before construction etc.

Benefits:

- Productivity gain of more than 15% in documentation production;
- Better visuals and presentations for owners' decision making;
- Better coordination and collaboration with other consultants and contractors;
- Information extracted from models used for other purposes e.g. computation of Buildability Score.

BIM/VDC In Action

Singa Hills

Gospel Light Christian Church

Grace Assembly of God Church

(Images Credit: LAUD Architects)

Award Winning Contractors

Recognising outstanding firms for going the extra mile in BIM and VDC adoption at the organization levels

2015 - 2016:

17 Contractor firms received BIM Awards

6 Platinum, 5 Gold^{PLUS} & 6 Gold

No.	Contractor Firms	Award
1	Kimly Construction Pte Ltd	Platinum
2	Obayashi Singapore Private Limited	Platinum
3	Penta Ocean Construction Co., Ltd	Platinum
4	Shimizu Corporation	Platinum
5	Straits Construction Singapore Pte Ltd	Platinum
6	Woh Hup (Private) Limited	Platinum
7	China Construction (South Pacific) Development Co. Pte. Ltd.	Gold^{PLUS}
8	Takenaka Corporation	Gold^{PLUS}
9	Teambuild Engineering and Construction Pte Ltd	Gold^{PLUS}
10	Tiong Aik Construction Pte Ltd	Gold^{PLUS}
11	Tiong Seng Contractors Private Limited	Gold^{PLUS}
12	Gammon Construction Limited	Gold
13	Hexacon Construction Pte Ltd	Gold
14	Lian Soon Construction Pte Ltd	Gold
15	Ssangyong Engineering & Construction Co., Ltd	Gold
16	Soil-Build (Pte) Ltd	Gold
17	Yau Lee Construction (Singapore) Pte Ltd	Gold

Award Winning Consultants

2015 - 2016:

16 Consultant firms received BIM Awards

4 Platinum, 3 Gold^{PLUS} & 9 Gold

Recognising outstanding firms for going the extra mile in BIM and VDC adoption at the organisation levels

No.	Consultant Firms	Award	Discipline
1	Aecom Singapore Pte Ltd	Platinum	Multi-disciplinary
2	Ong&Ong Group Pte Ltd	Platinum	Multi-disciplinary
3	RSP Architects Planners & Engineers (Pte) Ltd	Platinum	Multi-disciplinary
4	DCA Architects Pte Ltd	Platinum	Architectural
5	Parsons Brinckerhoff Pte Ltd	Gold^{PLUS}	Multi-disciplinary
6	Laud Architects Pte Ltd	Gold^{PLUS}	Architectural
7	Rider Levett Bucknall LLP	Gold^{PLUS}	Quantity Surveying
8	Surbana International Consultants Pte Ltd	Gold	Multi-disciplinary
9	DP Architects Pte Ltd	Gold	Architectural
10	P&T Consultants Pte Ltd	Gold	Architectural
11	Woha Architects Pte Ltd	Gold	Architectural
12	Arup Singapore Pte Ltd	Gold	Civil & Structural
13	KTP Consultants Pte Ltd	Gold	Civil & Structural
14	LSW Consulting Engineers Pte Ltd	Gold	Civil & Structural
15	Squire Mech Pte Ltd	Gold	Mechanical & Electrical
16	United Project Consultants Pte Ltd	Gold	Mechanical & Electrical

Award Winning Projects

2014 - 2016:

35 Projects received BIM Awards

7 Platinum, 9 Gold^{PLUS} & 19 Gold

Recognising outstanding project teams that have implemented BIM in their projects from design to construction

No.	Project	Award
1	Singapore Sports Hub	Platinum (2014)
2	Capital Green	Platinum (2015)
3	Mapletree Business City II	Platinum (2015)
4	Yishun Community Hospital	Platinum (2015)
5	Blossom Spring @ Yishun	Platinum (2016)
6	Changi General Hospital Medical Centre	Platinum (2016)
7	Gospel Light Christian Church	Platinum (2016)

Singapore Sports Hub
(Image Credit: Singapore Sports Council)

CapitaGreen
(Image Credit: Market Street Office Trustee Pte Ltd)

