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?

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

**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

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

(Source: High Park Residences by CEL Development)
BIM Adoption Rates

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**

- Option 1
- Option 2
- Option 3

*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*

**Site Progress Monitoring**

*Model used for monitoring actual site progress*

- Actual Site Progress
- Based on Schedule
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.

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**

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

**BIM/VDC In Action**

- 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**

- 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.

(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.

Images Credit: LAUD Architects

BIM/VDC In Action

Grace Assembly of God Church
Grace Assembly of God Church
Singa Hills
Gospel Light Christian Church
Awards Winning Contractors

2015 - 2016:

17 Contractor firms received BIM Awards

6 Platinum, 5 GoldPLUS & 6 Gold

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

<table>
<thead>
<tr>
<th>No.</th>
<th>Contractor Firms</th>
<th>Award</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kimly Construction Pte Ltd</td>
<td>Platinum</td>
</tr>
<tr>
<td>2</td>
<td>Obayashi Singapore Private Limited</td>
<td>Platinum</td>
</tr>
<tr>
<td>3</td>
<td>Penta Ocean Construction Co., Ltd</td>
<td>Platinum</td>
</tr>
<tr>
<td>4</td>
<td>Shimizu Corporation</td>
<td>Platinum</td>
</tr>
<tr>
<td>5</td>
<td>Straits Construction Singapore Pte Ltd</td>
<td>Platinum</td>
</tr>
<tr>
<td>6</td>
<td>Woh Hup (Private) Limited</td>
<td>Platinum</td>
</tr>
<tr>
<td>7</td>
<td>China Construction (South Pacific) Development Co. Pte. Ltd.</td>
<td>GoldPLUS</td>
</tr>
<tr>
<td>8</td>
<td>Takenaka Corporation</td>
<td>GoldPLUS</td>
</tr>
<tr>
<td>9</td>
<td>Teambuild Engineering and Construction Pte Ltd</td>
<td>GoldPLUS</td>
</tr>
<tr>
<td>10</td>
<td>Tiong Aik Construction Pte Ltd</td>
<td>GoldPLUS</td>
</tr>
<tr>
<td>11</td>
<td>Tiong Seng Contractors Private Limited</td>
<td>GoldPLUS</td>
</tr>
<tr>
<td>12</td>
<td>Gammon Construction Limited</td>
<td>Gold</td>
</tr>
<tr>
<td>13</td>
<td>Hexacon Construction Pte Ltd</td>
<td>Gold</td>
</tr>
<tr>
<td>14</td>
<td>Lian Soon Construction Pte Ltd</td>
<td>Gold</td>
</tr>
<tr>
<td>15</td>
<td>Ssangyong Engineering &amp; Construction Co., Ltd</td>
<td>Gold</td>
</tr>
<tr>
<td>16</td>
<td>Soil-Build (Pte) Ltd</td>
<td>Gold</td>
</tr>
<tr>
<td>17</td>
<td>Yau Lee Construction (Singapore) Pte Ltd</td>
<td>Gold</td>
</tr>
</tbody>
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Award Winning Consultants

2015 - 2016:

