

Singapore's BIM Roadmap

Vivien Leong

CPG Consultants

Singapore Government Body for Building Control:
Building and Construction Authority (BCA)



We shape a **safe**, **high quality**, **sustainable** and **friendly** built environment.

In November 2010,

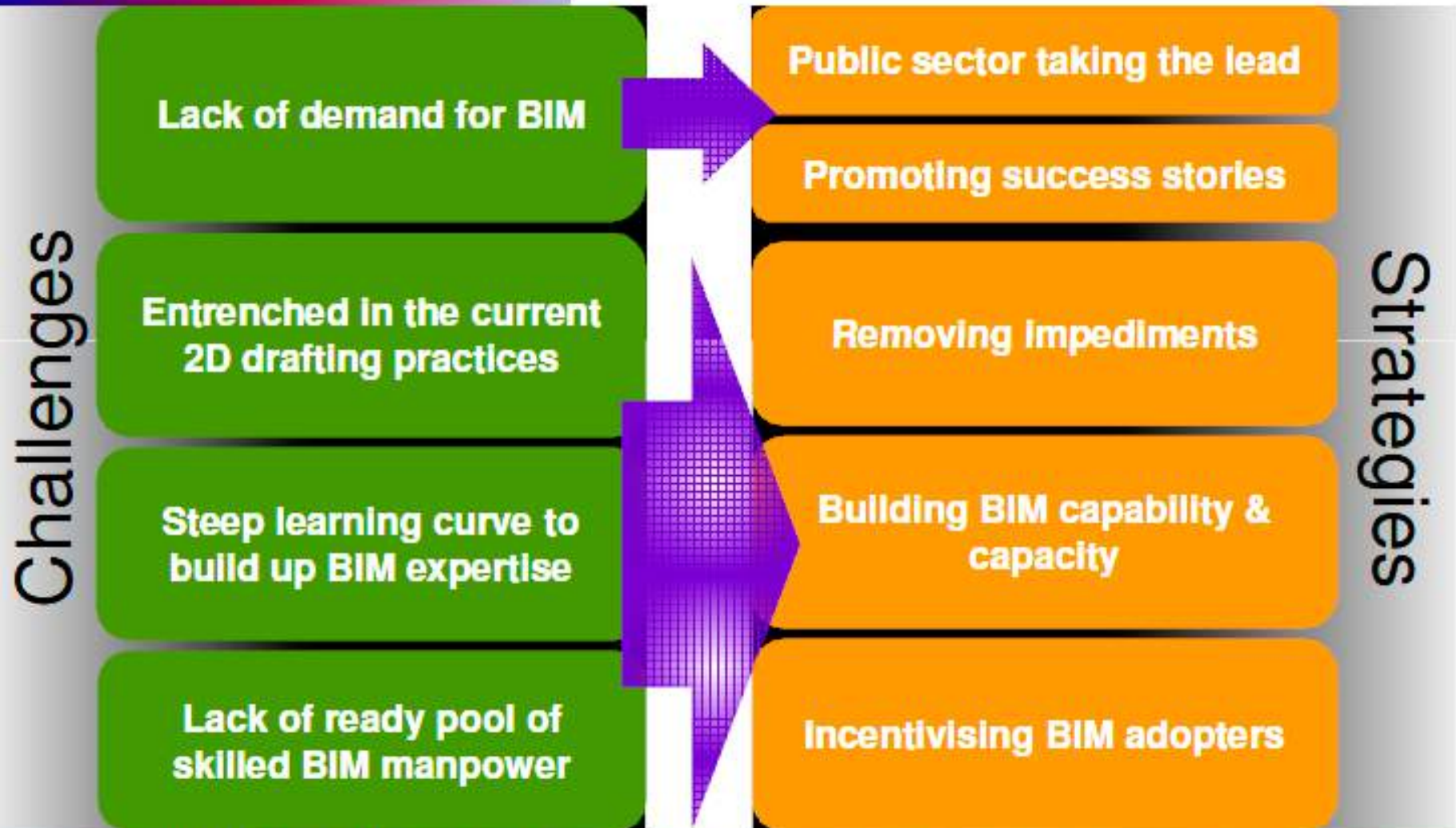
the **BIM Roadmap** was formulated by **BCA** to steer the industry towards wide adoption of **Building Information Modelling (BIM)** by 2015. BIM was identified as one of the key drivers to improve productivity and level of integration across various disciplines.

The **BIM Roadmap** aims to realise the vision of a **highly integrated and technologically advanced construction sector by 2020.**

Challenges faced by industry at the time:

- **Lack of demand for BIM**
- **Entrenched in 2D CAD drafting practices**
- **Steep learning curve to build up BIM expertise**
- **Lack of ready pool of skilled BIM manpower**

BIM ROADMAP



Singapore BIM Guide Version 2 (Aug 2013)

5 Strategic thrusts:

1. PUBLIC SECTOR TAKES THE LEAD

- BCA has collaborated with **Government Procurement Entities (GPEs)** to request the use of BIM for new public sector building projects from 2012.

To name a few:

Housing Development Board,
Land Transport Authority,
Ministry of Education
Ministry of Health
National Environment Agency
National University of Singapore
Nanyang Technological University,
Changi Airport Group



Singapore BIM Guide Version 2 (Aug 2013)

5 Strategic thrusts:

2. REGULATORY APPROVAL

- Since January 2010, architectural **BIM e-Submission** has been officially accepted by participating agencies of the Construction and Real Estate NETwork (CORENET), followed by engineering BIM e-Submission in April 2011.
- Starting July 2013, BIM e-Submission for regulatory approval would be made **mandatory** in phases.



Singapore BIM Guide Version 2 (Aug 2013)

5 Strategic thrusts:

3. REMOVE IMPEDIMENTS

- BCA developed a set of **submission templates and guidelines** to help professionals understand the new process of regulatory submission using BIM.
- BCA is also working with GPEs, professional bodies and buildingSMART Singapore to develop **project collaboration guidelines and an object library** standard.

Singapore BIM Guide Version 2 (Aug 2013)

5 Strategic thrusts:

4. BUILD BIM CAPABILITY AND CAPACITY

- BCA's **training** arm, the **BCA Academy**, launched short courses on BIM.
- BCA engaged various tertiary institutions to include BIM training in their curricula.
- BCA also provided “chaperon” services to businesses who needed assistance when doing BIM project implementation and regulatory submission for the first time.



Singapore BIM Guide Version 2 (Aug 2013)

5 Strategic thrusts:

5. INCENTIVISE EARLY BIM ADOPTERS

The BIM **Fund*** was introduced to help defray initial investment costs for BIM training, consultancy services and purchase of hardware and software for businesses and projects.