Award Winning Projects

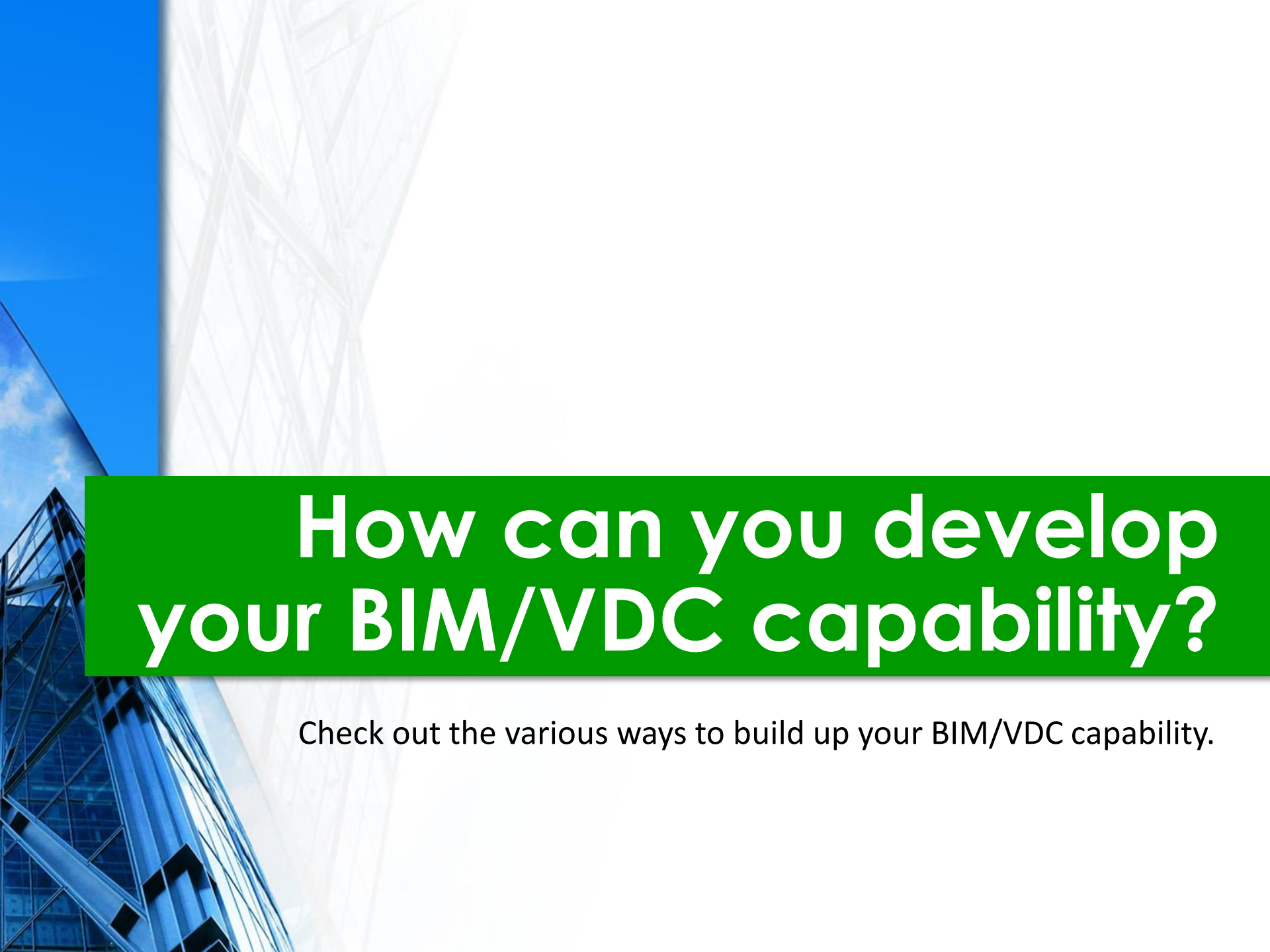
Yishun Community Hospital (YCH)
(Photo Credit: Yishun Community Hospital)

Gospel Light Christian Church
(Image Credit: Gospel Light Christian Church)

Blossom Spring @ Yishun
(Image Credit: Housing & Development Board)

Business City – Mapletree Business City II (MBC II)
(Image Credit: Mapletree Business City Pte Ltd)

Changi General Hospital Medical Centre
(Image Credit: MOH Holdings Pte Ltd)



How can you develop your BIM/VDC capability?

Check out the various ways to build up your BIM/VDC capability.

BIM Fund V2

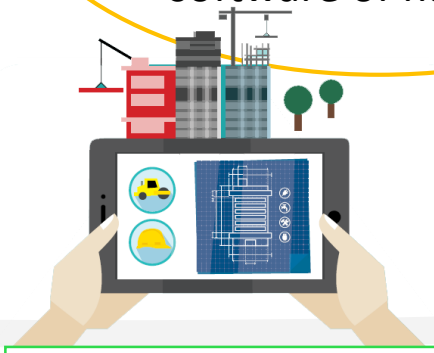
Check it out & apply for it!

