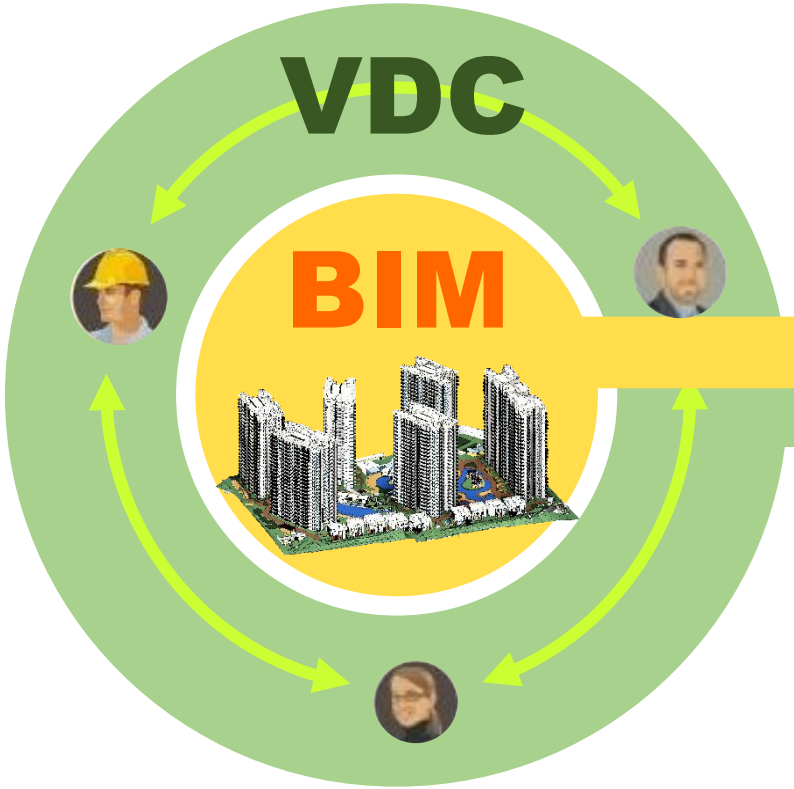
BIM & VDC Implementation in Singapore

(2011 to Present)

1st and 2nd BIM Roadmaps



2010

1st BIM ROADMAP

Widespread BIM adoption

2015

2ND BIM ROADMAP

Widen design and construction collaboration

1st and 2nd BIM Roadmaps Challenges

1st Roadmap (2010) Challenges

- Lack of demand for BIM
- Entrenched current 2D drafting practices
- Lack of ready pool of skilled BIM manpower
- Additional resources needed to build up BIM capacity and expertise

2st Roadmap (2015) Challenges

- 2D annotations required for regulatory BIM submission
- Lack of collaboration between stakeholders
- Lack of BIM skills for specialist subcontractors
- Lack of BIM usage for Facilities Management

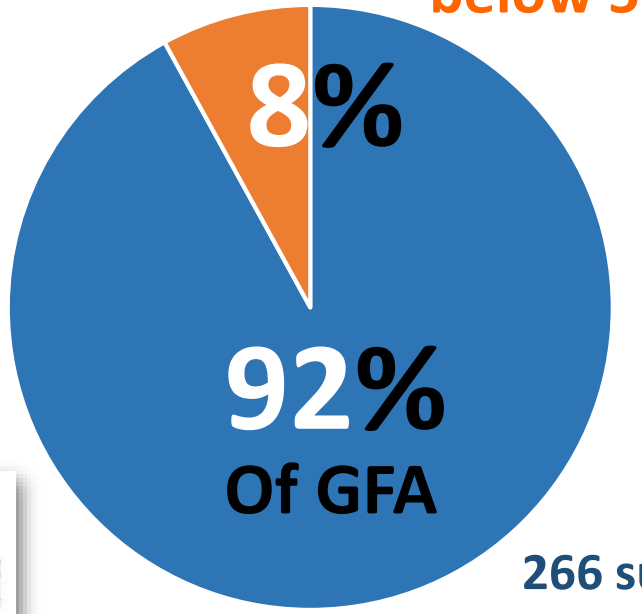
Public Sector Takes the Lead

BIM e-Submission to regulatory authorities is the 1st step towards driving BIM adoption in the industry

2013	Mandatory BIM for all architecture submissions of new building projects > 20,000 m^2
2014	Mandatory BIM for all engineering submissions of new building projects > 20,000 m^2
2015	**Mandatory BIM for all architectural & engineering submissions for all projects > 5,000 m^2**
2016	**Developed CoP for BIM E-Submission**



To date: 1274 submissions below 5000 m2



266 submissions above 5000 m2

■ > 5000 sqm ■ < 5000 sqm

Public Sector Takes the Lead in BIM/VDC Adoption

- Since 2012, >20 Government Procurement Entities (GPEs) have incorporated the **Public Sector BIM Requirements** into their contracts, with >200 public projects have embarked on BIM

- Since Aug 2015, under the **Productivity Gateway Framework (PGF),** GPEs must commit to implement VDC/BIM - 30-50 projects by 2020



Furniture Hub



Yishun N4C22

Private Sector Efforts to Promote BIM/VDC

BIM Steering Committee

- Set up in 2011
- Lead the development of BIM standards and supporting resources to facilitate the collaborative use of BIM;
- Advise on areas that would enable effective implementation of BIM at company, project and industry levels.