**Part of the Construction Productivity and Capability Fund (CPCF) for BIM adoption*

Singapore's Centralised Electronic Submissions Process

Urban redevelopment Authority (**Planning**)



Technical Departments:

- Fire
- Sewerage
- Drainage
- Environmental Health
- Pollution Control
- Greenery + Landscape
- Roads
- Rail
- Parking

Building & Construction Authority (**Building Control**)

- Buildability
- Accessibility
- Sustainability

BUILD BIM CAPABILITY AND CAPACITY

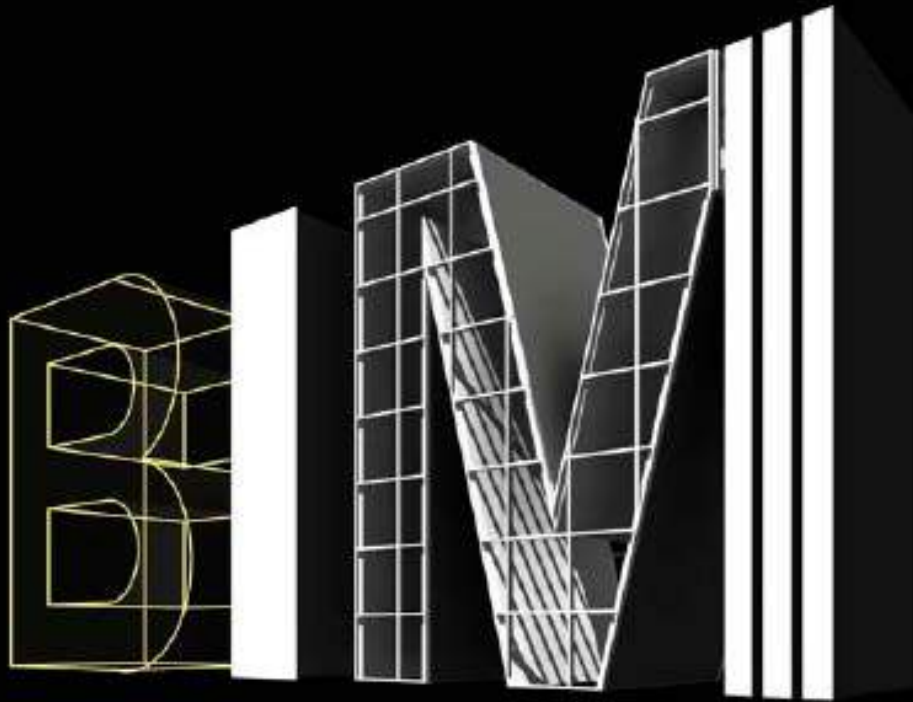
BIM e-Submission

2

Implementation of mandatory submission:

- from large to small buildings
- Starting with architectural submissions
- Followed by structure and MEP submissions

ARCHITECTURAL *BIM* E-SUBMISSION



Industry Briefing 2013

Presented by
Ms Soon Lay Kuan

You may download the softcopy of Architectural BIM e-Submission
PDF slides at
<http://sgbimarch.lkbimsite.com/course-materials>

PHASED MANDATORY BIM E-SUBMISSION

2013

Mandatory Architecture BIM e-Submissions for all new building projects > 20,000 m²

2014

Mandatory Engineering BIM e-Submissions for all new building projects > 20,000 m²

2015

Mandatory Architecture & Engineering BIM e-Submissions for all new building projects > 5,000 m²

BUILD BIM CAPABILITY AND CAPACITY

Submission Templates

3

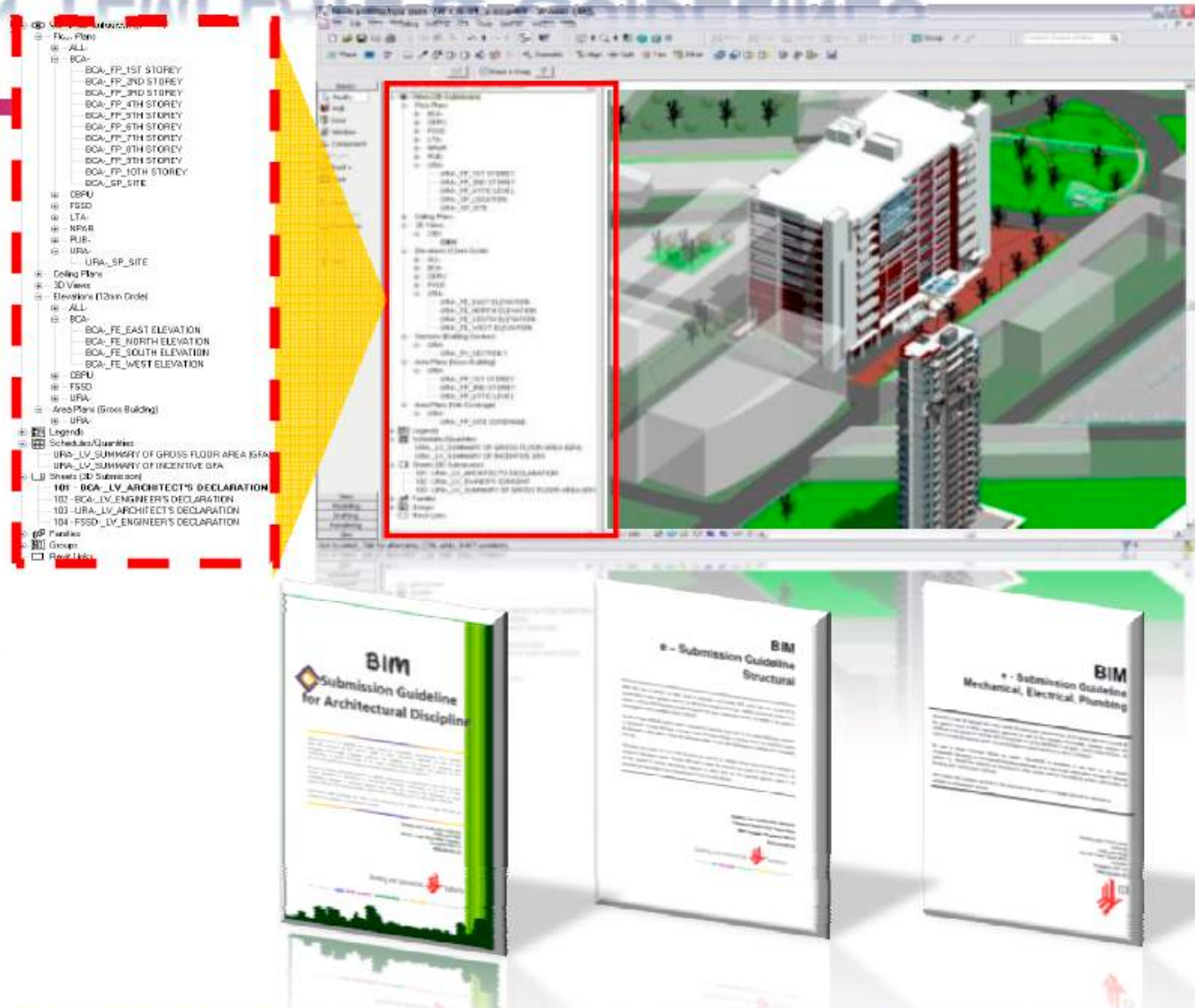
SUBMISSION TEMPLATE & GUIDELINES

Review
Templates
for BIM submissions

Review
Guidelines
for BIM submissions

**Step-by-Step
Guides**

Add-On Modules



Templates
for BIM submissions

Guidelines
for BIM submissions

E-Learning
**Step-by-Step
Guides**

Add-On Modules



E-learning



CHAPTER 1: CUSTOMISATION

CHAPTER 2: GETTING STARTED

CHAPTER 3: PROJECT
ELEVATION/DATUM LEVEL

CHAPTER 4: SITE CONFIGURATION

CHAPTER 5: GFA TABULATION

CHAPTER 6: SITE & SITE COVERAGE
TABULATION (ONLY AFFECTING SITE
PLAN)