$21m Committed since 2010

> 700 Firms would have benefitted

* As of Dec 2016

To help firms build up BIM collaboration capability by defraying part of the cost for training, consultancy, software of hardware



For more info on BIM Fund:
https://www.bca.gov.sg/BIM/bimfund.html

BEFORE APPLYING

1. Meet the **PROJECT SIZE** and **NUMBER OF DISCIPLINES REQUIREMENTS.**
2. Arrange for pre-consultation and present to BCA on proposed **SCOPE OF PROJECT, BIM METHODOLOGY** and **EXPECTED OUTCOME.**
3. Prepare all supporting **DOCUMENTS** - quotations and details for training, software, hardware and consultancy services, where applicable.

APPLYING FOR THE FUND ONLINE

1. Submit **APPLICATION ONLINE** via Business Grant Portal (BGP) at **https://www.businessgrants.gov.sg** together with supporting documents.
2. Receive your application outcome via email within **21 WORKING DAYS** after the pre-consultation presentation.

UPON SUCCESSFUL APPLICATION

1. View the **LETTER OF OFFER** online at BGP.
2. Accept the offer online at BGP **WITHIN 1 MONTH.**
3. Start your **CONTRACT OF SERVICE.**
4. Keep all **FINANCIAL RECORDS** (e.g. receipts, invoices etc.).
5. BCA Officer to attend **AT LEAST 1 PROJECT COORDINATION MEETING.**

