

Dragages Singapore

PPVC Construction Planning & Management

Shared **innovation**

BOUYGUES
CONSTRUCTION

Dragages Singapore & the Bouygues Construction Group



IN SINGAPORE SINCE
1984



BUILDING,
CIVIL WORKS, ENERGY
& SERVICES



58,149

EMPLOYEES IN THE
WORLD



2,000+

EMPLOYEES



+35

PROJECTS IN
SINGAPORE



13.4

BILLION EURO OF
TURNOVER



HIGHEST CONQUAS

PPVC PIONEER

BIZE SAFE STAR

TRIPLE ISO CERT.



60%

OF INTERNATIONAL
TURNOVER

ACTIVE IN **26**
COUNTRIES



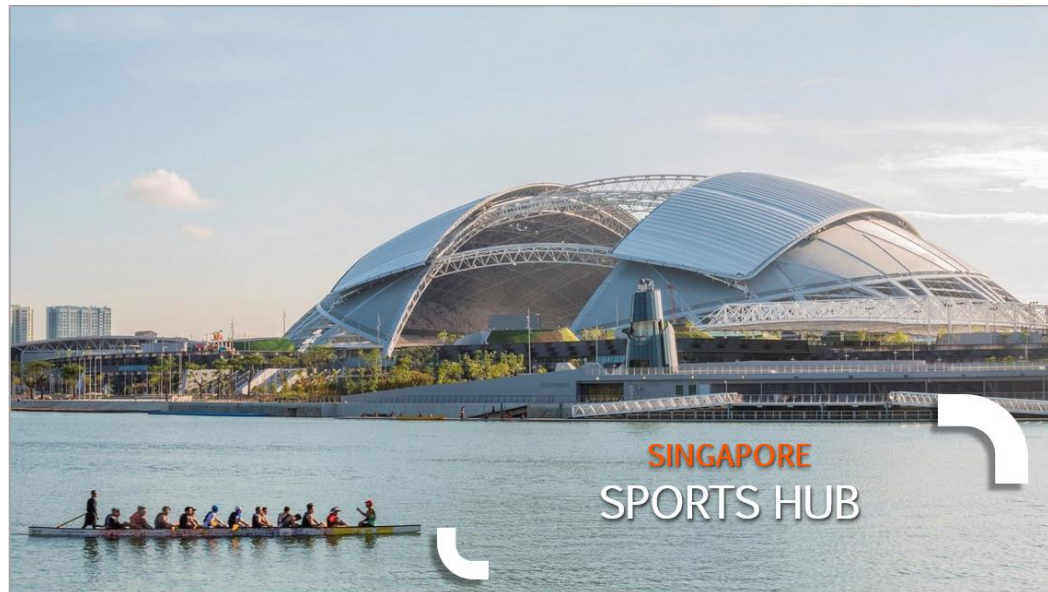
BOUYGUES

MEMBER OF THE
BOUYGUES GROUP

130,500 EMPLOYEES

CONSTRUCTION /
MEDIA / TELECOM

Some of our International Reference



Some of our International Reference



Our PPVC Experience

2014

Crowne Plaza Hotel Extension



Steel PPVC System
10-storey hotel, 252 PPVC modules

2016

Woodlands Nursing Home



Hybrid PPVC System
9-storey nursing home,
343 PPVC modules

2016

Clement Canopy



Concrete PPVC System
40-storey residential (505 units),
1866 PPVC modules

2017

Park Colonial



Concrete PPVC System
6 blocks, 14-15-16-storey apartments
(837 units),
2514 PPVC modules

2018

Perumal Road



Concrete PPVC System
1 tower 23-storey residential (116 units)
1 tower 18-storey service apartment (240 units)
680 PPVC modules

2018

Garden Residences



Concrete PPVC System
5 blocks, 15-storey apartments
(613 units),
2012 PPVC modules

2019

BCA Academy Phase 2



5S PPVC / APCS / PDV / MET
7-storey zero energy building (MET)
16-storey super low energy building
(PPVC, APCS and PDV)