CHAPTER 7: ANNOTATION & SYMBOLS

CHAPTER 8: A&A WORKS/RE-
SUBMISSION/AMENDMENTS

CHAPTER 9: ENDORSEMENT & DATA
INFORMATION

CHAPTER 10: EXPORT/PUBLISH TO

Templates
for BIM submissions

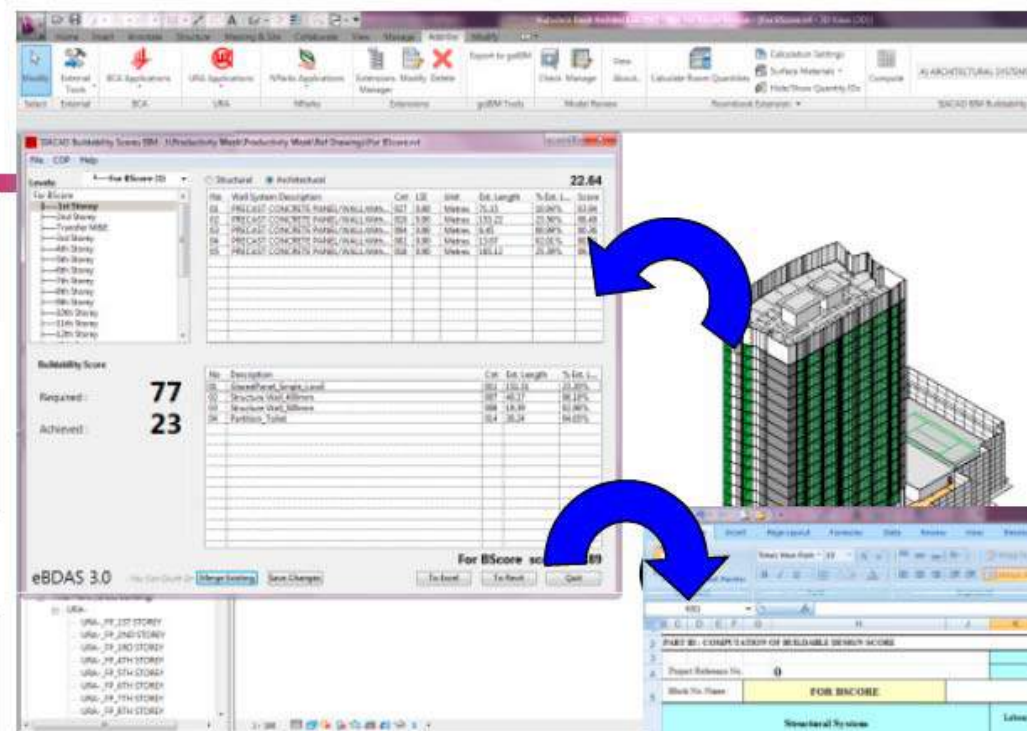
Guidelines
for BIM submissions

Step-by-Step
Guides

Add-On Modules

More development

- ✓ Buildability Score
- ✓ GM Score
- ✓ CUI
- ✓ Constructability Score



The screenshot shows a detailed table of building components and their scores. The table is organized into sections for different building systems, including Precast Concrete, Structural Steel, Cast in Situ, and Roof. Each section lists various components and their corresponding scores.

System	Component	Score	Weight	Weighted Score
1 PRECAST CONCRETE SYSTEM	1.1 Full precast	0.00	1.00	0.00
	1.2 Full precast column wall with full grain and no perimeter beams	0.00	1.00	0.00
	1.3 Full precast column wall with full grain and perimeter beams (beam depth > 100mm)	0.00	1.00	0.00
	1.4 Full precast column wall with full grain and perimeter beams (beam depth > 100mm)	0.00	1.00	0.00
	1.5 Full precast column wall with full grain and perimeter beams (beam depth > 100mm)	0.00	1.00	0.00
	1.6 Full precast column wall with full grain and perimeter beams (beam depth > 100mm)	0.00	1.00	0.00
	1.7 Full precast column wall with full grain and perimeter beams (beam depth > 100mm)	0.00	1.00	0.00
	1.8 Full precast column wall with full grain and perimeter beams (beam depth > 100mm)	0.00	1.00	0.00
	1.9 Full precast column wall with full grain and perimeter beams (beam depth > 100mm)	0.00	1.00	0.00
	1.10 Full precast column wall with full grain and perimeter beams (beam depth > 100mm)	0.00	1.00	0.00
2 STRUCTURAL STEEL SYSTEM	2.1 Steel beam and steel column (profiled concrete deck)	0.00	1.00	0.00
	2.2 Steel beam and steel column (profiled concrete deck)	0.00	1.00	0.00
	2.3 Steel beam and steel column (profiled concrete deck)	0.00	1.00	0.00
	2.4 Steel beam and steel column (profiled concrete deck)	0.00	1.00	0.00
	2.5 Steel beam and steel column (profiled concrete deck)	0.00	1.00	0.00
	2.6 Steel beam and steel column (profiled concrete deck)	0.00	1.00	0.00
	2.7 Steel beam and steel column (profiled concrete deck)	0.00	1.00	0.00
	2.8 Steel beam and steel column (profiled concrete deck)	0.00	1.00	0.00
	2.9 Steel beam and steel column (profiled concrete deck)	0.00	1.00	0.00
	2.10 Steel beam and steel column (profiled concrete deck)	0.00	1.00	0.00
3 CAST IN SITU SYSTEM	3.1 Full cast in situ	0.00	1.00	0.00
	3.2 Full cast in situ column wall with full grain and no perimeter beams	0.00	1.00	0.00
	3.3 Full cast in situ column wall with full grain and perimeter beams (beam depth > 100mm)	0.00	1.00	0.00
	3.4 Full cast in situ column wall with full grain and perimeter beams (beam depth > 100mm)	0.00	1.00	0.00
	3.5 Full cast in situ column wall with full grain and perimeter beams (beam depth > 100mm)	0.00	1.00	0.00
	3.6 Full cast in situ column wall with full grain and perimeter beams (beam depth > 100mm)	0.00	1.00	0.00
	3.7 Full cast in situ column wall with full grain and perimeter beams (beam depth > 100mm)	0.00	1.00	0.00
	3.8 Full cast in situ column wall with full grain and perimeter beams (beam depth > 100mm)	0.00	1.00	0.00
	3.9 Full cast in situ column wall with full grain and perimeter beams (beam depth > 100mm)	0.00	1.00	0.00
	3.10 Full cast in situ column wall with full grain and perimeter beams (beam depth > 100mm)	0.00	1.00	0.00
4 ROOF SYSTEM	4.1 Full roof	0.00	1.00	0.00
	4.2 Full roof with perimeter beams (beam depth > 100mm)	0.00	1.00	0.00
	4.3 Full roof with perimeter beams (beam depth > 100mm)	0.00	1.00	0.00
	4.4 Full roof with perimeter beams (beam depth > 100mm)	0.00	1.00	0.00
	4.5 Full roof with perimeter beams (beam depth > 100mm)	0.00	1.00	0.00
	4.6 Full roof with perimeter beams (beam depth > 100mm)	0.00	1.00	0.00
	4.7 Full roof with perimeter beams (beam depth > 100mm)	0.00	1.00	0.00
	4.8 Full roof with perimeter beams (beam depth > 100mm)	0.00	1.00	0.00
	4.9 Full roof with perimeter beams (beam depth > 100mm)	0.00	1.00	0.00
	4.10 Full roof with perimeter beams (beam depth > 100mm)	0.00	1.00	0.00