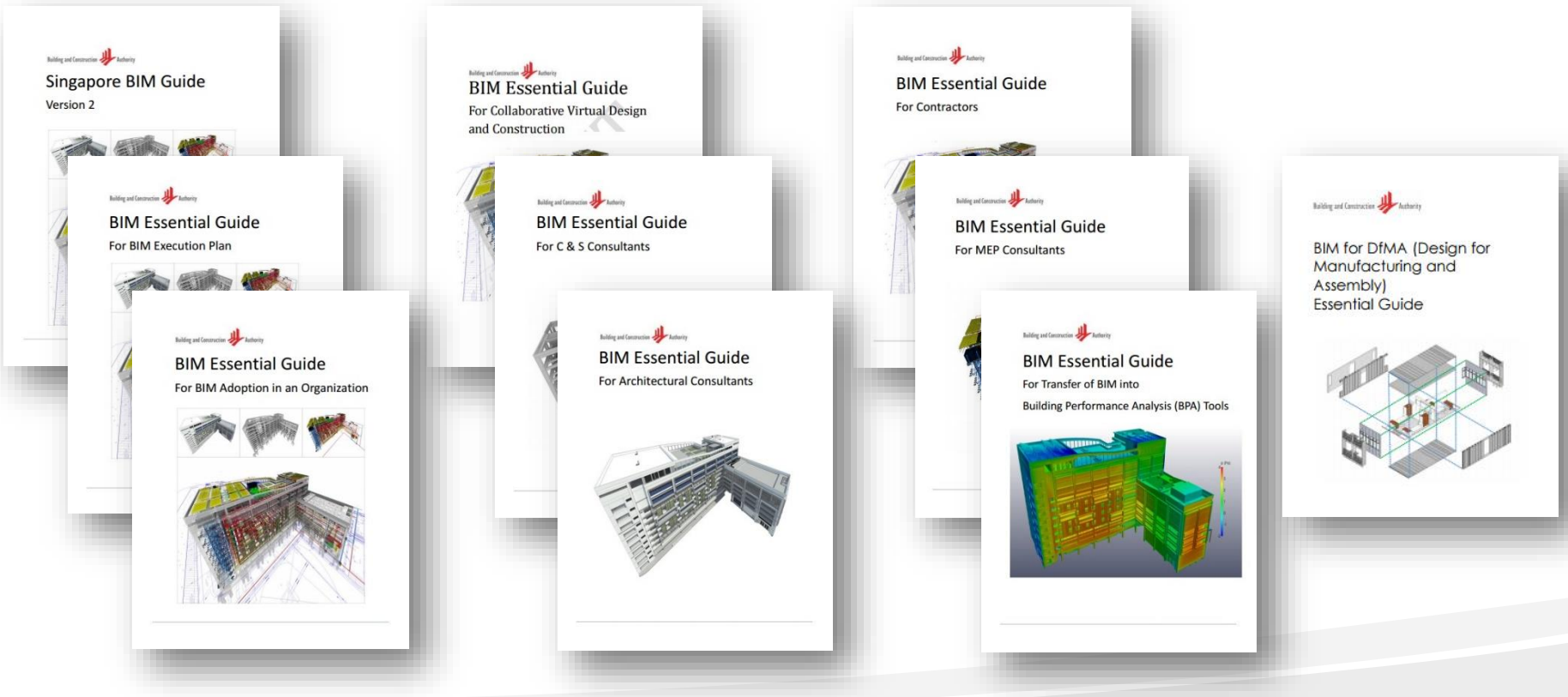
CLAIMING OF FUNDS

1. Submit your **CLAIM FORM, FINANCIAL AND FINAL REPORT** and **ALL SUPPORTING DOCUMENTS.**
2. Once BCA approves your final report and claim application, you will be reimbursed within 3 months.

Standards & Guides

Learn more about it!

Essential Guides to share good BIM practices

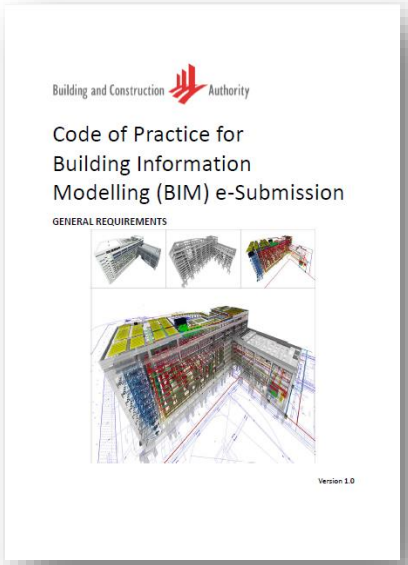


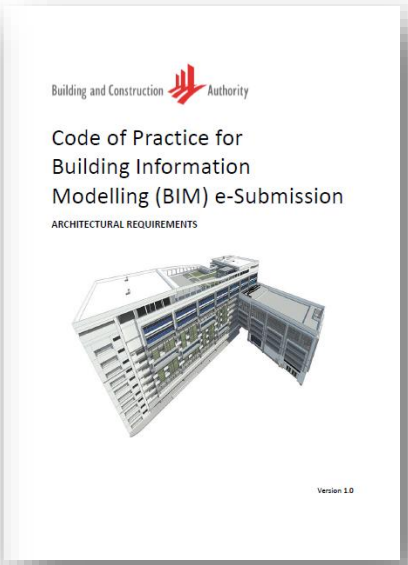
Guides can be downloaded from:
https://corenet.gov.sg/general/bim-guides/bim-essential-guides.aspx

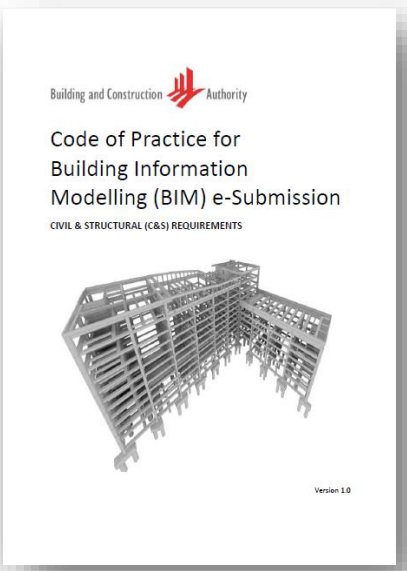
Codes of Practice & Templates

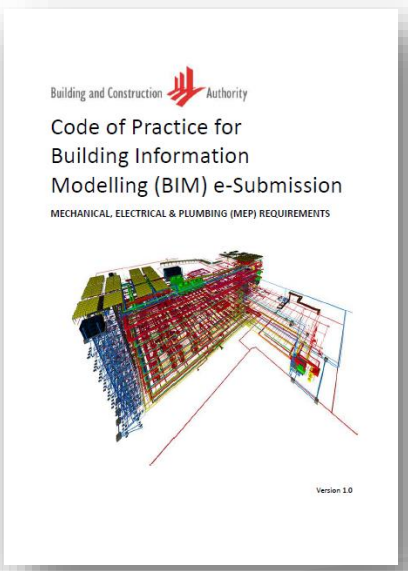
Learn more about it!