2019

The M @ Middle Road



Concrete PPVC System
4 blocks, 20-storey
522 units

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Design

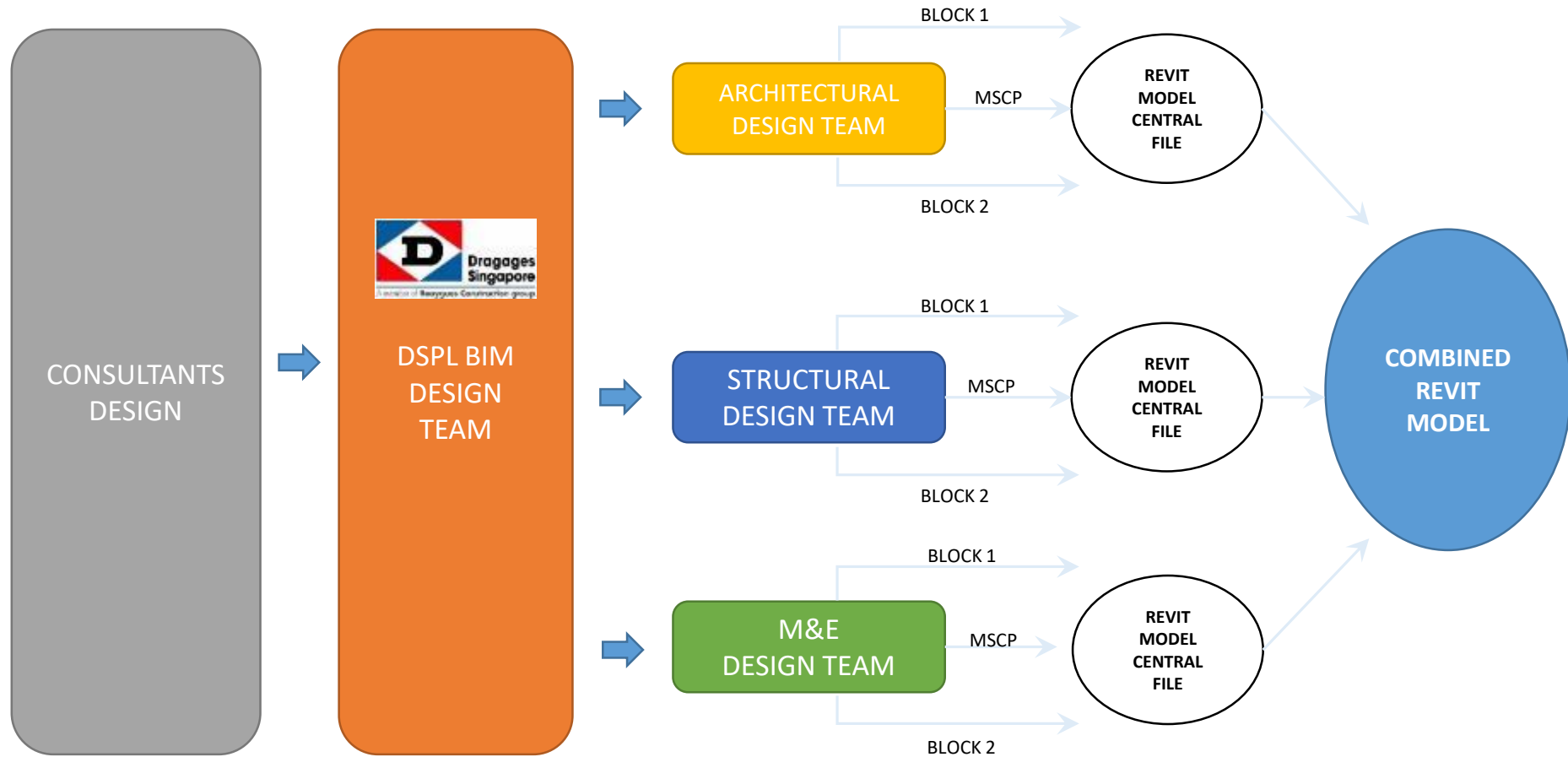


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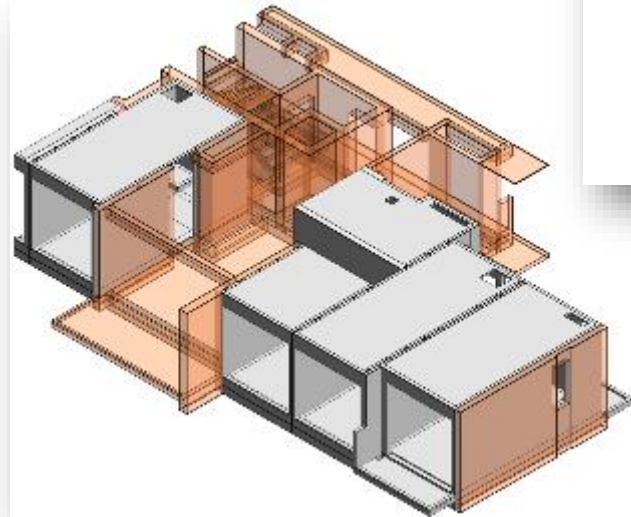
PPVC Design Development

BIM used in the Design to facilitate precast and prefabrication coordination



PPVC Design Development

Design Teamwork
3 Disciplines to
develop PPVC
collaboratively



STRUCTURAL
MODEL



M&E
SERVICES



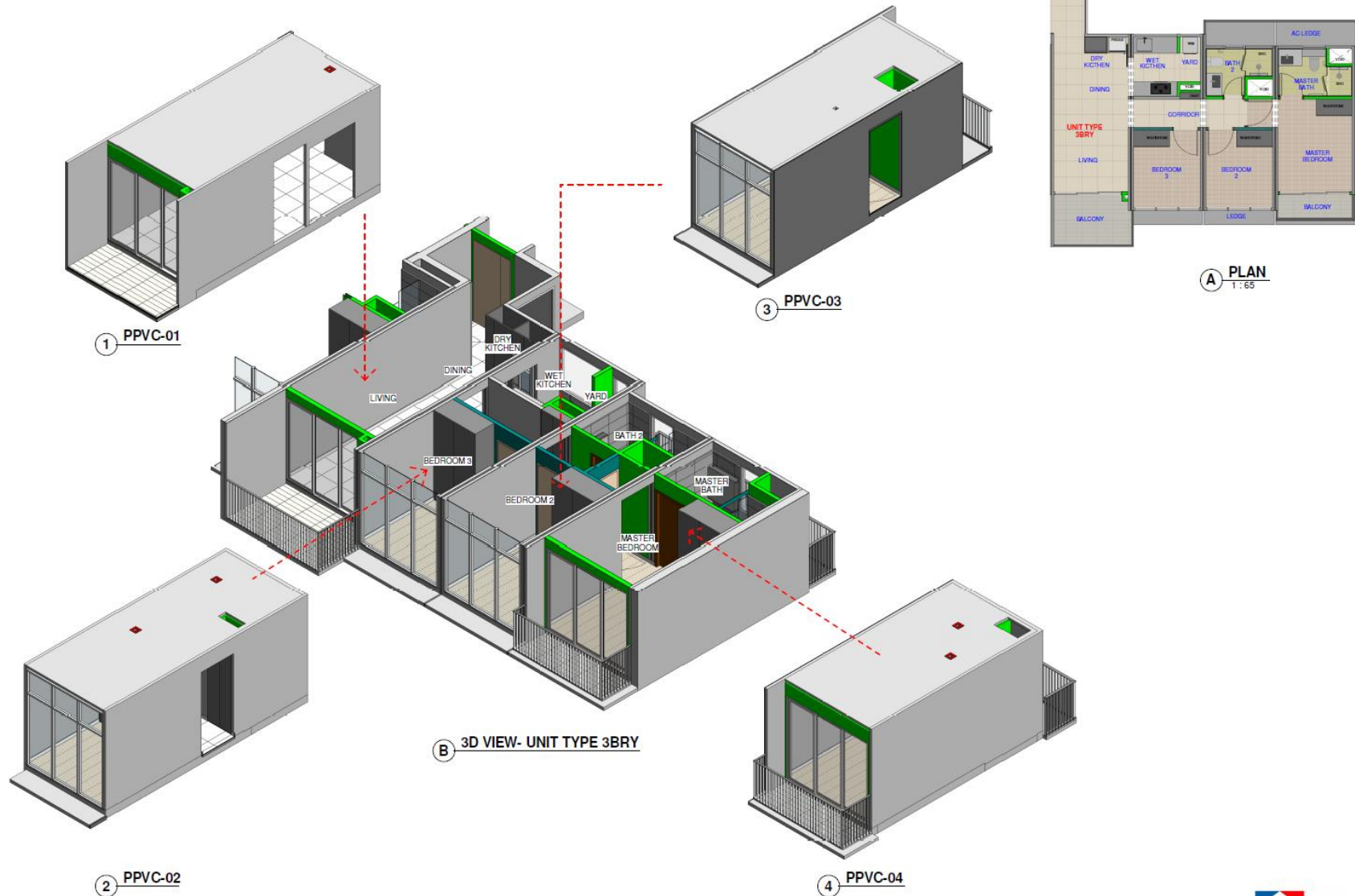
ARCHITECTURAL
FINISHES



COMBINED
MODEL

PPVC Design Development

MODULAR DESIGN FOR APARTMENT UNIT



Characteristics of the PPVC system

6 Sided RC PPVC Module

Wall

Comprises of RC walls located on the two long sides of the modules.