BUILD BIM CAPABILITY AND CAPACITY

Training



BCA ACADEMY

of the built environment

Title	Type	Online Application
Specialist Diploma in Building Information Modeling	Part Time/ Specialist Diploma Course	N.A
BIM Management	Short Course	 Individual Application  Company Application
BIM Planning Course (Building Developers and Facility Managers)	Short Course	 Individual Application  Company Application
BIM Modelling (Architecture Track)	Short Course	 Individual Application  Company Application
BIM Modelling (MEP Track)	Short Course	 Individual Application  Company Application
BIM Modelling (Structure Track)	Short Course	 Individual Application  Company Application
Workshop on Parametric Design for BIM	Short Course	N.A
Workshop on Lean Construction Mgt: Managing Workflow and Achieving Plan Reliability	Short Course	N.A
Workshop on Lean Construction Management: BIM Scheduling and Process Management	Short Course	N.A

INCENTIVISE EARLY BIM ADOPTERS

Funds

5

Taken from BCA website:

3. What is the objective?

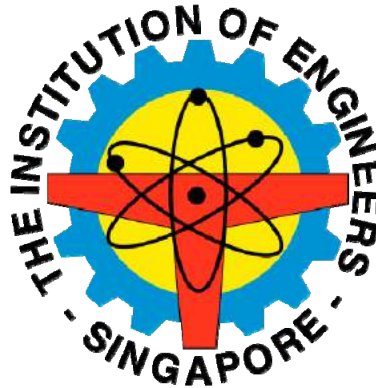
The BIM fund is intended to help firms build up BIM collaboration capability when put into practise to reduce design inconsistencies and costly reworks downstream.

4. What are the supportable items and funding details?

Supportable Items	Support Level, Funding Cap and Maximum Number of Application
1. Training costs	<u>Support Level</u> 50% of the supportable item cost if the collaboration achieves 20% KPI* improvement.
2. Consultancy costs	
3. Hardware (excluding printer, server and storage etc.) costs	
4. BIM or collaboration software costs or subscription	<u>Funding Cap</u> \$30,000 per applicant
All costs are exclusive of GST	<u>Maximum Number of Applications</u> Each firm can submit up to a maximum of 3 applications starting from July 2015.
All supportable items must be acquired only after the Letter of Offer has been issue by BCA.	<u>Disbursement of Fund</u> All funds will be disbursed on a reimbursement basis. The conclusive terms regarding disbursement will be set out in the Letter of Offer and its annexes
	*KPI refers to the Key Performance Indicators as found in the BIM Execution Plan Template.

Industry Support – BIM Advisory Panel

- Singapore Institute of Architects (SIA)
- Institute of Engineers Singapore (IES)
- Association of Consulting Engineers Singapore (ACES)



Findings of the BIM Advisory Panel

- No standards library
- No big data

SIA launches

- **iDOL: 'intelligent' Design Object Library**
- **Building the iNPQS (learning from UK's NBS)**

SIAiDOL

Parameters set to regulations and standards

- SIA members
- Manufacturers

‘... The SIAiDOL BIM Design Object Library System includes an ever growing range of generic and manufacturers’ object libraries. Most of these Object Libraries are code-compliant and we are extending these to meet the requirements for Green Mark Analysis. This year we will be embarking on the development of the iNPQS (National Productivity Quality Specifications) together with SIA, IES and ACES....’

Ben Thum, SIACAD

iNPQS – Intelligent National Productivity and Quality Specifications




National Productivity and Quality Specifications Singapore T:6225 3823 F:6234 3762

- To activate all Services, you have to Sign-In.
- If you have difficulty logging in after several attempts, it could be that your computer system is not accepting cookies.
- When leaving office, remember to Sign-Out!
- To retrieve your user info [Click Here](#)

3D to 7D

- Government sees BIM as part of productivity drive
- Technology Adoption Index
- Used in Singapore's healthcare system for Facilities Management


**Singapore Government**
Integrity • Service • Excellence

Building and Construction Authority
We shape a **safe, high quality, sustainable** and **friendly** built environment.

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High Quality

Info on Built Environment
Safe
High Quality
Sustainable
Friendly

Info For
Home Dwellers/Building Owners
Community
Industry Professionals
► Amusement Rides Safety




[Home](#) | [Procurement](#) | [Productivity Indices](#)

Productivity Indices

Please find below links to the various productivity indices for evaluation purposes in QFM and PQM.




The indices will be updated on a quarterly basis, i.e. Jan, Apr, Jul, Oct.

QFM - Consultancy Services

BS Index Buildable Design Score Index 	TA(D) Index Technology Adoption (Design) Index 	WD(D) Index Workforce Development (Design) Index 
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The first batch of TA(D) and WD(D) Indices has been published in Aug 2014.

PQM - Building Works (Contractor)

CS Index Constructability Score Index 	TA(C) Index Technology Adoption (Construction) Index 	WD(C) Index Workforce Development (Construction) Index 
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The TA(C) and WD(C) Indices will be used only for pilot PQMv2 tenders.