REGULATORY AGENCIES

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

SLA Singapore Land Authority

Urban Redevelopment Authority

GPEs

Housing & Development Board

jtc Corporation

Ministry of Education Singapore

Land Transport Authority

INDUSTRY ASSOCIATIONS

Singapore Institute of Architects

The Institution of Engineers Singapore

Singapore Institute of Surveyors and Valuers

REDAS

新加坡建築商公會有限公司
The Singapore Contractors Association Ltd
Building Our Nation Together

Association of Consulting Engineers Singapore

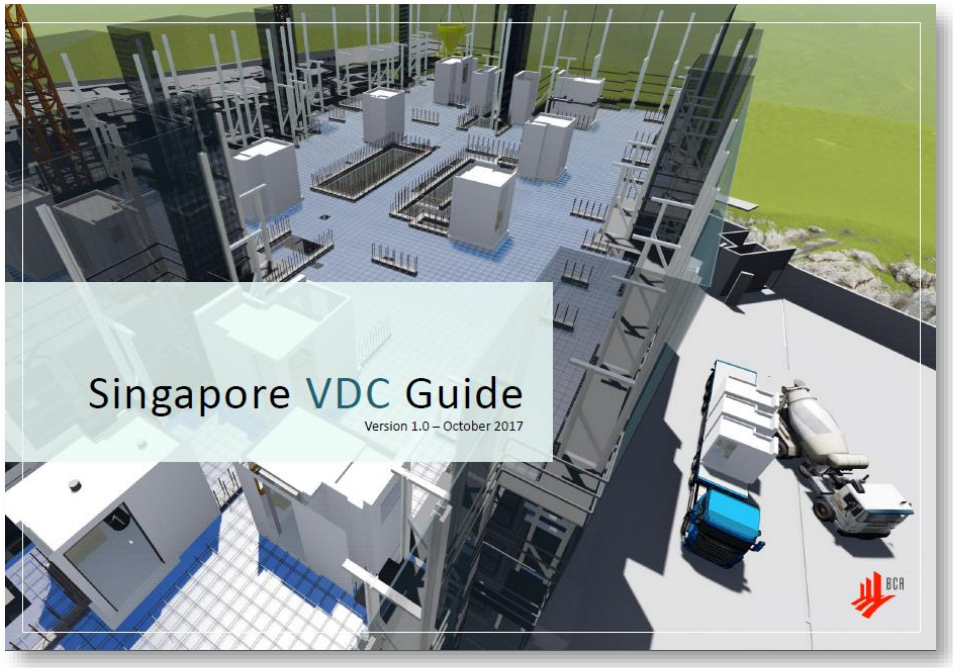


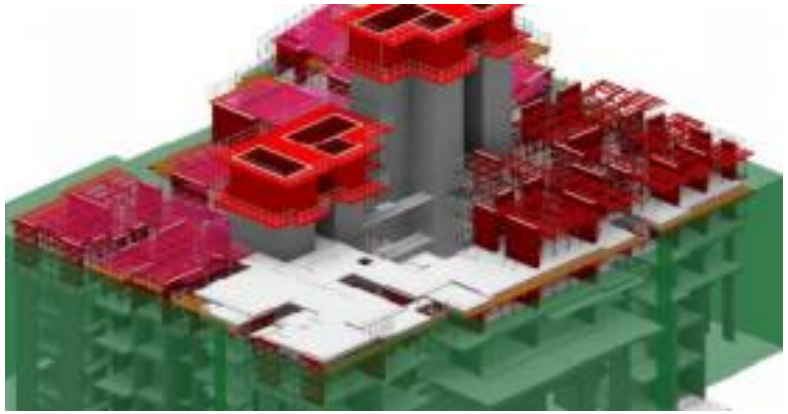
A **wide spectrum of BCA BIM Guides with BIM Steering Committee inputs** to share good practices with industry

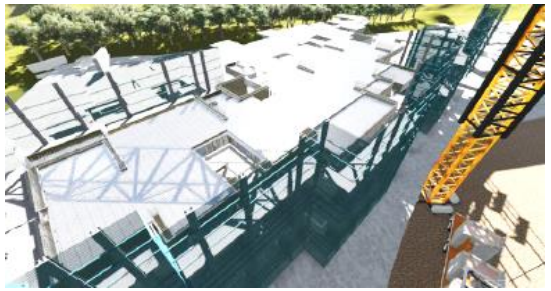
Singapore VDC Guide (launched Oct 2017)

Singapore VDC Guide

- Collaborative effort led by leading BIM/VDC practitioners in the industry
- Provides a common framework for VDC implementation in the Singapore context
- Consolidates best practices from both local and overseas implementation









BIM & Facilities Management

FM

- Public Sector BIM FM Pilots (ongoing)
- BIM for Asset Information Delivery Guide (April 2018)

1) MOHH

- 15 ongoing projects with BIM FM requirements

2) National Heritage Board

- National Gallery Singapore used 3D Lidar scanning for FM

3) Temasek Poly

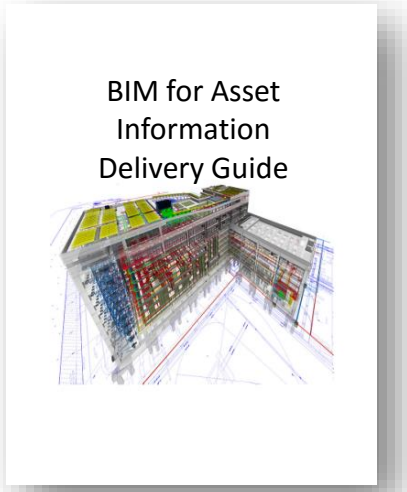
- To develop FM BIM for all existing buildings

4) State Courts

- State Courts Towers specified BIM for FM

5) JTC

- Chemicals Hub conducting proof of concept





Working with Private Sector to adopt BIM/VDC

Hosted Series of BIM/VDC Seminars and Sharing Sessions

BIM Symposiums

- May 2014: 1st REDAS BIM Symposium
- Sept 2015: 2nd REDAS BIM Symposium
- Sept 2016: 3rd REDAS BIM Symposium

Developers BIM Forums

- Oct 2014: 1st Developer BIM Forum
- Dec 2014: 2nd Developer BIM Forum
- Feb 2015: 3rd Developer BIM Forum