Floor Slab

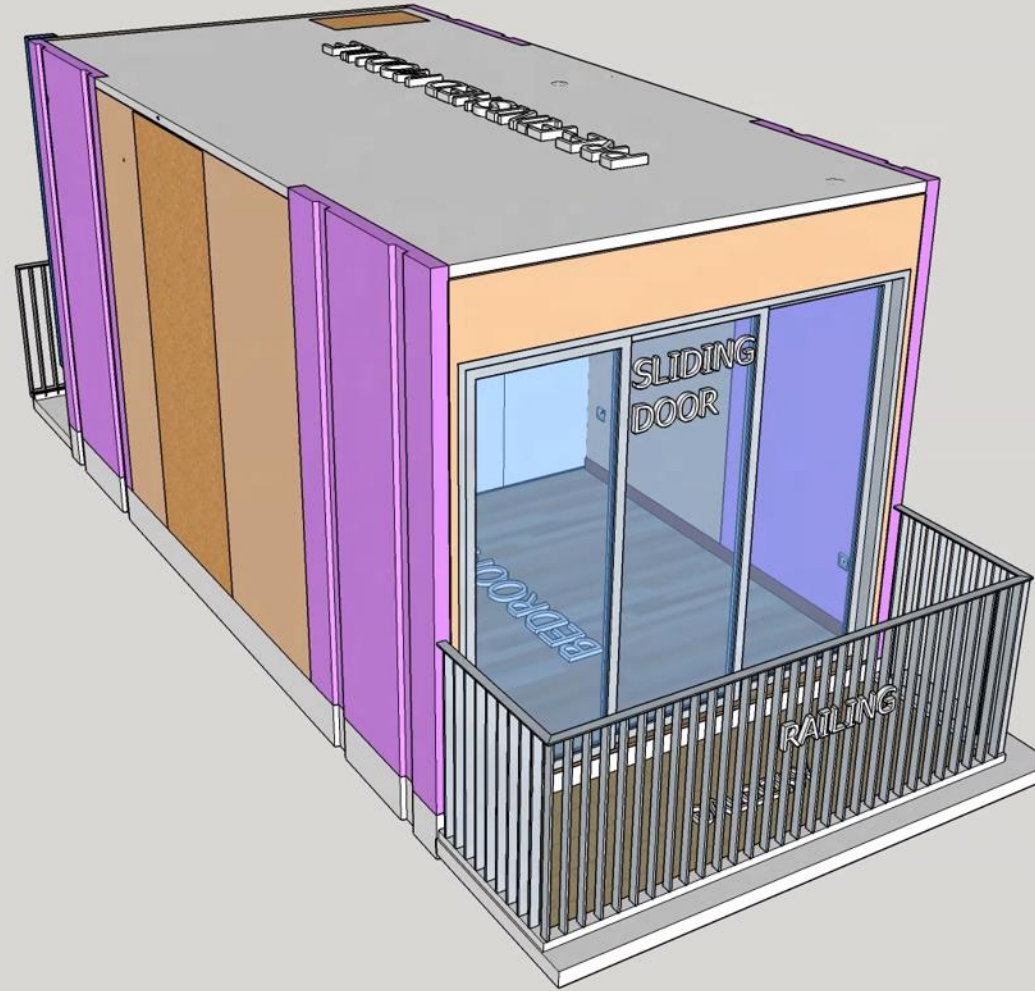
Comprises of RC floor slab spanning across the shorter span of modules on beams.

Balcony and AC Ledge

Balcony/ AC slab will be cantilever.

Ceiling

RC ceiling flat slab is provided



RC PPVC Modules

– Pre-finished in the factory

Following Requirements of
COP on Buildability 2015

This PPVC system developed by Dragages Singapore is particularly suited for residential building projects as it provides robustness on the structure and enhanced durability.