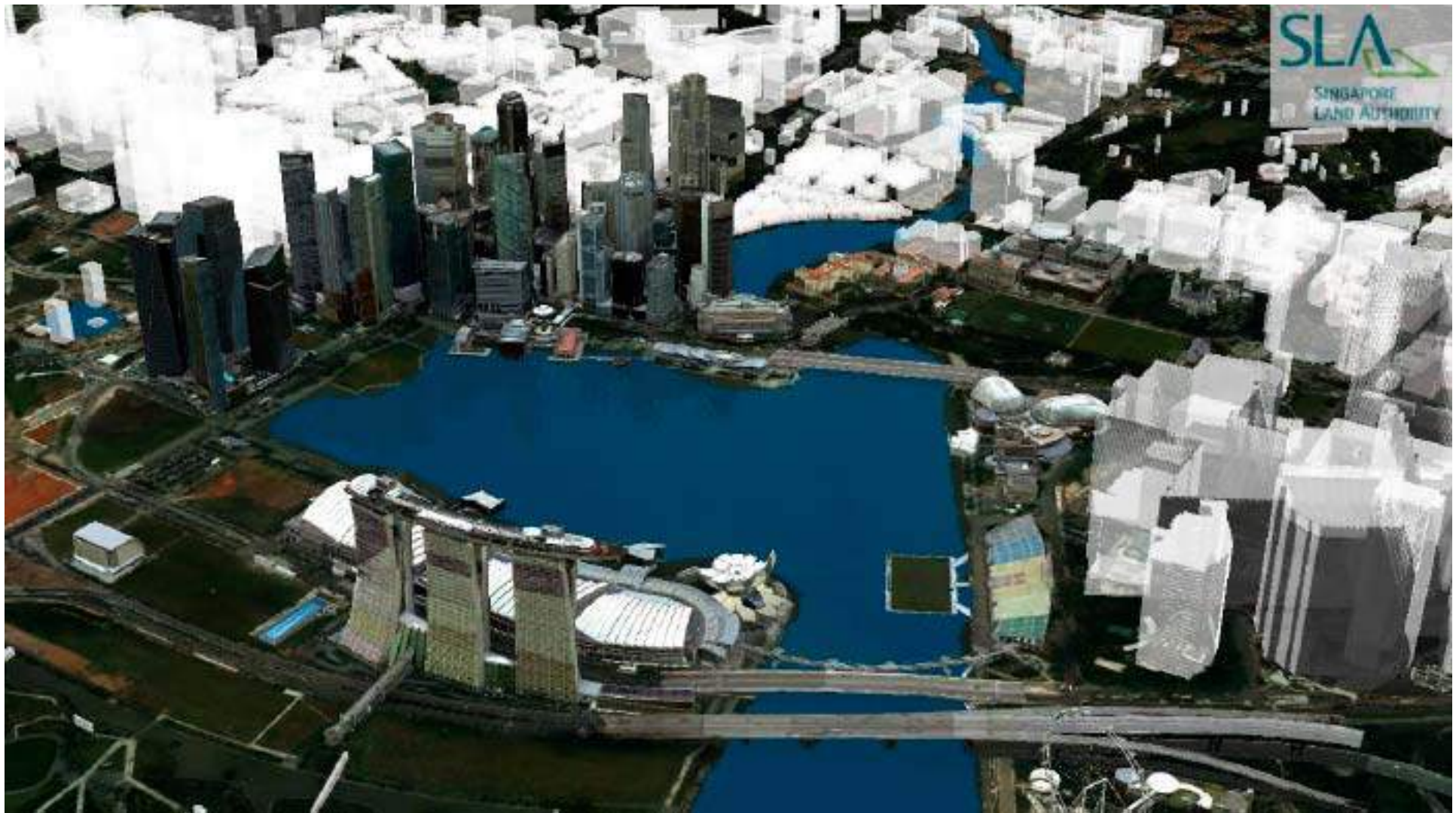
Work in Progress... Smart BIM Model

- Green Mark Version 5
- Towards integrated design
- BIM Model used for simulation
- 3D fabrication

Leading to....

Singapore Virtual City

Virtual City - Mapping Singapore in 3D



CNET > Tech Industry > Singapore plans to be world's first 'Smart Nation'

Singapore plans to be world's first 'Smart Nation'

The city-state unveils plans for sensors that can help manage traffic congestion, detect air pollutants, and even remind you to take your trash out.

by Aloysius Low [@longadin](#) / June 17, 2014 5:15 AM PDT

0 / 0 / 293 / 150 / [g+](#) / more +

- **3D Digital Built Environment** plays a key role in supporting the development and operation of Smart Nation.

- The digital environment supports planning, management, modelling, simulation and visualisation.

- The most important element is the 3D map data.



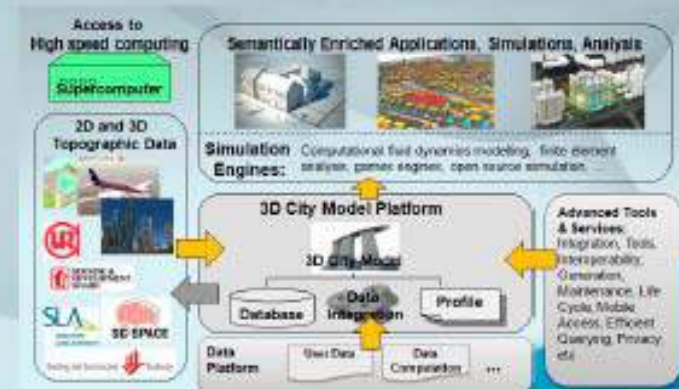
The District in Singapore will be used as a trial area for Singapore's ambitious Smart Nation plan.

Urban Redevelopment Authority of Singapore

What is Next ?



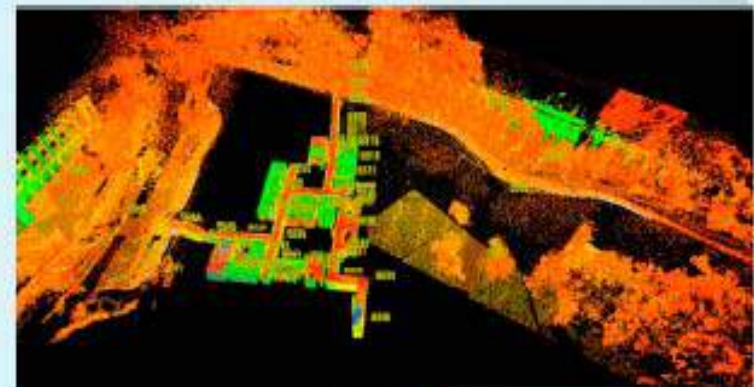
Integration with 3D Property Information and BIM



Virtual Singapore



Indoor Mapping



Underground Mapping

Latest events...