REDAS Industry Sharing Series

- Apr 2016: Virtual Design and Construction

Estimated 30 projects by 2020

REDAS taking the lead

REDAS — The leading professional and representative body for the real estate industry



Golden Shoe Redevelopment



Funan Mall Redevelopment



The Singapore Edition



CPF Building Redevelopment



High Park Residences



Northpoint City



Lake Grande Condo



Nexus International School



GEM Residences



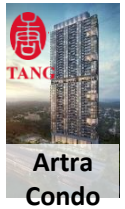
The Wisteria



Serangoon North Ave 1 Site



Marina East Desalination Plant



Artra Condo



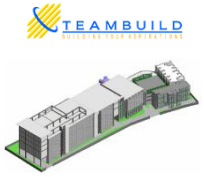
Alps Residences



Luxus Hills



ICPH3



ICPH4



Hundred Palms EC



Anchorvale EC

Working with Private Sector to adopt BIM/VDC

Sharing of good BIM practices and trouble-shooting tips with more firms

Boost smaller firm BIM capability and address technical issues faced.



BIMSC Engagement Dialogue



BIM technical sharing workshop

DCA ARCHITECTS PTE LTD
SIACAD PTE LTD Reinventing The Profession!
BIMAGE CONSULTING PTE LTD
DiHub Singapore
GRAPHISOFT
AUTODESK

Follow-ups since SIA Members Dialogue in July 2017

18 and 30 Aug 2017	BIM Technical Workshops for SIA Members	• 2 technical workshops organized to addressed design object, interoperability and other technical issues raised by SIA during the July Engagement Sessions. • A total of 93 participants from 38 firms, large and small, attended both workshops. • 3 most highly discussed topics included: (i) technical troubleshooting for SIA subsidiary SIACAD's eBDAS BIM tool to calculate B-Score (ii) tips and tricks enhancing interoperability between Revit and other BIM software (iii)SIA firms can help to recommend more suppliers to work with object library vendors (SIAiDOL, Dihub BIM Marketplace) to create objects for the industry

27 Sept 2017	BIM Technical Workshop for SIA Members	• Technical workshop held, where 16 representatives from 5 SIA firms attended. 3 topics were shared: (i) Interoperability of Bentley BIM software, (ii) BIM submission preview of Bentley Aecosim native BIM submission, and (iii)Graphisoft Archicad BIM plugin for SIACAD's eBDAS application for BIM-based Buildability Score calculation.

20 Dec 2017	Updates from SIA	SIA is exploring with BIM training targeted at small SIA firm owners, on revamping their workflow using BIM beyond e-submission, to assist those who cannot get/retain BIM staff on S Passes

Outreach Efforts

Singapore Construction Productivity Week

International BIM Competition





BIM Awards



BIM Shootout



Buildsmart Conference



Buildtech Asia





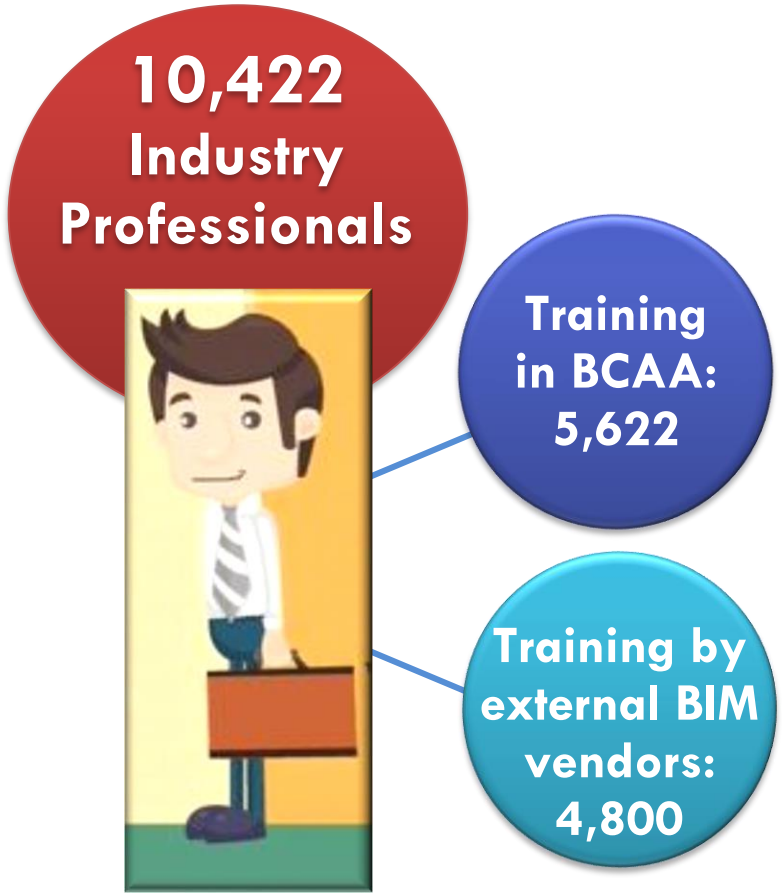
Govt BIM Symposium



Building BIM Capability among PMETs

Training existing professionals:

BCA Academy provides more than 10 VDC and BIM programmes, including the leadership level



BCA ACADEMY
of the built environment

MNGT.