DESIGN CONSIDERATIONS OF THE MEP IN PPVC SYSTEM

MEP services

**MEP
Coordination**

**Structural & Fire
Safety**

**Integrity
between
modules**

**Maintenance
accessibility**

**Robust design
for construction
errors**

PPVC Fabrication & Installation

M&E Services



Carcass Fabrication
at Grisek Jaya

- Embedded services



Fit Out Installation
at Jurong Port

- MEP High Level installation
- Ceiling Clearance
- MEP fittings



Final Installation on
Site

- MEP Connections
- Final Light Fixtures
- Condensing Units

CONSTRUCTION



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PPVC Construction

Stage 1 – Carcass Fabrication



Panel fabrication / casting



3D Module after casting



Module ready for delivery

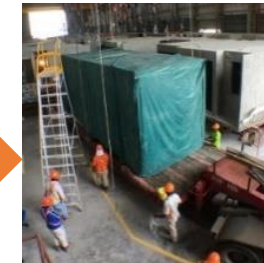
Stage 2 – Fit Out Installation



Module arrangement



Fit out works



Module ready for delivery

Stage 3 – Site Installation



Preparation for Transfer Slab



Lifting process



PPVC Module is installed

Carcass Fabrication Plant at Grisek Jaya



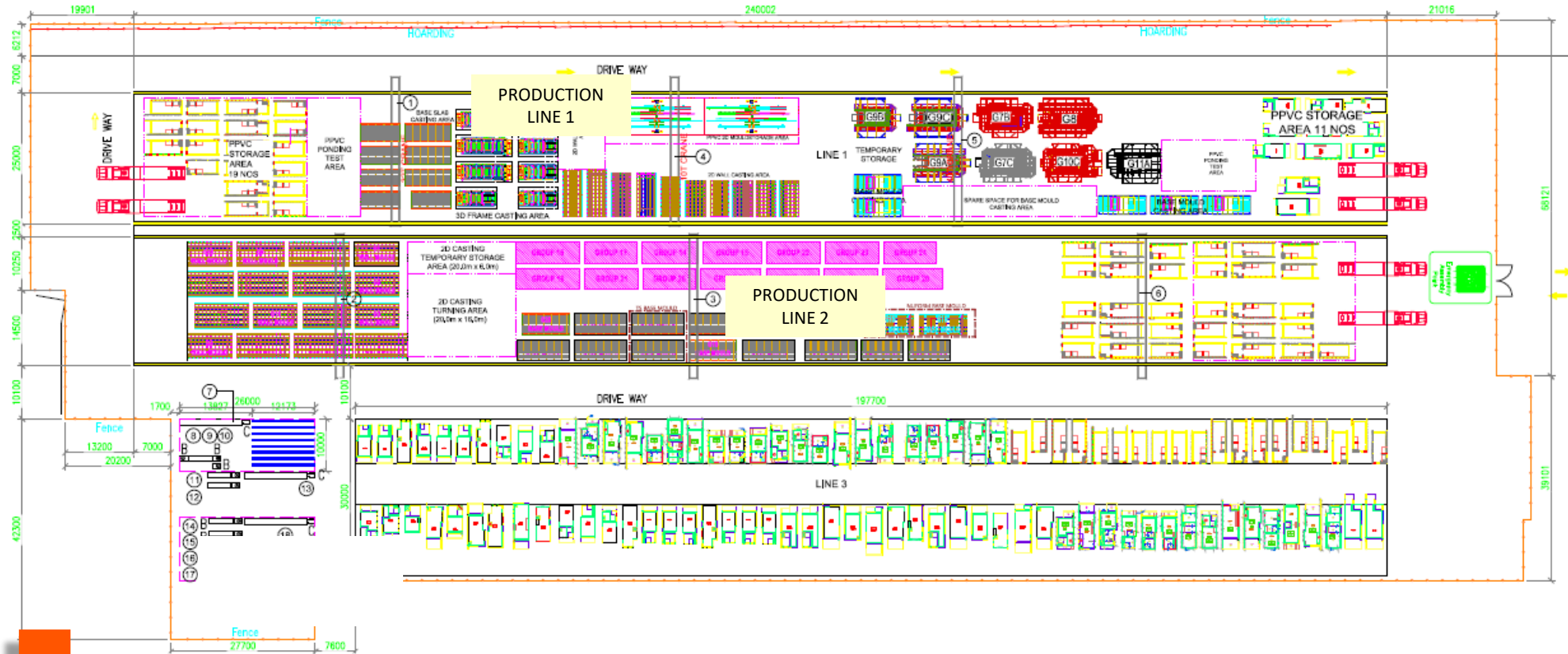
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PPVC Yard – Plant and Capacity

- ➡ Dragages Singapore has invested in large yard for self production
- ➡ This will guarantee timing and quality control

Carcass Module Production Yard



Total area = 19,000m²

Total production = 340 modules/month

Equipped with = 1no 32T / 1no 40T / 1no10T Gantry Crane (each line)

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PPVC Fit-Out Factory at Jurong Port



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PPVC Yard – Plant and Capacity

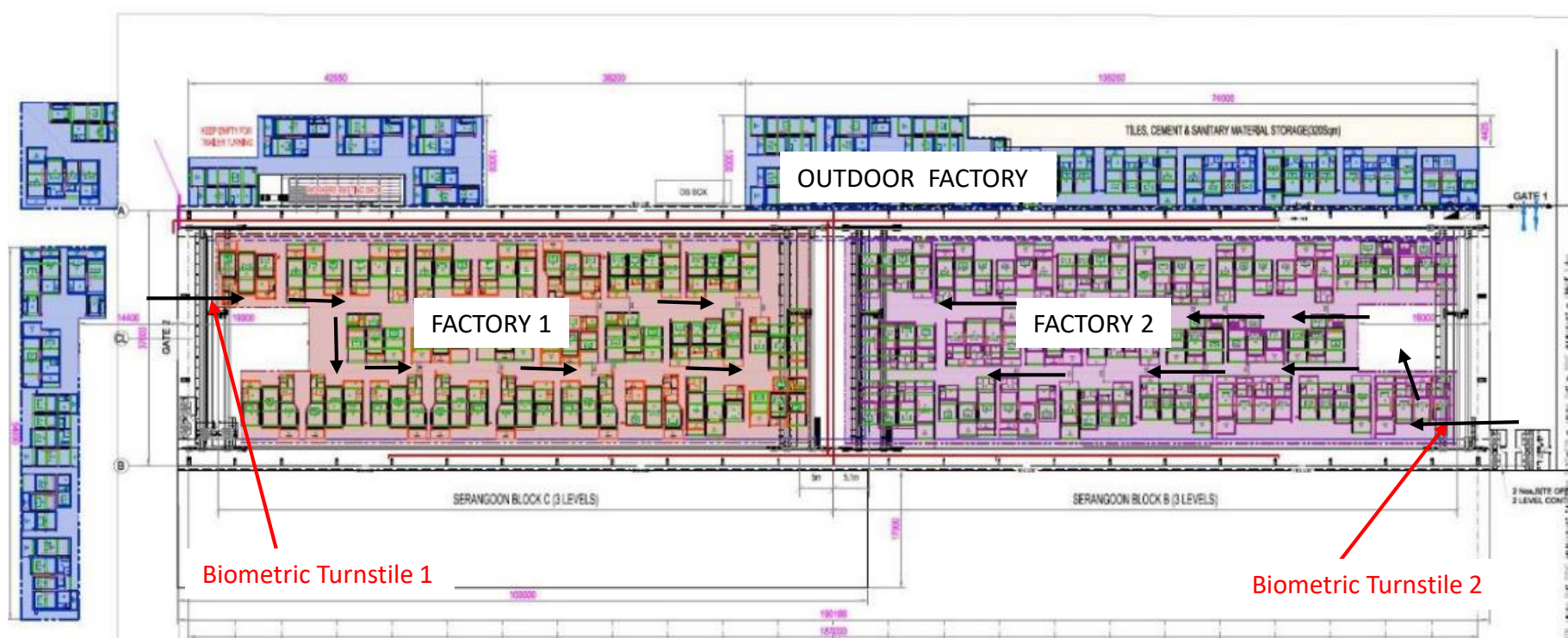


Location	Yard 10A & 10B of Free Trade Zone
Factory Area	7,400m2 (6,956m2 covered area and 444m2 open yard)
Capacity	140 modules
Machinery	Gantry Crane: 2nos 32T and 2nos 40T