SINGAPORE
CONSTRUCTION
PRODUCTIVITY
WEEK 2015

13-16 OCTOBER 2015
Singapore Expo | Hall 3 | Max Atria

HOMEEXHIBITIONCONFERENCECOMPETITIONSACTIVITIESGALLERYSPONSORS

Build Smart for a Future-Ready Singapore



BUILD SMART CONFERENCE 2015
HEAR FROM THE INDUSTRY EXPERTS ON THE BEST PRACTICES
TO INCREASE YOUR CONSTRUCTION PRODUCTIVITY

Latest events...



SINGAPORE
CONSTRUCTION
PRODUCTIVITY
WEEK 2015

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Build Smart for a Future-Ready Singapore



GOVERNMENT BIM SYMPOSIUM 2015

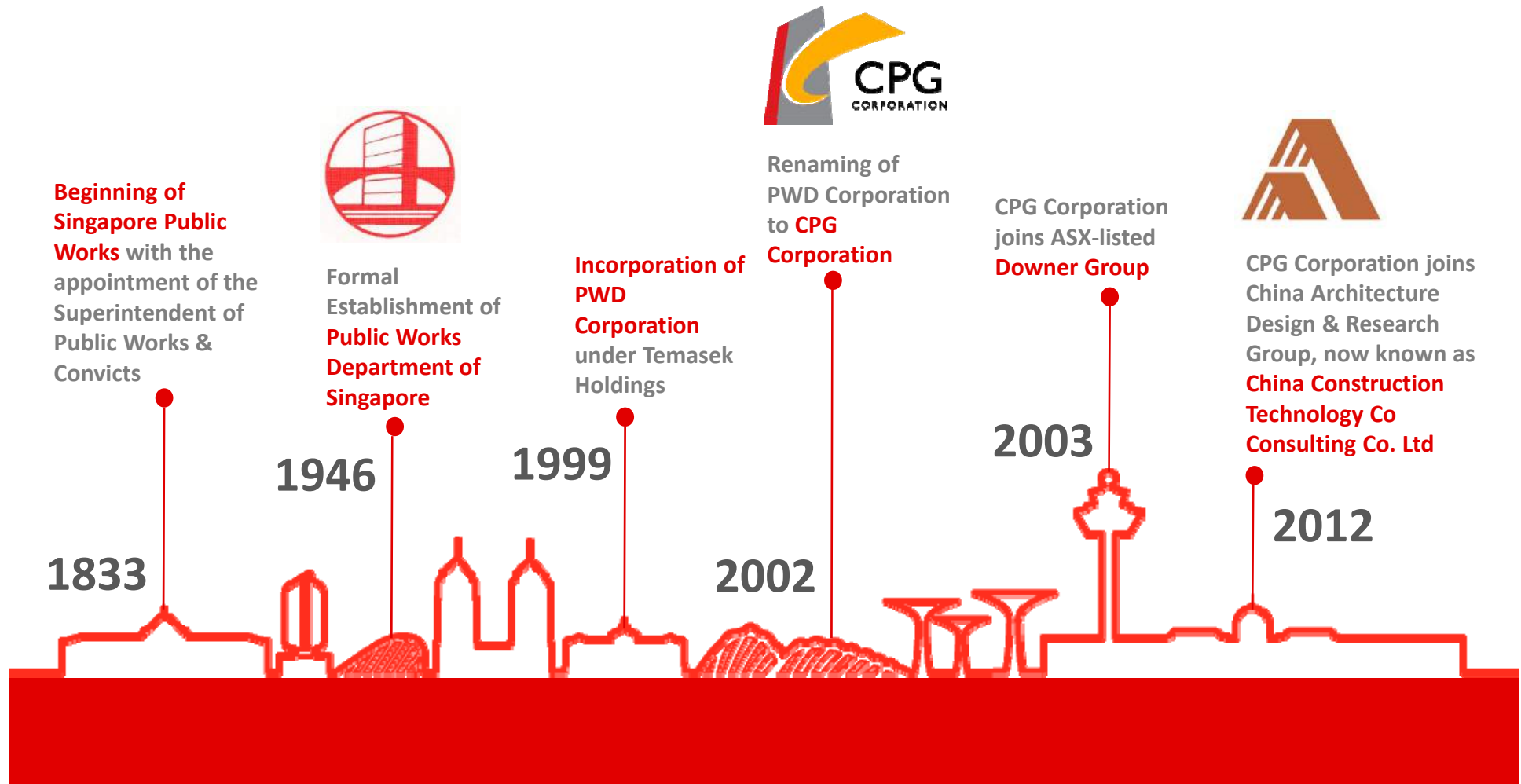
12 - 13 OCTOBER 2015

What is CPG's part in all of this...

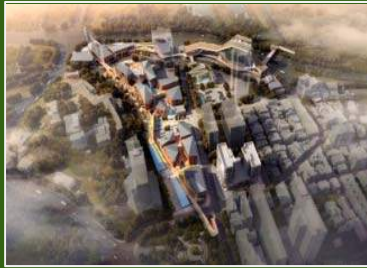
- DiHub – a company formed within CPG specialising in BIM
- Work closely with BCA Academy to provide training to industry
- Provide BIM services



Milestones



Our Thought Leadership



HEALTH Oriented Development

KNOWLEDGE Oriented Development



TRANSIT Oriented Development

ECOLOGIC Oriented Development

Our Brand of Expertise

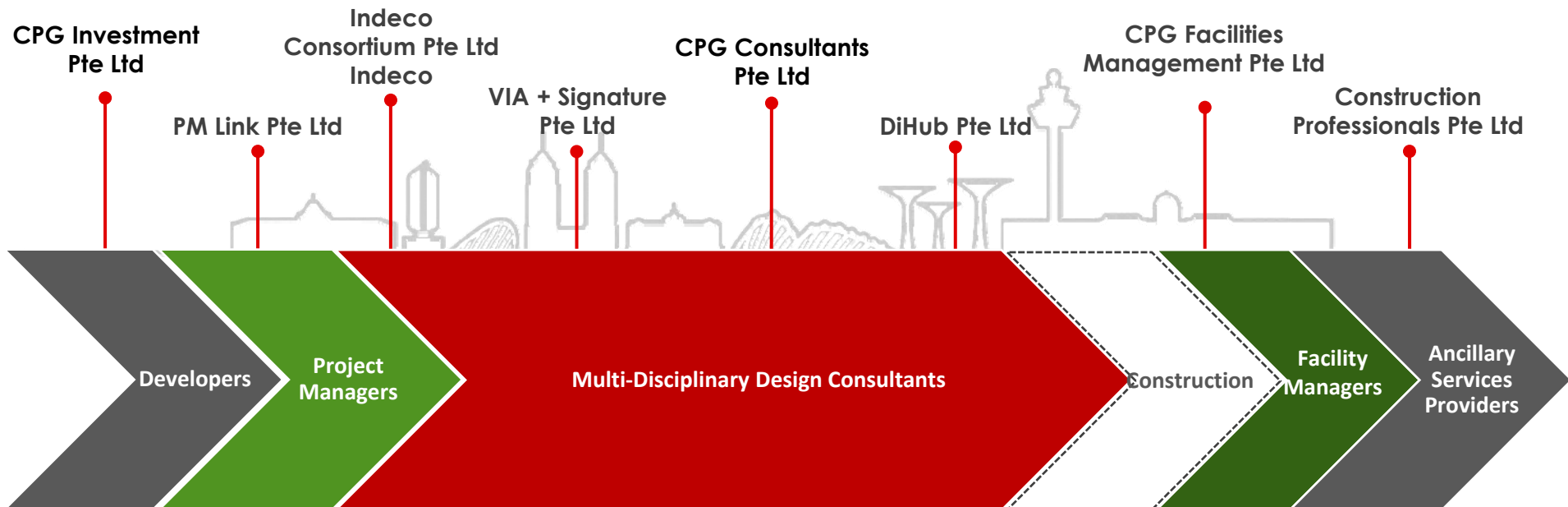
A design approach that **transcends multiple disciplines** and deeply grounded on **principles of sustainability**