- Stanford CIFE-BCA Advanced Management Program in VDC
- Stanford CIFE-BCA AMP in VDC Leadership

SPECIALIST

- Specialist Diploma in VDC
- Specialist Diploma in BIM
- Certification Course in BIM Management
- BIM Planning Course

MODELLER

- Certification Course in BIM Modelling
- Certification Course in BIM Modelling (Arch Track)
- Certification Course in BIM Modelling (MEP Track)
- Certification Course in BIM Modelling (Structure Track)
- Certificate Course in BIM for MEP Coordination
- BIM Quantity Take Off
- BIM Scheduling and Process Management
- BIM for Structural Design & Detailing

Building BIM Capability among IHLs

Training future graduates:

2,586 Full-time students



Training in BCAA: 706

Training in other IHLs: 1,880

10 Institutes of Higher Learning (IHLs) have incorporated BIM into 31 full-time programmes and 13 part-time programmes

SINGAPORE INSTITUTE OF TECHNOLOGY

BCA ACADEMY

Institute of Technical Education

NANYANG TECHNOLOGICAL UNIVERSITY

NUS National University of Singapore

NGEE ANN POLYTECHNIC

SIM UNIVERSITY

SINGAPORE POLYTECHNIC SP

SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

TEMASEK POLYTECHNIC







Young Leaders & International BIM Competition

BCA-Industry Build Environment Scholarship awardees





International BIM Competition





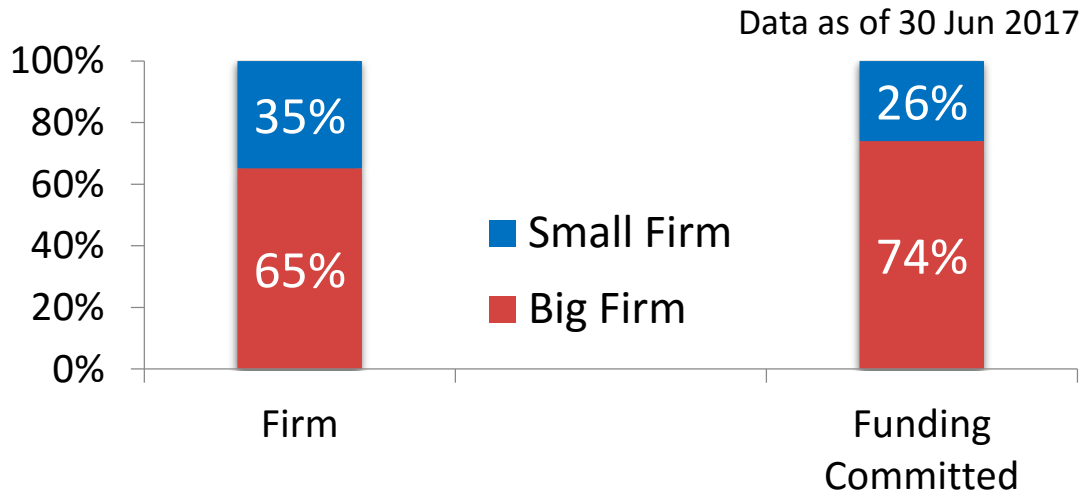


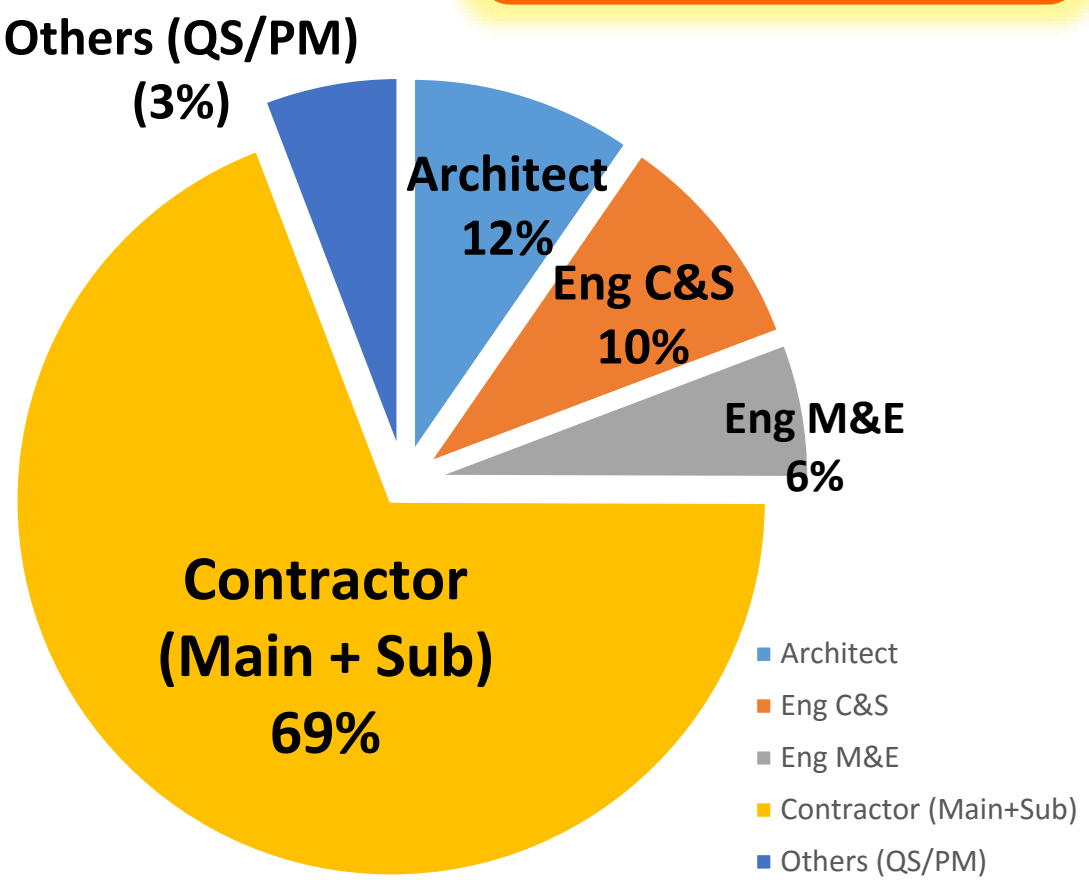


BIM/VDC Funding Support through CPCF

To **build up BIM collaboration capability in projects** by providing up to 70% co-funding for hardware, software, training cost, and consultancy cost.

