

### Annex A: Factsheet on ITM Progress

1 The Construction ITM was launched in October 2017, with the view to transform the construction industry into an advanced and integrated sector with widespread adoption of leading technologies, led by progressive and collaborative firms and supported by a skilled and competent workforce, offering good jobs for Singaporeans.

#### **Design for Manufacturing and Assembly (DfMA)**

2 Through the DfMA approach, buildings are designed with major components and modules fabricated off-site in a controlled manufacturing environment, then brought on-site for assembly. With more works done offsite, manpower and time needed to construct buildings are significantly reduced. With increase in productivity, sites have the potential to deliver buildings and infrastructure projects more quickly to end users. Work sites are cleaner, safer, and create less disamenities to the surrounding living environment. Over the course of **more than 140 DfMA projects**, we have found that the DfMA approach has indeed enabled us to achieve higher quality, productivity and sustainability in a traditionally manpower-intensive construction industry.

3 Singapore firms have also been investing in capability building to undertake DfMA projects. To date, more than 80 (architectural, C&S, engineering and M&E) consultancy firms and about 60 builders have undertaken over 140 DfMA projects in Singapore. We have also seen several leading firms investing in highly automated plants to produce higher quality prefabricated components and modules for DfMA in Singapore. In all, our industry has, since 2010, achieved a cumulative site productivity improvement of about 15%, and this will rise to 20% by the end of 2020, with the completion of more DfMA projects.

#### **Integrated Digital Delivery (IDD)**

4 Integrated Digital Delivery (IDD) refers to the use of digital technologies to integrate work processes and connect stakeholders working on the same project throughout the construction and building life-cycle: namely, from design, to off-site

fabrication, to on-site assembly and construction, and finally to operations and maintenance. IDD helps project teams to smoothen coordination, avoid miscommunication and reduces abortive works during construction.

5 The IDD Implementation Plan was launched in November 2018. IDD is being piloted in over 20 projects now and 30-40 more will adopt IDD in the coming year. These projects cover a wide spectrum of building types, from residential, institutional, industrial to commercial projects. Collaboration across the entire value chain is key to meeting the demands of the future, where we expect buildings to become more complex, high-density yet liveable and sustainable. Our industry's efforts in IDD to leverage data and digital technologies to connect the different project parties will help to facilitate this process.

### **Green Buildings**

6 Buildings contribute one-quarter of Singapore's carbon emissions and the industry has endeavoured to lower this through Singapore's green building journey since 2005. To date, we have greened close to 40% of our gross floor area in buildings, on track to meet the target of 80% by 2030. In September last year, BCA launched the Super Low Energy Programme to push the boundaries of energy efficiency in buildings even more. The programme was jointly developed with industry and academia, with best-in-class SLE buildings beginning to show 60% greater energy efficiency over 2005 levels. To date, 17 projects have already been certified and another 15 projects are ongoing (as of Aug 19).

### **Manpower**

7 The Construction ITM creates good jobs for Singaporeans through transformation. There is funding support from Government, and training to upskill workers in the construction sector. In addition, guided by the iBuildSG Tripartite Committee, our Institutes of Higher Learning (IHLs) have been updating their curricula to better equip students with the competencies to participate in this transformation.

8 As of March 2019, about 40,000 persons have been trained in the three transformation areas. This number will grow to 47,000 by 2020.

**DfMA examples:**

- P&T Group provides architectural and structural consultancy services to several DfMA projects in Singapore (i.e. Mass Engineered Timber (MET) for schools, Prefabricated Prefinished Volumetric Construction (PPVC) for Housing and Development Board (HDB) public housing, Structural Steel for commercial development, etc.). P&T also provided consultancy services for a residential project adopting steel Modular Integrated Construction (MiC) in Hong Kong.
- Surbana Jurong provides architectural, structural and M&E consultancy services to residential, dormitory and healthcare projects adopting PPVC and prefabricated Mechanical, Electrical, and Plumbing (MEP) systems in Singapore. Due to their expertise in DfMA, Surbana Jurong has unlocked opportunities in the APAC region where they have been appointed as the PPVC consultant for a project in Hong Kong.
- TW-Asia Consultants Pte Ltd provides structural consultancy services for private residential PPVC projects in Singapore. These projects include Le Quest mixed development, Lake Grande Condominium and Clement Canopy Condominium. TW-Asia has also been involved in the structural design of regional projects in Vietnam and Thailand. Particularly, in Hong Kong, for MiC.
- Tiong Seng Contractors Pte Ltd is the main contractor for dormitory, school and healthcare projects in Singapore adopting PPVC. The firm completed a housing project in Yangon, Myanmar, with one of the residential blocks built using PPVC in 2018. Tiong Seng also signed three (3) Memorandum of Understanding (MOUs) to set up precast factories in Tianjin.
- These progressive firms have also proactively evolved from employing the traditional method of construction. They have since developed capabilities in DfMA and successfully undertaken DfMA projects in Singapore. Their capabilities in DfMA in the Singapore market are now well entrenched and they are also starting to gain international recognition. This has helped them to develop a competitive edge to export their expertise overseas.