CPG Group of Companies



CPG Corporation Pte Ltd



**CPG Corporation is a member of the China Construction Technology Consulting Co. Ltd*

- DiHub offers BIM solutions for perfect project simulations, visualizations, clash detection, material & cost estimates, 4D simulation, Facility Management integration and various aspects of design & engineering coordination.
- Specializing in the fields of Architecture, Engineering and Construction that are designed to ease the creation, adoption and use of BIM methodologies.
- 16+ Staffs with extensive experience and skills in the BIM management and modelling.
- We have a dedicated team of BIM Managers, BIM Specialist and BIM Coordinators, and supporting technical staff.



DiHub's principal field of activities includes:



Why **DiHUB** BIM marketplace?

Did you know that the percentage of companies using BIM jumped from 28% in 2007 to 71% in 2012? Building Information Modelling is a great service, but it is limited by the fact that it is offered mainly as a service and not like a product. There is a lack of ready BIM models that architects, engineers and contractors can effortlessly download and use in their projects.



DiHub is an Authorized Training Centre of Autodesk, offering basic to advanced courses that are based on the needs of the trainees.



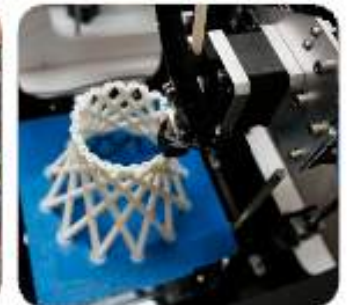
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[BIM SUPPORT](#)
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2	3 ○ AUTODESK REVIT ARCHITETURE 2015 - FUNDAMENTAL - 3, 5 & 7 Aug 2015 (Closed)	4	5	6	7
9	10	11 ○ AUTODESK REVIT MEP 2015 - FUNDAMENTALS - 11, 12 & 13 Aug 2015 (Closed)	12	13	14
16 ○ AUTODESK NAVISWORKS 2015 - 16 & 17 Aug 2015 (Closed)	17	18 ○ AUTODESK NAVISWORKS 2015 - 18 & 19 Aug 2015 (Closed)	19	20	21
23	24 ○ AUTODESK REVIT 2015 - ADVANCED + CERTIFICATION - 24, 26 & 28 Aug 2015 (Closed)	25	26	27	28

Questions?
[Click here to chat with DiHub](#)

Online - Chat with DiHub

Other Value-Added BIM Services



3D Modelling
Rendering

3D
Animation

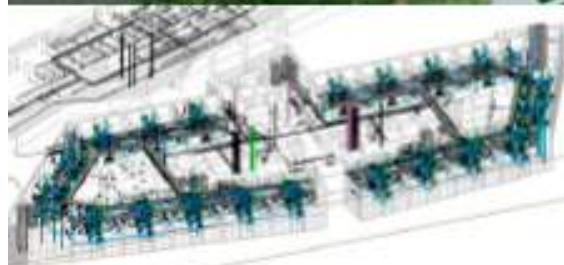
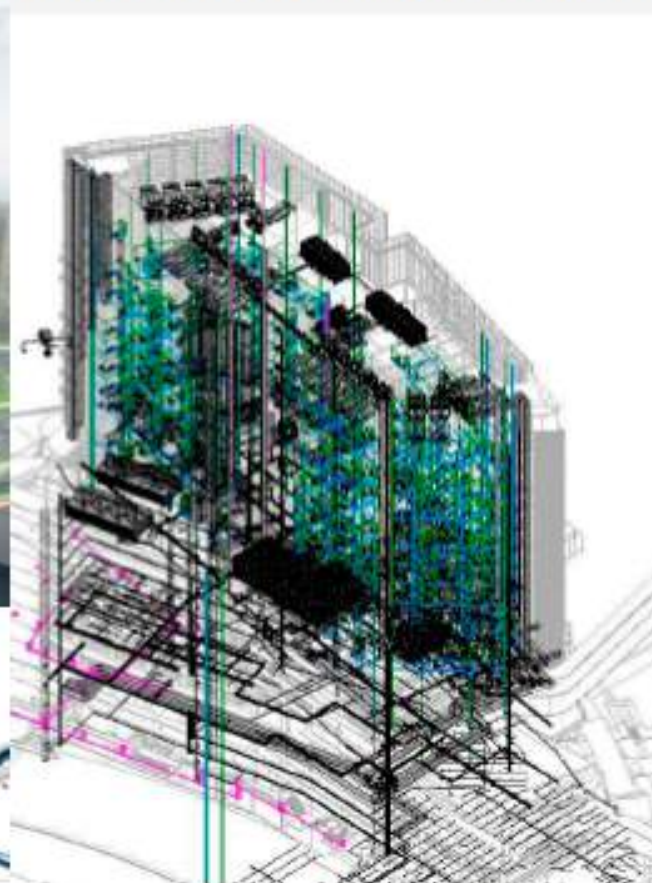
iPad
Application

Physical
Model

3D/
Printing

建筑设计
医疗建筑

陈笃生新传染病医院,新加坡
National Centre for Infectious Disease (NCID), SINGAPORE



项目介绍 | Project Details:

建筑面积 | GFA:

竣工日期 | Year of Completion:

项目介绍 | BIM Intent:

- To create a working BIM model with full M&E integration
- Utilize Model for Clash Detection

项目介绍 | BIM Challenges:

- Modeling works to focus on detailing and integration of multiple discipline used for construction works
- Co-ordination among various disciplines and within a discipline itself

项目介绍 | Stages:

- Concept Design Stage
- Design Development Stage
- Tender Stage

项目介绍 | Scope:

- 3D BIM Modeling

项目介绍 | BIM Software:



WARD PLANNING – Room Data Sheet Schedule

Autodesk Revit 2014 - ZBED WARD.rvt

Architecture Structure Systems Insert Annotate Analyze Massing & Site Collaborate View Manage Add-Ins StudioSoft Apps Modify