PPVC Yard – Plant and Capacity

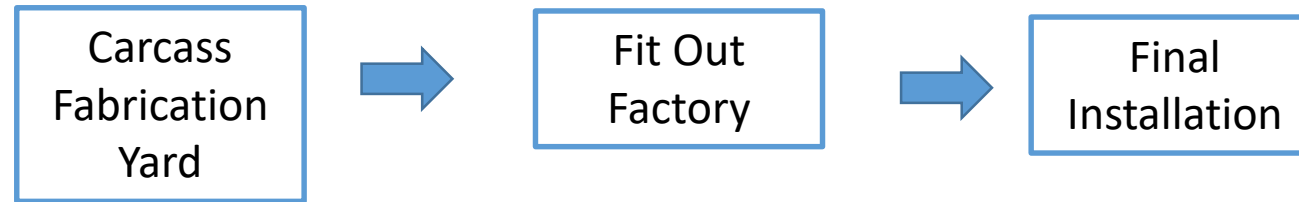
- ➡ Dragages Singapore has invested in a large factory for self production
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Fit Out Factory

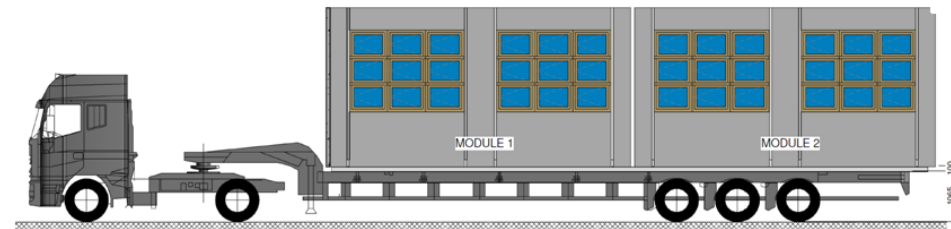


PPVC Construction – Logistic Management

Transportation Flow Chart

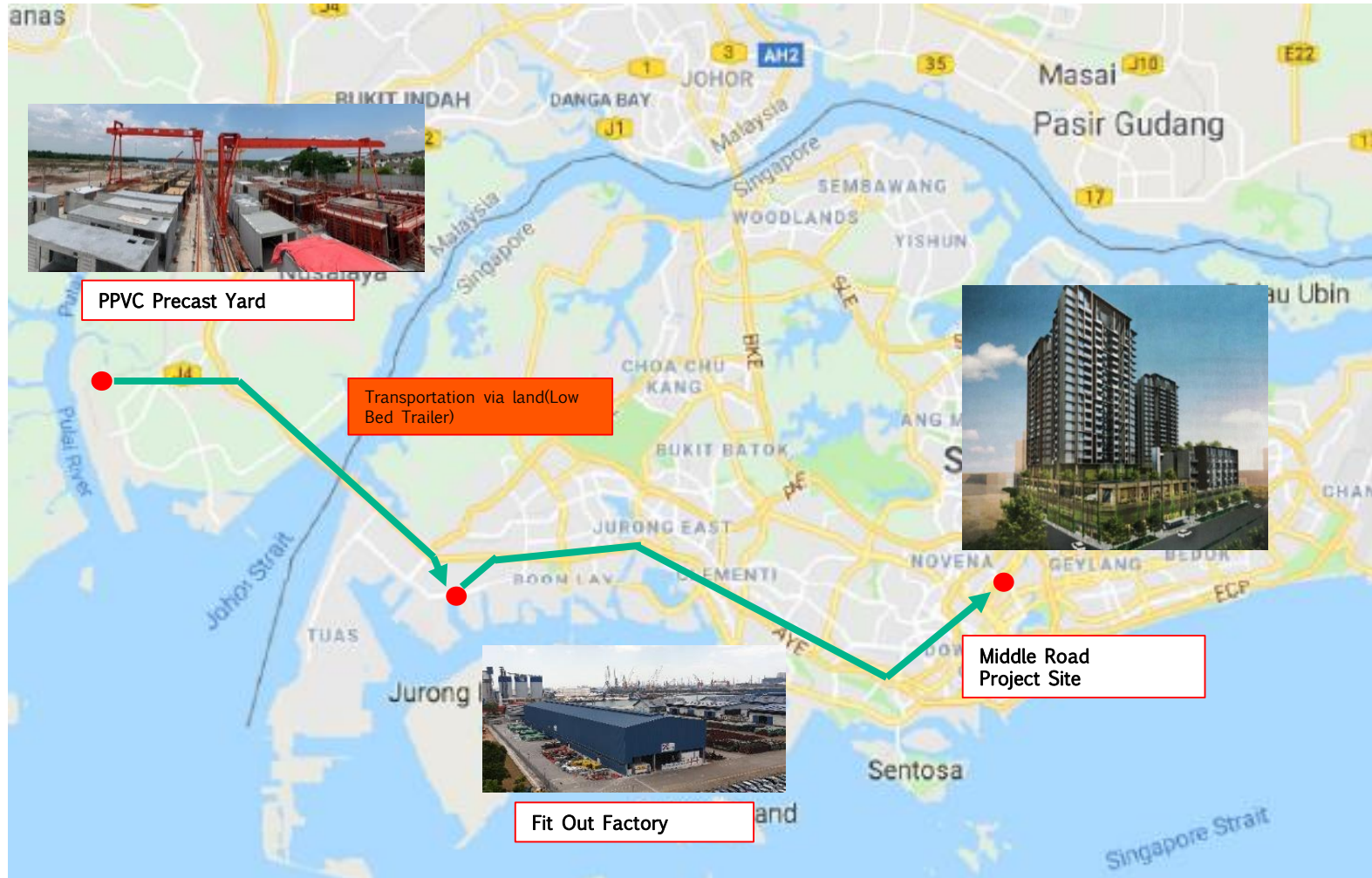


Typical Convoy



	<u>Convoy Size</u>	<u>LTA Guidelines w/o Police Escort</u>
Length	→ 18.950 m	No limit
Width	→ 3.100 m	< 3.4m
Height	→ 4.315 m	< 4.5m