Firm	DfMA expertise areas	Examples of DfMA Project in Singapore	Overseas DfMA Project experience
P&T Group	a) DfMA consultancy services provided: <ol style="list-style-type: none"> <li>i. Architectural consultancy</li> <li>ii. Structural consultancy</li> </ol> b) Project types: <ol style="list-style-type: none"> <li>i. Residential, commercial and institutional projects</li> </ol> c) Number of DfMA projects in Singapore: <ol style="list-style-type: none"> <li>i. More than 10 PPVC, 2 MET, 2 structural steel and 1 Prefab MEP project</li> </ol>	a) Rivervale Community Club (MET/Prefab MEP) b) 22-Storey Parc Botannia Condominium (PPVC)	Provided consultancy services for a residential project adopting steel Modular Integrated Construction (MiC) in Hong Kong.
Surbana Jurong	a) DfMA consultancy services provided: <ol style="list-style-type: none"> <li>i. Architectural Consultancy</li> <li>ii. Structural Consultancy</li> <li>iii. M&amp;E Consultancy</li> </ol> b) Project types: <ol style="list-style-type: none"> <li>i. Residential, dormitory and healthcare projects</li> </ol> c) Number of DfMA projects in Singapore: <ol style="list-style-type: none"> <li>i. 9 PPVC, 1 MET, 1 structural steel and 2 Prefab MEP projects</li> </ol>	a) Woodlands Health Campus (Prefab MEP) b) 12-storey Wisteria Commercial and Condominium (PPVC)	Appointed as the PPVC consultant for a project in Hong Kong
TW-Asia Consultants Pte Ltd	a) DfMA consultancy services provided: <ol style="list-style-type: none"> <li>i. Structural consultancy</li> </ol> b) Project types: <ol style="list-style-type: none"> <li>i. Residential and institutional projects</li> </ol> c) Number of DfMA projects in Singapore:	a) 16-storey Le Quest Commercial and Condominium (PPVC) b) 40-storey Clement Canopy	Involved in the structural design of regional projects in Vietnam and Thailand. Particularly, in

	i. More than 10 PPVC and 1 multi-tech <sup>^</sup> project	Condominium (PPVC)	Hong Kong, for MiC.
Tiong Seng Holdings	<ul style="list-style-type: none"> <li>a) Main contractor</li> <li>b) Project types: <ul style="list-style-type: none"> <li>i. Dormitory, institutional and healthcare projects</li> </ul> </li> <li>c) Number of DfMA projects in Singapore: <ul style="list-style-type: none"> <li>i. 5 PPVC projects</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>a) Dormitory at JTC Space @Tuas (PPVC)</li> <li>b) Northshore Primary School (PPVC)</li> </ul>	<ul style="list-style-type: none"> <li>a) Completed a housing project in Yangon, Myanmar, with one of the residential blocks built using PPVC in 2018; and</li> <li>b) Signed three (3) MOUs to set up precast factories in Tianjin.</li> </ul>

<sup>^</sup> Multi-tech refers to PPVC / MET / Advanced Precast Concrete System (APCS) / Prefabricated MEP

#### IDD examples:

Firm	IDD expertise areas	Examples of IDD Projects in Singapore	Overseas IDD Project experience
Ong & Ong Group	<ul style="list-style-type: none"> <li>a) IDD implementation in the Architectural, Structural and M&amp;E consultancy services, including: <ul style="list-style-type: none"> <li>a. Building Information Modelling (BIM)</li> <li>b. Virtual Design &amp; Construction (VDC)</li> <li>c. Analysis &amp; Simulation</li> <li>d. Computational &amp; Automation</li> <li>e. Information Management</li> </ul> </li> <li>b) Project types:</li> </ul>	<ul style="list-style-type: none"> <li>a) North-South Corridor Package N110</li> <li>b) Sloane Residences</li> <li>c) HDB Sembawang N2C3-5</li> </ul>	BIM departments set up in regional offices (KL, Jakarta, Vietnam, Bangkok and China) to provide BIM and IDD services to 15 projects in Malaysia, 27 projects in Vietnam and 7

	<ul style="list-style-type: none"> <li>a. Commercial, conservation, hospitality, industrial, infrastructure, institutional, mixed-use, religious, residential projects and public spaces</li> <li>c) Digital achievements: <ul style="list-style-type: none"> <li>a. 3 IDD projects: 1 infrastructural and 2 residential projects</li> <li>b. Won the 2016 BCA Platinum BIM Award (Organisation category)</li> <li>c. Won the MOHH BIM award for the design stage in the Jurong West Nursing home</li> <li>d. Collaborative Cloud platform implementation (CDE) using BIM 360 solutions for 100% of all projects and all offices</li> </ul> </li> </ul>		<p>projects in Indonesia as of today. These include the Kamala Kandara residential hub in Bekasi, Indonesia, the KL Eco-City and the Eco Ardence green building development in Selangor, Malaysia.</p>
ID Architects	<ul style="list-style-type: none"> <li>a) IDD implementation in the Architectural services, including: <ul style="list-style-type: none"> <li>i. Building Information Modelling (BIM)</li> <li>ii. Virtual Design &amp; Construction (VDC)</li> <li>iii. Mixed Reality</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>a) PSA Maintenance Base Development at Tuas F2 Terminal, including administration building, resource hub, store, workshops</li> </ul>	<p>Together with IDATEchnology, carried out projects in Myanmar, Sri Lanka, Malaysia and Palau, including the DHL Facility at the KL International</p>