Tranche 1 + Tranche 2 quantum committed





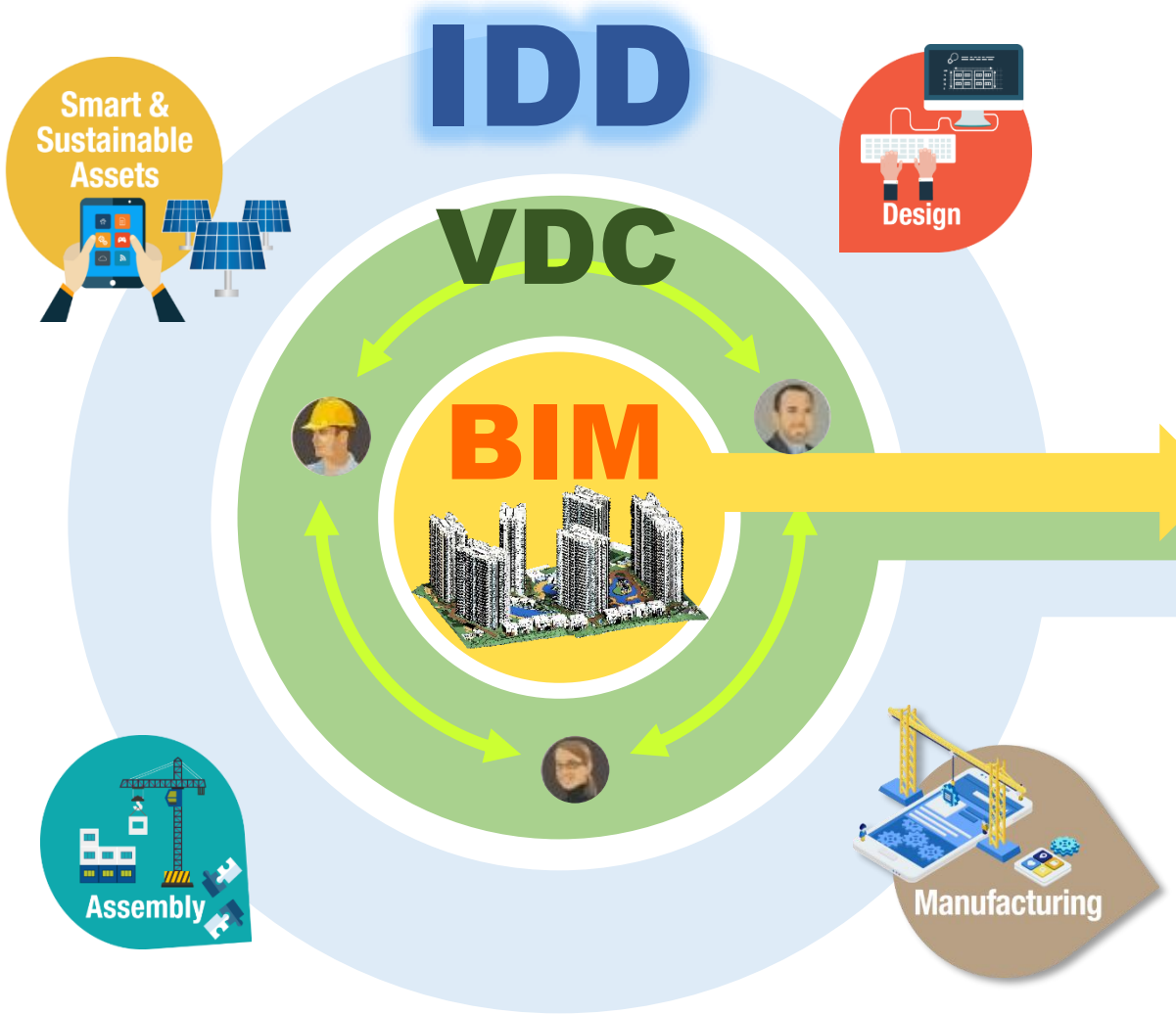
Firms benefitted

1st TRANCHE
$21M
706 Firms Benefitted

2nd TRANCHE
$4M
63 Projects
120 Firms

Integrated Digital Delivery
[IDD] Plan

Introduction



2010
BIM ROADMAP
- Widespread BIM adoption

2015
VDC ROADMAP
- Widen design and construction collaboration

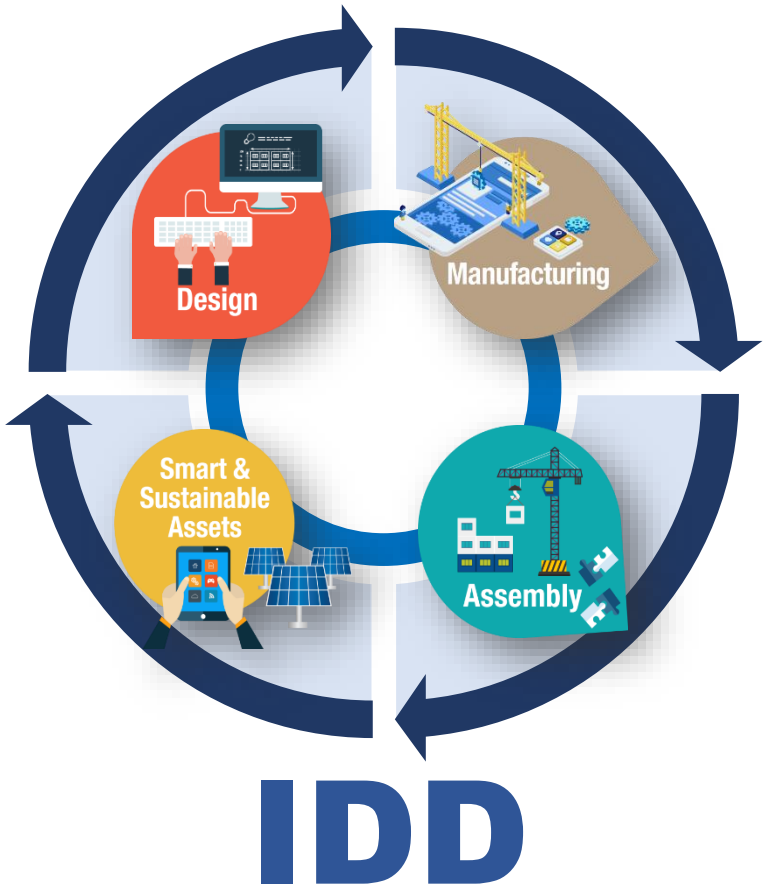
2017
IDD
PLAN
- Widespread integrated digital delivery throughout life cycle