PPVC Construction – Logistic Management

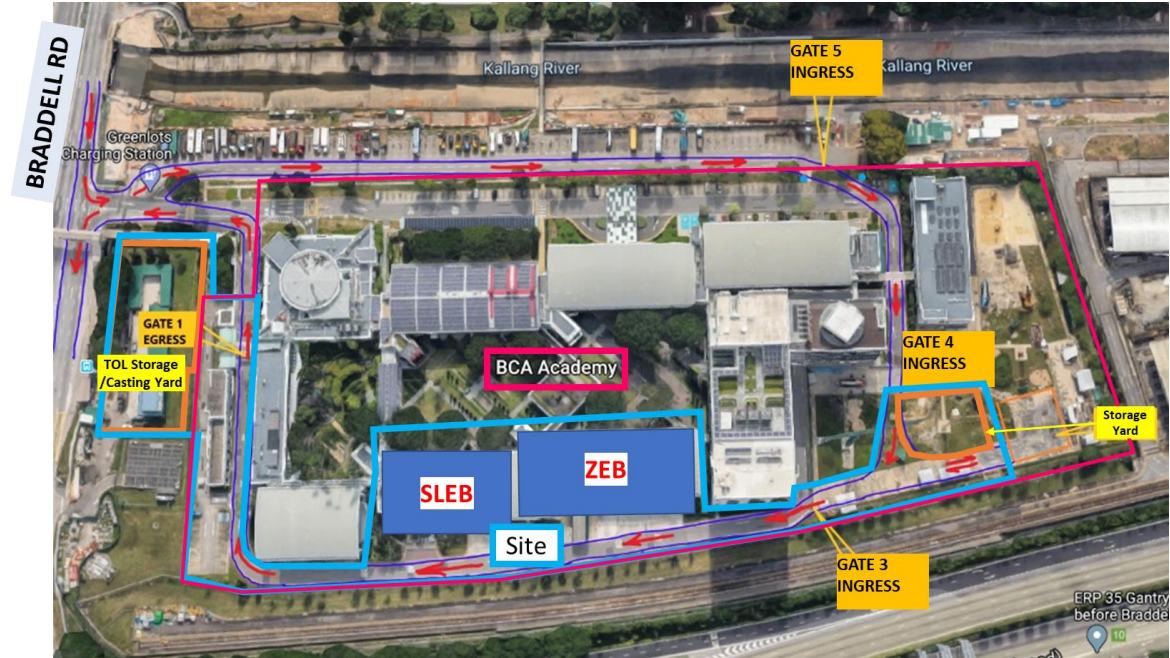


PPVC Construction – Logistics Management

Site Restrictions Consideration

Access

- Tight Access (One Lane)
- Limited Site Unloading Lots



PPVC Construction – Equipment



- High capacity tower crane
- ~ 15 minutes per module for lifting and installation only
- 10-12 modules a day per tower crane can be achieved

Digitalization

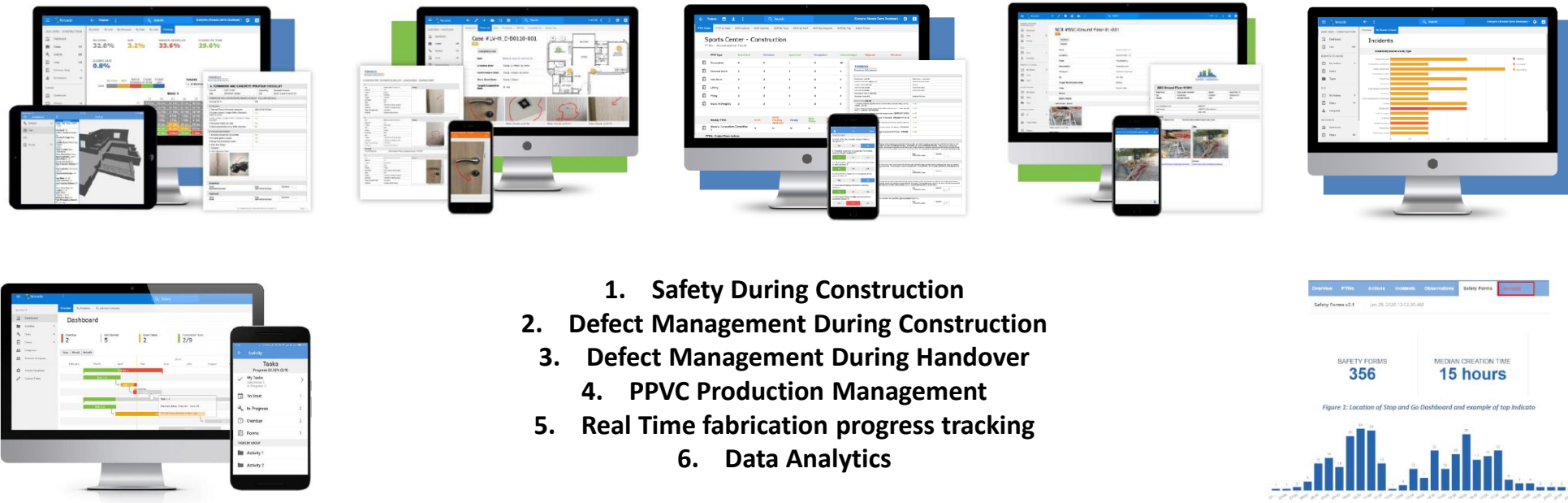


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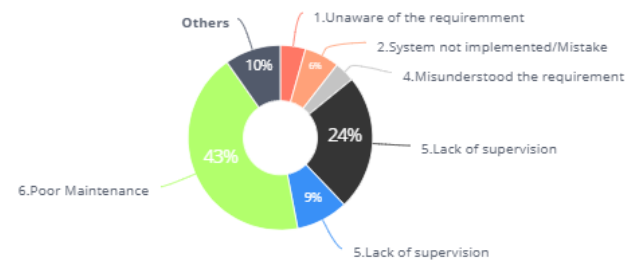
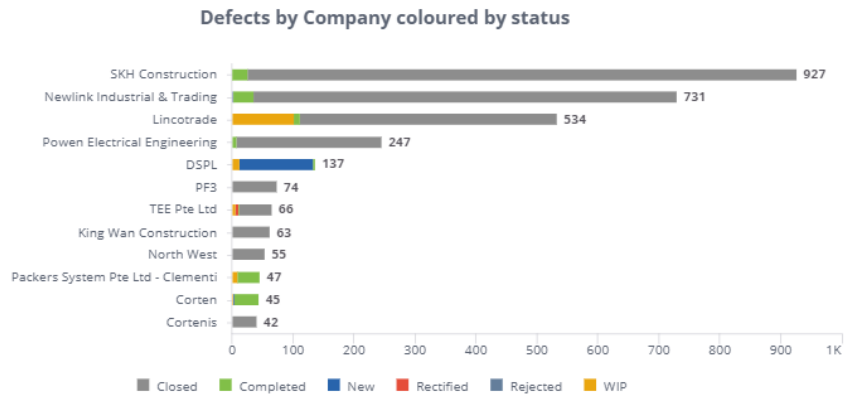
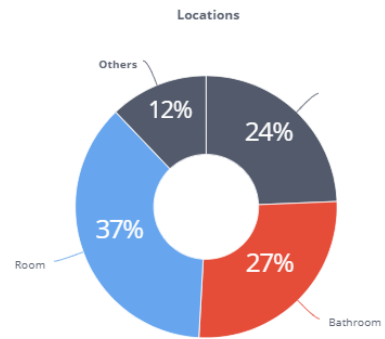
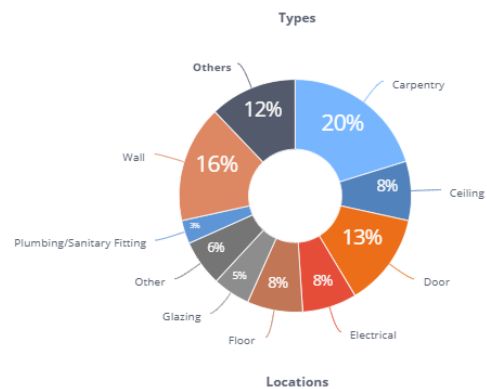
Project Site And Factories