16 Consultant firms received BIM Awards

4 Platinum, 3 GoldPLUS & 9 Gold

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

<table>
<thead>
<tr>
<th>No.</th>
<th>Consultant Firms</th>
<th>Award</th>
<th>Discipline</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Aecom Singapore Pte Ltd</td>
<td>Platinum</td>
<td>Multi-disciplinary</td>
</tr>
<tr>
<td>2</td>
<td>Ong&amp;Ong Group Pte Ltd</td>
<td>Platinum</td>
<td>Multi-disciplinary</td>
</tr>
<tr>
<td>3</td>
<td>RSP Architects Planners &amp; Engineers (Pte) Ltd</td>
<td>Platinum</td>
<td>Multi-disciplinary</td>
</tr>
<tr>
<td>4</td>
<td>DCA Architects Pte Ltd</td>
<td>Platinum</td>
<td>Architectural</td>
</tr>
<tr>
<td>5</td>
<td>Parsons Brinckerhoff Pte Ltd</td>
<td>GoldPLUS</td>
<td>Multi-disciplinary</td>
</tr>
<tr>
<td>6</td>
<td>Laud Architects Pte Ltd</td>
<td>GoldPLUS</td>
<td>Architectural</td>
</tr>
<tr>
<td>7</td>
<td>Rider Levett Bucknall LLP</td>
<td>GoldPLUS</td>
<td>Quantity Surveying</td>
</tr>
<tr>
<td>8</td>
<td>Surbana International Consultants Pte Ltd</td>
<td>Gold</td>
<td>Multi-disciplinary</td>
</tr>
<tr>
<td>9</td>
<td>DP Architects Pte Ltd</td>
<td>Gold</td>
<td>Architectural</td>
</tr>
<tr>
<td>10</td>
<td>P&amp;T Consultants Pte Ltd</td>
<td>Gold</td>
<td>Architectural</td>
</tr>
<tr>
<td>11</td>
<td>Woha Architects Pte Ltd</td>
<td>Gold</td>
<td>Architectural</td>
</tr>
<tr>
<td>12</td>
<td>Arup Singapore Pte Ltd</td>
<td>Gold</td>
<td>Civil &amp; Structural</td>
</tr>
<tr>
<td>13</td>
<td>KTP Consultants Pte Ltd</td>
<td>Gold</td>
<td>Civil &amp; Structural</td>
</tr>
<tr>
<td>14</td>
<td>LSW Consulting Engineers Pte Ltd</td>
<td>Gold</td>
<td>Civil &amp; Structural</td>
</tr>
<tr>
<td>15</td>
<td>Squire Mech Pte Ltd</td>
<td>Gold</td>
<td>Mechanical &amp; Electrical</td>
</tr>
<tr>
<td>16</td>
<td>United Project Consultants Pte Ltd</td>
<td>Gold</td>
<td>Mechanical &amp; Electrical</td>
</tr>
</tbody>
</table>
Award Winning Projects

2014 - 2016:

35 Projects received BIM Awards

7 Platinum, 9 GoldPLUS & 19 Gold

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

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<tr>
<th>No.</th>
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<tr>
<td>1</td>
<td>Singapore Sports Hub</td>
<td>Platinum (2014)</td>
</tr>
<tr>
<td>2</td>
<td>Capital Green</td>
<td>Platinum (2015)</td>
</tr>
<tr>
<td>3</td>
<td>Mapletree Business City II</td>
<td>Platinum (2015)</td>
</tr>
<tr>
<td>4</td>
<td>Yishun Community Hospital</td>
<td>Platinum (2015)</td>
</tr>
<tr>
<td>5</td>
<td>Blossom Spring @ Yishun</td>
<td>Platinum (2016)</td>
</tr>
<tr>
<td>6</td>
<td>Changi General Hospital Medical Centre</td>
<td>Platinum (2016)</td>
</tr>
<tr>
<td>7</td>
<td>Gospel Light Christian Church</td>
<td>Platinum (2016)</td>
</tr>
</tbody>
</table>
Award Winning Projects

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

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

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

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

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

$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:
Standards & Guides

Essential Guides to share good BIM practices

Guides can be downloaded from:
Codes of Practice & Templates

**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:
Building BIM/VDC Capability

Training for Industry Professionals

> 3700 trained in BCA Academy
> 4700 trained by external BIM Vendors

* As of Dec 2016

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

- Virtual Design and Construction Leadership Programme
- Virtual Design and Construction Programme for Project Teams
- Specialist Diploma in VDC
- Specialist Diploma in BIM
- Certification Course on BIM Management
- BIM Planning (Building Developers and Facility Managers)
- 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)
Building BIM/VDC Capability

Training for Full-time Students

- > 700 trained in BCA Academy
- > 1800 trained by other Institutes of Higher Learning

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

* As of Dec 2016

BIM Shoot-Out and International BIM Competition organised for students
Centre for Lean & Virtual Construction (CLVC)

- 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

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