IDD aims:

To achieve **timely**, **cost effective**, **productive** and **high quality** project delivery - design, manufacturing, fabrication, construction and asset delivery

by developing and adopting **BIM/VDC** and other **digital solutions** to convey **relevant**, **accurate**, and **timely digital information**

through **collaborative working approaches** & **integrated platforms**.



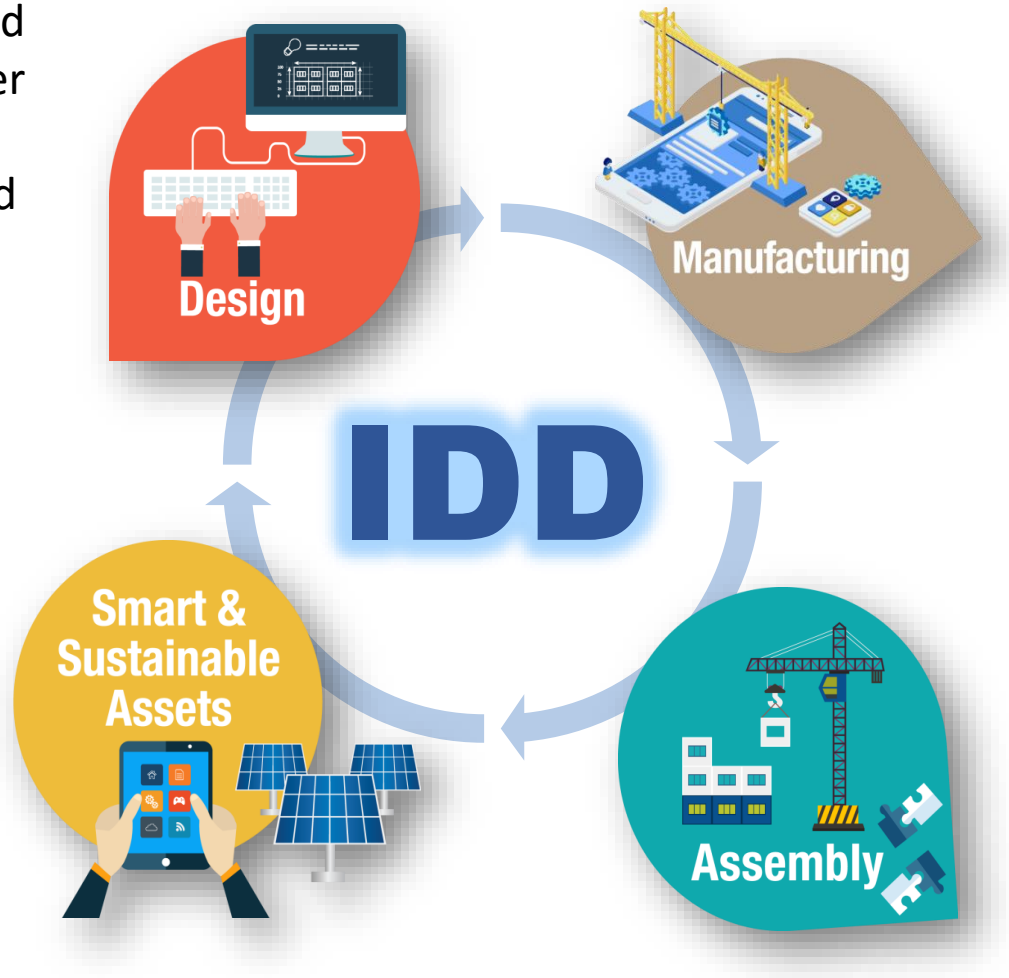
Scope of IDD

Digital Design

Collaborative and coordinated design via BIM/VDC and other computational tools to achieve design objectives and ease and optimize downstream manufacturing, fabrication, construction and maintenance.

Digital Asset Delivery & Management

Verification and handing over of the asset for operations and maintenance through effective use of digital tools.



Digital Manufacturing and Fabrication

Integration of BIM/VDC design to off-site production, fabrication and component management through automation, robotics optimization.

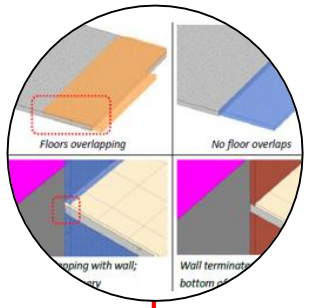
Digital Construction

Integration of BIM/VDC design and off-site manufacturing/ fabrication to delivery and installation on-site through use of real-time ICT solutions, as part of project management and Lean construction