DIGITAL TOOL FOR H&S, QA/QC AND PRODUCTION FOLLOW-UP

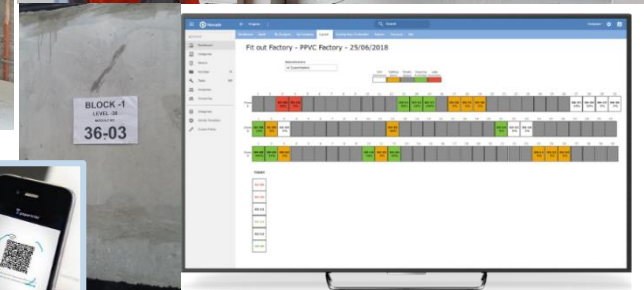
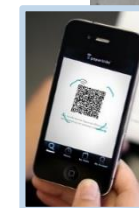
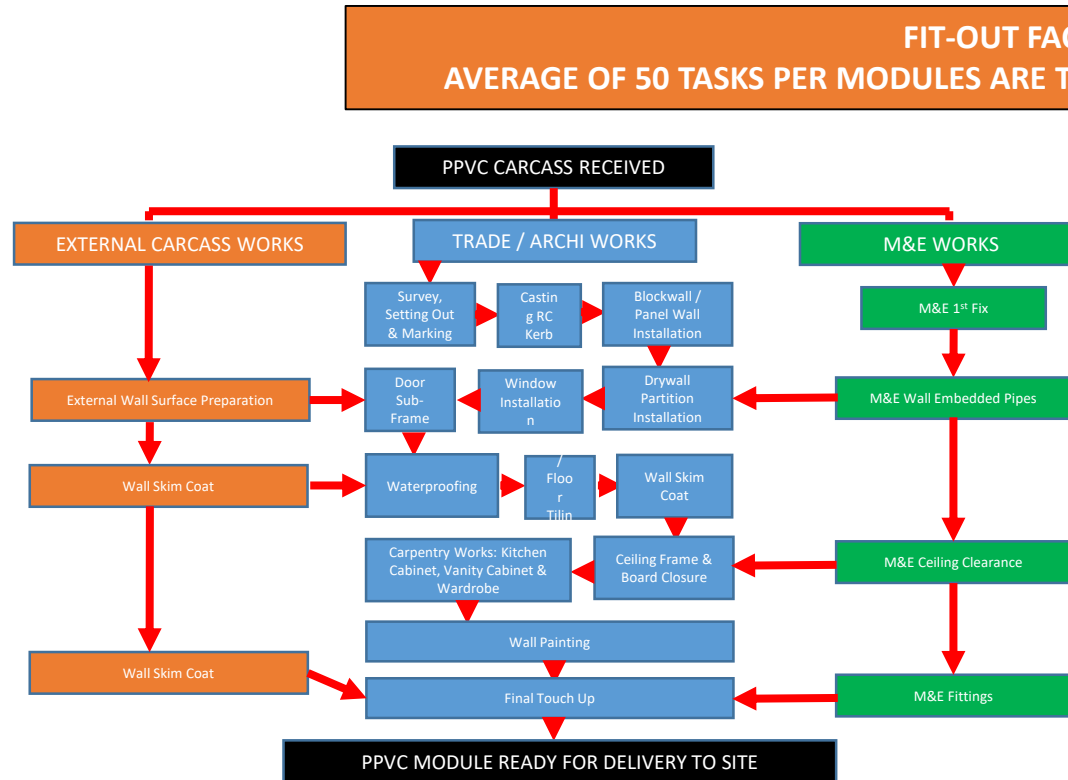


Project Site And Factories

DEFECT – DATA ANALYTICS

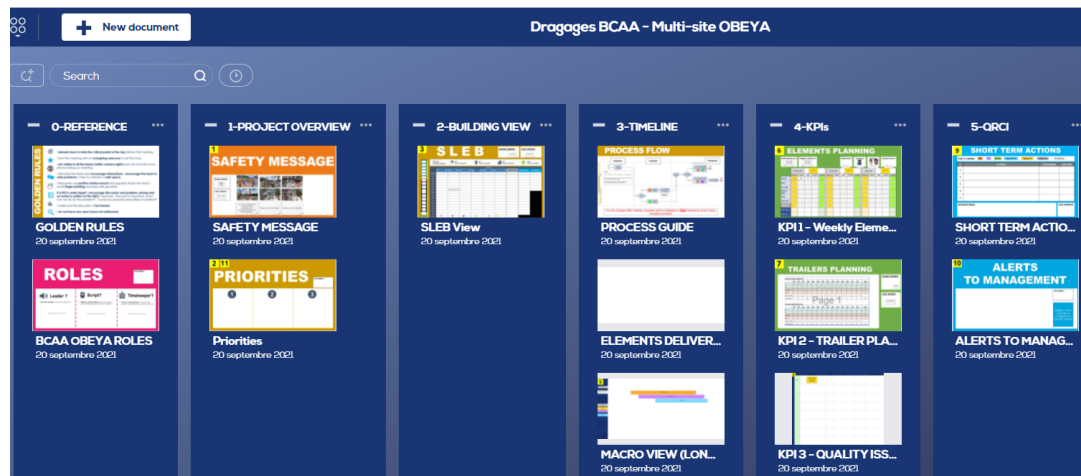


PPVC Fabrication & Installation – Real Time Tracking



PPVC Delivery – Real Time Tracking & Feedback

To ensure effective communication between site and factories (Grisek Jaya, Jurong Port, etc.), we are using **UBIKEY** as a common platform to share info, discuss issues/concerns, coordination for all delivery matters.