Codes of Practice to assist Qualified Persons (QPs) to develop BIM models to meet regulatory requirements for BIM e-Submission
(software-specific templates also provided to help QPs to jumpstart BIM e-Submission)









Codes of Practice & Templates can be downloaded from:
https://corenet.gov.sg/general/building-information-modeling-(bim)-e-submission.aspx

Building BIM/VDC Capability

Training for Industry Professionals

Upgrade your BIM skills!

> 3700 trained in BCA Academy

> 4700 trained by external BIM Vendors

* As of Dec 2016

CEOs

BCA ACADEMY of the built environment | STANFORD UNIVERSITY

- Virtual Design and Construction Leadership Programme

Middle Mgt & Professionals

BCA ACADEMY of the built environment | STANFORD UNIVERSITY

- Virtual Design and Construction Programme for Project Teams

BCA ACADEMY of the built environment

- Specialist Diploma in VDC
- Specialist Diploma in BIM
- Certification Course on BIM Management
- BIM Planning (Building Developers and Facility Managers)

Technical

BCA ACADEMY of the built environment

- Certification Course on BIM for Mechanical, Electrical and Plumbing (MEP) Coordination
- BIM Scheduling and Process Management
- BIM Quantity Take-off
- Certification Course in BIM Modelling (Architectural, Structural, MEP tracks)

For more info on BCA Academy's courses: http://www.bcaa.edu.sg/

Building BIM/VDC Capability

Build up your BIM team!

Training for Full-time Students

> 700 trained in BCA Academy

> 1800 trained by other Institutes of Higher Learning

* As of Dec 2016

11 IHLs have incorporated BIM into
33 full-time programmes and
20 part-time programmes

BCA ACADEMY
SINGAPORE POLYTECHNIC SP
NANYANG TECHNOLOGICAL UNIVERSITY
ITE Institute of Technical Education
NUS National University of Singapore
NYP NANYANG THE INNOVATIVE POLYTECHNIC
TEMASEK POLYTECHNIC
SIM UNIVERSITY
NGEE ANN POLYTECHNIC
SiT SINGAPORE INSTITUTE OF TECHNOLOGY
SUTD SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

BIM Shoot-Out and International BIM Competition organised for students

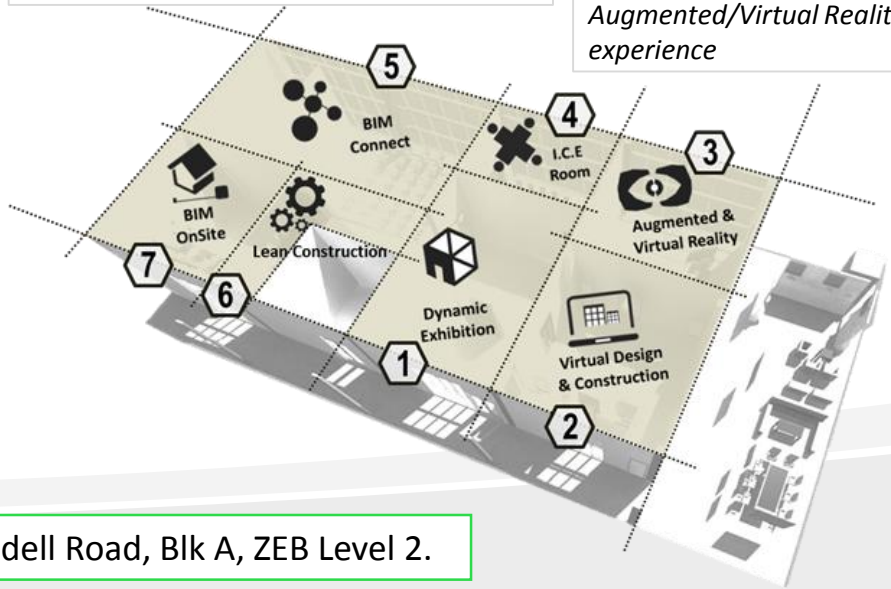
Centre for Lean & Virtual Construction (CLVC)

Check out the latest technologies!

- Launched in Dec 2015
- 1st fully integrated large-scale immersive and experiential learning facility
- Promote ICT, Virtual Design & Construction and Lean Construction
- Low cost space and facilities for the industry and IHLs to kick-start their VDC journey

Demo of Integrated Concurrent Engineering concept

Augmented/Virtual Reality hands-on experience



CLVC is located at BCA Academy, 200 Braddell Road, Blk A, ZEB Level 2.

Thank You