Modify Select Build Circulation Model Room & Area Opening Datum Work Plane

Project Browser - ZBED WARD.rvt

- Level 2
- PLAN
- Site
- Ceiling Plans
 - Level 2
 - RCP
- 3D Views
 - (3D)
- Elevations (Interior/Elevation)
 - 1
 - 2
 - 3
 - 4
- Legends
 - Door Legend
 - Key Plan
 - Keynote Legend
- Schedules/Quantities
 - A_RDS-Activity Schedule
 - A_RDS-MEDICAL AND NON-MEDICAL FINE
 - B_RDS-AMBIENT
 - B_RDS-FINISHES SCHEDULE
 - B_RDS-GENERAL NOTES
 - B_RDS-POPULATION
 - C_RDS-AUXILIARY SYSTEM
 - C_RDS-ELECTRICAL
 - C_RDS-GENERAL NOTES
 - C_RDS-HYDRAULICS
 - C_RDS-HYDRAULICS
 - C_RDS-MECHANICAL
 - C_RDS-MECHANICAL
 - C_RDS-MEDICAL GAS
 - C_RDS-POWER
 - ROOM AREA
- View List
- Sheets (1 of 6)
 - 01 - A-SHEET
 - 02 - B-SHEET
 - 03 - C-SHEET
 - 04 - PLANS
 - 05 - ELEVATIONS
- Families
- Groups
- Detail
- Model
- Revit Links

Sheet: 01 - A-SHEET - ZBED WARD.rvt

535

ROOM DATA SHEET

ROOM	TYPE	REMARKS
01	WOMEN'S	
02	WOMEN'S	
03	WOMEN'S	
04	WOMEN'S	
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92	WOMEN'S	
93	WOMEN'S	
94	WOMEN'S	
95	WOMEN'S	
96	WOMEN'S	
97	WOMEN'S	
98	WOMEN'S	
99	WOMEN'S	
100	WOMEN'S	

ROOM DATA SHEET

30 m

Schedule: A_RDS-Activity Schedule - ZBED WARD.rvt

A	B	C	D	E
ITEM	ACTIVITY	QTY	GRADE	Grp
1.0	PATIENT MAY ARRIVE ON FOOT OR WHEELCHAIR OR ON STRETCHER			
2.0	PATIENT TO BE REPOSITIONED ON THE BED AND/OR RECLINER			
3.0	PATIENT TO INGRESS & DRESS IN VICINITY OF BED WITH OR WITHOUT ASSIST			
4.0	PATIENT TO RECEIVE THERAPEUTIC & CLINICAL ATTENTION FROM STAFF			
5.0	RECEIVING VISITORS MAXIMUM 2			
6.0	PATIENT TO HAVE PRIVACY AS REQUIRED			
7.0	STORAGE OF PATIENTS CLOTHING & PERSONALS			
8.0	CLINICAL HANDWASHING			
9.0	USE OF MONITORING/DIAGNOSTIC EQUIPMENT			

3D View (3D) - ZBED WARD.rvt

1:300

WARDS : Prototyping

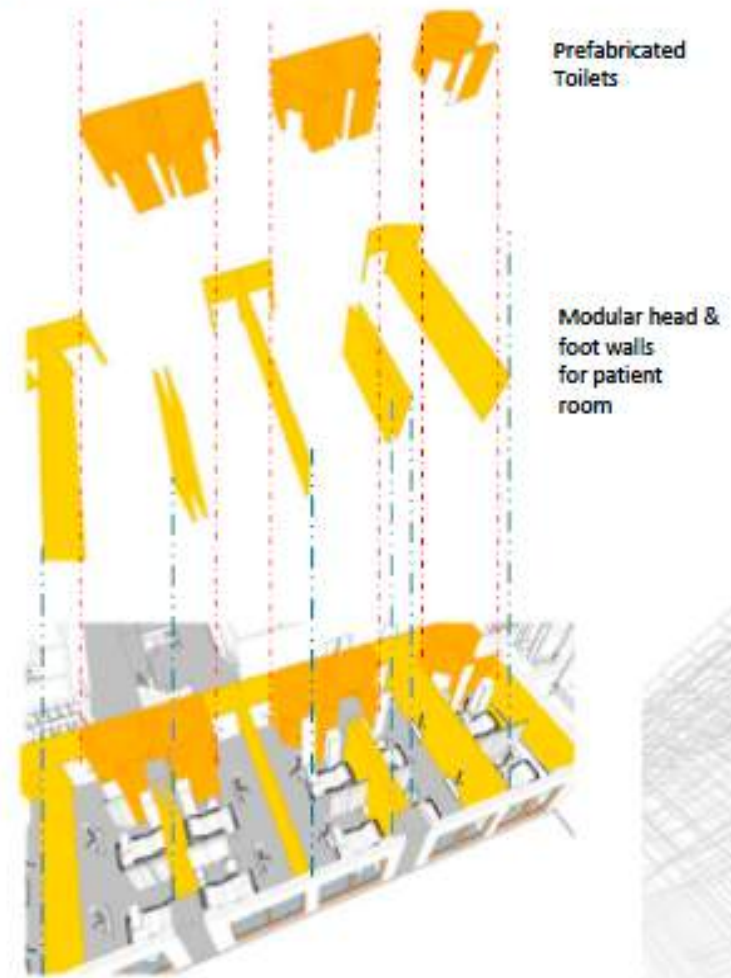
BIM in the Design Phase

- CPG used Building Information Modelling (BIM) to investigate the feasibility of prefabricating modular construction for the proposed project



Component based Prefabrication

- CPG suggests to prefabricate the toilets and modular construction for patient rooms which would help in accelerating the project schedule and yield higher quality construction



WORKFLOW: REVIT 2014 + COBIE EXCHANGE

INPUT MODEL



CONTRACTOR REVIT
MODEL

1

COBie Extension



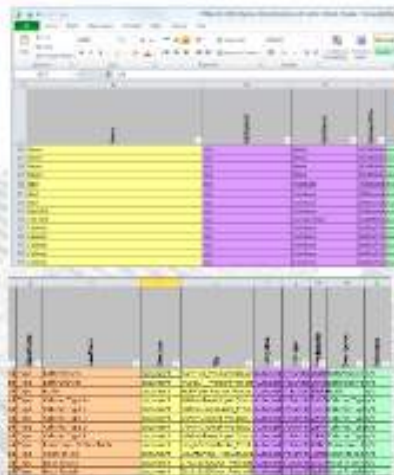
SETUP



COBie DATA PARAMETERS INSERTED AS REVIT PARAMETERS

2

SPREADSHEET



COBie DATA IN EXCEL
SPREADSHEET FORMAT

EXPORT



3

SCHEDULE



COBie DATA SCHEDULED WITHIN REVIT

BI-DIRECTIONAL DATA
SHARING USING PLUGIN