Technical Challenges



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Technical Presentation

Technical Challenges for PPVC 2.0

1). Design requirement from Client & Consultant:

- Bigger PPVC module results in heavier module
- Irregular shape results in 3D complex mould
- Bigger opening requires additional support and are prone to cracks (due to mishandling)



The Clement Canopy PPVC Carcass
(box modular shape)

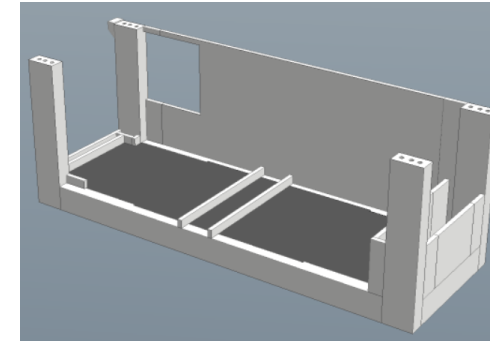


Technical Presentation

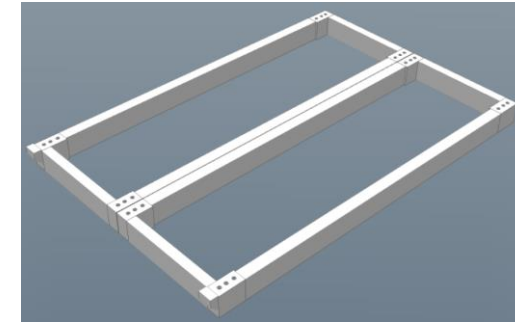
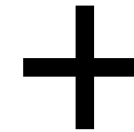
Technical Challenges for PPVC 2.0

1). Design requirement from Client & Consultant:

- Space Requirement
 - => High Headroom
 - => Ventilation requirements



BCAA PPVC Toilet Carcass
(5-sided modular shape)



BCAA PPVC Top Beam



The Clement Canopy PPVC Carcass
(box modular shape)



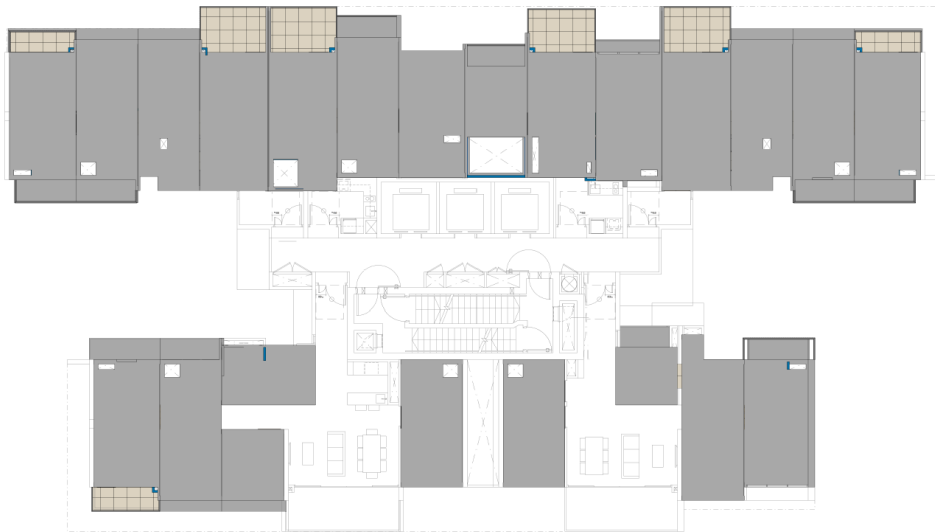
BCAA PPVC Carcass
(5-sided modular shape)



Technical Presentation

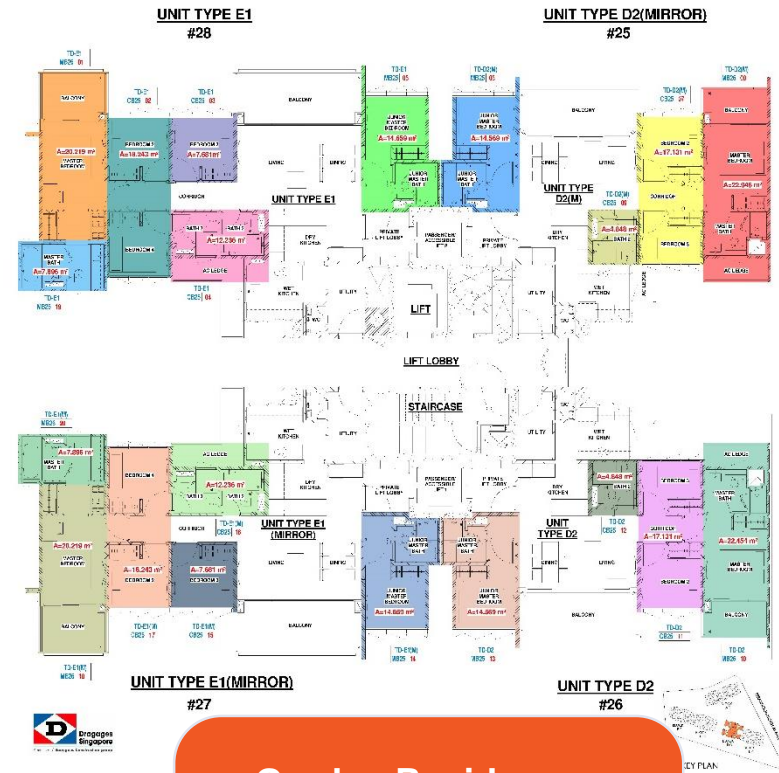
Technical Challenges for PPVC 2.0

2) Many Type of PPVC Module:



Clement Canopy

Total = 1,866 PPVC modules
48 types of PPVC Modules
26 sets of PPVC moulds



Garden Residences

Total = 2,012 PPVC modules
87 types of PPVC Modules
32 sets of PPVC moulds

Q&A



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THANK YOU

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