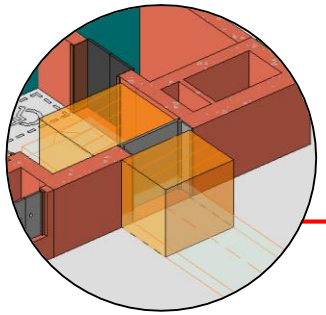
Digital Design - components



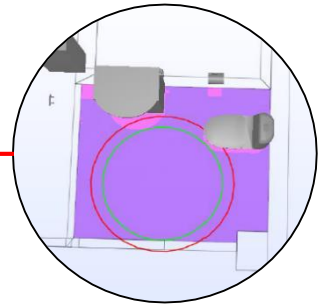
AR-VR



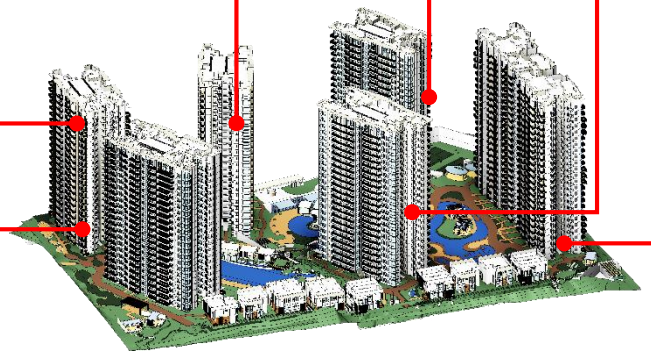
BIM Quality Checks



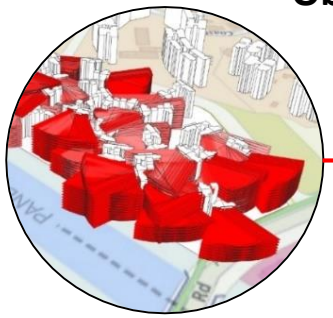
Use of Intelligent Objects



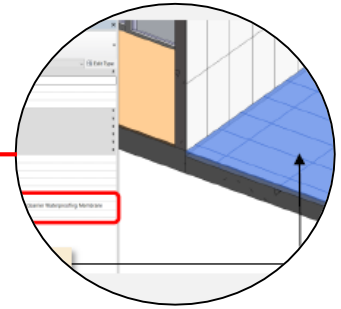
Automated Code Compliance Checker



DESIGN BIM MODEL



Computational & Rule-based design



Tender Release & Handover

Digital Manufacturing and Fabrication components



Production Management System
(e.g. from BIM to machinery)



BIM to Shop Floor
(e.g. using mobile device)



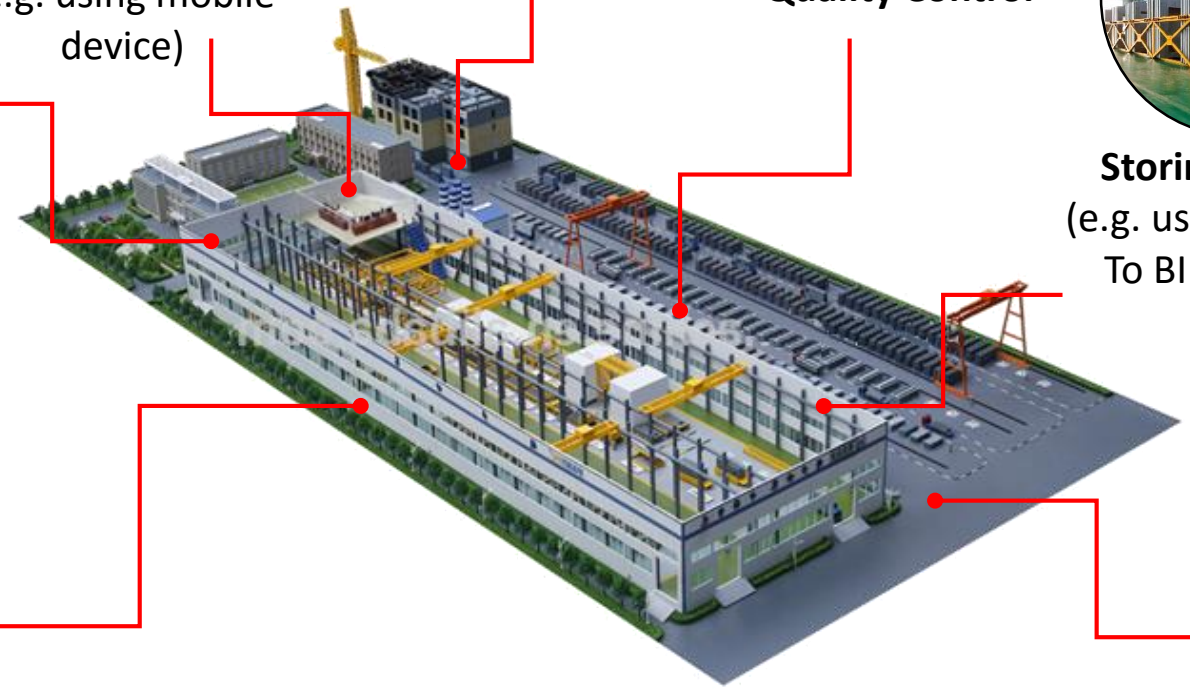
Robotics installation

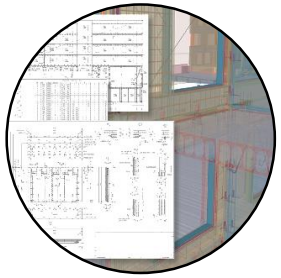


Quality Control



Storing & Tagging
(e.g. using RFID linked To BIM elements)





Fabrication Model Creation
(e.g. Detailing & BBS)

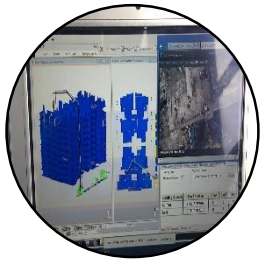


Delivery
(e.g. Fleet Tracking)

Digital Construction - components



Site Progress Tracking & Inspection
(e.g. using drone)



Smart Installation
(e.g. smart crane & robotics)



Site Safety & Security
(e.g. using video analytics)



Material Tracking
(e.g. using RFID)



Equipment Tracking
(e.g. using GPS)



Field BIM
(e.g. using BIM for layout)



Lean Construction



ICE Meeting Session



Manpower Tracking
(e.g. using wearable)