	<p>iv. Project Information Management</p> <p>b) Project types:</p> <p>a. Commercial, healthcare, hospitality, industrial, infrastructure, institution, interior, master planning, mixed development, residential, sports &amp; recreation</p> <p>c) Digital achievements:</p> <p>a. 1 IDD project: 1 industrial project</p> <p>b. Won the 2019 UOB SME Digital Leap AWard (Medium SME category)</p> <p>c. Established affiliate company IDATEchnology, to accelerate digital transformation of the BE sector through their Digit-Alpha solution</p> <p>d. Won the 2017 BCA Gold BIM Award (Organisation category)</p>	and main intake substations	Airport, Malaysia, a resort development at Koror, Palau, and a villa development at Yangon, Myanmar.
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**GM SLE examples:**

- MKPL Architects is a Singaporean Practice which was involved in 2 SLE projects, including the recently awarded SMU's Tahir Foundation Connexion and in more than 5 Green Mark higher rating projects. Tahir Foundation Connexion is a net zero energy building in the heart of the city. The Architects have designed the

building to respond the surroundings and our topical climate through the use of advanced cooling systems, on-site solar energy and sensors, leading to energy savings of 500MWh per year (similar to the energy consumption of 110 4-room HDB flats a year). This creates a comfortable, vibrant and healthy place for students and staff to learn and collaborate, whilst reducing the energy required to operate the building. As a leading business school, SMU through the Tahir Foundation Connexion and their green initiatives campus wide, shows that going green makes good business sense.

- GreenA Consultants is a Singaporean SME which was involved in 4 local SLE projects, has also participated in more than 15 overseas GM projects, including African countries like Rwanda and Tanzania. They received the Sustainable Building Award 2016 – Most Acclaimed Green Consultancy (Africa & Asia).

Firm	Expertise areas	Examples of SLE Projects in Singapore
MKPL Architects	a) Singaporean architectural firm which provides consultancy services and shows commitment and expertise in their field.  b) Project types: <ol style="list-style-type: none"> <li>i. Institutional projects,</li> <li>Residential (Public/Private),</li> <li>Mixed Use</li> </ol> c) Examples of higher rated Green Mark projects in Singapore: <ol style="list-style-type: none"> <li>i. Public Housing Development at Bidadari</li> <li>ii. Public Housing Development at Bedok Beacon</li> <li>iii. NUS Ventus (University Campus Infrastructure Building)</li> <li>iv. SMU School of Law Building</li> <li>v. SMU Residences at Prinsep</li> <li>vi. Woodleigh Village</li> </ol>	a) SMU-X Tahir Foundation Connexion (A-South 2)  Ongoing projects targeting GM SLE: b) SMU-X A-South 3
GreenA Consultants	a) Singapore certified environmental sustainability design firm (ESD) that provides green reporting, certification	Development of Camp Facilities at

	<p>advisory, environmental and energy studies services.</p> <p>b) Received the Sustainable Building Award 2016 – Most Acclaimed Green Consultancy (Africa &amp; Asia). Involved in more than 15 overseas GM projects, including African countries like Rwanda and Tanzania.</p> <p>c) Project types:</p> <ol style="list-style-type: none"> <li>i. Institutional projects, commercial, Private Residential, Mixed Use</li> </ol> <p>d) Examples of higher rated Green Mark projects in Singapore:</p> <ol style="list-style-type: none"> <li>i. Changi Airport Terminal 4</li> <li>ii. Passion Wave at Marina Bay</li> <li>iii. NTU Hall of Residential 4</li> <li>iv. Project Hamptons</li> <li>v. DSM Dyneema APAC Technical Center</li> </ol>	<p>Kranji Camp III for OES</p> <p>Ongoing projects targeting GM SLE:</p> <ol style="list-style-type: none"> <li>a) Nee Soon South CC</li> <li>b) PSA Maintenance Base</li> <li>c) Proposed Hangar Complex</li> </ol>
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### Smart FM examples:

CBM Pte Ltd – A local firm and subsidiary of City Developments Limited (CDL), is committed to enhance their operational flexibility through technology deployment, developing their staff through training programmes and continuously improve their processes. They have also embarked on their own Smart FM initiatives to harness data and optimise the deployment of resources. These include Smart CCTV analytics which allows security monitoring to be automated, alleviating the need for manual patrolling. By uniting siloed systems, CBM is able to provide strategically planned integrated smart solutions to increase productivity and effectiveness.