Project Management Command Centre



Construction BIM model



Site Data Monitoring & Submission
(e.g. Silt Detection System)

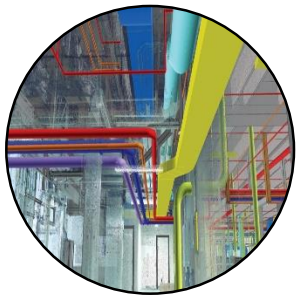
Digital Asset Delivery & Management - components



Defect Management System
(e.g. using cloud-based mobile system)



BIM Handover Quality Check
(e.g. check data correctness)



BIM As-built Verification
(e.g. using 3D scanner)



Asset Monitoring
(e.g. using video analytics to detect leakage)



Quality Assessment System
(e.g. using robot for building inspection)





Asset Management
(e.g. using BIM data for maintenance)

An IDD Scenario

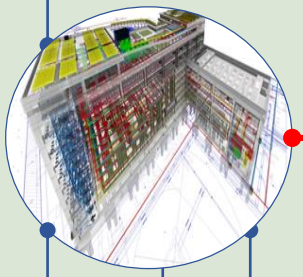
Design

Architect uses computational BIM to generate different design options



Engineers perform sustainability analysis







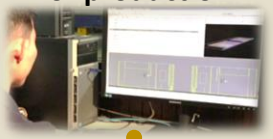
Contractor and Fabricator give early input on constructability

Developer use VR collaboration tool to visualise the building



Fabrication

Fabricator uses the digital DfMA model for production



Supervisor monitors all activities in a central control room







Digital data and robotics are used to drive the machinery and installation sequence



DfMA modules are delivered just-in-time to site



Digital IDs are embedded in DfMA modules

Construction

Contractor uses BIM to plan the construction activities & scheduling



Contractor uses BIM-to-Field technology for setting out







PM monitors site activities & tracks progress using drones



Crane Operator operates the smart crane

Asset Delivery

Contractor uses tablet to check construction vs digital model & records all defects







Digital asset are handed over to Building Owner



Building Owner & FM Operator monitor building performance

IDD Platform: Data Storage, Data Exchange, Data Processing, Data Mining, Analytics Engine/Machine Learning

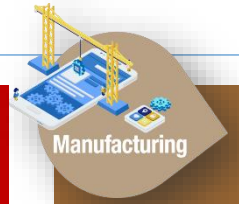
Common Standards for Regulatory Monitoring & Approvals

Challenges



DIGITAL DESIGN

- Design BIM model is often not developed to tender stage
- Regulatory agencies are still building BIM processing capabilities



DIGITAL MANUFACTURING & FABRICATION

- Design and construction BIM not directly linked to manufacturing, fabrication and logistics planning and execution
- Opportunities for further automation, use of robotics and 3D printing



DIGITAL CONSTRUCTION

- BIM is not fully utilized during construction beyond 3D
- Documentation still very paper-based
- Real-time information not captured and used effectively to guide coordination, execution, and validation

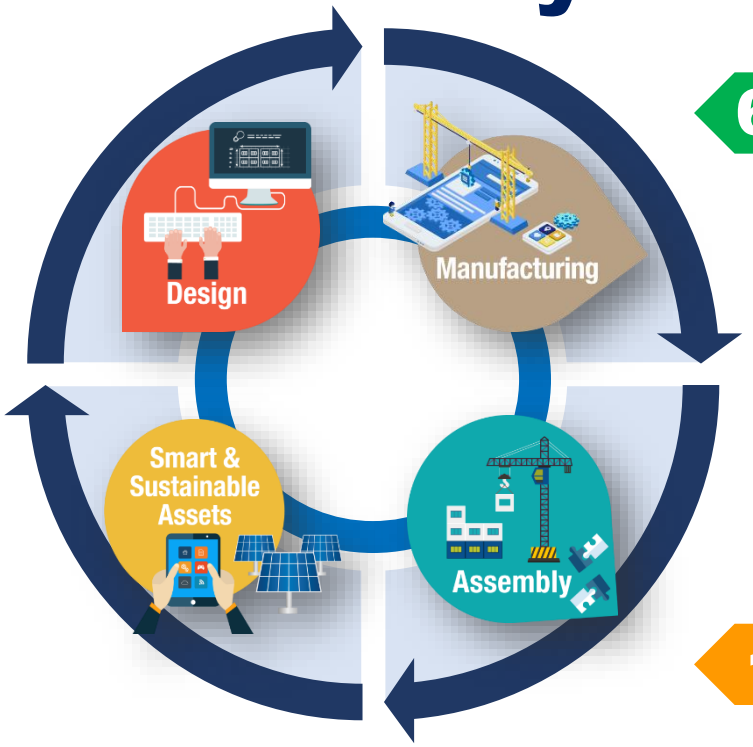


DIGITAL ASSET DELIVERY AND MANAGEMENT

- Building owners still learning how to link BIM to FM
- Lack of capability and infrastructure to support FM operations digitally.

- Digital information are mostly segregated, great need to integrate across the value chain for greater effectiveness

Integrated Digital Delivery



Broad Strategies:

6 Strengthening **IDD Capabilities** & **Enterprise Development**

5 Widening **adoption** through public & private sector clients

4 Nurturing **R&I** and **piloting new IDD solutions.**

3 Developing **collaborative procurement approaches**

2 Identifying & encouraging adoption of **vertical applications** (specialized software)

1 Developing & promoting **collaborative platforms** & **common standards**

Outcomes

1. To contribute to the built environment overall productivity target of 25-35% by 2025
2. Industry transformation through contractual, process, and structural changes
3. Pervasive and collaborative use of technology in large and medium sized projects that support DfMA and environmental sustainability
4. 150-200 firms with deep digital capabilities by 2025
5. Home-grown digital solutions that can be exported

Thank You